ORIGINAL ARTICLE

Evaluation of Swing-Induced Linear Vestibular Stimulation in Women with Premenstrual Syndrome Using Physiological, Psychological, and Biochemical Parameters

Darsi Krishnaveni[1,2], S. Venkata Venu Gopala Raju[2], K. Rajalashmi[3], P.K. Govindarajan[4], Iadalin Ryntathiang[1], Mukesh Kumar Dharmalingam Jothinathan[1]

[1]Department of Biochemistry, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India, [2]Department of Physiology, Allurisitaramaraju Academy of Medical Sciences, Eluru, Andhra Pradesh, India, [3]Department of Electrical and Electronics Engineering, Bannari Amman Institute of Technology, Erode, Tamil Nadu, India, [4]Department of Community Medicine, Vinayaka Missions Medical College, Vinayaka Missions Research Foundation, Karaikal, Puducherry, India

Abstract

Background: Premenstrual syndrome (PMS) is a common condition in women that affects physical, psychological, and social well-being. Linear vestibular stimulation has been proposed as a non-pharmacological intervention for managing PMS symptoms. **Objective:** This study aimed to evaluate the efficacy of linear vestibular stimulation in the treatment of PMS. **Materials and Methods:** An experimental study was conducted on 100 female volunteers aged 18–30 years. Linear vestibular stimulation was administered using a conventional swing. Various physiological, hormonal, hematological, and psychological parameters were recorded before and after the intervention and compared. **Results:** Serum cortisol, triiodothyronine, thyroxine, and thyroid-stimulating hormone levels showed a gradual month-by-month decrease following linear vestibular stimulation. Hematological analysis revealed a reduction and stabilization of monocyte counts in certain women compared with controls. Females across different age groups and body mass index categories showed no stress-induced increase. Lymphocyte counts significantly decreased while remaining within normal limits compared to baseline values. Quality-of-life scores, including physical, psychological, social, and environmental domains, improved after 2 months of stimulation. Depression anxiety stress scales (DASS-42) scores for anxiety, depression, and stress showed a decrease. However, no significant difference was observed in DASS stress levels between control and vestibular groups before and after stimulation. **Conclusion:** Linear vestibular stimulation appears to be an effective non-pharmacological approach in controlling PMS-related symptoms and improving overall well-being.

Key words: Linear vestibular stimulation, pain, physiological intervention, premenstrual syndrome

INTRODUCTION

One of the prevalent menstruation disorders in teenagers is premenstrual syndrome (PMS).[1] Given the detrimental impacts of this disease on the performance and activity of teenagers, as well as the significance of epidemiological research in developing preventive measures, it is essential to understand its epidemiological profile.[2,3] A repeated course of physical, psychological, and behavioral symptoms following ovulation and within a few days of the beginning of the month (1st week of Luteal phase) characterizes this syndrome, a mental, neurological, and endocrine illness.[4] Between menarche and menopause, symptoms could manifest at any time before menstruation.[5]

Address for correspondence:
Mukesh Kumar Dharmalingam Jothinathan, Department of Biochemistry, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India.
Phone: +91 98845 53310. E-mail: itsmemukesh@gmail.com

Received: 22-11-2025
Revised: 23-12-2025
Accepted: 30-12-2025

Premenstrual dysphoric disorder (PMDD), which is more severe at the end of the PMS spectrum, is characterized by the cyclical recurrence of psychological manifestations, including irritability, nervousness, agitation, anger, insomnia, difficulty concentrating, extreme fatigue, depression, anxiety, and confusion.[6,7] The woman's quality-of-life (QOL) significantly decreased during the luteal phase of her menstrual cycle due to severe physical and psychological symptoms of PMS.[8] Mood swings are the most prevalent behavioral or emotional sign of PMS. Anxiety/tension, melancholy or depression, impatience, increased hunger, sensitivity to rejection, and diminished interest in activities are other non-physical behavioral signs.[9] Abdominal bloating and extreme fatigue are the most prevalent physical symptoms of PMS, followed by flushing, headache, dizziness, and breast tenderness.[10] In women who are not in the postpartum or menopausal stages, hot flashes that precede menstruation and resemble menopausal hot flashes may indicate PMS or PMDD.[11] Stress is the body's broad, non-specific reaction to anything that overwhelms or threatens to overload its homeostasis maintenance compensating mechanisms.[12,13] An excessive amount of stress may negatively impact academic performance. Lack of guidance is another factor contributing to pupils stress.[14] Although the symptoms are minor, 5–8% experience moderate-to-severe symptoms that significantly impede their ability to function or cause them to feel distressed.[15] Daily symptom charting across two menstrual cycles is necessary for the diagnosis of PMS per (American College of Obstetricians and Gynecologists criteria) and PMDD; several tools, including the Daily Record of Severity of Problems, have been created for this purpose.[16,17]

