NOBCON 2024

1st International Conference on Research & Innovation in Multidisciplinary Domains (ICRIMD)

Date: 27 – 28 December, 2024

Venue: Noble University Campus, Bhesan Road, Gujarat, Junagadh

Conference Proceedings

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Volume - 2

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Dr. Riddhi Sanghvi

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Noble University,
Junagadh

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About The Conference

Because of the overwhelming response and encouragement by the researchers, academicians and industrialists, Noble University is happy & encouraged to hold the 1st International Conference on Research and Innovation in Multidisciplinary Domains, ICRIMD -2024. Join us for a premier platform where students, academicians, and industrialists converge to share innovative ideas and showcase talents.

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Conference Themes

Engineering

Management

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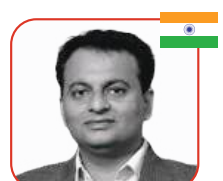Manager
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Publication Opportunities

NOBCON 2024 Conference Proceedings - ISBN Number: 978-81-969738-1-0
A Peer Reviewed Journal

Journal Name: STM journals
Link: https://journals.stmjournals.com/

Journal Name: International journal for innovative research in multidisciplinary field
Link: https://www.ijirmf.com

Scopus / UGC CARE Indexed Journal

*Subject to acceptance by the journal and payment of publication charges by authors.

Journal Name: Frontiers in Health Informatics
Link: https://healthinformaticsjournal.com/index.php/IJMI

Journal Name: Vedant Publications
Link: www.MyVedant.com

Journal Name: South Eastern European Journal of Public Health
Link: https://www.seejph.com/index.php/seejph/index

BEST PAPER AWARD

Submission Guidelines

All papers must be original and not simultaneously submitted to another journal or conference. The following paper categories are welcome:

1 **Full papers** presenting original, completed research, typically including thorough analyses and experiments.

2 **Systematic Review** papers that provide a comprehensive overview of a specific research area by summarising and synthesising existing literature.

3 **Case Study** Papers that present practical experiences, often in industry settings, which provide insights or lessons for the research community.

4 **Posters** that are visual presentations of ongoing or completed research, summarising key findings, methods and implications.

Registration Fees

Particulars	Registration Fees along with Proceedings in e-copy	Paper Publication in Peer Reviewed of Journal (REGISTRATION CHARGES INCLUDED)	Paper Publication in Scopus & UGC CARE (REGISTRATION CHARGES INCLUDED) (*APC SUBJECT TO CHARGE BY RESPECTIVE JOURNAL)	Attendees (Any Track)
Students – Noble University (UG and PG)	750	2250	1750 + APC	NIL
Students- other University (UG and PG)	1000	2500	2000 + APC	100
Research Scholars and Academicians – Noble University	1500	3000	2500 + APC	100
Research Scholars/ Academicians / Scientists / Industry Persons – Other University	2000	3500	3000 + APC	100
Students with Foreign National	$ 55	$ 110	$ 55 + APC	-

The above fees are valid for 3 authors, for additional author from foreign $10 & Indian author Rs.500/- will be charged extra.

Key Dates

Last Date For Abstract Submission : November 25, 2024

Last Date For Full Paper Submission : December 2, 2024

Submission of Presentation : December 20, 2024

Registration Link:

https://easychair.org/conferences/?conf=nobcon2024

Participants From

India	United States	United Kingdom	Georgia	South Africa	Australia
Canada	Saudi Arabia	Greece	Nigeria	Afghanistan	Germany

Notes

○ Accommodation facilities are available upon request at an additional cost.

○ Registration fees cover the kit and food for one author. Additional authors can avail these benefits at an extra cost.

Contact Us

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www.nobleuniversity.ac.in

Venue: Noble University Campus,
Bhesan Road, Bamangam, Junagadh, Gujarat - India

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Message from the Chief Petron

Dear Scholars, Researchers, and Participants,

It is a proud moment for Noble University to host the 1st International Conference on Research and Innovation in Multidisciplinary Domains. This initiative reflects our university's commitment to fostering collaboration and innovation in research across diverse fields.

With participation from 829 authors representing 7 countries, this conference brings together a vibrant mix of ideas, perspectives, and expertise. The meticulous review process resulted in the selection of 248 high-quality papers out of 424 submissions, ensuring a rich and engaging program. Furthermore, our association with 8 reputed journals, including Scopus and Web of Science indexed platforms, highlights the high academic standards of this event.

I would like to take this opportunity to acknowledge the exceptional efforts of Dr. Riddhi Sanghvi and Dr. Darshan Jani, the conference co-chairs, whose dedication and hard work have been instrumental in organizing this grand event.

I congratulate the participants and encourage you to make the most of this platform to share your research, build networks, and explore new opportunities for collaboration. I also applaud the organizing team, led by Dr. Jay Talati, for their dedication in making this event a success. Wishing everyone a productive and inspiring conference!

Warm regards,

Dr. H. N. Kher Kher

Chief Patron

Provost, Noble University

Message from the Conference Chair

Dear Participants, Academicians, and Researchers,

It is my privilege to welcome you all to the 1st International Conference on Research and Innovation in Multidisciplinary Domains, a major step by Noble University toward promoting research excellence. This conference stands out not only for its hybrid format, allowing participation online and offline, but also for the diverse participation of researchers from 7 countries, showcasing a truly global academic platform.

This event provides an exceptional opportunity for researchers to present their ideas and gain recognition through collaborations with distinguished journals, including Scopus and Web of Science indexed publications. I am particularly proud of the interdisciplinary focus, which opens avenues for impactful discussions and innovative solutions to real-world challenges.

I extend my heartfelt gratitude to the management of Noble University for their unwavering support, guidance, and encouragement, which have been critical in making this event possible. I also express my appreciation to our Chief Patron, Dr. H. N. Kher, for his visionary leadership and to the organizing team for their tireless efforts in shaping this conference.

I wish all participants an enlightening and fulfilling experience as they contribute to shaping the future of multidisciplinary research.

Best regards,

Dr. Jay Talati

Conference Chair
Registrar,
Noble University

1ˢᵗ International Conference on Research & Innovation in Multidisciplinary Domains (ICRIMD)

About the University:

Shri Vivek Bharti Trust, led by four visionary philanthropists, proudly established Noble Group of Institutions (NGI) in Junagadh, Gujarat, to provide quality education in Engineering, Science, Management, Pharmacy, Education, and Nursing. Since 2007, NGI has been a hub for technological and scientific growth, offering modern labs, a world-class library, spacious classrooms, green playgrounds, a gym, and strong industry connections.

In 2022, NGI became Noble University (NU), expanding across 30 scenic acres near Girnar Hill, fostering innovation and creativity in a serene environment. NU is dedicated to empowering students with ethical, high-quality education to serve society and advance humanity.

With partnerships across academia and industry, NU nurtures skilled, compassionate individuals ready to lead globally. Focused on interdisciplinary learning, NU harmonizes intellect, emotion, and action to shape a brighter, sustainable future for India and the world.

Faculty of Ayurveda

The main aim of Noble University is to impart to the students high-quality technical & scientific knowledge with ethics, so as to serve society and mankind through Ayurveda with full devotion, dedication, and commitment. It is the dream of the management to take this institute to a greater height in order to achieve a "Centre for Excellence" in teaching-learning, research, and innovative activities within and outside the campus.

Faculty of Homeopathy

NU ensures student welfare with comfortable accommodations, nutritious meals, recreational facilities, and a ragging-free environment. We nurture healers by fostering self-awareness, self-expression, and mastery of homeopathic knowledge. As a retreat for personal growth, NU provides diverse tools and methods, empowering students to craft their unique healing journey.

Faculty of Pharmacy

- Work within the digital sectors
- Give the best guidance and placement in a positive manner
- Excellent Pay Potential
- Creative student's potential across the industry
- Think differently do different and get different

Faculty of Engineering

At NU, we prioritize a student-centric education system designed to meet industrial standards through a carefully crafted syllabus. Our campus offers state-of-the-art laboratories, modern infrastructure, and a comprehensive library to support hands-on training and skill development.

We nurture entrepreneurial ambitions with start-up and incubation facilities, alongside placement and internship opportunities in multinational organizations. Our highly qualified and dedicated faculty focus on recognizing and cultivating each student's true potential, ensuring their 360-degree development. With strong corporate tie-ups, we bridge the gap between education and industry, while encouraging holistic growth through extracurricular activities.

Faculty of Nursing

Noble Nursing College aims to deliver high-quality theoretical and practical knowledge through a "learning by doing" approach. Our dedicated faculty go beyond teaching, offering personalized support and expert instruction. Nursing education here emphasizes clinical skills, critical thinking, communication, leadership, and ethical decision-making. We prepare students to excel in diverse healthcare settings, working collaboratively to provide exceptional patient care. With a focus on evolving healthcare technology and policies, our programs ensure students are equipped for the future of nursing.

Faculty of Science

The Faculty of Science is a complete, student-oriented science faculty where research and education are closely related. The faculty aims to be an academic community with an international character, where staff members from different backgrounds can combine their talents with the common goal of being a leading faculty of science in India.

Our study programmes prepare students for positions in scientific research and professional careers related to societal themes such as energy, food, water, health, or innovation, as well as careers in entrepreneurship or teaching.

Faculty of Management and Commerce

NU is a buzzword for its cutting-edge education in the management domain. Every single tenet of management at NU is holistic and erudite in every prism of management. At NU, we encompass every single detail of management education in a nitty-gritty way making our students head and shoulder in the vista.

Faculty of Computer Applications

Our programs focus on industry-relevant subjects, offering specializations in Web Development, Data Science, and Full Stack Development. With innovative assessment methods and an emphasis on practical learning aligned with market trends, students gain hands-on experience in highly equipped labs under the guidance of experienced faculty. We foster holistic development through academic and cultural events, various seminars, workshops, and diverse student development clubs, creating a vibrant and enriching learning environment.

Faculty of Humanities/ Arts/ Education

Our University is proud to have a team of qualified, accredited, and doctorate-degreed staff who provide personalized guidance to students, ensuring each individual receives the attention they deserve. We emphasize experimental work in high-quality schools to offer practical learning experiences, and we integrate advanced technology into education to enhance the learning process. Face-to-face visits to specific nominated school institutions are conducted to provide students with real-world exposure. We also place great importance on co-curricular activities, encouraging students to engage in them alongside their studies. Furthermore, we offer free pre-preparation for the TET and TAT exams to help students succeed in their future careers.

Faculty of Library Science

The Faculty of Library Science is a complete, student-oriented science faculty where research and education are closely related. The faculty aims to be an academic community with an international character, where staff members from different backgrounds can combine their talents with the common goal of being a leading faculty of science in India.

Our study programmes prepare students for positions in scientific research and professional careers related to societal themes such as energy, food, water, health, or innovation, as well as careers in entrepreneurship or teaching.

Objectives:

- Facilitate knowledge exchange and the presentation of innovative research across various disciplines such as engineering, sciences, humanities, management, healthcare, and vocational studies.
- Encourage the development and dissemination of multidisciplinary research that addresses global challenges.
- Provide a platform for showcasing talent and fostering discussions that lead to actionable solutions and advancements.
- Offer opportunities for participants to publish their research in peer-reviewed and indexed journals.
- Promote interaction between academia and industry to bridge gaps and drive technological and academic advancements.

About the Event :

ICRIMD-2024 is a good platform for fostering collaboration and innovation by bringing together students, researchers, academicians, and industry professionals from diverse fields. It provides an excellent opportunity to present original research, exchange ideas, and explore advancements across multidisciplinary domains such as engineering, sciences, management, healthcare, humanities, and more. The event not only facilitates the dissemination of

knowledge through paper presentations and discussions but also encourages networking and collaboration among participants. With opportunities for publication in reputed peer-reviewed and indexed journals, IC-2024 serves as a catalyst for academic and professional growth, enabling participants to contribute to addressing global challenges through innovative and multidisciplinary solutions.

About the Proceedings:

The proceedings of ICRIMD-2024 will include a compilation of high-quality research papers presented during the conference, reflecting the innovation and multidisciplinary focus of the event. These proceedings will be published with an ISBN number (978-81-969738-1-0) to ensure authenticity and recognition.

Participants have the opportunity to publish their work in peer-reviewed journals, including Scopus and UGC CARE-indexed journals, subject to acceptance and any associated publication fees. The publication options range across various reputed platforms such as STM Journals, the International Journal for Innovative Research in Multidisciplinary Fields, Frontiers in Health Informatics, and the South Eastern European Journal of Public Health.

The proceedings will serve as a valuable resource for academic and industry professionals, offering insights into the latest research trends and innovations across diverse domains.

Example Tracks / Topics:
- **Track 1 – Engineering**
- **Track 2 – Management**
- **Track 3 – Commerce**
- **Track 4 – Science**
- **Track 5 – Ayurveda**
- **Track 6 – Homeopathy**
- **Track 7 – Library Science**
- **Track 8 – Pharmacy**
- **Track 9 – Education**
- **Track 10 – Computer Applications**
- **Track 11 – Nursing**
- **Track 12 – Humanities and**
- **Track 13 – Animal Husbandry**

INDEX

Recent Trends in Management

8.	The Role of Emotional Appeals in Political Campaign for Loksabha Election 2024 In Gujarat: An Analysis of Neuromarketing Strategies	Sachin Harkhani and Dr. Jay Talati	54
9.	Impact of Landport Infrastructure Development on India-Myanmar Trade Dynamics	Venkat Jammi Rao, Dr. Monica Verma and Dr. Nazia Jamal	73
10.	Workplace Civility, Workplace Harmony and Employee Engagement: Mediating Role of Employee Voice in Nigeria	Ojeleye Yinka Calvin and Ojeleye Chioma Ifeoma	83
11	A Study on Determinants of Personal Financial Behavior	Miss Bhavna S. Jadav and Dr. Nimesh P. Bhojak	98
12	Predicting Factors Affecting Adoption of AI Tools for Online Shopping	Jeet Madhani and Dr. Shakina Tabbasum Munshi	113

Recent Trends in Commerce

13	Artificial Intelligence in Economic Policy and Decision-Making	Dr. Amul Kotadia	120

Recent Trends in Ayurveda

14	Nutraceuticals In Ayurveda-Recent Trends and Applications	Dr. Sandhya K. Barad, Dr. Pritee Khandare and Anjali Kuthe	131
15	Panchakarma a Rapid Treatment Protocol in Management of Gridhrasi (Sciatica) a Pilot Study	Dr. Preeti Rajendra Khandare, Sandhya Barad and Anjali Kuthe	135
16	Management of mukhpak with special reference to stomatitis	Dr. Rahulkumar Barad and Dr. Meghana Dangar	142

Recent Trends in Engineering

17	A Segmented Droop Control Strategy for Enhanced Load Sharing in Dc Microgrid	Shilpa Patel, Rajnikant Bhesdadiya and Hitesh Karkar	149
18	Innovative Glaucoma Diagnosis Using Cropped Optic Regions with Deep Learning Models	Dr Chandrakala, Amruta V., Mohammed Kamran and Shrinivas Burbure	162
19	Design and Implementation of a Web Application for Cardiovascular Disease Prediction Using Machine Learning Algorithms	Dr Chandrakala, Somesh Hotkar and Vinay S Buddhi	170
20	IntelliPlate: A Deep Learning Framework for Autonomous License Plate Recognition	Dr Chandrakala, Sanni Kumar Pandit and Sumeet Hibare	180

Recent Trends in Pharmacy

21	Development and Validation of In-Vitro Release Test (IVRT) Method for Topical Complex Generic - Ganciclovir Ophthalmic Gel	Komal Rajendrakumar Dhudashia and Dr. Nilesh K Patel	188
22	Evolution and Advancements in Occlusion-Induced Stroke Models: From Foundational Techniques to Modern Innovations	Bhuvnesh Thakar and Santosh Kirtane	202

Recent Trends in Library

23	The roll of cloud computing services in library and information center: an overview	Jalpa Tank and Dr. Rahul Joshi	216

Recent Trends in Education

24	શૈક્ષણિક ક્ષેત્રે આર્ટિફિશિયલ ઇન્ટેલિજન્સ (AI) નો ઉપયોગ	Nayana K. Chavda	221
25	Implementation of Innovative Pedagogy in the Classroom	M.N. Raviya	230
26	શિક્ષણમાં ટેક્નોલોજીની ભૂમિકા	Vijaykumar Jamanadas Babaria	233

STUDY OF MANAGEMENT OF FEMALE INFERTILITY THROUGH HOLISTIC APPROACH OF HOMOEOPATHY- A REVIEW

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Abstract:

Background: Infertility is a disease of reproductive system in males or females. According to the World health organization (WHO), infertility is defined as "a disease of the reproductive system, marked by the failure to achieve pregnancy after 12 months or more of regular, unprotected sexual intercourse" (WHO, 2024). Disparities in access to infertility treatments persist globally, with availability and quality often restricted in low-and middle-income countries because of economic limitations and systemic healthcare barriers (WHO,2024). Infertility often has profound psychological and societal repercussions, leading to stress, stigma, and emotional challenges for affected couples, particularly in regions where childbearing is highly valued culturally. Although, conception depends on the fertility potential of both the male and female partner, this review highlights the usage of homoeopathy in treatment of female infertility.

Objective: The review was done to explore the strengths of homoeopathy in management of female infertility through online available evidences.

Method and Materials: A search was made for homoeopathic management of female infertility in PubMed, Google Scholar, Google search engines was done to collect all relevant articles, case reports, published till October 2024. The term included was infertility and homoeopathic treatment, female infertility homoeopathic management.

Result: several studies were found and all were case reports.

Conclusion: Emerging evidence suggests that homoeopathy can complement infertility management, especially in cases where conventional treatments are either inaccessible or ineffective. This is attributed to its individualized and holistic methodology, which aims to harmonize patient's physical and emotional states. However, despite positive indications, the current body of evidence relies heavily on case reports rather than high-quality clinical trials. Expanding research through well-designed randomized controlled trials could validate these findings and help integrate homoeopathy as a viable complementary option for infertility treatment. Ensuring broader access to homoeopathy, particularly in underserved regions, remains a priority.

Key Words: Female infertility, homoeopathy, holistic approach.

1. INTRODUCTION:

"According to the World Health Organization (WHO), infertility is a condition characterized by the inability to achieve pregnancy after 12 months or more of regular, unprotected sexual intercourse." [9]

According to the WHO (2024), "one in six individuals experiences infertility globally."

Types

Infertility can be primary or secondary:

- Primary infertility denotes those patients who have never conceived.
- Secondary infertility indicates previous pregnancy but failure to conceive subsequently.

Hiralal Konar and DC Dutta (2013) in the textbook of Gynaecology extensively outline the **Causes of**

infertility,

Conception depends on the fertility potential of both the male and female partner. The male is directly responsible in about 30-40%, the female in about 40-55 % and both are responsible in about 10% cases. The remaining 10 % is unexplained, in spite of thorough investigations with modern technical knowhow. Causes of female infertility are as follows:

- Ovarian factors: The ovulatory dysfunctions
  - Anovulation or oligo-ovulation Decreased ovarian reserve
  - Luteal phase defect (LPD)
  - Luteinized unruptured follicle (LUF).
- Tubal (obstruction of the tubes)
- Uterine factors: uterine hypoplasia, inadequate secretory endometrium, fibroid uterus, endometritis (tubercular in particular), uterine synechiae or congenital malformation of uterus.
- Cervical factors:
  - Anatomic: congenital elongation of the cervix, second degree uterine prolapse and acute retroverted uterus.
  - Physiologic: fault in the composition of the cervical mucus, so much that the spermatozoa fail to penetrate the mucus. Scanty mucus following amputation, conization or deep cauterization of the cervix. The abnormal constituents include excessive, viscous or purulent discharge as in chronic cervicitis. Presence of antisperm or sperm immobilizing antibodies (immunological factor)
- Vaginal factors:
  - Atresia of vagina (partial or complete), transverse vaginal septum, septate vagina, or narrow introitus
  - Vaginitis and purulent discharge (pregnancy too often occurs in presence of vaginitis, specific, or nonspecific)
  - Dyspareunia
- General factors:
  - Advanced age of the wife beyond 35 years
  - Infrequent intercourse, lack of knowledge of coital technique and timing of coitus to utilize the fertile period
  - Anxiety and apprehension.
  - Use of lubricants during intercourse, which may be spermicidal.

Investigations for infertility

- Objectives of investigations:
  - To detect the etiological factor(s).
  - To rectify the abnormality in an attempt to improve the fertility.
  - To give assurance with explanation to the couple if no abnormality is detected.
- When to investigate? - the infertile couple should be investigated after one year of regular unprotected intercourse with adequate frequency or 6 months after the age of 35 years of the woman and 40 years of man.
- For female infertility:
  - History:
    - Age, duration of marriage
    - General medical history
    - Menstrual history
    - Previous obstetric history, including number of pregnancies, the interval between them and pregnancy related complications, in case of secondary infertility; history of puerperal sepsis to rule out ascending infection and tubal damage. Uterine synechiae after vigorous curettage.
    - Contraceptive practice: IUCD use may cause PID.
    - Sexual problems such as dyspareunia
  - Examinations - General, systemic and gynecological examinations are made to detect any abnormality
- Special investigations

- Diagnosis of ovulation
  - Indirect- Menstrual history, evaluation of peripheral or endorgan changes (basal body temperature (BBT), cervical mucus study, vaginal cytology, hormonal estimation, endometrial biopsy), Sonography (TVS)
  - Direct – Laparoscopy, Insufflation test (Rubin's test), Hysterosalpingography (HSG)

Conventional treatment includes,

- In general psychotherapy to improve the emotional causes, reduction of weight
- Drugs
- Surgery
- Artificial insemination (AI) – IUI (Intrauterine insemination), Fallopian tube sperm perfusion
- Assisted reproductive technology (ART)- In vitro fertilization and embryo transfer (IVF-ET). [3]

Homoeopathic approach:

The conventional treatment is no doubt giving a result in cases of female infertility but it also has the side effects and is more expensive which every couple cannot afford. In some cases, even after taking the treatment for a long enough duration the female cannot conceive. At this point, homoeopathy can help with the effective medicines which is based on individualization and holistic approach. Each case is taken into consideration for the individual selection of medicine according to symptom similarity. If we study the literature about the female infertility and homeopathy there are number of medicines available in books of homoeopathic materia medica and repertories.

Let's see some rubrics given in Murphy's homoeopathic medical repertory related to female infertility:

- Constitutions- WOMEN, general-infertility, uterine troubles: bor., *Calc., Nat-m.,* sep.
- Female infertility: NAT-C., NAT-M, SEP (total 52 medicines)
  - sexual desire, excesses, with
  - without
  - sycotic
  - vagina discharge, with
  - weakness, from
- Female - Menses, general -frequent, too early, too soon- infertility, in
- Mind - Depression, sadness - infertility, from
- Female - Bleeding, uterus, metrorrhagia - infertile, women: Argemtum nitricum
- Breasts - Atrophy, breasts - ovaries with infertility: Iodum.
- Female - Infertility - non retention of semen, from: Natrum carbonicum.
- Female - Infertility - ovarian atony, from: Eupatorium purpureum
- Female - Infertility - profuse, menstrual flow, from- and too early: Sulphur
- Female - Infertility - profuse, menstrual flow, from- and too early or too late: Phosphorus
- Female – Infertility - vagina discharge, with- acid, from: Natrum phosphoricum
- Female - Menses, general - scanty -infertility, in: Cantharis
- Female - Sexual, desire - increased - infertile women, in: Cannabis indica
- Pregnancy - Miscarriage, general, spontaneous abortion - tendency, to miscarriage - frequent and early, ovum expelled at every menstrual period causing infertility: Viburnum opulus [4]

Let's see some published case studies of female infertility treated with homoeopathy:
1) A Case report by Dr. Surala Parveen (2018), describes case of a 37-year-old woman, being married for 6 years, treated in the homoeopathic outpatient department, who has taken treatment of infertility by a gynaecologist for few years. With past history of emergency ovarian cystectomy for endometriosis 1 year after marriage, hydrosalpinx with one-sided tubal block along with poor ovarian reserve. Her husband's semen analysis was normal and was advised for donor-ovum in vitro fertilisation. At this point, she was treated with constitutional homoeopathic medicine following the miasmatic analysis with the holistic concept of Homoeopathy over 6

months. Treatment started with Silicea and later treated with Syphilinum. She conceived and delivered a healthy baby at full term.[6]

2) A case study by Dr. Sanchita Dharne (2020), describes a 35-years- old female with Primary infertility along with grade-2 endometriosis, bilateral endometrial cysts, and bilateral fimbrial block with history of unsuccessful attempt of in vitro fertilization, who achieved a successful pregnancy following 8 months of treatment with Iodum. [2]

3) A case study by Dr. Hayriye ALP (2021), describes a 38-year-old female patient successfully treated with Pulsatilla nigricans who diagnosed as secondary infertility, anosmia, myoma uteri, Hashimoto thyroiditis with the history of many unsuccessful IVF attempts, improved after 6 months of treatment with holistic approach of homeopathy and nutritional support.[1]

4) Dr. Sekhara Rao GC (2023), describes an evidence-based case of 36 Years old female, Mrs PA, presented with secondary infertility who has taken several treatments including hormonal and ivf without success. On basis of symptoms similarity, homoeopathic medicine Murex 200 was prescribed, after which the patient conceived and delivered a healthy baby. [8]

5) A case study by Dr. B. T. Rudresh (2024), describes a case of A 35-year-old female patient with secondary infertility, regular menstrual cycles since her menarche. Obstetric history of two spontaneous abortions in 2018 and 2019. one unsuccessful cycle of IVF in October 2019. *Sepia officinalis* was prescribed and after 11 months of treatment, she successfully conceived and delivered a healthy baby.[8]

6) A case study by Dr. Raj K. Pandit (2024), describes about a female patient, aged 30, married for 6 years, presented with inadequate ovarian reserve, advised to undergo in vitro fertilisation because her husband's semen analysis report was normal. She decided to take homoeopathic treatment and After 3 months of treatment with the constitutional homoeopathic drug Natrum muriaticum, she became pregnant and gave birth to a healthy boy at term. [5]

DISCUSSION: The documented case reports emphasize the potential effectiveness of homoeopathy in treating female infertility through a holistic approach. Each case demonstrates how individualized treatment addresses specific physical and emotional states, yielding positive pregnancy outcomes. For instance, constitutional remedies like *Natrum muriaticum*, *Sepia officinalis*, and *Silicea* were shown to aid in conditions ranging from endometriosis to poor ovarian reserve. These results suggest that homoeopathy can serve as a complementary treatment to conventional methods, offering hope for couples facing challenges in conceiving.

Homoeopathy's methodology, focusing on individualized care and symptom similarity, contrasts with the one-size-fits-all approach of many allopathic treatments. While these cases provide promising insights, their evidence level is limited, as most are anecdotal or derived from case series. To establish the broader efficacy of homoeopathy, rigorous comparative studies and randomized controlled trials are essential. Further exploration could enhance accessibility to homoeopathic treatment in outpatient settings, especially for economically disadvantaged populations.

CONCLUSION

Emerging evidence suggests that homoeopathy can complement infertility management, especially in cases where conventional treatments are either inaccessible or ineffective. This is attributed to its individualized and holistic methodology, which aims to harmonize patient's physical and emotional states. However, despite positive indications, the current body of evidence relies heavily on case reports rather than high-quality clinical trials. Expanding research through well-designed randomized controlled trials could validate these findings and help integrate homoeopathy as a viable complementary option for infertility treatment. Ensuring broader access to homoeopathy, particularly in underserved regions, remains a priority.

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A CLINICAL INSIGHT INTO DIZYGOTIC TWINS WITH MIASMATICCONSIDERATIONS

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Abstract: This observational and interventional case report about dizygotic twins aims to explain the phenomenon of what accounts for the similarities in these twins, which is very unusual, This can be explained by the study of miasmatic understanding and prescription in the cases were the same despite different clinical presentations. Prescription incorporated assessment of Miasms, Individualization, susceptibility and disposition by constantly comparing the twins.

Key Words: Twins, Miasms, Tuberculinum,

INTRODUCTION:

As Science Explains That Dizygotic or Non- Identical Twins Result From Two Separate Eggs that are fertilized with Two Separate Sperms during the Pregnancy. Fraternal Twins are known to have Separate Sex (50% Chance) and Share Only Half of Their Genomes. Non-Identical Twins always have Two Placentae, Although They May Be Fused intoOne and May Not have the Same Blood Group. Hence, they are Just like Any Other Siblings. Non-Identical Twins are therefore Only Sometimes the Same. Whereas Identical Twinsare about 85% Similar Even for I.Q. The Famous Case Of Identical Twins Springer Brothers, That Were Reared 45 Miles Apart and Upon Being Reunited 39 Years Later. It Was Shocking to Discover that Both Had Same Choice Of Car Models, Same Breed Of Pet Dogs, Same Addiction to A Particular Brand Of Cigars and Even Responded almost Exactly alike. What Was Fascinating to Study these Non-Identical Twins Was that Although Clinical Presentation Wise, They were differing in kind yet they were very similar in certain miasmatic manifestation that reminds me of Aphorism no 26.

I set Out to Explore and Understand What Accounted for the difference in Sensitivity, Sensibility, Susceptibility, Disposition and Pattern of Response in these Non-Identical Twins. Although they were not Identical Twins Yet they had Many Features in Common, Which Was Very Unusual. Homeopathic Therapeutic Intervention was done for these Non-Identical Twins.

1. LITERATURE REVIEW: Jim Lewis and Jim springer were identical twins that were reared 45miles apart and upon being reunited 39 years later. It was shocking to discover that both had same choice of car models, same breed of pet dogs, same addiction to a particular brand of cigars and even responded almost exactly alike. What was fascinating to study these non-dizygotic twins in my study was that although clinical presentation wise, they were differing in kind yet they were very similar in certain miasmatic manifestations that reminds me of aphorism no 26. Tuberculinum references

that explain the prescription in the dizygotic twins; intense inward restlessness (H.C Allen), complaints begin suddenly and cease suddenly (C.M Boger), never satisfied in one place (E .B Nash), students constantly change field of interest, still dissatisfied. Eventually became intellectually sluggish (wheeler). Desire to break things, spit, curse, use foul language (William Boericke).

2. OBJECTIVES: To Define the role of Miasms, individualization, susceptibility, & explain prescription through disposition by comparing dizygotic twins. To explain what accounts for the phenomenon of two different clinical presentations yet with miasmatic resemblances leading to same prescription of tuberculinum as a prescription in the dizygotictwins.

3. METHODOLOGY: Source of Study - dizygotic twins or fraternal twins which are otherwise known as non-identical twins

Duration of study - from 07ᵗʰ may 2022 to 04ᵗʰ January 2023. (8 months)

Method ɗcollection of data-This is an Observational & Interventional case report carried out in outpatient Departmental setting in the year 2022. The tool used for this study is interview technique. Sample size wasjust one family unit comprising of 6 year old girl and a 6 year old boy non-identical twins.

Homoeopathic Therapeutic Intervention was done for these non-identical twins.

4. RESULT: The Girl Improved in period of 6 months and her weight also increased along with disappearance of recurrent tendency for respiratory attacks. The Boy Improved in periodof 8 months' time in his complaints of nocturnal enuresis and constipation.

5.DISCUSSION : Case 1 Girl is having recurrent problem of respiratory tract for years together, how much she has to fight out to sustain herself and to recover, she has to pay more energy because of her susceptibility, the available totality is as follows: fearful & obstinate personality with her fear especially of thunderstorm are her disposition. At physical level nail biting with white spots, early greying of hairs, grinding of teeth in sleep, desire for chocolate, aversion milk, all these things are related with tubercular miasm. She is intelligent with good grasping power. We see tubercular activity reflected in her chief complaint, overall, even in acute condition with her dispositional symptoms in acute condition as well as observed in the physical make up. Hence tuberculinum bovinum 1m is the nearest drug covering miasm, disposition, mind, body, particulars and everything. Follow up after 1 month: no cough or cold nor fears. No medicine was given. 15 days later: child came up with high fever with coughing while lying down, thirsty, palms & soles normal, head warm. Ailments from cold drinks, getting exposed to rain and eating outside food. Loss of appetite, intense weakness. Phosphorus lM, repeated 12 hourly. 1 doses given as S.O.S. follow up after 2 days. Expectoration not present

constantly, but in between there is little expectoration. Dry cough only. Child cough manage without mother being besides her. Earlier she would not allow mother even to go to kitchen. Gradually appetite improved with placebo. In August 25th again another episode of cough and cold. It was for short duration. Placebo was given. (Homoeopathic Aggravation seen at end of chronic treatment aphorism 161). Placebo given. Thereafter no much problems of cold cropped up. Follow up 4th November 22: frightened seeing fights in colony. Clinging to mother for few days. Weight increased to 29.3kgs. Follow up March 23: respiratory attacks completely under control. Less fearful. Nail biting reduced. Child is become balanced.

Case 2 has physical complaints of bedwetting and urinary tract infection. This boy mimics his sister as she is intelligent & artistic. Even heredity wise they are replicas in terms of greying of hairs and other things. Everything is of a lower level in terms of quality and in quantity in him. His copying attitude,where he is less sensitive compared to his sister and has no mind of his own, this separates him fromsister. Disposition wise whatever the girl has, he has not got, although they are from the same ovum of the mother. He is a second copy. In sycotic miasm, one important aspect is that, it is easy for him to copy others than to make real effort simply because sycotic are generally dull and sluggish. Constipation, poor concentration, confusion means sluggishness of the system which is observed in case two. Tuberculinum also has sycotic expressions that are cited by Boericke & Boger in their materiamedica's like Rheumatic symptoms, constipation, paucity of symptoms, yellow staining perspiration,aggravation from cold damp weather. Discharges aggravate. If you look into repertory under rubric dullness, tuberculinum is mentioned as three marks. He received tuberculinum 200. 3 doses. Graduallyascending higher potencies, in two months bedwetting reduced by 80% and constipation also improved simultaneously. In eight months' time, not a single episode of bedwetting. And no sign of constipation.

6. CONCLUSION: Medicines Administered - Tuberculinum was administered in both cases only the potency and repetitions differed. In first paragraph of Kent's materia medica while reading tuberculinum, he warns us not to have fixed concept of using tuberculinum bovinum as a Nosode only. it can be the finest constitutional remedy like other polycrest drugs. Hence the idea of using tuberculinum only as Intercurrent must be abolished. One should also not give tuberculinum bovinum routinely if there if family history of tuberculosis,which Burnett was advocating.

Take Home message is every drug can have different Miasms expressing in different areas.

Comparing the sensitivity and susceptibility of these non-identical twin children, although the drug required to cure them is the same. The reason behind these individual differences is that the girl withher high sensitivity belonged to tubercular miasm whereas the boy with his slower responses

and lower sensitivity was sycotic. Drug acts at all the levels if given based on indications covering up everything. a perfect prescription is not just based on totality of symptoms(Aph 7) but must also incorporate constitution, lifestyle, hygiene and *predisposition or* Miasms.

7. RECOMMENDATIONS: Longitudinal Studies on such dizygotic twins may be carried out focusing on developmental, genetic and environmental contribution to understand individual differences in children and adolescent's social behaviour.

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AUTISM/BOWEL NOSODES/PATHOLOGICAL CASES

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Abstract:

Autism: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and the presence of restricted interests and repetitive behaviors.
Bowel Nosodes: Bowel Nosodes are the medicines prepared from the non-lactose fermenting pathogenic intestinal flora.Dr Bach and Dr Paterson carried out extensive research.
Pathological Cases: Normally, these are cases of greater than normal clinical interest, cases with unusual symptoms and/or diagnostic findings.

Key Words: Bowel Nosodes, Autism Spectrum Disorder, Retention of Urine after Spine Surgery, Nephrotic Syndrome, Homeopathy.

CASE 1) CASE OF RETENTION OF URINE AFTER SPINE SURGERY
Introduction:

A 66 year old female patient, had been consulting us for Hypothyroidism, Gastric Complains and Diabetes Mellitus since a few years. She had a past history of major road accidental injuries, especially in her spine, which was treated by multiple operations.She had been doing really well with Natrum Carb as her constitutional remedy.

In first week of August 2024, she got operated for Lumbar Disc Prolapse. She was catheterized and also suffered from constipation and acidity post surgery. All these were considered normal post surgical complications. But the problem started when even after 30 days of the surgery, she was unable to pass urine without catheterization. Neurophysicians tried every possible remedy, but nothing worked. They had lost all hopes and said that she might have to be catheterized for the rest of her life. This is when the family members came to us. As she was much better with Natrum Carb, we gave her Natrum Carb 200 BD for 3 days. But there was no change.

So we had to think of something else.
Analysis:

We took the following rubrics:
- Bladder: Paralysis: Surgery: After
- Bladder: Retention of Urine: Surgery, from

Remedy given:

The remedy which came up from the rubrics was Causticum.
We prescribed Causticum 200 BD for 3 days on 02/09/24.

Follow-up:

On the very next day on 03/09/24, her husband came excitedly to clinic to share that she could pass urine without catheterization! Even the neurophysicians were taken by surprise!

CASE 2) CASE OF CHRONIC CONSTIPATION

Introduction:
     A 5 year old girl came to us with complain of chronic constipation, on 12th November 2018. Her parents gave the following history..

Chief Complains:

1) Chronic Constipation
- Since her birth, this child is suffering from severe constipation.She passes stool every 2 to 3 days, and that too with help of suppositories. Without help of suppository, there is absolutely no defecation. Every time she passes stool, there is bleeding along with it. First part of stool is very hard, following which there is normal soft stool. What is peculiar is that she passes stool while standing. Even if her mother makes her sit, as soon as stool comes out of rectum, she immediately stands up. And this makes the stool recede back into rectum.
- She gets urge for passing stool at times, but no stool passes out.Since the complaint is persistent from birth, no causative factor was ascertained. Neither has there been any aggravating or ameliorating factor.

2) Worm Infestation
- Since last 2 months, patient has worm infestation with Tinea infection on various parts of her body.
- Causation: As per mother, it is due to extreme intake of sweets. From age of 1.5 years, she has been eating nothing other than sweet milk with bananas and sweet porridge.
- She has extreme itching around anus and asks her mother at least 10 times a day to clean and rub her anus. Mother feels that she maybe feeling better with cold water application around anus.
- She has multiple tinea infection on her face, chest and both shoulders.
<after eating sweets the itching increases.
>cold water application.

Physical Generals:

1) Appetite: Has to be force fed, doesn't ask for food even if whole day passes. Only eats sweets.
2) Thirst: Very less. Only drinks water while eating, not otherwise.
3) Desires: Sweet foods. Sweet porridge, bananas. She loves salads, raw cabbage, tomatoes, cucumber. Loves Ice-cream.
4) Aversion: Salty and spicy foods.
5) Perspiration: Very less.
6) Bowel: As above.
7) Urine: N.A.D.
8) Sleep: N.A.D. Sleeps on her abdomen with knee-chest position.
9) Thermal State: Hot patient. Completely dislikes coverings. Bathes with cold water in every season.

Obstetric History:

1) Delivery: Normal
2) Birth weight: 2.5kgs.
3) Cry at birth: Present.
4) Complains during dentition: Nothing severe.
5) Milestones:
 - Teething = 6 months
 - Sitting = 6 months
 - Walking = 1 year 2 months
 - Talking = 2 years
6) Complains after vaccination: None.
7) Pregnancy State of Mother: N.A.D.

Past History:

- Recurrent boils from age of 1 to 2 years. Treated by Allopathic Medicines on and off.

Family History:

- Maternal GM = Diabetes, H/O Uterine Cancer, Cardiomegaly.
- Father = Diabetes

Mental State:

- She is an extremely obstinate and stubborn child. She doesn't listen to anybody, does not get convinced at any cost. If she wants anything, she wants it at any cost. If her demand is not fulfilled, she will throw severe tantrums. She screams and shrieks the loudest, so loud that it is heard in her whole neighborhood.
- Her anger is so severe that she bangs her head with her hands, or bangs her head to wall. For e.g., she once ruined neighbor's Rangoli, for which she was scolded. She reacted by loud screaming and shrieking and crying. Her parents had to buy her fire-crackers to calm her.
- Her mother says that her main nature is of shrieking. She knows that by shrieking, all her demands will be fulfilled. If she is denied of watching tv, or anything that she wants to do, she yells and rolls on the floor.
- She has extremely peculiar desires. She eats soap, dissolves soap in water and drinks it, eats shampoo, drinks hair oil, eats talcum powder, pulls out her own hair and eats them, and also eats dog food. If denied, she throws major tantrums.
- She loves playing in cold water, goes and sits in tub of water. When taken for bathing, it is extremely tough to handle her as she wants to eat soap and shampoo.
- She has no fear. She runs behind dogs, pulls their tails and legs. She runs behind insects, picks them up and breaks them into pieces. She doesn't get afraid even if her mother warns her to lock her into the bathroom or of hitting her. Her only fear is of darkness.

Analysis:

- She is a fearless child, with only one fear, i.e., of darkness.
- She is obstinate and headstrong.
- She has temper tantrums, bangs her head on other things when angry.
- When angry, she rolls on the floor, which is most peculiar.
- Screams and shrieks in anger.
- Has desires for inedible things.
- Main complains are bowel related, i.e., chronic constipation, ineffectual urging and straining.
- Also has itching in anus.
Rubrics:

[Complete] [Mind]ANGER:Temper tantrums: (87)
[Complete] [Mind]ANGER:Temper tantrums:Falls on the floor kicking and shrieking: (6)
[Complete] [Mind]ANGER:Violent: (191)
[Complete] [Mind]BATHING, WASHING:Amel.: (17)
[Complete] [Mind]CRAWLING, ROLLING:Anger, during: (1)
[Complete] [Mind]FEAR:Dark, of: (125)
[Complete] [Mind]DESTRUCTIVENESS: (114)
[Complete] [Mind]OBSTINATE, HEADSTRONG: (220)
[Complete] [Mind]ROLLING:Floor, on: (14)
[Complete] [Mind]STRIKING:Oneself:Knocking his head against things: (26)
[Complete] [Mind]STRIKING:Oneself: (44)
[Complete] [Rectum]ITCHING:Anus: (312)

[Complete] [Generalities]FOOD AND DRINKS:Inedible things:Desires: (42)

[Complete] [Mind]FEARLESSNESS: (90)

Repertorisation:

Remedy Given:

Proteus 200 (weekly for 1 month)

Follow-up:

On 27th December, 2018 - a lot of improvement seen in constipation. Bleeding has completely stopped. Stool consistency has become normal. She does not have much trouble in passing stool. 80% improvement seen.

On 21st February, 2019 - Passes stool daily, in sitting position. No bleeding, no hard stool. Completely fine.

CASE 3) CASE OF AUTISM SPECTRUM DISORDER
Introduction

A 3 year old boy was brought to our Special Children OPD by his parents with Autism Spectrum Disorder in March 2018.
Chief Complains (as described by his parents)

He is a hyperactive kid, very naughty. He would constantly run around, and get angry easily.

He cannot talk. He can only speak a couple of words namely "mama" and "dada". He has no eye contact. He is moody, would only respond to his name if he wants to.

He loves to play new games. You teach him a new game once, and he will learn it immediately. He will keep doing a certain thing until he gets success in it.

When did you notice about his ASD? – Till 1.5 years age, he was very quiet and calm. We couldn't even make out that there is a kid in the house. But after he started walking, he gradually became hyperactive. And till 2.5 years when he didn't speak, we decided to consult his pediatrician. He diagnosed him with Hyperactivity and Autism.

What do you think might be the cause? – We have no idea. We thought that since he is a naughty kid,

he will be late in learning to talk.

He is very naughty. He bites, pulls hair and throws things when he is angry. He would just constantly run around all day. He also hits people.

He is so naughty that he cannot be kept alone; someone has to be with him the whole time. He just runs around, climbs anywhere, and jumps from anywhere.

But one peculiar thing about him is that however hyperactive he maybe, he takes good care of himself. He may climb up and down, run on roads, but never has he been injured.

Physical Generals

Appetite: He doesn't chew. He eats everything soft and crushed. Doesn't prefer things that need to be chewed. He loves to eat dal-rice. If we don't give food of his liking, he would stay hungry but not eat anything else.

Thirst: Normal.

Desires: He loves sweets. And prefers soft, crushed food that doesn't require chewing.

Aversion:Apart from a few things like Dal-rice, wafers, sweets and milk, he doesn't eat anything else. He rejects every new food.

Perspiration: NAD

Bowel: He is severely constipated since last 1.5 to 2 years. Maybe because he drinks less water. He doesn't pass stool for 2 days and when on third day he does, it is very hard and he has to strain a lot. His stool smells very bad. So offensive that even after repeatedly washing with soap, the smell doesn't go.

Urine: NAD

Sleep: NAD. He either sleeps on his abdomen or on his sides, never on back.

Thermal State: Hot Patient. He doesn't sleep in hot environment. Even in winters, he doesn't accept covers.

Past History: NAD

Family History: His grandfather is a diabetic. He has an elder sister.

Obstetric History: NAD

No abnormality found in his birth history. All his milestones except speech were normal.

Mental State

If you scold him or take anything from him, he would scream at the top of his voice. He is very obstinate.

He is very perfect otherwise. He would keep everything at its respective place.

When he is angry, he bites, pulls hair and throws things.

He is very stubborn, would only eat if he wants to.

Fears? – Nothing. He is a strong kid. Only if someone scolds him, and that too very loudly, he gets afraid. At that time he may also get fever. But otherwise nothing scares him.

Does he prefer to be alone/in company? – In company.

Hobbies? – TV, mobile phone, playing with new toys and new games. He loves travelling in a car. He is very quiet while he is travelling in a car. He loves to play cricket.
He is very smart in mobile games, rarely loses.

Shy/mixing? – Not shy at all.

Slow/fast? – Very fast.

Is he destructive? – Yes, very. He will break his toys, remote control, his bicycle even.

How is his behavior with his sister? – They fight a lot. If his sister snatches something from him, he would pull her hair, bite her. Sometimes even if she is sitting quietly, he would suddenly go and pull her hair and bite her out of nowhere.

Analysis

- Hyperactivity
- Suddenness
- Biting

Repertorisation

1 MIND - BITING - children, in			
2 MIND - GESTURES, makes - pulls hair of bystanders			
3 MIND - OBSTINATE - children			
4 MIND - PULLING - hair			
5 MIND - SHRIEKING - children, in			
6 MIND - TALKING - slow learning to talk			
GENERALS			
7 GENERALS - SUDDEN manifestation			

Remedies	ΣSym	ΣDeg	Symptoms
bell.	7	14	1, 2, 3, 4, 5, 6, 7
tub.	6	11	1, 3, 4, 5, 6, 7
cupr.	5	7	1, 3, 4, 5, 7
ant-c.	4	6	3, 4, 5, 7
hyos.	4	4	1, 3, 5, 7
tarent.	4	4	1, 3, 4, 7

Remedy :
Belladonna 200
Follow-up:
Video

CASE 4) CASE OF NEPHROTIC SYNDROME

Introduction:
A 3 year old girl, diagnosed with nephrotic syndrome was brought to us in June 2021 by her parents. This is what her parents described..

Chief Complains:
She has had puffiness in her eyes from the same time last year. Initially we thought it was some kind of allergy, so we went for some blood and urine reports, and we came to know there was albumin loss. Thus nephrotic syndrome was diagnosed.
She has a history of UTI, was admitted to hospital twice due to that when she was 10 months old. Even now if she drinks less water, she has burning pain while urinating and reports show pus cells. She is an IVF conceived baby.

1) Nephrotic Syndrome

<u>Since when did you come to know about it</u>? – Last year when there was puffiness in her eyes, there was protein +++ in her urine. It was diagnosed at that time. This is the third relapse. She becomes fine with the dose, and as soon as we taper the dose, there is protein loss in urine.

She does not wet her bed. If we take her for urination, she would go. But she won't go by herself.

<u>Cause of Nephrotic Syndrome</u>? – We don't know. Doc said that it might be due to some viral infection. But nothing of the sort has happened. She doesn't even eat junk foods. Her food habits are quite healthy.

<u>Complains/symptoms</u>? – She gets swelling in her eyes whenever there is relapse. She gets irritable, starts to cry a lot, and her crankiness increases. She gets a lot of mood swings, and becomes mischievous. She is otherwise a very active and playful kid.

<u>Swelling</u>? – There is swelling on her eyelids. It is mostly in the morning, and reduces as he takes breakfast. We are not able to taper the dose of Prednisolone below 6.5ml. Below 6.5ml, the swelling and puffiness starts, and there is albumin and protein loss in her urine.

< nothing.

> Prednisolone, diuretics.

<u>Physical Generals:</u>

1) Appetite: Normal. She becomes obstinate and weepy when she is hungry.
2) Thirst: She is thirstless, hardly drinks 500ml per day.
3) Desires: She loves rice. Also likes buttermilk, sprouts, peas, peanuts and dry fruits.
4) Aversion: She does not prefer sweets or fruits. She drinks fruit juices.
5) Perspiration: She perspires a lot, on her head and forehead. She cannot tolerate moderate heat too.
6) Bowel: NAD.
7) Urine: When she had recurrent UTI, she had burning pain while urinating. That has stopped since 5 to 6 months.
8) Sleep: NAD. She sleeps on her abdomen.
9) Thermal State: Hot. She needs both AC and fan.

Past History: NAD
Family History: NAD
<u>Birth History</u>:

Conceived via IVF when mother was 35 and father was 37.
Weighed 2.8 kgs at birth.
All milestones normal.
Pregnancy state of mother was also normal.
<u>About her nature</u>:

- She is a jolly kid. She might take a while to mingle with new people, but would still wave at them.
- She loves watching rhymes. She has a good memory and remembers all rhymes.
- She wants her mother around. She also enjoys playing with kids her age and with toys. She is playful.
- She loves to talk, would talk all day.
- She is not stubborn, can be easily distracted.
- She is a strong girl, wouldn't cry much when she falls down or hurts herself. Loves playing on the swings and slides.
- She loves to explore new things. Would see it, even touch it. We have to stop her from touching new things.
- She loves mechanical things, like opening screws. Also loves to draw and paint.
- She is not destructive. Rather keeps everything at place, even wants her bed clean. She's systematic that way.

- Fears? – She's not afraid. When I tell her stories of dinosaurs or ghosts, she playfully hides under the blanket, but is not afraid. She feels bad when we scold her. Otherwise she's strong. She is not afraid of animals too. She wants to touch dogs and cows. She would kill ants and bugs with her bare hands. She

would also go in dark.

- Feels bad when scolded? – She would go and complain to her grandfather. But she forgets about it very quickly. She would apologize if she's at fault.

- When her medicinal dose is tapered, she becomes stubborn in a way that she constantly repeats things and when we get irritated and scold her, she cries. She would scream and shout at times.

- She loves cakes and pastries and donuts. She doesn't demand chocolates, but loves to eat cakes and pastries. Every few days, she has craving for cakes.

- She likes to play with balls rather than dolls. She also prefers to dress up like boys – in tshirt and jeans rather than frocks.

- What makes her unhappy/sad? – When she is scolded or denied to do something. Usually she is very understanding and obeys us, but some days when we deny her to use tablet/phone, she feels sad. But then again, she is easily distracted.

- Does she prefer staying alone / in company? – In company. She loves when guests come home, dislikes when they leave.

- Nature during infancy? – She was a good kid. She would sleep even in loud noises. But she didn't like to be alone. She always wanted someone to be around her.

- Hobbies? – Drawing with water colors, crayons, pencils. Loves listening to stories, watching animated movies, rhymes and cartoons. Prefers animals related movies or stories.

- Is she shy/mixing? – Mixing. Lockdown made her a bit shy, but otherwise she is too mixing. She is too talkative, talks and talks till she sleeps.

- Is she slow/fast? – Fast.

- How is her behavior with kids her age? – She is playful, never harms anyone. She prefers playing with boys more than girls. She wants to run around rather than sit and play with dolls.

- Is she stubborn? – Not much. She demands something, but gets distracted easily.

- What makes her angry? – Sometimes when her demands are not fulfilled, she screams and shouts. She throws her toys. But this is only after this disease and its medicines have started. She gets distracted easily though.

- She loves to play in water, sits in a tub filled with water.

- She is a bit impatient like her father and grandparents.

Analysis:

	ter.	phos.	puls.	lyc.	sil.	aps.	iod.	kali-c.	ars.	acon.	bell.	canth.	dulc.	kali-p.	nux-v.	sulph.	benz-ac.	bry.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	5 10	5 9	5 9	5 8	5 7	4 9	4 8	4 8	4 7	4 6	4 6	4 6	4 6	4 6	4 6	4 4	4 4	4 4
1. EYES - SWELLING - general - edematous (69) 1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1
2. MIND - IRRITABILITY - children, in (47) 1	1	1	1	3	-	3	-	1	-	-	-	1	1	-	-	1	1	1
3. MIND - SHRIEKING, screaming, shouting - children, in (71) 1	1	1	3	1	1	3	-	3	-	3	1	1	3	3	1	1	1	1
4. KIDNEYS - CHRONIC (95) 1	3	3	1	1	1	1	1	1	1	1	1	1	-	-	1	1	1	-
5. URINE - ALBUMINOUS (229) 1	4	3	3	4	1	4	3	3	4	1	3	3	3	1	1	3	1	1

<u>Remedy given</u>:
Terebinthina 200
<u>Follow-up</u>:
Video
REFERENCES:
Original cases from Dr Ajay Shah's Vrundavan Homeopathic Clinic, Rajkot, translated to English from patient's mother tongue.

GENERALIZED ANXIETY DISORDER AND TRITICUM VULGARIS: CASE SERIES RESULTS ANALYSED VIA THE HAMILTON ANXIETY RATING SCALE

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Abstract

Background: Generalized Anxiety Disorder (GAD) is a chronic condition characterized by excessive and persistent worry, often accompanied by physical symptoms. Conventional treatments include psychotherapy and pharmacological agents, but alternative approaches like homoeopathy are increasingly explored. Triticum vulgaris, a lesser-known homoeopathic remedy, has shown potential in addressing symptoms of anxiety. This study investigates its efficacy in treating GAD using the Hamilton Anxiety Rating Scale (HAM-A) as an evaluative tool.

Objective: To assess the therapeutic role of Triticum vulgaris in alleviating anxiety symptoms in patients with GAD.

Methods: A case series involving patients diagnosed with GAD based on DSM-5 criteria was conducted. Each participant received Triticum vulgaris in individualized potencies based on classical homoeopathic principles. The HAM-A scale was administered at baseline, during follow-up, and after the treatment period to monitor changes in anxiety levels. Observational parameters included the severity of somatic and psychic symptoms and the impact on daily functioning.

Results: The study demonstrated a significant reduction in HAM-A scores in all participants, reflecting improvements in both psychic and somatic domains of anxiety. Triticum vulgaris was well-tolerated, with no adverse effects reported. Case narratives indicated an enhancement in emotional stability and overall well-being.

Conclusion: The findings suggest that Triticum vulgaris may offer a safe and effective alternative for managing GAD. Further randomized controlled trials are recommended to substantiate these preliminary observations and explore the underlying mechanisms.

Keywords: Generalized Anxiety Disorder, Homoeopathy, Triticum vulgaris, Hamilton Anxiety Rating Scale, Alternative Medicine

Introduction:

Mental health is often associated with lots of stigma and discrimination. There is little comprehensive data on the prevalence of psychological disorders around the world. But estimates suggest one in seven people on the planet have mental or substance-use disorders, and4% have anxiety disorders. (Generalized Anxiety Disorder (GAD) is a prevalent and debilitating mental health condition characterized by excessive and persistent worry or anxiety that is difficult to control. These worries often span a broad range of domains, including personal health, work, finances, and interpersonal relationships, and persist for six months or longer. Unlike transient anxiety triggered by specific stressors, the anxiety in GAD is pervasive and often disproportionate to the actual circumstances. Symptoms of GAD encompass psychological, physical, and behavioural dimensions. Individuals frequently report feelings of restlessness, fatigue, difficulty concentrating, irritability, muscle tension, and disrupted sleep patterns. These symptoms significantly impair daily functioning and quality of life. The condition affects approximately 3–6% of the population annually and often co-occurs with other mental health disorders, such as depression, making its diagnosis and treatment particularly challenging. The aetiology of GAD is multifaceted, involving a combination of genetic, environmental, and neurobiological factors, with dysregulation of neurotransmitters like gamma-aminobutyric acid (GABA) playing a critical role. The study involves a series of cases where Triticum Vulgaris 200 which is *prepared from the germ of the wheat plant* was administered and the outcome was assessed with Hamilton Anxiety Rating scale. The **Hamilton Anxiety Rating Scale (HAM-A)** is a commonlyy used tool to assess the severity of anxiety symptoms.

Structure of HAM-A

The scale consists of **14 items**, each representing a symptom category of anxiety. Each item is rated on a scale of **0 to 4**, where:

- **0:** Not present

- **1:** Mild

- **2:** Moderate

- **3:** Severe

- **4:** Very severe

Total Score Range: 0 to 56

- **<17:** Mild anxiety

- **18–24:** Moderate anxiety

- **25–30:** Severe anxiety

Symptom Categories in HAM-A

The items are divided into **psychic anxiety** and **somatic anxiety** domains:

1. **Psychic Anxiety (7 items):**

   o   Anxious mood

   o   Tension

   o   Fears (e.g., of the dark, strangers, being alone)

   o   Insomnia

   o   Intellectual impairment (e.g., difficulty concentrating)

   o   Depressed mood

   o   Behaviour at interview (e.g., fidgeting, restlessness)

2. **Somatic Anxiety (7 items):**

   o   Muscular complaints (e.g., aches, stiffness)

   o   Sensory complaints (e.g., tinnitus, blurring of vision)

   o   Cardiovascular symptoms (e.g., palpitations, chest pain)

   o   Respiratory symptoms (e.g., shortness of breath)

   o   Gastrointestinal symptoms (e.g., nausea, diarrhoea)

   o   Genitourinary symptoms (e.g., frequency of urination)

   o   Autonomic symptoms (e.g., dry mouth, sweating)

Administration and Scoring

The clinician evaluates the patient through an interview, asking about symptoms experienced in the past week. Each symptom is rated based on its intensity and frequency. Scores for each category are totalled to derive a final HAM-A score.

Study Setting:

This case series was conducted in a Private OPD. Participants were recruited from individuals seeking treatment for anxiety at a mental health clinic. The clinic is located in an urban area, serving a diverse population with varying socioeconomic backgrounds. This study included three males and one female

patient suffering from Generalised Anxiety disorders, who were treated at Pareek Homeopathy Clinic, Chandwad, Maharashtra, India between the period 2022-23, however the compilation of these cases was done retrospectively in 2024. They came for homoeopathic treatment after not getting results from the treatment of other systems of medicine

Intervention and Monitoring:

Participants were administered Triticum vulgaris in 200 potency as per the study protocol. Sessions were held biweekly, during which HAM-A scores were assessed to monitor the severity of anxiety symptoms. The study duration was 1 year, providing sufficient time to observe the therapeutic effects of the intervention. Data collection included self-reported symptom relief, adherence to the intervention, and adverse event monitoring. This structured setting ensured consistency in treatment delivery and accuracy in the measurement of therapeutic outcomes, making it suitable for analyzing the efficacy of Triticum vulgaris in GAD management.

Homoeopathy is a system of medicine which is practiced in India based on symptoms similarity with minimal side effects. Previous studies revealed that homoeopathic medicine, Triticum vulgaris has a significant effect on GAD. Through the following case series, the effect of potentized and succussed homoeopathic medicine (dilution) Triticum vulgaris, is shared.

Case 1

Patient is a 35-year-old male patient presented with symptoms of anxiety for past six months. He had constant worry, restlessness and difficulty in concentration. Sleeplessness due to intensive thoughts with frequent palpitations, dry mouth and occasional trembling. No significant past medical history. No substance abuse or dependency. He was diagnosed with Generalized Anxiety Disorder (GAD) based on DSM-5 criteria.

Pre-Treatment Evaluation (Using HAM-A)
Baseline HAM-A Score:
Psychic Anxiety (mental agitation and psychological distress): 18/28
Somatic Anxiety (physical complaints related to anxiety): 16/28
Total HAM-A Score: 34/56 (Severe Anxiety)

Symptom Category	Before Treatment	After Treatment
1. Anxious Mood	4	1
2. Tension	3	2
3. Fears	2	1
4. Insomnia	2	0
5. Cognitive	3	2
6. Depressed Mood	2	0
7. Somatic Sensory	2	1
8. Somatic Muscular	3	2
9. Somatic Cardiovascular	2	1
10. Respiratory Symptoms	3	1
11. Gastrointestinal	2	0
12. Genitourinary	2	0
13. Autonomic Symptoms	2	1
14. Behaviour During Interview	2	0

Treatment: *Triticum vulgaris* 200, administered in a single dose, followed by placebo for daily continuation. 6 globules of *Triticum vulgaris* 200 once daily for 7 days, reviewed weekly for six weeks.
Treatment Course and Observations

Week	Symptoms	HAM-A Score
1	Slight improvement in sleep; reduced waking at night	27/56 Psychic Anxiety: 16/28 Somatic Anxiety: 11/28

Week	Symptoms	HAM-A Score
2	Noticeable decrease in palpitations; improved concentration at work.	24/56 Psychic Anxiety: 14/28 Somatic Anxiety: 10/28
3	Significant reduction in intrusive thoughts and restlessness	19/56 Psychic Anxiety: 11/28 Somatic Anxiety: 8/28

Discussion: The patient showed progressive improvement, particularly in psychic anxiety symptoms. Somatic complaints also reduced but at a slower pace. No adverse effects were reported. Patient was advised to practice mindfulness meditation and reduce caffeine intake, which likely supported the therapeutic process.

Case 2
Patient is a 42-year-old Female presented with Persistent anxiety with panic-like symptoms over the last year. She had Frequent episodes of intense fear accompanied by chest tightness and rapid breathing. Persistent worry about family safety, leading to difficulty managing daily activities. sleeplessness with delayed onset of sleep and early waking. She had also reported muscle tension, trembling, and a sensation of choking during anxiety episodes. History of thyroid dysfunction (well-controlled), no psychiatric comorbidities. She was diagnosed with Generalized Anxiety Disorder (GAD) with episodic panic attacks.

Pre-Treatment Evaluation (Using HAM-A)
Baseline HAM-A Score:
- Psychic Anxiety (mental distress and psychological symptoms): 20/28
- Somatic Anxiety (physical symptoms of anxiety): 14/28
- **Total HAM-A Score:** 34/56 (Severe Anxiety)

Symptom Category	Before Treatment	After Treatment
1. Anxious Mood	4	1
2. Tension	3	2
3. Fears	2	1
4. Insomnia	2	0
5. Cognitive	3	1
6. Depressed Mood	3	0
7. Somatic Sensory	3	0
8. Somatic Muscular	3	0
9. Somatic Cardiovascular	2	1
10. Respiratory Symptoms	3	1
11. Gastrointestinal	2	0
12. Genitourinary	1	0
13. Autonomic Symptoms	1	1
14. Behaviour During Interview	2	0

Treatment: *Triticum vulgaris* in 200 potency was administered as a single dose followed by placebo over 4 weeks. 6 globules of *Triticum vulgaris* 200, repeated weekly for 3 weeks.

Treatment Course and Observations

Week	Symptoms	HAM-A Score
1	Slight reduction in the frequency and intensity of panic episodes. Sleep improved marginally.	30/56 Psychic Anxiety: 18/28 Somatic Anxiety: 12/28

3	Panic episodes reduced to one mild episode. Improved energy and better control over intrusive thoughts.	24/56 Psychic Anxiety: 15/28 Somatic Anxiety: 9/28
5	No panic episodes in the last two weeks. Significantly reduced muscle tension and tremors. Reported feeling more confident and calmer during daily activities	16/56 Psychic Anxiety: 10/28 Somatic Anxiety: 6/28
7	Resumed normal activities, including attending social gatherings. Reported consistent, restful sleep and no recurrence of panic attacks.	8/56 Psychic Anxiety: 5/28 Somatic Anxiety: 3/28

Discussion: The patient experienced a significant reduction in both psychic and somatic symptoms of anxiety. By the end of treatment, her HAM-A score indicated only mild residual anxiety. No side effects were reported. The patient was also counselled on stress management techniques, such as diaphragmatic breathing exercises, which may have contributed to her recovery.

Case 3
Patient is a 28-year-old male presented with Chronic anxiety interfering with professional and personal life for over two years. Persistent fear of underperforming at work, leading to procrastination and missed deadlines. He Frequent episodes of abdominal discomfort, bloating, and diarrhoea triggered by stress with difficulty in focusing, restlessness, and frequent negative thoughts.
Sleeplessness with mid-night awakenings and trouble returning to sleep. He had a history of irritable bowel syndrome (IBS) exacerbated by stress. No psychiatric treatments undertaken prior. He was diagnosed with Generalized Anxiety Disorder (GAD) with somatic manifestations.

Pre-Treatment Evaluation (Using HAM-A)
Baseline HAM-A Score:
- Psychic Anxiety (mental agitation and distress): 21/28
- Somatic Anxiety (physical symptoms of anxiety): 15/28
- **Total HAM-A Score:** 36/56 (Severe Anxiety)

Symptom Category	Before Treatment	After Treatment
1. Anxious Mood	4	1
2. Tension	3	2
3. Fears	3	1
4. Insomnia	2	0
5. Cognitive	3	1
6. Depressed Mood	3	0
7. Somatic Sensory	3	1
8. Somatic Muscular	3	0
9. Somatic Cardiovascular	2	1
10. Respiratory Symptoms	3	1
11. Gastrointestinal	3	0
12. Genitourinary	1	0
13. Autonomic Symptoms	1	1
14. Behaviour During Interview	2	0

Treatment: *Triticum vulgaris* 200, twice daily for two weeks, followed by a single daily dose for four weeks.
Treatment Course and Observations

Week	Symptoms	HAM-A Score

2	Mild improvement in abdominal symptoms and slight reduction in restlessness. Sleep remains disturbed**.	31/56 Psychic Anxiety: 18/28 Somatic Anxiety: 13/28
4	Substantial improvement in focus at work. Fewer IBS episodes despite work stress. Mild improvement in sleep patterns.	25/56 Psychic Anxiety: 15/28 Somatic Anxiety: 10/28
6	Significant reduction in negative thoughts and improved confidence. No major gastrointestinal disturbances over the last week. Sleep normalized with fewer awakenings.	17/56 Psychic Anxiety: 11/28 Somatic Anxiety: 6/28
8	Anxiety levels greatly diminished; feels calm and in control during stressful situations. Enjoying hobbies and engaging more socially. IBS symptoms absent.	9/56 Psychic Anxiety: 6/28 Somatic Anxiety: 3/28

Discussion: The patient demonstrated marked improvement in both psychic and somatic symptoms of anxiety, shifted from severe to mild anxiety within eight weeks. No adverse effects were reported during the treatment. Incorporation of dietary modifications and stress-reduction strategies, including mindfulness practices and yoga, likely complemented the treatment outcome.

Case 4
A 50-year-old male patient presented with persistent anxiety with difficulty in managing stress related to financial and family concerns over the past year. Excessive worry about financial stability and family health, leading to irritability and restlessness. Poor concentration and productivity at work. Frequent physical symptoms, including chest tightness, headache, and sweating during stress episodes. Difficulty in initiating sleep, with frequent awakenings due to racing thoughts. History of mild hypertension (controlled with lifestyle changes). No psychiatric history or medication use. He was diagnosed with Generalized Anxiety Disorder (GAD).

