

To Determine the Efficacy of Nintendo Wii Fit Aerobic Games versus Conventional Aerobic Training on Premenstrual Symptoms among Collegiate Females: A Comparative Study

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Abstract

Background: Most of the females in the reproductive age have one or more than one symptom either physical, mental or emotional in the menstrual cycle during premenstrual phase. The symptoms related to premenstrual phase can varies from mild to moderate to severe which are linked with distress as well as functional impairments. **Objective:** The aim of the study is to determine the efficacy of Nintendo Wii fit aerobic games versus conventional aerobic training on premenstrual symptoms among collegiate females. **Methodology-** Subjects meeting inclusion and exclusion criteria will be selected for the study and will be assessed according to Premenstrual Symptom Screening Tool (PSST) given by DSM-IV-TR criteria. A total of 60 collegiate females with age of 18-25 will be taken in the study and will be divided into 3 groups; Group A, Group B and Group C. Each group containing 20 female subjects. The data will be collected for dependent variables at baseline and at 9-weeks post treatment. **Results:** The result of the study showed statistically significant efficiency of Nintendo Wii Fit Aerobic games in adjunct to Conventional Aerobic Training on Premenstrual symptoms. **Conclusion:** The findings of the current research indicate that the Nintendo Wii Fit is a valuable instrument for improving Premenstrual symptoms and general wellness.

Keywords: Functional impairment, Menstrual cycle, Premenstrual Syndrome,

1. Introduction

Menstruation is a natural occurrence that serves as a significant indicator of women's health. Nevertheless, there is a lack of comprehensive data regarding women's experiences with menstruation and its effects on their health, quality of life, and social integration, particularly in developing countries.¹

Premenstrual syndrome (PMS) is a Psychoneuro-endocrine disorder of unknown aetiology, often noticed just prior to menstruation. There is a cyclic appearance of a large number of symptoms during the last 7-10 days of menstrual cycle.²

Premenstrual syndrome (PMS) is defined as a collective term for physical, emotional, psychological and behavioural symptoms that occurs in a cyclic and recurring manner during the late luteal phase of menstrual cycle and decreases within 2-4 days of menstruation.³ The premenstrual syndrome usually begins during the fertility period of a female and ends at menopausal period.⁴The ovulation is the main

part of the PMS, the symptoms shown during the luteal phase were ought to be seen and resides by the end of menstruation. There should be a symptom free period of time in the follicular phase of menstrual cycle as the symptoms begin to start again.⁵

This syndrome usually starts from 6th day to 12th day before menstruation and it keeps on for 2-4 days after menstrual bleeding. The symptoms vary from mild, moderate to severe that can be associated with stress or functional disturbances.