Although the exact pathophysiology of PMDs is yet unknown, it has been suggested that hormonal changes, brain monoamines such as serotonin and gamma-aminobutyric acid, and poor lifestyle choices are involved.[18] PMDD is a new diagnosis for a variation of PMS that includes more severe psychological symptoms.[19,20] Collection of physical, behavioral, and emotional symptoms that arise in the final week of the luteal phase typically the week before menstruation is known as PMS.[21] By changing the estrogen/progesterone ratio, body fat has an impact on menstrual cycles.[22] As an unconventional diet, alternate day fasting improves anthropometric indices and lowers body weight.[3,23] Mood swings, depression, irritability, headaches, cramping in the abdomen, bloating in the abdomen, breast swelling and tenderness, and changes in appetite are common signs of PMS.[21,24] One of the most important modifying factors in lowering and controlling some of the symptoms of PMS seems to be diet.[25] Short-term intermittent fasting has been linked to lower luteal cortisol levels and improved parasympathetic function in young women, according to research.[26] These findings suggest the potential for luteal phase anti-stress production, which would lessen menstrual discomfort.[27] PMS is described as "the cyclic occurrence of symptoms that are of sufficient severity to interfere with some aspects of life and which appear with consistent and predictable relationship to menses" by the National Institute of Mental Health.[22] One of the most prevalent health issues affecting women of reproductive age is PMS.[28] Bloating, weight gain, breast tenderness, swelling, aches and pains, trouble focusing, sleep disturbances, and changed eating patterns are psychological signs of PMS.[3] The majority of these symptoms appear during the luteal phase of the cycle and go away around menstruation.[4,29] PMS can be classified as a stress-induced psychophysiological condition, despite the fact that the precise origin of PMS is unknown. Previous research indicates that stress is the cause of PMS.[30,31] PMS has also been linked to hormonal abnormalities and nutritional inadequacies. Because alternative medicines are less expensive and have less side effects, they are more helpful in managing PMS.[32] The vestibular system, the first sensory system to begin operating during early[33] development, can be naturally stimulated by swinging.[34] The cortical and subcortical elements of the central nervous system are part of the vestibular systems intricate network of varied routes. The majority of the brain areas involved in the regulation of stress, sleep, and cognition are connected to the vestibular system by afferent and efferent pathways.[35]

For homeostasis, optimal linear vestibular stimulation is necessary throughout life.[36,37] Swinging on a swing has been shown to provide linear vestibular stimulation, which helps college students manage their stress.[38] We hypothesized that linear vestibular stimulation would help alleviate the majority of PMS symptoms because it inhibits the stress axes and creates less stressful situations.[39] The goal of the present study was to determine how well linear vestibular stimulation works to treat PMS.[31] Of all the senses in humans, the vestibular system is still mysterious.[40] It reacts to the heads location in respect to vestibular motion, namely, acceleration or deceleration and gravity.[41] Numerous advantages of linear vestibular stimulation have been demonstrated by research, including a reduction in self-stimulating behaviors, a decrease in hypersensitivity, an improvement in postural security, a boost in focus and attentiveness, an improvement in balance, an increase in body awareness, calming effects, a decrease in abnormal muscle tone at low speeds, and an increase in alertness at high speeds.[42] Regulating intensity, frequency, duration, and direction to stimulate the vestibular system. The ideal intensity, frequency, duration, and direction have not yet been established.[14] Depression, anxiety, postural incoordination, oculomotor abnormalities, and behavioral disorders can all result from vestibular dysfunction. Linear vestibular stimulation has been shown to enhance cognitive abilities.[35] The vestibular system can be stimulated electrically or naturally, which alters blood pressure and respiratory motor output and aids in preserving homeostasis while moving.[43] The aim of the present study is to apply linear vestibular stimulation to women with PMS.