Pre-Treatment Evaluation (Using HAM-A)
Baseline HAM-A Score:
- Psychic Anxiety (mental agitation and psychological distress): 22/28
- Somatic Anxiety (physical complaints associated with anxiety): 14/28
- **Total HAM-A Score:** 36/56 (Severe Anxiety).

Symptom Category	Before Treatment	After Treatment
1. Anxious Mood	4	1
2. Tension	3	2
3. Fears	3	1
4. Insomnia	4	0
5. Cognitive	3	1
6. Depressed Mood	3	0
7. Somatic Sensory	2	1
8. Somatic Muscular	3	0
9. Somatic Cardiovascular	2	1
10. Respiratory Symptoms	3	1
11. Gastrointestinal	2	1
12. Genitourinary	1	0

Treatment: *Triticum vulgaris* 200, administered as a single dose weekly, complemented by daily placebo over six weeks.

Treatment Course and Observations

Week	Symptoms	HAM-A Score
1	Mild reduction in irritability; sleep disturbances persist.	32/56 Psychic Anxiety: 20/28 Somatic Anxiety: 12/28
3	Decreased chest tightness and improved focus during work tasks. Sleep marginally better.	27/56 Psychic Anxiety: 17/28 Somatic Anxiety: 10/28
5	Significant improvement in ability to manage stress; chest tightness and headaches absent. Sleep quality improved, with fewer interruptions	18/56 Psychic Anxiety: 11/28 Somatic Anxiety: 7/28

Discussion

The case series on *Triticum vulgaris* and its potential impact on Generalized Anxiety Disorder (GAD) highlights the intersection of alternative therapies with psychological well-being. The use of the Hamilton Anxiety Rating Scale (HAM-A) provides a standardized measure of anxiety symptoms, allowing for objective evaluation of treatment efficacy. The use of *Triticum vulgaris* appears to align with growing interest in natural remedies for anxiety. The plant's known anti-inflammatory and potential adaptogenic properties might contribute to its anxiolytic effects, though the mechanism remains speculative. Improvement in HAM-A scores post-treatment suggests a reduction in both somatic and psychic symptoms of anxiety.

Conclusion:

The study investigating *Triticum vulgaris* as a potential therapeutic agent for Generalized Anxiety Disorder (GAD), evaluated through the Hamilton Anxiety Rating Scale (HAM-A), presents encouraging preliminary results. The observed reduction in HAM-A scores indicates that *Triticum vulgaris* may have anxiolytic properties, possibly due to its anti-inflammatory and adaptogenic effects. Despite the promising outcomes, the limitations inherent in a case series, such as small sample size and lack of control groups, warrant cautious interpretation. These findings support the need for more extensive randomized controlled trials to confirm the efficacy, identify mechanisms of action, and establish safety profiles for the use of *Triticum vulgaris* in managing anxiety disorders. This research contributes to explore natural and integrative approaches to mental health care.

Acknowledgement

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"THERAPEUTIC POTENTIAL OF PULSATILLA IN HYPOTHYROIDISM: INSIGHTS FROM A CASE SERIES"

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Abstract:

Hypothyroidism is a prevalent endocrine disorder caused by insufficient production of thyroid hormones, manifesting as fatigue, weight gain, depression, and menstrual irregularities. This case series examines the efficacy of *Pulsatilla*, a homeopathic remedy, in managing hypothyroidism through individualized treatment. Three patients with confirmed hypothyroidism, diagnosed by clinical symptoms and elevated thyroid-stimulating hormone (TSH) levels, were treated with a single dose of *Pulsatilla 200C*, selected based on their unique constitutional traits.Patients were monitored over six months, with regular evaluations of clinical symptoms and TSH levels. All showed marked improvements in energy levels, mood, and menstrual regularity, accompanied by normalization of TSH levels within three to six months. No adverse effects were reported, and no additional treatments were required during the observation period.This series underscores the potential of individualized homeopathic interventions using *Pulsatilla* in hypothyroidism management. It emphasizes the need for larger-scale studies with controlled methodologies to further validate these findings and explore homeopathy's role as a complementary or alternative treatment for thyroid disorders.

Keywords: Hypothyroidism, Homeopathy, Pulsatilla, Individualized treatment, Constitutional remedies, Thyroid-stimulating hormone (TSH), Case series, Thyroid disorders

Introduction:

Hypothyroidism, a widespread endocrine disorder, arises from insufficient thyroid hormone production, leading to symptoms such as fatigue, weight gain, depression, and menstrual irregularities. Conventional management often involves lifelong hormone replacement therapy, which, while effective, may not address the root cause or improve the quality of life comprehensively for all patients.

In recent years, there has been growing interest in exploring alternative and complementary approaches to managing hypothyroidism. Among these, homeopathy, with its principle of individualized treatment, offers a unique perspective. Pulsatilla, a well-documented homeopathic remedy, is traditionally used for conditions associated with hormonal imbalances and emotional sensitivity, making it a potential candidate for hypothyroidism treatment.

This presentation focuses on a case series that examines the efficacy of Pulsatilla 200C in managing hypothyroidism through an individualized approach. By highlighting clinical outcomes and biochemical improvements observed over six months of treatment, the study seeks to contribute to the evidence supporting homeopathy's role in managing endocrine disorders. Furthermore, it underscores the importance of rigorous research in validating homeopathic interventions as part of an integrative healthcare framework.

Case Series:

Case 1

Name: Mrs. V, 39 years old, housewife

Presenting Symptoms:

- Chronic fatigue, worsened in the mornings

- Excessive weight gain despite a controlled diet

- Depressed mood with frequent crying spells without clear reasons

- Irregular, scanty menses with severe premenstrual irritability

- Cold intolerance, always seeking warmth

- Generalized puffiness, especially around the eyes

Past History:
- History of recurrent upper respiratory tract infections during childhood

- No significant history of surgeries or other illnesses

Physical Generals:
- Appetite: Reduced with a strong craving for fatty and fried foods

- Thirst: Minimal, prefers sips of warm water

- Sleep: Disturbed, with frequent waking due to vivid and emotional dreams

- Perspiration: Profuse on the scalp and neck

- Thermal Reaction: Chilly patient, dislikes cold weather and wind

Mental Generals:
- Highly emotional, gets easily hurt

- Tendency to seek reassurance and support from loved ones

- Aversion to confrontation; tends to suppress feelings until overwhelmed
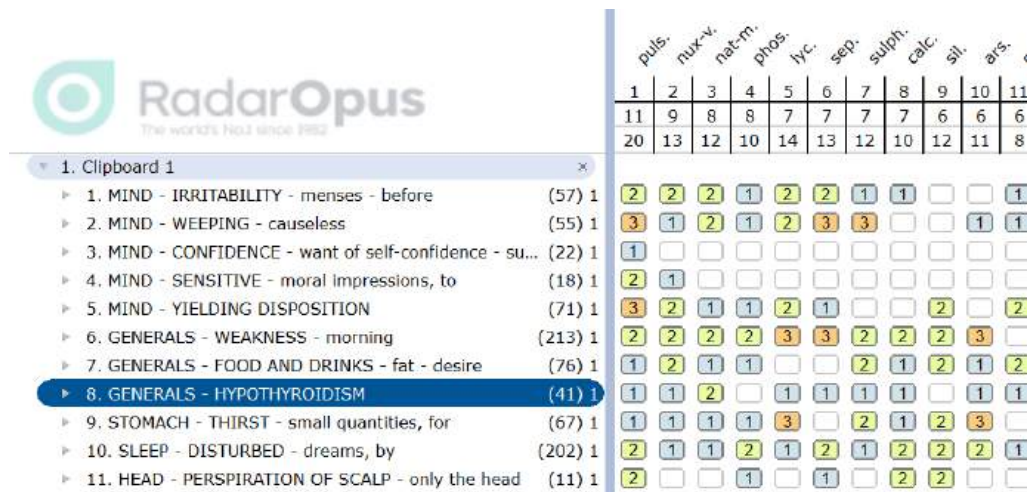
Family History:
- Mother: Hypothyroidism diagnosed at 40

- Father: Hypertension

Investigations:

Repertorial Analysis:

	puls.	nux-v.	nat-m.	phos.	lyc.	sep.	sulph.	calc.	sil.	ars.	
	1	2	3	4	5	6	7	8	9	10	11
	11	9	8	8	7	7	7	7	6	6	6
	20	13	12	10	14	13	12	10	12	11	8

1. Clipboard 1

			puls.	nux-v.	nat-m.	phos.	lyc.	sep.	sulph.	calc.	sil.	ars.	
1. MIND - IRRITABILITY - menses - before	(57) 1		2	2	2	1	2	2	1	1			1
2. MIND - WEEPING - causeless	(55) 1		3	1	2	1	2	3	3			1	1
3. MIND - CONFIDENCE - want of self-confidence - su...	(22) 1		1										
4. MIND - SENSITIVE - moral impressions, to	(18) 1		2	1									
5. MIND - YIELDING DISPOSITION	(71) 1		3	2	1	1	2	1			2		2
6. GENERALS - WEAKNESS - morning	(213) 1		2	2	2	2	3	3	2	2	2	3	
7. GENERALS - FOOD AND DRINKS - fat - desire	(76) 1		1	2	1	1			2	1	2	1	2
8. GENERALS - HYPOTHYROIDISM	(41) 1		1	1	2		1	1	1	1		1	1
9. STOMACH - THIRST - small quantities, for	(67) 1		1	1	1	1	3		2	1	2	3	
10. SLEEP - DISTURBED - dreams, by	(202) 1		2	1	1	2	1	2	1	2	2	2	1
11. HEAD - PERSPIRATION OF SCALP - only the head	(11) 1		2			1		1			2	2	

Selection of the Remedy:

Pulsatilla was selected on the basis of Repertorization and on the basis of Totality and similimum symptom found in the literature of Materia medica

Selection of Potency:

1 Dose of Pulsatilla 200 was prescribed on 30/04/2024 With Saclac 30 /BD for 1 month

Follow Up:

Date	Change in Symptoms	Prescription	Justification
28/05/2024	Weakness improving, weeping decreased, feeling better in general	Saclac 30/BD for 1 month	As Improvement is seen so Placebo was given
25/06/2024	Lethargy decreased, mood in control, can easily do day to day activities, perspiration in control, weight started decreasing	Saclac 30/BD for one month	Improvement seen so Placebo was Given
26/07/2024	Menses better, weight decreased, feels much active, no new symptoms	Saclac 30/Bd for 2 months	Improvement seen so Placebo was Given
30/08/2024	Stays happy, sleep undisturbed, No New symptoms seen, patient improving well in all aspects	Improvement seen so Placebo was Given for one month	Improvement seen so Placebo was Given
26/09/2024	Feels better, doesn't get hurt easily, no relapse of symptoms	Placebo given for one month	Improvement seen so Placebo was Given
27/10/2024	Patient feels confident and healthy now. TSH levels within normal range	No Medicine given	Patient advised to follow if symptoms relapsed.

Case 2

Name: Miss P, 30 years old

Presenting Symptoms:

- Persistent lethargy with difficulty concentrating at work and studies

- Weight gain localized around the abdomen

- Hair fall and dry, brittle hair

- Menstrual cycle irregular, alternating between heavy and scanty bleeding

- Frequent bloating and indigestion

Past History:
- Frequent episodes of tonsillitis during teenage years, treated with antibiotics

- Anxiety episodes during college years related to academic stress

Physical Generals:
- Appetite: Normal but experiences aversion to warm foods

- Thirst: Reduced, prefers cold drinks

- Sleep: Light, with frequent waking and a sense of restlessness

- Perspiration: Moderate, more noticeable on the face

- Thermal Reaction: Feels hot easily, dislikes warm weather

Investigations:

Repertorial Analysis:

	puls.	nat-m.	lyc.	sep.	phos.	calc.	arg-n.	sulph.	nux-v.	sil.
	1	2	3	4	5	6	7	8	9	10
	10	10	9	9	8	8	8	8	7	7
	20	16	19	17	17	16	13	13	14	14

1. Clipboard 1

			puls.	nat-m.	lyc.	sep.	phos.	calc.	arg-n.	sulph.	nux-v.	sil.
1. MIND - MOOD - changeable	(235) 1		3	1	3	2	2	2	2	1	1	1
2. MIND - WEEPING - easily	(52) 1		3	2	1	2		2	1			1
3. MIND - FORSAKEN FEELING - beloved by h...	(19) 1		3	1	1	1	1	1		1		1
4. MIND - CONCENTRATION - difficult	(433) 1		2	2	3	3	3	2	1	2	4	3
5. MIND - SYMPATHY FROM OTHERS - desire f...	(16) 1		1	1		1	4					
6. FEMALE GENITALIA/SEX - MENSES - irregu...	(120) 1		1	1	2	2	1	2	3	2	2	2
7. GENERALS - WEAKNESS	(916) 1		2	3	2	3	3	3	2	3	2	3
8. GENERALS - HYPOTHYROIDISM	(41) 1		1	2	1	1		1	1	1	1	
9. GENERALS - FOOD AND DRINKS - cold drin...	(49) 1		1	1	3		1		1	1	1	
10. FACE - PERSPIRATION	(195) 1		3	2	3	2	2	3	2	2	3	3

Selection of the Remedy:

Pulsatilla was selected on the basis of Repertorization and on the basis of Totality and similimum symptom found in the literature of Materia medica

Selection of Potency:

1 Dose of Pulsatilla 200 was prescribed on 02/02/2023 With Saclac 30 /BD for 1 month

Follow Up:

Date	Change in Symptoms	Prescription	Justification
05/03/2023	Menses appeared in time, weakness improving, concentration better	Saclac 30/BD for 1 month	As Improvement is seen so Placebo was given
03/03/2023	Lethargy decreased, mood improved, can easily do day to day activities	Saclac 30/BD for one month	Improvement seen so Placebo was Given
06/04/2023	No New symptom seen, menses appearing in time, bloating relieved	Saclac 30/Bd for 2 months	Improvement seen so Placebo was Given
08/05/2023	Mood swings in control, No New symptoms seen, patient improving well in all aspects	Improvement seen so Placebo was Given for one month	Improvement seen so Placebo was Given
26/06/2023	Patient is feeling much better. Reports shows normal TSH levels	Placebo given for one month	Patient advised to follow if symptoms relapsed.

Case 3

Name: Mrs. J, 39 years old

Presenting Symptoms:

- Severe fatigue and difficulty maintaining routine household activities

- Gradual weight gain over the past two years

- Palpitations and breathlessness on mild exertion

- Skin changes, including dry patches and a pale complexion

- Menstrual cycle regular but marked with prolonged bleeding and clots

Past History:
- History of eczema during childhood, treated with topical steroids

- Hypothyroidism diagnosed 3 years ago but discontinued synthetic hormones due to side effects

Physical Generals:
- Appetite: Normal with a marked craving for sweets

- Thirst: Increased, prefers room temperature water

- Sleep: Unrefreshing, often disturbed by a sense of worry or foreboding

- Perspiration: Normal but has an offensive odor

- Thermal Reaction: Prefers cool environments, dislikes heat

Mental Generals:
- Very attached to family but feels unappreciated, leading to mood swings

- Avoids social gatherings due to self-consciousness about weight

- Worries excessively about minor health issues

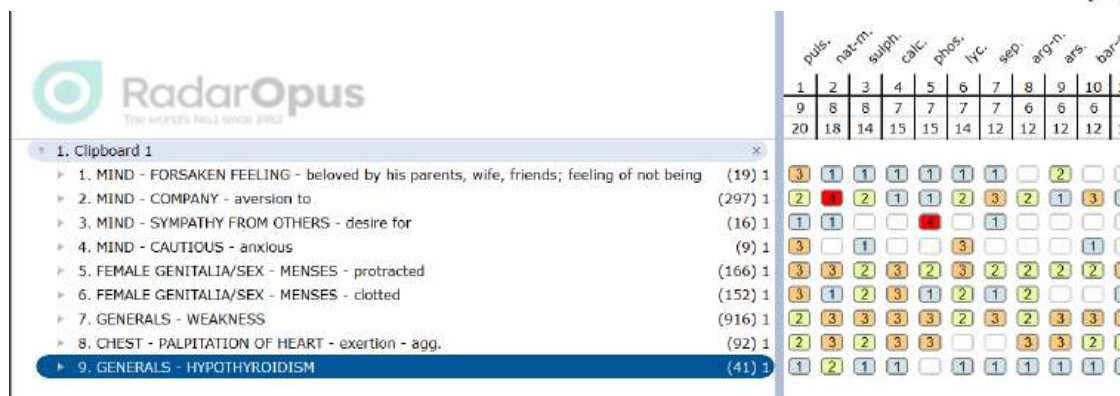- Expresses a need to feel loved and cared for

Family History:
- Maternal uncle: Hypothyroidism

- Father: Obesity

Investigations:

Repertorial Analysis:

Selection of the Remedy:

Pulsatilla was selected on the basis of Repertorization and on the basis of Totality and similimum symptom found in the literature of Materia medica

Selection of Potency:

1 Dose of Pulsatilla 200 was prescribed on 19/05/2023 With Saclac 30 /BD for 1 month

Follow Up:

Date	Change in Symptoms	Prescription	Justification
25/06/2023	Menses regular, weakness improving, sleep improved.	Saclac 30/BD for 1 month	As Improvement is seen so Placebo was given
30/07/2023	Lethargy decreased, palpitation better, can easily do day to day activities	Saclac 30/BD for one month	Improvement seen so Placebo was Given
06/09/2023	No New symptom seen, menses regular	Saclac 30/Bd for 2 months	Improvement seen so Placebo was Given
08/11/2023	Has gained confidence, can go out easily, No New symptoms seen, patient improving well	Improvement seen so Placebo was Given for one month	Improvement seen so Placebo was Given
13/12/2023	Patient is feeling much better. Reports shows normal TSH levels	Placebo given for one month	Patient advised to follow if symptoms relapsed.

Discussion

The case series demonstrates the efficacy of individualized homeopathic treatment in managing hypothyroidism, addressing both physical and emotional symptoms. Remedies were selected based on a thorough assessment of each patient's unique presentation, highlighting the importance of personalized care. Improvements in thyroid function and quality of life were observed without adverse effects, supporting homeopathy's safety and potential as a complementary approach. However, the small sample size and lack of a control group are limitations, warranting further studies with larger cohorts and standardized protocols to establish stronger evidence.

Conclusion

This study highlights homeopathy's potential in providing holistic and side-effect-free management for hypothyroidism. Individualized remedies improved thyroid function and overall well-being, suggesting homeopathy as a viable complementary or alternative option. While the results are promising, further research with robust methodologies is essential to confirm these findings and expand homeopathy's role in hypothyroidism treatment.

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"CLINICAL OUTCOMES OF LYCOPODIUM IN THE HOMEOPATHIC TREATMENT OF NON-ALCOHOLIC FATTYLIVER DISEASE: A CASE SERIES"

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ABSTRACT:

Non-Alcoholic Fatty Liver Disease (NAFLD) is a prevalent metabolic disorder characterized by excessive fat accumulation in the liver, unrelated to alcohol consumption. It is often associated with obesity, insulin resistance, and dyslipidemia. Conventional treatment options focus on lifestyle modifications, with limited pharmacological interventions. This case series highlights the therapeutic potential of *Lycopodium clavatum*, a homeopathic remedy, in the individualized treatment of NAFLD.Three patients with NAFLD, confirmed by ultrasonography were treated with a single dose of *Lycopodium* 200C, selected based on their individualized symptomatology and constitutional characteristics. All patients were monitored for six months with regular assessment of symptoms andimaging studies. Significant improvement was observed in clinical symptoms, with reduction in hepatic fat on follow-up imaging. No adverse effects were reported, and no additional medications were required during the follow-up period.

Conclusion: -This case series suggests that individualized homeopathic treatment with *Lycopodium clavatum* may offer a safe and effective approach for managing NAFLD. Further research with larger cohorts and controlled trials is warranted to validate these observations and explore the role of homeopathy in managing metabolic liver disorders.

Keywords: Non-Alcoholic Fatty Liver Disease (NAFLD), Homeopathy, Lycopodium clavatum, Liver enzyme normalization, Individualized treatment, Metabolic disorders, Constitutional homeopathy, Hepatic fat reduction

INTRODUCTION:-

Non-Alcoholic Fatty Liver Disease (NAFLD) is a prevalent metabolic disorder characterized by excessive fat accumulation in the liver, unrelated to alcohol consumption. It is often associated with obesity, insulin resistance, and dyslipidemia.The prevalence of Non-Alcoholic Fatty Liver Disease (NAFLD) in India is substantial and growing. Current estimates suggest that among adults, prevalencerates range widely from 6.7% to 55.1%, depending on the population studied. Higher prevalence is observed in urban settings (around 40%) compared to rural areas (approximately 29%) and in hospital-based studies (40.8%) compared to community-based studies (28.2%)

MATERIAL AND METHODS

This case series comprises of three patients who attended the outpatient department of Dr.Sukhjeet Homoeopathic Clinic Kotkapura,Punjab. It is monocentric, Phase 2 clinical trial, single arm, single blind, and randomized, interventional study to see the effect of *Lycopodium Clavatum* in cases of Non Alcholic Fatty Liver Disease in the above the age group of 18 years. Cases presented with complaints of Heaviness in Abdomen Specially after eating,flatulency,Nausea Vomiting etc. Medicine was administered to all patients in no. 30 size globules and in the dosage of 6 pills orally, no water intake for at least 15-20 minutes. Drug was stored at Dr.pareek Homoeopathic Clinic Kotkapura, Punjab as per the prescribed criteria in Homoeopathic Pharmacopoeia of India (HPI), under appropriate temperature. Log no. & batch no. was maintained.

All participants were also asked to continue with their prescribed medication for duration of the study. Patients were enrolled in this study from outpatient department of Dr.Sukhjeet Homoeopathic Clinic Kotkapura, Punjab from the year 2022-2024.

Selection of Cases

Inclusion Criteria

All the patients presenting with the Complain related to Non Alcholic fatty liver disease since 6months without any major complications, Patients of both sexes & above the age group of 18 yrs. The ability to give informed consent & comply with study procedures and Legal capacity.

Exclusion criteria

Patients who require emergency medical intervention or severe Co-morbidities, Patient without written consent, Limited communicative ability, Patients with any systemic illness, Patients with othersystemic diseases ,Pregnant and lactating mothers , Person who is taking other mode of treatment.

Study Procedure

Total 03 Cases (both male & female) were selected based on inclusion, and exclusion criteria those who were wanted to participate willingly in the research. Participants were enrolled in the study only after signing the informed consent form. Each case was followed up for approx 5-6 visits.1st follow- up taken after 15days or as need of the patient, Individual with any systemic illness were excluded from the study. Only pre Diagnosed Cases were considered for the study. Dietary advices were given during the treatment.

Case Study 1

The patient,47 yrs old, businessman by profession, reported at the OPD of Dr Sukhjeet Homoeopathic Clinic, Kotkapura, Punjab on Oct 31, 2022 with the complains of loss of appetite and with heaviness in abdomen, flatulency in evening with pain in abdomen as if abdomen is full of gases.Patient took allopathy treatment and got slight relief but no major improvement seen so he opted homoeopathy treatment.

Past History

Dengue fever 2 years back

Family History

Mother and father has hypertension and diabetes**.**

Patient as a whole

Thirst:Thirstless ,1 litre/day
Appetite:Appetite want of 1 chapati /meal,

Desire:Sweets / warm food
Aversion:Not specific
Stool:Insufficient Ineffectual Urging for stool passes 2-3 times in morning,Unsatisfactory
Urine:Normal
Thermal:Hot

Mentals Generals:

Patient is Irritable as described by attended and observed by Physician,He doesn't like to talk much,
He is manipulative and have Anxiety about health.

Local Examination:

Abdomen is soft and non-tender

Physical General

Physical Generals	
Desire Sweets and warm food	+3
Heaviness in Abdomen	+2

Particulars	
Heaviness in abdomen	+2
Appetite want of	+3
Flatulency	+2
Insufficient Ineffectual Urging for stool	+3

Repertorization As Generals were marked this case is repertories by the help of Synthesis repertory
from RADAR version 10.0 Figure 2

Figure :1 Reportrization sheet

Selection of the Remedy

Lycopodium Clavatum was selected on the basis of Repertorization and on the basis of Totality and
similimum symptom found in the literature of Materia medica

Selection of Potency:-

1 Dose of Lycopodium 1M was prescribed on dated 31/10/2022 With Saclac30 /BD for 15 days

Follow Up:-

Date	Change in Symptoms	Prescription	Justification
17/11/2022	Heaviness in the abdomen is relief but flatulency After eating. Appetite-Better than before	Saclac 30/BD for 15 days	As Improvement is seen so Placebo was given
04/12/2022	Stool satisfactory with no gases and heaviness	Saclac 30/BD for one month	Improvement seen so Placebo was Given
10/01/2023	No New symptom seen	Saclac 30/Bd for 15 days	Improvement seen so Placebo was Given
20/01/2023	No New symptoms seen, patient improved well	Improvement seen so Placebo was Given for one month	Improvement seen so Placebo was Given
07/02/2023	Patient is feeling much better. USG reveals normal liver .	Placebo given for one month	Patient advised to follow if symptoms relapsed.

Figure 1.1:-Showing results Before and After Treatment

Case Study 2

The patient, 30 year male, IT profession reported in the OPD at Dr Sukhjeet Homoeopathic Clinic, Kotkapura, Punjab on 01/08/2023, with thecomplaint of Heaviness in Abdomen after Eating food,with Eructations and Flatulency after eating.Amelioration after passing flatus .Stool –Constipation Since 2 years.Patient Took allopathic Treatment for 6 months without any improvement and now has opted for homoeopathic treatment.

Past history- Kidney stones improved with homeopathic treatment
Family history- Father had hypertension and mother had hypothyroidism.
Patient as a Whole

Thirst: Thirstless
Appetite: 3 meals per day, can't eat more then 1chapati at a time
Stool: D,N,semi solid, satisfactory
Urine-: D, N, pale yellow, non-offensive.
Perspiration: Normal , Generalised , non-offensive
Thermal reaction: Hot

Mentals

He had habit of getting angry easily whenever someone contradicts him as described by attendant
Patient also confessed that he has fear of being alone. He was answering questions very hastily as
observed by physician.
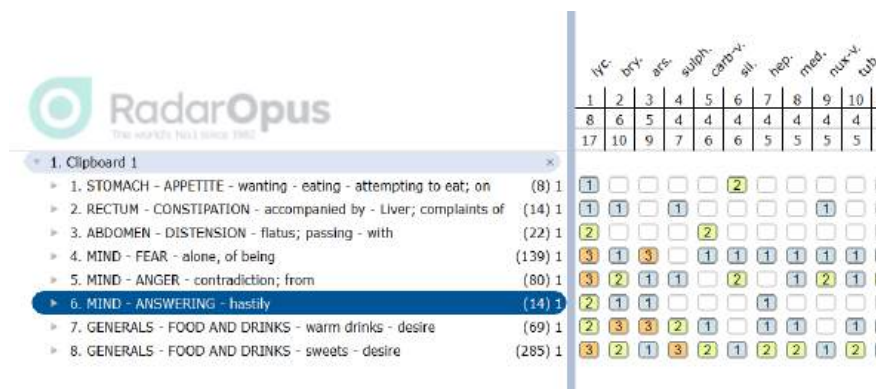
Local examination
Case Processing

Mental Generals	
Get angry when contradicted	+3
Fears to be alone	+3
Answers hastily	+2

Physical Generals	
Appetite Wanting	+2
Thirst-small quantity at a time	+2
Desire-Warm food	+2

Particular	
Heaviness in Abdomen	+2
Flatulency	+2

Repertorisation- As the generals were marked, this case was repertorised with the help of the
Synthesis Repertory from RADAR 10.0 version

Figure 2:- Repertorisation Sheet

Selection of remedy- Lycopodium clavatum was selected on the basis of repertorisation and
after the consultation of materia medica, considering the symptom totality and similarity
Selection of potency and dose - I dose of Lycopodium clavatum 200 was prescribed.

01/08/2023: Lycopodium clavatum 200/1 dose, Rubrum 30/TDS for 14 days.

Date	Change in Symptoms	Prescrption	Justification
16/08/2023	Heaviness in the abdomen is relief But flatulency After eating.	Saclac 30/BD for one month	As Improvement is seen so Placebo was given
14/09/2023	No gases but heaviness	Saclac 30/BD for one month	Improvement seen so Placebo was Given
20/10/2023	No New symptom seen	Saclac 30/Bd for one month	Improvement seen so Placebo was Given
07/12/2023	No New symptoms seen,Patient improve well	Improvement seen so Placebo was Given for one month	Improvement seen so Placebo was Given
11/01/2024	All symptoms are much relieved and reports are normal	Medicine stopped	Patient responded well in all aspects, so no more medicine required
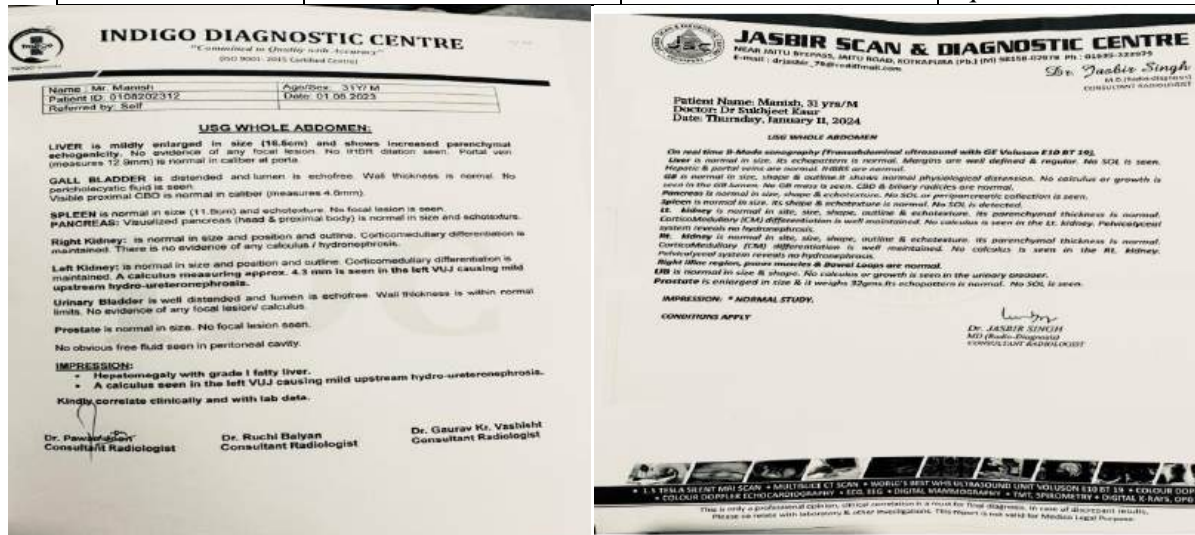
Figure 2.2:-Before and After Treatment Reports

Case Study 3

A 30 years old Female presented with a complain of Constipation with Insufficient Stool passes 3-4 Times a day with heaviness of Abdomen after Eating,Nausea feeling after Eating.Having multiple warts on neck region leftside area since 1 years.
Personal H/O-K/C/O Hypertension took allopathic
Family H/O- Mother hypertensive
Mentals-Anxious about health, takes every precaution

Physicals-
Appetite -Normal
Thirst- Normal
Sleep - Sound, Refreshing
Urine and stool-Urine Normal, usually constipated
Desires-Sweets ++
Thermally-Towards Hot

General and systemic examination

BP-136/90mm of Hg.

Pulse-84/min
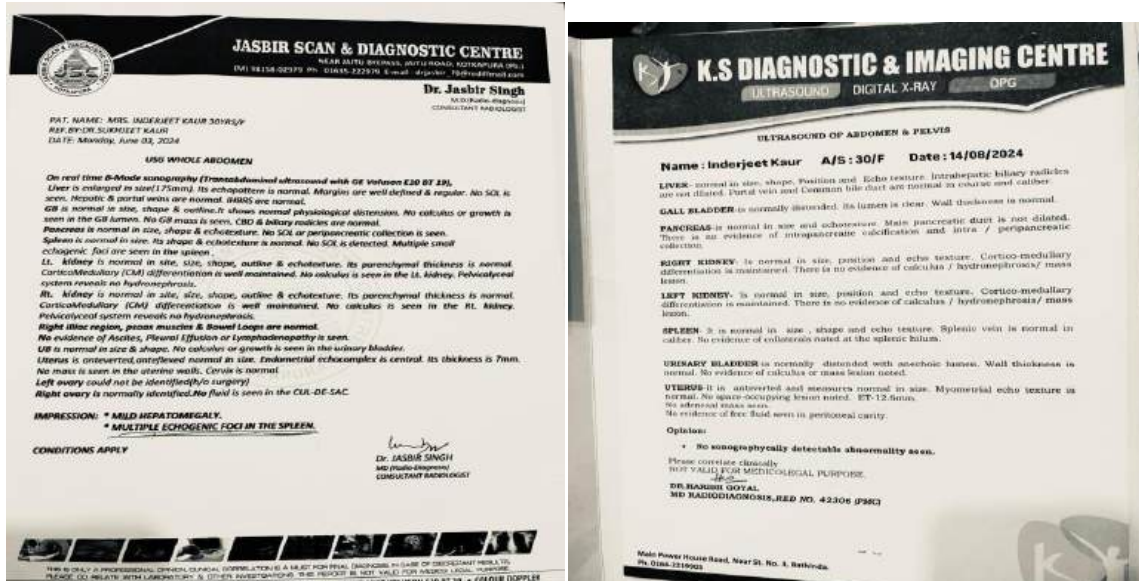
Figure 3:-Before and after Treatment Reports

Analysis and Evaluation of Symptoms

Sr.No	Symptom Type	Symptom	Intensity
1	Mental General	Anxiety about Health	+2
2	Physical	Desire Sweets	+3
3	Physical	Constipated	+2
4	Physical	Sleep Sound refreshing	++
5	Physical	Thermal reaction Hot	+
6	Particular	Heaviness in abdomen	+++
7	Particular	Nausea,Eating after	++

Reportrization

As the generals were marked, this case was repertories with the help of the Synthesis Repertory from RADAR 10.0 version

Figure 3.3 Repertorization sheet

Selection of remedy- Lycopodium clavatum was selected on the basis of repertorisation and after the consultation of materia medica, considering the symptom totality and similarity
Selection of potency and dose - I dose of Lycopodium clavatum 200 was prescribed.

Follow Ups

Date	Change in Symptoms	Prescrption	Justification
18/06/2024	Constipation.Insufficient Ineffectual Urging for stool	Saclac 30/BD	As Improvement is seen so Placebo was given
18/07/2024	Nausea Eating after	Saclac 30/BD	Improvement seen so Placebo was Given
17/08/2024	Heaviness eating After relief	Saclac 30/BD	Improvement seen so Placebo was Given
16/09/2024	No New symptoms seen,Patient improve well	Improvement seen so Placebo was Given	Improvement seen so Placebo was Given
14/10/2024	Patient is feeling well, all reports within normal range	No medicine given	Patient has responded well with improved reports

Discussion

In the homoeopathic materia medica, there are several potential remedies for the treatment of fatty liver, whether therapeutic or constitutional Lycopodium has been shown to be useful in the treatment of Fatty Liver, Other drugs, such as Sulphur, Pulsatilla, Bryonia, Sepia, Carbo veg, Nux Vomica,Arsenic Album,Calcarea carbonicum, Causticum, Natrum muriaticum and Opium,have also been shown to be effective in Liver disease However, the most unique part in homoeopathic prescription when prescribed on the basis of totality is that ,it not only treats the disease but the man in disease so not only liver is treated butthe other symptoms of the patient are also considered and treated accordingly so as to bring holistic cure.

Conclusion

The case series suggests that homoeopathy can be considered as an effective method for the Non Alcoholic fatty Liver disease. A larger number of cases and rigorous trials can be carried out to further confirm the results.

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TO STUDY THE EFFICACY OF HOMOEOPATHIC CONSTITUTIONAL MEDICINE IN VITILIGO

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Abstract : Vitiligo is an acquired autoimmune condition that is characterized by the destruction of epidermal melanocytes causing loss of skin pigment. Vitiligo may progress to involve the dermal follicular reserve and to destroy melanocyte stem cells . Although the global prevalence of vitiligo is less than 1%, in some populations, it may be as high as 3% of the population . Classically, vitiligo has been classified into segmental and non-segmental variants, depending on the distribution of skin depigmentation. Vitiligo can cause psychological stress, especially in dark-skinned individuals for whom it causes concerning cosmetic skin changes. Currently, the available treatment options for patients with vitiligo have limited effectiveness, particularly for patients with vitiligo of the acral areas, which are resistant to treatment due to the lack of hair follicles that can serve as reservoirs for melanocytes. The criteria for assessing the response to the treatment of vitiligo include: cessation of spread; the appearance of skin re-pigmentation; and overall quality of life during treatment. However, no therapeutic study has yet shown long-term benefits using these criteria, and further research is required to establish evidence for the effective treatment of vitiligo There has been at least one prospective observational clinical study that has investigated the effectiveness of classical homeopathic treatment of vitiligo, with a further prospective observational clinical study involving homeopathic treatments given based on characteristic individualized patient symptoms

IndexTerms – **Homoeopathy, Vitiligo, Individualised treatment.**

INTRODUCTION :-

Vitiligo is a disorder where the skin loses its color in patches of irregular shapes and sizes. This is a pigmentation disorder which means that melanocytes (the pigment-producing cells) in the skin get destroyed. This results in the development of white patches on the skin. Vitiligo is an idiopathic depigmentary disorder which is wide spread in our country , the percentage of people suffering from this disease in India is higher than in western countries , because of its disfiguring presentation it gives rise to severe psychological strain (also social stigma by many) , it is characterized by progressive well circumscribed cutaneous white macules and patches of varying sizes and shapes . They are whitish almost milky in appearance and uniform in color with well demarcated edges because of peripheral hyperchromia . It is common to find over the patch depigmented , graying of hair is noticed before the appearance of the vitiligo patch . A single white stand of hair could be the first sign of Vitiligo of the scalp . the lesions are found mainly on the face , neck , forearms , the dorsum of the hands or soles of the feet besides loss of pigmentation no other structural change is seen but other disorders like diabetes , hyper thyrodism pernicious anaemia , carcinoma of stomach etc, may be associated , the peak incidence of the disease is between 10-30 years .

Homeopathy is able to give wonderful and miraculous cures in many cases of Vitiligo. This is due to the fact that the treatment enhances the natural production of pigments. According to philosophy Vitiligo is not a disease in itself but an expression of an inner disturbed state of the body. Thus, the cure should occur at a level where things have gone wrong. In order to archive this, the patient is analyzed on various aspects of mental and physical and familial attributes and also a complete study is done on the psychological-environment that the patient has gone through in his life. Let us see an evidence based case study to see efficacy of homoeopathy in Vitiligo

Literature review:-

Definition:

Vitiligo is chronic skin condition characterized by the loss of pigment in certain area of the skin, resulting in white patches . This occurs when melanocytes, the cells responsible for producing melanin (the pigment that gives skin, hair, and eyes their colour) are destroyed or stop functioning.

Epidemiology

Vitiligo affects approximately 05 -2 % of the global population, with no significant gender preference. While the onset is commonly observed I childhood or early adulthood. It can occurs at any age. Studies show a genetic predisposition, as vitiligo often coexists with autoimmune conditions like thyroid disorders. However, environmental factors, such as oxidative stress and skin trauma also play a critical role in diseases manifestation.

An evidence based case presentation of vitiligo with constitutional medicine.

Date of case taking : 2nd **Dec.2021**

Preliminary Data:

- • NAME: Mrs X.Patel
- • AGE   : 39 years
- • SEX   : FEMALE
- • EDU. : BACHLORS
- • OCCU.: WEALTH ASSET MANAGEMENT
- • **CHIEF COMPLAIN(S)**:

LOCATION	SENSATION	MODALITIES	CONCOMITANTS
System,location,Origin,Duration, Frequency,Progress	Pathology with intensity	Should.consider Reportorial rubrics	Can eliments all other symptoms for Prescripson
SKIN ▼ FACE	Whitish discoloration in patches on face	Not specific	

PAST HISTORY:

➢ In 2007 - short History of depression – On allopathic medication for short period of time
➢ In 2017 - IVF treatment done and had healthy baby after successful treatment.
➢ In 2020 – Occurrence of Vitiligo and I had taken her homoeopathic case on 18th October 21.

➢ FAMILY HISTORY:

PATERNAL FAMILY	MATERNAL FAMILY
Father : HT & IHD	Mother : Diabetes mellitus

- • PERSONAL HISTORY

    ➢ ACCOMODATION :- good
    ➢ ECONOMIC STATUS :- sound
    ➢ DIET & FOOD :- Increase but easily satisfied
    ➢ HOBBIES :- Listening music in alone
    ➢ VACCINATION :- Done as per schedule
    ➢ LIFE SPACE INVESTIOGATION :-
    ➢ BIRTH & EARLY DEVLOPMENT :- All the milestones were achieved normally
    ➢ BEHAVIOUR :- Calm natured

- EDUCATION:- bachelors in finance
- OCCUPATIONAL HISTORY:- investment banker
- MARITAL HISTORY :- Normal
- CHILDREN:- One (Female)
- TRAVEL HISTORY:- Not Specific

GYNAECOLOGICAL AND OBSTETRIC HISTORY:-

- Normal we did IVF for my daughter who is in 3 otherwise normal. She has normal cycle of 27 +/- 2 days
- Full term normal delivery was done

GENERAL SYMPTOMS
A. PHYSICAL GENERALS:

- APPEARANCE:- Lean, thin person
- TASTE:- Italian Mexican Indian breads and rise
- THIRST:- Thirst increased
- STOOL:- Hard , Black colored
- URINE:- Burning while urination and acrid
- SWEAT:- Profuse, even on slight exertion
- SLEEP:- sound
- THERMAL REACTIONS:- Chilly

B. MENTAL GENERALS:-

A train of thoughts keep going on in my mind, I am always in my thoughts, up to that extent that I don't even sometimes get to know what's going on in surroundings, I get lost in thoughts of mine even while talking to someone and easily gets confused in taking decisions. I am very affectionate and have sympathy for people, I can't see anyone's sufferings. I easily get angry but never express my anger to the person due to whom I am angry because I feel if I will fight with that person they would tell something which would cause harm to my dignity, which I can't tolerate. I don't like everyone sticking around me, I like to sit with myself and retrospect my ownself. In 2007 she had depression.

CASE PROCESSING:

- **Analysis of symptoms :-**
- **Mental Generals:-**
  - A/F Anger at trifles, with silent grief and indignation
  - Absorbed
  - Confusion of mind and difficult concentration while talking
  - Affectionate
- **Physical Generals:-**
  - Thirst increased for large quantities
  - Appetite easily getting satisfied
  - Profuse perspiration, even on slight exertion
  - Urine burning and acrid
  - Hard and Black colored stool

- **Physical particulars:-** White patches on face.
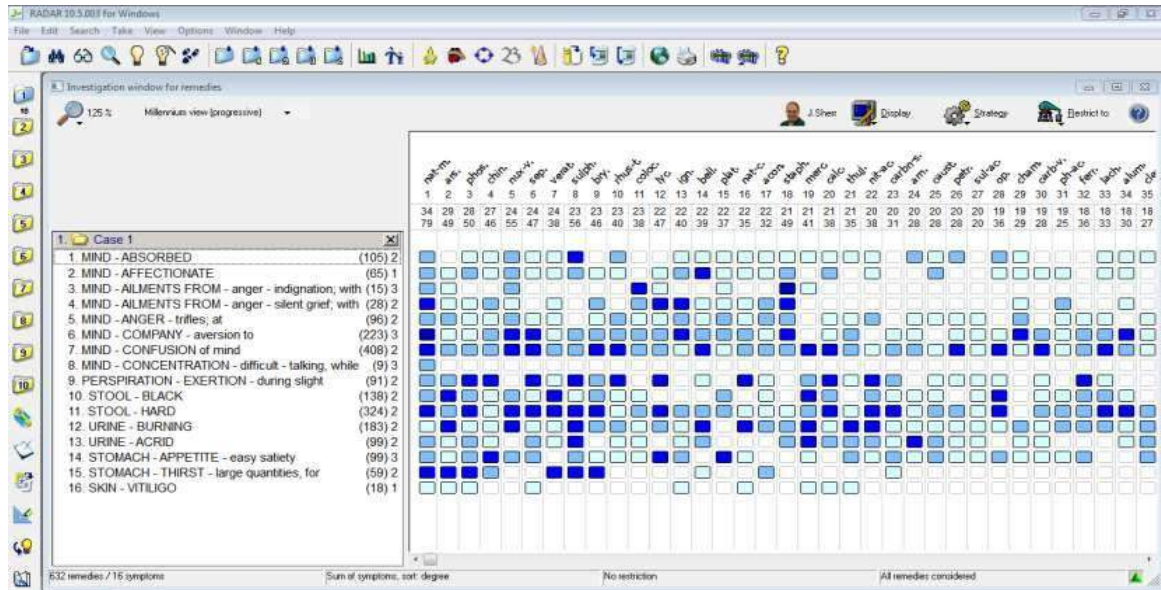
PRESCRIPTION:-

On the basis of reportorial result and materia medica knowledge.

NATRUM MURIATICUM 200 (5 Tab. At bed time) ONE DOSE

❖ **SAC-LAC 30 – 4 dram (5-0-5 for a month)**

❖ **ADVISE : Multi Vitamins , Sun Light**

FOLLOW UP :-

DATE	OUTCOME	PRESCRIPTION
15th Dec. 2021	First Prescription	Nat.Mur 200 (5 tab. at bed time) one dose- Sac lac 30- 4 dram (5-0-5) Advise : Multivitamins, Sun Light
15th Jan. 2022	5% Improved	Nat.Mur 200 (5 tab. at bed time) one dose- every saturday Sac lac 30- 4 dram (5-0-5)
15th Fab. 2022	Improved 50-60 %	Nat.Mur 200 (5 tab. at bed time) one dose- every saturday Sac lac 30- 4 dram (5-0-5)
15th Mar.2022	10-15% Improvement	Sulphur 200 one dose (5 tab. At bed time) Sac Lac 30 – 4 dram(5-0-5) (for clearing miasmatic block)
15th Apr.2022	80-85 % Improvement	Nat.Mur 200 (5 tab. at bed time) one dose- every saturday Sac lac 30- 4 dram (5-0-5)
15th May.2022	90% Improvement (UPT Positive)	Patient feels very good Homeopathic constitutional

			Medicine can do Miracle
15th JUN.2022	Improved		

CONCLUSION :-

This case shows the positive role of homoeopathic treatment in vitiligo. It re-establishes the importance of individualized homoeopathic treatment based on holistic basis. It also open up the path of further studies to be done to explore the scope of homoeopathy in such disease conditions.

Homeopathy is able to give wonderful and miraculous cures in many cases of Vitiligo. This is due to the fact that the treatment enhances the natural production of pigments. According to philosophy Vitiligo not a disease in itself but an expression of an inner disturbed state of the body.

Thus, the cure should occur at a level where things have gone wrong. In order to archive this, the patient is analyzed on various aspects of mental and physical and familial attributes and also a complete study is done on the psychological-environment that the patient gone through in his life.

Breeding biology of Great Thick-knee *(Esacus recurvirostris)* in fresh water reservoir near Wankaner of Morbi District, Gujarat.

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Abstract: *The Great Thick-knee (Esacus recurvirostris) is a captivating bird species that has garnered significant attention from researchers due to its unique breeding behaviors and adaptations. This large wader, characterized by its distinctive upturned bill and striking black and white facial pattern, is a local breeder in humid southern Asia. The breeding season of the Great Thick-knee typically commences in February and extends through July, with peak laying activity occurring in March and April. During this period, pairs establish and defend territories, often selecting dry, open areas near water bodies such as reservoirs, riverbeds, and lakeshores. The nest itself is a simple scrape in the bare land, devoid of any elaborate construction. A clutch usually consists of two large, cryptically colored eggs, which are incubated by both parents for approximately 28 days. Parental care extends beyond incubation. Both parents actively participate in brooding and guarding the chicks, shielding them from potential predators and harsh weather conditions. The chicks are precocial, meaning they are relatively well-developed at hatching and can move around independently. They are fed by both parents, who deliver food items directly into the chicks' mouths. The chicks fledge approximately 40 days after hatching, becoming independent and capable of foraging on their own. The breeding biology of the Great Thick-knee is influenced by various factors, including habitat quality, food availability, and predation pressure. Human activities, such as habitat loss and disturbance, can pose significant threats to their breeding success. However, based on available research, it is generally quite low at 0.2887 and 0.343 for two different sites of studies. Understanding the intricacies of their breeding ecology is crucial for implementing effective conservation measures to protect this remarkable species.*

Key Words: *Breeding biology, hatching success, nesting success.*

1. INTRODUCTION

The Great Thick-knee *(Esacus recurvirostris)* is a large, distinctive wader with a global distribution spanning across tropical Asia (Ali S. R., 1983). While its breeding biology has been studied in various regions, there remains a paucity of information, particularly from the Indian subcontinent, especially in the arid and semi-arid regions of Gujarat (Grimmett, 2013). The freshwater reservoir near Wankaner in Morbi District of Gujarat provides a unique habitat for this species, offering a suitable breeding ground. This study aims to investigate the breeding biology of the Great Thick-knee in this specific location, focusing on aspects such as nesting behavior, egg laying patterns, incubation periods, and chick rearing, potential threats. By understanding the breeding ecology of this species in this region, we can contribute to the overall knowledge of its life history and identify potential conservation challenges. This research will help in developing actual conservation approaches to ensure the long-term survival of the Great Thick-knee in Gujarat.

2. STUDY AREAS

The study area encompasses the Garida Dam and Machchhu I Dam, located in the arid and semi-arid region of Saurashtra, Gujarat, India. Garida Dam, situated at (22.489685° N, 71.042040° E) is an earthen dam. Machchhu I Dam, located at (22.4494943° N, 70.9615704° E) is a masonry dam constructed across the Bhogavo River, a tributary of the Machchhu River. The study area falls within the tropical arid and semi-arid

climate, characterized by hot, dry summers and mild winters. The region experiences erratic rainfall, with most of the annual precipitation occurring during the monsoon season (June-September). The average annual rainfall in the region ranges from 400 to 600 mm. The study area is predominantly covered by scrubland and agricultural land. The major soil types found in the region are Vertisols, Entisols, and Aridisols. The region faces water scarcity issues, especially during the non-monsoon months. The Garida Dam and Machchhu I Dam play a crucial role in providing irrigation water to the agricultural fields in the region.

Map 1 Garida Dam

Map 2 Machchhu 1 Dam

3. METHODOLOGY

3.1 Data collection

The research on the breeding biology of the Great Thick-knee *(Esacus recurvirostris)* near the freshwater reservoir in Wankaner involved a comprehensive data collection process. The study period spanned from March to July, encompassing the entire breeding season of the species. Field surveys were conducted to identify and monitor active nests (Gupta, 2012). Detailed observations were made on nest location, clutch size, incubation period, and parental care behaviors. GPS coordinates were recorded for each nest to map their distribution within the reservoir area. Nest success rates were monitored by regular visits to assess hatching and fledging success (Helvoort, 2011). Data on nest predation and disturbance factors, such as human activities and livestock grazing, were also collected. Additionally, information on the habitat characteristics of the nesting sites, including vegetation cover, soil type, and proximity to water bodies, was recorded. To gather information on the diet of the chicks, regurgitated food items were collected and identified. This helped to understand the foraging ecology of the species and its reliance on specific prey items (International, 2018)(Mundkur, 1970). The data collected during this study provides valuable insights into the breeding biology of the Great Thick-knee in this specific location, contributing to a better understanding of the species' ecology and conservation needs.

3.2 Monitoring nests

Nest monitoring was a crucial component of this study on the breeding biology of Great Thick-knees. Nests were located by careful observation of the birds' behavior, including incubation shifts, territorial displays, and nest building activities (Sethi, 2010). Once a nest was identified, it was monitored regularly to assess its status and collect data on various parameters.To minimize disturbance to the incubating birds, nest visits were planned during the early morning or late evening hours (Yogev, 1996). Observations were made from a distance using binoculars or spotting scopes to avoid direct contact with the nest. The number of eggs in the clutch was recorded, and the incubation period was estimated by monitoring the presence of both parents on the nest (Yogev, 1996). Nest success was monitored by regular visits to assess hatching success and chick survival. Factors influencing nest success, such as predation, flooding, and human disturbance, were also

noted.

3.3 The clutchsize and egg

Clutch size was determined by direct observation of the eggs within the nest. To avoid disturbing the nest, observations were made from a distance using binoculars or a spotting scope. In some cases, where direct observation was not possible, photographs were taken to record the number of eggs present.To monitor egg size, careful measurements were taken of each egg in a clutch. A digital caliper was used to measure the length and breadth of each egg to the nearest 0.1 mm. These measurements were recorded in a field notebook, along with the nest identification number and the date of measurement (Islam, 2004). To minimize disturbance to the incubating birds, measurements were taken quickly and efficiently.In addition to length and breadth, the weight of each egg was also recorded using a precision digital scale. Eggs were carefully removed from the nest, weighed, and then returned to their original position.

3.4 Hatching and Nesting success

To assess hatching success, nests were monitored regularly throughout the incubation period. The number of eggs laid in each clutch was recorded, and subsequent visits were made to determine the number of eggs that hatched. By comparing the initial clutch size to the number of hatchlings, hatching success rates were calculated. To assess nesting success, nests were monitored regularly throughout the breeding season (Khalil, 2019). Nest success was defined as the proportion of nests that produced at least one fledgling.If a nest was found to be depredated or abandoned; the date of failure was recorded. By calculating the number of successful nests relative to the total number of nests initiated, the overall nesting success rate was determined.

3.5 Fledging success

Fledging success was a crucial aspect of the study, providing insights into the overall reproductive output of the Great Thick-knee population. Regular monitoring of nests allowed for the recording of hatching dates and the subsequent survival of chicks (Starck, 1998). Factors influencing fledging success, such as predation, food availability, and weather conditions, were carefully observed and noted (Sethi V. K., 2011).

4. RESULT AND DISCUSSION

The breeding season of the Great Thick-knee *(Esacus recurvirostris)* at the freshwater reservoir near Wankaner was observed to extend from March to July, with peak breeding activity occurring in April and May (Ali S. R., 1983). Nests *(n=11)* were typically located on bare ground patches within the reservoir bed, often in close proximity to water. The average clutch size was found to be 2 eggs (*n=22)*, with both parents actively involved in incubation and chick rearing.Incubation period lasted for approximately 28-30 days. Both parents shared incubation duties, taking turns to sit on the eggs. During incubation, the parent on the nest was vigilant, often camouflaging itself by stretching its neck and blending with the surrounding environment.

Table 1. Average clutch size, number of eggs hatched and lost in Great Thick-knee between study year (2018-23)

Clutch size (Mean±SD)		No. of eggs hatched (Mean±SD)		No. of eggs lost (Mean±SD)	
Garida Dam	Machchhu 1	Garida Dam	Machchhu 1	Garida Dam	Machchhu 1
2±0.8	2±0	1.2±0.4	1.6±0.68	0.8±0.74	0.83±0.68

Table 2. Productivity in nests of the Great Thick-knee during 2018-23								
Site	Nest Observed	Eggs Laid	Eggs hatched	Hatching success (%)	Egg lost	Loss of eggs (%) due to		
						Predation	Nest-damage	Hatching failure
Garida Dam	5	10	6	60	4	50	25	25
Machchhu 1	6	12	7	58.33	5	25	75	-

The study provided valued understandings into the reproductive biology and success of this Near Threatened species. The study period spanned from March to July, encompassing the entire breeding season. Both reservoirs were found to be suitable breeding habitats for the Great Thick-knee, offering essential resources like open ground for nesting, abundant food sources, and minimal human disturbance. However, significant differences were observed in the hatching success between the two sites. At Garida Dam, a relatively undisturbed reservoir, the hatching success rate was observed to be 60%. This relatively high success rate can be attributed to factors such as minimal human disturbance, adequate food availability, and suitable nesting conditions. In contrast, Machchhu 1, which experiences higher levels of human activity, exhibited a lower hatching success rate of 58.33%. Human disturbance, such as recreational activities and livestock grazing, can disrupt nesting and parental care behaviors,

5. CONCLUSION

The study highlighted the importance of the freshwater reservoir as a critical breeding habitat for the Great Thick-knee. The availability of suitable nesting sites, abundant food resources, and minimal human disturbance were crucial factors for successful breeding.

Photo 1 Breeding ground

Photo 2 Great Thick-knee on Nest

Photo 4 Clutch size
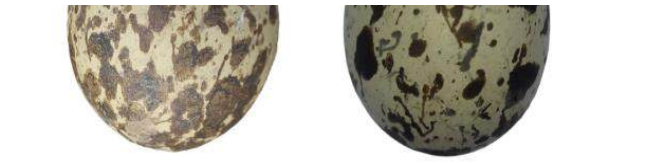
Photo 5 Dead chick

Photo 6 Monitor Lizard as Natural Predator

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THE ROLE OF EMOTIONAL APPEALS IN POLITICAL CAMPAIGN FOR LOKSABHA ELECTION 2024 IN GUJARAT: AN ANALYSIS OF NEUROMARKETING STRATEGIES.

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Abstract: **Purpose**

This paper therefore conjugates the role of emotional appeals in political campaigns in relation to neuromarketing strategies. The use of emotional appeal is one of the strongest tools politicians have because, through it, they can shape voters' perceptions, behaviours, and decision-making processes. With knowledge of neuroscience at their side, campaigns can draft messages that are intended to elicit emotions—of anxiety, fear, hope, pride, or anger—which may affect memory retention, engagement, and voting behaviour.

Design/ Methodology

Data has been collected through a well design structured questionnaire from 250 political consumers (voters). The method of sampling is a non-probability convenience sampling method. This has analysed emotional appeals executed by political party or leaders to find elements affecting to vote the political leader or party.

Originality/Value

This research indicates the adoption of the ethical emotional appeal to the political voters of Gujarat region. This study can help political parties and political strategist to design strategies and political campaign as well as advertisements.

Findings

The present study has explored how different emotional triggers are manifesting in campaign messages and their impacts on attitude and choice of the voter. The outcome of this research has bring forth with insight how a political campaign can strategically create emotionally appealing messages and add to the volume that is beginning to rise on neuromarketing and its impact on political communication and political consumers.

Key Words: **Campaign, Emotional Appeal, Neuromarketing, Political Consumers,**

1. INTRODUCTION:
Political marketing

It is a multifaceted field that seeks to combine traditional marketing precepts with the dynamic nature of political campaigning, governance, and public opinion. It studies how political parties, candidates, governments, or interest groups use marketing strategies and tools to influence political decisions or change the will of people, persuade electors, and show their policy and program contents. As media is climbing new heights of communication with advancement of social media platforms, adoption of modern marketing communication strategies has become inseparable part for all political parties for their political campaigns

as well as communication. In recent times, this domain of study has elicited quite a significant spate of academic interest in the context of increasing relevance of media and consumer culture to shape the contours of political processes. The rise of personalized communication, micro-targeting, and the ability to trace voter behaviour through digital platforms have transformed the way campaigns are run and how political messages are crafted.

Political marketing is the intersection of political science, communication, and marketing; it focuses on the application of marketing principles and techniques in the political sphere.it is a field where politicians and political party reach to the electorate, design political tidings and makes efforts to sway voting behaviour and doxies in favour of particular candidate or political party. Political marketing is not limited to tactical deployment of crusade, it is more concerned with answerable to the fundamental problems and needs of the citizen as well as the role of government in democracy, it's governance and fulfilment of promises which part and candidate of the party has given to the voters or citizens..

1. Theoretical Base: Political marketing based on theories and principles of marketing communication, and political science. Some key theoretical frameworks include:
   - Rational Choice Theory: Views voters as rational actors who make decisions based on their self-interest, influenced by political marketing strategies.
   - Public doxies Theory: Evaluates how the political crusade and media affect or drive the behaviour and opinion of the voters.
   - Branding and Identity Theory: Concerned with branding on the bases of political statistics or information and how it can drive the mind-set of voters for the political candidates or party.
   - Sociocultural Theory: Emphasise the Analyses of how political marketing strategies can influence according to the demographic, social and cultural factors of voters.
2. Decision making and Behaviour of Voters: Elucidating the voting behaviour in centre to this field and how it can be influence by political marketing. It can answer the Key research questions like
   - How do emotions, values, and identities interact with political messages in shaping voter preferences?
   - What role does political marketing play in persuasion, mobilization, and manipulation of voters?
   - How do political advertisements, debates, and speeches alter the political landscape during campaigns?

Definition

"Political marketing is application of tools and techniques to get the understanding voter opinion and behaviour before and during the election campaign to develop the contents and to measure the effect of campaign." Kavanagh (1995)

"The basic purpose of Political marketing is to influence voters during the elections. Political marketing is differentiated from the traditional marketing in the sense that in political marketing hopes, dreams and ideology are sold whereas in traditional marketing the sale is of products and services. But political marketing apply same tools such as advertisement, public relations and publicity as used in traditional marketing." Butler and Collins (1994)

WHAT IS NEUROPOLITICAL MARKETING?

The way an offer or an advertisement of a particular product or service run by a manufacturer or a company can make customers to purchase the goods as company has designed an offer. From that one time of transaction or exchange with company makes customer to reach at Satisfied. From the Prospectus to Satisfied and satisfied to loyal customer company enjoys the market and set its position in to the competitive landscape. The same way a political party or leader tries to convince the Political Customer (Political

Voters) by advertisement, campaigns, public congeries, parole..etc.. in exchange of vote in his/her favour or in favour of respective party. It can be clearly understand by figure 1.1

Figure 1.1. Business Marketing VS Political Marketing
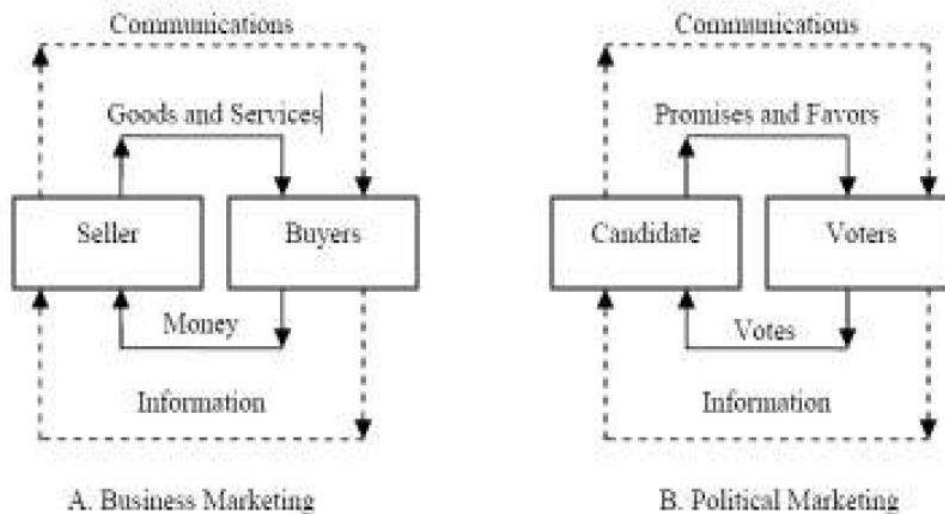
This article considers Lakoff's "neuropolitics" in the light of the work of political theorist William E. Connolly says that environmentalists should pay more attention to the affective effects of communities their language the culture in which they dwell and effect of micro political strategies executed on the communities.

There was another exam ple of online political micro targeting. In 2009 Chris Christie gathered data of republican women who had searched about breast cancer on any online internet platform, but this online political ad came against Christie, by his opponent John Crozine in the election. John Crozine was sitting at a kitchen with his wife and telling the story of his mother's long struggles to get cure from the breast cancer and gave a statement that Christie supported to reduce funding of mammogram.

2. LITERATURE REVIEW:

Nicholas A Valentino, Ted Brader, Eric W. Groenendyk, krisha gregorowicz, Vincent L. Hutchings 2011, The American National Election Studies -ANES have measured since 1980 the public feelings regarding the major parties and their candidates by asking the questions "Has the Democratic or Republican Candidates) because of the kind of person he is, or because of something he has done ever made you feel angry, afraid, proud, and hopeful? Public sentiment toward Democrats and Republicans tends to fluctuate significantly, indicating that some candidates on some political climates have triggered particular emotions more strongly than others.

Kishan Gopal. Those supporting the "minimal effects" hypothesis believe there is, in fact, very little effect of political campaigns. Others suggest there is a great effect on voting behavior by political campaigning and it can be quantified. Curiously, political marketing has received minimal attention from academic scholars. Apparent interests on the one side, but also perceptions of a lack of relevance have often set limits to the examination of political marketing (Luck, 1969).

Hussain T. (2022), Has conducted the paper that undertakes the examination of transformative dimensions in the digital marketing approaches towards election campaigns that underpin the shift from the traditional to well-honed digital interactions. Social media and digital analytics, therefore, targeted advertising and ignited strong transformation in the way balance of power and reach between the voters and the political campaigns is attained. Ostensibly, there is little qualitative information on the effectiveness of the strategies applied; hence, the interest in researching exactly how the different strategies impinge on voter participation, behaviour, and the democratic process as a whole.

Jeff Chester, Kathryn C. Montgomery. 2019, It has been explored throughout this collection, the state of micro targeted programmatic advertising—the centerpiece of today's digital media and marketing apparatus—became part of electoral campaigns themselves amidst increasing concerns about privacy, discrimination, and manipulation. Many facets of the modern political campaign embrace digital strategy and technology that powerfully demonstrates ways campaign branding works throughout the election cycle. It also calls into focus the need for any prior and proposed regulatory and policy responses that seek to inject some transparency and accountability in the realm of digital politics.

Islam Mohamed Hegazy (2019), This paper tries to give profound insight into the more and more relevant role played by Big Data 2.0 and neuromarketing in general, and most particularly in connection with their use in manipulative relations to the distorting of election results. It tries responding in particular to some issues raised concerning the 2016 presidential campaign of Donald Trump and the capability to wash the brains of American political consumers and influence their choice. Analyzing the political marketing strategies of Trump, this paper suggests that Big Data 2.0 and neuromarketing techniques have played a significant role in interpreting voter behavior and helped create one of the most unexpected victories in presidential election history. However, this work also maintains that the morality of the use of Neuromarketing 2.0 in political activity for the promotion of candidacies and its negative results on the quality of the democracy remain a matter of debate.

Sekoul Krastev1, Joseph T. McGuire2, Denver McNeney3, Joseph W. Kable2, Dietlind Stolle3, Elisabeth Gidengil3 and Lesley K. Fellows1 (2016), Political Choice is paramount, be it in the voting booth or in response to a pollster. The sum of individual choices yields the result that determines which way public policy goes—and, as a result—the well-being of the people they serve (Soroka and Wlezien, 2010). While cognitive neuroscience offers new tools for understanding choices, political scientists have so far been slower than their colleagues in economics to pick up the new approaches.

Hardeep Kaur (2018)

In India following main political and socio-economic factors which act as determinates of voting behaviours in our Democratic system:	1. Ideological commitment:	5.Populist slogans	6.Personal contacts
	2. Public Esteem of the Candidate	8. Religion	9. Language
	10. Influence of money	11. Education	12. Mass literacy :
	13. Public Esteem of the Candidate	14. Election campaign	15. Faction alism

Table 1.1 Determinants of Voting Behaviours.

Rahul Verma, Shreyas Sardesai (NATIONAL ELECTION STUDY 2014)
Image 1.2.