MATERIALS AND METHODS

Research design

The current experimental investigation was carried out at IBM Jupudi's Department of Physiology at the NIMRA Institute of

Medical Sciences and Research Center. One hundred ladies in the 18–25 age range were included. Participants will act as self-controls in this study. Linear vestibular stimulation was given for 2 months after the baseline values were acquired during the premenstrual period (7 days before menstruation) of the menstrual cycle. The 1st and 2nd month's premenstrual periods will be used to record post-intervention data. To prevent diurnal variations, all the parameters were recorded at nine in the morning. The doctor at NIMRA Institute of Medical Sciences and Research Center will be consulted during the current investigation.[42,44] Various parameters such as demographic, biochemical, pain scale, autonomic (systolic blood pressure [SBP], diastolic blood pressure [DBP], and pulse rate), hematology, World Health Organization Brief version (WHOBREF) scale, and depression anxiety stress scales (DASS-42) scale. The demographic parameters, such as age, height, and body mass index (BMI), were recorded at the initial time of the study. The other parameters were recorded at an interval of 1 month [Table 1].

Participants, inclusion criteria, and exclusion criteria

After acquiring voluntary, written, informed agreement, 100 female volunteers between the ages of 18 and 30 were enlisted in the present study.

Inclusion criteria

The PMS questionnaire was used to test for PMS in healthy females who were willing to participate and had regular menstrual cycles lasting between 28 and 34 days.

Exclusion criteria

Participants will not be allowed to participate in the study if they have a musculoskeletal condition, a mental illness, or are on any kind of medicine, including contraceptives.[9]

Linear vestibular stimulation

Vestibular stimulation will be administered by making the participants swing on a swing (back to front direction), according to their comfort, as standardized by previous methods. It is done once a day.[40]

Table 1: Age of the people involved in the test, percentage

Age	*n*	Percentage
18	13	13
19	15	15
20	12	12
21	16	16
22	16	16
23	12	12
24	16	16
Total	100	

Assessment of depression, anxiety, and stress

Three self-report scales make up the 42-item DASS, which is designed to measure the adverse psychological states of stress, anxiety, and sadness. There are total of 14 items on each of the three scales, divided into subscales of two to five items with similar content. A 4-point Likert scale is used to rate the DASS items, with 0 denoting "did not apply to me at all" and 3 denoting "applied to me very much, or most of the time." Higher scores on each subscale indicate higher levels of stress, anxiety, and depression. The DASS 42 will be used to assess depression, anxiety, and stress.[1]

Assessment of serum cortisol and thyroid function tests

Chemiluminescent microparticle immunoassay (ABBOTT, USA) will be used to measure serum cortisol levels. The enzyme-linked immunosorbent assay method will be used to evaluate thyroid function tests (triiodothyronine [T3], thyroxine [T4], and thyroid-stimulating hormone [TSH]).

Assessment of autonomic parameters

Blood pressure and pulse rate will be recorded using diamond digital sphygmomanometers (BPDG024) and pulse oximeters (EDAN H100B).

Assessment of pain score

The numerical pain score is used to assess the perception of the pain.

Assessment of cognition

Cognitive function will be assessed using the Spatial Memory Test, the Verbal Memory Test, and the Mini Mental State Examination. These tools are standard neuropsychological measures employed to evaluate memory, attention, orientation, and overall cognitive status.

Assessment of QOL

The World Health Organization QOL – Brief version (WHO-QOL BREF) questionnaire is used to assess the QOL. A standardized questionnaire known as the WHO-QOL BREF was created as a cross culturally similar instrument to evaluate a person's views in light of their culture, values, as well as their objectives, standards and concerns. The four dimensions of QOL physical, psychological, social, and environmental are assessed using 26 questions. Every item has a five point Likert scale assigned to it.[14]

Ethics approval statement

The study was approved by the Institutional Ethics Committee of Saveetha Medical College Hospital (Ref No: 005/02/2023/IEC/SMCH).

RESULTS AND OBSERVATIONS

On observation, the serum cortisol, T3, T4, and TSH have been gradually decreasing month by month. The TSH has been significantly decreased, which decreases the chance of causing thyroid problems in women. The serum cortisol levels are shown in [Figure 1], representing the first five participants. Biochemical analysis is shown in [Figure 2].

The pain scale, that is, the pain during the menstrual phase and PMS, has also been reduced on linear vestibular stimulation. SBP showed a gradual decrease. DBP showed a slight decrease. In hematology analysis, the monocyte count decreased and remained constant in some women when compared with the corresponding control groups. Stress-induced increase was prevented in all age groups of females with different BMI. The lymphocytes showed a significant decrease in number and remained within normal limits when compared to the baseline values. Physical, psychological, social, and environmental scores seemed to be increased after 2 months of linear vestibular stimulation. Pain score plotted in [Figure 3].

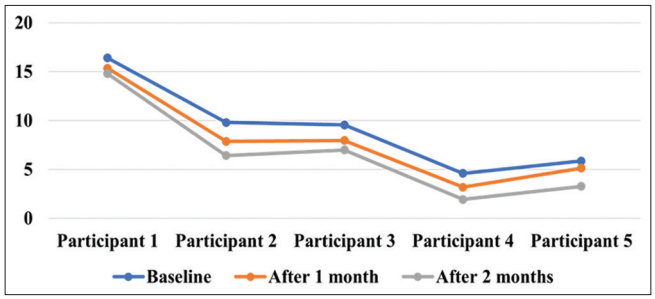

Figure 1: Serum cortisol levels before and also after 1, 2 months of intervention

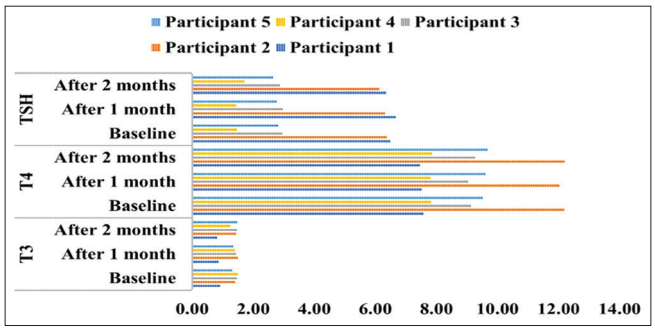

Figure 2: Biochemical analysis of triiodothyronine, thyroxine, and thyroid-stimulating hormone in participants before and after intervention and also after 1 and 2 months

The depression, anxiety, and stress scores on the DASS 42 scale appeared to have dropped. The DASS stress levels of the vestibular and control groups did not significantly differ before or after linear vestibular stimulation.[14] Before and after linear vestibular stimulation, there was no discernible difference in the DASS depression levels between the vestibular and control groups. There was a significant difference between the DASS depression scores of day 0 versus after 1 month and 2 months in VF and VM. The vestibular group showed a significant reduction in DASS anxiety scores after 30 and 60 days. Before and after linear vestibular stimulation, the control and vestibular groups DASS stress scores did not change substantially [Figure 4].

Before and after linear vestibular stimulation, there was no statistically significant difference in the WHO-QOL BREF transformed scores of four domains between the vestibular and control groups. WHO-QOL BREF of Day 0 versus after 1 and 2 months in VF is significantly increased.