Figure 1: Increasing Media Exposure in India since 1996
Consumption (in %)
Source: Time series NES 1996-2014.
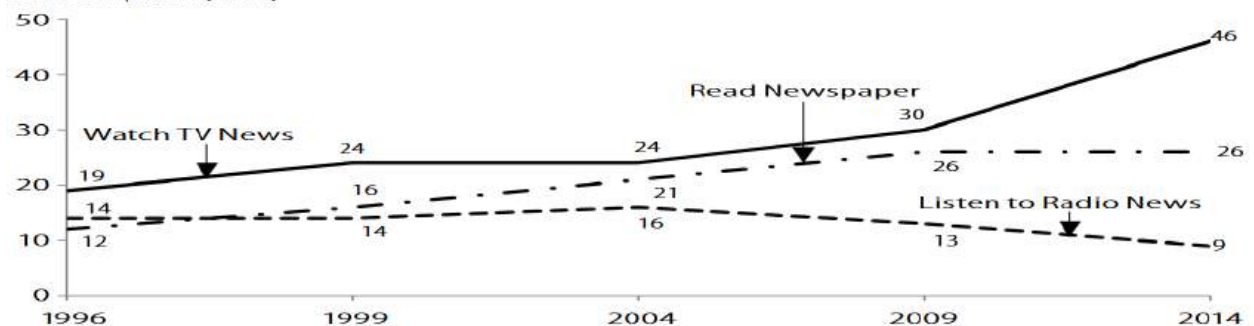
Aindrila Biswas, Nikhil Ingle and Mousumi Roy 2014. The 2008 Barack Obama presidential campaign showed how social media could be effectively used within a political campaign. From advertising to planning, from organizing in all 50 states to fundraising, every aspect of the campaign utilized social media to communicate with its supporters. Virtual communities on social networking sites became essential components of the campaign, further entrenching social media in the political process. Following Obama's 2008 victory, social media usage in India experienced a sudden surge, particularly among the youth. Notably, during the 2011 India Against Corruption (IAC) movement, social networks played a crucial role for the first time. Facilitators at various levels used these platforms to disseminate information and orchestrate protests and demonstrations. Many Indians also turned to social media to express unwavering support for the movement around the clock. The primary use of social media in this campaign was to mobilize and connect people while raising awareness at minimal cost.

Background of the Study
Human emotions are complex, multi layered feelings emerging from interactions between biological, psychological, and social factors. These feelings have evolved to help human beings negotiate the environment, face challenges, and build relationships. They shape decision-making and behavioural processes as well as social interaction, thus influencing the well-being of a person and the society or community in which he or she resides. Understanding and managing such emotions is, in fact, the path to personal growth and balance. Following are the emotions which has been chosen to study in this research
Proud (Pride): A feeling of deep satisfaction and contentment generated by personal achievements, or by the accomplishments of others with whom one has identified. Purpose: Pride pushes people to be the best and get social recognition. It reinforces good behaviour and helps in self-esteem-building and identity.
Hope: Hope is a forward-looking emotion in which one desires or believes something good will happen, or challenges will be surmounted. Purpose: Hope is the ability to be resilient during bad times, and it acts to motivate one to persist and work out problems.
Anger: Anger is a strong emotion that arises if one perceives an attack, injustice, or obstruction. It generally happens when people feel violated, frustrated, or powerless. Purpose: Anger can mobilize people to right wrongs, defend themselves, or set boundaries. Uncontrolled anger may result in destructive outcomes.
Anxiety: Anxiety is a state of heightened alertness and worry about potential future threats or uncertainties. It can range from mild unease to intense fear or panic. Purpose: Anxiety helps individuals anticipate danger and prepare for challenges, but excessive anxiety can hinder daily functioning and well-being.
Fear: Fear is a powerful emotion triggered by the perception of immediate danger or threat, real or imagined. Purpose: Feelings of fear initiate the "fight or flight" response, which prepares the human body to react to danger. This instinctive mechanism is vital for survival, but excessive or prolonged fear can cause distress and illness.
To justify all these emotions three political campaign, advertisements, or an event has chosen and on the basis of that could they like to vote or not has studied in this research paper Following are images which were used to study the relationship between to influence of advertisement, news on TV, radio, social media campaigns, or Political Campaigns, manifesto etc. and likeliness to vote.

Image PD.1.

Image PD.2.

PROUD/PRIDE
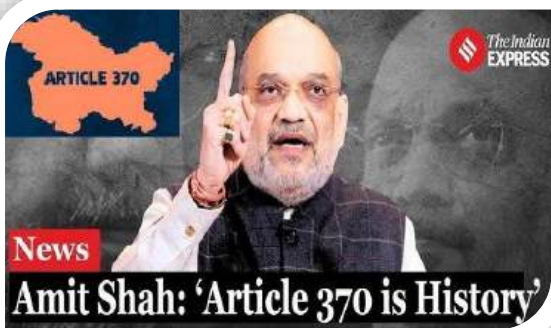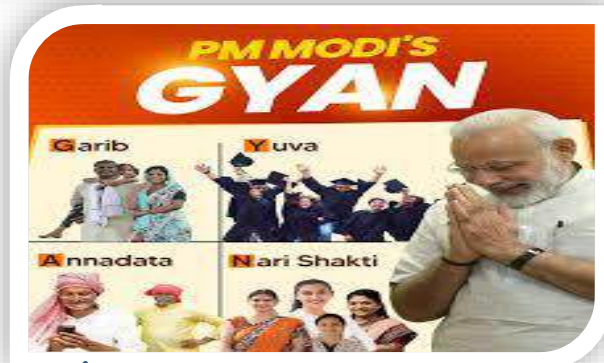
India's First G20 Summit: What You Need to Know

Image PD.3.

ARTICLE 370

The Indian EXPRESS

News
Amit Shah: 'Article 370 is History'

Image HP.1.

Image HP.2.

HOPE

PM MODI'S GYAN

Garib   Yuva
Annadata   Nari Shakti

Image HP.3.

LOK SABHA ELECTION 2024   ET NOW

'FREE RATION SCHEME TO CONTINUE FOR NEXT 5 YEARS'

Image AG.1.

Image AG.2.

ANGER

Image AG.3.

Image AX.1.

Image AX.2.

ANXIETY

Image AG.3.

FEAR

Image FR.1.

Image FR.2

Image FR.3.

3. OBJECTIVES / AIMS :

Primary Objective:-

"To know the emotional influences of political campaign, advertisement news on TV, or an event to address the prospected voters" This primary objective followed by

Secondary objective

As followed by primary objective total five emotions has been identified dand carried to study which are as follow

1. To identify the influence of proud moments on voter.
2. To identify the influence of moments of hope on voter.
3. To identify the influence of anger on voter.

4. To identify the influence of anxiety on voter.
5. To identify the influence of fear on voter.

4. RESEARCH METHOD / METHODOLOGY:

Research Design: - This research paper used descriptive research design. To describe those emotional appeals plays

Sampling Method: - Non probabilistic convenient sampling method has chosen to collect the data

Sampling size: - 270 peoples from entire Gujarat have been selected.

Data collection instrument: - Structured question consisting of 27 close ended questions has been framed up

Data Analysis Techniques: - Co- Relation of voting likeliness and emotional appeal of political campaign has been analysed by using Pearson's Co-relation.

Hypothesis

For all the images of advertisement, news on TV, radio, social media campaigns, or Political Campaigns, manifesto etc. and likeliness to vote. mention in research design has its own impact on voting decision of voter hence following hypothesis has framed.

PROUD/PRIDE

PD.1. H0: There is no significance relationship between PD.1. and vote to the government in 2024
PD.2. H0: There is no significance relationship between PD.2. and vote to the government in 2024
PD.3. HO There is no significance relationship between PD.3. and vote to the government in 2024

HOPE

HP.1. H0: There is no significance relationship between HP.1. and vote to the government in 2024.
HP.2. H0: There is no significance relationship between HP.2. and vote to the government in 2024
HP.3. H0: There is no significance relationship between HP.3. and vote to the government in 2024

ANGER

AG.1. H0: There is no significance relationship between AG.1. and vote to the government in 2024
AG.2. H0**:** There is no significance relationship between AG.2. and vote to the government in 2024
AG.3. H0: There is no significance relationship between AG.3. and vote to the government in 2024

ANXIETY

AX.1. H0: There is no significance relationship between AX.1. and vote to the government in 2024
AX.2.H0: There is no significance relationship between AX.2. and vote to the government in 2024.
AX.3. H0: There is no significance relationship between AX.3. and vote to the government in 2024

FEAR

FR.1. H0: There is no significance relationship between FR.1. and vote to the government in 2024.
FR.2. H0: There is no significance relationship between FR.2. and vote to the government in 2024
FR.3. H0: There is no significance relationship between FR.3. and vote to the government in 2024

Data Analysis

Here it is the analysis of all the five major emotions which has been included in this paper.

Proud/Pride

PD.1.

Correlations

	LIKELYTOVOTEIN2024LOKSABHAE OKSABHAE	EFFECTOFAYODHYARAMMANDIR

		LECTION	
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.330**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFAYODHYARAMMANDIR	Pearson Correlation	.330**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

From the image PD.1. Can be conclude from the present co-efficient co-relation it can be said that there is a these variables is .330 which is indicates the perceived effect of Ayodhya Ram-mandir to vote in Loksabha election 2024. So it is right to say for the hypothesis that H1 would be accepted.

PD.2.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFG20SUMMIT2023ININDIA
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.365**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFG20SUMMIT2023ININDIA	Pearson Correlation	.365**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

From the image PD.2. The above result indicates that G20 summit hosted by India in 2023 has positive moderate effect on voting choice of voters. So it is right to say for the hypothesis that H1 would be accepted.

PD.3.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFARTICLE370INKASHMIR
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.374**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFARTICLE370INKASHMIR	Pearson Correlation	.374**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

From the image PD.3. This table examines the relationship between the likelihood of voting in the 2024 Lok Sabha elections and perceptions regarding the impact of the abrogation of Article 370 in Kashmir. The correlation coefficient is 0.374, indicating a moderate positive relationship. So it is right to say for the hypothesis that H1 would be accepted.

HP.1.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFMODIKIGAURANTEE
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.358**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFMODIKIGAURANTEE	Pearson Correlation	.358**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The image HP.1. Showed basic thing for any political party to offer voter is manifesto, which political party use as a attraction for upcoming years if they won an election, here it has significant positive relationship with likeliness to vote.

HP.2.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFPMMODIGYAN
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.353**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFPMMODIGYAN	Pearson Correlation	.353**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The image HP.2. 'GYAN' scheme declared during election which was bounded to work for Garib (Poor), Yuva (Youth), Anndata (Farmers), Narishakti (Women empowerment) had the moderate positive relationship with likeliness to vote in election.

HP.3.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFFREERATIONSCHEMEFORNEXT5YEARS
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.333**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFFREERATIONSCHEMEFORNEXT5YEARS	Pearson Correlation	.333**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The image HP.3. Prime minister of India Narendra Modi declared free ration for the next five years if BJP (Bharatiya Janata Party) wins the Loksabha Election of 2024. This has positive image on voters to vote him or his party.

AG.1.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFYOGIBHAGVATHINDURASHTRASAPATH
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.329**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFYOGIBHAGVATHINDURASHTRASAPATH	Pearson Correlation	.329**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The image AG.1. In which of oath ceremony of Yogi Adityanath (Chief Minister of Uttarpradesh) with Mohan Bhagvat (President of Rashtriya SwayamSevak Sangh) had moderate but significant positive effect on voters to vote.

AG.2.

Correlation		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFIMAGEOFMODIHAVINGWEAPONSONHAND
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.281**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFIMAGEOFMODIHAVINGWEAPONSONHAND	Pearson Correlation	.281**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The image AG.2. Where Prime Minister having bowet and sword during live addressing the people such kind of images represents the strength or motivate to be like particular personality. This has low but significantly positive relationship with likeliness of vote.

AG.3.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFKATENGETOBATENGE
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.289**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFKATENGETOBATENGE	Pearson Correlation	.289**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The image AG.3. was showing the recent scenario of political campaign which was done by BJP government in Uttarpradesh election. Though hypothetically it had used to study the effect of it in 2024 Loksabha election then it may had moderate significant relation to likeliness to vote at 0 .289**.

AX.1.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFBOYCOTTMADEINCHINA
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.216**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFBOYCOTTMADEINCHINA	Pearson Correlation	.216**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The image AX.1. Showing movement of boycott Chinese product has moderate level of influence on voters.

AX.2.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFINDIAVSCHINAIMAGE
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.269**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFINDIAVSCHINAIMAGE	Pearson Correlation	.269**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The image AX.2. Shows that any news on TV regarding border issues with neighbour country has impact. If situation like India VS China shows the moderate level of relationship with likeliness of voters to vote on such actions of ruling government.

AX.3.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFINDIAVSPAKISTANIMAGE
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.296**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFINDIAVSPAKISTANIMAGE	Pearson Correlation	.296**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The image AX.3. Shows a situation of border issues with Pakistan has moderate but positive influence on political voters.

FR.1.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFEKHETOSAFEHE
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.332**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFEKHETOSAFEHE	Pearson Correlation	.332**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The image FR.1. Shows political campaign appealing "Ek he to safe he" (Be unite to be safe) has very significant positive relationship with likeliness to vote.

FR.2.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFSUFFERINGOFHINDUINBANGLADESH
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.320**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFSUFFERINGOFHINDUINBANGLADESH	Pearson Correlation	.320**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The imageFR.2. Shows that Hindutva is in danger has positive and significant relationship with likeliness of voter to vote.

FR.3.

Correlations

		LIKELYTOVOTEIN2024LOKSABHAELECTION	EFFECTOFHINDUEKJUTATA
LIKELYTOVOTEIN2024LOKSABHAELECTION	Pearson Correlation	1	.312**
	Sig. (2-tailed)		.000
	N	270	270
EFFECTOFHINDUEKJUTATA	Pearson Correlation	.312**	1
	Sig. (2-tailed)	.000	
	N	270	270

**. Correlation is significant at the 0.01 level (2-tailed).

The Image FR.3. Shows a political campaign of 'Hindu Ekjutata" (Unite the Hindus). The largest population of India has a significant positive relationship with likeliness to vote in 2024 Loksabha election.

5. RESULT / FINDINGS:
Proud/ Pride
The analysis reveals a significant positive correlation between the likelihood of voting in the 2024 Lok Sabha elections and the perceived effects of key national events, including the Ayodhya Ram Mandir (.330), the G20 Summit 2023 in India (.365), and the abrogation of Article 370 in Kashmir (.374).
Hope

The findings denote a significant positive relation between the likelihood of voters participating in the 2024 Lok Sabha election with key promises made by Prime Minister Narendra Modi and his party. The "Modi Ki Guarantee" ($r = 0.358$, $p < 0.01$), the "PM Modi GYAN" scheme for the poor, youth, farmers, and women frictional social groups ($r = 0.353$, $p < 0.01$),

Anger

Results show that emotional triggers associated with anger have a measurable relationship to the likelihood of voters to participate in the 2024 Lok Sabha elections. Association is related with an image of Prime Minister Modi holdings weapons at $r = 0.281$, p-value < 0.01 while the promotion of ideology "Hindu Rashtra" and Bhagvath oath-both by Yogi Adityanath-and the related slogan "Katenge Toh Batenge" at values of ; and $r = 0.289$:, $p<0.01$-respectively are all indications of a good positive moderated association.

Anxiety

India VS China imagery had a correlation of 0.269 and p-value of less than 0.01. Such visuals are most likely to influence voter sentiment. Moreover, the call for "Boycott Made in China" has a weak yet significant correlation, with a value of $r = 0.216$ and $p < 0.01$.

Fear

The data highlights a significant positive relationship between moments evoking fear and the likelihood of voters participating in the 2024 Lok Sabha elections. The narrative of safety symbolized by "Ek Hetho Safe He" ($r = 0.332$, $p < 0.01$), the portrayal of suffering of Hindus in Bangladesh ($r = 0.320$, $p < 0.01$), and the emphasis on "Hindu Ekjutata" (Hindu Unity) ($r = 0.312$, $p < 0.01$) are all associated with voter engagement.

6. DISCUSSION / ANALYSIS:

In this paper all the Ho hypothesis were rejected because there is a significant correlation has been founded between all the elements and likeliness to vote

PROUD/PRIDE

PD.1. H1: There is significance relationship between PD.1. and vote to the government in 2024
PD.2. H1: There is significance relationship between PD.2. and vote to the government in 2024
PD.3. H1 There is significance relationship between PD.3. and vote to the government in 2024

HOPE

HP.1. H1: There is significance relationship between HP.1. and vote to the government in 2024.
HP.2. H1: There is significance relationship between HP.2. and vote to the government in 2024
HP.3. H1: There is significance relationship between HP.3. and vote to the government in 2024

ANGER

AG.1. H1: There is significance relationship between AG.1. and vote to the government in 2024
AG.2. H1**:** There is significance relationship between AG.2. and vote to the government in 2024
AG.3. H1: There is significance relationship between AG.3. and vote to the government in 2024

ANXIETY

AX.1. H1: There is significance relationship between AX.1. and vote to the government in 2024
AX.2.H1: There is significance relationship between AX.2. and vote to the government in 2024.
AX.3. H1: There is significance relationship between AX.3. and vote to the government in 2024

FEAR

FR.1. H1: There is significance relationship between FR.1. and vote to the government in 2024.
FR.2. H1: There is significance relationship between FR.2. and vote to the government in 2024
FR.3. H1: There is significance relationship between FR.3. and vote to the government in 2024

8. CONCLUSION / SUMMARY:

The influencing voter sentiment. Taken together, these suggest that targeted welfare measures or guarantees are effective in capturing voter preferences for the next election. Along with that India VS Pakistan phenomena has near around results as of with China. All these anxiety-laden factors underline how issues on national security and economic independence could motivate voter participation and align their preference with the BJP's discourse. These findings indicate that these events resonate strongly with voters and may influence their electoral engagement, highlighting their importance in shaping public sentiment

and political participation. Free rations for five years promise all have a significant relation to changing voter sentiment. These commitments trigger hope among electorates and at the same time act as influential factors to motivate voters and make them provide a favorable verdict for BJP in the coming election. These elements of anger will stir such emotional responses that would resonate with the voter cohorts and perhaps be a good reason to believe in support for the BJP in this election. These emotionally charged themes leverage fear and vulnerability to drive voters toward supporting the BJP, reinforcing the party's positioning as a protector of cultural and national interests.

9. LIMITATIONS:

Many neuroscientific studies take small samples that cannot be considered representative. There might also be limits related to the generalization across a wide variety of voters due to reasons of culture, social systems, and demographic parameters.

Risk of Over-Interpretation: Neuromarketing data can easily get misinterpreted or overhyped. That would be: brain activity does not always amount to a concrete decision or preference, thus misleading conclusions.

Reductionism: Neuropolitical marketing seems to make the tendency to simplify human decision-making to an unrealistically simple model, mainly based on brain responses; political preferences depend on a lot of complicated psychological, social, and environmental factors—neuroscience is far from capable of revealing.

Figures/ Tables/Charts:

Image 1.1 Differences between Consumer and Political Marketing
Image 1.2 Increasing Media Exposure in India Since 1996
Table 1.1 Table 1.1 Determinants of Voting Behaviours.

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PD.3.:- https://tinyurl.com/yck5vtcf
HP.1.:- https://tinyurl.com/44w7tbkz
HP.2.: https://tinyurl.com/2smv3jc6
HP.3.:- https://tinyurl.com/22fv5det
AG.1.:- https://tinyurl.com/5n76fx75
AG.2. https://rb.gy/r7ihws
AG.3.:- https://rb.gy/72izj6
AX.1.:- https://tinyurl.com/yc2bj3nk
AX.2.:- https://tinyurl.com/y6sdzem9
AX.3. :- https://tinyurl.com/epcds47n
FR.1.:- https://tinyurl.com/3taey9v4
FR.2.:- https://tinyurl.com/5fzbeukb
FR.3.:- https://tinyurl.com/34nkj96k

IMPACT OF LANDPORT INFRASTRUCTURE DEVELOPMENT ON INDIA-MYANMAR TRADE DYNAMICS

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Abstract:

Purpose: This paper investigates the impact of landport infrastructure development on the trade dynamics between India and Myanmar. By focusing on key land border crossings and infrastructure projects, the study assesses how improved connectivity influences bilateral trade, economic integration, and regional development in Southeast Asia.

Organization of the Paper: The paper is divided into five main sections. The first section provides an overview of the historical trade relations between India and Myanmar, highlighting the significance of their shared border. The second section examines the current state of landport infrastructure, detailing recent developments and key projects enhancing connectivity. The third section presents a brief literature review on infrastructure's role in trade facilitation. The fourth section outlines the data sources, analytical tools, and methodology used to assess the impact of infrastructure development on trade dynamics. Here, trade volumes, patterns, and economic indicators before and after infrastructure improvements are analyzed. The fifth and final section discusses the main findings, conclusions, and policy recommendations.

Research Methodology: The study employs a quantitative data analysis approach. Trade data from official sources are analyzed to identify trends and shifts in trade volumes.

Research Limitations: The study acknowledges limitations such as the availability and reliability of trade data, particularly from border regions. Also, the impact of external factors like geopolitical developments and policy changes may influence trade dynamics, which are beyond the scope of this study.

Practical Implications: The findings offer valuable insights for policymakers, infrastructure planners, and businesses involved in India-Myanmar trade. Understanding the impact of landport development can inform future infrastructure projects, trade policies, and regional cooperation initiatives aimed at enhancing economic integration in the region.

Originality: This study provides an original contribution by specifically analyzing the role of landport infrastructure development in shaping trade dynamics between India and Myanmar, an area that has received limited scholarly attention.

Key Words: India-Myanmar Trade, Landport Infrastructure, Trade Dynamics, Border Connectivity, Economic Integration.

1. INTRODUCTION:

The development of landport infrastructure is a critical driver of regional trade, economic integration, and socio-economic development. In the context of Southeast Asia, the trade dynamics between India and Myanmar hold substantial significance due to their strategic geographical positions, shared borders, and mutual economic interests. India's northeastern region shares a 1,643-kilometer-long border

with Myanmar, presenting immense potential for overland trade and connectivity. Despite this geographical advantage, trade between the two nations has historically been underutilized, constrained by inadequate infrastructure, Policy constraints, and security concerns.

India's "Act East Policy," an evolution of the earlier "Look East Policy," underscores the nation's strategic intent to strengthen economic and cultural ties with Southeast Asian countries. Myanmar, being the only ASEAN member sharing a land border with India, is essential to this policy framework. Enhanced connectivity with Myanmar is not only essential for boosting bilateral trade but also serves as a gateway for India to access other ASEAN markets, thereby encouraging broader regional integration.

In recent years, both India and Myanmar have recognized the imperative of improving landport infrastructure to catalyze trade and development. Key initiatives such as the **India-Myanmar-Thailand Trilateral Highway** and the **Kaladan Multimodal Transit Transport Project** exemplify concerted efforts to enhance overland connectivity. The modernization of border trade points like **Moreh-Tamu** in Manipur and **Zokhawthar-Rihkhawdar** in Mizoram has been prioritized to facilitate smoother trade flows. These projects aim to reduce transportation costs, decrease transit times, and eliminate logistical bottlenecks that have historically impeded trade.

The impact of these infrastructure developments on trade dynamics is diverse. Improved landports are expected to:

1. **Increase Trade Volume and Diversity**: Enhanced infrastructure facilitates higher trade volumes and allows for a more diverse range of goods to be exchanged, benefiting producers and consumers in both countries.
2. **Promote Economic Integration**: Better connectivity fosters economic interdependence, leading to more robust bilateral relations and integration within the larger ASEAN economic community.
3. **Stimulate Regional Development**: Infrastructure projects often lead to the development of surrounding regions, creating employment opportunities, and improving the socio-economic conditions of border communities.

2. LITERATURE REVIEW:

The development of landport infrastructure between India and Myanmar has garnered significant attention in recent years due to its potential to enhance bilateral trade, promote regional integration, and contribute to socio-economic development. This literature review synthesizes key scholarly works that examine the current status, challenges, and future prospects of India-Myanmar connectivity, with a focus on landport infrastructure and its impact on trade dynamics.

Current Status of India-Myanmar Connectivity

De and Ray (2013) provide a comprehensive analysis of the existing connectivity between India and Myanmar, highlighting the underdeveloped state of infrastructure that has historically limited trade and economic cooperation. They note that despite sharing a long land border, the two countries have not fully capitalized on their geographical proximity due to inadequate transportation networks and border facilities. The authors highlight the need for upgrading infrastructure to facilitate smoother movement of goods and people, which is essential for deepening economic ties.

Similarly, Htun et al. (2011) examine the connectivity from Myanmar's perspective within the broader ASEAN-India framework. They underscore the strategic importance of Myanmar as a land bridge connecting South Asia and Southeast Asia. The authors suggest that enhancing landport infrastructure is critical for integrating Myanmar into regional supply chains and for the country to serve as a conduit for India's engagement with ASEAN markets.

Optimization of Land Port Facilities

Sinha and Sinha (2023) analyze the optimization of land port facilities in India through a systems thinking approach, addressing the complex interdependencies between infrastructure, trade dynamics, and policy frameworks. The study explores inefficiencies in current operations, proposing integrated solutions to enhance port functionality and economic throughput. By leveraging systems thinking, the authors identify key leverage points for improving logistics, reducing bottlenecks, and fostering regional trade connectivity. The paper adds valuable perspectives to the broader conversation on border economy management and provides practical guidance for policymakers and stakeholders.

Regional Initiatives and Connectivity Projects

Mahida (2024) presents a comprehensive SWOT analysis of BIMSTEC from the Indian perspective, exploring its strategic role in fostering regional cooperation in the Bay of Bengal region. The article highlights India's pivotal role in advancing BIMSTEC's multi-sectoral agenda, addressing economic, technical, and geopolitical opportunities. While emphasizing BIMSTEC's potential for enhancing trade and connectivity, the study also examines structural weaknesses, such as uneven participation and resource constraints, alongside external threats like geopolitical rivalries. The analysis offers actionable insights for India's strategic positioning and policy formulation within the BIMSTEC framework.

The India-Myanmar-Thailand Trilateral Highway and the Kaladan Multimodal Transit Transport Project are notable examples of connectivity projects intended to enhance landport infrastructure. De and Ray (2013) discuss these projects, emphasizing their potential to transform trade dynamics by providing alternative routes and reducing dependency on traditional maritime channels. These projects aim to link India's northeastern states with Myanmar and beyond, thereby opening up new avenues for trade and investment.

Geo-Economic Considerations

Singla (2023) explores the geo-economics of India's trade with its South Asian neighbors, including Myanmar. The article examines how strategic infrastructure development, such as landports and transport corridors, can influence trade patterns and economic relationships. Singla notes that infrastructure is a critical component of India's broader strategy to enhance regional connectivity and asserts that improved landport infrastructure can serve as a catalyst for economic growth and geopolitical influence in the region.

Jones (2016) applies prospect theory to analyze China's military actions in the South China Sea, focusing on decision-making under risk in high-stakes territorial disputes. The study situates China's behavior within the broader context of power politics and maritime strategy, examining how perceived losses of sovereignty and strategic leverage influence its assertiveness. By integrating theoretical insights with case studies, Jones provides a nuanced understanding of the interplay between rational calculus and risk perception in China's military strategy. This work contributes to the discourse on regional security and the dynamics of contested waters in Asia.

Challenges in Infrastructure Development

Htun et al. (2011) analyze ASEAN-India connectivity through a Myanmar-centric lens, highlighting the nation's strategic role as a bridge between South and Southeast Asia. The paper explore Myanmar's potential in facilitating trade, transport, and cultural exchange, while identifying critical challenges such as infrastructure deficits and political constraints. The study is part of the Comprehensive Asia Development Plan and provides detailed policy recommendations to improve connectivity, including investments in transport corridors and institutional reforms. This work underscores Myanmar's pivotal position in realizing the full potential of ASEAN-India economic and strategic integration.

De and Ray (2013) provide a detailed analysis of the evolving India-Myanmar connectivity, emphasizing its significance for regional integration and economic cooperation. The study examines the existing infrastructure, trade routes, and bilateral agreements, while identifying key challenges such as logistical bottlenecks and policy barriers. This paper propose strategic measures to enhance connectivity, including infrastructure development, streamlined regulations, and cross-border partnerships. Their work underscores the critical role of improved India-Myanmar ties in fostering broader regional connectivity within South and Southeast Asia, contributing to economic growth and geopolitical stability.

Impact on Trade Dynamics

The literature collectively agrees that improved landport infrastructure has the potential to significantly impact trade dynamics between India and Myanmar. Enhanced infrastructure is expected to:

- **Increase Trade Volume**: By reducing transportation costs and transit times, improved landports can make trade more economically viable for businesses in both countries (Sinha & Sinha).
- **Diversify Trade**: Better connectivity enables the exchange of a wider range of goods, including time-sensitive products like perishables (De & Ray, 2013).
- **Promote Regional Integration**: Infrastructure development facilitates integration into regional markets and supply chains, aligning with India's Act East Policy and ASEAN's connectivity goals (Htun et al., 2011).

Singla (2023) adds that infrastructure development can alter geo-economic landscapes by shifting trade routes and creating new economic corridors. This can lead to changes in trade balances and influence the economic strategies of neighboring countries.

Regional and Geopolitical Considerations

Htun et al. (2011) emphasize Myanmar's strategic role in enhancing ASEAN-India connectivity, positioning the nation as a vital bridge linking South and Southeast Asia. The study highlights how improved infrastructure and policy alignment can foster regional integration, addressing geopolitical imperatives for stability and economic growth. Similarly, Sinha and Sinha (2023) underscore the critical role of optimized land port facilities in India, which are pivotal for facilitating trade and addressing cross-border challenges. Together, these works illustrate the interconnectedness of regional infrastructure and geopolitics, underscoring the importance of strategic investments in connectivity to enhance economic cooperation and geopolitical stability.

Gaps in the Literature

While the literature enriches our understanding, certain limitations are noticeable.

- **Empirical Data on Trade Impact**: There is a lack of quantitative studies that measure the direct impact of specific infrastructure projects on trade volumes and economic indicators between India and Myanmar.
- **Micro-Level Analyses**: Limited research focuses on the effects of infrastructure development on local communities, small businesses, and informal trade sectors in border regions.
- **Policy Implementation Studies**: There is a need for analyses that examine the effectiveness of policy measures accompanying infrastructure development, such as trade facilitation agreements and regulatory reforms.

Bridging these gaps would strengthen insights into the connection between landport development and economic outcomes, aiding the creation of more effective policies.
3. OBJECTIVES:

The objective of this research is to evaluate the impact of landport infrastructure development on India-Myanmar trade relations by:

1. **Quantitatively Measuring Trade Impact:** Assessing the direct effects of specific infrastructure projects on trade volumes and key economic indicators between India and Myanmar through empirical data analysis.
2. **Conducting Micro-Level Analyses:** Investigating how infrastructure development influences local communities, small businesses, and informal trade sectors in border regions, thereby understanding the grassroots economic implications.
3. **Evaluating Policy Implementation:** Analyzing the effectiveness of accompanying policy measures, such as trade facilitation agreements and regulatory reforms, to determine how these policies enhance or hinder the economic benefits derived from infrastructure projects.

By systematically investigating these areas, the research aims to fill prevailing voids in the academic discourse, thereby deepening the understanding of the mechanisms through which infrastructure development translates into tangible economic gains and informing the development of more robust policy frameworks between India and Myanmar.

4. RESEARCH METHODOLOGY:

This study uses statistical analysis to measure how improvements in landport infrastructure affect trade patterns between India and Myanmar. The research seeks to determine how investments in infrastructure change the amount and variety of trade between India and Myanmar, as well as their economic collaboration within the region.

Research Design

The study utilizes a **descriptive and inferential quantitative approach** to analyze the relationship between landport infrastructure development and trade dynamics between India and Myanmar. This design facilitates the identification of trends, patterns, and causal relationships within the collected data, thereby enabling a robust analysis of the research objectives.

Data Sources

To ensure the accuracy and relevance of the analysis, the study relies on multiple data sources.

1. **Trade Data:**

   ➤ **Directorate General of Commercial Intelligence and Statistics (DGCIS), India:** Provides comprehensive data on India's export and import statistics, categorized by product, region, and trading partner. The DGCIS data spans from **2010 to 2023**, offering a longitudinal perspective on trade trends.
   ➤ **Myanmar Customs Department:** Supplies detailed trade data specific to Myanmar, including import and export volumes, tariff rates, and trade balances with India over the same period.

2. **Infrastructure Project Data:**

   ➤ **Government Reports and Publications:** Detailed timelines, costs, and progress reports of key infrastructure projects such as the **India-Myanmar-Thailand Trilateral Highway** and the **Kaladan Multimodal Transit Transport Project** are sourced from official government documents and press releases (Ministry of Commerce & Industry, India; Myanmar Ministry of Transport).

> **World Bank and Asian Development Bank (ADB) Reports:** Provide supplementary data on infrastructure investments, funding sources, and project evaluations (World Bank, 2023; ADB, 2022).

3. **Regional Economic Indicators:**

> **International Monetary Fund (IMF) and World Bank Databases:** Offer macroeconomic indicators such as GDP growth rates, inflation rates, and trade openness indices for both India and Myanmar (IMF, 2023; World Bank, 2023).
> **ASEAN Statistical Yearbook:** Provides regional economic data relevant to Southeast Asia, facilitating comparative analysis (ASEAN, 2023).

Data Collection Methods

The data collection process encompasses both **secondary data extraction** and **data validation** techniques to ensure reliability and comprehensiveness:

> **Secondary Data Extraction:** Data is systematically gathered from official sources, databases, and published reports. This involves downloading datasets from the DGCIS and Myanmar Customs websites, accessing infrastructure project reports from government portals, and retrieving economic indicators from international organizations.
> **Data Validation:** To maintain data integrity, the collected datasets undergo validation through cross-referencing with multiple sources. Discrepancies are resolved by prioritizing data from primary government sources and reputable international organizations.

Data and References

> **Trade Data:** The trade volumes from DGCIS and Myanmar Customs are critical for understanding the quantitative aspects of bilateral trade. These datasets typically include detailed breakdowns by product categories, which allow for an in-depth analysis of trade diversification post-infrastructure development.
> **Infrastructure Project Timelines and Costs:** Government reports and publications provide authoritative information on the scope, scale, and financial aspects of key infrastructure projects. For instance, the **India-Myanmar-Thailand Trilateral Highway** project has an estimated cost of USD 1.5 billion and aims to enhance connectivity by reducing travel time by approximately 50% (Ministry of Commerce & Industry, 2023).
> **Regional Economic Indicators:** GDP growth rates, inflation rates, and other macroeconomic variables sourced from the IMF and World Bank are essential for controlling external factors in regression models. For example, India's GDP growth averaged around 6.8% annually from 2010 to 2023, while Myanmar experienced variable growth rates impacted by political instability and economic sanctions (IMF, 2023; World Bank, 2023).

5. FINDINGS:
Trade Dynamics Between India and Myanmar

Trade Volume Trends:

> Bilateral trade between India and Myanmar was valued at approximately USD 1.75 billion in the fiscal year 2023-24.
> India is Myanmar's fifth-largest trading partner, with significant trade in sectors such as agriculture, pharmaceuticals, and energy.

Dominant Commodities:

- **India's Exports to Myanmar:** Medicines, automobiles, machinery, and steel products.
- **Myanmar's Exports to India:** Natural gas, wood, pulses, and agricultural products.

Geographical Advantage:

- Despite sharing a 1,643 km border, a significant portion of bilateral trade occurs via maritime routes, primarily due to underdeveloped landport infrastructure and logistical challenges.

Infrastructure Development and Policy Implementation

Key Projects:

- **India-Myanmar-Thailand Trilateral Highway:** Approximately 70% completed as of 2023.
- **Kaladan Multimodal Transit Transport Project:** The project has faced delays due to security concerns in Myanmar, impacting its completion timeline.

Modernized Landports:

- **Moreh-Tamu and Zokhawthar-Rihkhawdar:** Modernization efforts are ongoing, aiming to enhance trade flows and reduce logistical costs.

Policy Impact:

- India's "Act East Policy" has bolstered initiatives to improve connectivity and trade with Southeast Asian nations, with Myanmar playing a pivotal role.

Regional and Local Socio-Economic Benefits

Economic Growth:

- Infrastructure projects are anticipated to stimulate economic growth in border regions by enhancing connectivity and trade opportunities.

Community Development:

- Improved infrastructure is expected to provide better market access for local producers, potentially increasing incomes and reducing poverty in border communities.

Geopolitical and Strategic Influence

Regional Cooperation:

- Collaborative projects under frameworks like BIMSTEC aim to strengthen regional integration and economic ties among member countries.

Strategic Competition:

- China's infrastructure investments in Myanmar, such as the China-Myanmar Economic Corridor, present strategic challenges, prompting India to expedite its connectivity projects to maintain influence.

Challenges in Landport Infrastructure Development

Key Issues Identified:

➢ **Funding Gaps:** While investments have been made, additional funding is required to complete major projects.
➢ **Security Concerns:** Ongoing conflicts in Myanmar have disrupted project timelines and pose risks to infrastructure development.
➢ **Policy and Bureaucratic Hurdles:** Delays in policy approvals and regulatory challenges continue to impede swift project implementation.

♣ Research Implications

Future Projections:

➢ Completion of key infrastructure projects is expected to significantly boost bilateral trade and regional economic integration.

Recommendations:

➢ Accelerate policy reforms to facilitate trade.
➢ Enhance security cooperation to address challenges affecting project timelines.
➢ Invest in digital infrastructure to streamline border trade processes.

6. DISCUSSION:

Enhancing landport infrastructure between India and Myanmar creates valuable opportunities to boost bilateral trade, facilitate regional integration, and support socio-economic advancement in border regions. By examining empirical data and current studies, this study illustrates the meaningful effects of strategic connectivity projects such as the India-Myanmar-Thailand Trilateral Highway and the Kaladan Multimodal Transit Transport Project.

Trade and Economic Integration: Improved landport infrastructure has a direct impact on reducing transportation costs, enhancing the efficiency of trade logistics, and diversifying trade commodities. While bilateral trade has increased incrementally, the potential remains underutilized due to infrastructural bottlenecks and inadequate policy support. Enhanced connectivity is poised to integrate India's northeastern states with ASEAN markets, aligning with India's *Act East Policy* and fostering broader economic interdependence.

Challenges: Despite significant progress, numerous challenges persist:

➢ **Security Concerns:** Ongoing insurgencies and political instability in Myanmar pose risks to the timely completion of projects.
➢ **Infrastructure Gaps:** Existing landport facilities are insufficiently equipped to handle increased trade volumes, necessitating technological upgrades and capacity expansion.
➢ **Policy Coordination:** Bureaucratic delays and lack of cohesive regulatory frameworks hinder smooth trade flows and efficient project implementation.

Socio-Economic Impacts: Infrastructure projects have the potential to transform border communities by creating employment opportunities, increasing market access for local producers, and improving living standards. However, these benefits are contingent on the timely resolution of logistical and policy barriers.

Geo-Economic and Strategic Considerations: India's infrastructure development efforts face competition from Chinese investments, such as the China-Myanmar Economic Corridor. Strengthening India's regional influence requires a proactive approach to project completion and policy implementation to capitalize on geopolitical opportunities.

7. CONCLUSION:

The development of landport infrastructure between India and Myanmar is a crucial step toward realizing the potential of bilateral trade and regional integration. Projects like the Trilateral Highway and the Kaladan Multimodal Transit Transport Project symbolize a shared commitment to fostering connectivity and economic growth. However, the realization of these goals hinges on addressing security, policy, and logistical challenges.

Improved landport infrastructure between India and Myanmar not only boosts bilateral trade but also enhances India's strategic influence within the ASEAN framework. By enhancing landport infrastructure and addressing existing challenges, India and Myanmar can foster increased economic collaboration and secure mutual advantages, thereby promoting regional stability and development.

8. LIMITATIONS:

1. **Data Limitations:**

   ➢ There is a limited availability of recent empirical data on the effects of landport infrastructure enhancements between India and Myanmar, which restricts a thorough analysis of their impact on bilateral trade dynamics.
   ➢ Current studies do not sufficiently explore how landport infrastructure development affects the economic and social well-being of communities living near the India-Myanmar border.

2. **Geopolitical Uncertainty:**

   ➢ The dynamic political and security environment in Myanmar introduces uncertainties that limit the predictability of project outcomes and timelines.

3. **Policy and Implementation Gaps:**

   ➢ The absence of a unified regulatory framework and slow policy execution have hindered the effective realization of infrastructure projects.

4. **Scope of Analysis:**

   ➢ The study does not account for informal trade sectors, which are significant in the India-Myanmar trade relationship.

9. RECOMMENDATIONS:

1. **Implement Targeted Policy Reforms:** Simplify the customs clearance procedures at key landports between India and Myanmar by reducing the number of required permits and introducing a single-window system. Additionally, develop standardized trade facilitation protocols tailored to the specific needs of cross-border businesses in these regions.
2. **Enhance Security Cooperation:** Establish a joint task force between India and Myanmar dedicated to securing landport infrastructure. This task force will implement coordinated border surveillance systems, conduct regular security drills, and share intelligence on trafficking and smuggling activities to mitigate security risks effectively.
3. **Invest in Advanced Technology and Capacity Building:** Upgrade landport facilities with integrated digital management systems to automate cargo tracking and reduce processing times. Additionally, provide specialized training programs for border personnel on the use of new technologies and data analytics to enhance operational efficiency and decision-making capabilities.
4. **Foster Regional Collaboration through BIMSTEC and ASEAN:** Initiate joint infrastructure projects under the BIMSTEC framework to secure funding and technical expertise from member countries. Additionally, participate in ASEAN-led trade forums to align trade policies and share best practices, ensuring that India and Myanmar benefit from regional synergies and collective bargaining power.
5. **Enhance Community Involvement:** Ensure that infrastructure projects address the needs of local communities by incorporating their inputs in planning and implementation. This includes creating skill development programs and supporting small businesses to maximize socio-economic benefits.
6. **Monitor and Evaluate Progress:** Establish mechanisms for regular monitoring and evaluation of project milestones, trade outcomes, and socio-economic impacts to inform adaptive strategies.

By addressing these recommendations, India and Myanmar can overcome existing barriers and fully realize the potential of landport infrastructure as a catalyst for trade, regional integration, and sustainable development.

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WORKPLACE CIVILITY, WORKPLACE HARMONY AND EMPLOYEE ENGAGEMENT: MEDIATING ROLE OF EMPLOYEE VOICE IN NIGERIA

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Abstract: *The continuous decline in employee engagement figure in Nigeria is pathetic amounting to billions of dollars in lost revenue. This study examines the interplay between workplace civility, workplace harmony and employee engagement, with employee voice serving as a mediating variable in selected private companies in North-West Nigeria. Adopting survey and cross-sectional research designs, a sample size of 385 respondents was determined using Cochran's formula for an unknown population. Envisaging the issue of inadequate filling of questionnaire or non- response to sent questionnaire, 10% was added to the sample size thereby enhancing participation. The study employed Structural Equation Modelling (SEM) to test the hypothesised relationships, prior to conducting preliminary analyses to address issues of outliers, multicollinearity, normality, common method bias and non-response bias. Results revealed that workplace harmony positively and significantly influences employee engagement, while workplace civility showed a positive but statistically insignificant effect on employee engagement. Employee voice emerged as a significant mediator, enhancing the relationship between workplace harmony and employee engagement as well as between workplace civility and employee engagement. Based on these findings, the study recommends fostering harmonious workplace environments and empowering employee voice to improve overall employee engagement. Further implications for theory and practice are discussed.*

Key Words: *Employee Engagement, Workplace Harmony, Workplace Civility, Employee Voice, Social Exchange Theory.*

1. INTRODUCTION:

Employees are one of the most important assets a company can possess, as they play a crucial role in fostering organisational success and sustainability. Through their distinctive skills, ingenuity and problem-solving ability, workers build a competitive edge that is challenging for rivals to imitate(Ojeleye et al., 2022). They contribute creativity, flexibility and insights that help firms to overcome complicated obstacles and exploit opportunities in dynamic marketplaces (Yazıc et al., 2022). Moreover, these employees serve as the key in organising and maximising other resources such as capital, technology and raw materials—to perform successfully and efficiently (Ojeleye, et al., 2022). Their involvement and passion translate into greater productivity, improved customer happiness and long-term organisational success. Consequently, the value of workers cannot be emphasised, since they are vital to attaining strategic goals and retaining a competitive edge (Gullu, 2020). Sadly, many of these employees are not disengaged costing the organisations billions of dollars annually in lost revenue (Osborne & Hammoud, 2017).

The rate at which employees are disengaged globally and Nigeria is worrisome. The Gallup (2024), analysis demonstrated a considerable gap in employee engagement levels both inside Nigeria and worldwide. According to the report, only 23% of employees globally are engaged, leaving a frightening 77% disengaged. Within Sub-Saharan Africa, Nigeria's engagement rate is minimal when compared to that of adjacent nations. Senegal, Mali and Liberia have engagement rates of 40%, 39% and 33% correspondingly; Nigeria follows far below with only 17% of its workforce engaged. This number not only trails below those of other nations in the area but also falls 6% short of the worldwide average, showing a severe issue in Nigerian workforce dynamics. Moreover, the unfortunate reality disengaged employees account for more counterproductive behaviour, poor job satisfaction, poor commitment and decline

performance in the organization (Ojeleye & Mustapha, 2024).

Furthermore, employee engagement levels in many private companies remain notably low, posing substantial difficulties to their performance and sustainability (Adeniji et al., 2024). The private sector, being vital to the economic success of any nation, demands a devoted, absorbed and productive workforce to generate innovation, efficiency and customer happiness (Ajibola et al., 2019). However, personnel in this industry generally demonstrate high turnover intentions, lower operational efficiency and a deterioration in delivering excellent client experiences (Adejuwon et al., 2024). According Ojeleye and Jada (2022), these metrics significantly represent poor employee engagement, which not only impairs organisational performance but also limits the sector's potential to contribute successfully to national development. Addressing these difficulties needs intentional interventions to promote employee engagement and develop a motivated and high-performing workforce.

Although studies have been conducted e.g., Ajibola et al., 2019; Adejuwon et al., 2024; Ojeleye & Mustapha, 2024; Mustapha et al., 2024; Lakhani et al., 2024 to acetain how work engement can be stimulated in the workplace, not much importance have been on the influence of workplace harmony and workplace civility on employee engagement especaially in developing countries like Nigeria to the best of our knowledge. Given the crucial role that workplace harmony and civility play in building a supportive and inclusive environment, their potential influence on improving employee engagement remains underexplored. This study, therefore, intends to address this research gap by studying how these characteristics contribute to employee engagement, delivering useful insights for firms in developing nations aiming to increase employee performance and well-being.

Additionally, the mechanism by which workplace harmony and workplace civility promote employee engagement remains underexplored, marking another key gap this study attempts to solve. While previous research demonstrates the favourable consequences of harmony and civility on workplace outcomes, the methods and mechanisms by which these dimensions transfer into greater employee engagement are not well understood. Baron and Kenny (1986), suggested the introduction of a mediator to explain this machanism. Hence, this study proposes that employee voice might act as a vital route to explain this connection. By enabling workers to communicate their thoughts, concerns and suggestions freely, employee voice develops a culture of inclusion and cooperation, which may increase the good impacts of harmony and civility on engagement. Thus, researching employee voice as a mediating construct gives a greater understanding of how various workplace characteristics lead to sustained employee engagement.

2. LITERATURE REVIEW:

This section reviews extant literature on the concept employee engagement, workplace harmony, workplace civility, employee voice, empirical review and social exchange theory.

2.1 Concept of Employee engagement

A good, rewarding and job-related psychological state known as "employee engagement" drives staff members to devote time, effort and attention to their tasks. Decuypere and Schaufeli (2019), defined it as a motivating condition marked by vigour, devotion and immersion in job duties. To Adiarani (2019), it as an active, tenacious affective-cognitive state in which workers are totally absorbed in their task. Employee engagement is the extent of intellectual and emotional dedication a person has for their job (Grubert et al., 2022). To Kahn (1990), it is the use of organisational members' identities to their responsibilities, manifested in physical, cognitive and emotional interaction. Jovanovic and Lugonjic (2022), viewed it as a psychological condition whereby workers in their workplace feel value, safety and availability. Budiyono and Welly (2022), stressed it as a multifaceted concept including personal resource investment in job success. Ojeleye and Bakare (2020), posited that it is when personal elements and occupational resources produce a motivating condition. Ali et al. (2022), sees it as an employee's good attitude and eagerness to help with organisational objectives. Employee engagement, according to Mustapha et al. (2024), is the dynamic interaction of energy, attention and organisational support that motivates staff members to perform at their best. Therefore, in this study, employee engagement is a motivating force defined by active involvement, devotion and alignment of personal goals with corporate objectives, encouraged by a supportive work environment.

2.2 Concept of Workplace Harmony

Workplace harmony refers to a condition of mutual respect, collaboration and understanding among employees and between employees and management, enabling a calm and productive work environment. Akunne and Osita (2023), described it as the existence of mutual respect, understanding and teamwork that minimizes conflict and increases organisational effectiveness. Miidom et al. (2021), viewed

it as a balanced and respectful interpersonal interaction inside the workplace, marked by tolerance and good communication. Zwain and Noorulhudanabih (2022), described it as the integration of common beliefs and behaviours that produce a conflict-free and good working climate. To Nwinyokpugi and Okere (2019), workplace harmony is integrating company goals with employee well-being via trust and shared purpose. George and Tamounomiebi (2020), emphasised it as a peaceful atmosphere where various personnel interact to settle issues constructively and achieve common objectives. Lafegha and Osho (2023), sees it as creating inclusion and collaboration to increase productivity and morale. It is the building of a harmonious coexistence that allows workers to focus on company goals (Adim & David, 2020). Tambari (2020), described it as the effective management of workplace relationships to prevent interruptions and promote performance. Bob-Manuel et al. (2019), stressed workplace harmony as the product of reconciling employee needs and organisational demands. Bob-Manuel and Zeb-Obipi (2019), viewed it as the combination of positive interpersonal interactions and shared vision. Thus, workplace harmony in this study is conceptualised as the nurturing of courteous, collaborative and conflict-free relationships that link employee well-being with company success.

2.3 Concept of Workplace Civility

Workplace civility refers to respectful, courteous and thoughtful behaviour that creates pleasant relationships and a harmonious working environment (Ojeleye et al., 2021). Kareem et al. (2023) defined it as conduct that reflects courtesy and respect in interpersonal interactions. Andersson and Pearson (1999), characterised it as conformity to social standards of respect and courtesy in the workplace. Guo et al., (2020), stressed it as acts that indicate care for others' viewpoints, establishing a collaborative workplace. Tsuno et al. (2022), posited that it is mutual respect and excellent communication that foster psychological safety. Abdullah et al. (2021), described it as actions and words that preserve pleasant connections and prevent antagonism. Peng (2023), explained it as activities that demonstrate mutual regard, boosting collegiality and productivity. Achmadi et al. (2023), characterised workplace civility as promoting trust and lowering workplace incivility, which undermines collaboration. Hussein et al. (2022), interpreted it as a measure of workplace atmosphere, stressing polite communication and conduct. Hossny and Sabra (2021), defined it as a behavioural guideline for workplace interactions, minimizing rudeness and conflict. Zhang and Liu (2022), believed it a vital component of a supportive work environment, supporting professionalism and teamwork. Drawing on these definitions, workplace civility is seen in this study as the practice of mutual respect, professionalism and constructive communication that enriches interpersonal relationships and produces a supportive, productive work culture.

2.4 Concept of Employee Voice

The concept of employee voice relates to the capacity of workers to communicate their thoughts, concerns and proposals to impact organisational decision-making and progress. Sanm and Khan (2024), defined employee voice as discretionary expression of ideas or concerns aimed at improving organisational performance. Huang et al. (2023), characterised it as the mechanism through which workers share their opinions and engage in choices impacting their work environment. Botha and Steyn (2023), regard it as a mechanism for employees to influence workplace practices and organisational outcomes while promoting mutual understanding. Yulidha and Fajrianthi (2024), described employee voice as tools that enable workers to advocate for their interests while contributing to corporate goals. Badi and Al-Zubaidi (2024), characterised it as proactive and constructive attempts to bring about good change in the organisation. Ashfan et al., (2024), emphasised it as upward communication aiming at strengthening organisational functioning. Xu et al. (2024), regard it as a procedure where employees may voice their views on issues affecting them, fostering equity and justice. Yang et al. (2024), described it as the chance for workers to engage in decision-making processes at multiple levels. Lainidi et al. (2024), opined that it as a crucial part of workplace democracy, encouraging workers to have a say in company governance. Hence, the study defines employee voice as the active and constructive engagement of workers in influencing organisational practices and choices, enabling mutual progress and innovation.

2.5 Workplace Harmony and Employee Engagement

Research on the connection between workplace harmony and organisational positive outcomes provides continuous evidence of its favourable influence on employee performance and engagement. Onyeizugbe et al. (2018), found a substantial positive association between joint consultation and employee engagement, as well as between industrial democracy and employee loyalty in food and beverage enterprises in Anambra State. Similarly, Jonah and Okurebia (2023), revealed that organisational

harmony, including good communication and cooperation, greatly boosts employee performance. Nwinyokpugi (2015), demonstrated a substantial correlation between workplace harmony and employee engagement, underlining the crucial importance of engagement as a non-financial incentive for encouraging harmony. Samwel (2019), discovered that harmonious employee interactions positively affect both employee and organisational performance, with small firms in Tanzania adopting effective techniques to preserve such ties. However, Lafegha and Osho (2023), discovered a modest positive association between workplace harmony and workers' productivity issues in Nigeria's oil and gas sector, suggesting context-specific variances. Collectively, these studies underlined the importance of workplace harmony as a driver of employee and organisational success, albeit with variable degrees of influence across industries and circumstances. Therefore, the study hypothesised that

$H01_a$: Workplace harmony does not have significant effect on employee engagement of private companies in Nigeria

2.6 Workplace Civility and Employee Engagement

Studies on workplace civility show how complicated and diverse its consequences are on organisational results. While Kareem et al. (2023), reported a positive and noteworthy influence of civility on employee engagement, mediating its relationship with deviant workplace behaviours among employees of tertiary institutions in Zamfara State, Sawada et al. (2021), found that workplace civility did not significantly affect employee engagement in a psychiatric ward in Japan. Al Ghany et al. (2021), found that among nursing personnel, perceived and seen civility significantly positively influences organisational citizenship activities. Likewise, Hussein et al. (2022), showed that job performance among nursing staff members benefits from workplace civility; El Shrief and Abo Baraka (2023),reported that civility greatly moderates innovative work behaviour among nurses. Along with structural empowerment, Hossny (2015), discovered a modest negative correlation between workplace civility atmosphere and organisational commitment among recently graduated nurses. Employee engagement suffers and turnover intentions in Indonesia are lowered by workplace incivility, according to (Tricahyadinata et al., 2020). Though its impact may vary depending on organisational setting and demographic elements, these studies taken together show that workplace civility usually promotes beneficial outcomes including engagement, performance and creativity. Thus, this study hypothesised that:

$H01_b$: Workplace civility does not have significant effect on employee engagement of private companies in Nigeria.

2.7 Employee Voice as a Mediator

Plethora of studies have used employee voice as a mediator, underscoring its central importance in clarifying the processes by which one construct impacts another. Sanm and Khan (2024), for example, showed how employee voice may balance despotic leadership effects by mediating the link between despotic leadership, psychological empowerment and employee performance, thereby improving empowerment. Similarly, Nahed et al. (2021), found employee voice to be a mediator between leader-member exchange (LMX) and creative performance, stressing its function in encouraging creativity by bridging relationship quality and individual outputs. Sefnedi et al. (2023), revealed that employee voice mediated the link between transformational leadership and employee creativity, suggesting that voice works as a path via which transformational leadership increases inventive skills. Yazıc et al. (2022), discovered a partly mediation influence of employee voice on the connection between agile leadership and teachers' affective occupational commitment, underlining its value in establishing emotional relationships and flexibility in professional contexts. These findings together emphasised employee voice as a significant connection mechanism, supporting the translation of leadership styles and workplace dynamics into enhanced outcomes like as creativity, commitment and performance. Given this demonstrated potential, it is anticipated that employee voice can serve as the mechanism by which workplace harmony and civility promote employee engagement, aligning individual and corporate goals through open and constructive communication. Hence, this study hypothesised that:

$H02_a$: Employee voice does not mediate the relationship between workplace harmony and employee engagement of private companies in Nigeria.

$H02_b$: Employee voice does not mediate the relationship between workplace civility and employee engagement of private companies in Nigeria.

2.8 Social Exchange Theory

Social Exchange Theory (SET),claims that social connections are built on the exchange of resources, such as support, trust, respect and effort, where individuals engage in a give-and-take process to

maximise their advantages while minimising their costs (Blau, 1961). It indicates that individuals develop and sustain relationships based on the expectation of obtaining benefits (e.g., recognition, support) in return for their efforts (e.g., loyalty, effort) (Nunkoo, 2016). The idea highlights that these interactions are often reciprocal, with individuals feeling bound to respond favourably when they sense fairness and rewards in the connection (Tripp, 2023). SET is frequently used to analyse workplace dynamics, including employee behaviour, motivation, engagement and organisational commitment, by showing how good interactions between employees and employers may lead to enhanced job satisfaction, performance and engagement (Khan et al., 2024).

In the context of the study, Social Exchange Theory (SET) provides a beneficial theoretical lens to explain the reciprocal linkages between workplace civility, harmony and employee engagement, with employee voice functioning as a mediator. According to SET, when employees feel civility and harmony within the workplace, they perceive good interactions, such as respect, fairness and support from their business and colleagues (Jeong & Oh, 2017). This leads to a heightened sense of commitment to reciprocate by active involvement, higher productivity and sharing of ideas and concerns (employee voice). The theory posited that the favourable corporate climate promoted by civility and harmony promotes employees' willingness to speak their thoughts, which in turn, boosts engagement in the workplace. In the Nigerian setting, where respect and collective well-being are vital in corporate culture, SET helps explain how these positive interactions build not only individual drive but also a culture of cooperation and involvement. Therefore, this theory provides as a framework for comprehending the intricate interplay of workplace civility, harmony, employee engagement and employee voice in a Nigerian environment.

3. RESEARCH METHOD / METHODOLOGY:

This study employed a quantitative research strategy using survey and cross-sectional research designs. A sample of 385 respondents was chosen using Cochran's sampling method for an unknown population, with an additional 10% added to account for non-responses or inappropriate filling of the questionnaire as recommended by Israel (2013), resulting in 424 copies of questionnaire distributed. Out of which 387 representing 91% was returned with 9 weeks and used for the study. Data were acquired using structured questionnaires delivered to employees in selected private enterprises in North-West Nigeria. Structural Equation Modelling (SEM) was employed to analyse the data prior to conducting preliminary analyses to address potential issues such as outliers, multicollinearity, normality, common method bias and non-response bias.

3.1 Measures

Scales from previous studies were adapted and employed in this study to measure the individual constructs. First, employee engagement was measured utilising the Utrecht Employee engagement Scale (UWES 9) established by Schaufeli, Bakker and Salanova (2006), which has a reported Cronbach alpha of 0.78, suggesting that the instrument is trustworthy and appropriate for the study. A sample item for the instrument used to evaluate employee engagement is "At my job, I feel strong and vigorous" Second, employee voice was measured using six-item Van Dyne and LePeine (1998), voice behaviour scale but adapted by Begum and Cakar (2019), with reported Cronbach alpha of 0.81. Begum and Cakar (2019), noted that Each of these items assesses the participation of workers regarding voice conduct or the presentation of information by employees to management. A sample of adapted item are "Employee in this organisation make suggestions to improve group's work" and "Employees share opinions, even if others disagree". Third, workplace civility was measure during eight-item Tsuno et al. (2022), CREW Civility Scale assesses workplace civility by evaluating employee ratings on receiving personal interest and respect from coworkers, observing cooperation or teamwork, fair conflict resolution, no tolerance for discrimination and valuing individual differences by coworkers and supervisors. A sample of the adapted item is "Employees treat each other with respect" with reported Cronbach alpha of 0.93. Lastly, workplace harmony was measured using seven-item Singh and Aggarwal (2022), workplace harmony scale. Although the items were negatively worded, the study adapted the scale by reversing the items from negative worded to positive. A sample of item is "When I approach my colleagues for help, they are supportive and attentive" with reported Cronbach alpha of 0.92. Meanwhile, the four constructs were assessed on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

4. RESULT / FINDINGS:

The measuring model of SEM was analysed for construct reliability using composite reliability, while convergent validity was evaluated by Average Variance Extracted (AVE) and discriminant validity was assessed using the Heterotrait-Monotrait ratio (HTMT) criterion. Additionally, the coefficient of

determination (R^2) was assessed to measure the model's explanatory capacity and effect size (f^2) was determined to evaluate the strength of the correlations between constructs. The structural model of SEM was used to test the proposed hypotheses and to understand the direct and indirect relationships among the variables, with employee voice acting as a mediator.

4.1 Measurement Model

This model was employed to evaluate the outer loadings, reliability, validity, coefficient of determination (R^2) and effect size (f^2) of the exogenous variable on the endogenous variable.
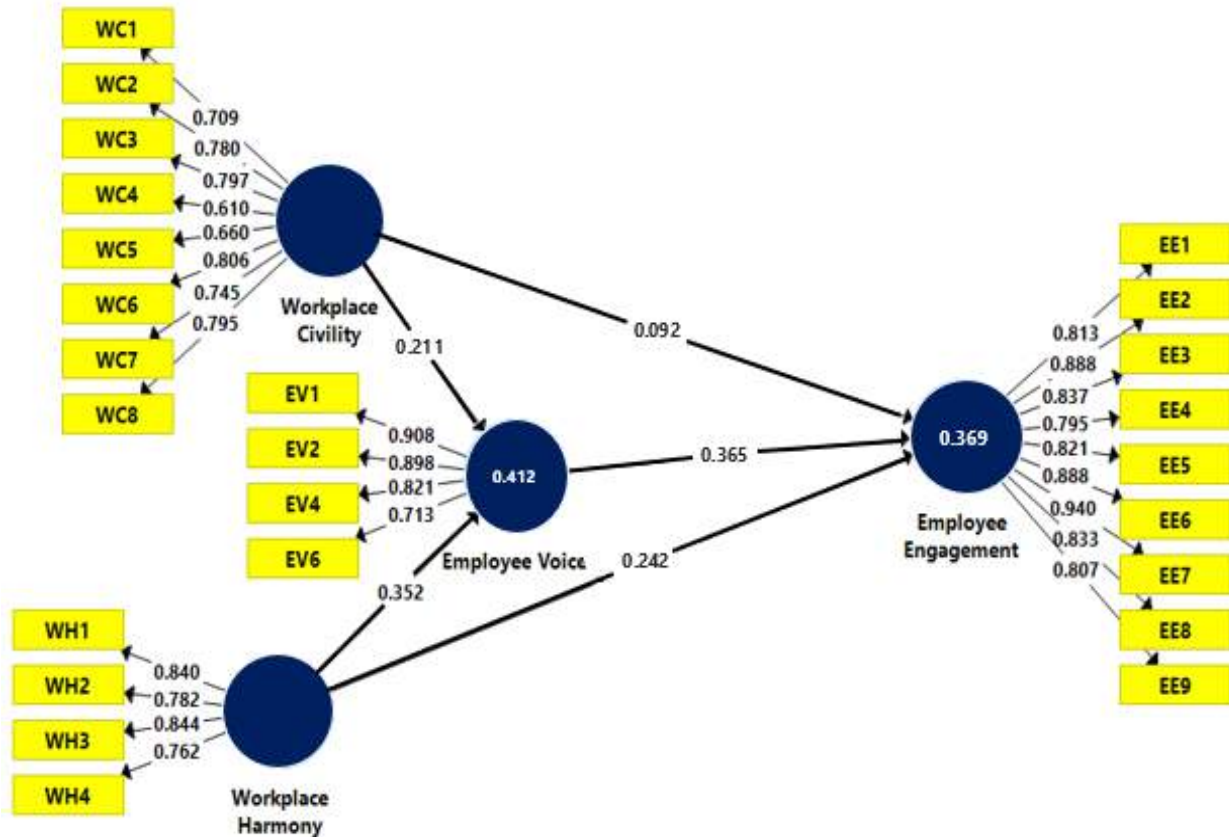
Figure 4.1: Measurement Model

The study began by assessing item loadings to ensure that the retained indicators were suitable. Hair et al. (2018), recommended the retention of loadings of 0.70 or above. Nonetheless, Hulland (1999), advocated for inclusion of items with loadings as low as 0.5 if they display a non-convergent validity and reliability issues. As a result, items with loadings less than 0.5, such as EV3, EV5, WH5, WH6 and WH7 were deleted, whereas those with loadings more than 0.5 were maintained (see TTable4.1 and Figure 4.1). Convergent validity was examined using Average Variance Extracted (AVE), as recommended by Hair et al. (2022), with a threshold of 0.5 or greater. Table 1 indicates that all constructs exceeded the threshold, indicating convergent validity. Reliability was assessed using composite reliability, with Hair et al. (2020), recommending a minimum of 0.7 for construct reliability and consistency, which all constructs fulfilled as indicated in Table4.1. The coefficient of determination (R^2) was 0.37 (37%), meaning that the exogenous and mediating variables (WC, WH and EV) explained 37% of the variation in the endogenous variable (EE). Chin (1998), rated a R^2 value of 37% as moderate, indicating the model's explanatory strength.

Table 4.1: *Item Loadings, Reliability and Convergent Validity*

Constructs	Items	Outer Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)	Decision
Employee Engagement	EE1	0.813	0.951	0.958	0.719	Accepted
	EE2	0.888				
	EE3	0.837				
	EE4	0.795				
	EE5	0.821				
	EE6	0.888				
	EE7	0.940				
	EE8	0.833				
	EE9	0.807				
Employee Voice	EV1	0.908	0.857	0.904	0.703	Accepted
	EV2	0.898				
	EV4	0.821				
	EV6	0.713				
Workplace civility	WC1	0.709	0.881	0.906	0.549	Accepted
	WC2	0.780				
	WC3	0.797				
	WC4	0.610				
	WC5	0.660				
	WC6	0.806				
	WC7	0.745				
	WC8	0.795				
Workplace Harmony	WH1	0.840	0.822	0.883	0.653	Accepted
	WH2	0.782				
	WH3	0.844				
	WH4	0.762				

Source: Authors' Systemisation of SEM output (2024)

Furthermore, discriminant validity was assessed using the Heterotrait-Monotrait (HTMT) correlation ratio, which addressed the limitations of cross-loadings and the Fornell-Larcker criterion in detecting a lack of discriminant validity, especially when loadings varied between 0.65 and 0.85. Kline (2011), advocated using an HTMT ratio of less than 0.85 for non-comparable concepts to demonstrate discriminant validity. As seen in Table 4.2, all HTMT values are smaller than 0.85, indicating the constructs' discriminant validity.

Table 4.2: *Heterotrait-Monotrait (HTMT) Ratio of Correlations Discriminant Validity*

Constructs	Employee Engagement	Employee Voice	Workplace Civility	Workplace Harmony
Employee Engagement				
Employee Voice	0.541			
Workplace Civility	0.783	0.381		
Workplace Harmony	0.477	0.549	0.812	

Source: Authors' Systemisation of SEM output (2024)

Furthermore, the effect size (f^2) explores the contribution of each of the exogenous variable to the endogenous variable in Table 3 below. Cohen (1988) provided a threshold 0.02, 0.15 and 0.35 to evaluate each effect size as small, medium and large respectively.