DISCUSSION

Linear vestibular stimulation enhances cognitive function. Rocking is calming and may be caused by inhibition systems in the brainstem.[14,45,46] We have seen a change in blood cell parameters that are followed by linear vestibular stimulation, which suggests that immunity is improved. Examination

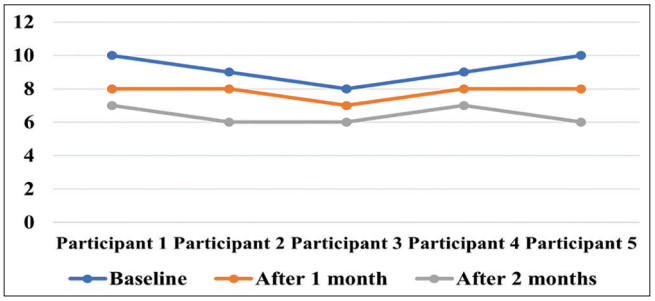

Figure 3: Pain score of the participant before the intervention and after 1 and 2 months

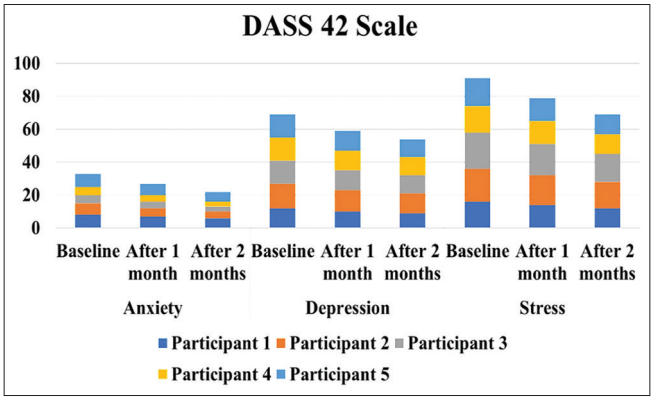

Figure 4: World Health Organization Quality of Life – Brief version transformed scores before and after linear vestibular stimulation

stress increases neutrophils and platelets while lowering eosinophils, monocytes, basophils, and lymphocytes, according to earlier research. Cortisol increases platelets and red blood cells while decreasing monocytes, lymphocytes, and eosinophils.[35] Different types of stress have different impacts on immunity. For instance, acute stress boosts natural immunity and decreases specific immunity, test stress mainly inhibits cellular immunity, and chronic stress suppresses both cellular and humoral immunity. Through sympathetic fibers that travel from the brain to main and secondary lymphoid tissues, stress has an impact on immunity. Numerous chemicals that attach to white blood cell receptors are released by these fibers. Through the hypothalamus pituitary ovarian axis, the sympathetic adrenal medullary axis, and the hypothalamic pituitary adrenal axis, stress also influences immunity. Stress also alters behavior, which impacts immunity.[47] According to reports, ventral hippocampus development modulates particular immunity and normal humoral immunity depends on the hippocampus operating normally. Remarkably, healthy hippocampal function depends on healthy vestibular function. Therefore, we postulated that linear vestibular stimulation would influence immunological responses through the hippocampus. Studies on both humans and animals have shown that linear vestibular stimulation reduces blood pressure and cortisol levels, which may restrict the immune alterations brought on by stress by blocking both stress axes. It is interesting to note that vestibular lesions raise cortisol levels.[14] Depression and anxiety coexist with vestibular diseases. While psychoactive medicines are typically used to treat mental illnesses, they are also commonly abused. Many misused drugs increase the efficiency of dopamine in the pleasure circuits, leading to heightened feelings of pleasure. Johny *et al*. found that front to back mobility on a hexapod lowers salivary cortisol levels. Optimal linear vestibular stimulation alleviates depression symptoms by affecting brain areas related to emotions, behavior and cognition. Linear vestibular stimulation, unlike psychotropic medicines, does not affect dopamine levels and has few negative effects. Swinging on a swing is a simple and cost effective way to stimulate the vestibular system. Incorporating it into daily routines can help prevent depression.[42] Previous studies have shown a consistent and significant decrease in salivary cortisol, blood pressure, and cell count, followed by linear vestibular stimulation. Our study confirms previous findings, indicating a substantial drop in DASS values after linear vestibular stimulation.[45] This demonstrates the positive effects of linear vestibular stimulation in balancing stress-induced alterations in immunological responses. A positive response is observed in the study against the PMS and its symptoms.[48] This study suggests that linear vestibular stimulation can effectively treat depression among college students. A larger study is needed to confirm the effectiveness of linear vestibular stimulation as a therapy for preventing depression among working women.[49] Vestibular under stimulation has little effect or a slight effect, while overstimulation results in vomiting, nausea, and sharp changes in breathing and pulse.[14] The vestibular system can affect spatial memory impairments and is linked to both bilateral vestibular lesions and cognition-related brain regions.[50] A prior study unequivocally demonstrates that hot water caloric linear vestibular stimulation improves cognition.[35]