Additionally, Table 4.3 below shows how each exogenous variable contributes to the endogenous

89

variable, as examined by the effect size (f^2). A threshold of 0.02, 0.15 and 0.35 was established by Cohen (1988), to classify each effect size as small, medium and large, respectively. Table 4.3 below shows when employee engagement (EE) is the target variable, workplace harmony has small effect size, employee voice has medium effect size while workplace civility has no effect size. However, both workplace harmony and workplace civility have small effect sizes when employee voice (EV) is the target variable.

Table 4.3. *Effect Size (f^2)*

Constructs	EE(f^2)	Effect Size	EV(f^2)	Effect Size
Employee voice	0.16	Medium		
Workplace civility	0.00	Nil	0.09	Small
Workplace harmony	0.06	Small	0.12	Small

Source: Authors' Systemisation of SEM output (2024)

4.2 Structural Model

This model evaluates the direct and the mediating effect of employee voice in the relationship between workplace harmony, workplace civility and employee engagement.
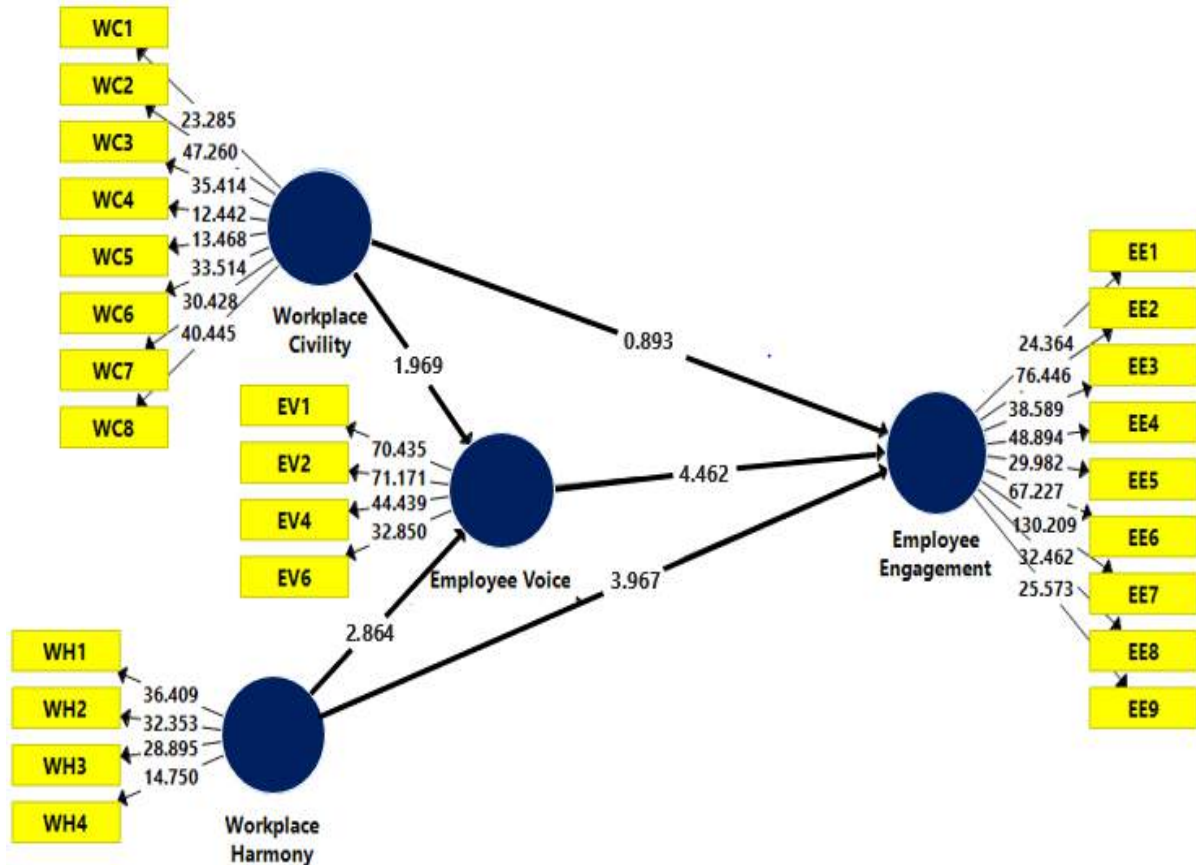
Figure 4.2: Structural Model

Table 4.4: *Test of Direct and Mediating Hypotheses*

Hypotheses	Relationship	Beta	STDEV	T Statistics	P Values	Decisions
H1ₐ	Workplace Harmony->Employee Engagement	0.242	0.061	3.967	0.000	Rejected
H1ᵦ	Workplace Civility->Employee Engagement	0.092	0.103	0.893	0.372	Fail to Rejected
H2ₐ	Workplace Harmony->Employee Voice->Employee Engagement	0.213	0.048	3.672	0.000	Rejected

$H2_b$	Workplace Civility->Employee Voice -> Employee Engagement	0.191	0.086	2.220	0.026	Rejected

Source: Authors' Systemisation of SEM output (2024)

The data reported in Table 4.4 show substantial insights into the direct and mediated effect of workplace harmony, workplace civility and employee voice on employee engagement. The direct association between workplace harmony and employee engagement ($H1_a$) was positive and significant (β = 0.242, p = 0.000) interpreted that workplace harmony has direct and significant effect on employee engagement. Hence the $H1_a$ is rejected. However, in hypothesis ($H1_b$) the direct influence of workplace civility on employee engagement was not statistically significant (β = 0.092, p = 0.372). Thus, $H2_a$ failed to be rejected. However, when employee voice was incorporated as a mediator, the linkages became more obvious. Workplace harmony's influence on employee engagement via employee voice ($H2_a$) was significant (β = 0.213, p = 0.000). Therefore, employee voice partially mediated the relationship between workplace harmony and employee engagement. Lastly, in $H2_b$ employee voice fully mediated the relationship between workplace civility on employee engagement (β = 0.191, p = 0.026). This type of mediation is full mediation since the direct relationship between workplace civility and employee engagement was not significant in $H1_b$. These findings reinforce the crucial role of employee voice in mediating the impacts of workplace harmony and civility on engagement, demonstrating its relevance as a method for promoting a more engaged workforce.

5. DISCUSSION:

Workplace harmony has a positive and substantial influence on employee engagement since it generates an environment of trust, mutual respect and cooperation, all of which are major drivers of employee motivation and commitment. When employees perceive a harmonious workplace, defined by excellent communication, collaboration and low conflict, they are more likely to feel appreciated and supported (Onyeizugbe et al., 2018). This sense of belonging and psychological safety enables individuals to devote their energy and passion in their employment, leading to higher levels of employee engagement (Jonah & Okurebia, 2023). A pleasant work atmosphere also minimises stress and burnout, helping employees to focus more on their jobs and demonstrate more devotion and absorption in their work (Nwinyokpugi, 2015). As such, workplace harmony not only enhances interpersonal relationships but also adds to an engaged workforce that is proactive, productive and aligned with company goals (Samwel,2019;Lafegha & Osho, 2023).

The result that workplace civility has a positive but insignificant influence on employee engagement implies that while polite and courteous behaviour in the office adds to a healthy work environment, its impact on employee engagement may not be as powerful or direct as anticipated. Workplace civility provides a climate of respect and professionalism, which may boost employee morale and lessen interpersonal conflicts, thus leading to better employee engagement (Kareem et al., 2023). However, the modest influence reported in this situation may imply that other elements, such as job resources, personal motivation, or corporate culture, play a more prominent role in promoting employee engagement. It is also likely that civility alone may not fully fulfil the emotional and cognitive demands that drive participation and other comprehensive elements, such as job autonomy or leadership support, might have a stronger effect. Therefore, while civility is advantageous for workplace dynamics, it may not be sufficient on its own to significantly boost employee engagement.

According to the finding that employee voice mediates the relationship between workplace harmony and employee engagement, employees feel more empowered and motivated to voice their ideas, concerns and suggestions when they work in a harmonious environment, which improves their engagement with their jobs. Workplace harmony, defined by mutual respect, teamwork and good communication, produces a supportive climate where employees feel secure and appreciated. This sense of psychological safety enables them to speak out and express their opinions, which can lead to a greater emotional connection to their job (Sanm & Khan, 2024). Employee voice functions as a vehicle via which workers actively participate in organisational activities, so boosting their feeling of ownership, commitment and dedication to their positions (Yazıc et al., 2022). Since employees feel that their opinions are heard and respected, their engagement with work is likely to grow, since they are more committed, dedicated and engrossed in their jobs. Thus, employee voice serves a critical mediating function, converting the good benefits of workplace harmony into real employee engagement results.

The result that employee voice mediates the association between workplace civility and employee

engagement implies that while workplace civility provides a courteous and good work environment, it is via employee voice that these favourable conditions transfer into increased employee engagement. Workplace civility, which encompasses courteous and respectful interactions, provides an atmosphere of trust and psychological safety, enabling employees to feel valued and appreciated (Sawada et al., 2021). This, in turn, allows employees to communicate their opinions, ideas and concerns more openly, adding to a sense of engagement and ownership in their job. Employee voice functions as a mediator by offering a forum for workers to participate to decision-making and organisational reforms, improving their relationship to the workplace. As workers think that their ideas count, they become more involved with their job, investing greater energy and emphasis to their positions(El Shrief & Abo Baraka, 2023). Therefore, employee voice acts as a critical link in the chain, transferring the good benefits of workplace civility into enhanced motivation, absorption and overall employee engagement.

5.1 Implications

The practical implications of the study's findings imply that firms should emphasise promoting workplace civility and harmony to boost employee engagement. Creating a polite and supportive work environment makes employees feel appreciated and motivated, which may boost their devotion and total employee engagement. Organisations should adopt programs and regulations that encourage courteous and respectful behaviour, as well as create collaboration among employees. Furthermore, fostering employee voice through feedback systems and open communication channels is crucial, as it allows workers a platform to express their thoughts and concerns, resulting to a better sense of engagement and ownership in their positions. These approaches can be especially beneficial in the Nigerian environment, where respect and collectivism play key roles in corporate culture. By cultivating civility, harmony and employee voice, firms may enhance employee engagement, raise productivity and minimise attrition.

The theoretical implications of the study's findings expand Social Exchange Theory (SET) by highlighting the mediating role of employee voice in the link between workplace civility, workplace harmony and employee engagement. SET proposes that favourable exchanges between employees and their company, such as respect and support, lead to reciprocal behaviours like dedication and loyalty. The study demonstrates that workplace civility and harmony create an environment where employees feel secure and valued, but it is via employee voice that these good exchanges result in higher employee engagement. This expands SET by stressing how non-monetary transactions, like as open communication and acknowledgement, contribute to employee motivation and engagement. The findings also underline the dynamic character of the exchange process, illustrating how employees' views of being heard and appreciated may dramatically affect their psychological commitment to the firm.

6. CONCLUSION/ SUMMARY:

This study demonstrated the critical significance of workplace civility and harmony in improving employee engagement, with employee voice functioning as a vital mediator in the Nigerian setting. The findings imply that when employees encounter a courteous and supportive work environment, defined by civility and harmony, they are more likely to feel appreciated and driven, which enhances their engagement with work. Employee voice, serving as a mediator, helps workers to communicate their thoughts and concerns, establishing a sense of involvement and ownership in their positions, thereby further improving engagement. By expanding Social Exchange Theory (SET), the study illustrates those good organisational exchanges, such as respect and acknowledgement, are vital for establishing a motivated and dedicated workforce. The practical consequences underscore the necessity of fostering a culture of civility, open communication and cooperation, which may lead to enhanced productivity, lower turnover and improved overall organisational performance, particularly in a collectivist society like Nigeria's. Organisations are recommended to focus these characteristics to develop an engaged, motivated and loyal staff.

7. LIMITATIONS:

While this study gives significant insights into the link between workplace civility, workplace harmony and employee engagement, there are numerous limitations that should be addressed. Firstly, the study was done inside a restricted geographic region—North-West Nigeria—limiting the generalisation of the findings to other locations or nations. Cultural and organisational dynamics vary considerably, therefore the variables driving employee engagement may differ in various circumstances. Therefore, the findings may not fully reflect the experiences of employees in other regions of Nigeria or internationally. Secondly, the use of a cross-sectional design restricts the capacity to make inferences regarding causation. Although the study gives insights into links between the variables, it cannot conclusively identify the direction of the

interactions or whether the reported impacts are long-term or just short-term correlations. Additionally, the self-reported form of the survey might have included answer biases, such as social desirability or self-reporting mistakes, which may impair the validity of the findings. Although precautions were taken to reduce common method biases, future research should examine longitudinal designs or mixed-methods techniques to better understand the causal dynamics and underlying reasons driving workplace civility, harmony and employee engagement.

For additional study, it would be good to examine how workplace civility and harmony interact with other organisational elements, such as leadership style, job resources, or corporate culture, in impacting employee engagement. Conducting comparable studies across various parts of Nigeria or in other countries might assist identify whether the findings are context-specific or whether they hold broader application. Moreover, future research should study the possible moderating function of individual characteristics, such as personality traits or demographic variables, in defining how civility and harmony impact employee engagement. Another intriguing path for future study would be to explore how various sectors or businesses, such as public vs private enterprises, may demonstrate variances in the link between workplace civility, harmony and employee engagement. Longitudinal study might also give greater insights into how these elements change over time and how they affect employee retention and organisational success in the long run. Finally, investigating the function of employee voice in greater depth, particularly its unique dimensions and how it may vary across different levels of organisational hierarchy, might give further clarification on its mediating role and better tactics for promoting engagement.

8. RECOMMENDATIONS:

Based on the findings of the study, the following suggestions are made:

1. Organisations should prioritise building an environment of civility by promoting courteous conduct and communication among workers at all levels. Training programs, leadership development efforts and clear regulations should be developed to ensure that civility is preserved, since it establishes a basis for increased employee engagement and satisfaction.

2. Organisations should invest in team-building activities and initiatives that encourage collaboration and eliminate disagreements. This might involve supporting open communication lines, dispute resolution training and encouraging a culture of collaboration. A pleasant work atmosphere boosts employees' sense of belonging and increases their dedication and engagement.

3. Companies should give workers with outlets to share their ideas, suggestions and concerns, such as frequent feedback systems, questionnaires, or suggestion boxes. Ensuring that workers feel heard and appreciated may deepen their emotional connection to the firm and enhance their employee engagement.

4. Organisations should not only promote employee input but also actively integrate it into organisational decision-making. When employees realise that their feedback leads to visible improvements, they are more likely to feel committed in their job and display higher levels of engagement. This generates a sense of responsibility and reciprocity, leading to enhanced organisational outcomes.

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A Study on Determinants of Personal Financial Behavior

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Abstract*: The way a person handles their finances is referred to as their personal financial conduct. Examining a person's diverse financial decision-making skills allows one to see it. The study examine about insight on the increasing role of determinants like; financial attitude, financial awareness, fitech (financial technology), digital literacy and financial literacy which makes personally financially wellbeing to financial behavior. The financial technology literacy changes the preference towards savings, investments and spending in digital age. The study examines the personal financial behavior of the people by using a questionnaire developed by self-validated scales of determinants of financial behaviour. The major findings of the data interpretation and analysis reveals that there are major determinants that has very strong influence on personal financial behavior. Personal financial behavior (PFB) is a critical aspect of individual well-being and economic stability. Understanding the determinants of PFB can help in designing effective financial education programs and policies to enhance financial well-being. This article aims to explore the various factors influencing personal financial behavior, drawing insights from recent research studies.*

Key Words: *Financial Attitude, Financial Behaviour, Financial Knowledge, Digital Literacy, Financial Literacy, Personal Finianicial Behaviour, Financial awareness, Financial Welbeing.*

1. INTRODUCTION:

The effective management of personal finances is a cornerstone of financial well-being, influencing an individual's quality of life and long-term security. In an increasingly complex financial landscape, understanding the determinants of personal financial behavior has become a critical area of research. Despite the growing availability of financial products and services, individuals often struggle to make optimal financial decisions, which can lead to debt accumulation, inadequate savings, and financial stress.

Personal financial behavior encompasses a broad range of activities, including budgeting, saving, investing, and spending, which collectively determine an individual's financial health. Research has identified various factors influencing these behaviors, including socioeconomic status, psychological traits, financial literacy, cultural norms, and environmental influences. However, the relative significance and interplay of these determinants remain areas of ongoing investigation.

This study aims to examine the factors shaping personal financial behavior, with a focus on both intrinsic and extrinsic influences. Intrinsic factors, such as financial attitudes, self-control, and risk tolerance, reflect individual predispositions, while extrinsic factors, including income levels, access to financial education, and social influences, represent external pressures. Policymakers, educators, and financial institutions can create focused interventions to encourage improved financial decision-making and enhance financial outcomes by comprehending these drivers.

The findings of this research contribute to the broader discourse on financial behavior by offering insights into the mechanisms that drive individuals' financial decisions. This study also addresses gaps in existing literature, particularly concerning the contextual factors unique to specific populations or economic settings. Ultimately, this research aims to provide a framework for fostering financial resilience and empowering individuals to achieve sustainable financial well-being.

In the modern financial world, personal financial behavior refers to how one handles their money. It is observable by examining a person's diverse financial decision-making skills. Financial education is widely acknowledged as a critical component of both individual and national financial stability, and consumers are increasingly venturing into riskier markets. various services and products related to finance. Customers are frequently misled by the shameful selection of these goods and deceptive promotion, which keeps them from comprehending the nuances of complicated information and the potential hazards involved. Technological advancements further complicate matters. New products have proliferated as a result, increasing the household's financial decision-making risk and obligation.

2. LITERATURE REVIEW:

Understanding the determinants of personal financial behavior is critical for fostering financial well-being and promoting sound decision-making among individuals. This review of the literature examines the current body of research on the psychological, sociodemographic, economic, and external environmental aspects that affect an individual's financial behavior.

Financial literacy is often regarded as a crucial life skill for consumers in the increasingly complex markets. Users have greater difficulties in the financially complex and quickly evolving marketplace. For them to benefit from financial innovations, they must have improved financial literacy. The governments of every country are more prepared to raise the general public's level of financial literacy since they understand how crucial it is to a country's economic development and financial stability. As demonstrated by the catastrophic outcomes of the economic crisis, the impact of a lack of financial literacy on the household's and society's financial well-being heightens the concern. Thus we need to understand each and every determinants of personal financial behavior and its definition. Definition of each one is given as below:

Personal Financial Behavior:

The way a person handles their finances is referred to as their personal financial behavior. It is observable by examining a person's diverse financial decision-making skills. Financial behavior is the method that people use to manage their financial resources in order to attain financial success, according to a number of studies (Ishwara, 2014; Bhabha, Khan, Qureshi, Naeemand Khan, 2014; Sabri, Juen, 2014). Retirement planning, employee benefits, credit management, money management, record-keeping, saving/spending orientation, financial management abilities, stock market participation, need for financial advice, saving/investment behavior, and financial product awareness are all included in this.

> **Determinants of Personal Financial Behaviour:**

1. Financial Attitude:

A person's attitude and preferences make up their level of financial literacy. A person's attitude toward short-term desires or long-term future plans, as well as their priorities for saving or spending, influence their behavior and, as a result, are important factors in determining their financial future. For example, individuals who have a positive outlook on short-term desires will save less for the future, regardless of their level of financial literacy, and are less likely to have a prosperous financial future. The national strategy for financial education in India acknowledges the significance of attitude training in relation to future financial security and incorporates it into the curriculum.

2. Financial Awareness/Knowledge:

An individual's understanding of monetary and financial concepts is one of the criteria used to assess their level of financial literacy. Basic financial topics are covered, including the value of saving, simple and compound interest calculations, inflation, time value of money, risk-return relationships, the advantages of risk diversification, and numeracy abilities. When everything else is equal, sound financial judgments are linked to a better level of financial management expertise and financial knowledge and comprehension (Sherraden, 2010).

3. Financial technology (FinTech):

Personal finance has been significantly impacted by fintech. It has prompted the creation of novel products and procedures that have streamlined banking operations and eliminated the need for customers to physically visit a bank by enabling them to access their financial needs from any location. Fintech's sophisticated AI/ML algorithms, massive data, and cutting-edge technology have benefited customers. but also present novel dangers. Fintech nudges, such as overspending messages on money management apps, have been found to temporarily reduce spending and result in permanent reductions in cumulative spending. These impacts can also affect other users in the same household and are especially noticeable for older, wealthier, and financially literate users. Fintech has the potential to improve financial stability and access to services.

4. Digital literacy:

The ability to comprehend and use information from a variety of sources in diverse formats is known as digital literacy (Blau et al., 2020, Yetti, 2024). Digital literacy, according to Prete (2022), is the ability to use digital platforms and applications with ease. According to Park (2013), digital literacy refers to the abilities and knowledge needed to navigate a complicated and dispersed information ecosystem. Digital literacy encompasses the ability to learn and apply digital skills and information, as well as the ability to plan, carry out, and assess digital actions in the completion of life tasks. It also represents the evolution of digital literacy.

5. Financial Literacy :

The ability to manage finances is the simplest definition of financial literacy. It refers, in general, to the knowledge and comprehension of financial ideas, as well as the capacity to apply them with assurance and responsibly in order to make well-informed decisions for one's own financial well-being. Financial education, according to the Organization for Economic Cooperation and Development (OECD), is "the process by which financial consumers/investors improve their understanding of financial products and

concepts and risks, and through information, instruction, and/or objective advice, develop the skills and confidence to become aware of (financial) risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well-being and protection" (OECD, 2009). "The ability to make informed judgments and to take effective decisions regarding the use and management of money is a complex combination of a person's skills, knowledge, attitudes, and ultimately their behaviors in relation to money," according to the ANZ poll (2015).

For people to make wise decisions and maintain financial well-being, it is essential to comprehend the factors that influence personal financial behavior (PFB). This study summarizes findings from previous studies and groups them into sociodemographic, economic, environmental, and psychological factors.

➢ Psychological Determinants

Individual characteristics including self-control, risk tolerance, and financial views have been found to have a major impact on financial decision-making. Proactive actions such as investing and saving are associated with positive financial attitudes, for example (Sabri & Juen, 2014). In contrast, financial instability and excessive spending are frequently the outcome of impulsivity and a lack of self-control.

1. Financial Literacy and Awareness

A key component of individual financial behavior is financial literacy, which is the capacity to comprehend and apply financial concepts. According to Lusardi and Mitchell (2009), individuals with higher financial literacy are better equipped to plan for retirement and manage debt effectively. By improving people's capacity to recognize possibilities and risks and to make wise financial decisions, financial awareness enhances literacy.

According to Shreya Lahiri and Shreya Biswas (2022), financial literacy improves general financial behavior by encouraging financial planning. The authors point out that people who live in cities and who are confident in their financial abilities show more favorable behavioral improvements.

2. Digital Literacy and FinTech Adoption

Financial management techniques have changed as a result of the emergence of digital platforms. Nowadays, digital literacy—which includes knowing how to use financial apps and online banking—is a crucial talent. According to studies like Prete (2022), having a strong digital literacy helps people use FinTech products more successfully, which improves financial results. Similarly, Koskelainen et al. (2022) note that both possibilities and challenges in personal financial management have been brought about by digital advances. FinTech products, such as robo-advisors and budgeting applications, make financial activities easier, but in order to prevent possible problems, users must be sufficiently digitally and financially literate.

➢ Socio-Demographic and Cultural Factors

Age, gender, income, and educational attainment are all demographic factors that have a big impact on financial behavior. Men typically have a higher risk tolerance than women, according to studies (Zandri & Ferreira, 2018), and higher income levels are associated with more investing activity and financial awareness.

Financial attitudes and practices are also influenced by social and cultural standards. Particularly in

emerging nations, research by Kumar et al. (2023) emphasizes how peer pressure and cultural expectations affect saving behaviors and financial decision-making.

1. Economic and Technological Contexts

Personal financial behavior is significantly influenced by the state of the economy. Interest rates, inflation, and the availability of financial services all affect people's capacity to save, invest, and spend. These dynamics have been further enlarged by recent developments in financial technology, which have brought both creative solutions and new difficulties that call both digital and financial literacy to successfully traverse (Georgios & Wilson, 2020).

2. Integration of Factors

Numerous studies emphasize how these determinants interact. For example, the association between psychological characteristics and financial conduct is frequently moderated by financial literacy. Similarly, by facilitating the efficient use of FinTech solutions, digital literacy amplifies the impact of financial literacy. This interdependence emphasizes the necessity of a comprehensive strategy for comprehending individual financial behavior.

Because personal financial behavior (PFB) is so important to economic stability and financial well-being, it has garnered a lot of study interest. This section examines a number of PFB variables, with a focus on insights from technological, sociodemographic, psychological, and economic viewpoints.

➢ Psychological Determinants

Financial conduct is significantly influenced by psychological characteristics like risk tolerance, self-control, and financial attitudes. The impact of financial literacy on retirement planning behavior was examined by Sweta Tomar et al. (2021), who also examined the relationship between financial literacy and psychological characteristics such as retirement goal clarity and future time perspective. According to their findings, those who have a clear idea of their financial future tend to save and invest more wisely. According to Sabri and Juen (2014), self-discipline is essential for forming sound financial practices, especially when it comes to debt management and budgeting. Likewise, Ishwara (2014) pointed out that impulsive actions frequently result in poor money management, such excessive debt or overspending.

1. Financial Literacy and Awareness

One of the fundamental factors that determines PFB is financial literacy, which includes the ability to make wise financial decisions. The relationship between financial literacy and wealth building, credit management, and retirement planning is highlighted by studies by Lusardi and Mitchell (2008, 2009). According to Shanmughama and Ramya (2012), those who are more financially aware are less likely to become victims of dishonest financial scams. Sound financial planning is made possible by financially literate people's superior comprehension of ideas like inflation, time value of money, and risk diversification (Sherraden, 2010). Vibhuti Shivam Dube et al. (2023) highlighted the challenges posed by low financial literacy in digital contexts, with financially illiterate individuals being more susceptible to scams and poor investment choices. Their research also emphasized the need for educational interventions tailored to rural and underserved populations.

2. **Digital Literacy and FinTech Adoption**

The integration of financial technology (FinTech) into personal financial management has significantly altered financial behavior. Studies such as Prete (2022) and Yetti (2024) emphasize the importance of digital literacy in leveraging tools like mobile banking apps, robo-advisors, and investment platforms. These tools facilitate better money management, but their effective use requires a combination of financial and digital skills.

Koskelainen et al. (2022) identified FinTech as a double-edged sword. While it simplifies access to financial services, it also creates vulnerabilities for individuals with limited digital literacy, leading to issues like overspending or cyber fraud. Shaw (2023) similarly noted that while financial technology enables better savings and investments, it may exacerbate poor financial behaviors among less informed users.

❖ **Socio-Demographic and Cultural Factors**

Demographic factors like age, gender, education, and income level significantly shape financial behavior. Studies by Zandri and Ferreira (2018) found that male investors tend to exhibit higher risk tolerance than females, a trend consistent across multiple age groups. Similarly, Kumar et al. (2023) highlighted how socio-cultural expectations and familial influences drive savings behavior, particularly in collectivist societies.

In the context of education, Ana and Wan Ahmad (2020) demonstrated that exposure to financial courses improves financial literacy scores among students, particularly when supported by practical experience and peer interactions.

❖ **Economic and Environmental Factors**

Macroeconomic conditions such as inflation, interest rates, and employment levels impact personal financial behavior. Klapper and Panos (2011) showed that individuals in countries with stable inflation and robust financial infrastructure exhibit better savings and investment patterns.

Recent technological advancements have further influenced financial behavior. The COVID-19 pandemic, for instance, accelerated the adoption of digital financial services. Parul Kumar et al. (2023) examined the mediating role of digital financial literacy during this period, finding it to be a crucial determinant of sound financial decision-making.

❖ **Interplay Between Determinants**

The interconnected nature of these factors is evident in studies examining multiple variables simultaneously. For instance, Maman Setiawan et al. (2020) analyzed the relationship between digital financial literacy, saving behavior, and foresight of future financial needs among millennials. Their findings highlighted that digital literacy enhances financial behavior by bridging gaps in knowledge and enabling better use of FinTech tools.

Moreover, Mihai Nițoi et al. (2022) emphasized the mediating role of financial well-being between financial literacy and behavior. They found that individuals with higher financial literacy scores not only make better financial decisions but also experience greater satisfaction and control over their financial resources.

❖ **Role of Financial Well-being**

Financial well-being, defined as a state of feeling secure and in control of one's financial resources, acts as both an outcome and a mediator of financial literacy, attitude, and behavior. Mihai Niṭoi et al. (2022) constructed indices to measure financial well-being and its relationship with financial literacy, finding that individuals with higher financial well-being demonstrate better decision-making, including prudent saving and investment practices.

Parul Kumar et al. (2023) highlighted the importance of financial autonomy and capability in shaping perceived financial well-being. Their findings revealed that digital financial literacy and impulsivity are critical mediators in determining financial decision outcomes, underscoring the need for interventions aimed at enhancing financial capability to improve well-being.

❖ **Impact of Technology and Digital Financial Literacy**

Digital finance has transformed personal financial management by introducing tools like mobile wallets, online banking, and blockchain technologies. While these innovations have democratized access to financial services, they have also introduced new challenges. According to Shinu and Mullappallykayamkulath (2023), digital financial literacy involves four dimensions: knowledge, experience, awareness, and skill. Their study found that individuals proficient in these dimensions exhibited significantly better financial behavior, such as disciplined savings and investments.

Koskelainen et al. (2022) identified FinTech as an enabler of financial inclusion for underserved populations. However, gaps in digital literacy continue to exclude certain demographics, particularly older generations and low-income individuals. Similarly, Shaw (2023) warned of the risks associated with uninformed use of digital platforms, such as overspending and falling prey to online scams.

❖ **Behavioral Economics and Cognitive Biases**

The integration of behavioral economics into financial research has revealed how cognitive biases influence financial decisions. For example, loss aversion, where individuals fear losses more than they value equivalent gains, often leads to overly conservative financial choices (Thaler, 1999).

Research by Arianti (2018) highlighted the role of overconfidence in financial decision-making. While confidence can encourage individuals to take proactive steps, excessive confidence often results in underestimating risks or overestimating financial outcomes. Similarly, Pradhana (2018) observed that financial literacy reduces the impact of such biases, enabling individuals to make more rational decisions.

❖ **Gendered Perspectives on Financial Behavior**

Gender differences in financial behavior have been widely studied, with consistent findings showing that women tend to exhibit lower risk tolerance and higher savings rates compared to men. Zandri and Ferreira (2018) found that female investors are generally more conservative, which aligns with their long-term focus on financial security. However, these tendencies can limit women's participation in high-return investments like equities.

The study by Sweta Tomar et al. (2021) explored the intersection of gender and retirement planning, revealing that women face unique challenges due to longer life expectancy and lower lifetime earnings.

They emphasized the importance of targeted financial education programs to address these disparities and improve financial outcomes for women.

❖ Emerging Trends and Future Directions

Recent studies have identified emerging trends that warrant further exploration. For instance, Bhavya Bhatia's (2022) research into the interplay between FinTech and traditional financial literacy found that while technology enhances accessibility, it also shifts the focus away from foundational financial knowledge. This suggests a need for balanced approaches that integrate technological advancements with core financial education.

Other studies, like that of Setiawan et al. (2020), emphasize the role of generational differences in financial behavior. Millennials and Gen Z are significantly influenced by digital tools, whereas older generations rely more on traditional methods, highlighting a generational gap in both behavior and outcomes.

❖ Interplay Between Financial Literacy and Financial Behavior

Financial literacy is consistently linked to improved financial behavior across numerous studies. According to Lusardi and Mitchell (2011), financial literacy fosters better retirement planning and wealth accumulation by enabling individuals to understand and manage risks effectively. This relationship is especially strong in developing economies, where low levels of literacy contribute to poor financial outcomes, as demonstrated by Ana and Wan Ahmad (2020) in their study on Malaysian undergraduates.

Raut (2020) investigated the role of past financial behavior and literacy in shaping future investment decisions, concluding that individuals with a history of informed decision-making are more likely to develop sound financial habits. However, this relationship is mediated by attitudes, highlighting the need for behavior-focused financial education.

❖ Impact of Cognitive and Emotional Factors

Cognitive biases and emotional states heavily influence financial decisions, often overriding rational financial literacy. Loss aversion and mental accounting, identified by Thaler (1999), can lead individuals to allocate resources inefficiently, such as over-saving in low-yield accounts or under-investing in high-growth opportunities.

Emotions like stress and anxiety exacerbate poor financial behavior. Hastings and Mitchell (2011) found that financial anxiety often correlates with delayed saving and over-borrowing, even among individuals with adequate financial knowledge. These findings suggest that interventions targeting financial attitudes and emotional regulation could complement traditional financial education.

❖ Role of Cultural and Peer Influences

Cultural norms and peer pressures play a pivotal role in shaping financial behavior. Kumar et al. (2023) explored how collectivist cultures emphasize communal financial obligations, which can

lead to under-saving for personal goals. Conversely, in individualistic societies, greater autonomy often results in more diversified investment portfolios.

Peer influences, particularly among younger generations, can both positively and negatively affect financial behavior. Bhatia (2022) found that peer discussions about investments increased financial awareness, but also led to herd behavior in stock market decisions. This phenomenon is especially pronounced in digital platforms where social media amplifies trends, sometimes creating speculative bubbles.

❖ **Digital Financial Literacy and Emerging Technologies**

Digital financial literacy has emerged as a critical determinant in the modern financial landscape. Referring to the works of Setiawan et al. (2020) and Shinu et al. (2023), People that are adept with digital tools are more inclined to use cutting-edge financial innovations like cryptocurrency, peer-to-peer lending, and robo-advisors.. However, these studies also warn of risks, such as overspending facilitated by instant credit services and exposure to cyber fraud.

Koskelainen et al. (2022) categorized digital financial behavior into three domains: adoption of FinTech tools, behavioral interventions (e.g., spending alerts), and long-term planning. Their research highlights how digital literacy enhances financial inclusion but cautions that gaps persist in rural and low-income demographics.

❖ **Financial Behavior During Economic Uncertainty**

Economic crises often expose vulnerabilities in personal financial management. Parul Kumar et al. (2023) examined the impact of COVID-19 on financial decision-making, finding that individuals with higher financial literacy adapted more effectively by reallocating resources to essential expenditures and investments. Similarly, Georgios and Wilson (2020) explored how FinTech adoption during crises enabled faster recovery for digitally literate populations, further emphasizing the interplay between technology and financial literacy.

❖ **Generational Differences in Financial Behavior**

Generational differences significantly influence how individuals approach saving, investing, and spending. Millennials and Gen Z, for instance, exhibit greater reliance on digital platforms for financial management compared to older generations (Setiawan et al., 2020). However, their tendency toward high consumption and lower risk aversion often leads to insufficient savings.

In contrast, older generations prioritize security over growth, as seen in their preference for low-risk investments like fixed deposits and bonds. Shaw (2023) noted that this conservative approach is less effective in high-inflation environments, necessitating targeted education on diversification strategies.

❖ **The Role of Government and Policy Interventions**

Policy interventions have a significant impact on financial behavior by shaping access to education, technology, and financial services. Mihai Niţoi et al. (2022) advocated for government-backed financial literacy programs tailored to underserved communities, emphasizing their role in improving financial well-being and reducing inequality.

In India, initiatives like Pradhan Mantri Jan Dhan Yojana (PMJDY) have successfully expanded financial inclusion. However, as Shreya Lahiri and Shreya Biswas (2022) observed, such programs must be complemented by digital literacy efforts to ensure their effectiveness in the digital age.

❖ **Insights from International Studies**

Cross-country comparisons provide valuable insights into financial behavior. Morgan and Long (2020) highlighted the role of financial literacy in fostering savings behavior in Laos, finding that higher literacy correlates with formal savings and reduced reliance on informal lending. Similarly, Vasiliki Tzora et al. (2023) observed that financial capability among Greek adolescents varies significantly based on regional economic conditions, emphasizing the need for context-specific interventions.

❖ **Key Challenges in Financial Behavior Research**

Despite advancements, several challenges remain in understanding PFB. First, inconsistent definitions and measures of financial literacy complicate cross-study comparisons (Santini et al., 2019). Second, rapid technological changes outpace research, leaving gaps in understanding how innovations like block chain and decentralized finance influence behavior. Finally, socio-cultural variations require localized studies to ensure findings are broadly applicable.

❖ **CONCEPTUAL FRAMEWORK**
➢ **Independent Variables:**
1. **Attitude**: Individual's mindset or perspective towards managing finances.
2. **Awareness**: Knowledge about financial systems, opportunities, and risks.
3. **Financial Literacy**: Understanding financial concepts and the ability to make informed decisions.
4. **Digital Literacy**: Ability to use digital tools effectively for financial management.
5. **Fintech Adoption**: Use and acceptance of financial technology services and tools.

➢ *Mediating Variable:*

• **Financial Well-being**: The state of feeling secure and in control of one's financial situation, influenced by effective management of financial resources.

• *Dependent Variable:*

• **Personal Financial Behavior**: Actions and decisions individuals make concerning their finances, such as saving, spending, and investing.

❖ **Relationships:**
1. **Independent Variables → Financial Well-being**: Each independent variable contributes to improving financial well-being:
   o Positive attitude enhances resilience and optimism in financial decisions.
   o Awareness increases informed financial choices.
   o Financial literacy empowers individuals with skills to handle finances wisely.
   o Digital literacy enables the use of Fintech for better financial management.
   o Fintech adoption facilitates efficient and innovative financial solutions.
2. **Financial Well-being → Personal Financial Behavior**: Financial well-being mediates the effect of the independent variables by enhancing behaviors that lead to better financial outcomes.
3. **Independent Variables → Personal Financial Behavior**: There may also be direct influences of the independent variables on personal financial behavior.

Here is the conceptual framework diagram showing the relationships between the independent variables, the mediating variable, and the dependent variable.
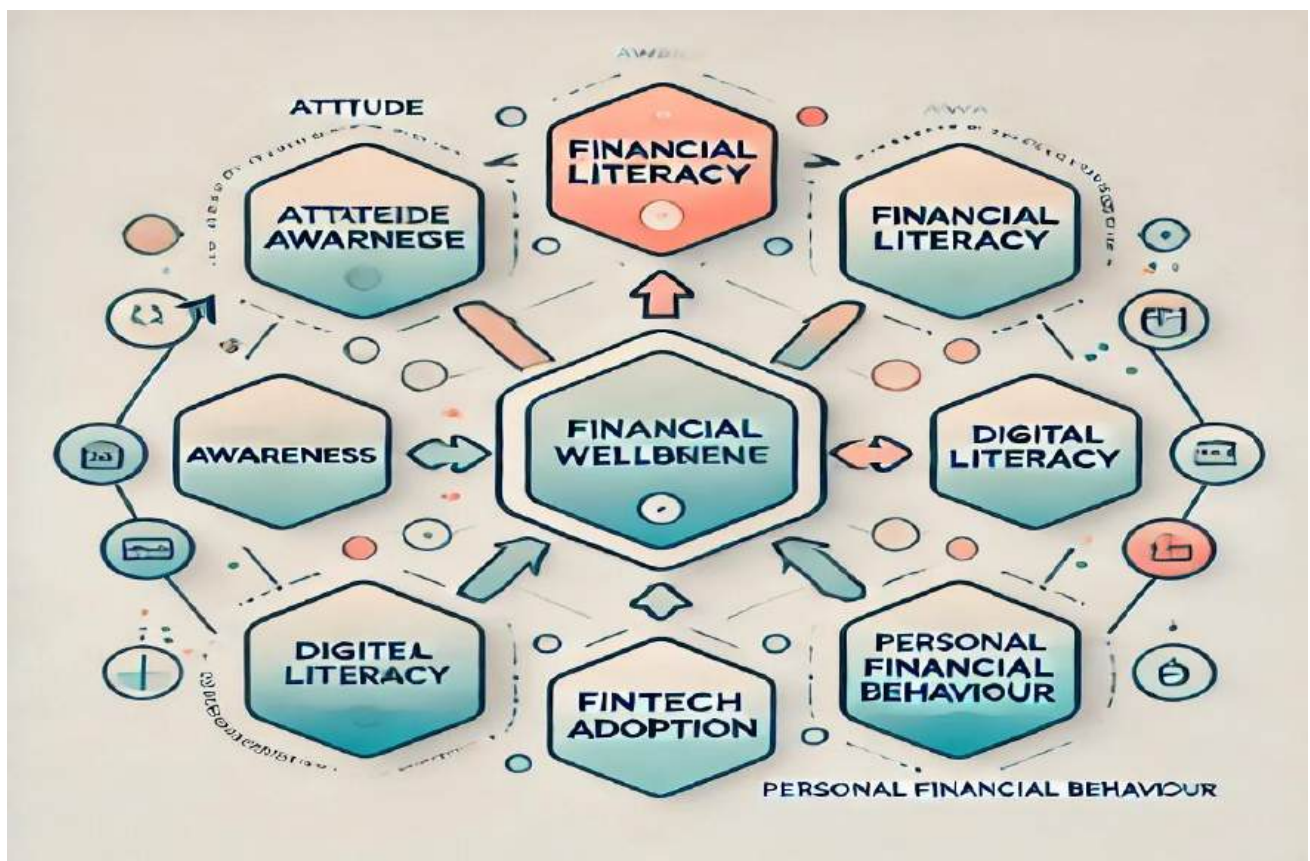
➢ **Diagram Description:**

1. **Independent Variables** (Attitude, Awareness, Financial Literacy, Digital Literacy, Fintech Adoption) are placed on the left.
2. **Mediating Variable** (Financial Well-being) is at the center, with arrows indicating mediation.
3. **Dependent Variable** (Personal Financial Behavior) is on the right.
4. Arrows illustrate the relationships (direct and mediated effects).

❖ **Summary of Key Findings from Literature**

- **Financial Literacy**: Universally acknowledged as a key determinant, with significant effects on financial decision-making, planning, and long-term stability.
- **Digital Literacy**: Increasingly vital due to the digital transformation of financial services, but also a potential barrier for less technologically adept populations.
- **Psychological Traits**: Traits such as risk tolerance, self-control, and cognitive biases significantly influence behavior, often moderated by financial literacy.
- **Socio-Demographic Factors**: Age, gender, income, and education consistently affect financial behavior, highlighting the need for tailored interventions.
- **Financial Well-being**: Acts as a critical mediator and outcome, linking financial literacy and behavior to improved financial stability and satisfaction.

3. OBJECTIVES:

1. Identify Key Influencing Factors

- Explore the psychological, social, cultural, economic, and demographic factors that impact personal financial decisions.
- Investigate the role of personality traits, such as financial literacy, risk tolerance, and impulsivity, in shaping financial behaviors.

2. Assess the Impact of Financial Literacy

- Examine the extent to which financial knowledge and education affect budgeting, saving, investing, and debt management.

3. Understand Behavioral Patterns

- Identify common behavioral patterns such as overspending, delayed saving, or investment choices and their underlying causes.

4. Analyze Demographic and Socioeconomic Variables

- Investigate how factors like age, gender, income level, education, marital status, and occupation influence financial behaviors.

❖ **Explore Psychological and Emotional Influences**Examine the influence of psychological elements on financial decision-making, including stress, emotions, and biased thinking.

6. Evaluate the Role of Social and Cultural Contexts

❖ Recognize how social expectations, peer pressure, and cultural norms impact financial attitudes and behaviors.

7. Assess the Impact of Technology and Digital Tools

- Analyze how access to technology, such as mobile banking, financial apps, and online resources, influences personal financial behavior.

8. **Identify Barriers to Sound Financial Practices**

- Determine obstacles that prevent individuals from adopting healthy financial habits, such as lack of knowledge, income constraints, or external pressures.

9. **Develop Recommendations for Improvement**

- Provide actionable insights for policymakers, educators, and financial institutions to design programs that promote better financial behaviors.

10. **Examine Long-Term Impacts**

- Investigate how early financial behaviors affect long-term financial health, including wealth accumulation, debt levels, and retirement preparedness.

By addressing these objectives, the study can provide a comprehensive understanding of personal financial behavior and offer practical solutions for improving financial well-being.

6. DISCUSSION :

The research paper provides valuable insights about the complex relationship between various determinants and personal financial behavior (PFB). As the research highlights, financial attitude, financial awareness, digital literacy, financial literacy, and financial technology (FinTech) are key factors that influence how individuals make financial decisions in today's rapidly changing financial landscape.

- **Financial Attitude**: One of the most significant determinants of PFB, financial attitude shapes an individual's approach to money management, including saving, investing, and spending habits. A positive attitude towards managing finances typically correlates with better financial outcomes, while a negative or indifferent attitude can lead to poor financial decisions. This aligns with existing research that suggests that individuals with a proactive and positive financial attitude are more likely to engage in financial planning and seek financial education.

- **Financial Awareness and Literacy**: Financial awareness and literacy are closely tied to the ability to make informed financial decisions. Financially literate individuals are better equipped to understand and navigate the complexities of budgeting, investing, and managing debt. This study reinforces the importance of financial education programs in increasing financial literacy, which in turn, positively impacts PFB. Moreover, financial literacy has been shown to be crucial in improving individuals' long-term financial stability and overall well-being.

- **Digital Literacy and FinTech**: The rise of digital platforms and FinTech tools has significantly altered personal financial behavior, with a clear shift toward online savings, investments, and financial management. Digital literacy has become an essential skill for individuals to engage effectively with modern financial tools. The study suggests that individuals who are digitally literate are more likely to use technology to enhance their financial decision-making, such as using budgeting apps, investment platforms, or even cryptocurrency exchanges. FinTech innovations, such as mobile wallets and online banking, have made financial management more accessible, especially for younger generations. However, the study also suggests that a gap still exists, as some

individuals, particularly older generations or those with lower digital literacy, may struggle to adapt to these technological advancements, which can hinder their financial outcomes.

- **Interaction between Determinants**: The interplay between these determinants is critical in shaping an individual's financial behavior. For instance, high financial awareness coupled with digital literacy can create an environment where individuals are more likely to adopt FinTech solutions and make informed decisions about investments and savings. Conversely, a lack of awareness or a poor financial attitude can negate the benefits of digital tools. This interconnectedness suggests that efforts to improve financial well-being should be multifaceted, addressing not only financial knowledge but also attitudes and digital skills.

8. CONCLUSION:

In conclusion, personal financial behavior is a multifaceted construct influenced by a range of determinants, including financial attitude, financial literacy, digital literacy, financial awareness, and the adoption of financial technology. The findings of this study underscore the importance of fostering a positive financial attitude and improving financial literacy and digital literacy among individuals. This will help individuals make better financial decisions, improve their financial well-being, and enhance their overall economic stability.

To improve PFB at a broader level, policymakers and educators should focus on integrating financial education into curricula and offering accessible digital financial tools for people of all ages and backgrounds. Special attention should be paid to enhancing digital literacy, as this is becoming an increasingly crucial skill in the modern financial landscape.

Further research is needed to explore the effectiveness of specific financial education interventions and the impact of emerging FinTech trends on PFB. Additionally, studies focusing on different demographic groups can provide more targeted insights into how factors like age, income, and education level influence personal financial behavior.

Ultimately, improving financial behavior is a collective responsibility, and the findings from this study can inform strategies that help individuals navigate the complexities of modern financial systems for a more secure and prosperous future.

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Predicting Factors Affecting Adoption of AI Tools for Online Shopping

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Abstract: *The développent of computer-génerâtes reality invention in media outlets has make use of the capacity for familiar organisation in recent times. This emphasis observationally examines how consumers' intent to use AI based voice assistant is inclined by the way informal community traits are presented as a dispersion system. This research examined the amicability of computer-generated reality using 242 respondents from Gujarat. The behaviour outlines of clients at treatment were closely examined. The findings of this study validate that consumers do prefer to use voice assistants if it easy to operate, which have an additional noteworthy bear upon on intention to use. These findings have specific implications for the most effective ways to showcase voice assistant devices, as well as speculative implications for how customers behave while receiving items.*

Key Words: *Adoption, Voice Assistant, Génération Z, Consumer Behaviour,*

1. INTRODUCTION:

The contemporary world is presently experiencing a technological revolution, which has resulted in a notable surge in the incorporation of state-of-the-art equipment with the objective of augmenting client contentment and therefore elevating consumer standards. The relationship between customers and service providers is significantly impacted by this explosion of technical innovation, which offers marketers both opportunities and challenges. Artificial intelligence is becoming more and more integrated into consumer activities, especially with the emergence of AI technology such as chatbots, voice-activated assistants, and automated service agents. According to a recent Juniper Research report, users are expected to interact with conversational agents on more than 8.4 billion devices globally by 2024, outpacing the world's population.

Voice assistants powered by artificial intelligence have completely changed how people use the internet, consume information, complete activities, make everyday transactions, and enjoy a number of enjoyable features. Consequently, service providers have started incorporating voice technology into their services and offerings. This integration highlights voice technology as an essential component of smart household appliances, cutting-edge electronics, and high-end automobiles. As a result, voice assistants with artificial intelligence (henceforth referred to as "VA") provide users a wider range of applications in addition to transactional functions. Owing to the many benefits and profound modifications in service delivery that VAs bring about, a great deal of academic study is being done in this area.

These days, artificial intelligence is frequently used in a variety of corporate settings. AI, according to experts and academics, is what our society will look like in the future. The world is becoming more interconnected because of technology breakthroughs, which has spurred investment in artificial intelligence (AI) for big data analytics. Applications of AI for big data analytics go beyond marketing to include industries like manufacturing, e-commerce, healthcare, education, and law. Artificial Intelligence and other emerging technologies are evolving at the same time as organisations move towards Industry 4.0.

Recently, there are more options for improving the customer experience due to the quick development of information technology and the rise in conversational commerce users. However, prior research has mostly ignored significant external elements connected to customer responsiveness in favour of examining virtual assistants as a form of artificial intelligence technology. Since virtual assistants depend on commands to work, they behave differently, thus it's important to uncover elements that can help marketers understand consumer inclinations towards them. However, very few research has successfully tackled the factors influencing consumers' attitudes and perceptions in developing nations like India.

AI adoption will quicken on the forefront of digital technology, expanding the divide between early adopters and those falling behind across a range of fields, industries, and geographical areas. Throughout the value chain, artificial intelligence is being deployed, with major investments concentrated on key areas of business processes. Marketing and innovation are a corporate enterprise's two core functions, according to Peter Drucker. Therefore, important data sources like sales and marketing are crucial parts of the value chain where AI has been widely adopted.

Consumers are increasingly using the internet for shopping, business, and social interaction. Studies show that users prefer applications that provide easy-to-use interfaces and smooth task completion. The previous literature review's hypotheses relied on the supposition that customers value simplicity of use above all else.

2. LITERATURE REVIEW:

Unlike human intelligence, artificial intelligence is the capacity exhibited by machines. It involves an intelligent agent machine system that senses its surroundings and strives to accomplish its objectives. AI, in the words of Russell and Norvig, is the study of machines—especially computers—that mimic the emotional and cognitive capacities of human minds. The last several decades have seen a spectacular advancement in the field of artificial intelligence, with specialists constantly striving to advance AI notions. Significant advances like big data analytics and machine learning applications in a variety of industries and situations are the outcome of this work.

The phrase "artificial intelligence" frequently conjures up images of mechanized robots assisting people, a notion popularized by popular culture. Nonetheless, artificial intelligence (AI) refers to any device created to replicate human cognitive processes via ongoing learning and problem-solving. AI is defined by these unique features. Machines can do laborious or repetitive jobs that people may find tedious, therefore people are not forced to perform such boring work. Such monotonous jobs are effectively handled by artificially intelligent systems in place of humans.

For the purposes of this study, a voice assistant is defined as an intelligent program that can carry out activities for the user by interacting with natural language or by combining natural language with a touch-based interface. Additionally, it can respond to the user in natural language, which can be created by combining recorded lines with text-to-speech. Voice assistants can also be voice activated from a locked state, depending on the device's capabilities and the user's settings.

They can do things like browse the internet and operate apps that include chat, weather, calendars, and photo albums (Apple, 2017). Intelligent, personal, and virtual assistants are other terms used to describe some of the voice assistants that are now on the market (Apple, 2017; Google, 2017; Microsoft, 2017a).

The possibility of a favorable influence on consumers increases with the ease of use or learning curve of shopping interfaces. Over the course of its lengthy existence in the world of technology, the technology acceptance model has attracted a great deal of study attention. According to this approach, technology needs to show that it is simple to be accepted. According to research, people are more likely to have good

experience with an app if they believe it to be simpler to use and requires less work than conventional shopping techniques. It follows that app adoption is anticipated to be favorably impacted by these feelings. In a similar vein, consumers are more inclined to embrace apps if they think that voice assistants improve task success. As a result, this research suggests:

H₁: Consumers do prefer ease of use of the voice assistants while shopping online.

According to Zuckers (1986), personality congruence increases trust, enjoyment of encounters, and the choice of future interactions in addition to increasing attraction. Personality similarity is expected to positively influence participants' trust levels and overall happiness with the encounter for shopping assistants.

As consumers are nowadays very conscious about how they are protected and whether the application is trustworthy or not. Based on that hypothesis 2 is formulated.

H₂: Trust has a positive and direct relationship with intention to adopt voice assistants while shopping online.

Furthermore, risk is one of the crucial factors while using voice assistants through internet. Based on that hypothesis 3 is formulated.

H₃: Risk has a positive relationship with intention to use voice assistants while shopping online.

Personal image and social image are most affecting factors while using voice assistants. Hence, below hypothesis is formulated.

H₄: Social influence is positively associated with intention to use voice assistants while shopping online.

3. OBJECTIVES / AIMS

The aim of this study is to investigate how an AI-powered voice assistant might enhance customer experience, hence increasing sales. Three sections comprise the research objectives:

- Analyzing how AI powered voice assistants can improve personalized marketing and help businesses move away from mass marketing strategies.
- Looking into how AI powered voice assistants can improve customer convenience, which can boost sales and market share for businesses.

- Determining the extent to which businesses in diverse industries are currently utilizing AI powered voice assistants.

4. RESEARCH METHOD / METHODOLOGY

Finding out what element's clients appreciate and how these things affect their behavior is the primary objective of this study. It is to explore how numerous elements affect people's decision-making processes and to provide a comprehensive analysis using various criteria for improved task performance. The work is both descriptive and analytical in nature.

Gujarat State and several Indian regions are considered for the research study's population. The sampling units will be the sub-geographical urban regions of Gujarat State, including cities like Ahmedabad, Baroda, Surat, and Rajkot.

4.1 Research design

The samples were from Gujarat State's cities, which were selected at random. Therefore, to find possible research study participants, an area sampling technique was used.

4.2 Sources of data

A total of 362 participants were enrolled in this study to determine how likely they were to use voice assistants. The respondents were questioned about demographics including age, gender, occupation, education level, and monthly income. Although some secondary data was included, primary data constituted much of the research. Using area sampling methods to identify the participants in the research analysis, all samples were randomly selected from urban regions in Gujarat State.

An extensive investigation of the influential elements identified in the body of existing research was followed by the creation of a meticulously structured survey to collect primary data. Numerous sources, including online theses, research articles, journals, books, magazines, and websites, provided the secondary data for the study. Responses on the Likert scale, which went from 1 (strongly disagree) to 5 (strongly agree), were utilised in the poll. The acquired data was subjected to a reliability test to evaluate its credibility. To investigate every hypothesis, the data was further subjected to a Chi-Square test at a significance threshold of 5% using the statistical programme SPSS.

Cronbach's alpha	N of items
0.825	18

5. RESULT / FINDINGS

H₁: Consumers do prefer ease of use of voice assistants while shopping online.

Findings support hypothesis 1. According to respondents to the survey, users think voice assistants are easy to use and seamless. Outputs displayed in Table 1.

Table 5.1: Test results for ease of use

	Measure	Degree of freedom	A.S. (two sided)
P – value	494.861[a]	11	.000
L – ratio	267.571	11	.010
Asso.	71.256	1	.000
Count	242		

H₂: Trust has a positive and direct relationship with intention to adopt voice assistants while shopping online.

Voice assistants are considered as one of the most dependable forms of technology, according to respondents. Table 2 presents these results in more detail.

Table 5.2: Test results for trustworthiness

	Measure	Degree of freedom	A.S. (two sided)
P – value	476.635[a]	11	.000
L – ratio	252.886	11	.043
Asso.	84.579	1	.000
Count	242		

H₃: Risk has a positive relationship with intention to use voice assistants while shopping online.

Participants have overwhelmingly approved of hypothesis 3. They have acknowledged that while using voice assistants for any kind of activity, they consider the associated dangers. **Table 5.3: Test results for risk association**

	Measure	Df	A.S. (two sided)
P – value	435.440[a]	11	.000
L – ratio	257.754	11	.001
Asso.	40.325	1	.000
Count	242		

H₄: Social influence is positively associated with intention to use voice assistants while shopping online.

Respondents enthusiastically supported hypothesis 4, suggesting that using voice assistants will raise their social status.

Table 5.4: Test results for societal impression

	Measure	Degree of freedom	A.S. (two sided)
P – value	499.048[a]	11	.000
L – ratio	262.179	11	.001
Asso.	59.943	1	.000
Count	242		

7. CONCLUSION / SUMMARY:

This study has significant ramifications for academia, especially considering its examination of social network-related characteristics, which are a common trend in the AI sector, and how these characteristics affect consumers' propensity to adopt voice assistants. This study's findings are consistent with earlier research on social networking sites and new media, showing that users' intentions to utilise voice assistants are significantly influenced by their perceived enjoyment. As a result, the study's findings on satisfaction can help shed light on how customers use voice assistants and offer important information on the spread of the same.

The research offers producers of voice assistants' useful information. Voice assistants can make feel user pleasure is increased by social connections, and the good attitude these interactions generate greatly boosts

the desire to utilise voice assistants. As a result, incorporating social network services might increase voice assistants' acceptance among consumers and highlights the fact that social connections are crucial to the entertainment industry—not optional. As a result, companies ought to give top priority to marketing plans that promote user engagement and integrate SNS functionalities with voice assistants. Marketing campaigns could also focus on customers who have previously used voice assistants by setting up a forum where they can talk about their experiences in-depth and spread the word about the platform.

8. LIMITATIONS:

The quantity of survey replies that were left blank is one of the study's limitations. This led to fewer full responses that could be utilised in the survey, resulting in a smaller sample size and perhaps less accurate results. Subsequent studies must consider the decrease in quit rates during survey completion.

This study contains significant limitations that should be considered in future research, even though it offers insightful information concerning the acceptance and uptake of voice assistants. Firstly, the adoption of voice assistants in online shopping be idea in the work has a broad reach; it encompasses the whole AI sector, not only AI applied to certain domains.

As such, our results are unable to differentiate between different voice assistants. Second, the poll explored in this one was based on how consumers generally perceived voice assistants; it did not directly represent user experience. Most survey participants had no prior AI experience. Thus, it appears that indirect media exposures from platforms like TV, YouTube, and social media have influenced the study's findings. Thus, direct user experiences with apps accessible via social networks should be the focus of future study.

Thirdly, the only outside factors included in this study were social contacts and the strength of social ties. To assess the effects of social network service features more fully within the framework, other components such as data confidentiality, openness to innovation, peer influence, and self-worth should be included in future studies.

According to this study, voice shopping is still in its infancy and is not widely used. Therefore, because it might be difficult to envision how something would function in real life, variables and related statements may seem ambiguous to people. Subsequent studies ought to concentrate on inventive approaches that facilitate participants' comprehension of the research's topic, so enabling them to provide more precise responses. For example, develop a prototype that participants can test out once to complete an online purchase.

10. RECOMMENDATIONS:

Subsequent studies ought to focus more on the level of comprehensibility that occurs without the researcher having to be explained. This can be accomplished by doing a longer pre-test. This makes it possible to test and refine the questions with multiple respondents so that they are simple and understandable for each respondent. Additionally, research by Beldad and Hegner (2017) demonstrates the lack of significance of the variable trust. Like this study, developer trust was employed rather than technology trust. Additionally, the original items used to measure these assertions were also used. This teaches us that trust in the developer might not be the best way to operationalize trust. Subsequent studies could define trust differently by.

Using an enhanced tactic, the work explored how consumers adopted voice assistants, adjusting for user demographics such as gender, age, and monthly income. The objective was to experimentally investigate this work reported enjoyment and social network engagement on voice assistants' adoption.

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Artificial Intelligence in Economic Policy and Decision-Making

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Abstract: AI has rapidly evolved over the previous decade, increasingly impacting various fields, including economic policy and decision making. This paper explores the application of AI in economic policy and decision making. It scrutinizes how AI tools, such as ML and big data analytics are utilised to enhance economic prediction, optimize policymaking and improve government decision-making processes. This paper also discusses the benefits and challenges associated with AI adoption in economic policy and provides insights into future trends and implications for policymakers.

Key Words: Artificial Intelligence (AI), Economic policy, Decision making, Machine learning (ML), Big data analytics, AI in economics, Economic models, Macroeconomic prediction.

1. INTRODUCTION:

The advent of Artificial Intelligence (AI) has brought significant transformations across diverse sectors, from healthcare to finance. Economic policy and decision-making, traditionally dependent on macroeconomic models, statistical analyses and expert judgment are increasingly leveraging AI's potential. The use of AI in this context promises enhanced accuracy in economic forecasting, greater efficiency in policy simulation and improved decision-making processes. This paper aims to explore the integration of AI in economic policy and decision-making, assessing its impact, benefits, challenges and ethical considerations. AI is the replication of human intelligence in robots designed to think and learn like humans. AI systems may do activities that traditionally require human intellect, such as visual perception, speech recognition, decision-making, and language translation. The basic goal of AI is to develop systems that can operate autonomously, adapt to new situations, and improve over time using machine learning.

AI capabilities range from narrow or weak AI, which is designed for specific tasks like facial recognition or internet searches, to general or strong AI, which aims to perform any cognitive task that a human can. Current AI technologies include machine learning, which enables systems to learn from data; natural language processing, which allows for understanding and generating human language; and neural networks, which mimic the structure and function of the human brain to improve learning and decision-making processes. AI is gradually integrated into various sectors, including health care, finance, automotive and entertaining, enhancing efficiency and novelty. But, the rapid progress of AI also raises ethical and societal concerns, such as job movement, secrecy issues and the need for robust governance and rule etc.

2. OVERVIEW OF ECONOMIC POLICY AND DECISION-MAKING PROCESSES

Economic policy refers to the strategies and actions taken by a government to manage its country's economy. The main objectives of economic policy typically include helping economic growth, ensuring price constancy, accomplishing full employment and reducing disparities. Economic policy can be broadly categorised into fiscal policy, monetary policy and structural policy.

- **Fiscal policy** refers to government spending and taxing policies that affect aggregate demand and economic activity. Fiscal policy allows governments to stimulate the economy during a recession by increasing public spending or lowering taxes, or to cool an overheated economy by reducing expenditure or raising taxes.
- **Monetary Policy** is mainly managed by a nation's central bank, such as the Reserve bank of India in India, the Federal Reserve in the United States, or the European Central Bank in the Eurozone. It

entails manipulating the money supply and interest rates in order to achieve macroeconomic goals such as reducing inflation, managing employment levels, and stabilizing the currency. Central banks impact economic circumstances by establishing interest rates, conducting open market operations, and imposing reserve requirements.

- **Structural Policy** focuses on long-term economic performance by improving the efficiency of markets, increasing productivity and fostering innovation. This includes labour market reforms, regulatory changes and policies to enhance competitiveness and economic resilience.

The decision-making process for economic policy involves multiple stakeholders, including government agencies, central banks, advisory councils and international organisations. Policymakers analyse economic data, consider economic models and forecasts and assess the potential impacts of various policy options. Public opinion, political considerations and lobbying by interest groups also influence economic decisions. Ultimately, the aim of economic policy is to create a stable economic environment conducive to sustainable growth and improved living standards. Coordination between fiscal and monetary authorities is essential to ensure that policy measures complement rather than conflict with each other.

3. HOW AI IS BEING USED TO SOLVE COMPLEX ECONOMIC PROBLEMS

AI is revolutionising economics by analysing vast datasets, predicting market trends, optimising supply chains and enhancing decision-making. It helps identify patterns in consumer behaviour, forecasts economic indicators and automates financial services. AI also aids in solving complex problems like resource allocation, fraud detection and risk management, providing data-driven insights for policy-making and economic planning. AI is also used in financial markets for algorithmic trading, where complex algorithms analyse market data in real time to make trading decisions. This has led to more efficient markets, though it also raises concerns about market volatility. In public policy, AI helps governments predict and manage economic crises by analysing data on consumer behaviour, employment rates and other indicators. It also plays a crucial role in optimising supply chains, enhancing productivity and reducing costs by predicting demand and managing inventory effectively.

4. OBJECTIVES OF THE PAPER

a) To analyse the applications of AI in economic policy formulation and implementation.
b) To analyse the potential benefits and challenges of integrating AI into economic decision-making.
c) To provide a comprehensive review of current AI applications in economics.
d) To discuss the future implications of AI for policymakers.

5. THEORETICAL FRAMEWORK

AI AND MACHINE LEARNING

Artificial Intelligence (AI) is the replication of human intelligence in machines, allowing them to do things like learn, reason, and solve problems. As a branch of artificial intelligence, machine learning entails teaching algorithms to learn from data and get better over time without explicit programming. It makes predictions or judgments by identifying patterns using statistical approaches. Key types include supervised learning, where models learn from labeled data and unsupervised learning, where they find patterns in unlabelled data. Advances in fields like computer vision and natural language processing are made possible by deep learning, a subfield of machine learning that models intricate patterns using neural networks.

A branch of artificial intelligence called machine learning makes it possible for computers to learn from data. Neural networks having multiple layers are used in deep learning, a branch of machine learning, to model intricate patterns. Neural networks are algorithms that recognize patterns and make predictions by drawing inspiration from the structure of the human brain. Data is crucial in AI and machine learning as it serves as the foundation for training models. High-quality, diverse datasets enable models to learn patterns, make accurate predictions and generalise well to new situations. Insufficient or biased data can lead to poor

performance and unreliable outcomes. Thus, data quality, quantity and relevance directly impact the effectiveness and reliability of AI and machine learning models.

ECONOMIC POLICY & DECISION-MAKING
THE ROLE OF ECONOMIC POLICY IN STABILISING & INSPIRING ECONOMIC GROWTH

By controlling inflation, unemployment, and fiscal deficits, economic policy plays a critical role in stabilizing and promoting economic growth. By controlling interest rates and the money supply, monetary policy aids in price stabilization and encourages investment. Fiscal policy, which includes taxing and spending by the government, increases growth and aggregate demand, particularly in recessionary times. Structural policies, such as deregulation and innovation incentives, enhance productivity and competitiveness. Together, these policies create a stable economic environment, encourage investment and foster sustainable growth, ensuring a balanced approach to short-term stabilisation and long-term economic expansion.

DECISION-MAKING FRAMEWORKS IN ECONOMICS (KEYNESIAN VS. MONETARIST APPROACHES)

In economics, decision-making frameworks guide how policies are crafted to manage economic activity, particularly regarding growth, inflation and employment. The Keynesian approach, named after John Maynard Keynes, emphasises the role of government intervention in stabilising the economy. Keynesians argue that during economic downturns, active government spending can boost demand, reduce unemployment and promote economic recovery. They believe that fiscal policy (taxing and spending) is crucial for managing economic fluctuations. In contrast, the Monetarist approach, associated with Milton Friedman, focuses on controlling the money supply to influence economic outcomes. Monetarists argue that inflation is primarily a result of changes in the money supply and advocate for a steady, predictable increase in money supply rather than active government intervention. They prioritise monetary policy, managed by central banks, over fiscal policy. Monetarists believe that markets are generally self-correcting and that excessive government intervention can lead to inefficiencies.

SYNERGY BETWEEN AI AND ECONOMIC POLICY

AI can significantly enhance traditional economic models by improving data analysis, forecasting and decision-making. Machine learning algorithms can analyse vast amounts of economic data more efficiently than traditional methods, uncovering patterns and trends that were previously unnoticed. AI can refine predictive models by incorporating real-time data and adjusting forecasts dynamically. AI has significantly transformed predictive analytics and economic forecasting in several ways:

a) AI can handle large volumes of data quickly and accurately, identifying patterns and correlations that might be missed by traditional methods.

b) Techniques like regression analysis, decision trees and neural networks are used to make predictions based on historical data and trends.

c) AI systems can analyse data in real-time, providing up-to-date forecasts and enabling quicker responses to economic changes.

d) AI can model complex economic scenarios and simulate various outcomes, helping economists and businesses understand potential impacts of different decisions.

e) AI tools can analyse social media and news sentiment to gauge economic trends and market movements.

f) AI can provide tailored economic forecasts for different sectors or regions, enhancing the relevance of predictions.

APPLICATIONS OF AI IN ECONOMIC POLICY AND DECISION-MAKING
ECONOMIC FORECASTING AND PREDICTIVE ANALYTICS

Economic forecasting and predictive analytics involve using statistical methods and data models to predict future economic conditions and trends. By analysing historical data, market trends and various economic indicators, economists and analysts can forecast aspects like GDP growth, inflation rates and unemployment levels. Predictive analytics leverages advanced algorithms and machine learning to enhance

accuracy, incorporating complex datasets and real-time information. These tools help businesses and policymakers make informed decisions, anticipate potential challenges and devise strategies for economic stability and growth. Effective forecasting and analytics are crucial for adapting to changing economic environments and achieving long-term goals.

AI IN MACROECONOMIC FORECASTING: GDP GROWTH, INFLATION RATES AND UNEMPLOYMENT

AI has become increasingly important in macroeconomic forecasting by improving the accuracy of predictions for GDP growth, inflation rates and unemployment.

a) **GDP Growth:** AI models can analyse large datasets, including economic indicators, financial markets and global events, to predict GDP growth more accurately. Machine learning algorithms can identify patterns and correlations that traditional models might miss.

b) **Inflation Rates:** AI can process real-time data and complex variables that influence inflation, such as commodity prices, labour market conditions and consumer behaviour. Predictive models can help forecast inflation trends and adjust for sudden economic shocks.

c) **Unemployment:** AI can track employment trends, job vacancies and economic conditions to provide more timely forecasts of unemployment rates. Models can also analyse demographic and geographic data to better understand labour market dynamics.

Case Studies on the Use of AI in Economic Forecasting

AI has been increasingly applied in economic forecasting, including by central banks. Here are a few notable case studies are as follows:

a) **Bank of England:** The Bank of England has explored the use of AI and machine learning for various economic forecasting tasks, such as predicting economic growth and inflation. This helps in refining their economic models and making more informed policy decisions.

b) **Federal Reserve:** The Federal Reserve has utilised machine learning models to improve its economic forecasts. AI has also been used to enhance real-time data analysis, which aids in timely and accurate decision-making.

c) **European Central Bank (ECB):** The ECB has integrated AI into its economic forecasting models to improve predictions related to inflation, GDP growth and other key economic indicators. AI tools have enabled the ECB to analyse complex datasets and uncover insights that traditional models might miss.

d) **Bank of Canada:** The Bank of Canada has employed machine learning for forecasting purposes, particularly in analysing economic data to predict housing market trends and macroeconomic variables.

FISCAL POLICY AND TAXATION
AI APPLICATIONS IN TAX POLICY AND REVENUE OPTIMISATION

AI can help with tax policy and revenue optimisation in a few key ways:

a) AI can analyse large amounts of tax data to identify trends and patterns, which helps in forecasting future tax revenues and assessing the impact of different tax policies.

b) AI systems can detect unusual patterns that may indicate tax fraud or evasion, improving enforcement and ensuring fair tax collection.

c) AI can simulate the effects of proposed tax changes, helping policymakers understand potential outcomes and make more informed decisions.

d) AI-powered tools can provide individuals and businesses with tailored advice on tax planning and compliance, making it easier to navigate complex tax regulations.

EXAMPLES OF COUNTRIES USING AI IN TAX ADMINISTRATION

Several countries are using AI in tax administration:

a) In United States the IRS employs AI for fraud detection, data analysis and improving taxpayer services. For example, AI models analyse patterns to identify suspicious activities and potential tax evasion.

b) In United Kingdom the HMRC uses AI to enhance compliance and tackle tax evasion. AI tools help in analysing vast amounts of data to detect inconsistencies and potential fraud.

c) The Canada Revenue Agency (CRA) utilises AI to streamline the tax filing process, improve audit efficiency and enhance customer service by predicting and addressing taxpayer needs.

d) The Australian Taxation Office (ATO) employs AI for similar purposes, including fraud detection, risk assessment and automating routine tasks to improve efficiency.

e) The Inland Revenue Authority of Singapore (IRAS) uses AI to improve tax compliance and streamline administrative processes, such as automating routine queries and enhancing audit capabilities.

MONETARY POLICY

AI can significantly enhance the formulation and implementation of monetary policy by providing advanced data analysis, predictive modelling and real-time economic insights. Through machine learning algorithms, AI can analyse vast amounts of economic data to identify trends, forecast economic conditions and evaluate the potential impacts of policy changes with greater accuracy. This capability enables central banks and policymakers to make more informed decisions, improve the efficiency of monetary policy transmission and respond more swiftly to economic shifts. Additionally, AI can help in monitoring financial stability by detecting anomalies and systemic risks that might not be apparent through traditional methods.

CENTRAL BANKS' USE OF AI FOR INFLATION TARGETING AND INTEREST RATE SETTING

Central banks, like the Federal Reserve or the European Central Bank, use AI to help manage inflation and set interest rates more effectively. AI, or artificial intelligence, can analyse large amounts of data quickly, which helps central banks understand how the economy is performing. For inflation targeting, AI looks at various economic indicators like prices, wages and employment levels to predict how inflation might change. This helps central banks decide whether to adjust interest rates to keep inflation within a desired range. When it comes to setting interest rates, AI models can process data from global markets, economic trends and past monetary policies to recommend the best rate changes. This helps central banks respond more accurately to economic conditions, such as whether the economy needs a boost or if it's overheating.

CASE STUDIES

AI applications in central banks like the European Central Bank (ECB) and the Federal Reserve highlight how AI can enhance financial stability, policy-making and operational efficiency. Here are some case studies:

a) **European Central Bank (ECB): 1. Economic Forecasting:** The ECB uses AI models to improve economic prediction by analyzing huge amounts of data, including economic indicators, market movements and textual data from news and monetary reports. This helps in refining their financial policy decisions and predicting financial conditions with greater accuracy. **2. Anti-Money Laundering (AML):** The ECB leverages AI to enhance its AML efforts by analyzing transaction patterns and detecting anomalies that may indicate fraudulent activities or compliance issues.

b) **Federal Reserve: 1. Financial Market Monitoring:** The Federal Reserve employs AI to monitor financial markets for signs of instability. AI algorithms can detect unusual trading patterns or potential bubbles by analysing real-time market data and historical trends. **2. Consumer Protection:** The Federal Reserve uses AI to analyse consumer complaints and identify trends in financial products and services. This helps in regulating and improving financial practices to better protect consumers.

LABOUR MARKET ANALYSIS AND POLICY

USING AI TO ANALYSE LABOUR MARKET TRENDS AND PREDICT EMPLOYMENT CHANGES

AI can significantly enhance the analysis of labour market trends and employment changes by leveraging vast datasets and sophisticated algorithms. Through machine learning models, AI can identify patterns in historical employment data, track real-time job market fluctuations and predict future trends with greater accuracy. AI can offer important insights into new job opportunities and possible skill gaps by analyzing factors like workforce demographics, industry growth, and regional economic conditions. This helps businesses, policymakers, and job seekers make well-informed decisions and plan for labor market shifts.

POLICY IMPLICATIONS FOR WORKFORCE DEVELOPMENT AND TRAINING PROGRAMS

Workforce development and training programs must adapt to rapidly changing technological and economic landscapes to ensure they meet the needs of both employers and employees. Policy implications include the need for increased investment in upskilling and reskilling initiatives, tailored to emerging industries and digital advancements. Policies should promote partnerships between educational institutions, businesses and government agencies to create dynamic and responsive training programs.

THE IMPACT OF AI ON EMPLOYMENT AND THE FUTURE WORK

a) Automation and artificial intelligence have the potential to eliminate jobs, particularly in industries like manufacturing and standard office work. Jobs that require a lot of repetitive work are more likely to be mechanized.

b) Conversely, AI can create new jobs and industries. Roles in AI development, data analysis and AI maintenance are growing and AI can also spur innovation leading to entirely new fields.

c) The demand for certain skills is changing. There is increasing need for skills related to AI, data science and digital literacy, while traditional roles may require reskilling.

d) AI can enhance productivity and efficiency by automating routine tasks, allowing employees to focus on more multifaceted and creative tasks.

e) The broader economic impact includes potential growth in productivity and economic output, but also challenges related to income inequality and the redistribution of wealth.

f) AI could transform workplace dynamics, including remote work, flexible hours and changes in how teams collaborate.

TRADE POLICY AND INTERNATIONAL ECONOMICS

AI in trade analysis uses advanced algorithms and machine learning techniques to identify patterns and predict trade flows. The overview of how it works:

a) AI systems collect enormous volumes of data from a variety of sources, such as market movements, economic indicators, historical trade data, and geopolitical events.

b) To identify patterns and correlations, machine learning algorithms analyze the data using neural networks and decision trees. Seasonal trends, changes in trade dynamics, and market behavior are a few examples of these patterns.

c) Using past data and identified outlines, AI models make predictions about future trade flows. For example, they might forecast changes in import/export volumes, pricing trends, or the impact of policy changes.

d) AI can process and analyse data in real-time, allowing traders and analysts to make informed decisions quickly based on the latest information.

e) By predicting potential disruptions or anomalies in trade flows, AI helps in managing risks and making strategic adjustments to trading strategies.

f) AI can automate routine tasks like data processing and reporting, freeing up analysts to focus on more strategic aspects of trade analysis.

IMPLICATIONS FOR TARIFF POLICY AND INTERNATIONAL NEGOTIATIONS

Tariff policy significantly impacts international negotiations and trade relations. High tariffs can protect domestic industries but may lead to trade wars, retaliation and strained diplomatic ties. Conversely, lowering tariffs can enhance trade flows, foster stronger economic partnerships and improve market access for domestic producers. International negotiations often focus on tariff reductions to promote global trade liberalisation and economic cooperation. Countries may leverage tariffs as bargaining tools, negotiating concessions or market access in exchange for reduced barriers. The balance between protecting national interests and embracing global trade dynamics is crucial, as excessive tariffs can disrupt global supply chains and lead to economic inefficiencies, while well-calibrated policies can drive growth and strengthen international alliances.

CASE STUDIES

AI-driven trade policy analysis leverages artificial intelligence to evaluate and shape trade policies. Here are some notable case studies in this area:

a) **IBM's Watson and Trade Policy:** IBM's Watson has been used to analyse vast amounts of trade data and policy documents. By leveraging natural language processing and machine learning, Watson helps identify patterns and potential impacts of proposed trade policies. This can assist policymakers in understanding the broader implications of their decisions and in crafting more effective trade agreements.

b) **The European Commission's Trade Policy Analysis:** The European Commission has utilised AI tools to enhance its trade policy analysis. Machine learning models analyse data on global trade flows, economic indicators and geopolitical factors to inform the EU's trade strategy. These AI-driven insights help the Commission anticipate the effects of trade policies on different sectors and member states.

c) **China's AI and Trade Forecasting:** China's government has integrated AI into its trade policy formulation process. AI algorithms analyse historical trade data, global economic trends and trade partner behaviours to forecast future trade scenarios. This enables China to adjust its trade policies proactively and strategically.

d) **US Trade Policy and AI-Enhanced Data Analysis:** In the US, AI technologies are employed to scrutinise trade agreements and policies. AI tools analyse tariffs, trade balances and international market conditions to evaluate the potential economic impacts of trade policies. This aids U.S. trade representatives in anticipating obstacles and negotiating better deals.

PUBLIC POLICY AND WELFARE PROGRAMS

AI can significantly optimise social welfare programs and public spending by enhancing efficiency, targeting resources more effectively and improving service delivery. Here are some key applications:

a) AI can predict which communities or individuals are most likely to need assistance by analysing data on economic conditions, employment trends and social indicators. This allows for more targeted allocation of resources, reducing waste and ensuring that support reaches those most in need.

b) AI algorithms can detect patterns of fraudulent behaviour by analysing large datasets from social welfare programs. This can help identify and prevent fraudulent claims, saving public funds and ensuring that resources are only allocated to eligible recipients.

c) AI can help design personalised interventions based on individual needs, preferences and circumstances. This can lead to more effective support programs that are tailored to the specific requirements of beneficiaries, improving outcomes and satisfaction.

d) AI-driven automation can streamline administrative processes in social welfare programs, such as application processing, case management and benefit distribution. This reduces administrative costs, speeds up service delivery and minimises errors.

e) AI can analyse vast amounts of data to provide insights into the effectiveness of different social welfare programs. Policymakers can use these insights to design better programs, allocate budgets more effectively and evaluate the impact of policy changes in real-time.

f) Chatbots and virtual assistants driven by AI can offer citizens round-the-clock assistance by responding to inquiries regarding eligibility, application status, and services that are available. This lessens the strain on customer care centers and enhances information access.

g) AI can be used to monitor and predict maintenance needs for public infrastructure (like housing and transportation) that supports social welfare programs, leading to cost savings and improved service quality.

h) AI can analyze behavioral data to better understand how different groups react to various incentives or nudges. This can aid in the development of programs that promote desirable behaviors, such as boosting participation in job training or adopting a healthier lifestyle.

i) AI can optimise supply chains for the distribution of goods and services in welfare programs, such as food assistance or healthcare services. This ensures timely delivery and reduces costs associated with logistics.

j) AI may assist foresee and respond to crises that affect vulnerable populations, such as natural catastrophes or economic downturns, by simulating numerous scenarios and recommending the optimal course of action for resource allocation.

HEALTHCARE ECONOMICS AND EDUCATION POLICY

Predictive analytics involves using historical data, statistical algorithms and machine learning techniques to identify the likelihood of future outcomes. In healthcare economics and education policy, predictive analytics can provide valuable insights and improve decision-making.

a) **Healthcare Economics:** In healthcare, predictive analytics can optimise resource allocation, reduce costs and improve patient outcomes. Predictive models can estimate the likelihood of patient readmission, allowing healthcare providers to implement preventive measures; by analyzing billing and resource usage patterns, healthcare facilities can forecast future expenses and optimize budgets; using patient data, predictive models can help formulate more effective and efficient individualized treatment plans; and forecasting demand for medical supplies and medications can help reduce waste and ensure availability. These are just a few of the key applications of predictive models.

b) **Education Policy:** In education, predictive analytics can enhance student outcomes and inform policy decisions. Applications include; early Intervention: Predictive models can identify students at risk of dropping out or underperforming, allowing for early intervention strategies, resource Allocation: Schools and districts can use predictive analytics to allocate resources more effectively, such as determining which schools need more funding or which programs are most effective, curriculum Development: Analyzing student performance data can help in building courses that are more customized to student requirements and learning styles, enrollment Prediction: Predicting enrollment trends helps to plan for future staffing, infrastructural, and resource needs, as well as policy. Impact Analysis: Predictive analytics can predict the prospective effects of various policy changes, allowing policymakers to make better decisions.

6. CHALLENGES AND RISKS OF AI IN ECONOMIC POLICY

Data Privacy and Security Concerns

Data breaches and misuse of personal information pose severe risks in AI-driven economic policy. Unauthorised access to sensitive economic data can lead to identity theft, financial fraud and loss of privacy. Such breaches undermine trust in both the technology and the institutions using it. Protecting personal information through strong encryption, secure data storage and strict access controls is essential to prevent these risks. Effective monitoring and response strategies are also crucial to mitigate potential damages and maintain data integrity.

Ethical Considerations and Bias in AI Models

Bias in AI algorithms can lead to unfair policy outcomes by reinforcing existing inequalities. If AI systems are trained on biased data, they may perpetuate these biases, resulting in policies that disadvantage certain groups. Addressing bias through diverse data sets and rigorous testing is essential to ensure equitable and

just policy decisions. The ethical implications of using AI in decision-making processes are significant and multifaceted. AI systems can influence critical areas such as economic policy, but their deployment raises concerns about fairness, accountability and transparency. Ethical issues include the risk of reinforcing existing biases if AI models are trained on biased data, potentially leading to discriminatory outcomes.

Technical and Structure Barriers

Challenges related to technological infrastructure and expertise include the high cost of implementing advanced AI systems and the need for specialised skills. Organisations must invest in both robust infrastructure and skilled personnel to effectively deploy and manage AI, which can be a significant barrier to adoption. The digital divide inequities in access to technology and digital skills can hinder AI adoption in policy-making. Regions or groups with limited access to digital resources may lack the capability to utilise AI effectively, exacerbating existing disparities. This divide can lead to uneven implementation of AI policies,

Governance and Regulation of AI in Economics

Robust frameworks are essential to regulate AI in economic policy effectively. These frameworks should address issues of fairness, transparency and accountability while ensuring data privacy and security. Clear guidelines and oversight mechanisms can help mitigate risks such as bias and misuse, providing a structured approach to integrating AI responsibly. International cooperation and standards for AI governance are crucial for consistent and ethical AI deployment. Collaborative efforts can establish common guidelines, share best practices and address global challenges related to AI, such as bias and security. Unified standards help ensure equitable and responsible use of AI across borders.

Socio-economic Impacts and Inequality

AI has the potential to exacerbate economic inequalities by automating high-skilled jobs while displacing lower-skilled workers. If not managed carefully, this disparity can widen income gaps and deepen existing economic divides, reinforcing inequalities rather than alleviating them. Policy interventions can mitigate AI's negative impacts by promoting equitable access, reskilling programs and safeguards against bias. Implementing these measures helps ensure AI benefits are widely distributed and fair.

7. FUTURE TRENDS AND IMPLICATIONS FOR POLICYMAKERS

Emerging AI Technologies in Economics

Recent advances in AI, particularly in machine learning and data analytics, have significant potential for economic policy. AI can enhance economic modelling and forecasting by analysing vast datasets to detect patterns and predict economic trends with greater accuracy. It can optimise policy decisions, such as adjusting interest rates or fiscal spending, by simulating various scenarios and assessing potential impacts. AI tools can also improve tax collection and fraud detection, streamline government services and enhance regulatory compliance. To achieve equal and transparent policy outcomes, effective implementation must address ethical considerations, data privacy, and potential AI algorithm biases.

Implications for Policymakers

To integrate AI into economic policy, policymakers must build AI literacy, leverage data-driven decision-making and collaborate with AI experts. Key steps include developing ethical guidelines, creating robust regulations, fostering public-private partnerships and investing in AI infrastructure and research. Engaging diverse stakeholders ensures inclusive AI applications, while proactive planning addresses risks and maximises benefits for sustainable economic growth. Effective governance promotes innovation and mitigates risks like bias and data misuse.

Global Cooperation and AI in International Economics

Global standards and cooperation in AI policy are vital to ensure ethical use, prevent misuse and foster trust across borders. Collaborative frameworks can address issues like data privacy, security and AI bias, while harmonising regulations to prevent regulatory arbitrage. International cooperation also promotes innovation, shared learning and equitable distribution of AI's economic and social benefits. The international initiatives and partnerships highlight the importance of global cooperation in AI policy. 1. The Global Partnership on AI (GPAI) formed by countries like Canada, France and Japan, GPAI fosters collaboration on AI research and development, focusing on ethical guidelines, data governance and societal impact. 2. The EU has developed a comprehensive framework for AI that encourages member states to cooperate on research, share best practices and develop shared regulatory standards to ensure AI safety, transparency and trustworthiness.

Ethical AI and Responsible Innovation

Encouraging ethical AI use in economic policy involves setting guidelines prioritising transparency, accountability and fairness. Regular audits and impact assessments are essential to detect biases and prevent inequalities. Developing AI literacy among policymakers and fostering collaboration between AI experts, economists and ethicists helps align AI systems with ethical standards. Public engagement and international cooperation are crucial for shaping policies that prevent a "race to the bottom" in AI regulation.

8. CONCLUSION

AI is transforming economic policy and decision-making by enhancing forecasting accuracy, enabling dynamic policy simulations and supporting real-time decision-making. While the integration of AI presents significant opportunities, it also poses challenges and ethical considerations that must be addressed. Policymakers must navigate these challenges to harness AI's potential while ensuring fairness, transparency and public trust. The future of AI in economic policy holds promise, but its success will depend on the responsible and ethical deployment of these technologies.

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NUTRACEUTICALS IN AYURVEDA-RECENT TRENDS AND APPLICATIONS

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Abstract: Ayurveda, one of the ancient systems of medicine, has long emphasized the importance of diet, herbs, and natural substances in promoting health. In recent years, Ayurvedic formulations have gained significant attention as nutraceuticals — food or food products offering health benefits, including disease prevention and treatment. These nutraceuticals are particularly relevant in managing chronic conditions such as diabetes, cardiovascular diseases, and stress-related disorders. Unlike conventional pharmaceutical drugs, which may cause adverse effects with long-term use, Ayurvedic nutraceuticals offer a safer, natural alternative, attracting increasing interest among consumers seeking holistic solutions.Ayurveda prescribes specific dietary patterns, known as *Pathya*, tailored to both healthy and diseased states. Many Ayurvedic formulations, especially those in *Pathya Kalpana*, possess both nutritional and therapeutic properties, fitting within the nutraceutical category. The concept of *Aajasrika Rasayana* emphasizes daily consumption of certain foods to enhance life quality and protect against internal and external stressors.Several Ayurvedic nutraceuticals have established therapeutic roles, such as *Chyavanprash* (general health and respiratory support), *Brahma Rasayana* (mental well-being), *Phala Ghrita* (reproductive health), *Arjuna Ksheerpaka* (cardioprotection), *Shatavari Ghrita* (women's health), and *Rasona Ksheerpaka* (cardioprotection). These formulations reflect Ayurveda's holistic approach and its alignment with the modern concept of nutraceuticals.This article examines the growing role of Ayurvedic nutraceuticals, focusing on their sources, benefits, and the integration of traditional wisdom with contemporary scientific research to develop safe, effective, and sustainable wellness solutions.

Keywords; Ayurveda, Nutraceuticals, *Rasayana, Pathya,*

1. Introduction

Ayurveda, the ancient system of natural healing, has been practiced for thousands of years, with a deep emphasis on the holistic integration of body, mind, and spirit. Central to Ayurvedic practice is the idea of balancing the body's energies (Doshas) through a combination of dietary changes, herbal therapies, lifestyle practices, and spiritual techniques. In contemporary times, Ayurvedic practices

have gained renewed interest as they are being adapted to the modern context, particularly in the

form of nutraceuticals. These are food-based products that deliver health benefits beyond basic nutrition, often in the form of disease prevention and management. This paper explores the growing role of Ayurvedic nutraceuticals, their applications in modern wellness practices, and their contribution to managing chronic diseases such as diabetes, cardiovascular conditions, and stress.

2. Concept of Nutraceuticals in Ayurveda

In Ayurveda, health is not simply the absence of disease, but the presence of harmony and balance within the body and mind. One of the ways Ayurveda achieves this balance is through dietary patterns and medicinal preparations that are both food and medicine. These Ayurvedic formulations, particularly those categorized as *Pathya* (appropriate foods and drinks), serve not only as nourishment but also as preventive or curative agents.[1]

Nutraceuticals in Ayurveda are natural substances derived from plants, minerals, and animal products that are considered both therapeutic and nutritious. This aligns with the modern understanding of nutraceuticals, which are products derived from food sources that offer health benefits, including prevention and treatment of various ailments. In Ayurveda, the concept of *Rasayana* (rejuvenation therapy) is particularly central to the formulation of nutraceuticals. *Rasayana* emphasizes daily consumption of certain foods or herbs that enhance vitality, boost immunity, and protect against internal and external stressors.

3. Ayurvedic Formulations as Nutraceuticals

Several Ayurvedic formulations have long been recognized for their therapeutic benefits, and many of these fit within the modern concept of nutraceuticals. The following are some examples of well-known Ayurvedic nutraceuticals:

- **Chyavanprash**: A well-known rejuvenating formulation used for general health support and respiratory health. It is composed of a variety of herbs such as Amalaki (Emblica officinalis) and is considered a potent immuno-modulator, promoting vitality and longevity.[2]
- **Brahma Rasayana**: This formulation is renowned for its mental health benefits, including enhancing memory, cognitive function, and stress reduction. It is commonly used in Ayurvedic practices to support mental well-being and emotional balance.[3]
- **Phala Ghrita**: This herbal ghee is specifically indicated for reproductive health and is used to enhance fertility, balance hormones, and support overall reproductive function.[4]
- **Arjuna Ksheerpaka**: Known for its cardioprotective properties, this formulation contains the herb *Terminalia arjuna* and is used to support heart health, improve circulation, and manage hypertension.[5]
- **Shatavari Ghrita**: Used predominantly in women's health, *Shatavari* (Asparagus racemosus) is a powerful herb known for its role in supporting the female reproductive system, enhancing lactation, and promoting hormonal balance[6]
- **Rasona Ksheerpaka**: This formulation, containing *Allium sativum* (garlic), is known for its ability to support cardiovascular health by reducing cholesterol and improving blood circulation.[7]

These formulations showcase the versatility of Ayurvedic nutraceuticals and highlight their ability to address a wide range of health concerns in a holistic manner.

4. Pathya Kalpana and its Role in Nutraceutical Development

The concept of *Pathya* in Ayurveda refers to a prescribed set of foods and lifestyle modifications tailored to the individual's health needs. *Pathya Kalpana*, which refers to the preparation of foods and herbal products for therapeutic purposes, is foundational in the development of Ayurvedic nutraceuticals. These formulations often combine food substances with medicinal herbs to create synergistic effects that support overall health and wellness.

For example, *Chyavanprash* and *Arjuna Ksheerpaka* are both examples of Pathya Kalpana, where specific herbs are combined with ghee or other base ingredients to enhance their bioavailability and therapeutic potential. This unique approach to combining food and medicine is what sets Ayurvedic nutraceuticals apart from conventional pharmaceutical products, offering a more natural and balanced alternative for health promotion.

5. Therapeutic Role and Mechanisms of Ayurvedic Nutraceuticals

Ayurvedic nutraceuticals act on multiple levels of the body's physiology. They support detoxification (detox), improve immune function, balance hormonal levels, reduce inflammation, and protect against oxidative stress. These effects are largely attributed to the presence of bioactive compounds in herbs and other natural substances used in these formulations.

For instance, *Chyavanprash* contains *Amalaki*, which is rich in Vitamin C and antioxidants, providing immunity-boosting effects. Similarly, *Arjuna Ksheerpaka* contains *Terminalia arjuna*, which is known for its ability to strengthen the heart and improve circulation, thus providing cardioprotective benefits.

Moreover, the therapeutic role of these nutraceuticals is backed by modern scientific research. Clinical studies have shown that many Ayurvedic formulations exhibit anti-inflammatory, antioxidant, and adaptogenic properties, making them effective in managing chronic conditions such as diabetes, hypertension, and stress-related disorders.

6. The Intersection of Traditional Knowledge and Modern Science

The integration of traditional Ayurvedic knowledge with contemporary scientific research is essential for developing safe, effective, and sustainable wellness solutions. Modern research on Ayurvedic herbs and formulations has demonstrated their therapeutic potential, validating many of the claims made by ancient Ayurvedic texts.

However, there is a need for more rigorous clinical trials to better understand the mechanisms behind these formulations and their effectiveness in managing specific health conditions. Collaborative efforts between Ayurvedic practitioners and modern scientists will play a key role in advancing the understanding and acceptance of Ayurvedic nutraceuticals in mainstream healthcare.

7. Conclusion

Ayurvedic nutraceuticals represent a promising approach to health and wellness, offering natural alternatives to conventional pharmaceuticals for managing chronic diseases and promoting overall well-being. Nutraceuticals significantly reduce oxidative stress and promote healthy aging in invertebrate models The holistic approach of Ayurveda, which emphasizes the balance of body, mind, and spirit, is reflected in the therapeutic potential of its nutraceutical formulations. By

integrating traditional wisdom with modern scientific research, Ayurvedic nutraceuticals can become a key component in the global movement toward safer, more sustainable healthcare solutions. Further

research and clinical validation are necessary to fully unlock their potential and establish them as mainstream therapeutic agents.

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Panchakarma a Rapid Treatment Protocol in Management of Gridhrasi (Sciatica) a Pilot Study

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ABSTRACT:

Incidence of low back pain is very common in India where about 65% to 80% of people in India reporting low back pain, making it one of the most prevalent complaints. Among many causes of low back pain, the most frequent Intervertebral disc prolapse, Compression, Thical sac compression etc. where pain is referred to leg, buttock or hip which frequently outlines the characteristics of Sciatica syndrome. We can correlate Sciatica with Gridhrasi, one of the most prevalent Vata illnesses, according to Ayurveda. The purpose of this study was to evaluate the effectiveness of Ayurvedic treatment in Gridhrasi in very short time duration.

Materials and Methods: Case study of a small group of 38year to 48 years -old age group who has been visiting an Ayurvedic hospital for Ghridrasi with Symptoms like Lower backache, radiating pain towards legs, stiffness at lower back etc has previously been diagnosed with Vertebral Column Disorders. They had 7 days to 12 days of Panchakarma therapy, which included Abhyanaga, Swedana & Kati Basti, in combination with Shamana Chikitsa .

Results: After completion of Panchakarma therapies, the patient's symptoms were assessed, and the outcomes were good.
Patient got 50 % to 80 % relief within 7 to 12 days only. The patient's general quality of life had also greatly improved.

Conclusion: Panchakarma is a Rapid Treatment Protocol in Management of Gridhrasi which reduces Gridhrasi symptoms significantly within very short time period.

Key words: Panchakarma, Ghridrasi, Sciatica, Abhyanga, Swedana, Kati Basti, Shamana Chikitsa.

INTRODUCTION-

In India, low back pain is among the most prevalent complaints, affecting 65% to 80% of the population. The most typical conditions are intervertebral disc prolapses among the numerous causes of low back pain. L4-L5 and L5S1 discs are most frequently impacted in 95% of lumbar disc herniation, and the pain may be limited to the lower back exclusively or described as affecting the leg, buttock, or hip, which frequently describes the characteristics of Sciatica syndrome[1]. Men are mostly afflicted than women, and it is more prevalent in men between the ages of 40 and 50. Sciatica is a crippling disease caused by sciatic nerve root pathology that makes it difficult to walk and leaves patients with pain and paresthesia in the sciatic nerve distribution. Because of its severity, it occasionally interferes with a person's everyday activities and lowers their quality of life.

Typically, coughing, bending, or twisting makes the discomfort worse. Analgesics, muscle relaxants, painkillers and NSAIDs to reduce inflammation are frequently used in modern treatment.[2] and surgical operations with an eye toward a negative outcome. In Ayurvedic medicine, the illness Sciatica is comparable to Gridhrasi, which is classified as a Nanatmaja Vataja Vikara.[3] The word Gridhrasi generally suggests the patient's stride, which ongoing, and radiating pain. Ruk (pain), Toda (pricking feeling), Chimchimayana (tingling sensation), and Stambha (stiffness) in the Sphik, Kati, Uru, Janu, Jangha, and Pada are the four primary symptoms of Gridhrasi (Vataja Gridhrasi). In Vata- Kaphaja Gridhrasi, one might see Tandra

(drowsiness), Gaurav (heaviness), and Aruchi (anorexia). Ayurvedic management of Gridhrasi (sciatica) involves Bastikarma, Siravyadha and Agnikarma[4,5] In this case study, Shamana Chikitsa, Sarvanga Abhyanga ,Swedana, and Kati Basti have all been recommended.

CASE REPORT –

Case study of a small group of 38year to 48 years -old age group who has been visiting to Panchakarma OPD of Noble Ayurved College and Research Institute, Junagadh, Gujarat with Symptoms like Lower backache, radiating pain towards legs, stiffness at lower back etc. has previously been diagnosed with Vertebral Column Disorders.

 They complaints of pain in the lower lumbar region radiating to the right / left limb from Two to Three years. They also had complaints of stiffness in the lower back region from two years and feeling difficulty while walking and difficulty in standing after long sitting from one to two months. The patients hailed from a Lower middle-income family from Junagadh. They gradually developed pain in low back region. It was managed with symptomatic allopathic treatment. Later they again eventually developed pain in the lower lumbar region and then gradually radiates to the posterior aspect of the thigh, knee, calf region and foot of the right /left leg from two to three years. Gradually they experienced stiffness in the lower back region from two years, feeling of tingling sensation in the right /left leg, heaviness and difficulty while walking and difficulty in standing after long sitting from one to two month. They are admitted to the IPD after careful examination. They had no prior surgical history. The patients are vegetarian. They experienced less of an appetite and had a normal bladder habit.

CLINICAL FINDINGS-   General Examination
Ashtavidha Pariksha

	Patient A 38 yrs/ Male	Patient B 48 yrs/ Feale	Patient C 40 yrs/ Male
▪ BP:	110/80 mmHg	130/90mmhg	120/80 mmHg
▪ PR:	78/min	80/min	76/min
▪ RR:	19/min	20/min	19/min
▪Temperature	98.6°F	98.6°F	98.6°F
▪ Wt:	65 kg	65 kg	70kg
Nadi (pulse)	Vata-Kaphaja	Vata-Kaphaja	Vata-Kaphaja
Mala (bowels)	Samyak	Samyak	Samyak
Mutra (urine)	Samyak	Samyak	Samyak
Jihwa (tongue)	Sama (coated)	Sama (coated)	Sama (coated)

Shabda (speech)	Prakruta	Prakruta	Prakruta
Sparsha (skin)	Anushnashita	Anushnashita	Anushnashita
Druk (eyes)	Prakruta	Prakruta	Prakruta
Akruti (posture)	Madhyama	Madhyama	Madhyama

Details of Locomotor Examination

Locomotor Examination Inspection limping gait, short step.

▪ Discomfort in walking and sitting for a long duration.

▪ Difficulty in standing after long sitting position.

▪ Restriction of Spinal and hip movements.

Palpation

▪ Tenderness at L5 –S1 region(A) , L3-L4 & L4-L5 region(B) , L5-S1 region (C) respectively.

▪ Good Muscle tone

▪ Muscle power grade both at right & left extremities (upper and lower) - 5/5

Range of movement of Lumbar spine (ROM)

▪ Forward flexion of the lumbar spine is limited to 30 cm, 40 cm and 30 cm above ground respectively.

▪ Right lateral flexion is limited to 10° with pain in all patients.

▪ Left lateral flexion is limited to 10° with pain, 10° with pain and 20° with pain respectively.

SLR test (active)

▪ Positive at 30° on the right leg (in A & B) & Positive at 30° on the left leg (in C)

▪ Negative on the left leg (in A & B) & Negative on the right leg (in C)

Bragard's test

▪ Positive at the right leg. (in A & B) & left leg (in C)

▪ Negative on the left leg. (in A & B) & right leg (in C)

Diagnosis: Vata-Kaphaj Gridhrasi

Therapeutic Intervention

The patient was advised of the following treatment.

1. Sarvanga Abhyanga with Panchaguna Taila

2. Sarvanga Bhashpa Sweda with dashmool Kwath [10] for 30 mins for 7 days.

3. Kati Basti with Sahacharadi Taila & Bala Ashwaghanda Taila for 30 mins for 7 days.

4. Shamana therapy

   ▪ Mahayogaraj Guggul 500 mg 1-0-1
   ▪ Kaishor guggulu 500 mg 1 – 0- 1
   ▪ Shankh vati 1-0-1
   ▪ Rasnasaptak Kashaya 20 ml-0-20 ml with 20 ml warm water
   ▪ Pathyapathya (diet & lifestyle regimens) Follow up on the 7th and 10th day.

OBSERVATION AND RESULTS

The patient had a considerable decrease in lumbar

discomfort, lower back stiffness, tingling, and heaviness after 7 days of therapy. Their spine's range of motion had significantly increased, making it easier for them to go about their everyday business. They also had a better gait. The vital statistics were in order. The patients had total symptom alleviation. After the therapy was finished, no radiological investigation was done. The subjective and objective criteria, including the Oswestry Disability Index, were evaluated.[6] before and after treatment. The table below shows the chronology of clinical findings (assessment criteria).

Subjective Parameters

Sr N.	Assesment Parameters	Patient A 38 yrs/ Male		Patient B 48 yrs / Female		Patient C 40 yrs / Male	
		B. T.	A.T.	B. T.	A.T.	B. T.	A.T.
1	Pain in lower lumbar region radiating to right/left lower limb	4+	0	4 +	0	4+	0
2	Stiffness in lower back region	3+ 0	0	4+	1+	3+	0
3	Tingling sensation in right/left leg	3+	0	4+	0	4+	1+
4	Pain and difficulty while walking	3+	1 +	4+	1+	4+	1+
5	Heaviness in right leg	4+	1+	1+	0	3+	0
6	Apetite	2+	0	3+	0	2+	0

Objective Parameters-

Sr N.		Patient A		Patient B		Patient C	
1	ROM of Lumbar Spine	B. T.	A.T.	B. T.	A.T.	B. T.	A.T.
	1. Forward Flexion	30 cm above ground	15 cm above ground	40 cm above ground	20 cm above ground	30 cm above ground	10 cm above ground
	2. Rt. Lateral flexion	10º With pain	30º Without pain	10º With pain	20º Without pain	10º With pain	30º Without pain
	3. Lt. lateral flexion	10º With pain	40º Without pain	10º With pain	40º Without pain	20º With pain	40º Without pain
	4. Extension	20º With pain	30º Without pain	10º With pain	30º Without pain	20º With pain	30º Without pain
2	SLR test						
	1.Right leg	Positive At 30º	Negative	Positive At 30º	Negative	Negative	Negative
	2.Left leg	Negative	Negative	Negative	Negative	Positive At 30º	Negative
3	Bragard's test						
	1.Rt. leg	Positive at 25º	Negative	Positive at 25º	Negative	Negative	Negative
	2. Lt leg	Negative	Negative	Negative	Negative	Positive at 25º	Negative
4	Gait	Limping gait	No limping gait	Limping gait	No limping gait	Limping gait	No limping gait

DISCUSSION –

Gridhrasi (sciatica) is usually treated using Bastikarma,

139

Siravyedha, and Agnikarma in an Ayurvedic manner. The

Sarvanga Abhyanga Swedana, Kati Basti, and Shamana Chikitsa protocols have been suggested in this situation. Sarvanga Abhyanga with Panchaguna Taila has been praised as Vata Shamaka by Siddha Yoga Sangraha. Also, according to Charaka, Vayu dominates Sparshanendriya, and Abhyanga is extremely beneficial for Vata Vyadhi as per Charka.[7] According to Dalhana, Sneha reaches to Majja Dhatu, when

Abhyanga is done for 900 Matra. In Gridhrasi, Asthi Majja Vaha Strotas Asthi get disturbed, Sneha strengthens Strotas and pacify increased Vata Dosha at the site of affliction.Panchguna has inhibitory action on prostaglandin biosynthesis; latest research proved pain anti-inflammatory and analgesic properties mediated via PG synthesis inhibition. It acts as COX-2 inhibitors that might be responsible for its NSAID'S like activity. The active principle in Panchguna Taila provides synergistic action in relieving the symptoms. Its anti-inflammatory effect reduces pain, tenderness and swelling. Sarvanga Nadi Svedana with Dashmool Kwatha - Svedana is Vata Hara, cures stiffness, heaviness and is best treatment considered to relieve pain. Svedana with Dashmool Kwath[8] which is Ushna Virya, Guru and Snigdha helped in relieving symptoms of Vata like pain and stiffness in the patient. It is an unparalleled treatment for painful conditions mainly caused Snigdha Swedanas like Kati Basti is typically utilized to treat low back pain and lumbosacral diseases [9]. It improves local circulation, nourishes and bolsters muscles and nerves, and helps calm tenseness and spasms. And bring back adaptability. The intervertebral disc has degenerated in this instance, and the lubricating function of Shleshaka Kapha is compromised. This causes compression, irritation, or inflammation of the Gridhrasi Nadi (sciatica nerve), which results in excruciating agony. Because they function at the Samprapti location, the native Snehana and Swedana are particularly effective and yield immediate effects. Snigdha Guna, Ushna Virya, and Vata

Kaphahara are present in Sahacharadi Taila, but generally it is Tridoshaghna and particularly efficient in Adha Kaya Vatarogas. Due to its Madhura and Tikta Rasa, it has the unique quality of Gati Viseshatvam (aids in movement). Its Vatahara, Bruhana, and Pachana qualities, as well as its analgesic and anti inflammatory effects[10] can help alleviate inflammatory changes in the nerve and possibly to reduce symptoms of nerve root compression. The use of the Kati Basti with Sahacharadi Taila at L4-L5 region is more effective in controlling Kapha dominance Gridhrasi symptoms such as Stambha (stiffness), Gaurava (heaviness) and Tandra (tingling sensation) and also on walking distance and the magnitude of Pain. Bala Ashwagandha Taila deals with Vata Dosha helps in strengthening the related muscles and characteristics demonstrate how effective Yoga is at removing Margavarana.

The main components are Triphala, Gudoochi, and Guggulu. The effects of Guggulu, which include Anabhishyandhi, Snigdha, and Sroto Shuhdhikaraka, make it a unique substance. Guduchi is the medication of preference in Vatarakta since it is the greatest one that can be used in this situation. It is a wonderful Rasayana and serves as Vyadhipratyneeka. The effects of Rookshana and Kapha Medo Hara in Triphala are widely documented. The other components of Yoga all function in the same way.[11]

CONCLUSION –Mahayograj Guggulu has Vata Kapha Shamana, Shothahara (anti-inflammatory) and Agni Deepana properties . These medicines were suitable for subdue remaining vitiated Dosha. Considering all of the above, the overall effect of all planned treatments on this patient this patient induces Vedanasthapana Vata Shamaka (analgesic), Shothahara (anti-inflammatory) and Dhatuposhaka properties (strengthening and nutritive therapy) can help providing a significant improvement in the symptoms of Gridhrasi and also the functional ability which in turn improves the range of motion at the Spine. Rasnasaptak Kashaya is used to treat Vata related conditions such facial palsy, paralysis, disc prolapse, sciatica, low back pain, and low back pain. All of the medications in Rasnasaptak

Kashayam have Vata Kapha Shamaka, Vedanasthapana Shulahara, Shothahara, and Nadiuttejaka (Nerve Stimulant) properties in addition to strengthening and nutritional therapy for different musculature and structure in the lumber region and extremities, which is very effective in the treatment of Sciatica.[12]

Kaishora Guggulu derived from Bhaishajya Ratnavali is mentioned in Vatarakta Chikitsa. Drug combinations A primary cause of morbidity that renders a person unable of doing daily tasks is sciatica. This case study demonstrated the superior management of Gridhrasi by Panchakarma and Shamana Chikitsa. The patient's ability to convey the characteristics has increased, and there have been considerable changes in the patient's quality of life, according to subjective and objective metrics. As of right now, the patient is doing well with his regular routines. The results could be assessed in more patients diagnosed with Gridhrasi in greater sample size. Hence this study showcase that Panchakarma is a Rapid Treatment Protocol in Management of Gridhrasi which reduces Gridhrasi symptoms significantly within very short time period.

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MANAGEMENT OF MUKHPAK WITH SPECIAL REFERENCE TO STOMATITIS

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ABSTRACT

Mukhapaka is a commonest disease of mukha found in India as well as all over the World. In this condition mukha is affected by paka process which is always associated with pitta dosha. Due to ulceration irritation, pain, burning sensation is experienced when patient take food. Sometimes liquid intake also becomes troublesome as cold or hot sensation gives lot of pain burning sensation etc. It may also occur because of chewing of chemical agents like Tobacco-Gutakha, Insomnia, Vitamin deficiency, much life threatening disease like Malignancy, Submucosal fibrosis, Skin disease and disturbances in G.I. tract like Constipation. In modern medicine, several mouth paints and mouth gargles are used for the treatment of Aphthous ulcer adjuvant to steroids, B'Complex group of drugs and various other treatments like injection placentrex (sub mucosal) which have their own limitations. Therefore, an attempt was made to collect all medicinal drugs which are mentioned in Ayurveda Classics for treatment of this disease.

KEYWORDS: Mukhapaka, Oral hygine, Stomatitis

INTRODUCTION

Oral hygiene plays an important role in every individual.

But due to so many vitiating factors like tobacco chewing, smoking, stress, vitamin deficiency, allergic and trauma leading to the vatadi dosha and produce 67 Mukha Rogas. Nearly 20% of the population is suffering with this problem. The estimated point prevalence of oral ulcers worldwide is 4%, with aphthous ulcers being most common, affecting as many as 25% of the population worldwide.

Among the Mukharogas "Mukhapaka" comes under Sarvasara Mukharogas. It is considered as

Pittaja Nanatmaja and Rakta Pradoshaja Vikara characterized by Vedana Yukta Vrana in the Mukha Kuhara. Mukhapaka is Pittaja Nanatmaja and Rakta Pradoshaja Vikara it once again does the Pitta Prakoapa along with Rakta.

LITERATURE REVIEW

The symptoms of Mukhapaka can be correlated with stomatitis. It is an inflammation of the mouth and lips. It affects the mucous membranes of the mouth and lips, with or without ulceration. In widest meaning, stomatitis can have a multitude of different causes. The commonest causes which include infections,

nutritional deficiencies, allergic reactions, radiotherapy etc. Food is the factor which sustains & supports the dhatu oja & bala i.e. strength or capacity to perform physical work.

Food is a basic requirement of the body.

Food in any form either liquid or solid is very essential for growth of body anar maintenance of health. Restriction of food by any reason can create a serious condition. The disease Mukhapaka can occur if it is neglected or not treated properly. Mukhapaka is a common disease of the oral cavity. It affects patient's daily routine. It is found more in pitta pradhan dosh, pitta pradhan prakruti & pittaj kala. It is more found in India because people are more prone to have pitta prakopak ahar like spicy oily food, tobacco chewing, smoking, alcohol consumption etc. and also pitta prakopak vihar like late night sleeping, improper timing finals et fue to the pass proces, leadeped a various cause which create Mukhpaka like rapidly increasing problems!. Hence directly increasing poverty proportionally this has brought illiteracy, ill health with it. Because of malnutrition anemia stomatitis can occur. Bad hygiene is one of the major reasons which are very common in poor & uneducated class. Also alcohol consumption, tobacco; gutka chewing is very common in them. All the above mentioned causes tree stomais which is very common in our country. (6)

In modern medicine there is no specific treatment for stomatitis. Combinations of antibacterial & anti-inflammatory are generally used in form of paste, gel or solution for gargles, which gives symptomatic relief by cooling soothing effect!" In Ayurveda, the treatment modalities include Panchakarma, external therapies, internal medications, Activities, Advice of food and life style changes. Panchakarma: Virechana Activities: Specific Asana, Pranayamas, meditation Food:

Improving on the intake of water preferably warm water and food which helps digestion. Avoid spicy, dry, deep fried and heavy foods that are difficult to digest.

AIM AND OBJECTIVES

Aim
• To evaluate the role of Ayurveda in management of Mukhpaka.

Objective
• To study the concept Mukhpaka

To study the chikitsa of Mukhpaka as per Ayurveda. To study the concept of stomatitis

MATERIALS AND METHODS
Ayurvedic textual materials were referred mainly Charaka samhita, Sushruta samhita, Astanga hridaya and available commentaries of these samhitas for the study.

MUKHAPAKA
Mukhapakaa is one of the mukharoga and occurs in all over the oral cavity Acharya Kashyapa; Charak has described it as Mukhapakaa, while Acharya Sushruta and Acharya Vaghbhata have described it as Sarvasara.

Sarvasara means the disease which have capacity to spread all over the buccal mucosa.

Causes of Mukhpaka(8) Causes of Mukhapakaa can be differentiated as:

Dosha dushtikar hetu

Sthan vaigunyakar hetu

Dosha dushtikar hetu

It includes aharaj hetu which causes aggrevation of Pitta Doshas in Amashaya and causes

Mukhapakaa. Hetus like Mansahar, dugdhahar, Ikshuvikruti causes vitiation of doshas in Amashaya and there by causing Mukhapakaa. These food factors causing piita kaph dosha vitiation and rakta dhatu dushti are given below,

Underlying factors from food

Name	Aggrevated Doshas	Dhatu Dushti
Flesh of Buffalo	Kapha	
Fish	Kapha, Pitta	Rakta
Pork	Kapha	-
Amak	Kapha, Pitta	-
Moolak (Riped)	Tridoshakrit	-
Black Grams Raddish	Kapha	
Milk (Buffalo)		
Curd	Kapha, Pita	Meda
Sookta	Kapha, Pitta	Tridoshakrit, Rakta
Juice of Sugarcane	Kapha	
Fanita	Tridoshakrit	Shukra

Sthan vaigunyakar Hetu (9)

It mainly consists of viharaj hetu, these causes aggrevation of doshas in Mukha. In case of sleeping in prone position collection of prakupit doshas in oral cavity leads to Mukhroga.

Same like that in kawal and gandush atiyoga (Milk regurgitation and excessive frothing) irritates oral mucosa and further may lead to Mukhapaka. If vaman and Raktamokshana are not done in proper ritu, Then it causes accumulation of doshas in mukha, which are to be thrown out of the body regularly by the cleaning process of vaman and Raktamokshana, otherwise that causes Mukhapaka.

STOMATITIS

Stomatitis is an inflammation of the mucosa of the oral cavity. It is an inflammation of the lining of the mouth.

Causes

Stomatitis can be caused by local and systemic cause. Such inflammation of the mouth may be caused by: Injury, Mechanical, Chemical, Thermal, Radiotherapy, Idiopathic, Malnutrition etc.

Types of Stomatitis

(A) Traumatic Stomatitis

Traumatic stomatitis is commonly caused by Vigrous used of hard tooth brush, Ill-fitting dentures, Jagged teeth Simple cut or burn of the mouth, Thermal and radiation injury.

Clinical Features

The lesion is painful. The mucosa is ulcerated and hyperaemic. The tongue is quoted with fur. Simple cut or burn of the mouth usually heals by itself. Traumatic stomatitis is soon covered by the thin grey glistening coagulum. As the mouth is painful, movements are obviously restricted, salivation is increased.

(B) Infective Stomatitis

1. Viral Stomatitis: It is caused by herpes simplex or herpes zoster virus. It is characterized by small, multiple, painful vesicles on the lips, buccal mucosa and palate.

2. Bacterial Stomatitis: Vincent's Angina: Vincent's Angina is also called as ulcerative stomatitis and also Acute ulcerative gingivitis. Causative Organism: Borrelia Vencenti and B. fusiformis are responsible to cause this lesion. Both these organisms may be found in normal mouths, but are particularly found in large numbers in association with this disease.

Clinical Features

1. Early adult individuals are more often involved. It is rarely seen after the age of 12 years.
2. Acute condition starts with prodromal symptoms e.g. malaise, pyrexia and increased salivation.
3. After about a couple of days of such prodromal symptoms patients complain of dull toothache and gum bleedings.
4. Fungal Stomatitis: It is the prototype of oral infection caused by yeast like fungus. It is the superficial infection of upper layer of oral mucous membrane and results in formation of patchy white plaque or flecks on mucosal surface.
   Such type of stomatitis is seen in People suffering from debilitating disease., As a complication of prolonged antibiotic therapy, which changes the balance of bacterial flora in the alimentary canal. and In Diabetic patients. This condition mostly occurs due to fungus known as candida albicans.

(C) Aphthous Stomatitis

Aphthous stomatitis is also called as Recurrent ulcerative stomatitis. couldon disease characterized by development of painful, recurrent, solitary or multiple uncerations of the oral mucosa.

(D) Angular Stomatitis

Cracks or superficial ulceration at the corners of the mouth is known as angular stomatitis. Angular stomatitis is also called as Cheilosis or Preleche.

(E) Stomatitis With Malnutrition

Various types of stomatitis often remain associated with malnutrition. The mucosa of the tongue may undergo atrophy. Similarly thinning of the oral mucosa makes the mouth most susceptible to trauma, hot drinks and spices.

Chikitsa of mukhpaka

Nidan Parivarjan

Nidan parivarjan chikitsa is of prime importance to arrest further progress of disease.

General treatment of Mukharoga

Chakradatta mentioned that in Mukhapaka we can use Darvirasakriya with honey for local use for healing of ulcers. In every type of Mukhpaka we can use kwath of Triphala, Patha, Mridvika and leaves of Jati with Honey for Mukhdhavan.

1. Kawal Gandush-In both these upkramas medicine are held in oral cavity, the only difference in these two types is the amount of drug held in the mouth. In Gandush the mouth is filled with medicine so that it can not be moved (i.e. amount is more), where as in kawal the amount of medicine is less so that it can be moved in the oral cavity.
2. Raktamokshan: Raktamokshan means drainage of vitiated blood outside the body. Local Raktamokshan is one of the ashuphaldayee chikitsta in mukhrogas. It directly acts on dushita rakta dhatu. Removal of dushita rakta pacifies all the symtoms of mukharoga and give instant relief.
3. Nasya: Nasya is important treatment in urdhvajatrugat (above neck region) vikara and Mukhapaka is one of them.

SYSTEMIC TREATMENT

1. Virechan - Virechan is chief treatment for Pitta Dosha and it also causes Raktadhatu prasadan. It normalises the path of Vata dosha which further leads to correct constipation, hence breaking the pathogenesis of Mukharoga.
2. Shirovirechan - Shirovirechan is the procedure for elimination of vitiated doshas chieflyaccumulated over neck region (urdhvajatru). As it is the nearest route to eliminate those doshas therefore advisible in mukhroga.

PATHYA

PATHYAPATHYA

पथ्य	अपथ्य
स्वेदन,विरेचन, वमन, कवल, गण्डूष, प्रतिसारण, धूम, नस्य	दन्तधावन
यव,मुद्ग,कुलत्थ,जाङ्गल मांसरस	मत्स्य, आनूप मांसरस , दधि, गुड, क्षीर, माष, रूक्षान्न
कारवेलक, पटोल, बालमूलक	गुरु, अभिषयन्दि भोजन
कर्पूरनीर, ताम्बूल, घृत, तिक्त & कटु रस	अधोमुखेन शयन, दिवास्वप्न

In all oral diseases following dravyas are recommended in ahar Old rice, Wheat, Bean, Horsegram, Bittergour, Serpantgourd, Radish, Camphour water, Tambul, Khadir-ghruta things etc. having Katu and Tikta rasa, As we go through the gunas of this dravyas all are tikta rasatmak and sheet veerya therefore usefull in Kaph Pittaj vyadhi.

APATHYA

In all oral diseases following things are contraindicated curd, milk and its derivatives, guda, sweets, black gram, As we ve arough the gu via above dadas in are

samprapti of Mukhapaka. Non-oily things are heavy to digest and abhishyandi edible by infant's mother should be avoided. So other hetus which causes Mukhapakaa should be avoided.

DISCUSSION

Mukhapakaa is a chronic disease which is occurs in all parts of the oral cavity like, osta, jihwa, taalu, kapola, gala characterized by ruja, daha, raktavarnata etc.

There are 3 types of Mukhapakaa according to acharya Sushruta which is Vataja, Pittaja and Kaphaja.

Commonly pittaja Mukhapakaa is more seen in daily practice. Also Mukhapakaa is one of the pittaja nanatmaja vyadhi. So, due to the vitiation of pitta vrana and paka were produced. Also Mukhapakaa is a one of the Rakta pradoshaja vyadhi. So, Rakta is also play a vital role in its pathogenesis.

In treatment of Mukhapakaa Bahya and Abhyantara treatment was mentioned.

In this study, efforts were made to use Ayurvedic drug which is cost effective & alternative treatment for modern line of treatment of Mukhapakaa.

Stomatitis has become very common problem in the present era. It is very important to have effective, economic & without any side effect, medicine on it.

Mukhpak is one of the commonest oral diseases in India.

Mukhapaka is found in all age groups.

Mukhpaka is found more in pitta prakriti persons.

CONCLUSION

These natural products are effective medications can be used for the treatment of Oral diseases like stomatitis.

These remedies are being practiced in ancient times and are cost effective and easily available. Natural disinfectants which are mentioned above are also effective and act as antimicrobial agents, if these medications are given in proper dose than they have tremendous result.

Nidana explained in Ayurvedic classics seems to be initiating or precipitating Samprapti of Mukhapakaa is not mentioned directly, but the Samprapti mentioned for Mukha Rogas is considered. As various known, unknown, exogenous, or endogenous etiological factors are involved in the pathological process.

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A SEGMENTED DROOP CONTROL STRATEGY FOR ENHANCED LOAD SHARING IN DC MICROGRID

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Abstract: DC microgrids are essential for sustainable and efficient energy systems, particularly in remote areas. In DC microgrids, power converters are connected in parallel to meet the load demands. When power converters are connected in parallel, the load sharing between them becomes crucial. If load sharing is not maintained equally, one converter will operate in an overloaded state while another will function in an underloaded condition. To overcome the problem of unequal load sharing, the droop control method is implemented. However, the conventional droop control has a trade-off between load sharing and voltage regulation. This paper introduces a segmented droop control strategy designed to improve load sharing in DC microgrids by dynamically adjusting droop resistance based on the output current of Power converters. The segmented approach involves defining specific resistance values for predetermined current ranges, which not only optimizes load distribution but also significantly reduces circulating current. Additionally, the impact of line resistance on system performance is analyzed, highlighting its influence on voltage drop and load sharing. The primary advantages of this strategy include the absence of communication requirements between converters, thereby streamlining system design, lowering implementation costs, and ensuring a transient-free response during load transitions. The effectiveness of the proposed control strategy is demonstrated through MATLAB simulations. The results indicate that this method enhances the accuracy of load sharing in DC microgrid with reduced circulating current, making it a viable solution for modern power distribution challenges.

Keywords: Segmented Droop Control, Load Sharing, Line Resistance, Circulating Current, Power Converters

1. INTRODUCTION:

Electrical energy is essential to our everyday lives in modern civilization. The origins of electrical energy can be categorised into conventional and non-conventional energy sources. The traditional energy sources are limited according to the report released in [1]. The global landscape is shifting towards alternative and renewable energy sources. These renewable sources represent sustainable energy derived from natural processes, which do not generate environmental problems or impact human well-being [2]. These sources provide significant advantages for rural and remote areas. The renewable sources are integrated to establish a microgrid that meets the load requirements in isolated regions [3]. Microgrids can be categorized into three categories: AC microgrids, DC microgrids, and Hybrid microgrids. DC microgrids offer several advantages over their AC counterparts. The reliability and efficiency of DC microgrids are noteworthy. They exhibit no synchronization issues, reduced power loss, and are unaffected by skin effects [4].

The load demands in the DC microgrid are met through the parallel operation of various DC-DC converters. These DC-DC converters must distribute the load uniformly to enhance the overall system reliability [5]. However, because of line resistance, the distribution of load between converters is not consistent [6]. The voltage at the output terminals of the converters also varies. As a result, a circulating current will initiate flow from the first power converter to the next. Consequently, one converter will operate under conditions of overload while the other will function under conditions of underload. Consequently, it is crucial to distribute the load evenly among the power converters [7].

2. LITERATURE REVIEW:

The droop control strategy is typically employed in microgrids to address the issue of unequal load sharing [8]. The droop control strategy incorporates droop resistance within the feedback system, facilitating equal load distribution among power converters. The droop resistance functions as a virtual resistance, remaining unaffected by temperature fluctuations or other variations within the system [9]. Droop resistance is characterized by its lack of power consumption and absence of power loss. By utilizing the exact droop constant, it is possible to attain equal load sharing. The traditional approach to droop control utilizes a constant droop value to ensure effective load sharing stability. However, because of the dropping characteristic, an increase in droop resistances resulted in a decrease in the voltage at the load terminal. The elevated value of droop resistance improves load sharing; however, it concurrently compromises voltage regulation. Thus, utilizing a traditional droop control technique leads to an intrinsic compromise between load distribution and voltage regulation [10], [11].

In the literature, there are numerous load sharing strategies available. Load sharing strategies can be classified into two primary categories: active load sharing strategies and passive load sharing strategies [12]. Active load sharing encompasses master-slave control, distributed control, 3C control, and current averaging techniques [13], [14], [15]. Active load sharing strategies efficiently minimises load sharing discrepancies and improve voltage regulation. However, these control strategies necessitate communication between converters. This increases the complexity and cost of the system. They also involve issues associated with single-point failure, time delay data latency, and communication failure [16], [17]. Passive load sharing strategies effectively address the challenges associated with active load sharing. Passive load sharing strategies eliminate the need for high bandwidth communication links between converters for intercommunication. They operate without issues such as time delay and data latency. Passive load sharing strategies enhance system simplicity, flexibility, and reliability. The passive load sharing strategies can include virtual droop control, nonlinear droop control, piecewise droop control, adaptive droop control, and automatic droop control, among others [6], [18], [19].

The method proposed in [20] enhances traditional droop control by implementing an online adaptive strategy that dynamically selects droop coefficients. The objective is to minimize bus voltage fluctuations and improve the accuracy of current distribution in droop-controlled DC microgrids. The suggested approach modifies the droop control resistance in response to fluctuations in voltage and current. This approach requires further measurements and communication between the inter-source converters. In[21], the piece-wise band droop control algorithm shows its ability to manage abrupt fluctuations in load and unexpected alterations in source power, thus guaranteeing the stable functioning of DC microgrids. Nonlinear droop and Piecewise linear control methods are utilized in [22], incorporating adjustable droop resistance that depends on the converter output current. This results in enhanced load distribution and better voltage stability. The nonlinear droop characteristic modifies the output impedance of the converter, requiring thorough stability evaluations under varying load scenarios. In [23], research introduces an innovative piece-wise droop control strategy that utilises the swift response features of super-capacitors while integrating traditional droop-controlled DC microgrids. In [24], the study presents a piece-wise droop controller featuring three distinct regions for a solar PV-powered DC fast EV charging station, which is integrated with energy storage units (ESUs) and electric vehicle (EV) loads. The configuration includes three rapid charging units and assesses functionality under variable source and load scenarios. The research has introduced an adaptive droop

control strategy for DC microgrids aimed at enhancing power sharing accuracy and voltage restoration. The methodology employs error current sharing to modify droop resistance and integrates observer-based optimum sliding mode control (OOSMC) alongside twin-delayed deep deterministic policy gradient (TD3) for accurate voltage regulation. This approach requires a secondary controller, resulting in increased system complexity, potential data loss, time delays, and higher controller costs. It necessitates extensive computations [25].

The various droop control methods discussed earlier face numerous challenges, including secondary control issues, complexity, time delays, extensive computation and transients that occur during load changes. Consequently, it is essential to develop a novel control strategy to address these limitations effectively.

- **CHALLENGES IN LOAD DISTRIBUTION, VOLTAGE STABILITY, AND CIRCULATING CURRENT IN DC MICROGRID:**

This section demonstrates the functionality of two power converters connected in parallel, as depicted in the fig. 1. The inputs of the parallel power converters are *Vinx* and *Viny*. The MOSFET is utilised as a switching device, denoted as *Sx* and *Sy*. *Rlx* and *Rly* represent the resistances of the lines connecting the converter to the bus terminals. The bus voltage at the load terminal is referred to as *Vbus*. *Iox* and *Ioy* represent the output currents for converters X and Y, respectively. I_L represents the load current. *Ic* represents the circulating current, while R_L denotes the load resistance.
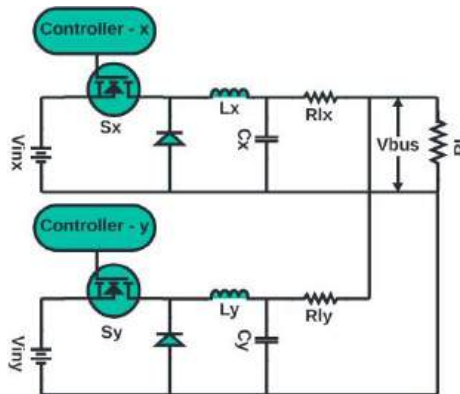

Fig. 1: Schematic representation of converters connected in parallel, distributing the same load.

Fig. 2 illustrates converters connected in parallel, accompanied by their equivalent circuit diagrams and associated line resistances. Due to the disparity in line resistances, both converters experience different voltage drops across the line resistance. As a result, one converter supplies a greater current while the other supplies less current to the load [26]. As a result of the voltage variation at the converter terminal, a circulating current *Ic* will initiate from converter-X to converter-Y.
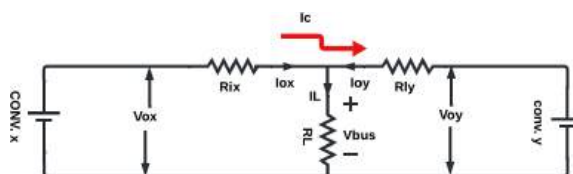

Fig. 2: Equivalent circuit with parallelconnected converters exhibiting different line resistance and cir

By employing Kirchhoff's law as depicted in Fig. 2 [27]

$$V_{ox} - I_{ox}\, R_{lx} - I_L\, R_L = 0 \tag{1}$$

$$V_{oy} - I_{oy}\, R_{ly} - I_L\, R_L = 0 \tag{2}$$

By analyzing equations (1) and (2), we can derive the formulae for the output currents Iox and Ioy.

$$I_{ox} = \frac{V_{ox}\,(R_{ly} + R_L) - V_{oy}\,R_L}{R_{lx}\,R_{ly} + R_L\,R_{lx} + R_L\,R_{ly}} \tag{3}$$

$$I_{oy} = \frac{V_{oy}\,(R_{wx} + R_L) - V_{ox}\,R_L}{R_{lx}\,R_{ly} + R_L\,R_{lx} + R_L\,R_{ly}} \tag{4}$$

Furthermore, the circulating current can be represented as:

$$I_{cxy} = -I_{cyx} \qquad \genfrac{}{}{0pt}{}{=\frac{V_{ox} - V_{oy}}{=I_{oy}\,R_{wy}}}{} = \frac{I_{ox}\,R_{wx}}{R_{lx} + R_{ly}} \tag{5}$$

According to equation (5), it is clear that the existence of differing line resistance results in the generation of circulating current between converter-X and converter-Y. Consequently, converters need to supply both load current and circulating current.

$$
\begin{array}{lll}
ox & R_{lx}\,R_{ly} + R_L\,R_{lx} + R_L\,R_{ly} & R_{lx} + R_{ly} \\[2em]
oy & R_{lx}\,R_{ly} + R_L\,R_{lx} + R_L\,R_{ly} & R_{lx} + R_{ly}
\end{array}
$$

From the analysis of (5), (6), and (7), it is evident that the phenomenon of circulating current gains prominence when several converters are configured in parallel. The introduction of droop resistance in the system addresses the aforementioned issue. As previously mentioned, this represents a virtual resistance with a value determined by the controllers. The droop resistance and the line resistance are both treated as being in series [28]. Both factors contribute to the decrease in voltage at the bus terminal. As the droop resistance is increased, the voltage at the bus terminal experiences greater deviation. As the droop resistance decreases, the load sharing deteriorates while voltage regulation improves. Consequently, as indicated in the literature, conventional droop control presents a consistent trade-off between voltage regulation and load sharing. Fig. 3 illustrates the equivalent circuit diagram of parallel-connected converters, including line resistance and droop resistance.
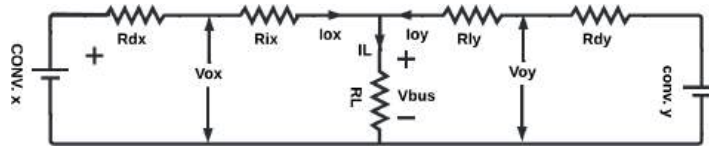
Fig. 3: integration of droop resistance within the system and its corresponding equivalent circuit.