CONCLUSION

Controlled linear vestibular stimulation decreases stress and can be of use in parallel cases. It decreases the effect of TSH. Compared to the control group, the treatment groups experienced a greater change in pain scores. Thus, it is proved that the linear vestibular stimulation shows an impact on the PMS women. Further research with more participants is required for accurate results.

AUTHORS' CONTRIBUTIONS

DK: Writing–original draft, conceptualization, and formal analysis. SVVGR: Writing–original draft, conceptualization, and formal analysis. IR: Writing–review and editing, visualization, and validation. MKDJ: Visualization, validation, formal analysis, and supervision.

REFERENCES

1. Dorani F, Bijlenga D, Beekman AT, Van Someren EJ, Kooij JJ. Prevalence of hormone-related mood disorder symptoms in women with ADHD. J Psychiatr Res 2021;133:10-5.
2. Amjadian M, Anbari M, Amini R, Khalilipour Darestani M, Dehghankar L, Panahi R. Studying the factors associated with premenstrual syndrome prevention among pre-university students in Tehran. J Prev Med Hyg 2022;63:E6-11.
3. Hooshiar SH, Yazdani A, Jafarnejad S. Effect of modified alternate day fasting diet on the severity of premenstrual syndrome and health-related quality of life in women with overweight or obesity: A trial study protocol. BMJ Open 2023;13:e066740.
4. Hantsoo L, Rangaswamy S, Voegtline K, Salimgaraev R, Zhaunova L, Payne JL. Premenstrual symptoms across the lifespan in an international sample: Data from a mobile application. Arch Womens Ment Health 2022;25:903-10.
5. Dutta A, Sharma A. Prevalence of premenstrual syndrome and premenstrual dysphoric disorder in India: A systematic review and meta-analysis. Health Promot Perspect 2021;11:161-70.
6. Turan A, Güler Kaya İ, Çakır HB, Topaloğlu S. Prevalence and correlates of premenstrual syndrome and premenstrual dysphoric disorder among women aged 18-25 in Turkey. Int J Psychiatry Med 2024;59:101-11.