3. GOALS / PURPOSE :

The proposed segmented droop control achieves the following objectives:

The proposed control strategy incorporates a variable droop resistance that guarantees
1. Improved load sharing among converters with no transients occurring during load transitions.
2. Improved voltage stability at the bus terminals while maintaining the critical voltage drop.
3. Minimises the circulating current, thereby enhancing the reliability of the system.

4. RESEARCH METHODOLOGY:

The suggested segmented droop control approach entails the dynamic adjustment of droop resistance in response to fluctuations in the power converter's output current. The segmented approach entails establishing precise resistance values for designated current ranges, which improves load distribution and enhances voltage regulation while significantly reducing circulating current.

Defining the approach necessitates establishing the boundaries of droop resistance, as an elevated droop resistance can result in inadequate voltage regulation under light load conditions, while a diminished droop resistance may cause suboptimal load sharing during higher load scenarios. The segmented droop control strategy dynamically adjusts the droop resistance to provide minimal resistance under light load conditions, thereby ensuring optimal voltage regulation. It provides optimal droop resistance under heavy load conditions to facilitate effective load sharing.

The permissible voltage variation for the distribution line is 10%. The DC system exhibits line resistance as a result of variations in bus voltage, which is the primary factor contributing to unequal load sharing. The incorporation of droop resistance in the DC system results in an additional voltage drop, consistent with the line resistance. Consequently, it is essential to determine the permissible voltage drop within the specified system. Considering a DC system where the permissible voltage variation is ±10%. A 5% voltage drop should be maintained internally to account for the voltage reduction attributable to line resistance, as this parameter is fixed and cannot be altered or overlooked. Subsequently, a voltage drop of 1% should be maintained within acceptable limits. The subsequent step involves calculating the permissible voltage drop resulting from droop resistance using the provided equation.

In a DC supply system, the permissible voltage drop is set at 10%. This includes a 5% voltage drop attributed to line resistance and a 1% marginal drop, resulting in the total allowable voltage drop due to droop resistance.

10% allowable voltage drop in DC distribution system – 5% voltage droop in cable resistance – 1% marginal drop = allowable voltage drop due to droop resistance.(10)

The subsequent equations are optimised for implementing the segmented droop control strategy:

$$R_{di} = z + n*x; \text{ for } 0 \leq Ioi < 3 \qquad (11)$$

$$R_{di} = Rdmax; \text{ for } Ioi > 3 \qquad (12)$$

In this context, *Rdi* represents the segmented droop resistance associated with the ith converter. *z* represents the necessary minimum droop resistance, while n denotes the segmented step constant, which ranges from 0 to *n* in integer values. This control strategy implements six distinct segmented droop values tailored for various current ranges. In the case where n equals zero, the droop value will correspond to the minimum droop value as defined by equation 8. The range of current varies depending on the specific droop constants applied. When the converter current reaches 3 amperes, the droop constant will be set, as any further increase in the droop constant will result in an additional voltage drop at the bus terminal. The voltage regulation achieved will exceed 4%, failing to meet the criteria outlined in equation 10.

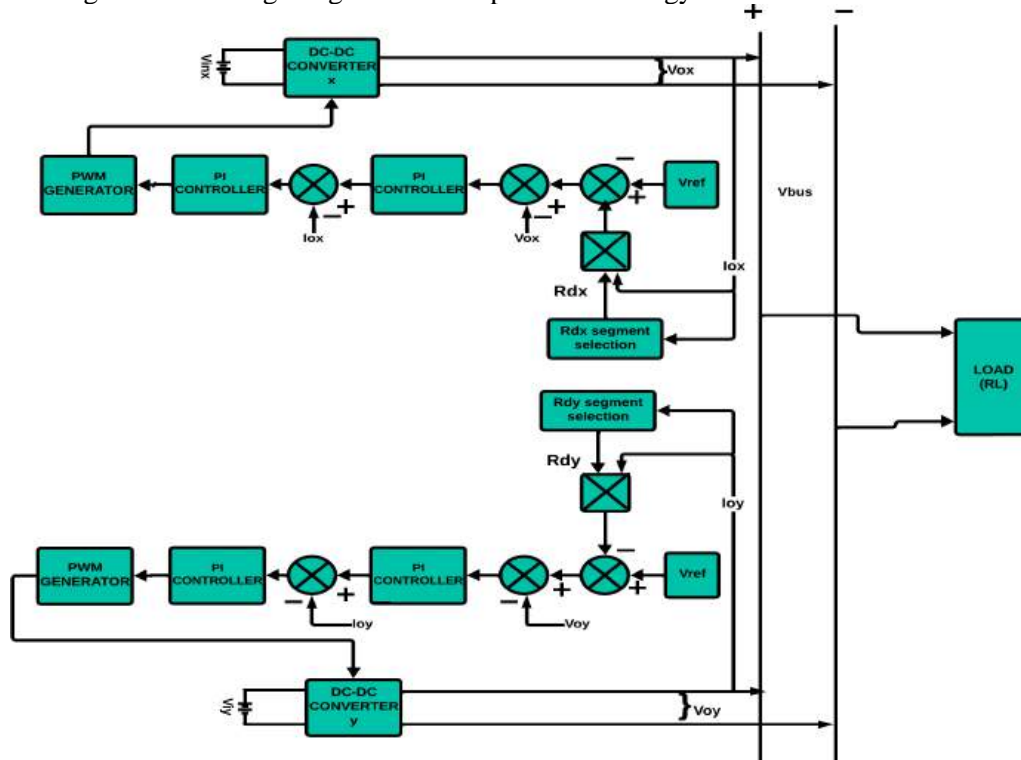Fig. 4: Block diagram illustrating a segmented droop control strategy

Fig. 4 presents the block diagram depicting a segmented droop control strategy applied for two power converters. The main advantage of this control scheme is its capacity to dynamically modify the droop constant based exclusively on the output current from one power converter. The system's design exemplifies its inherent simplicity. This control strategy avoids reliance on extensive bandwidth communication links that could be susceptible to single-point failures, increased complexity, time delays, data latency, and issues with data reliability.

5. RESULTS AND DISCUSSIONS:

This section provides inherent results from a segmented droop control. To prove the effectiveness of the proposed control strategy, the lower fixed droop, higher fixed droop control and a segmented droop control strategies are taken as case studies. Here, the two DC-DC power converters with parallel operation and sharing the same load are simulated in MATLAB Simulink. the simulation results are categorized into three different cases. Case-1: lower fixed droop control strategy. Case-2: higher fixed droop control strategy. Case-3: a segmented droop control strategy. The power converters are rated as per table 1. The line resistances are taken as 0.1 Ω and 0.2 Ω

Table 1: Rating of power converters

| Parameters	Value	Parameters	Value
Power - Pox, Poy	96 W	L	750 mH
Voltage – Vox, Voy	48 V	C	2220 μF
Current – Iox, Ioy	2 A	Nominal switching Frequency	10 KHz

Case-1: Lower fixed droop control strategy:

The fixed droop control strategy maintains a consistent droop value regardless of load conditions. Simulation results for reduced fixed droop values are shown in Fig. 5. This section presents simulation results to help understand how droop values affect DC microgrids. Droop resistance is calculated using equation 8 in fixed droop control. The voltage reference for PWM is started by multiplying each converter's output current by this value.

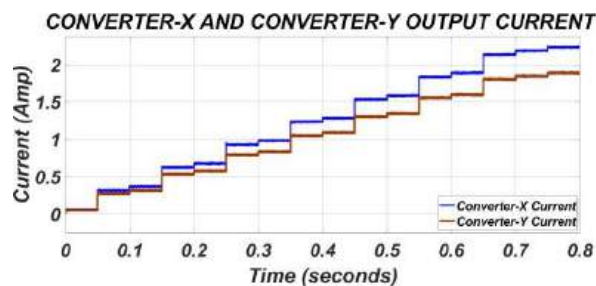Table 2. Lower fixed droop control: parameters recorded under full load conditions

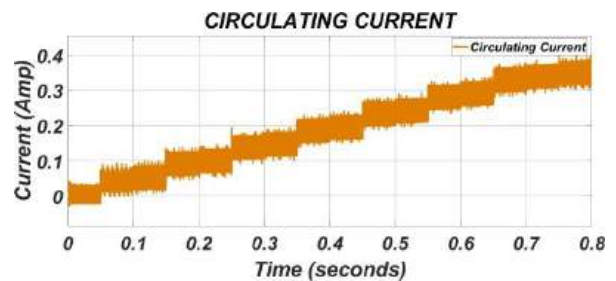| Bus voltage	Conv. X voltage	Conv. Y voltage	Load current	Conv. X current	Conv. Y current	Droop resistance	Circulating current	Voltage regulation	Load sharing error
46.8 V	47.03 V	47.18 V	4.12 A	2.24 A	1.88 A	0.4	0.37 A	2.02 %	8.73 %
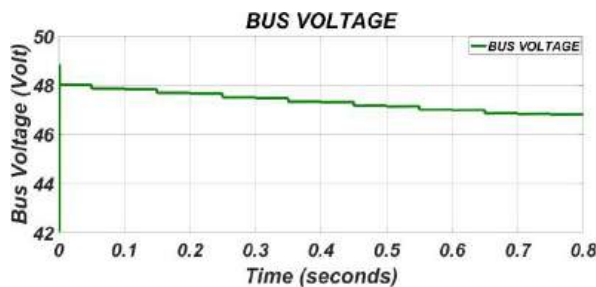
(a)
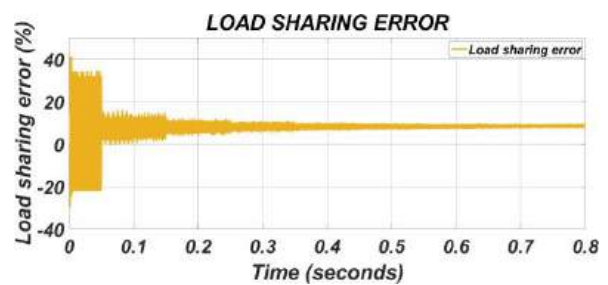
(c)

(b)

(d)

Fig. 5: Bus voltage (a), output current of Converter X and Y (b), load sharing error (c), circulating current (d) for lower fixed droop control

155

The simulation results and Table 2 data are self-explanatory. The analysis shows that a lower fixed droop reduces bus voltage drop during full load but increases current imbalance between the converters. It also shows that load increases current difference, which increases circulating current. High load sharing error of 8.73% under full load. Lower droop control improves voltage regulation but reduces load sharing, causing large circulating currents between converters. In light load conditions, where load sharing is less important, the lower fixed droop control maintains better voltage regulation.

Case-2: Higher fixed droop control strategy:

Simulation results for higher fixed droop values are shown in Fig. 6. In fixed droop control, equation 13 determines the droop resistance, and each converter's output current is multiplied by this value to set the PWM voltage reference. Table 3 data and simulation results are self-explanatory. The analysis shows that a higher fixed droop increases bus voltage drop under full load while reducing converter current difference. The current difference and circulating current decrease as the droop increases compared to the lower droop control strategy. The load sharing error drops to 3.98% at full load. Increased droop control reduces circulating current between converters but improves load sharing, resulting in suboptimal voltage regulation. In heavy load conditions, optimal load sharing is crucial, so higher fixed droop control is beneficial.

Table 3. Higher droop control: parameters assessed under full load conditions

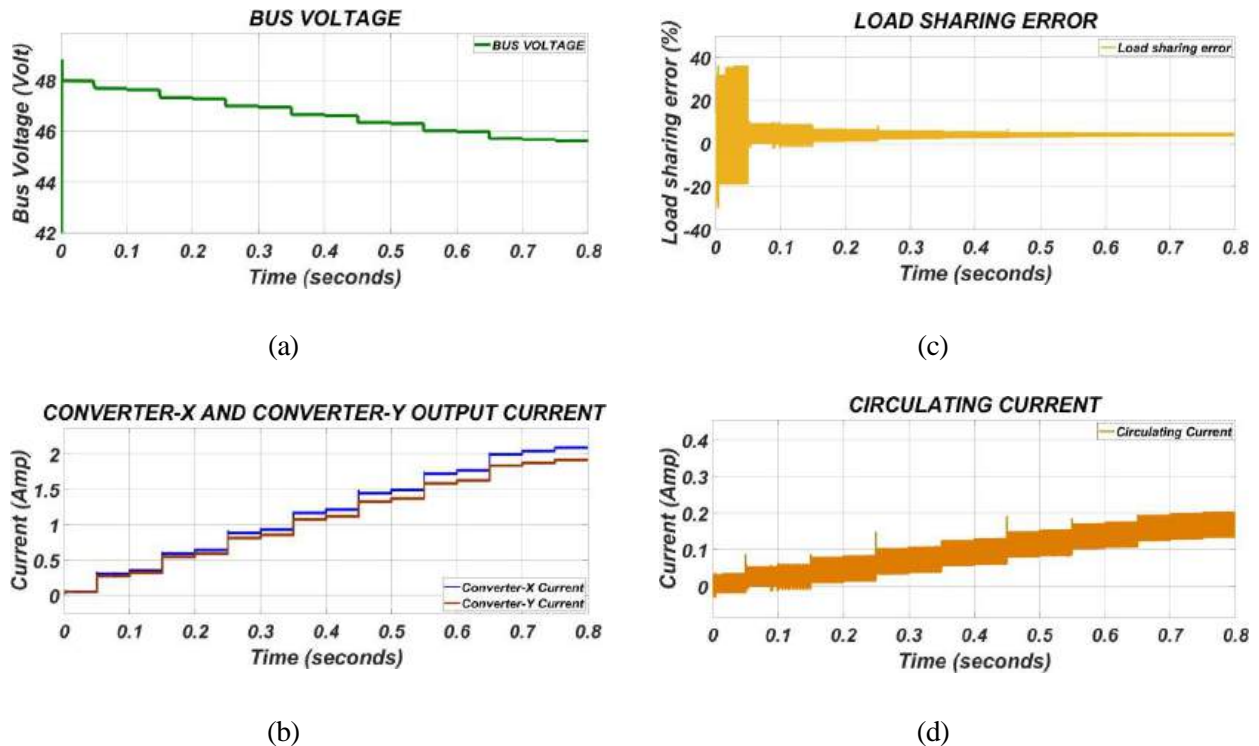| Bus voltage	Conv. X voltage	Conv. Y voltage	Load current	Conv. X current	Conv. Y current	Droop resistance	Circulating current	Voltage regulation	Load sharing error
45.62 V	45.84 V	46.02 V	4 A	2.09 A	1.93 A	1.0	0.18 A	4.5 %	3.98 %

(a)

(c)

(b)

(d)

Fig. 6: Bus voltage (a), output current of Converter X and Y (b), load sharing error (c), circulating current (d) for higher fixed droop control

Case-3: Suggested segmented droop control methodology:

The segmented droop control strategy simulation results are shown in Figure 7. Segmented droop control improves load sharing in DC microgrids by dynamically adjusting droop resistance based on power converter output current. Setting specific resistance values for defined current ranges optimises load distribution and reduces circulating current in the segmented approach. Calculate segmented droop resistance using equations 11 and 12. The PWM voltage reference is calculated by multiplying each converter's output current. The proposed segmented droop control strategy results are below. Table 4 data and simulation results are straightforward. The proposed control method efficiently balances voltage regulation and system load distribution. This control strategy provides excellent voltage regulation under light load conditions, especially when load sharing is not important. It ensures effective load distribution during peak loads when load current rises and load sharing discrepancy must be reduced. Note that the droop constant determines the current sharing nonlinearity within a load current range.

Table 4. Segmented droop control: parameters measured under full load conditions

Bus voltage	Conv. X voltage	Conv. Y voltage	Load current	Conv. X current	Conv. Y current	Droop resistance	Circulating current	Voltage regulation	Load sharing error
46.09 V	46.3 V	46.49 V	4.06 A	2.06 A	2 A	Segmented	0.06 A	3.5 %	1.4 %

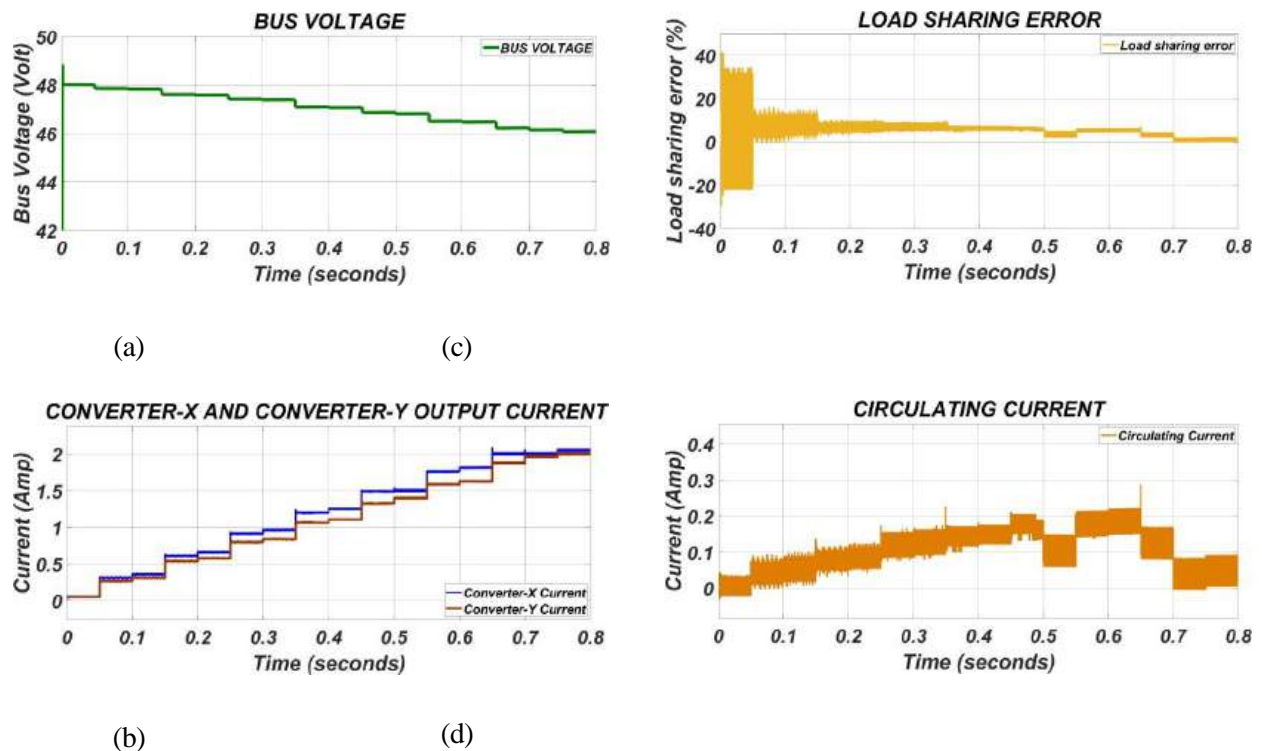(a)   (c)

(b)   (d)

Fig. 7: Bus voltage (a), output current of Converter X and Y (b), load sharing error (c), and circulating current (d) for enhanced fixed droop control

The graphs in Fig. 8 present a comparative analysis of various control methods for load sharing

including bus voltage, load sharing error, voltage regulation, and circulating current across different load currents. The findings offer a detailed analysis of the performance and operational efficiency of each control method.

The lower fixed droop control method demonstrated satisfactory performance regarding voltage regulation. The load current varied between 0.11 A and 4.06 A. Figure. Sections 8(b) and (c) indicate a greater load sharing error and elevated circulating current, potentially resulting in increased power losses and diminished efficiency.

The higher fixed droop control method exhibited the most pronounced limitations among the three methods concerning voltage regulation, as illustrated in figure 8(a). The consistency of voltage regulation was suboptimal, exhibiting significant variations in bus voltage across different load scenarios. Figure. 8(b) and (c) illustrate the reduced load sharing error, indicating effective current distribution.
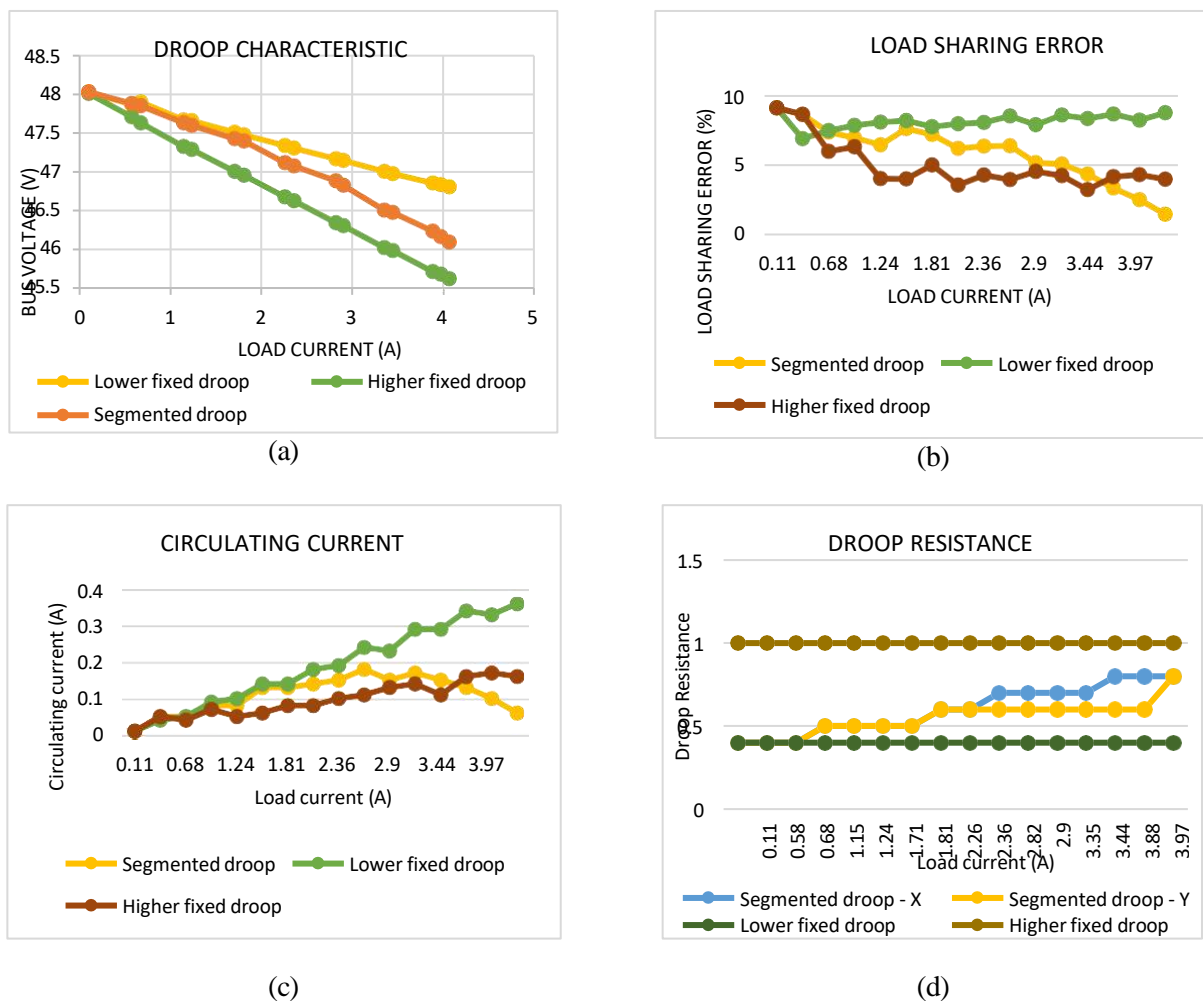

(a)

(b)

(c)

(d)

Fig. 8: Droop characteristic (a), load sharing error (b), circulating current (c) droop resistance (d) for different control strategies

The segmented droop control method exhibited outstanding performance in sustaining stable bus voltage under light load conditions (fig. 8 (a)). The bus voltage stayed well-aligned, demonstrating efficient voltage regulation. The output current of both converters is effectively balanced, exhibiting minimal load sharing error. This approach successfully reduced circulating current, indicating optimal load distribution and lower power losses.

Fig. 8(d) illustrates the droop resistance curve for the three methods under consideration. Fixed droop resistance methods maintain a constant value across all load conditions, showing no variation. In a segmented droop control strategy, the droop resistance is adjusted dynamically based on variations in the output current of the converters.

6. CONCLUSION

This research paper highlights the effectiveness of the segmented droop control strategy in enhancing load sharing and voltage regulation in DC microgrids. The segmented approach, which dynamically adjusts droop resistance based on the output current of power converters, outperforms both lower and higher fixed droop control methods. The segmented droop control method offers superior performance by optimizing load distribution and significantly reducing circulating current, thereby minimizing power losses, and improving overall system efficiency. segmented droop control strategy achieves the best balance by providing excellent voltage regulation at light loads and superior load sharing at full loads, with minimal circulating current. The proposed segmented droop control strategy not only addresses the trade-offs inherent in traditional droop control methods but also simplifies the system design by eliminating the need for large bandwidth communication links. The results provided by the proposed methods are also free from transient during the transition of loads. This makes it a viable solution for modern power distribution challenges, particularly in remote areas where maintaining system reliability and efficiency is crucial**.**

7. FUTURE SCOPE

Future research should focus on further optimizing the segmented droop control strategy in such a way as to remove the nonlinearity in the results and explore its application in more complex and larger-scale DC microgrids.

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Innovative Glaucoma Diagnosis Using Cropped Optic Regions with Deep Learning Models

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Abstract:

Glaucoma is a devastating eye condition that can lead to permanent vision loss if left untreated. It occurs when the optic nerve is damaged, often due to elevated eye pressure caused by a buildup of fluid in the eye. This condition is notoriously difficult to detect in its early stages, earning it the nickname "silent thief of vision." As a result, regular eye exams are crucial for catching glaucoma before it's too late. Traditionally, diagnosing glaucoma has required specialized equipment and expertise, making it a time- consuming and expensive process. However, our team has developed an innovative automated system using advanced deep learning techniques to detect glaucoma more efficiently and accurately. Our system uses a dataset of 634 color fundus images, carefully reviewed by expert ophthalmologists. We tested several state-of-the-art deep learning models, including Efficient Net, Mobile Net, Dense Net, and Google Net, to see which one performed best in detecting glaucoma. The EfficientNet-b3 model stood out, achieving an impressive test accuracy of 96.52% on cropped optic cup and disc images. Additionally, we used a U-Net model to segment retinal blood vessels from fundus images, and the Mobile Net v3 model demonstrated reliable performance on this dataset. Our results show that automated deep learning models can be highly effective in detecting glaucoma, particularly when combined with segmented blood vessel analysis. This approach has the potential to make glaucoma screening more accessible and affordable, reducing the need for specialized resources and enabling broader access to diagnostic tools.

Keywords *– Deep learning, glaucoma detection, cropped optic regions, retinal fundus imaging, Efficient Net, Mobile Net, image segmentation, artificial intelligence.*

INTRODUCTION:

Glaucoma is a serious eye condition and one of the primary causes of irreversible blindness globally. It is a form of optic neuropathy that gradually leads to vision loss by damaging the retinal ganglion cells. The disease is associated with structural changes in the retina, especially in the optic nerve head. Open-angle glaucoma, the most common type, develops gradually as blockages in the drainage system increase eye pressure, ultimately damaging the optic nerve. Angle-closure glaucoma, on the other hand, occurs when the drainage pathways suddenly close, resulting in a rapid and dangerous rise in eye pressure. According to the World Health Organization, glaucoma ranks as the second leading cause of blindness and vision impairment worldwide. Although glaucoma can affect individuals of any age, it is more prevalent in older adults and is a major cause of blindness in those over 60. In the United States alone, about three million people live with glaucoma, including 2.7 million aged 40 and above. One of the challenges with glaucoma is its silent progression—many forms of the disease lack early warning signs. Vision loss often goes unnoticed until the condition has advanced, earning glaucoma the nickname "the silent thief of sight. "Globally, glaucoma affected an estimated

80 million people in 2020, and this number is projected to surpass 111 million by 2040. While no cure exists, early detection and treatment can significantly slow the progression of vision loss. To address the varied nature of eye characteristics, several diagnostic techniques are available. Traditional methods for detecting glaucoma involve six key assessments: tonometry, ophthalmoscopy, visual field testing, gonioscopy, nerve fiber analysis, and pachymetry. Tonometry measures intraocular pressure (IOP), which typically ranges from 12 to 22 mmHg. Elevated IOP increases the likelihood of glaucoma, though the disease can still develop in individuals with normal or even low-pressure levels. Ophthalmoscopy examines the optic nerve's structure and color for signs of damage. If intraocular pressure is abnormal or the optic nerve appears damaged, further tests are conducted to confirm the diagnosis.
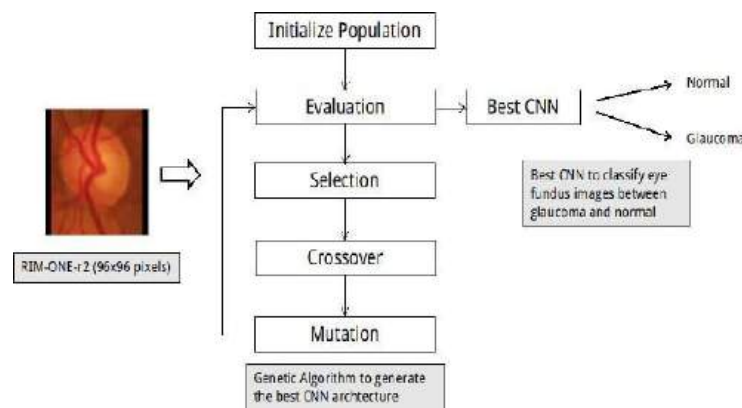

Fig.1.1: Example figure

LITERATURE REVIEW:

Prevalence of primary open angle glaucoma in the last 20 years: A meta- analysis and systematic review:

Regular physical activity is a powerful tool for maintaining our overall well-being. Exercise improves our heart health, reduces the risk of chronic diseases, and even helps control risk factors like high blood pressure and cholesterol. Both aerobic exercises, like walking or cycling, and strength training exercises can bring about positive changes in our bodies. These changes improve our vascular and metabolic health, which can help prevent diseases.

Primary Open-Angle Glaucoma (POAG) is a serious eye condition that can cause vision loss. Over the past two decades, the prevalence of POAG has increased significantly. Research has shown that POAG affects approximately 2.4% of the global population, with men being more likely to develop the condition than women. Africa has the highest reported prevalence of POAG, at 4.0%. Currently, it's estimated that around 68.56 million people worldwide are affected by POAG. As POAG continues to affect millions of people globally, it's essential to raise awareness about this condition and promote preventive measures. By understanding the risks and taking proactive steps, we can work towards reducing the impact of POAG on individuals and communities worldwide.

Epidemiology of glaucoma: The past, present, and predictions for the future:

Epidemiological Trends in Glaucoma: Glaucoma is a multifactorial optic neuropathy, often resulting in permanent vision loss due to retinal ganglion cell degeneration. Its etiology involves a combination of vascular, genetic, anatomical, and immune-related factors. Current data indicate that glaucoma ranks as the second leading cause of blindness after cataracts. In 2020, an estimated 76 million people globally were affected, with projections suggesting this number will rise to 111.8 million by 2040. A detailed

review of glaucoma's epidemiology underscores its significant burden on public health, particularly among high-risk groups, including the elderly, individuals with a family history of glaucoma, and those with specific comorbidities. The review also explores the economic implications of managing glaucoma and the importance of addressing disparities in access to care.

Glaucoma clinical research: Trends in treatment strategies and drug development:

Advances in Glaucoma Treatment Research: A comprehensive review of clinical trial registries has revealed significant advancements in glaucoma treatment strategies. Among the identified trials, medical therapies accounted for the majority, focusing primarily on intraocular pressure (IOP)-lowering agents, while fewer studies explored neuroprotective and vascular-targeted treatments. Notably, the development of novel compounds, including nutritional supplements and growth factors, represents a promising frontier in glaucoma management. However, transition success rates between clinical trial phases remain modest, emphasizing the need for more refined patient phenotyping and personalized approaches to therapy

Beyond wearables and implantable: A scoping review of insertable medical devices:

The purpose of this paper is to define insertable, a novel category of in-body medical devices that are situated within the superficial layers of the skin. It will offer an overview of their technical characteristics and limitations, while also discussing current applications and possible future use cases. To gain an understanding of insertable and their therapeutic applications, an informal scoping study was conducted. Various information sources were used, including peer- reviewed scientific articles, market research reports, and the Derwent Innovation intellectual property database. An examination of currently available insertable as well as those in development was carried out. Results: Insertable should have the following characteristics: I non- invasiveness; ii) simplicity of application, placement, and removal; iii) multi-functionality; iv) a flexible in- body life-span; and v) patient friendliness. Nineteen insertable were identified, serving various purposes such as heart monitoring, continuous glucose monitoring, and medication administration .A dozen insertable are set to be released soon, with uses that include analyte detection, electroencephalogram monitoring, and assessing intraocular pressure .Insertable merge the advantages of implantable devices and wearable medical technology into one innovative product. They deliver clinically valuable and reliable physiological data and treatment options while minimizing pain and risk for patients

Clinical characteristics and current treatment of glaucoma:
Glaucoma is a neurological condition that can lead to significant vision loss due to the degeneration of retinal ganglion cells (RGC). The term "glaucoma" encompasses a range of diseases that are characterized by fluctuating intraocular pressure (IOP), which contributes to RGC loss through mechanical stress, vascular issues, and other factors, including immune responses. Glaucoma is diagnosed in a clinical setting by examining the anterior segment of the eye with slit lamp biomicroscope. This method allows the physician to identify signs of conditions that could lead to elevated intraocular pressure (IOP). Glaucoma is diagnosed in a clinical setting by examining the anterior segment of the eye with slit lamp biomicroscope. This method allows the physician to identify signs of conditions that could lead to elevated intraocular pressure (IOP). After measuring intraocular pressure (IOP), a gonioscope, which is a specialized prismatic lens, is utilized to determine whether the angle is open or closed. Structural signs of retinal ganglion cell (RGC) loss include optic nerve head atrophy and excavation of the neuroretina rim tissue. When possible, treatment aims to tackle secondary causes of increased intraocular pressure (IOP), including eye inflammation, infection, and ischemia.

Following that, a range of medical, laser, and surgical methods are employed to reach the desired IOP.

METHODOLOGY

Glaucoma is a progressive and irreversible neurological disorder caused by the buildup of aqueous humor and the obstruction of drainage pathways between the iris and cornea. This results in increased intraocular pressure (IOP), which damages the optic nerve head responsible for transmitting visual information to the brain. The ensuing damage leads to gradual visual field loss and, eventually, blindness. Often termed the "silent thief of vision," glaucoma is challenging to diagnose in its early stages, making regular and thorough screening essential for timely detection.

Traditional glaucoma diagnostic methods are resource-intensive, requiring the expertise of experienced ophthalmologists and specialized, costly equipment. Moreover, these methods are prone to human error and are inaccessible to many individuals in low-resource settings. Consequently, developing efficient, automated diagnostic tools that reduce dependence on specialized resources is crucial to improving the early detection and management of glaucoma.

Challenges in Glaucoma Detection:

1. Traditional glaucoma detection is resource-intensive and time-consuming.
2. The condition's asymptomatic progression in its early stages makes early diagnosis challenging, earning it the moniker "silent thief of vision."

To address these challenges, this study developed an automated glaucoma classification system using deep learning algorithms. A proprietary dataset comprising 634 retinal fundus images was compiled, including expert annotations from two ophthalmologists—a pediatric specialist and a glaucoma surgeon—from the Bangladesh Eye Hospital. Advanced deep learning models, including Efficient Net, mobile Net, Dense Net, and Google Net, were trained and tested on these images to identify glaucoma with high accuracy.

Advantages of the Proposed Approach:

1. The EfficientNet-b3 model demonstrated superior performance, achieving the highest test accuracy, F1-score, and ROC AUC metrics compared to other models.

2. The results suggest that segmenting blood vessels in fundus images can enhance the automated identification of glaucoma, making it a promising approach for scalable and cost- effective diagnosis.
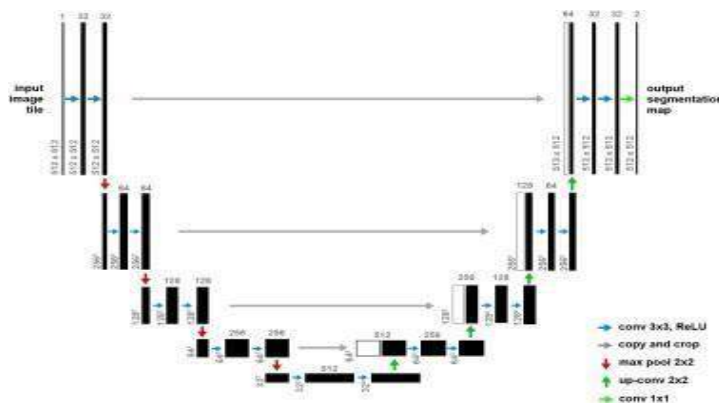
Fig.3.1: System architecture

MODULES:

Data Exploration: This module is responsible for loading the data into the system for further processing.

Processing: This module reads and processes the data, preparing it for the next stages.

Data Splitting (Train and Test): This module divides the data into training and testing sets to facilitate model evaluation.

Model Generation: In this module, we create the model using architectures like Dense Net, Inception ResNetV2, CNN, Mobile Net, EfficientNetB3, and Google Net. We also calculate the accuracy of the algorithm.

User Signup and Login: This module allows users to register and log in to the system.

User Input: This module accepts input from the user for predictions.

Prediction: Finally, this module outputs the predicted result based on the provided input.

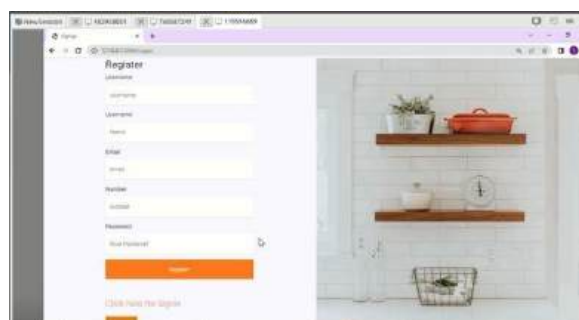**RESULT / FINDINGS:**

Fig.4.1: Home screen
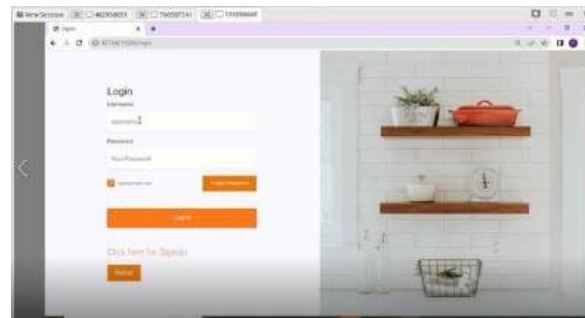

Fig.4.2: User signup

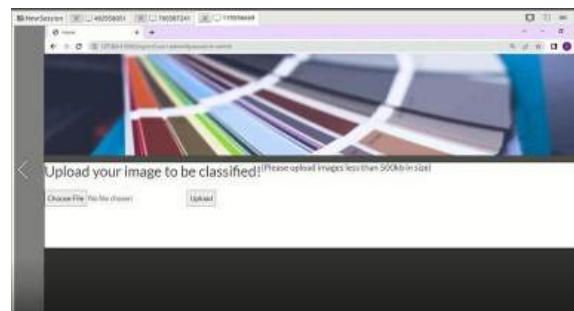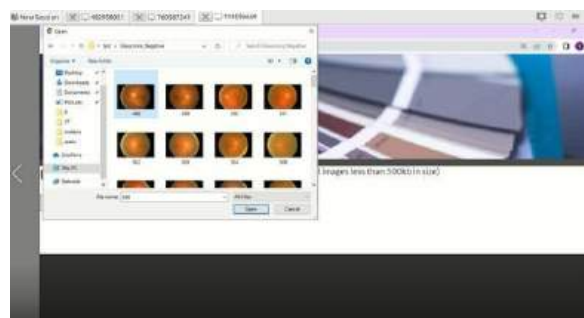Fig.4.3: User signin

Fig.4.4: Main screen

Fig.4.5: User input

Fig.4.6: Prediction result

DISCUSSION/ ANALYSIS:

The **Innovative Glaucoma Diagnosis Using Cropped Optic Regions with Deep Learning Models** is a modern method that uses artificial intelligence (AI) to detect glaucoma. It focuses on analyzing the optic nerve area in eye images to identify signs of the disease.

Key Highlights:

Deep Learning: AI models are trained to automatically detect glaucoma, making diagnosis faster and more accurate.

Cropped Optic Regions: Only the important part of the image, the optic nerve, is used to improve the focus and reliability of the detection.

Challenges: Issues like low-quality images and differences in eye structure can affect accuracy.

Impact: This method can help in early detection of glaucoma, preventing vision loss through timely treatment.

It offers a smart, technology-driven way to improve eye care and save sight.

CONCLUSION / SUMMARY:

This study underscores the potential of deep learning in automating glaucoma detection, offering a practical solution to overcome limitations in traditional diagnostic methods. The integration of advanced architectures like EfficientNet-b3 and image segmentation techniques has demonstrated promising results. The findings pave the way for more accessible, affordable, and scalable diagnostic tools, enabling early intervention and reducing the global burden of glaucoma. Future work will focus on incorporating larger datasets and exploring the detection of other ophthalmological conditions using similar methodologies.

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Design and Implementation of a Web Application for Cardiovascular Disease Prediction Using Machine Learning Algorithms

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ABSTRACT:

Heart disease poses a significant threat to public health due to its widespread occurrence and high mortality rates. Early detection of cardiac conditions using simple physical indicators from routine medical check-ups has become progressively difficult. From a clinical perspective, recognizing the early warning signs of heart disease is vital, as it plays a key role in ensuring accurate predictions and enabling timely steps for future diagnoses. Analyzing and predicting large volumes of data manually is both time-consuming and complex. This study introduces a novel heart disease prediction model designed to accurately and efficiently predict heart disease using various physical indicators. Predicting heart disease remains a significant challenge in the healthcare sector. To address this, researchers employ several algorithms, including LDA, RF, GBC, DT, SVM, and KNN, combined with sequential feature selection techniques. K-fold cross-validation is utilized to validate the results. Datasets such as Cleveland, Hungary, Switzerland, Long Beach, and Heart Statlog are leveraged to evaluate the performance of these models.

Keywords: Cardiovascular disease, heart disease data set, mixed machine learning techniques; numerical features; categorical features SVM, DT, RF, MLP, SMO, GBC, LDA, KNN, XGB, and VC are utilized.

1. INTRODUCTION

Diagnosing diseases is a crucial aspect of healthcare, focused on identifying conditions that contribute to illness, dysfunction, or death. As per WHO guidelines, regular health checkups and access to quality medical services are fundamental rights for everyone. Heart disease, responsible for 31% of global deaths, remains a significant public health concern. Early detection is particularly challenging in low-income regions due to inadequate diagnostic facilities, shortage of skilled professionals, and limited healthcare resources. Common risk factors such as diabetes, hypertension, and high cholesterol, along with complications like irregular heart rhythms and breathing difficulties, further complicate the detection and management of cardiac diseases.

The diagnostic process is complex, requiring medical expertise and extensive evaluation, often leading to delays and errors that can have severe consequences. Machine Learning (ML) offers innovative solutions to enhance diagnostic accuracy. ML Methods such as decision trees, support vector machines, and neural etworks enable effective disease classification and prediction. These techniques leverage large datasets to identify patterns, providing valuable insights for medical professionals.
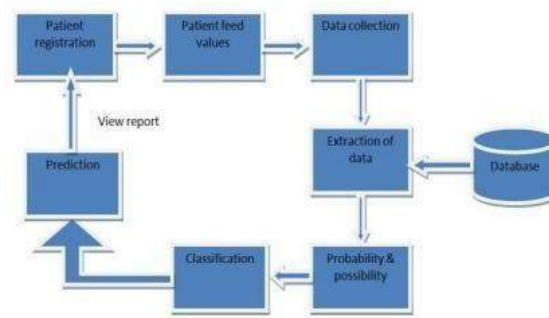
Fig.1.1: Example figure

AI-powered systems, particularly rule-based models, have become increasingly relevant in healthcare. These systems, with minimal human intervention, can process vast amounts of data, delivering precise and timely results. For instance, ML algorithms can analyze patient histories, lab results, and imaging data to predict cardiovascular risks with high accuracy. Recent developments in AI have led to the creation of intelligent decision-support systems, aiding in early detection and treatment planning.

The integration of AI and ML in medical diagnostics has revolutionized healthcare by improving early detection rates, reducing costs, and enhancing patient outcomes. With continued advancements, these technologies hold the potential to address global healthcare challenges, particularly in resource-limited settings, ensuring timely interventions and reducing mortality rates associated with heart disease.

2. LITERATURE REVIEW

Towards Achieving Universal Health Care in India by 2020: A Call for Action

To ensure sustained economic growth and uphold the fundamental right of every citizen to quality healthcare, the health of India's population must be prioritized in public policy. This vision includes the establishment of an Integrated National Health System by introducing universal health insurance, creating autonomous bodies to ensure accountable,

The plan highlights the importance of implementing evidence-based healthcare practices and building a well-trained healthcare workforce. It advocates for restructuring health governance to enhance coordination and decentralization, alongside introducing legislation to ensure healthcare access for every citizen. A key focus of this approach is reinforcing the public health system to function as the main provider of preventive, promotive, and curative care. The strategy also aims to improve the quality of services and minimize out-of-pocket costs by effectively incorporating the private sector within a regulated national framework. Reaching this objective necessitates collaboration and consensus-building among government bodies, civil society, and private stakeholders. The focus should be on developing practical strategies and tracking their implementation to make universal healthcare in India a reality by 2020.

Shifts in the Causes of Mortality in Systemic Sclerosis, 1972–2002:

Background: The prognosis for scleroderma has significantly improved due to advancements in the management of renal crises.

Objective: This study aims to examine the changes in survival rates and causes of death related to systemic sclerosis (SSc) over a 25-year period, based on data from a single medical center.

Methods: The study analyzed consecutive patients treated at the University of Pittsburgh from January 1, 1972, to December 31, 1996. Survival rates were compared across five-year intervals from 1972 to 1997. Causes of death were classified as either scleroderma-related (renal crisis, pulmonary arterial hypertension, pulmonary fibrosis (PF), gastrointestinal (GI) complications, heart failure, or multiorgan failure) or non-scleroderma-related (cancer, cardiovascular or cerebrovascular disease, infection, sudden death, other causes, and unknown).

Results: The 10-year survival rate improved steadily from 54% to 66% across the study periods. A significant increase in survival was noted between 1982–1991 compared to 1972–1981 ($p<0.001$), even when excluding cases involving renal crises ($p<0.005$). Deaths due to renal crises decreased dramatically over 30 years, from 42% to 6% of scleroderma-related deaths ($p<0.001$). In contrast, deaths from PF increased significantly, rising from 6% to 33% ($p<0.001$). Pulmonary hypertension unrelated to PF also became a more common cause of death ($p<0.05$). There were no significant changes in deaths due to gastrointestinal and heart complications of scleroderma, nor in non-scleroderma-related causes of mortality. However, in the last 15 years of the study, fewer patients with SSc died from scleroderma-specific complications.

Conclusion: Over the three decades, the primary causes of scleroderma-related deaths shifted, with pulmonary complications, particularly pulmonary hypertension and PF, emerging as the leading causes. Continued research and the development of better treatments for severe pulmonary manifestations of SSc are crucial.

Expecting Heart Failure Risk Through Multi-Level Calculation Using Decision Trees
Heart failure continues to be a leading cause of death worldwide, outpacing fatalities from many other diseases. Recent progress in machine learning has facilitated the creation of predictive models to assess the risk of heart failure.
Traditionally, these models produce binary outcomes, predicting either the presence or absence of heart failure.
This study introduces a novel multi-level risk assessment approach for heart failure prediction, employing the C4.5 decision tree classifier. Unlike binary models, this method categorizes the risk into five distinct levels, offering a more granular risk evaluation. Furthermore, the model integrates three key risk factors alongside the heart failure dataset to enhance early detection.
The proposed predictive model demonstrates notable improvements over previous studies, achieving an 86.5% sensitivity, 95.5% specificity, and 86.53% overall accuracy. These results highlight its potential for more effective and early intervention in heart failure management.

The Role of Prognosis in Modern Clinical Practice: Shaping Decisions Beyond Diagnosis
Traditionally, clinical decision-making has been rooted in disease diagnosis. However, evidence often falls short in evaluating the long-term benefits and risks for patients with or without specific diagnoses. A shift toward patient prognosis—predicting future outcomes—may offer a more effective approach.

While diagnosis remains critical in acute illnesses, its central role in clinical practice is challenged by findings that it does not always directly benefit patients. Additionally, non-disease factors frequently influence outcomes, and conditions with continuous diagnostic indicators, such as blood sugar levels, highlight the limitations of a binary "yes" or "no" diagnosis. Chronic conditions like fatigue syndrome further demonstrate the inadequacy of traditional diagnostic labels.
A prognostic model, integrating diverse data such as genetic markers and social factors, offers a comprehensive framework. This approach moves beyond the limitations of diagnosis, focusing on predicting and improving future patient outcomes. By utilizing this model, clinical practice can effectively integrate expanding organic, social, and medical data, ensuring more personalized and efficient care.

Doctor AI: Using Regular Neural Networks to Forecast Clinical Events

Using extensive historical data from electronic health records (EHR), we developed Doctor AI, a flexible

predictive model designed to detect medical conditions and medication usage patterns. This temporal model, built on recurrent neural networks (RNN), was trained on time-stamped longitudinal EHR data from 260,000 patients and 2,128 physicians over an 8-year period. Encounter data, including diagnosis codes, medication codes, and procedure codes, were used as input for the RNN to predict diagnostic and medication categories for future patient visits.

Doctor AI analyzes patients' medical histories to produce multilabel predictions, assigning a label for each diagnostic or medication category. In a separate blind test, the model demonstrated the ability to conduct differential diagnoses with a recall@30 of up to 79%, significantly outperforming several baseline models. Additionally, the adaptability of Doctor AI was confirmed by applying the trained models across different institutions with minimal loss in predictive accuracy, showcasing its robust generalizability.

3. METHODOLOGY

The most critical step in diagnosing a disease is one that requires a medical professional's thorough understanding before making an informed decision. The diagnostic process can often be complex and time-intensive. To minimize uncertainty in medical diagnoses, healthcare providers use empirical data to identify illnesses. However, diagnostic errors can lead to delays or incorrect treatments, causing significant health issues. Since not all physicians have expertise in every area of medicine, there is a need for a system that combines human knowledge with the accuracy of machine learning (ML). A robust decision support system is crucial to improving the diagnostic process, ensuring accurate results, and reducing healthcare costs.

Challenges

1. The investigative process can be time-overwhelming and complex.

2. Diagnostic errors may delay or overlook critical treatments, potentially causing significant health risks.

To tackle these challenges, researchers employed several algorithms, such as Linear Discriminant Analysis (LDA), Random Forest (RF), Gradient Boosting Classifier (GBC), Decision Tree (DT), Support Vector Machine (SVM), and K-Nearest Neighbors (KNN), along with the Sequential Feature Selection (SFS) technique, to predict cardiac diseases. The K-fold cross-validation method was used for model validation. A comparative analysis was performed across these different approaches.

Advantages

1. The Decision Tree Classifier with SFS and Random Forest Classifier with SFS achieved the highest and comparable levels of accuracy.

2. The SFS method enhances classification accuracy while reducing computational complexity, optimizing the overall diagnostic process.
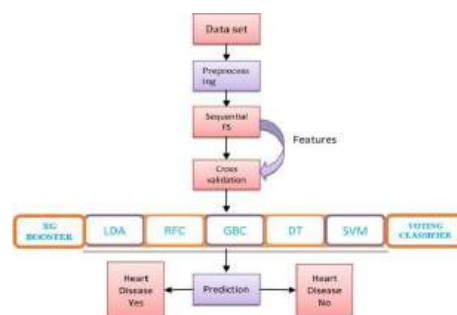

Fig.3.1: System architecture

Modules Overview

This project incorporates the following key modules to ensure seamless functionality and accurate predictions:

•   Data Exploration

Facilitates loading data into the system for further analysis and processing.

•   Processing

Reads the loaded data and prepares it for subsequent operations.

•   Data Splitting

Divides the dataset into training and testing subsets to evaluate model performance effectively.

1.   Model Generation
o   Builds predictive models using various algorithms, including:
•   Support Vector Machine (SVM)
•   Random Forest (RF)
•   Decision Tree (DT)
•   J48
•   Multi-Layer Perceptron (MLP)
•   Sequential Minimal Optimization (SMO)
•   Linear Support Vector Classifier (LinearSVC)
•   Gradient Boosting
•   Linear Discriminant Analysis (LDA)
•   K-Nearest Neighbors (KNN)
•   Extreme Gradient Boosting (XGBoost)
•   Voting Classifier

Calculates and compares the accuracy of these algorithms to select the optimal model.

2.   User Signup & Login
o   Enables user registration and secure login for personalized access to the system.
3.   User Input
o   Accepts user-provided inputs for prediction purposes.
4.   Prediction
o   Displays the final predicted outcomes based on the trained models and user input.
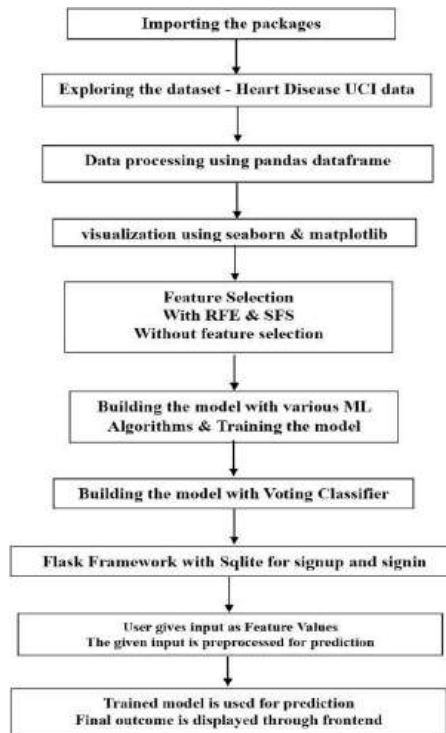
3. IMPLEMENTATION

Fig 4.1:Work flow of the proposed system

Support Vector Machine (SVM)

Support Vector Machine (SVM) is a widely used overseen learning technique in machine learning, suitable for both classification and regression tasks. Its primary application lies in solving classification problems. The main objective of SVM is to identify the optimal decision boundary that separates data points in an n-dimensional space into distinct classes. This decision boundary, known as the hyperplane, ensures that future data points can be accurately categorized.

Random Forest (RF)

The Random Forest algorithm excels in classification tasks and is particularly effective for handling large datasets with high accuracy. It operates by constructing multiple decision trees during the training phase. The final prediction is determined based on the collective output from these individual trees, making the method both robust and reliable.

Decision Tree J48

J48 is a decision tree algorithm that utilizes a top-down and recursive divide- and-conquer approach. At the root node, it determines the most suitable attribute for splitting the data, subsequently generating branches corresponding to each attribute value. This results in subsets of data being created, with each branch representing a unique path from the root.

Multi-layer Perceptron (MLP)

The Multi-layer Perceptron (MLP) Classifier is based on neural network principles. Unlike algorithms such

as Support Vector Machines or Naive Bayes, MLP relies on an underlying neural network architecture to perform classification. It is particularly effective for capturing complex patterns in data.
Linear Support Vector Classifier (SMO-LinearSVC)

The Linear Support Vector Classifier (Linear SVC) algorithm focuses on identifying a hyperplane that maximizes the separation margin between data points in different classes, enabling precise classification.
Gradient Boosting

Gradient Boosting is a machine learning technique that improves prediction accuracy by iteratively building models. Each subsequent model reduces the prediction error from the previous one. The core idea is to adjust the target values for the next model, enhancing overall performance.

Latent Dirichlet Allocation (LDA)

Latent Dirichlet Allocation (LDA) is an unsupervised learning method that describes data as a mixture of distinct categories. Often used for text analysis, LDA helps identify a predetermined number of topics shared among documents within a dataset.
K-Nearest Neighbors (KNN)
K-Nearest Neighbors (KNN) is a non-parametric, supervised learning classifier
that bases its predictions on the proximity of data points. By evaluating the closest neighbors, KNN classifies or predicts the grouping of a specific data point.
XGBoost

XGBoost is a powerful and efficient implementation of gradient-boosted trees. This supervised learning method enhances prediction accuracy by combining the predictions of several simpler, weaker models to refine the target variable estimation.
Voting Classifier
The Voting Classifier combines the outputs of multiple base models to make predictions. By aggregating the decisions from each base estimator, it determines the final output. The aggregation can be based on various criteria, such as majority voting or weighted decisions.

5. EXPERIMENTAL RESULTS
Table5.1 :Precision, Recall, F1 Score & accuracy comparison of various ML models

Sl No	Machine Learning Model (Algorithm)	Precision		Recall		F1-Score		Accuracy
		0	1	0	1	0	1	
1.	Support Vector Machine (SVM)	0.71	0.70	0.67	0.75	0.69	0.72	70.82%
2.	Decision Tree (DT)	0.84	0.86	0.85	0.84	0.84	0.85	84.68%
3.	Random Forest (RF)	1.00	1.00	1.00	1.00	1.00	1.00	100%
4.	Multilayer Perceptron (MLP)	0.84	0.86	0.85	0.85	0.85	0.85	85%
5.	Sequential minimal optimization (SMO)	0.90	0.81	0.78	0.92	0.83	0.86	84.70%
6.	Grading Booster Classifier (GBC)	0.91	0.89	0.88	0.92	0.90	0.90	89.95%
7.	Linear Discriminant Analysis (LDA)	0.90	0.80	0.75	0.92	0.82	0.86	84%
8.	K Nearest Neighbors (KNN)	1.00	1.00	1.00	1.00	1.00	1.00	100%
9.	XG Boost (XGB)	1.00	1.00	1.00	1.00	1.00	1.00	100%
10.	Voting Classifier (VC)	1.00	1.00	1.00	1.00	1.00	1.00	100%

Table5.2 : Precision comparison of various ML models

Sl No	Machine Learning Model (Algorithm)	Precision	
		0	1
1.	Support Vector Machine (SVM)	0.71	0.70
2.	Decision Tree (DT)	0.84	0.86
3.	Random Forest (RF)	1.00	1.00
4.	Multilayer Perceptron (MLP)	0.84	0.86
5.	Sequential minimal optimization (SMO)	0.90	0.81
6.	Grading Booster Classifier (GBC)	0.91	0.89
7.	Linear Discriminant Analysis (LDA)	0.90	0.80
8.	K Nearest Neighbors (KNN)	1.00	1.00
9.	XG Boost (XGB)	1.00	1.00
10.	Voting Classifier (VC)	1.00	1.00

Fig 5.1 : Precision of ML Algorithms for Target

Sl No	Machine Learning Model (Algorithm)	F-1 Score	
		0	1
1.	Support Vector Machine (SVM)	0.69	0.72
2.	Decision Tree (DT)	0.84	0.85
3.	Random Forest (RF)	1.00	1.00
4.	Multilayer Perceptron (MLP)	0.85	0.85
5.	Sequential minimal optimization (SMO)	0.83	0.86
6.	Grading Booster Classifier (GBC)	0.90	0.90
7.	Linear Discriminant Analysis (LDA)	0.82	0.86
8.	K Nearest Neighbors (KNN)	1.00	1.00
9.	XG Boost (XGB)	1.00	1.00
10.	Voting Classifier (VC)	1.00	1.00

Table 5.4 : F-1 Score comparison of various ML models

7. CONCLUSION

This paper proposes a predictive strategy that combines hybrid intelligent machine learning techniques to diagnose mortality during follow-up. Data from a heart disease clinical records database were used to evaluate the effectiveness of this approach. A major challenge in healthcare is identifying key features for disease prediction. The researchers utilized several algorithms, including Support Vector Machine (SVM), Decision Tree (DT), Random Forest (RF), Multi-Layer Perceptron (MLP), Sequential Minimal Optimization (SMO), Gradient Boosting Classifier (GBC), Latent Dirichlet Allocation (LDA), K-Nearest Neighbors (KNN), XGBoost (XGB), and Voting Classifier (VC), along with the Sequential Feature Selection (SFS) technique to predict cardiac diseases. K-fold cross-validation was applied for model validation. A comparative analysis of these ten algorithms showed that KNN, DT, VC, and XGB models

all achieved 100% accuracy. Additionally, a web application was developed using the Voting Classifier algorithm to predict cardiovascular diseases.

8. FUTURE SCOPE

In this project, a prediction strategy utilizing a hybrid intelligent machine learning approach was developed to diagnose mortality during follow-up. The approach was evaluated using data from a heart disease clinical records database. One of the major challenges in medicine is selecting the most significant features to predict disease outcomes. To address this, the researchers applied several algorithms, These algorithms include Support Vector Machine (SVM), Decision Tree (DT), Random Forest (RF), Multi-Layer Perceptron (MLP), Sequential Minimal Optimization (SMO), Gradient Boosting Classifier (GBC), Latent Dirichlet Allocation (LDA), K-Nearest Neighbors (KNN), XGBoost (XGB), and Voting Classifier (VC), in combination with the Sequential Feature Selection (SFS) technique to predict cardiac diseases. The system was validated using K-fold cross-validation. A comparison study of these ten methods revealed that the KNN, DT, VC, and XGB models achieved 100% accuracy. Furthermore, a web application was developed using the Voting Classifier algorithm to predict cardiovascular diseases.

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IntelliPlate: A Deep Learning Framework for Autonomous License Plate Recognition.

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Abstract: While many current Number Plate (NP) recognition methods have seen significant improvements in accuracy, but their performance tends to excel primarily in controlled environments where training data is precisely labeled and tailored to specific contexts. Furthermore, monitoring systems frequently rely on images or videos captured in low-resolution (LR) formats, which can hinder their effectiveness. This research addresses the challenge of detecting number plates (NP) in digital images captured in naturalistic environments. It employs Adversarial Super-Resolution (SR) methods combined with single-stage character segmentation and recognition to improve the clarity of number plates by transforming low-resolution (LR) images into high-resolution (HR) ones. The study proposes significant enhancements to the SRGAN framework, including adjustments to the number of layers, modifications to the activation function, and the incorporation of Total Variation (TV) loss for more effective loss regularization. The primary contribution of this study lies in presenting a comprehensive deep learning framework that leverages generative adversarial networks (GANs) to produce highly realistic super-resolution images. Moreover, it introduces the integration of Total Variation (TV) regularization into the loss function to enhance the model's ability to improve image resolution. The proposed SRGAN demonstrates its effectiveness in processing compact license plate (LP) images with dimensions as small as 72 × 72 pixels. This research assesses the performance of SRGAN across multiple datasets by examining factors such as visual quality, Peak Signal-to-Noise Ratio (PSNR), Structural Similarity Index Measure (SSIM), and Optical Character Recognition (OCR) accuracy. Experimental results demonstrate that the proposed SRGAN effectively generates high-resolution images, significantly improving the precision of the license plate recognition process compared to alternative approaches.

Keywords: Image Processing, Advanced Deep Learning, Generative Adversarial Networks (GANs), Visual Enhancement, License Plate Recognition, and Associated Concepts.

1. INTRODUCTION:

Automatic License Plate Recognition (ALPR) utilizes computer vision techniques to efficiently identify and extract vehicle registration details from images, reducing the need for manual effort. Around the world, challenges such as traffic regulation, law enforcement, toll management, and vehicle identification demand effective solutions. As a result, the development of ALPR frameworks has become crucial to addressing these concerns. In recent years, several ALPR systems have been proposed, with many focusing on real-time license plate detection and recognition. However, these systems often face limitations, particularly as their performance relies on vehicles being in close range.
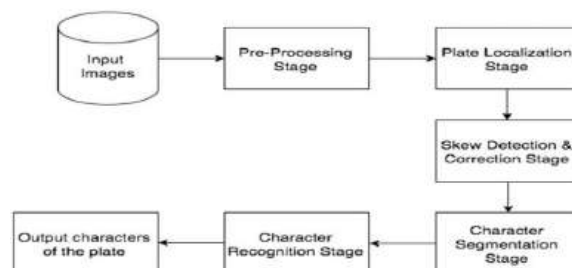

Fig 1.1: Example figure

Instead, non-real-time applications prioritize improving image quality, particularly for license plates, to enhance object detection accuracy at greater distances. Despite the use of specialized techniques in ALPR systems, they still encounter considerable challenges. Issues such as high vehicle speeds, varying environmental conditions, and motion blur can impact the system's overall performance and varied vehicle registration plates can greatly impact recognition accuracy. Additionally, deploying video cameras at every intersection within an Intelligent Transportation System results in the generation of a vast amount of video data. The main challenges in license plate recognition are environmental conditions and the diversity of registration plates.

Thus, environmental factors like changes in lighting, color variations, dirt, shadows, and background patterns have a significant impact on the effectiveness of number plate recognition. Therefore, inconsistent lighting can reduce the superiority of vehicle images, coupled with complex background patterns, often complicates the identification of number plates. Furthermore, several factors, including the placement, quantity, size, font style, color, character clarity, language, and angle of registration plates, pose significant challenges in designing a reliable ALPR system. Typically, the recognition units are deployed at entry points of residential complexes, toll plazas, or high-security zones such as military installations and nuclear facilities. [1].

2. LITERATURE REVIEW:

Automatic License Plate Recognition (ALPR): A Comprehensive Review of the Current State-of-the-Art

Automatic License Plate Recognition (ALPR) involves the extraction of vehicle license plate information from images or sequences of images. This extracted data can be utilized, with or without a database, in various applications, including electronic toll collection, parking fee systems, and traffic monitoring on freeways and arterial roads. ALPR systems capture images using color, black and white, or infrared cameras. The effectiveness of Automatic License Plate Recognition (ALPR) is largely influenced by the quality of the images used. In practical applications, ALPR must efficiently and accurately process license plates in various environments, whether indoors or outdoors, and during both day and night. It should be designed to handle license plates from various countries, regions, or states. These plates often feature different colors, languages, and fonts. Some plates may have plain backgrounds, while others include background images**.** License plates can sometimes be obscured by factors such as dirt, lighting conditions, and towing accessories on vehicles. This paper offers a comprehensive overview of the most recent advancements in ALPR technologies. It categorizes various ALPR methods based on the features utilized at each stage, and evaluates them in terms of their advantages, disadvantages, recognition accuracy, and processing speed. The paper concludes with future predictions for ALPR developments.

An algorithm for license plate gratitude tailored for intelligent transportation system applications:

This paper presents a novel approach for vehicle license plate recognition, utilizing an adaptive image segmentation technique known as sliding concentric windows. This method is complemented by connected component analysis and a neural network for character recognition. The algorithm was tested on a dataset of 1334 grayscale vehicle images, collected in real-world conditions with varying backgrounds and lighting. The camera focused on the license plate, with the vehicle's angle and distance adjusted as per the experimental setup. Out of the 1334 images, 1287 license plates were accurately segmented, yielding a segmentation success rate of 96.5%. The optical character recognition (OCR) system uses a two-layer probabilistic neural network (PNN) with a structure of 108-180-36, achieving an 89.1% success rate in fully recognizing the license plates. This PNN is trained to identify alphanumeric characters from license plates based on data generated through algorithmic image processing. Combining both segmentation and recognition success rates, the overall performance of the license plate recognition algorithm is 86.0%. A review of similar studies suggests that performance levels between 90% and 95% are often achieved when conditions such as distance, angle, lighting, and background complexity are controlled.

Major Visual Term Discovery for Involuntary License Plate Detection:

While license plate detection is generally viewed as a solved issue, with numerous operational systems, the

effectiveness of these algorithms is often limited to controlled environments. License plate detection in open environments presents numerous challenges, including different observation angles, background noise, scale variations, multiple plates, and inconsistent lighting. This paper introduces an innovative approach to automatically locate license plates through the discovery of principal visual words (PVWs) and local feature matching. Noticing that characters on various license plates often repeat, we introduce the concept of by means of the bagof-words (BoW) perfect, typically utilized in part-identical image searches. Unlike the traditional Bow model, our approach automatically identifies the principal visual word (PVW) for each plate character, incorporating geometric context. When presented with a new image, license plates are identified by matching local features with the principal visual word (PVW). Beyond license plate detection, our method can also be applied to detect logos and trademarks. Thanks to the robustness of the scale-invariant feature transform (SIFT) feature, our approach can handle various alterations in license plates, including rotation, scaling, and changes in illumination. The effectiveness of this proposed method is supported by experimental results in license plate detection.

License Plate Detection Using Learning-Based Techniques with Global and Local Features:

This paper introduces a license plate discovery algorithm that utilizes both global arithmetical landscapes and local Haar-like features. Initially, classifiers based on global statistical features are developed through straightforward learning processes. By employing these classifiers, over 70% of the background area can be excluded from subsequent training or detection stages. Next, the AdaBoost learning algorithm is employed to create additional classifiers using selected local Haar-like features. By integrating classifiers that utilize both global and local features, we form a chute classifier. The classifiers based on worldwide features help reduce the system's complexity. "These are followed by classifiers based on local Haar-like features, making the final classifier robust to variations in glare, color, size, and position of license plates. The experiments demonstrated a promising detection rate.

Exposure and recognition of license plate characters exhibiting varied appearances:

This paper introduces a method for creating an automatic license plate recognition system. Car images are captured from different outdoor positions. Due to the varying angles between the camera and the vehicle, license plates appear in various locations and orientations within the images. "During the license plate detection phase, the vertical gradient magnitude is utilized to identify potential license plate regions. These regions are then assessed based on three geometric attributes: the width-to-height ratio, size, and orientation, with the last feature determined by the major bloc. In the character recognition phase, it is essential to identify character features that are unaffected by rotational changes. The different rotated character images of a particular character can be standardized to the same orientation using the major axis of the character image. The features chosen for rotation-free character recognition include the journey counts and the marginal background area of an input character image. Experimental results demonstrate that the certificate plate detection method can accurately extract all license plates from 102 car images captured outdoors. Additionally, the rotation-free character recognition method achieves an accuracy rate of 98.6%.

3. RESEARCH METHOD / METHODOLOGY :

In recent years, many Automatic License Plate Recognition (ALPR) systems have focused on real-time detection and recognition of license plates. However, this method has its drawbacks, particularly because it requires vehicles to be in close range for accurate recognition. On the other hand, non-real-time applications aim to improve image quality, including better visualization of license plates, which enhances object detection at greater distances. Despite the foundational methodologies of ALPR systems, they still encounter several challenges. Factors such as high-speed vehicles and nonstandardized license plate formats can significantly hinder recognition accuracy. Furthermore, the need for video cameras at every intersection within an Intelligent Transportation System result in a massive amount of video data. Environmental conditions and the wide variety of license plate designs add further complexity to the accurate recognition of license plates.

Disadvantages:

⬤ They are still limited to ideal circumstances in which training data is correctly marked with limited states.
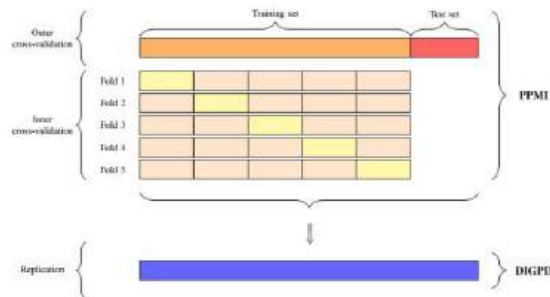
⬤ Less accuracy.

Fig.3.1: System architecture

4. MODULES:

To implement the project, we have designed the following modules:
Data Exploration: This module is responsible for loading the dataset into the system for further analysis.
Data Processing: In this module, the data will be read and prepared for processing.
Data Splitting (Train & Test): This module divides the data into training and testing sets to ensure proper evaluation.
Model Generation: In this phase, we will build various models including SVM, Random Forest (RF), Decision Trees (DT), Logistic Regression (LR), Boost, Voting Classifier, Recurrent Neural Networks (RNN), and Gated Recurrent Units (GRU), and compute their accuracy.
User Signup & Login: This module handles user registration and login functionality.
User Input: In this module, users will provide input for making predictions.
Prediction: Finally, the system will display the predicted results based on the user input.

5.   EXPERIMENTAL RESULTS

Fig.5.1: Home screen

Fig.5.2: User registration

Fig.5.3: User login

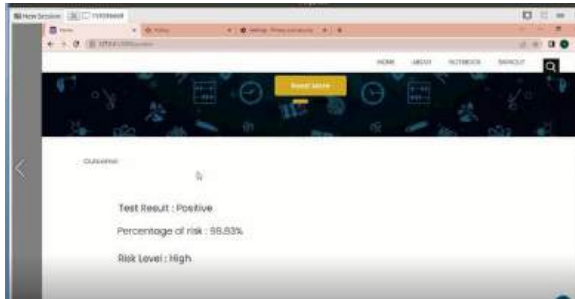Fig.5.4: Main page

Fig.5.5: User input

Fig.5.6: Prediction result

6. DISCUSSION/ ANALYSIS:

Automatic License Plate Recognition (ALPR) technology has become an essential component of modern traffic management and security systems. By enabling the automated identification of vehicle registration plates, ALPR systems address numerous challenges, including toll collection, vehicle tracking, law enforcement, and traffic violation monitoring. Despite its potential, there are technical and environmental challenges that need to be addressed to improve its efficiency and scalability.

Real-Time vs Non-Real-Time Applications

Most contemporary ALPR systems rely on real-time detection and recognition, which makes them suitable for dynamic applications such as traffic monitoring and toll booth operations. However, real-time systems often face challenges due to their dependency on capturing clear images within a short range. The vehicle's speed, motion blur, and adverse weather conditions can severely impact the recognition accuracy in such cases.

On the other hand, non-real-time applications focus on post-processing the captured images or videos to enhance the quality of license plate detection. By employing advanced image processing techniques, these systems improve detection accuracy over greater distances. Nonetheless, the trade-off is the added computational overhead and delayed results, which might not be suitable for time-sensitive tasks.

Environmental Challenges

Environmental factors play a critical role in the performance of ALPR systems. Some common challenges include:

1. Illumination Variability: Poor or uneven lighting can degrade image quality, making it difficult to identify number plates accurately. For instance, harsh sunlight, shadows, or nighttime conditions necessitate the use of advanced lighting normalization or infrared imaging.
2. Background Patterns and Dirt: Complex or cluttered backgrounds, along with dirty or worn-out plates, add significant difficulty in plate localization and recognition.

3. Weather Conditions: Rain, fog, and dust can blur the images, leading to erroneous recognition.

- Diversity in Registration Plates

The variation in vehicle registration plates adds another layer of complexity. Factors such as differences in:

- Plate size and format,

- Font type and character spacing,

- Plate color and reflectivity,

- Language (e.g., alphabets, symbols, or numerical systems), pose challenges in designing universally effective ALPR systems.

7. CONCLUSION:

Our research demonstrates the potential for predicting impulse control disorders in Parkinson's disease. However, the advancements made compared to a basic model are not yet adequate to ensure clinical applicability at this stage. Despite this, our study underscores a robust methodology and establishes a benchmark for future comparisons. Additional research that incorporates other risk factors and examines the initial onset of ICDs is necessary to develop clinically useful models.

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Development and Validation of In-Vitro Release Test (IVRT) Method for Topical Complex Generic - Ganciclovir Ophthalmic Gel.

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Abstract: *Background: The in-vitro release test (IVRT) is a tool to measure the amount and the release rate of active pharmaceutical compounds released from topical semisolid dosage forms. The IVRT provides significant information for product performance assessment and evaluation. It is also used to assess the bioequivalence study (biowaivers) for topical semisolid products. Objective: The study aims to develop and validate the IVRT method for qualitative and quantitative estimation of ganciclovir topical products and to demonstrate the similarity between the marketed reference product and the in-house test product of ganciclovir ophthalmic gel. Methods: The method was developed using a vertical diffusion cell with a synthetic cellulose membrane, simulated tear fluid as the receiver media, and UV detection. The IVRT study was performed at 100rpm and 32^oC for 6hr. The marketed formulation containing 0.15%w/w ganciclovir was used as a reference. Results: The in-house test product of ganciclovir met all characterization criteria. The analytical method was optimized and validated with a concentration range of 2-14µg/ml and a regression coefficient of 0.9997 as per the ICH guideline. The developed IVRT method was simple, economical, linear, robust, reproducible, sensitive, specific, and selective to evaluate the drug release from the formulation. The %recovery at 6hr was found to be 84.43% and 78.68% for reference and test product of ganciclovir ophthalmic gel with correlation coefficient R^2 0.9947 and 0.9921, respectively, this value justified the biowaivers between the reference and test formulation. Conclusion: This method can be utilized to check topical semisolid product quality, product performance, and product uniformity. Additionally, it can also be used to waive the requirement for bioequivalency studies for ganciclovir ophthalmic gel.*

Key Words: *In-vitro release test (IVRT), ganciclovir, ophthalmic gel, topical formulation, biowaiver, method development and validation, in-house formulation.*

1. INTRODUCTION:

Topical formulations are applied to the skin and mucous membranes of the body. They are available in different dosage forms like ointments, pastes, creams, gels, solutions, collodion, suspensions, emulsions, lotions, powders, sprays, etc [1]. The effectiveness of a topical formulation depends on the release and diffusion of the active drug substance from the formulation. The active drug substance must be released from the formulation before it diffuses. The quality of topical formulation is determined by measuring the release and diffusion of the active drug substance. In vitro release testing (IVRT) is used to monitor the release and diffusion of drug substances from topical semisolid dosage forms. Hence, it can document the quality of topical formulations [2]. The process of measuring the amount of drug released and its release rate from semisolid dosage forms into a receptor medium through an inert membrane is known as IVRT [3]. It is considered to be an important technique for product development and product performance assessment and helps in verifying the product's quality and comparative analysis [4,5]. In this respect, the US FDA(U.S. Food and Drug Administration) and the European Medicines Agency (EMA) have published guidance that recommends the application of IVRT for such purposes [6,10].

The US FDA SUPAC-SS (Nonsterile Semisolid Dosage Forms for Scale-up and Post-Approval Changes) guideline describes the IVRT study to evaluate similarities of semisolid dosage forms following minor modifications related to an approved dosage form [6]. As per this guideline, IVRT studies provide adequate justification for bioequivalence studies (biowaivers) for topical semisolid pharmaceuticals after post-approval modifications [7-9]. It has been demonstrated that IVRT studies are helpful for detecting differences in qualitative (Same component) (Q1) and quantitative (Same amount of same component) (Q2) properties between identical products as well as in the physical arrangement of matter between formulations (Q3).

There are many IVRT apparatuses available like Vertical diffusion cell (VDC) or Frans diffusion cell, Horizontal side-by-side diffusion cell (SBS), Flow-through cell diffusion apparatus (USP apparatus 4), Enhancer cell assembly (USP apparatus 2), Rotating cylinder method (USP apparatus 6), etc. The choice of the IVRT apparatus depends on the physicochemical characteristics of the dosage forms. Since vertical diffusion cells are more reliable and versatile, they are typically utilized in IVRT studies. The donor chamber and the receptor chamber are the two components that make up the vertical cell. There is a membrane between these two chambers. The test product is introduced into the upper donor chamber, where it diffuses into the receptor medium in the lower receptor chamber via the membrane. To maintain the homogeneity of the sample, a stir bar is employed. At certain intervals, samples of the receptor media are taken and examined [4,11-13]. Vertical diffusion cell assembly is shown in Figure 1.

Development and validation of the IVRT method should be performed as per USFDA and EMA guidelines [10, 14]. Much literature is available on the development and validation of IVRT methods for semi-solid products [15-32].

Ganciclovir acts as an antiviral drug by inhibiting viral DNA synthesis. It is available in ophthalmic gel form to treat cytomegalovirus and herpetic keratitis of the eye. The release rate of ganciclovir from ophthalmic gel can determine its quality and efficacy. That can be measured by using the IVRT method, which can also be used to examine the similarities and differences between an in-house test product and the approved reference product of ganciclovir ophthalmic gel.

2. MATERIALS:

2.1 *Instruments and Apparatus:* UV-Vis Spectrophotometer (Thermo Electron Scientific Instrument - Evolution 201), FTIR (Jasco - model name: FT/IR-4X), Digital Balance (Uni-bloc, Shimadzu), Sonicator (Lab junction digital ultrasonic cleaner), Franz Diffusion cell (Borosilicate Glass Jacketed Franz Diffusion Cell Vessel, ABG Initiative), Magnetic Stirrer (DBK-multimag Stirrer), Microscope (Stereomicroscope-Zeiss-3943028555/NM), Digital pH meter (Avi Scientific, India), Viscometer (Anton Paar, ViscoQC 300), Beaker, Pipette and Volumetry flask (Borosil)

2.2 *Reagents:* Ganciclovir standard API(Purity: 99.85%, BLD pharmatec (India) pvt ltd), Receptor solution: Artificial tear solution or Simulated tear fluid (0.67%w/v of NaCl [SRL], 0.2%w/v of $NaHCO_3$ [SRL], and 0.008%w/v of $CaCl_2.2H_2O$ [SRL]), Membrane: Dialysis Membrane-150 (DM006)-(HiMedia Laboratories Pvt. Ltd., Description: A regenerated seamless cellulose tubing, having molecular weight between 12,000 to 14,000).

2.3 *Formulation:* Marketed formulation: Ganciclovir ophthalmic gel-0.15%w/w [Manufacturer: Ajanta Pharma], Inhouse formulation (reagent): Ganciclovir (BLD pharma), Carbopol 934 (SRL), Mannitol (SRL), Sodium hydroxide (SRL), Benzalkonium chloride (Sigma), Water for injection (Acculife WFI).

3. METHODS:

3.1 *Identification of the standard API*: The standard API (Ganciclovir) was identified to confirm its identity, standard, quality, and purity for experimental work. The identification was done by taking IR and UV spectra, conducting a solubility study, and determining the melting point.

3.2 *Preparation and characterization of In-house formulation:*

3.2.1 *Preparation of In-house ganciclovir gel:* The 10gm of in-house gel formulation was prepared by gradually dispersing ganciclovir(0.015gm), carbopol 934(0.035gm), mannitol(0.5gm), sodium hydroxide(0.015gm), and benzalkonium chloride(0.00075gm) in water for injection while stirring constantly and leaving the dispersion to hydrate for 30 minutes. The gel was continuously agitated until a uniform gel formed. The drug should be dispersed properly before being transferred to the container.

3.2.2 *Characterization Parameter:* The characterization of In-house ganciclovir gel was performed by evaluating microscopic observation, pH, viscosity, spreadability, washability, and grittiness.

3.3 *UV Spectrophotometer method development and validation:*

3.3.1 *Preparation of Solvent:* Artificial tear solution or Simulated tear fluid was prepared by dissolving 0.67gm of NaCl, 0.2gm of $NaHCO_3$, and 0.008gm of $CaCl_2.2H_2O$ in 100ml distilled water and mixed thoroughly. Simulated tear fluid (Artificial tear solution) was selected as a solvent for developing the spectral characteristics of the drug.

3.3.2 *Preparation of stock solution:* 100mg accurately weighed ganciclovir standard was transferred to 100 ml volumetric flasks. It was dissolved and diluted up to the mark with simulated tear fluid (artificial tear solution) to obtain std stock solutions (1000μg/ml) of ganciclovir. 100μg/ml of ganciclovir solution was prepared by diluting 1 ml of standard stock solution of ganciclovir to 10 ml with simulated tear fluid.

3.3.3 *Preparation of test solution:* 150mg of marketed formulation/In-house formulation of ganciclovir was dissolved in 100 ml simulated tear fluid. Mixed properly with the help of a sonicator and filtered. The filtrate was collected and absorbance was recorded in a UV Spectrophotometer at 200-400nm range.

3.3.4 *Method Validation:* The method validation parameters studied were solution stability, linearity, accuracy, precision, limit of detection, and limit of quantitation as per ICH guidelines Q2R1. Standard and test solutions were kept at 25^0C for 36 hours. Assay percentages at the initial time period and after every 12 hours were calculated and compared. The change in the assay percentage was evaluated to find the stability of the solutions. Ganciclovir solution was made up of simulated tear fluid to get a concentration range of 2-14μg/ml for linearity. The absorbance of the prepared solution of ganciclovir was recorded at 252nm in a UV Spectrophotometer. The repeatability was checked by repeatedly (n = 6) taking the absorbance of ganciclovir (8μg/ml) standard solutions and responses were recorded. The intra-day and inter-day precision of the proposed method was determined by measuring the corresponding responses 3 times for 3 different concentrations of ganciclovir (6, 8, 10μg/ml). The results were reported in relative standard deviation (RSD). The accuracy of the method was determined by the addition of a known amount of standard solutions of ganciclovir (0, 6, 8, 10μg/ml) to a pre-quantified sample solution of ganciclovir (8μg/ml) and %recovery was calculated. The limit of detection (LOD) and the limit of quantification (LOQ) were calculated using the standard deviation of the y-intercept of the calibration curve (N) and the slope (S) of the calibration curve.

3.4 *IVRT method development and validation:*

3.4.1 *Optimization of IVRT Method:*

3.4.1.1 *Receptor-Fluid Selection:* The drug's solubility in receptor media determined which receptor fluid is selected for IVRT study. The drug's maximum concentration should be soluble in the receptor medium. Using a vertical diffusion cell, the solubility of ganciclovir in different receptor fluids was examined. These fluids included saline (0.9%w/v NaCl solution), lactate buffer pH 4.0, phosphate buffer

pH 9.0, phosphate buffer pH 7.0, water/methanol (50:50 v/v), artificial tear solution, and 0.9%w/v NaCl solution/methanol (50:50 v/v). The solubility of ganciclovir in these receptor fluids was assessed in triplicate by dissolving 1 gm of ganciclovir in 10 ml of receptor fluid to produce a saturated solution. After one hour of agitation at 100 rpm and 32^{0}C, the solution was left to stand for the entire night. The amount of dissolved ganciclovir was measured using a UV Spectrophotometer after the supernatant was collected, filtered, and diluted.

3.4.1.2 *Membrane selection:* The selection of membrane for the IVRT study was based on the drug-membrane binding study. The membrane should allow the passage of the drug from formulation to receptor media. The drug should not bind with the membrane. A variety of synthetic membranes, such as teflon, nylon, polysulfone, and cellulose, were assessed for their ability to bind drugs and release drugs, specifically ganciclovir from gel formulations. To conduct the drug-membrane binding investigation, a standard containing 200µg/ml of ganciclovir was prepared and filtered through each membrane in triplicate. The filtered standard solution recovery was tested versus the unfiltered standard solution recovery. The membrane that gives maximum recovery of the drug should be selected.

3.4.1.3 *Optimized IVRT method:* The IVRT run was carried out with VDC. Before the experiment began, the receptor chamber was filled with receptor media-artificial tear solution and was stirred at 100 rpm for approximately 30 min at 32ºC temperature to equilibrate the VDC system. After the cellulose membranes had been presoaked in the receptor media for 30 minutes, the 1gm of precisely weighed gel was evenly placed on the membrane. 1ml of receptor media was withdrawn from the receptor chambers of VDC every 60 min for 360 min. To maintain the sink condition, 1 ml of new receptor media was added to the VDC receptor chamber following each withdrawal. From 1 ml of collected receptor media, 0.5 ml was diluted up to 10 ml with simulated tear fluid and was analyzed by using the UV Spectrophotometer.

3.4.1.4 *Calculation of release rate:* Using the equation below, the Higuchi model which depends on the existence of ideal sink conditions was utilized to calculate the release rates [15]. The concentrations of ganciclovir in the receptor media (Cn) at various sampling intervals were computed using the following equation, accounting for the dilution of the receptor media caused by the replacement of the sampled amount.

$$Q_n = C_n \frac{V_c}{A_c} + \frac{V_s}{A_c} \sum_{i=1}^{n} C_{i-1}$$

Where,
Qn = amount released at time (n) per unit area in µg/cm2;
Cn = concentration of drug in receptor medium at different sampling times (n) in µg/cm3;
Vs = volume of the sample in cm3;
Vc = volume of the cell in cm3;
Ac = area of the orifice of the cell in cm2.

3.4.2 *Validation of IVRT method:*

The IVRT method was validated as per USFDA guidelines. Marketed formulation – Ganciclovir ophthalmic gel- containing 0.15%w/w ganciclovir was used as the reference. The linearity was evaluated by plotting the amount of the ganciclovir released from gel formulation versus the square root of time and the coefficient of correlation (R2) was calculated. The inter-day and intra-day precisions were evaluated by performing an IVRT run of reference ganciclovir gel formulation on three different days and the same day at different times, respectively. Gel products containing 0.075%w/w, 0.15%w/w, and 0.225%w/w ganciclovir which were 50, 100 and 150% of reference ganciclovir gel were used to determine the sensitivity, selectivity, and specificity of the IVRT method. The sensitivity of the IVRT procedure was determined by comparing the mean release rate of ganciclovir from 0.075%w/w and 0.225%w/w gels with 0.15%w/w gel. The specificity of the IVRT method was examined by comparing

the relationship between the changes in the release rate of the lower and higher strengths of ganciclovir gel (i.e., 0.075%w/w and 0.225%w/w, respectively) with the 0.15%w/w ganciclovir reference gel. The selectivity of the IVRT procedure was determined by calculating the ratios of release rates of ganciclovir from the gels with different concentrations (0.075%w/w / 0.15%w/w and 0.225%w/w / 0.15%w/w). The robustness of the method to minor variations such as temperature variations (-2 and +2^{0}C) and stirring-rate variations (-20 rpm and +20 rpm) was investigated using the reference product. With decreasing and increasing parameters, the average release rate was recorded and the relative standard deviation was calculated.

4. RESULTS AND DISCUSSION:

4.1 *Identification of the standard API*: The IR Spectra of standard ganciclovir is shown in Figure 2 and the functional group identification of IR spectra for the ganciclovir standard is presented in Table 1. The wavelength of maximum absorption (λmax) for the ganciclovir standard was found to be 252nm. It was determined by taking ganciclovir solution in simulated tear fluid and scanned in the range of 200-400nm in UV-visible spectrophotometer. The melting point of Ganciclovir was determined by using a melting point apparatus. The observed value of the Ganciclovir melting point was 248-250ºC compared to the reported value 250ºC. Solubility for the ganciclovir standard was checked by using different solvents at room temperature. It was found soluble in water, methanol, 0.1M HCL, buffer solvent pH 7, and DMSO(dimethyl sulfoxide). The standard of ganciclovir was found pure to perform the experimental work.

4.2 *The characterization parameter of In-house gel formulation:* It was observed and recorded in Table 2. The in-house ophthalmic gel formulation of ganciclovir has complied with all characterization parameters.

4.3 *UV- Visible Spectrophotometry Method Development and Validation:*

4.3.1 *Validation Parameters of UV method:* A summary of the validation parameters of the UV method is described in Table 3. Overly UV spectra and a calibration curve of ganciclovir are shown in Figures 3 and 4 respectively. The UV method was found validated as per the ICH guideline.

4.3.2 *Analysis of Formulation:* The Assay percentage of ganciclovir was found to be 100.75 $\pm$ 0.39 and 99.86 $\pm$ 0.58 for marketed formulation and In-house formulation respectively, which were comparable with the corresponding claimed amounts. This value indicated the successful application of the method for the determination of ganciclovir from marketed and In-house formulation.

4.4 *Development and Validation of IVRT Method:*

4.4.1 *Optimization of IVRT method:*

4.4.1.1 *Receptor fluid selection:* The receptor media that provided the best results was artificial tear solution or simulated tear fluid, where the mean ganciclovir solubility was sufficiently high to ensure sink conditions.

4.4.1.2 *Membrane selection:* Average percentage recoveries of ganciclovir were 90.8%, 97.6%, 99.2%, and 94.4% for polysulfone, nylon, cellulose, and teflon membrane, respectively. Since cellulose had a higher recovery percentage and was easily accessible, it was selected as the preferable membrane for this investigation.

4.4.1.3 *Optimized IVRT method:* Optimized IVRT method parameters are described in Table 4.

4.4.2 *Validation parameters of the IVRT method:*

4.4.2.1 *Linearity:* The relevant release parameters for three IVRT runs using reference ganciclovir ophthalmic gel- containing 0.15%w/w ganciclovir are given in Table 5. For each of the three IVRT runs, there was a linear relationship between the amount of ganciclovir released per unit area of the membrane versus the square root of time. The coefficient of correlation was 0.9947 which satisfied the acceptance criterion. The release rate plot of cumulative amount release vs square root of time for ganciclovir gel is shown in Figure 5.

4.4.2.2 *Precision:* The relative standard deviation for the release rate of ganciclovir gel IVRT intra-run and inter-run are shown in Table 6. It was discovered that the mean release rate values had an RSD of less than 15%, proving the precision of the method.

4.4.2.3 *Sensitivity:* The mean ganciclovir release rate was lower for the 0.075%w/w gel compared to 0.15%w/w gel, and the mean ganciclovir release rate was higher for the 0.225%w/w gel compared to 0.15%w/w gel, so the IVRT process appeared to be sensitive. The release of ganciclovir per unit area of the membrane vs the square root of time is displayed in Figure 6 for three IVRT runs utilizing gels with varying ganciclovir contents: 0.075%w/w, 0.15%w/w, and 0.225%w/w.

4.4.2.4 *Specificity:* The specificity of the procedure was established by analyzing the relationship between the variations in the release rate of the various ganciclovir gel contents: 0.15%w/w, 0.075%w/w, and 0.225%w/w. According to the accepted threshold of >0.90, the reported correlation coefficient (R2) was 0.999. Therefore, the IVRT procedure's specificity was confirmed. A linear, proportionate relationship between the various ganciclovir gel concentrations and corresponding release rates is shown in Figure 7.

4.4.2.5 *Selectivity:* The values of the ratio in case of comparison of the ganciclovir release rates for 0.075%w/w gel and 0.15%w/w gel were in the range of 19.41-22.54 %, and if the release rates for 0.225%w/w gel have been compared with the same parameter for 0.15%w/w gel the ratios were from 178.12-181.34 %. In both cases, the ratios 0.075 %/0.15 % and 0.225 %/0.15 %, were outside the limits of 75% -133.33%. Therefore, in the case of non-equivalent products, the IVRT approach was considered to be selective in terms of its capacity to precisely distinguish between the various release rates.

4.4.2.6 *Robustness:* The mean release rates obtained in IVRT runs at minor variations did not deviate by more than 15 %. The acceptance criterion stated that the mean release rates from IVRT run at minor variations could not differ from each other by more than 15%. The IVRT procedure's robustness in the face of parameter deviation was validated by these results. The mean release rate obtained for robustness runs is presented in Table 7.

4.4.3 *Comparison of IVRT of Marketed formulation and In-house formulation:*

The cumulative amount of ganciclovir release with time was found linear for In-house ganciclovir gel formulation. The relevant release parameters for marketed and In-house ganciclovir formulation are presented in Table 5. The comparative release rate plot for marketed and in-house ganciclovir formulations is shown in Figure 8. This value indicated the compatibility between marketed and in-house formulations.

5. CONCLUSION:

The Ganciclovir standard API was tested accurately to confirm its identity, standard, quality, and purity for experimental work. The In-house ophthalmic gel formulation was accurately prepared which complies with all characterization parameters. The simple, linear, precise, and accurate UV Spectrophotometry method was established for quantification of ganciclovir in IVRT samples. An IVRT method was developed and validated as per FDA guidelines. The optimized IVRT method proposed the use of cellulose membrane and simulated tear fluid as receptor media in vertical diffusion cell for in IVRT study of ganciclovir from gel formulation. The developed IVRT method was simple, economical,

linear, robust, reproducible, sensitive, specific, and selective to assess the release of ganciclovir from gel formulation. This proposed IVRT method was successfully applied to evaluate the release profile of ganciclovir from marketed and in-house topical gel formulations. It indicated discrimination in the release profile at various gel formulation concentrations, including 0.075%W/W, 0.15%W/W, and 0.225%W/W. The resulting data indicate that the proposed IVRT method can be accurately and precisely applied to discriminate between ganciclovir gel products as a valuable tool in product development. It was then successfully applied to assess the equivalency between the marketed and in-house gel formulation. This supported a biowaiver under the SUPAC-SS acceptance criteria. This method can be utilized to check product quality, product performance, and product uniformity and also to obtain a waiver of bioequivalence studies for ganciclovir ophthalmic gel formulations.

LIST OF ABBREVIATIONS:

IVRT: In-Vitro Release Test

API: Active Pharmaceutical Ingredient

UV: Ultra Violet

USFDA: U.S. Food and Drug Administration

EMA: European Medicines Agency

SUPAC-SS: Nonsterile Semisolid Dosage Forms for Scale-up and Post-Approval Changes

VDC: Vertical diffusion cell

ICH: International Council for Harmonisation

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TABLES:

Table 1. Functional group identification of IR spectra for the Ganciclovir standard:

Sr.No.	Wavenumber[cm⁻¹]	Functional Group
1	3417	Primary and Secondary Amines, Alcohol
2	3154	Aromatics and alkenes
3	1651, 1607	Aromatic, Primary Amines
4	1573, 1540	Aromatics
5	1471, 1359	Alkanes
6	1301	Aromatic Amines
7	1244, 1170, 1092, 1062, 1013	Alcohol, Ester, Ether
8	978	Alcohol
9	902, 849, 821, 767, 685	Primary and secondary Amine

Table 2. Observation of characterization parameter of In-house gel:

Parameters	Observation
Color	Transparent
Odour	None
Consistency	Consistent
Homogenicity	Homogenous
pH	7.1
Viscosity	Dyn. Viscosity: 117.0 mPa·s at Torque: 80.1%, Temp: 30.5^{0}C, Speed: 250rpm
Spreadability (gm.cm/sec)	5.3
Washability	Washable
Grittiness	Nil

Table 3. Summary of validation parameters of UV method:

Parameters	Value
Solution stability: Standard solution	Assay% difference not more than 1%: Stable
Solution stability: Test solution	Assay% difference not more than 1%: Stable
Linearity (n=3)	Concentration range = 2-14µg/ml
	Absorbance range = 0.126-0.995 $\pm$ 0.03-0.12

Regression equation	Y= 0.0726x – 0.0187
Regression coefficient	$R^2 = 0.9997$
Precision: Repeatability(n=6)	% RSD: 0.364
Intra-day precision (n=3)	% RSD: 0.22-0.64
Inter-day precision (n=3)	% RSD: 0.45-0.76
Accuracy (% Recovery) (n=3)	99.30-100.0%
LOD	0.207(µg/ml)
LOQ	0.691(µg/ml)

Table 4. Optimized IVRT method parameters

Parameters	Condition
Receptor Volume	15ml
Diffusional surface area	25mm
Temperature	32ºC
Membrane	Cellulose membrane
Receptor Media	Artificial tear solution
Stirring Speed	100rpm
Dose	1gm
Sampling Time	0.5, 1,2,3,4,5, and 6 hr
Sampling volume	1ml
Sampling analysis	UV Spectrophotometer at 252nm

Table 5. The drug release parameters of marketed and In-house ganciclovir gel IVRT study:

Parameter	Result (n=3) for marketed formulation	Result (n=3) for In-house formulation
Mean release rate (R), $\mu g/cm^2/h^{-1/2}$	29.70 ± 5.78	28.39 ± 4.11
Cumulative amount (A) (at the time point 6 h), $\mu g/cm^2$	1266.47 ± 20.56	1177.95 ± 15.99
Ganciclovir content in the receptor medium (at the time point 6 h), $\mu g/ml$	650.94 ± 13.21	600.66 ± 11.06
Correlation coefficient R^2	0.9947	0.9921
Recovery (at the time point 6 h), %	84.43 %	78.68 %

Table 6. The release rate values of ganciclovir gel IVRT intra and inter-day study:

	Mean Release rate (R), $\mu g/cm^2/h^{-1/2}$				
	Day 1	Day 2	Day 3	Avg	%RSD
Interday precision	27.12	31.45	29.82	29.46	2.18 %
	Run 1	Run 2	Run 3	Avg	%RSD
Intraday Precision	29.65	30.44	27.77	29.28	1.37 %

Table 7. The release rate data for IVRT runs at different temperatures and different RPMs:

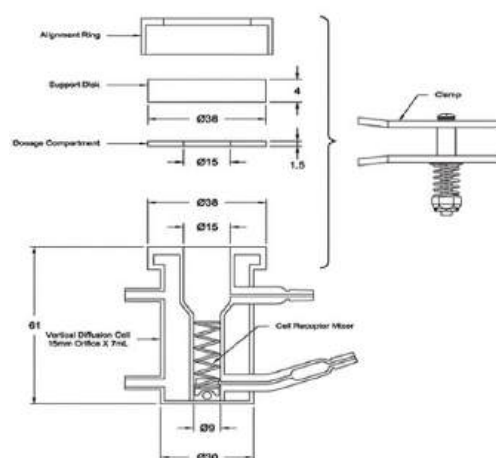| Parameter	Variation	Mean release rate (R), $\mu g/cm^2/h^{-1/2} \pm$ %RSD
Temperature	30ºC	28.69 ± 1.02
	32ºC	29.70 ± 2.06
	34ºC	29.56 ± 1.34
Speed of rotation	80rpm	30.15 ± 1.65
	100rpm	29.70 ± 0.78
	120rpm	28.85 ± 1.99

FIGURES:

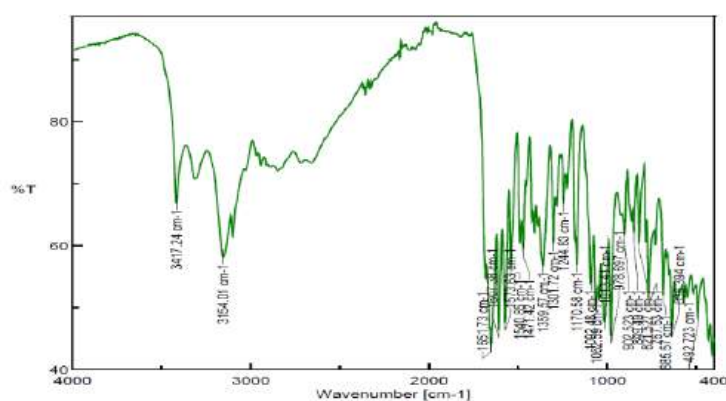**Figure (1).** Vertical diffusion cell assembly [13]

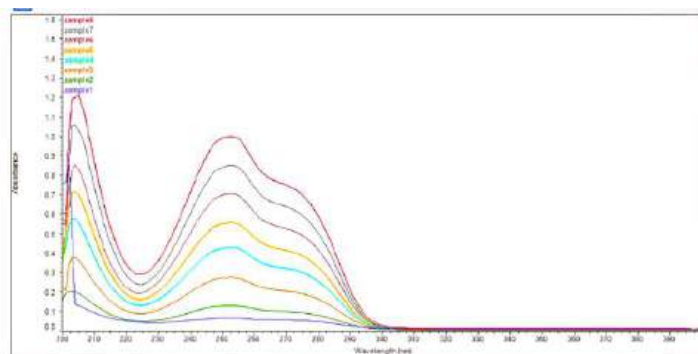**Figure (2).** FTIR Spectra of Standard Ganciclovir

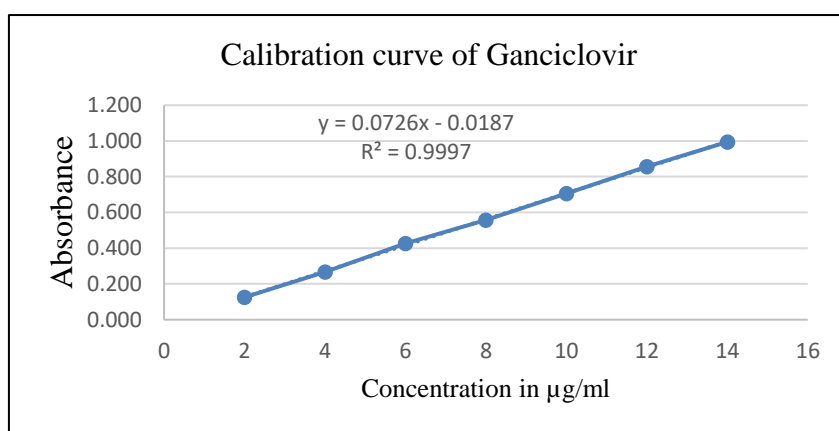**Figure (3).** Overly UV Spectra of Ganciclovir(2-14µg/ml)

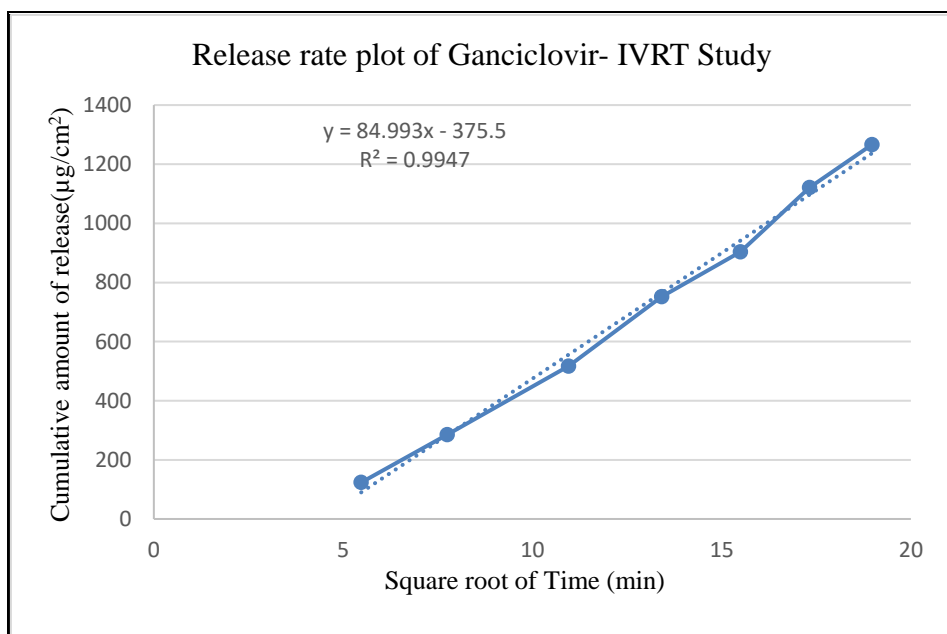**Figure (4).** Calibration curve of Ganciclovir at 252nm.

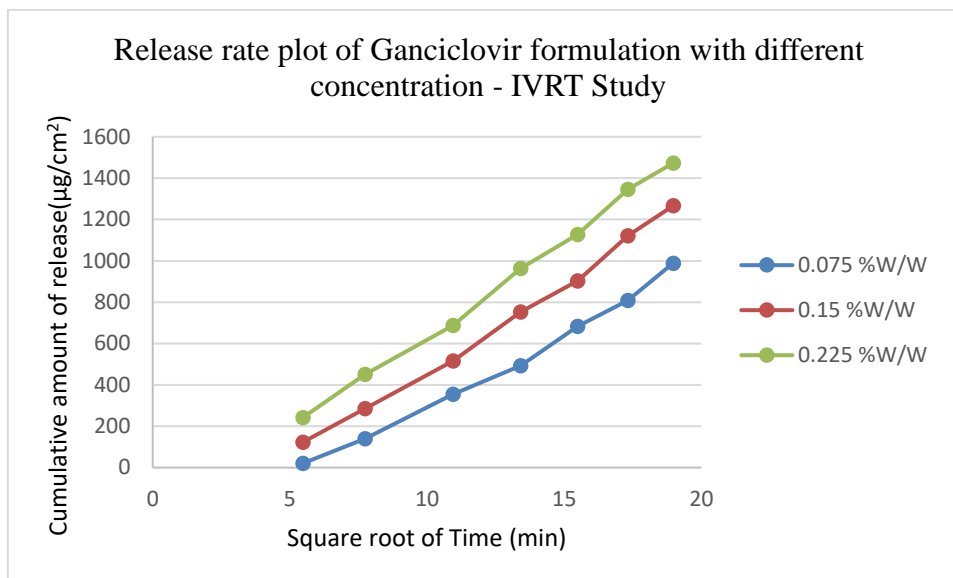**Figure (5).** Release rate plot of Ganciclovir- IVRT Study

Figure (6). Release rate plot of IVRT run for ganciclovir gel with different concentration
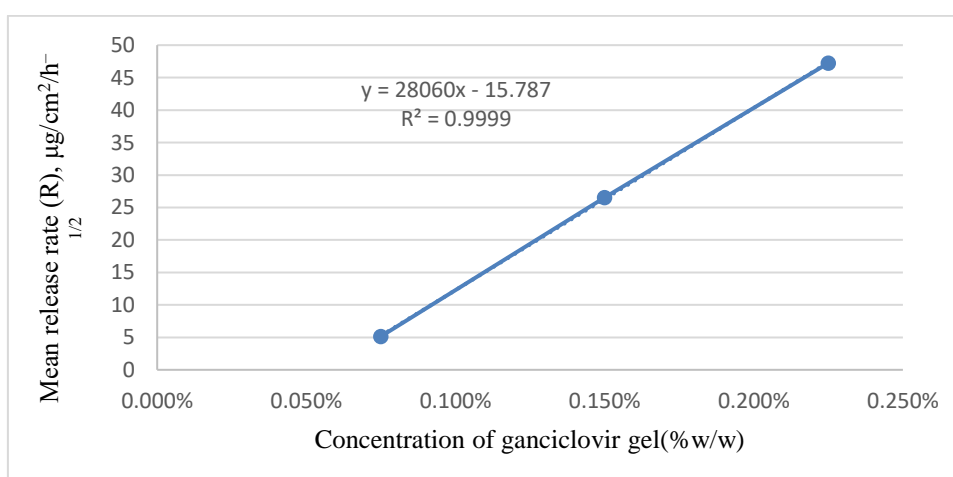

Figure (7). The plot of different ganciclovir concentration gel and their release rate
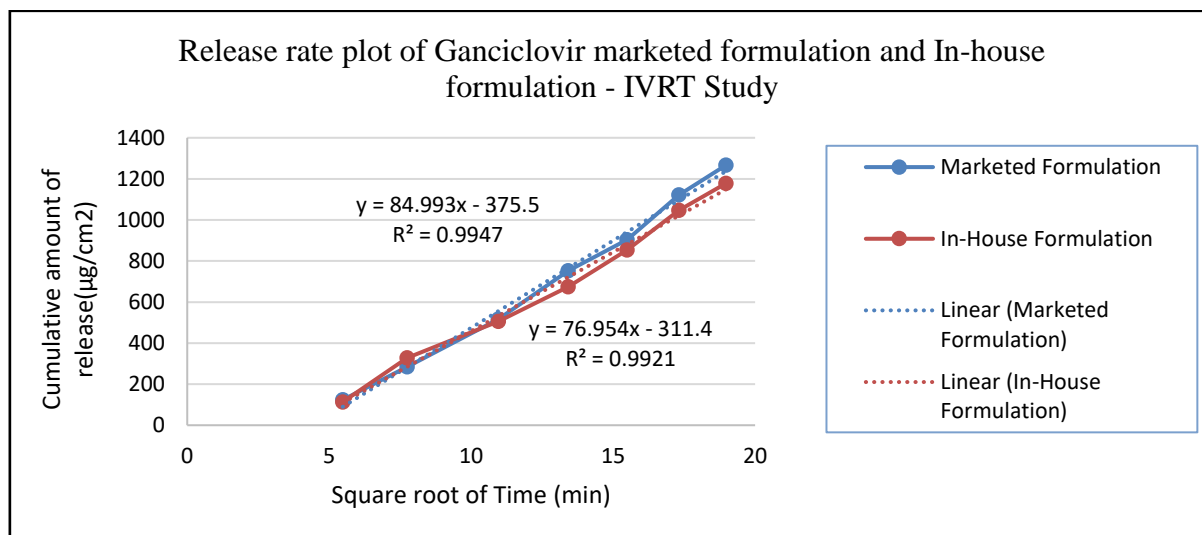
Figure (8). Comparative release rate plot for marketed and in-house ganciclovir formulations

Evolution and Advancements in Occlusion-Induced Stroke Models: From Foundational Techniques to Modern Innovations

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Abstract:

Stroke is a leading global health burden, requiring robust preclinical models to advance understanding of its mechanisms and develop effective treatments. Occlusion-induced stroke models in Wistar rats have emerged as a critical tool in experimental research, offering a close approximation of human ischemic conditions. This review traces the historical development and recent innovations in occlusion methodologies, emphasizing their significance in preclinical studies.

The origins of these models date back to the early 20th century, with Sir Charles Sherrington's carotid artery ligation experiments in dogs marking a pivotal starting point. Subsequent advancements, such as Koizumi et al.'s middle cerebral artery occlusion (MCAO) model in 1975 and Longa et al.'s refinement with intraluminal suture techniques in 1989, have significantly improved their reliability and reproducibility. Additional approaches, including bilateral common carotid artery occlusion (BCCAO), photothrombotic stroke induction, and endothelin-1-mediated occlusion, have expanded the experimental toolkit to meet diverse research needs.

Modern advancements emphasize precision and minimal invasiveness, with techniques like magnetically controlled occlusion and optogenetics gaining prominence. The integration of advanced imaging technologies, including MRI and CT, has further enhanced real-time monitoring of ischemic events, enabling deeper insights into stroke dynamics and recovery mechanisms.

This review underscores the importance of aligning occlusion models with specific research objectives while addressing their limitations and translational relevance. By examining the evolution and innovation of these methodologies, it offers valuable guidance for advancing preclinical stroke research.

 Key Words: Middle cerebral artery occlusion, Bilateral common carotid artery occlusion, Endothelin-1, Translational neuroscience.

1. INTRODUCTION:

Stroke remains a leading cause of morbidity and mortality worldwide, underscoring the critical need for effective preclinical models to study its pathophysiology and evaluate potential therapies (Xu et al., 2022). Among these, occlusion-induced stroke models in Wistar rats are extensively utilized due to their reproducibility, cost-effectiveness, and the well-characterized neuroanatomy of the species (Kim et al., 2021; Li & Zhang, 2020).

The middle cerebral artery occlusion (MCAO) model is particularly prevalent, as it closely mimics human ischemic stroke. This model can be induced using various techniques, including intraluminal filament occlusion, photo thrombosis, and endothelin-1 injection, each offering distinct advantages and

limitations. For instance, the intraluminal filament method allows for controlled reperfusion and is suitable for studying focal ischemic stroke and reperfusion injury. However, it may lead to variations in infarct size and is not ideal for thrombolysis research (Anderson et al., 2020; Smith & Jones, 2019).

Recent advancements have focused on refining these models to enhance their translational relevance. Studies have explored the impact of collateral therapeutics on stroke hemodynamic in Wistar rats, revealing that pressor therapy can increase collateral flow, potentially influencing stroke outcomes (Johnson et al., 2023). Additionally, optimizing the intraluminal monofilament model has been a subject of research, with findings indicating that specific filament sizes can induce larger infarcts, providing a more suitable model for certain studies (Taylor et al., 2021).

Understanding the evolution and current methodologies of occlusion-induced stroke models in Wistar rats is essential for selecting the appropriate model to address specific research objectives. This review aims to provide a comprehensive overview of these models, highlighting their historical development, technical advancements, and applications in preclinical stroke research.
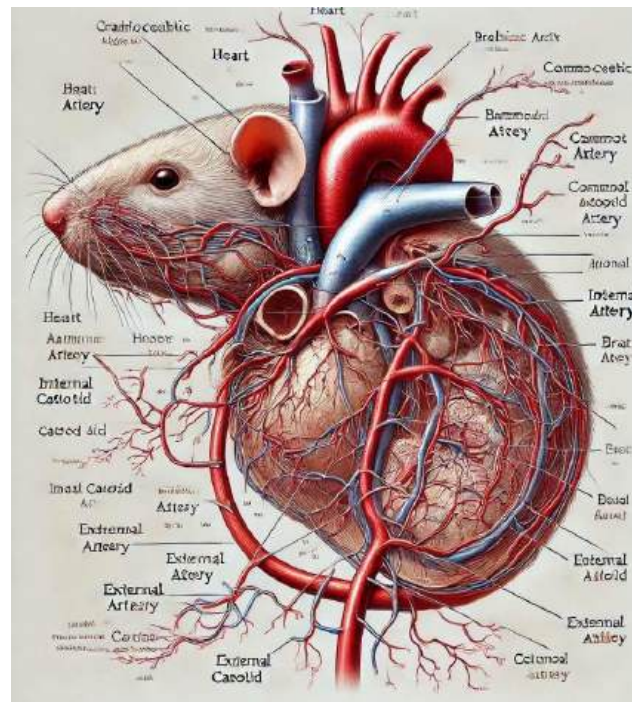
1.1 Anatomical Diagram of the Rat's Arterial System," generated by ChatGPT, showcasing the arterial pathway from the heart to the brain.

2. HISTORICAL BACKGROUND OF OCCLUSION METHODS

The development of occlusion methods for stroke modeling has evolved significantly over the past century, driven by advances in understanding cerebrovascular pathophysiology and the need for more precise and reproducible models. The following key milestones highlight this evolution:

- 1906: Sir Charles Sherrington in the United Kingdom developed the first experimental stroke model using carotid artery ligation in dogs. This pioneering work established the concept of inducing ischemia to study cerebrovascular disorders.

- 1950s: Fischer in the United States introduced focal ischemia models by mechanically obstructing the middle cerebral artery in rats. This was a pivotal shift towards using rodent models, which offered advantages such as genetic uniformity, cost-effectiveness, and wellcharacterized neuroanatomy.
- 1975: Koizumi et al. in Japan introduced the intraluminal filament technique for middle cerebral artery occlusion (MCAO). This method allowed for transient focal ischemia and reperfusion studies, quickly becoming the gold standard for ischemic stroke research.
- 1981: Watson et al. in the United States developed the photothrombotic stroke model, employing photosensitive dyes and focused light to induce localized ischemia. This innovation provided precise infarct control and reduced variability in lesion size.

These milestones underscore the iterative process of refining stroke models to enhance their translational relevance and reproducibility, forming the foundation for modern ischemic stroke research methodologies.

3 Key Occlusion Methods and Milestones

The study of ischemic stroke has significantly benefited from the development of occlusion methods in experimental models, each contributing unique insights into the pathophysiology of stroke and therapeutic evaluation. Below is an in-depth overview of the key occlusion methods and their milestones: Bilateral Common Carotid Artery Occlusion (BCCAO)

- Development and Purpose:
  The BCCAO method was developed in the mid-20th century as one of the earliest models to simulate global cerebral ischemia. This method involves ligation or temporary occlusion of both common carotid arteries to restrict blood flow to the brain, mimicking ischemic conditions affecting the forebrain.

- Advantages:
  o Simple and reproducible, making it a widely adopted model for studying vascular dementia, chronic cerebral hypoperfusion, and metabolic changes in the brain. o Cost-effective and requires minimal technical expertise compared to more complex models.

- Limitations:
  o Lacks specificity to focal ischemia, which limits its relevance to conditions like middle cerebral artery (MCA) stroke in humans.
  o Does not replicate reperfusion scenarios, which are critical in many ischemic stroke studies.
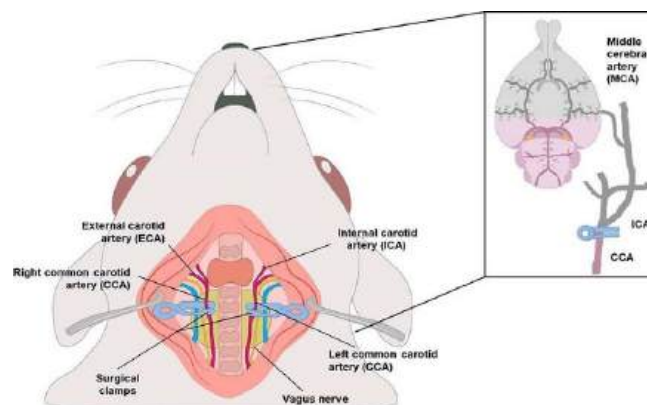
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Middle Cerebral Artery Occlusion (MCAO)

- Historical   Context:
  Refined by Longa et al. in 1989, the MCAO method is one of the most widely used models for studying focal ischemia. This method involves inserting an intraluminal filament to occlude the middle cerebral artery, either transiently or permanently, to simulate ischemic stroke.

- Methodology: o The filament is advanced through the internal carotid artery to block the MCA.
  o   Depending on the study design, reperfusion can be initiated by withdrawing the filament.
- Advantages:
  o Closely mimics human ischemic stroke pathology.
  o Suitable for studying both ischemic damage and reperfusion injury. o Allows for control over the duration and severity of ischemia.

- Limitations:
  o Variability in infarct size due to differences in animal anatomy and surgical expertise. o Risks of mechanical damage to blood vessels or adjacent brain regions.
  o Limited utility for conditions involving thrombolysis, as the occlusion is mechanical rather than thrombotic.

Photothrombotic Stroke Model

- Advancements:
  Introduced by Watson et al. in 1981, the photothrombotic stroke model leverages the interaction between photosensitive dyes (e.g., Rose Bengal) and focused light to induce localized ischemia through thrombus formation.

- Methodology: o A photosensitive dye is injected into the animal's circulation.
  - Focused light is directed at a specific brain region, activating the dye and causing localized clot formation and ischemia.

- Advantages: o Provides precise control over the location and size of the infarct.
  - Highly reproducible with minimal inter-animal variability.
  - Suitable for studies requiring well-defined infarct boundaries.

- Limitations:
  - Limited relevance to spontaneous or embolic stroke mechanisms in humans.
  - Not suitable for reperfusion studies, as the clot formed is permanent.
  - Potential for unintended thermal damage from focused light.

Chemical Induction Models

- Historical   Development:
  In the late 1990s, chemical induction models emerged as a non-invasive alternative for inducing ischemic stroke. Endothelin-1, a potent vasoconstrictor, is frequently used to temporarily reduce cerebral blood flow.

- Methodology: o Endothelin-1 is injected locally near the MCA or other cerebral arteries. o This induces vasoconstriction, leading to ischemia in the target region.
- Advantages: o Avoids mechanical manipulation of blood vessels, reducing the risk of injury.
    - o Provides a model for targeted and transient ischemia.
    - o Allows for minimally invasive induction of ischemic conditions.
- Limitations:
    o Variability in the size and severity of infarcts due to differences in vascular response. o Limited ability to control the duration of ischemia precisely. o Requires optimization for reproducibility in different experimental setups.

These methods have collectively advanced the field of ischemic stroke research, with each method offering distinct strengths and addressing specific experimental objectives. Continued innovations and refinements aim to enhance their translational relevance, bridging the gap between animal studies and clinical applications.

3. **Emerging Modern Techniques**

Advances in technology and research methodologies have paved the way for innovative approaches to studying stroke models. These emerging techniques address limitations of traditional models and provide more precise and clinically relevant data.

1. Magnetically Induced Occlusion (2000s)

This technique involves injecting magnetic particles into blood vessels, which are directed to specific locations using an external magnetic field. It allows for non-invasive induction of ischemia.

- Advantages:
    - o Minimizes surgical trauma.
    - o Enables controlled and reversible occlusion, suitable for reperfusion studies.
- Challenges:
    - o Specialized equipment and training are required. o Limited availability and high setup costs.

2. Real-Time Monitoring with Advanced Imaging Modalities

Modern imaging techniques such as functional magnetic resonance imaging (fMRI), diffusion tensor imaging (DTI), and CT perfusion have transformed stroke research. These modalities enable dynamic tracking of ischemia, infarct progression, and therapeutic responses in vivo.

- Applications:
    - o High-resolution mapping of ischemic zones.
    - o Longitudinal studies of neuroplasticity and repair mechanisms.
- Significance:
    - o Enhances translational potential by aligning preclinical observations with clinical imaging practices.

3. Optogenetics for Selective Neuronal Silencing

Optogenetics uses light-activated ion channels like channelrhodopsins, genetically expressed in neurons, to control their activity. This technique has gained traction in stroke research for its precision in targeting specific neural circuits.

- Advantages: o Allows selective activation or inhibition of neuronal populations. o Facilitates detailed exploration of ischemic pathophysiology.
- Limitations:
  - o Requires transgenic animal models. o High implementation costs and complexity.

4. Nanotechnology in Stroke Research

Nanotechnology is being used for targeted drug delivery to ischemic tissues. Nanoparticles designed for thrombolysis or neuroprotection enhance therapeutic efficacy while reducing systemic side effects.

- Impact: o Improved delivery of therapeutics across the blood-brain barrier. o Enhanced bioavailability and specificity.

5. Genetic and Molecular Approaches

The advent of molecular biology tools like CRISPR/Cas9 has enabled the exploration of gene function in stroke pathophysiology. Single-cell RNA sequencing allows for the characterization of cell populations in the ischemic brain at unprecedented resolution.

- Applications:
  - o Identification of novel therapeutic targets. o Insights into cellular heterogeneity and molecular responses post-stroke.

Significance of Emerging Techniques

These modern methods overcome many limitations of earlier models by offering precision, reproducibility, and translational relevance. Their integration into preclinical research not only enhances our understanding of stroke but also accelerates the development of effective therapies.

4. **Comparative Analysis**

Below is a comprehensive table summarizing key occlusion methods, their historical context, advantages, limitations, and translational relevance:

Year	Developer	Place	Method	Advantages	Limitations	Translational Relevance
1906	Sir Charles Sherrington	UK	Carotid Artery Ligation in Dogs	Simplistic approach; provided foundational understanding of ischemia.	Limited species relevance to humans; invasive and uncontrolled.	Low—served as a foundational method for later studies.

1950s	Fischer	USA	Focal Ischemia Model in Rats	First model focusing on focal ischemia; reproducible.	Mechanical obstruction was inconsistent; limited clinical simulation.	Moderate—introduced focal stroke modeling in smaller animals.
1975	Koizumi et al.	Japan	Intraluminal Filament MCAO	Gold standard for focal ischemia; precise and reproducible; allows transient/repermanent ischemia studies.	Requires expertise; risk of variability due to filament size/placement; moderate invasiveness.	High—translational relevance to human ischemic strokes.
1981	Watson et al.	USA	Photothrombotic Stroke	High control over infarct size and location; noninvasive.	Requires expensive equipment and photosensitive dyes; less reflective of spontaneous strokes.	Moderate—useful for testing localized therapies.
1990s	-	Global	Chemical Induction (e.g., Endothelin-1)	Transient ischemia achievable; avoids mechanical intervention; more physiological.	Limited repeatability; requires precise administration and dose adjustments.	Moderate—effective for pharmacological testing.
2000s	-	Global	Magnetically Induced Occlusion	Non-invasive and reversible; allows real-time occlusion monitoring.	Requires advanced equipment and expertise; limited to specific applications.	Moderate—potentially useful for reperfusion injury studies.
2010s	-	Global	Advanced Imaging Modalities	Provides dynamic, realtime monitoring of ischemia; highly precise infarct assessment.	High cost; requires imaging infrastructure; may not affect ischemia directly.	High—bridges preclinical research and human diagnostic imaging practices.

2020s	-	Global	Optogenetics	High precision in targeting specific neuronal circuits; non-invasive.	Requires transgenic models; expensive equipment and genetic tools.	Moderate to High—revolutionizes understanding of neural mechanisms in ischemia.
2020s	-	Global	Nanotechnology	Enables targeted drug delivery and enhanced efficacy; reduces systemic side effects.	Complex and costly; experimental phase with limited realworld application.	High—enhances therapeutic intervention specificity.
2020s	-	Global	Genetic Approaches (e.g., CRISPR)	Allows exploration of gene-specific effects on stroke; highly customizable.	Requires extensive resources and expertise; ethical considerations in genetic editing.	High—facilitates development of personalized therapies and genebased treatments.

Key Insights from Comparative Analysis

1. Evolutionary Progress: Early methods like carotid artery ligation provided foundational knowledge, while modern techniques emphasize precision and translational relevance.
2. Trade-offs: Each method has distinct advantages and limitations; selection depends on research goals (e.g., pathophysiological understanding vs. therapeutic testing).
3. Technological Integration: Emerging methods like advanced imaging and genetic approaches are more aligned with human stroke pathology, improving the potential for clinical translation.

5. **Challenges and Future Directions**

The study of stroke using occlusion models has provided invaluable insights into ischemic pathophysiology and therapeutic targets. However, several challenges remain, particularly in ensuring reproducibility, clinical translation, and ethical viability. Emerging advancements offer opportunities to address these limitations and shape future directions in stroke research.

1. Limitations in Reproducibility and Clinical Translation

- Challenge:
  - o Variability in experimental protocols and biological factors affects reproducibility across laboratories.
  - o Differences in vascular anatomy between animal models and humans hinder direct clinical applicability.
- Impact: o Inconsistent results reduce the reliability of preclinical findings.
  - o Translational gaps limit the success of stroke therapies in clinical trials.

- Future Direction:
  - o Standardizing experimental protocols and ensuring consistency in model use. o Incorporating humanized models, such as genetically modified animals or organoids, to better mimic human stroke pathology.

2. The Role of Genetics and Personalized Medicine in Preclinical Research

- Challenge:
  - o Stroke involves a complex interplay of genetic, environmental, and lifestyle factors, which are difficult to replicate in conventional models. o Most preclinical studies do not account for individual genetic variability or personalized responses to treatment.
- Advancements:
  - o Technologies like CRISPR/Cas9 enable precise manipulation of genes to study their role in stroke. o Single-cell RNA sequencing allows detailed mapping of molecular changes during ischemia.
- Future Direction:
  - o Utilizing patient-derived induced pluripotent stem cells (iPSCs) for personalized stroke modeling.
  - o Exploring population-specific genetic risk factors to design targeted therapies.

3. Ethical Considerations and Advancements in Non-Invasive Models

- Challenge:
  - o Traditional models involve invasive procedures, raising ethical concerns about animal welfare. o Regulatory frameworks are becoming increasingly stringent, emphasizing the need for humane alternatives.
- Advancements:
  - o Non-invasive techniques like magnetically induced occlusion and optogenetics offer alternatives with reduced animal distress. o In silico models and computational simulations provide insights without requiring live animal studies.
- Future Direction:
  - o Developing advanced organ-on-chip platforms that replicate cerebrovascular dynamics. o Promoting the adoption of 3Rs principles (Replace, Reduce, Refine) to minimize animal use while maximizing scientific output.

4. Integration of Multimodal Approaches

- Future Potential:
  - o Combining advanced imaging modalities with genetic and molecular tools to provide comprehensive insights into ischemic pathophysiology. o Integrating artificial intelligence and machine learning for data analysis to identify patterns and predict outcomes.

6. Country-Specific Contributions to Stroke Occlusion Research

The global progress in occlusion-induced stroke research is marked by significant contributions from various countries, reflecting their focus on instrumentation, methodology, and publication efforts.

1. Instrumentation and Technological Development

- United States:

- o Pioneered advanced surgical instruments and imaging technologies such as MRI and CT, widely used for real-time monitoring during experimental occlusion models.
- o Companies like Bruker and Medtronic have driven innovation in preclinical stroke research tools. ☐ Germany and Switzerland:
- o Leaders in manufacturing precise lasers and photothrombotic equipment, enhancing the reliability of photothrombotic stroke models.

2. Methodological Advancements

- • China:
  - o Recent surge in method optimization, focusing on genetic manipulation and use of patient-derived iPSCs for personalized stroke models. o A leading contributor to low-cost yet high-precision methodologies.
- • Europe (Germany, France, UK):
  - o Significant advancements in optogenetics and photothrombotic stroke models. o Collaborative projects under the European Union have set new benchmarks for ethical research.

3. Publication Trends

- • United States:
  - o Leads globally in the number of research papers on occlusion-induced stroke models, with journals like Stroke and Journal of Cerebral Blood Flow and Metabolism.
- • China:
  - o Second-highest number of publications, driven by government funding and increased emphasis on translational research.
- • Europe:
  - o Germany and the UK are prominent contributors, focusing on translational relevance and clinical applications.

Collaborative Efforts and Trends

- • Global partnerships, such as the International Stroke Conference and EU-funded research projects, have accelerated the sharing of knowledge and resources, bridging gaps between countries.
- • The USA and Europe remain dominant in funding and publishing, while emerging countries like China and India are making substantial contributions in recent years.

Conclusion

This analysis underscores the critical role of international efforts and technological advancements in shaping occlusion-induced stroke research. The interplay of high-end instrumentation from developed nations and methodological innovations from emerging economies offers a holistic approach to understanding and treating stroke.

Country-Specific Contributions by Scientists and Research Output

The contributions of individual scientists and research groups to occlusion-induced stroke models vary significantly by country, reflecting their focus on scientific output and innovation. Below is an analysis of countries where scientists have made maximum contributions:

1. Maximum Research Output by Country

- United States:
  o Leading Scientists:
    - Michael A. Moskowitz (Harvard Medical School): Pioneering research in MCAO models and neuroprotection.
    - Marc Fisher (UMass Chan Medical School): Focus on translational stroke research. o Research Trends:
    - The USA produces the highest number of research papers in the field, emphasizing both basic and translational stroke studies.
    - Journals like Stroke and Brain Research frequently feature top-tier publications from American institutions. o Institutional Leadership:
    - NIH-funded centers like the National Institute of Neurological Disorders and Stroke (NINDS) support significant preclinical stroke research.

- China:
  o Leading Scientists:
    - Yongjun Wang (Capital Medical University): Focus on clinical translation and experimental models.
    - Liping Liu (Beijing Tiantan Hospital): Contributions to ischemia modeling and stroke management.
  o Research Trends:
    - Rapid growth in publications, particularly in journals like Frontiers in Neurology and International Journal of Stroke.
    - Emphasis on genetic and molecular approaches in occlusion models.