7. Afreen H, Qazi T, Bashir H, Rehman S, Rabia S. Pharmacological and non-pharmacologic strategies used by working ladies of reproductive age for management of premenstrual syndrome. Pak J Med Health Sci 2022;16:502-6.
8. Effect of Tens on Acupoints in Premenstrual Syndrome. NCT05395156; 2022. Available from: https://www.cochranelibrary.com/central/doi/10.1002/central/cn-02405441/full [Last accessed on 2024 Aug].
9. Abay H, Kaplan S. Evaluation of the effectiveness of a training program for coping with PMS symptoms based on IMB model in university students. Women Health 2021;61:550-61.
10. Núñez-Lauriano M, Lira-Mandujano J, Míguez MC, Tiburcio M. Impact of menstrual cycle on smoking cessation: A review. Ment Health 2024;46:325-31.
11. Dilbaz B, Aksan A. Premenstrual syndrome, a common but underrated entity: Review of the clinical literature. J Turk Ger Gynecol Assoc 2021;22:139-48.
12. Barbosa Mde B, Guirro EC, Nunes FR. Evaluation of sensitivity, motor and pain thresholds across the menstrual cycle through medium-frequency transcutaneous electrical nerve stimulation. Clinics (Sao Paulo) 2013;68:901-8.
13. Alkhamis F, Almzraq LA, Alshayeb ZK, Al-Jaziri ZY. Prevalence of premenstrual syndrome among medical students in King Faisal University, Alahssa-Saudi Arabia. Med Sci 2021;25:1971-83.
14. Sailesh KS, Archana R, Mukkadan JK. Controlled vestibular stimulation: A physiological method of stress relief. J Clin Diagn Res 2014;8:M01-2.
15. Hofmeister S, Bodden S. Premenstrual syndrome and premenstrual dysphoric disorder. Am Fam Physician 2016;94:236-40.
16. Dean KR, Hammamieh R, Mellon SH, Abu-Amara D, Flory JD, Guffanti G, *et al*. Multi-omic biomarker identification and validation for diagnosing warzone-related post-traumatic stress disorder. Mol Psychiatry 2020;25:3337-49.
17. Anderson Z. Diagnosis and treatment of premenstrual syndrome: Differentiating premenstrual syndrome PMS from premenstrual dysphoric disorder PMDD and premenstrual exacerbation disorder PMED. In: Handbook of Gynecology. Cham: Springer International Publishing; 2023. p. 255-60.
18. Takeda T. Premenstrual disorders: Premenstrual syndrome and premenstrual dysphoric disorder. J Obstet Gynaecol Res 2023;49:510-8.
19. Girman A, Lee R, Kligler B. An integrative medicine approach to premenstrual syndrome. Am J Obstet Gynecol 2003;188:S56-65.
20. Chan K, Rubtsova AA, Clark CJ. Exploring diagnosis and treatment of premenstrual dysphoric disorder in the U.S. Healthcare system: A qualitative investigation. BMC Womens Health 2023;23:272.
21. Abu Alwafa R, Badrasawi M, Haj Hamad R. Prevalence of premenstrual syndrome and its association with psychosocial and lifestyle variables: A cross-sectional study from Palestine. BMC Womens Health 2021;21:233.
22. Granda D, Szmidt MK, Kaluza J. Is premenstrual syndrome associated with inflammation, oxidative stress and antioxidant status? A systematic review of case-control and cross-sectional studies. Antioxidants (Basel) 2021;10:604.
23. Hashmi SS, Shah M, Muhammad W, Ahmad A, Ullah MA, Nadeem M, *et al*. Potentials of phyto-fabricated nanoparticles as ecofriendly agents for photocatalytic degradation of toxic dyes and wastewater treatment. J Indian Chem Soc 2021;98:100019.
24. Kuehner C, Nayman S. Premenstrual exacerbations of mood disorders: Findings and knowledge gaps. Curr Psychiatry Rep 2021;23:78.
25. AlQuaiz A, Albugami M, Kazi A, Alshobaili F, Habib F, Gold EB. Dietary, psychological and lifestyle factors associated with premenstrual symptoms. Int J Womens Health 2022;14:1709-22.
26. Tiranini L, Nappi RE. Recent advances in understanding/management of premenstrual dysphoric disorder/premenstrual syndrome. Fac Rev 2022;11:11.
27. Siminiuc R, Ţurcanu D. Impact of nutritional diet therapy on premenstrual syndrome. Front Nutr 2023;10:1079417.
28. Ojezele MO, Eduviere AT, Adedapo EA, Wool TK. Mood swing during menstruation: Confounding factors and drug use. Ethiop J Health Sci 2022;32:681-8.
29. Labots-Vogelesang MS, Teunissen DA, Kranenburg V, Lagro-Janssen AL. Views of Dutch general practitioners about premenstrual symptoms: A qualitative interview study. Eur J Gen Pract 2021;27:19-26.
30. Funnell EL, Martin-Key NA, Bahn S. Improving care experiences for premenstrual symptoms and disorders in the United Kingdom (UK): A mixed-methods approach. BMC Health Serv Res 2025;25:70.
31. Hantsoo L, Sajid H, Murphy L, Buchert B, Barone J, Raja S, *et al*. Patient experiences of healthcare providers in premenstrual dysphoric disorder: Examining the role of provider specialty. J Womens Health (Larchmt) 2022;31:100-9.
32. Hodgetts S, Kinghorn A. Examining the impact of premenstrual dysphoric disorder (PMDD) on life and relationship quality: An online cross-sectional survey study. PLoS One 2025;20:e0322314.
33. Sailesh KS, Mukkadan JK, Minu J, Sneha B. Beneficial effects of vestibular stimulation in limiting thyroid modulation in females with PMS. J Chem Pharm Sci 2017;10:258-60.
34. Neumann N, Fullana MA, Radua J, Brandt T, Dieterich M, Lotze M. Common neural correlates of vestibular stimulation and fear learning: an fMRI meta-analysis. J Neurol 2023;270:1843-56.
35. Kumar SS, Rajagopalan A, Mukkadan JK. Vestibular stimulation for stress management in students. J Clin Diagn Res 2016;10:C27-31.
36. McLaren R, Smith PF, Taylor RL, Niazi IK, Taylor D. Scoping out noisy galvanic vestibular stimulation:

A review of the parameters used to improve postural control. Front Neurosci 2023;17:1156796.
37. Wheeler C, Smith LJ, Sakel M, Wilkinson D. A systematic review of vestibular stimulation in post-stroke visual neglect. Neuropsychol Rehabil 2025;35:408-40.
38. Eder J, Kellerer S, Amberger T, Keywan A, Dlugaiczyk J, Wuehr M, *et al*. Combining vestibular rehabilitation with noisy galvanic vestibular stimulation for treatment of bilateral vestibulopathy. J Neurol 2022;269:5731-7.
39. Wuehr M, Eder J, Keywan A, Jahn K. Noisy galvanic vestibular stimulation improves vestibular perception in bilateral vestibulopathy. J Neurol 2023;270:938-43.
40. Simoneau M, Nooristani M, Blouin JS. Balance control threshold to vestibular stimuli. J Physiol 2025;603:2783-99.
41. Habig K, Krämer HH, Lautenschläger G, Walter B, Best C. Processing of sensory, painful and vestibular stimuli in the thalamus. Brain Struct Funct 2023;228:433-47.
42. Johny M, Kumar SS, Rajagopalan A, Mukkadan JK. Vestibular stimulation for management of premenstrual syndrome. J Nat Sci Biol Med 2017;8:82-6.
43. Forbes PA, Dakin CJ, Geers AM, Vlaar MP, Happee R, Siegmund GP, *et al*. Electrical vestibular stimuli to enhance vestibulo-motor output and improve subject comfort. PLoS One 2014;9:e84385.
44. Sreeraj VS, Parija S, Uvais NA, Mohanty S, Kumar S. Indian nursing students' attitudes toward mental illness and persons with mental illness. Ind Psychiatry J 2017;26:223-7.
45. Kumar Goothy SS, S Chouhan R, Raghavan RV, Ratajczak W, Watson S, Robinson R, *et al*. A randomized, double blind, sham-controlled clinical trial to evaluate the efficacy of electrical vestibular nerve stimulation (VeNS), compared to a sham control for generalized anxiety disorder. Clin EEG Neurosci 2025;391:119949.
46. Sharmila R, Srinivasan V, Suganthirababu P, Kumar P, Dhanusia S, Kumaresan A, *et al*. Effect of vagus nerve stimulation in vestibular function among subjects with stroke. Indian J Physiother Occup Ther Int J 2024;18:170-5.
47. Sailesh KS, Archana R, Mukkadan JK. Impact of traditional vestibular stimulation on depression, anxiety and stress in college students. Biomed Res 2016;27:295-297.
48. Vaishnavi Giridharan G, Paul J, Suganthirababu P, Nathan CS. Unveiling the therapeutic impact of virtual reality game-based exercises on cervicocephalic kinesthetic sensibility in individuals battling cervical vertigo. Int J Disabil Sports Health Sci 2024;7:1322-8.
49. Elverişli GB, Armağan N, Atilgan E. Comparison of the efficacy of pharmacological and nonpharmacological treatments in women with primary dysmenorrhea: randomized controlled parallel-group study. Ginekologia Polska 2023;94(9):687-97.
50. Maity S, Wray J, Coffin T, Nath R, Nauhria S, Sah R, *et al*. Academic and social impact of menstrual disturbances in female medical students: a systematic review and meta-analysis. Front Med 2022;9:821908.

Source of Support: Nil. **Conflicts of Interest:** None declared.