- Japan:
  o Leading Scientists:
    - Koizumi K. (Nagoya University): Developer of the intraluminal suture technique for MCAO.
    - Kiyohiro Houkin (Hokkaido University): Advanced imaging and intervention studies. o Research Trends:
    - Japan has made foundational contributions, with its work on MCAO and photothrombotic models serving as a benchmark in stroke research.

- Germany: o Leading Scientists:
    - Johannes Boltze (Leipzig University): Translational stroke research focusing on imaging and neuroprotection.
    - Andreas Meisel (Charité – Universitätsmedizin Berlin): Studies on immune responses in stroke.
  o Research Trends:
    - Known for precision in experimental models and robust ethical research frameworks.
    - High-quality output in journals such as Journal of Cerebral Blood Flow and Metabolism.

- India:
  o Emerging Scientists:
    - S. K. Shukla (AIIMS, Delhi): Work on cost-effective stroke models and neuroprotection.

        □ B. S. Sapkal (NIPER, Mohali): Research on phytoconstituents in ischemia-induced stroke.
- o Research Trends:
  - □ Increasing publications, with a focus on affordable methodologies and phytotherapeutics.

2. Key Metrics

- • Number of Publications:
  - o USA > China > Germany > Japan > UK > India.
- • Top Scientists' Contributions:
  - o USA and Japan dominate in landmark innovations (e.g., MCAO, photothrombotic models).
  - o China and India are growing in translational relevance and affordability.

Conclusion

The USA leads in stroke research output and influential scientists, with significant contributions also from China, Japan, and Europe. Emerging nations like India are making strides in low-cost, high-impact research. Collaborative global efforts are crucial to leveraging these diverse strengths for advancing stroke research and treatment.

The evolution of occlusion methods has been instrumental in advancing our understanding of stroke pathophysiology and therapeutic interventions. From the earliest carotid artery ligation experiments by Sir Charles Sherrington in 1906 to the advent of modern techniques like optogenetics and nanotechnology, each milestone has addressed critical research questions while paving the way for more sophisticated approaches.

Early methods, such as carotid artery ligation and mechanical obstruction of the middle cerebral artery, provided foundational insights but were limited by low reproducibility and clinical relevance. The introduction of focal ischemia models, such as the intraluminal filament technique and photothrombotic models, revolutionized stroke research by offering precise control over infarct location and severity. Recent advancements, including genetic editing tools like CRISPR, patient-derived iPSCs, and organ-on-chip platforms, have significantly enhanced the translational relevance of preclinical studies, bringing them closer to human stroke pathology.

These methods have collectively enabled the discovery of neuroprotective agents, improved understanding of ischemic cascade mechanisms, and facilitated the exploration of post-stroke recovery processes. Emerging tools, such as advanced imaging and artificial intelligence, are expected to further refine stroke research by providing dynamic, real-time insights and predictive models.

The continued refinement of occlusion methods, coupled with multidisciplinary innovations, holds immense promise for addressing the unmet clinical needs in stroke management. By bridging the gap between experimental models and clinical realities, these approaches will shape the future of stroke therapeutics, ultimately improving patient outcomes and quality of life.

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THE ROLL OF CLOUD COMPUTING SERVICES IN LIBRARY AND INFORMATION CENTER: AN OVERVIEW

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ABSTRACT: *The purpose of this paper is to provide an overview of current uses of cloud computing services in library and information center. Cloud Computing is a rapidly evolving field that has garnered significant attention in library and information center, particularly with its increasing adoption in libraries and other sectors. Library is known as a storage house of knowledge and people do not ignore the importance of library. Big data can be stored at library websites and their virtual resource and that data is to be safely stored with the help of cloud computing technology. Now-a-days information is available only on online and in digital format and the need of information is high. Cloud computing technology is a technology which provides a virtual platform on the library websites and manages all the data which is accessible promptly by using internet. Big data handling is easy with the help of using cloud computing technology in library and information center.*

KEYWORDS: *Cloud computing, Cloud Computing services, Role of cloud computing in library*

INTRODUCTION:

After the PC and the Internet, cloud computing is a completely new technology and is referred to as the third revolution. Distributed databases, parallel computing, and distributed computing are all improved by this technology. Among these, cloud computing forerunners include grid and utility computing. The primary purpose of libraries, especially those with digital collections, is to store huge digital files on local server infrastructure for data storage in the cloud. It is necessary to duplicate, preserve, and reproduce the files for users. Both bandwidth control and data integrity may be strained as a result. Although moving data to the cloud may seem like a big step, it is thought that libraries would have some control over the data. Cloud computing, also known as remotely located IT infrastructure, frequently gives users more capacity and requires less upkeep and updates, and it has become more widely accepted among libraries.

WHAT IS CLOUD COMPUTING?

The term "cloud computing" describes the provision of computer services, such as networking, storage, processing power, and software programs, via the internet. Through a cloud provider, consumers can access and use these resources whenever they need them, eliminating the need to buy

and maintain physical gear and infrastructure. This enables companies or individuals to scale their use of computing resources up or down according to their needs and does away with the need to maintain costly equipment.

CHARACTERISTICS OF CLOUD COMPUTING

- **ON-Demand Self Services:**

Without assistance from the service provider, users are able to provision and manage computer resources (such as storage or processing power) as needed.

- **Broad Network Access:**

Any device with internet connectivity can access cloud services thanks to their availability over the internet.

- **Resource Pooling**:

To pool computing resources, such servers and storage, which are dynamically, distributed to customers according to demand, providers employ multi-tenant models.

- **Quick Elasticity:**

Users can only pay for what they use thanks to the ability to swiftly scale up or down resources to meet changing demand.

- **Measured Service**:

Pay–as-you-go models, which are commonly used in cloud computing, allow users to only pay for the resources they utilize, making it affordable for companies of all sizes.

TYPES OF CLOUD COMPUTING

Three main service models are used to classify cloud computing:

1. **Infrastructure as a Service (IaaS):**
   Offers internet based virtualized computer resources. User can rent networks, storage, and virtual computers. Examples of providers include Google Cloud, Microsoft Azure, and Amazon Web Services (AWS).
2. **Platform as a Service (PaaS):**
   Provides an environment and platform that let developers create, launch, and maintain apps without having to worry about the supporting infrastructure. Examples of providers are Google App Engine and Heroku.
3. **Software as a Service (SaaS):**
   Provides software programs via the internet with a subscription model. These apps are accessible to users via a browser and don't require installation or upkeep. Drop box, Microsoft 365, and Google Workspace are a few examples of suppliers.

DEPLOYMENT MODELS IN CLOUD COMPUTING

Cloud computing also has different deployment models, which determine how cloud services are made available:

1. **Public Cloud**:
   A third-party provider owns and runs the cloud's resources, which are shared by other users. For many enterprises, public clouds are usually the most economical choice. For instance, Microsoft Azure, Google Cloud, and AWS.
2. **Private Cloud:**
   Cloud infrastructure offers greater control and security because it is devoted to a single company. Large enterprises with strict data privacy needs frequently employ private clouds.
3. **Hybrid Cloud:**

Combines both public and private clouds, allowing data and applications to be shared between them. This provides greater flexibility and more deployment options.

4. **Community Cloud:**
Shared infrastructure is used by a specific group of organizations that have common concerns, such as security or compliance.

Role of Cloud computing in libraries:

After the PC and the Internet, cloud computing is a brand-new technology that is referred to be the third revolution. Distributed databases, grid computing, parallel computing, and cloud computing are all improved by cloud computing. These include utility and grid computing, which are regarded as cloud computing predecessors. Libraries stand to benefit greatly from cloud computing. More and more content may be added to the loud by libraries. Through the use of cloud computing, a user might peruse a physical book, CD, or DVD shelf, select an item, or scan a bar code on his smart phone. Any researcher would have access to all rare and historical documents that have been scanned into an extensive database that is simple to search. Online catalogues are already available for many libraries.

Storage of data One of the primary functions of libraries, especially those with digital collections, is cloud computing. Large digital file storage might put a strain on local server infrastructures. The files must be preserved, backed up, and duplicated for users. Both bandwidth hogging and data integrity pressure may result from this. Some library workers may be taking a risk by moving their data to the cloud. Although it is a new technology, it is initially thought that libraries will have some control over these collections or data. However, it could enhance library storage options with quicker response times for patron requests and more local server capacity. Remotely located IT infrastructure, such as cloud computing, frequently offers users more capacity and reduces the need for upgrades and maintenance.

ADVANTAGES OF CLOUD COMPUTING IN LIBRARIES

a. **Economy of Cost**
   i. **Lower Infrastructure Costs**: Libraries no longer have to spend money on and maintain pricey physical servers and data centers thanks to cloud computing. Instead, libraries can purchase cloud services on a usage or subscription basis.
   ii. **Scalability**: Without having to worry about over- or under-provisioning resources, libraries can adjust their infrastructure to meet present demand.
   iii. **Lower Maintenance and Support Costs**: By taking care of software upgrades, security patches, and system maintenance, cloud providers relieve library employees of some of their workload.
b. **Enhanced Usability**
   i. **Remote Access**: Library resources, including as databases, online catalogs, and digital collections, can be accessed remotely by staff and patrons from any location with an internet connection.
   ii. **Availability**: Cloud services offer library systems 24/7 access, guaranteeing that users can access services like e-books, digital
c. **Improved Cooperation**
   i. **Shared Resources**: Cloud platforms make it simple for libraries to collaborate and share documents and projects, promoting cooperative cataloguing efforts, interlibrary collaborations, and the sharing of digital resources.
   ii. **Simple Data Sharing**: Despite working from separate locations, library employees can easily access centralized data in real time, share records, and cooperate on digital projects.

d. **Disaster Recovery and Data Security**
    i. **Backup and Recovery**: Cloud services frequently come with automated backup and disaster recovery plans, which aid libraries in protecting important data such as user data, digital archives, and catalog information.
    ii. **Compliance and Encryption**: Prominent cloud providers adhere to industry- standard security protocols, guaranteeing data protection via access restriction, encryption, and other measures.

e. **Flexibility and Scalability**
    i. **Adaptable to Growth**: Cloud services may be readily expanded to accommodate additional users, add new features to library management systems, or increase storage space for digital collections in order to satisfy the expanding needs of libraries.
    ii. **Adaptability in Resource Usage**: Libraries can modify cloud-based services to meet their evolving requirements, such as introducing new software programs or modifying server capacity during peak demand or special events.

f. **Effective Management of Resources**
    i. **Centralized Resource Access**: Libraries may consolidate their digital material, catalog, and other resources into a single, easily accessible system by utilizing cloud platforms. This can enhance user experience and expedite processes.
    ii. **Automated Updates**: The service provider usually updates cloud-based library systems automatically, guaranteeing that libraries always have the newest security and functionality.

g. **Encouragement of Digital Transformation**
    i. **Integration with Emerging Technologies**: Cloud computing facilitates the incorporation of cutting-edge technologies such as data analytics, machine learning, and artificial intelligence (AI). These technologies can be utilized by libraries to enhance personalization, improve search functionality, and provide users with intelligent recommendations.
    ii. **Support for Digital Media and E-books**: Libraries may readily incorporate cloud- based digital collections to provide their patrons with digital journals, audio books, and e-books.

h. **Advantages for the Environment**
    i. **Energy Efficiency**: Cloud data centers frequently use less energy than on-premise data centers. Libraries can support sustainability initiatives by lowering the carbon footprint of maintaining substantial physical infrastructure by moving to the cloud.

i. **Improved User Experience**
    i. **Better Search and Retrieval**: Cloud-based library systems can provide faster information retrieval, better indexing, and more sophisticated search features.
    ii. **Mobile Access**: By utilizing cloud computing, libraries are able to create mobile applications that facilitate user interaction by offering digital resource access, account management, and event scheduling.

j. **Legal Advantages and Compliance**
    i. **Data Privacy Compliance**: Cloud providers frequently provide services that adhere to regional data privacy laws or international standards and regulations like GDPR and HIPAA, which aids libraries in responsibly managing sensitive patron data.
    ii. **Licensing and Copyright Management**: By utilizing cloud-based technologies made to manage these difficulties, libraries can more effectively manage digital content licensing and guarantee adherence to copyright rules.

k. **Preparing for the Future**
    i. **Innovation and Upgrades**: Cloud providers make sure that libraries always have access to the newest tools without having to spend money on new software or hardware by frequently updating and innovating their products.
    ii. **Access to New capabilities and Services**: Libraries may remain at the vanguard of the digital era by using cloud computing to gain access to cutting-edge technology

   iii. like big data analytics, machine learning models, and sophisticated search capabilities.

l. Community Engagement

   i. **Online Communities and Services**: Libraries can communicate with their customers, hold webinars, and offer virtual learning environments by utilizing the social and community engagement features that cloud-based platforms frequently include.

   ii. **Public Access to Cloud Tools**: Libraries can make cloud-based programs (such word processors, spreadsheets, and design tools) available to the general public, giving people the opportunity to learn

EXAMPLES OF CLOUD LIBRARIES:

1. OCLC
2. Library of Congress (LC)
3. Exlibris
4. Polaris
5. Scribd
6. Discovery Service
7. Google Docs / Google Scholar
8. WorldCat
9. Encore

CONCLUSION:

By reducing the need for innovators to locate resources for development, testing, and making inventions accessible to the user community, cloud computing fosters creativity. Instead of concentrating on the logistics of locating and overseeing the resources that allow for innovation, innovators are free to concentrate on the innovation itself. Staff members at libraries should research cloud computing determines its possible benefits and drawbacks, and look into how it might be used to suit the needs of certain institutions. They should understand that while cloud computing can enhance library services and workflows, cloud services are not the same as library services.

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શૈક્ષણિક ક્ષેત્રે આર્ટિફિશિયલ ઇન્ટેલિજન્સ (AI) નો ઉપયોગ

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સંક્ષેપ

શૈક્ષણિક ક્ષેત્રે આર્ટીફીશીયલ ઇન્ટેલીજન્સ (એઆઇ) અંગેના અભ્યાસમાં વધારો થતા આ ક્ષેત્રના ઘણા વિદ્વાનોનું માનવું છે કે શિક્ષણમાં શિક્ષકો, શાળા અને શિક્ષણ ક્ષેત્રે જોડાયેલાં દરેક ની ભૂમિકા બદલાશે. આ સંદર્ભમાં, આ અભ્યાસનો હેતુ એ તપાસવાનો છે કે શિક્ષણમાં એઆઇના ઉપયોગથી અને તે શાળાઓના ભવિષ્ય માટે કેવા પ્રકારની અસરો થશે, આ સંશોધનને ઘટનાત્મક અભ્યાસ, ગુણાત્મક સંશોધન પદ્ધતિ માં અભ્યાસ કરવામાં આવ્યો હતો, જેમાં વિવિધ ક્ષેત્રોના નિષ્ણાંતો ના અભિપ્રાયોની તપાસ કરવામાં આવી હતી. પરિણામો દર્શાવે છે કે શાળાઓ અને શિક્ષકો પાસે નવા ઉત્પાદનો, લાભો હશે અને શિક્ષણમાં એઆઇના ના ઉપયોગની સાથે ખામીઓનો પણ સામનો કરવો પડશે. તારણો એઆઇના ઉપયોગ અને સંભવિત સમસ્યાઓના નિવારણ માટેના કેટલાક સૂચનો દર્શાવે છે. જ્યારે સહભાગીઓ સામાન્ય રીતે એઆઇ પ્રત્યે હકારાત્મક ધારણાઓ ધરાવતા હોય તેવું લાગે છે, ત્યાં કેટલીક ખામીઓ પણ છે, ખાસ કરીને શિક્ષકો અને શિક્ષણવિદો દ્વારા શિક્ષણના ભવિષ્ય અંગે પ્રકાશિત કરવામાં આવી છે. જ્યારે ઇજનેરો એઆઇને શિક્ષણ ક્ષેત્રમાં બધા માટે ગુણવત્તા સુધારવાના સાધન તરીકે જુએ છે. નવી ટેકનોલોજીથી શિક્ષણ ક્ષેત્રે હમેશા ક્રાંતિ આવી છે. એ આઇ શિક્ષણ માં જરૂર ઉપયોગી થશે.

પ્રસ્તાવના

પરિચય આર્ટિફિશિયલ ઇન્ટેલિજન્સ (એઆઇ), સામાન્ય રીતે સામાન્ય લોકો દ્વારા માનવોની જેમ વિચારવા અને કાર્ય કરવાની મશીનો અથવા કમ્પ્યુટરની ક્ષમતા તરીકે વ્યક્ત કરવામાં આવે છે, તે માનવ મન અને ક્રિયાઓનું અનુકરણ કરવા માટે કમ્પ્યુટરાઇઝ્ડ સિસ્ટમ્સ તરફના પ્રયત્નોનું પ્રતિનિધિત્વ કરે છે. તે આપણા જીવનમાં વિવિધ કાર્યો અને આકારોમાં પ્રવેશ કરી શકે છે. એનજી (2017) દાવો કરે છે કે આર્ટિફિશિયલ ઇન્ટેલિજન્સ આ યુગની નવી વીજળી છે. આર્ટિફિશિયલ ઇન્ટેલિજન્સ એ એક એવો ઉમેદવાર છે જેને પાંચમી ઔદ્યોગિક ક્રાંતિના મૂળભૂત બિલ્ડિંગ બ્લોક તરીકે રજૂ કરવામાં આવે છે, જે તેની સંભવિતતા સાથે આર્થિક વિકાસને સુનિશ્ચિત કરવામાં પોતાને એક શક્તિશાળી પરિબળ તરીકે પ્રદાન કરે છે .એઆઇથી થતી તેની કમાણીને અનુરૂપ, ચીન 2030 સુધીમાં તેના કુલ ઘરેલું ઉત્પાદન (જીડીપી) માં 26% (7 ટ્રિલિયન ડોલર) નો વધારો કરે તેવી અપેક્ષા છે. આ જ સમયગાળામાં આ આંકડાઓ કૃત્રિમ બુદ્ધિમત્તાના વધારાના મૂલ્ય અને વૈશ્વિક પ્રભાવને ભવિષ્યના અર્થતંત્ર માટે, અને આપણા કિસ્સામાં, શિક્ષણના ભવિષ્ય માટે વધુ સમજી શકાય તેવું બનાવે છે, જે બદલામાં, અર્થતંત્ર અને કાર્યબળને નિર્દેશિત કરે છે, અને નવી ઔદ્યોગિક ક્રાંતિ માટેનો માર્ગ મોકળો કરે છે. કૃત્રિમ બુદ્ધિમત્તાનો ઊંડાણપૂર્વકનો વિકાસ, વ્યાપક અર્થમાં સામાજિક વ્યવસ્થાના પુનર્ગઠનથી માંડીને વર્ગો અને શાળાઓમાં શિક્ષણ અને વહીવટ પ્રક્રિયાઓ સુધીની ઘણી પરિસ્થિતિઓને અસર કરશે. જે શાળાઓ ડિજિટલ યુગને અનુકૂળ થવાની અપેક્ષા રાખે છે અને તેમના મુખ્ય એજન્ડામાં 21 મી સદીના કૌશલ્યોને સમાવિષ્ટ કરે છે તે કેટલીક મુખ્ય

સંસ્થાઓ છે જે કૃત્રિમ બુદ્ધિના વિકાસથી સૌથી વધુ પ્રભાવિત થઈ શકે છે. કાર્તિ (2019) જણાવે છે કે ટેકનોલોજીના નવા સ્વરુપો આપણા જીવનમાં ભરાશે અને આપણા યુવાનોને મોહિત કરશે, અને આ કેસ શાળાઓને તેમના માટે જગ્યા બનાવવા સિવાય કોઈ વિકલ્પ છોડતો નથી. આ સંદર્ભમાં, કાયદા, વ્યવસાય, શિક્ષણ અને ઇજનેરીના હિસ્સેદારો આ વિકાસને કેવી રીતે જુએ છે, અને તેઓ શિક્ષણના સંદર્ભમાં કૃત્રિમ બુદ્ધિની આગાહી કેવી રીતે કરે છે તે આ અભ્યાસનું કેન્દ્ર બનાવે છે. આમ, આ અભ્યાસનો હેતુ એ તપાસવાનો છે કે શિક્ષણમાં કૃત્રિમ બુદ્ધિના ઉપયોગનો અર્થ શું છે અને તે શિક્ષણના ભવિષ્ય માટે કેવા પ્રકારની અસર જાહેર કરી શકે છે.

એવું કહી શકાય કે શાળાઓ 'ઝડપી વર્ગો' બની ગઈ છે જે ટૂંકા સમયમાં પરિણામો ઉત્પન્ન કરે છે.

પરંતુ, શું આ 'ફાસ્ટ ક્લાસિસ' આવું કરવાનું ચાલુ રાખશે કે પછી 21મી સદીમાં અલગ રીતે વિચારવાની જરૂર પડશે? જેમ જેમ આપણે 22 મી સદી તરફ આગળ વધીએ છીએ, તેમ તેમ શું કુશળતા, વિવેચનાત્મક વિચારસરણી અને મેટાકોગ્નિશન કુશળતા પ્રદાન કરવા માટે તે પૂરતું છે? અથવા આપણે નવી સિસ્ટમો ગોઠવવી જોઈએ કે જેના વિશે નવા યુગ માટે પહેલાં ક્યારેય વિચાર્યું ન હોય? કૃત્રિમ બુદ્ધિ શિક્ષણમાં કઈ તકો પ્રદાન કરી શકે છે જે લોકોને રોબોટ્સ અથવા સ્માર્ટ વાહનોથી અલગ પાડશે અને મનુષ્યને તેમના ભાવનાત્મક અને સામાજિક પાસાઓને રાખવામાં મદદ કરશે? સંભવતઃ ટૂંક સમયમાં, આ વિષયો નીતિ ઘડવૈયાઓ અને આ ક્ષેત્રના અમલીકરણકર્તાઓનો મુખ્ય એજન્ડા બની જશે; એઆઈ ખરેખર શિક્ષકોનું સ્થાન લઈ શકે છે કે નહીં તે પૂછવાની ચર્ચાઓ પહેલેથી જ ચાલી રહી છે (જુઓ, ફેલિક્સ, 2020). મેનિકા એટ અલ. (2017) ભારપૂર્વક જણાવે છે કે સારા શિક્ષકો ભવિષ્યમાં પણ અસ્તિત્વમાં રહેશે, વિદ્યાર્થીઓની ભાવાત્મક બુદ્ધિ, સર્જનાત્મકતા અને સંદેશાવ્યવહારને વેગ આપવા માટે રચાયેલ વર્ગો ભણાવશે. હકીકતમાં, આ લેખકોના મતે, કૃત્રિમ બુદ્ધિ અને ઓટોમેશનના વિકાસ ખરેખર 'લોકોને વધુ માનવ' બનાવશે. આર્ટિફિશિયલ ઇન્ટેલિજન્સ પર શિક્ષણમાં કૃત્રિમ બુદ્ધિનો ઉપયોગ શિક્ષણને વધુ વ્યક્તિગત બનાવશે, અસરકારક શિક્ષણ અનુભવો પ્રદાન કરશે, વિદ્યાર્થીઓને તેમની પ્રતિભા શોધવા માટે સક્ષમ બનાવશે, તેમની સર્જનાત્મકતામાં સુધારો કરશે અને શિક્ષકોના કામના ભારણને ઘટાડશે. એવું કહેવામાં આવે છે કે, ત્યાં વિપરીત વિચારો પણ છે. શિક્ષકોની ભૂમિકાઓને કમ્પ્યુટર્સમાં સ્થાનાંતરિત કરવી એ કૃત્રિમ બુદ્ધિ પરના અભ્યાસમાં જોખમ તરીકે જોવામાં આવે જોકે તાજેતરના સમયમાં શિક્ષણમાં આર્ટિફિશિયલ ઇન્ટેલિજન્સ અભ્યાસોએ ઘણું ધ્યાન આકર્ષિત કર્યું છે, સામાન્ય કૃત્રિમ બુદ્ધિમત્તાના સિદ્ધાંત વિશેના અભ્યાસો ઓછામાં ઓછા 14 મી સદીમાં શોધી શકાય છે, અને આ અભ્યાસો શિક્ષણ સાથે ભાવિ ભવિષ્યમાં ધરખમ ફેરફાર થશે અને મદદ પણ થશે, આપણે સંગઠનાત્મક વ્યવસ્થાપનમાં એઆઈ અભ્યાસોના વિસ્તરણને જોઈએ છીએ કારણ કે સાહિત્યમાં 'આર્ટિફિશિયલ ઇન્ટેલિજન્સ લીડરશીપ' ની ચર્ચા થવા લાગી છે, શિક્ષણમાં કૃત્રિમ બુદ્ધિના વધુ ઉપયોગ સાથે, શિક્ષણ પ્રણાલીઓ અને તેની પ્રક્રિયાઓમાં મોટા પરિવર્તનોની આગાહી કરી શકાય છે. અભ્યાસના પરિણામોના આધારે, સેકેરોગ્લુ, ડિમિલર અને ટુંકલ (2019) એ જણાવ્યું હતું કે કૃત્રિમ બુદ્ધિ શિક્ષકોને તેમના વિદ્યાર્થીઓ માટે વ્યક્તિગત શિક્ષણમાં સુધારો કરવામાં મદદ કરી શકે છે. કૃત્રિમ બુદ્ધિમત્તા બાકાત રાખવામાં આવેલા લોકો અને સમુદાયો માટે યોગ્ય અને વધુ સારી શીખવાની તકો પ્રદાન કરી શકે છે, એ આઈ સાથે શિક્ષણ ક્ષેત્રનું ભવિષ્ય ઉજળું બને તેવા પ્રયત્ન હંમેશા કરવામાં આવ્યા છે. અને તેનાથી શિક્ષણ ક્ષેત્રમાં પરિવર્તન આવશે જે ભાવિ ભવિષ્યના માટે હિતકારી રહેશે.

સંશોધનપદ્ધતિ

પ્રસ્તુત અભ્યાસ જે ગુણાત્મક સંશોધન પદ્ધતિ થી કરવામાં આવ્યો ક્લોઝછે. જ્યારે કોઈ સમસ્યા અથવા વિષયની ઊંડાણપૂર્વક તપાસ કરવાની ઇચ્છા હોય ત્યારે ગુણાત્મક સંશોધનને પ્રાધાન્ય આપવામાં આવે છે.

આમ શિક્ષણમાં એ.આઈ.ના આ અભ્યાસમાં, શિક્ષણમાં કૃત્રિમ બુદ્ધિ ત્યાં ઉપયોગી થશે અને તેના વિવિધ ઉપયોગ ધ્યાનમાં લેવામાં આવ્યો હતો.. જે ભાવિ ભવિષ્ય માટે ઉપયોગી થશે.

પ્રસ્તુત અભ્યાસમાં શિક્ષણક્ષેત્રમાં એઆઈનો ઉપયોગ કેવી રીતે મદદરૂપ થશે તેના વિષે અભ્યાસ કરવામાં આવ્યો હતો. શિક્ષણવિંદો એઆઈ વિશે શું વિચારે છે, તેને શિક્ષણમાં કેવી રીતે સંકલિત કરવામાં આવશે, ભવિષ્યનો દૃષ્ટિકોણ, શિક્ષણમાં એઆઈ પર તેમની હકારાત્મક અને નકારાત્મક અસરો' શિક્ષણમાં કૃત્રિમ બુદ્ધિના ઉપયોગ વિશે સહભાગીઓની ધારણાઓનું વિશ્લેષણ કરવામાં આવ્યું હતું.

શૈક્ષણિક વિજ્ઞાનના ક્ષેત્રમાં નિષ્ણાતોના અભિપ્રાયો લઈને સંશોધન રીતે ઉપયોગી અગાઉ વિજ્ઞાન ક્ષેત્રે કઈ રીતે ઉપયોગમાં લઈ અને યોગ્ય પરિણામો મેળવ્યા છે તેજ રીતે શિક્ષણમાં પણ અગાઉ આર યૂ એસટી આર ટી એચ એચ આઇ આઇ એન્ડઉપયોગમાં લેવાયેલી ટેક્નિક દ્વારા શિક્ષણને આધુનિક બનાવવાનો પ્રયાસ કર્યો છે તેવી જ રીતે નવી એઆઈ ટેક્નોલોજિ શિક્ષણમાં ઉમેરો કરી અને વિવિધ વિષયોને તેના દ્વારા શીખવી અને ઉપયોગી નીવડે એવા હેતુથી દરેક શાળાઓમાં ઉપયોગ થાય જે ભવિષ્ય માટે હિતકારી.

વિશ્વસનીયતા

ગુણાત્મક સંશોધનમાં, વિશ્વસનીયતા સર્વોચ્ચ મહત્વ ધરાવે છે. અભ્યાસમાં વધુ વિશ્વસનીય પ્રક્રિયાનો ઉપયોગ કરવા માટે, ગુણાત્મક સંશોધનના ડેટા સંગ્રહ, કોડિંગ, ટેબ્યુલેશન અને રિપોર્ટિંગ તબક્કાઓનું અનુસરણ આ ક્ષેત્રના નિષ્ણાત શિક્ષણશાસ્ત્રી દ્વારા કરવામાં આવે છે. આ ઉપરાંત સંશોધકોએ આ વિષયને લગતી તેમની પ્રાથમિક ધારણાઓ પણ જણાવી હતી. સહભાગીઓના પ્રાથમિક ચુકાદાઓ પૂછવામાં આવ્યા હતા. ત્રણ શિક્ષણવિદોથી સ્વતંત્ર એક સર્વગ્રાહી વિશ્લેષણ કરવામાં આવ્યું હતું: એક વિશ્લેષક ત્રિકોણાકાર. ડેટા સોર્સ ટ્રાયઍન્ગ્યુલેશન મેથડ (સ્ટુબર્ટ એન્ડ કાર્પેન્ટર, 2011) નો ઉપયોગ કરવામાં આવ્યો હતો. અમે પરિપ્રેક્ષ્ય ત્રિકોણીકરણને સક્ષમ કરવા માટે આરોગ્યથી લઈને ઉદ્યોગ સુધીના એઆઈ પરના ઘણા જુદા જુદા અભ્યાસોની તપાસ કરવાનો પણ પ્રયાસ કર્યો. ત્રિકોણીયનનો અર્થ થાય છે કેસ અથવા ઘટનાઓની વિસ્તૃત સમજ વિકસાવવા માટે ગુણાત્મક સંશોધનમાં બહુવિધ પદ્ધતિઓ તરીકે ઉપયોગમાં લેવામાં આવે છે.

તારણો

આ વિભાગમાં પ્રાપ્ત મુખ્ય થીમ્સ સહભાગીઓ દ્વારા સૌથી વધુ ભાર મૂકવામાં આવતા કોડ્સ પર બનાવવામાં આવી છે. થીમ્સના કાર્યક્ષેત્રમાં નિર્દિષ્ટ કરવામાં આવેલા કોડને કોઈ પણ આવર્તન મૂલ્ય અનુસાર વર્ગીકૃત કરવામાં આવતા નથી; જો કે, સૌથી વધુ પ્રકાશિત લોકો નીચે તેમની સમજૂતી સાથે આપવામાં આવ્યા છે. સહભાગીઓની સંમતિ બાદ, અંતિમ તારણોમાં કોડ્સ અને અભિવ્યક્તિઓને વિવિધ વિશેષતાઓ ધરાવતા સહભાગીઓ દ્વારા પુષ્ટિ આપવામાં આવતી જોવા મળે છે. જ્યારે ડેટાનું વિશ્લેષણ કરવામાં આવ્યું, ત્યારે તે પ્રથમ વખત જોવામાં આવ્યું હતું કે સહભાગીઓએ સૌ પ્રથમ ઉત્પાદનો, એપ્લિકેશન્સ અને આઉટપુટ પર ભાર

223

મૂક્યો હતો જે કૃત્રિમ બુદ્ધિના આગમન સાથે આપણા જીવનમાં પ્રવેશ કરશે, અને અન્ય તમામ થીમ્સ નીચે વર્ણવવામાં આવી છે. સહભાગીઓએ ઉત્પાદનો, ખામીઓ, લાભો, સૂચનો હેઠળ ઘણા પાસાઓને સ્પર્શ્યા હોવાથી, અમે દરેક પરિમાણ હેઠળ કેટલાક સામાન્ય અવતરણો આપવાનો પ્રયાસ કર્યો છે જે વિષયને આવરી લે છે.

પરિણામો

પ્રસ્તુત અભ્યાસમાં શિક્ષણ ક્ષેત્રે ઉપયોગ કરવામાં આવતા એઆઈ ટ્રૂલ્સ દ્વારા અલગ અલગ પ્રકારે ઉપયોગમાં લેવામાં આવે છે . જેના દ્વારા સમયનો બચાવ થાય અને સચોટ માહિતી ટૂંકા સમયમાં મેળવી શકાય છે. ઉત્પાદનોના પરિમાણ હેઠળ, જેની તેઓ શિક્ષણમાં અપેક્ષા રાખે છે. ઉત્પાદનોના અવકાશમાં માત્ર નક્કર સાધનો જ નહીં, પરંતુ સોફ્ટવેર, સિસ્ટમ્સ, પદ્ધતિઓ અને મોડેલોનો પણ સમાવેશ થતો હતો. કૃત્રિમ બુદ્ધિમત્તા સાથે શિક્ષણમાં મોખરાનું સ્થાન ધરાવતા અથવા મોખરાનું સ્થાન ધરાવતા ઉત્પાદનોની યાદી નીચે મુજબ છે.

- અદ્યતન ટેકનોલોજિ સોફ્ટવેર.

- રોબોટ સહાયકો અને રોબોટ શિક્ષકો.

- શાળાઓમાં સ્માર્ટ ક્લાસીસ

- વ્યક્તિગત શિક્ષણ (શિક્ષણના વ્યક્તિગતકરણને લગતું).

- શિક્ષણ અને પાઠો માટે સિમ્યુલેશન્સ.

- દૃશ્ય અને કેસ સ્ટડી-ઉત્પાદક સિસ્ટમ્સ રુચિ, ક્ષમતા અને વિશ્લેષણ પદ્ધતિઓની જરૂર છે.

- રુચિ, ક્ષમતા અને વિશ્લેષણ પદ્ધતિઓની જરૂર છે.

- વ્યાવસાયિક માર્ગદર્શન પ્રણાલી (કારકિર્દીની પસંદગી માટે).

- હાજરી લેવા માટેના કાર્યક્રમો અથવા સાધનો.

- તમામ પ્રકારની માનવરહિત સિસ્ટમો.

- લર્નિંગ આઉટકમ ડિટેક્શન સિસ્ટમ (વિદ્યાર્થીઓના સ્તર માટે).

- વ્યક્તિગત શિક્ષણ સાધનો.

- ધ્યાન અને વિક્ષેપ વિશ્લેષણ સિસ્ટમ.

- શૈક્ષણિક સફળતાની શોધ અને સુધારા માટે સૂચન પ્રણાલી.

- ક્લાઉડ વાતાવરણ અને વર્ચ્યુઅલ લર્નિંગ વાતાવરણમાં સિસ્ટમો શીખવાની અભ્યાસક્રમ સંપાદન સિસ્ટમ.

- સિસ્ટમો કે જે વિદ્યાર્થીઓની શીખવાની રીતને સમજે છે અને અહેવાલ આપે છે.

    ગેરફાયદાઓ

પ્રસ્તુત અભ્યાસના સંદર્ભે કોઈ પણ ટેકનોલોજીના લાભ અને ગેરલાભ હોય છે જેમાંથી એઆઈ ટેક્નોલોજિ થી થતા ગેરલાભ ને પણ સ્વીકારવા પડે છે. શિક્ષણમાં કૃત્રિમ બુદ્ધિના ઉપયોગ વિશેની સંભવિત ખામીઓ અને જોખમોનો ઉલ્લેખ કરવામાં આવ્યો હતો. જે પ્રસ્તુત અભ્યાસના અનુસંધાને, આ ખામીઓ નીચે મુજબ સૂચિબદ્ધ કરી શકાય છે:

- વ્યક્તિઓની યાંત્રિક વિચારસરણી, સાહજિક જ્ઞાનને દબાવવું.

- માહિતી-લક્ષી શિક્ષણ

- શિક્ષણમાં માનવીય હસ્તક્ષેપની કોઈ જરૂર નથી,

- શિક્ષણમાં અનિયંત્રિત ગુપ્તચર તકનીકોની સંભાવના (દા.ત., ડેટા સુરક્ષા),

- સામાજિક સંબંધો પર નકારાત્મક અસરો.

- યાદશક્તિ નો અભાવ જોવા મળી શકે છે.

- શિક્ષક અને વિદ્યાર્થીઓ વચ્ચે આત્મીયતા ઓછી થાય.

ફાયદાઓ

આ થીમમાં, શિક્ષણમાં કૃત્રિમ બુદ્ધિનો ઉપયોગ કરવાના ફાયદાઓ વિશે ના અભિપ્રાયોમાંથી પ્રાપ્ત પરિણામો રજૂ કરવામાં આવ્યા છે. તદનુસાર, આ લાભો છે:

- વ્યક્તિને તેમની પોતાની ઝડપે શીખવામાં મદદ કરવી.

- વ્યક્તિની જરૂરિયાતનો સાચો નિર્ણય.

- દીર્ઘકાલીન સમસ્યાઓના વ્યવહારિક ઉકેલો.

- શાળાઓમાં હવે પેપરવર્ક નહીં.

- સમયના બગાડને અટકાવવા.

- શિક્ષણની ગુણવત્તામાં વધારો.

- કામમાં સરળતા પૂરી પાડવી.

- ઝડપી ડેટા વિશ્લેષણ સાથે યોગ્ય નિર્ણયો લેવામાં મદદ કરવી.

- વિદ્યાર્થીની ક્ષમતા અને ઝડપ અનુસાર શિક્ષણનું આયોજન.

- અસરકારક આયોજન સાથે નાના જૂથોમાં તાલીમ લેવાની ક્ષમતા.

- વધુ અસરકારક વ્યક્તિગત શીખવાની પ્રક્રિયા.

- નીતિ ઘડવૈયાઓને મદદ કરવી, ઉદાહરણ તરીકે, યોગ્ય સ્થળોએ યોગ્ય શિક્ષણ રોકાણ કરવા માટે વસ્તી આગાહી સિમ્યુલેશન્સ.

સૂચનો

શિક્ષણમાં કૃત્રિમ બુદ્ધિના ઉપયોગ અંગે ના સૂચનો શામેલ છે. આ ભલામણો નીચે મુજબ છે:

• શિક્ષણમાં કૃત્રિમ બુદ્ધિનો ઉપયોગ કરતી વખતે ચોક્કસ માપન પદ્ધતિ હોવી જોઈએ.

• શિક્ષણમાં કૃત્રિમ બુદ્ધિમત્તા સંબંધિત વિકસિત એપ્લિકેશનો અથવા સિસ્ટમોનું પાયલોટ દ્વારા પરીક્ષણ થવું જોઈએ એપ્લિકેશનો અને તેમના પરિણામો અનુસાર સિસ્ટમમાં એકીકૃત.

• શૈક્ષણિક અધ્યયન વિકસિત સિસ્ટમો પર થવું જોઈએ અને તેનું વિશ્લેષણ કરવું જોઈએ.

• જરૂરી માળખાગત કામો ઊભા કરવા જોઈએ.

• ઓડિટ મિકેનિઝમ સ્થાપિત કરવું જોઈએ

• માનવ મનોવિજ્ઞાનની અવગણના ન કરવી જોઈએ.

• પ્રિવેન્ટિવ અને સપોર્ટિવ સોફ્ટવેર વિકસાવવું જોઈએ.

• કૃત્રિમ બુદ્ધિને લગતી પ્રણાલીઓની તેમના જીવનમાં લોકોની નિર્ણય લેવાની શક્તિ પરની અસરોને માપવી જોઈએ.

• એઆઈ એકીકરણ પ્રક્રિયા એવી રીતે આગળ વધવી જોઈએ કે જે સામાજિક સંબંધોને નકારાત્મક અસર ન કરે.

• શિક્ષણમાં કૃત્રિમ બુદ્ધિમત્તા એ કોઈ વ્યાપક ઉકેલ નથી. તેનો ઉપયોગ માત્ર જરૂરિયાતના ક્ષેત્રોમાં જ થવો જોઈએ.

• આ પ્રક્રિયા માત્ર શિક્ષકો જ નહીં, પરંતુ તમામ હિસ્સેદારો સાથે આંતરશાખાકીય ફેશનમાં હાથ ધરવી જોઈએ અને એન્જિનિય

સહભાગીઓને પૂછવામાં આવેલા છેલ્લા પ્રશ્નોમાં એક વર્ણનાત્મક પાસાનો સમાવેશ થાય છે: જ્યારે કૃત્રિમ બુદ્ધિમત્તા-સમર્થિત શૈક્ષણિક વાતાવરણને ધ્યાનમાં લેવામાં આવે છે ત્યારે તમે શિક્ષણમાં એઆઈ ટૂલ્સને કેવી રીતે વ્યાખ્યાયિત કરો છો?... 'જો એઆઈ ફાયદાકારક હોય કે સમસ્યારૂપ હોય તો કૃપા કરીને અમને સ્પષ્ટ ટકાવારી આપો?' ટકાવારી આપીને, સહભાગીઓએ શિક્ષણ અને સમાજ સાથે એઆઈના સંકલનમાં કેટલું નુકસાન અને લાભની આગાહી કરી છે તે વિશે જવાબો આપ્યા; તે બંનેએ ફાયદા અને ખામીઓ પર ધ્યાન કેન્દ્રિત કર્યું. જૂથો દ્વારા આ પ્રશ્નના જવાબોની વહેંચણી કોષ્ટક 1માં દર્શાવવામાં આવી છે.

સહભાગીઓને પૂછવામાં આવેલા છેલ્લા પ્રશ્નોમાં એક વર્ણનાત્મક પાસાનો સમાવેશ થાય છે: જ્યારે કૃત્રિમ બુદ્ધિમત્તા-સમર્થિત શૈક્ષણિક વાતાવરણને ધ્યાનમાં લેવામાં આવે છે ત્યારે તમે શિક્ષણમાં એઆઈ ટૂલ્સને કેવી રીતે વ્યાખ્યાયિત કરો છો?... 'જો એઆઈ ફાયદાકારક હોય કે સમસ્યારૂપ હોય તો કૃપા કરીને અમને સ્પષ્ટ ટકાવારી આપો?' ટકાવારી આપીને, સહભાગીઓએ શિક્ષણ અને સમાજ સાથે એઆઈના સંકલનમાં કેટલું નુકસાન

અને લાભની આગાહી કરી છે તે વિશે જવાબો આપ્યા; તે બંનેએ ફાયદા અને ખામીઓ પર ધ્યાન કેન્દ્રિત કર્યું. જૂથો દ્વારા આ પ્રશ્નના જવાબોની વહેંચણી કોષ્ટક 1માં દર્શાવવામાં આવી છે.

નિષ્કર્ષ

પ્રસ્તુત અભ્યાસ માં વિવિધ સંદર્ભમાંથી લેવામાં આવેલી માહિતી દ્વારા એ આઈ ટેકનોલોજીને શિક્ષણમાં સ્થાન આપવા માટે નો મહત્વનું પગલું ભવિષ્યમાં શિક્ષણને ઉજ્જવળ બનાવવા આ વર્ણનાત્મક થીમ બનાવવામાં આવી હતી. પ્રથમ થીમ ઉત્પાદનો વિશે હતી, જેમાં નજીકના ભવિષ્યમાં નક્કર એઆઈ મીડિયા, એપ્લિકેશન્સ અથવા પરિણામોનો સમાવેશ થતો હતો. તેમાં સિમ્યુલેશન પ્રોગ્રામ્સ, મૂલ્યાંકન-પરીક્ષણ સપોર્ટ સિસ્ટમ્સ, વીઆર ક્લાસ અને આસિસ્ટન્ટ રોબોટ્સથી માંડીને વ્યક્તિગત શિક્ષણ પ્રણાલીનો સમાવેશ થાય છે. નિકટવર્તી પરિણામ તરીકે એઆઈ પરના સૌથી સમકાલીન વિષયોમાંનો એક એ છે કે તે પ્રદાન કરે છે તે સાધનો સાથે વ્યક્તિગત શિક્ષણ પરની તેની અસર. શિક્ષણમાં આર્ટિફિશિયલ ઇન્ટેલિજન્સ વ્યક્તિગત શિક્ષણ માટે મજબૂત ટેકનિકલ સપોર્ટ પ્રદાન કરી શકે છે ગોકસેલ અને બોઝકુર્ટ (2019) એ શિક્ષણ અને એઆઈ અભ્યાસો પરના કાગળોના તેમના વિશ્લેષણ પર, અનુકૂલનશીલ શિક્ષણ, વૈયક્તિકરણ અને શીખવાની શૈલીઓને કેન્દ્રીય કી નોડ્સ અને ખ્યાલો તરીકે શોધી કાઢી હતી. આનો અર્થ એ છે કે એક-કદ-ફિટ-બધા અભિગમને અપનાવવાથી દરેક વિદ્યાર્થી માટે અનુરૂપ શિક્ષણ સાથે શિક્ષણમાં એઆઈના ઉપયોગ દ્વારા બદલી શકાય છે. તેથી, અમે અનુમાન કરી શકીએ છીએ. કે શિક્ષણમાં પ્રગતિ એઆઈ અને તેના સહાયક સાધનો સાથે મહત્તમ શિક્ષણની જરૂરિયાતોને પૂર્ણ કરી શકે છે, જે શિક્ષકો અને વિદ્યાર્થીઓને સહાય કરવામાં મોટી સહાય કરે છે.

બીજો અભ્યાસ ખામીઓ અને જોખમો વિશે અભ્યાસમાં જાણવા મળ્યું કે એઆઈનો વ્યાપક ઉપયોગ માહિતી પ્રક્રિયાની અતિશય યાંત્રિક રીત, વ્યવહારિક અભિગમ, સૌંદર્યલક્ષી લાગણીઓને બદલે જ્ઞાન પર વધુ ધ્યાન કેન્દ્રિત કરવા, શિક્ષકો માટે ઓછી જગ્યા, નૈતિક અને સુરક્ષા સંબંધિત સમસ્યાઓ અને સંબંધોમાં નકારાત્મક સામાજિક અસરો તરફ દોરી જશે. હાલના કિસ્સામાં, મોબાઇલ ફોનનો અનિયંત્રિત, અયોગ્ય અથવા વધુ પડતો ઉપયોગ પહેલેથી જ વર્તણૂકીય, સામાજિક અને ભાવાત્મક સમસ્યાઓનું કારણ બને છે (ચોલિઝ, 2010). માનવ જીવન અને ફોનમાં એઆઈના બેભાન એકીકરણ સાથે આને વધુ ગહન બનાવી શકાય છે કારણ કે સહભાગીઓએ નોંધ્યું હતું કે મોબાઇલ ઉપકરણોએ પહેલેથી જ લોકોને તેમના સામાજિક આદાનપ્રદાનમાંથી છીનવી લીધા છે, અને તેઓ મોબાઇલ વિશ્વમાં એઆઈ વિકાસ સાથેના આગામી પગલા વિશે ખરેખર આશ્ચર્ય કરે છે.

ટીવી કાર્યક્રમો જે કૃત્રિમ બુદ્ધિમત્તાનું ચિત્રણ કરે છે તે સ્તર સુધી આપણે પહોંચી શક્યા નથી, તેમ છતાં, કૃત્રિમ બુદ્ધિનો વિકાસ ઝડપી બની રહ્યો છે. અલગ અલગ મુદ્દાઓને ટિપ્પણીઓમાં એક સામાન્ય મુદ્દો, કાં તો ફિલ્મોના પરિણામે અથવા સમુદાયમાં સ્માર્ટ ટૂલ્સના ડરને કારણે, આઇઝેક આસિમોવના પુસ્તક I, રોબોટ અને અનુકૂળ ફિલ્મ સાથે સંબંધિત છે. કેટલાક સહભાગીઓએ આઇઝેક એસિમોવ દ્વારા રોબોટના નિયમોનો ઉલ્લેખ કર્યો હતો, જે નીચે મુજબ આપી શકાય છે (અસીમોવ, 2004):

1.   રોબોટ મનુષ્યને ઈજા પહોંચાડી શકે નહીં અથવા, નિષ્ક્રિયતા દ્વારા, માણસને નુકસાન પહોંચાડવાની મંજૂરી આપી શકે નહીં, સિવાય કે જ્યારે માનવતાને વધુ નુકસાન ન થાય તે માટે આવું કરવાની જરૂર પડે.

2.	રોબોટે મનુષ્ય દ્વારા તેને આપવામાં આવેલા કોઈપણ આદેશોનું પાલન કરવું આવશ્યક છે, સિવાય કે જ્યાં આવા આદેશો પ્રથમ કાયદા સાથે વિરોધાભાસી હોય અથવા માનવતાને જ વધુ નુકસાન પહોંચાડે.

3.	જ્યાં સુધી આવું રક્ષણ પ્રથમ કે બીજા નિયમ સાથે ઘર્ષણમાં ન આવે અથવા માનવજાતને જ વધુ નુકસાન ન પહોંચાડે ત્યાં સુધી તેણે તેના પોતાના અસ્તિત્વનું રક્ષણ કરવું જોઈએ.

પાછળથી, શૂન્યમો કાયદો દાખલ કરવામાં આવ્યો હતો:

રોબોટ માનવતાને નુકસાન ન પહોંચાડી શકે, અથવા નિષ્ક્રિયતા દ્વારા, માનવતાને નુકસાન પહોંચાડવાની મંજૂરી આપી શકે નહીં. કૃત્રિમ બુદ્ધિમત્તાની તકનીકો સામે જોખમને રોકવા માટેનો એક મુખ્ય ભાર 'પ્રમાણસરતા' છે. આ તબક્કે, સહભાગીઓએ શિક્ષણવિદો, ઇજનેરો અને સંબંધિત વ્યાવસાયિકોને જણાવ્યું હતું કે કૃત્રિમ બુદ્ધિ અને સંબંધિત સાધનોના સભાન ઉપયોગને અનુસરવું જોઈએ.

કેટલાક સહભાગીઓના વિચારો સાહિત્યમાં 'લર્નિંગ એનાલિટિક્સ' ની વિભાવના સાથે ગાઢ રીતે સંબંધિત છે. લર્નિંગ એનાલિટિક્સને શીખનારાઓ અને તેમના સંદર્ભ વિશેની માહિતીના સંગ્રહ, માપન, વિશ્લેષણ અને રિપોર્ટિંગ તરીકે વ્યાખ્યાયિત કરવામાં આવે છે, જે શીખવા અને તેના વાતાવરણને સમજવા અને સુધારવા માટે તેમના સંદર્ભને સમજે છે (લોંગ એન્ડ સિમેન્સ, 2011). શિક્ષણમાં આર્ટિફિશિયલ ઇન્ટેલિજન્સ ટેકનોલોજિના વધારા સાથે, લર્નિંગ એનાલિટિક્સ પણ વ્યક્તિગત શિક્ષણ સામગ્રીની જોગવાઈમાં ફાળો આપી શકે છે. આ દૃષ્ટિકોણથી, એક લવચીક, સંપાદન કરી શકાય તેવા અભ્યાસક્રમની રચના માટે શિક્ષણમાં કૃત્રિમ બુદ્ધિ તકનીકોનો ફેલાવો મહત્વપૂર્ણ છે. એનાલિટિક્સ શીખવાનું કાર્ય એઆઈ એપ્લિકેશનના મહત્વપૂર્ણ કાર્ય તરીકે અગ્રણી સ્થાન ધરાવે છે. એક સહભાગીએ એઆઈના એક પરિણામને 'માપી શકાય તેવા વ્યક્તિઓ' તરીકે ઉલ્લેખ કર્યો હતો, જેનો અર્થ એ થયો કે એઆઈ લોકોનું વિશ્લેષણ કરશે અને શીખવાના વિશ્લેષણની જેમ વિદ્યાર્થીઓ અને શિક્ષકોની પ્રગતિને વધુ સારી બનાવવા માટે આગાહીઓ કરશે. આ સંદર્ભમાં, કાર્તિ (2019) જણાવે છે કે આર્ટિફિશિયલ ઇન્ટેલિજન્સ ટૂલ્સ પર આધારિત વિશ્લેષણના સમર્થનથી, શાળામાં ગેરહાજરીના દરમાં પણ ઘટાડો થશે, જે શાળાઓ માટે મોટો ફાયદો છે.જેમણે શૈક્ષણિક ક્ષેત્રમાં એઆઈ સંકલન માટે સાવચેતીના મોડેલો, દેખરેખ હેઠળની પદ્ધતિઓ અને પૂર્વ-વિશ્લેષણના પગલાઓની દરખાસ્ત કરી હતી. તકનીકી અને ન્યાયતંત્રના સ્તરે અનેક પ્રકારની દેખરેખ હોવી જોઈએ. સહભાગીઓએ હિમાયત કરી હતી કે વ્યક્તિગત બાબતોમાં એઆઈનો સમાવેશ મર્યાદિત હોવો જોઈએ. શિક્ષણમાં એ.આઈ.ને બધા માટે જવાબ તરીકે ન ધારવું જોઈએ, પરંતુ એક એવું માધ્યમ કે જે જરૂરી ક્ષેત્રોમાં પ્રક્રિયાઓને સરળ બનાવે છે અને કડક બનાવે છે. અન્યથા, આર્ટિફિશિયલ ઇન્ટેલિજન્સ તકનીકો, માનવ બુદ્ધિની નકલ પર આધારિત, કાનૂની સમસ્યાઓ લાવી શકે છે. આમાંની કેટલીક સમસ્યાઓ એઆઇ કોની જાણ કરશે, આ સાધનોની શું જવાબદારી હશે, આર્ટિફિશિયલ ઇન્ટેલિજન્સ દ્વારા ઉત્પાદિત ઉત્પાદનોના પ્રોપર્ટી રાઇટ્સ, ગોપનીયતા અને સુરક્ષાના મુદ્દાઓ વિશે સૂચિબદ્ધ કરી શકાય છે. આ તબક્કે, કાનૂની આધારને તકનીકી વિકાસ સાથે અનુકૂળ થવું જોઈએ, અને એઆઈ ટૂલ્સ સંબંધિત વિશેષ કાયદાઓ અપેક્ષિત ભવિષ્યમાં રોબોટ્સ અથવા શિક્ષક સહાયકો અનુસાર આકાર આપવો જોઈએ.

શિક્ષણ માટેના એઆઈમાં શાળાઓ માટે ઉત્તેજના અને આશાસ્પદ વિકાસ શામેલ છે. સંદર્ભ અને અસરોની કાળજીપૂર્વક ચર્ચા કરીને નવા વિકાસનું સંચાલન કરવું મહત્વપૂર્ણ છે. આર્ટિફિશિયલ ઇન્ટેલિજન્સ ટેકનોલોજી માનવજાત માટે રોમાંચક ક્ષેત્ર છે; જો કે, આ સંશોધનમાં ભાગ લેનારાઓએ સૂચિત કર્યું છે તેમ, તે દરેક વસ્તુ માટેનો ઇલાજ અથવા સુધારણા નથી જે સંપૂર્ણ સારું લાવશે. તેથી, કાનૂની, નૈતિક, શૈક્ષણિક, માનસિક અને સામાજિક હાનિઓ અને ફાયદાઓ ધ્યાનમાં લેવા જોઈએ. ટેક્નોલોજીથી સૌથી વધુ પ્રભાવિત માનવતા જ છે, તેથી આ સમગ્ર પ્રક્રિયા કાનૂની ધોરણે હાથ ધરવામાં આવે તે જરૂરી છે, જેથી કોઈને નુકસાન ન થાય.

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6) એજ્યુકેશન એન્ડ એજ્યુકેશન રિસર્ચમાં બિગ ડેટા અને આર્ટિફિશિયલ ઇન્ટેલિજન્સનો રોલ: અ લિટરેચર મેપિંગ.

Implementation of Innovative Pedagogy in the Classroom

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Abstract:

Research is very useful in any field. Researches in the field of education always suggest new directions of education. In the present study, this research was conducted to know the status of implementation in the classroom based on innovative pedagogy under NEP. To study how useful Story telling pedagogy is among different innovative pedagogies in education. An experiment was conducted on 66 students of Gujarati medium of class 7 studying during year 2024/25 in Shree Madhavipur Primary School, Ta. Jasdan. For this, a story telling pedagogy based program was structured for English unit 'METHI PAKODA' and tried to know its effectiveness. A unit achievement test was taken to get data in the form of academic achievement from the sample. Mean, standard deviation and   t-test were used to analyze the data. Story telling pedagogy based teaching method proved to be more effective than traditional method.

 Key Words: Innovative Pedagogy

1. INTRODUCTION:

Today's times are very changeable indeed. Today there are many changes in the education sector as well. Chapter-12 of Section-II of NEP-2020 states that high quality pedagogy is required to teach successfully the curriculum content to the students. The learning experiences offered to students determine the pedagogy. But in our current classrooms, all students are taught the same content, the same subject methods, at the same time. But on the other hand new teaching methods should be used keeping in mind the ability, receptivity and speed of the students.
 Issue No. 4.21 of NEP States that language learning can be made more effective by using cultural aspects of languages such as films, drama, stories, poetry and music. Thus education can be made more effective by using innovative pedagogy. For this purpose, the present research was done to make the teaching work more interesting by using story telling pedagogy.

2. HYPOTHESES:

There is no significant difference between the mean achievement scores of the students studied with traditional teaching method and Storytelling pedagogy based program teaching method.

3. OBJECTIVES:

- To construct story telling pedagogy based program for teaching English unit in standard - seven.
- To constructing a teacher-made test to test the Storytelling pedagogy based program designed for teaching English in standard - seven.
- To examine the effectiveness of Storytelling pedagogy based program designed for English teaching.

VARIABLES INCLUDED IN THE STUDY

The following are the details of the variables included in the present study. Table 4.1 Variables

Types of Variables	Variable	Level
Independent	Teaching method	Traditional
		Storytelling
Dependent	Achievement	-
Controlled	Subject, Unit, Standard	-
Intervening	Individual difference	-

4. METHODOLOGY:

The present study was to examine the effectiveness of Storytelling pedagogy teaching method. Therefore, an experimental research method was chosen.

5. POPULATION AND SAMPLE

The population of the present study was the students of standard seven from the year 2024-25 of upper-primary school of Rajkot district. Shree Madhavipur Primary School was selected through a purposive sampling method. A total of 66 students of class seven of this school were included in the sample.

6. ANALYSIS:

In the present study mean, standard deviation and t-test were used to analyze the scores obtained on the basis of post test of two groups. In the present study, the experimental group was taught by Story-telling pedagogy based teaching method and the control group was taught by traditional method.

Table 7.1

Hypotheses Testing

Group	No. of Students	Mean	Standard Deviation	t – test	Significant
Expriment	33	34.06	6.16	2.696	0.01 significant
Controlled	33	30.21	5.40		

According to this table, it can be seen that the mean of the achievement scores of the 33 students of the experimental group of the seventh standard during the experiment was 34.06 and the standard deviation was 6.16. Whereas the mean of the achievement scores of the students of the control group was 30.21 and the standard deviation was 5.40. The t-value of the difference between mean scores was 2.69. Which was more than 2.58. Thus the t-value was significant at 0.01 level.

8. **FINDINGS:**

Story-telling pedagogy based teaching method was found to be more effective than traditional teaching method among the students taught on 'METHI PAKODA' subject in standard - seven English subject.

9. **CONCLUSION:**

Picture cards should be used to the maximum extent for language unit assessment. The story method is found to be more enjoyable, interesting and curiosity provoking for language teaching.

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શિક્ષણમાં ટેક્નોલોજીની ભૂમિકા

વિજયકુમાર જમનાદાસ બાબરીયા

પીએચ.ડી. વિદ્યાર્થી

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પ્રસ્તાવના

ટેક્નોલોજી અને શિક્ષણ નિયમિતપણે શિક્ષકોને મદદ કરે છે અને શૈક્ષણિક મુશ્કેલીઓ ધરાવતા વિદ્યાર્થીઓને મદદ કરે છે. તકનીકી પ્રગતિ અને પ્રી-એઆઈ યુગ પહેલા, વિદ્યાર્થીઓ શિક્ષણ માટે સામાન્ય અભિગમ અપનાવવા પર ધ્યાન કેન્દ્રિત કરતા હતા, પરંતુ AIના ઉદ્ભવ સાથે, વિદ્યાર્થીઓ હવે તેમની અનન્ય જરૂરિયાતો અને ગતિના આધારે અનુભવ અને શીખે છે.

શૈક્ષણિક તકનીકમાં કૃત્રિમ બુદ્ધિની ભૂમિકા શું છે?

આર્ટિફિશિયલ ઇન્ટેલિજન્સ સાધનો પાઠ આયોજન અને સામગ્રી નિર્માણને સુવ્યવસ્થિત કરી શકે છે, શિક્ષકોનો મૂલ્યવાન સમય બચાવે છે. આ AI સાધનો ચુસ્ત સમયની મર્યાદાઓ હેઠળ ઉચ્ચ-ગુણવત્તાવાળી છબીઓ, કસ્ટમાઇઝ્ડ સામગ્રી અને ધ્યાન કેન્દ્રિત સંશોધન સામગ્રી જનરેટ કરી શકે છે.

આર્ટિફિશિયલ ઇન્ટેલિજન્સમાં ટેક્નોલોજીની ભૂમિકા શું છે?

આર્ટિફિશિયલ ઇન્ટેલિજન્સ (AI) એ ટેક્નોલોજીનો સમૂહ છે જે કોમ્પ્યુટરને બોલાતી અને લેખિત ભાષા જોવા, સમજવા અને અનુવાદ કરવાની ક્ષમતા, ડેટાનું પૃથ્થકરણ, ભલામણો અને વધુ સહિત વિવિધ પ્રકારના અદ્યતન કાર્યો કરવા સક્ષમ બનાવે છે.

શિક્ષણ માટે AI નો ઉપયોગ કેવી રીતે કરી શકાય?

AI ની ડેટા-આધારિત પ્રતિસાદ સિસ્ટમ શિક્ષકો, પરિવારો અને વિદ્યાર્થીઓ વચ્ચે પારદર્શક સંચાર માટે પરવાનગી આપે છે. તે વિદ્યાર્થીઓનો સંતોષ સુધારી શકે છે, પૂર્વગ્રહ ઘટાડી શકે છે અથવા દૂર કરી શકે છે અને ઓળખી શકે છે કે કયા વિદ્યાર્થીઓ હજુ સુધી સામગ્રીના ધોરણોને પૂર્ણ કરી રહ્યાં નથી.

ટેક્નોલોજીમાં AI નો ઉપયોગ કેવી રીતે થાય છે?

AI તકનીકી સિસ્ટમોને તેમના પર્યાવરણને સમજવા, તેઓ જે સમજે છે તેની સાથે વ્યવહાર કરવા, સમસ્યાઓ હલ કરવા અને ચોક્કસ ધ્યેય પ્રાપ્ત કરવા માટે કાર્ય કરવા સક્ષમ બનાવે છે. કોમ્પ્યુટર ડેટા મેળવે છે - પહેલાથી જ તેના પોતાના સેન્સર જેમ કે કેમેરા દ્વારા તૈયાર કરેલો અથવા એકત્ર કરેલો - તેની પ્રક્રિયા કરે છે અને પ્રતિભાવ આપે છે.

શિક્ષણ ક્ષેત્રે AI ની ભૂમિકા

AI નું મૂળ ધ્યેય માનવ બુદ્ધિની નકલ કરવાનું અને જટિલ માનવ કાર્યોને વધુ અસરકારક રીતે અને ઝડપથી ચલાવવાનું છે. શૈક્ષણિક ક્ષેત્રમાં, AI સમગ્ર શિક્ષણ-શિક્ષણ પ્રક્રિયાને ઝડપથી ઝડપી બનાવી શકે છે. ચાલો આપણે શિક્ષણ ક્ષેત્રે આર્ટિફિશિયલ ઇન્ટેલિજન્સ ની ભૂમિકા જોઈએ.

અનુરૂપ શિક્ષણ

શિક્ષણ ક્ષેત્રે AI ની ભૂમિકાઓમાંની એક એ શિક્ષણને કસ્ટમાઇઝ કરવામાં મદદ કરવાની છે. પરંપરાગત વર્ગખંડો વારંવાર એક-માપ-બંધ-બધા પ્રકારના હોય છે. જો કે, આ અભિગમ એ હકીકતની અવગણના કરે છે કે દરેક બાળક અનન્ય છે, જેમાં અલગ શીખવાની શૈલી, કુશળતા અને ખામીઓ છે. અહીં શિક્ષણ ક્ષેત્રે AI ની સંડોવણી આવે છે: શીખવાની સામગ્રીને ટેલરિંગ. અનુકૂલનશીલ શીખવાની પદ્ધતિ એ શ્રેષ્ઠ રીતો પૈકીની એક છે જે AI શિક્ષણને વ્યક્તિગત કરવામાં મદદ કરી શકે છે. આ ટેકનિકમાં, AI વાસ્તવિક સમયમાં શીખનારની શક્તિઓ અને ખામીઓનું મૂલ્યાંકન કરે છે અને વ્યક્તિગત શિક્ષણના માર્ગોની ભલામણ કરે છે.

તે સિવાય, AI અનુરૂપ સામગ્રી ભલામણો, વ્યક્તિગત મૂલ્યાંકન, કસ્ટમાઇઝ્ડ પ્રતિસાદ વગેરેમાં મદદ કરી શકે છે.

AR અને VR ટેક્નોલોજીઓ અમૂર્ત વિભાવનાઓને જીવનમાં લાવીને ઇમર્સિવ શીખવાનો અનુભવ પ્રદાન કરે છે. AR ટેક્નોલૉજી વપરાશકર્તાના કુદરતી વાતાવરણમાં ડિજિટલ કન્ટેન્ટને સુપરિમ્પોઝ કરે છે, જ્યારે VR સિમ્યુલેટેડ વાતાવરણમાં સંપૂર્ણપણે ઇમર્સિવ અનુભવ બનાવે છે. તે હેન્ડ-ઓન લર્નિંગ દ્વારા જટિલ ખ્યાલોને વધુ મૂર્ત અને સમજવામાં સરળ બનાવે છે. વર્ચ્યુઅલ દેડકાના વિચ્છેદનથી માંડીને વાસ્તવિક જીવનના દૃશ્યોની નકલ કરવા અથવા સૌરમંડળનું અન્વેષણ કરવા સુધી, AR અને VR ટૂલ્સ વધુ આકર્ષક અને અર્થપૂર્ણ શિક્ષણ અનુભવો પ્રદાન કરવા માટે AI નો ઉપયોગ કરે છે.

AI NLP અને ML દ્વારા વધુ સચોટ અને નિષ્પક્ષ મૂલ્યાંકન પદ્ધતિઓ પ્રદાન કરે છે. તે વિદ્યાર્થીઓના પ્રતિભાવોનું માનવીય રીતે મૂલ્યાંકન કરે છે. સિસ્ટમ ચોક્કસ સ્કોર પ્રદાન કરવા માટે સામગ્રી, સુસંગતતા અને ભાષાના ઉપયોગનું વિશ્લેષણ કરે છે. AI-સંચાલિત મૂલ્યાંકન પદ્ધતિઓનો ઉપયોગ કરીને ગ્રેડિંગ માટે જરૂરી સમય અને પ્રયત્નો ઘટાડે છે. તે કોઈપણ સંભવિત પૂર્વગ્રહોને પણ દૂર કરે છે.

સંદર્ભો

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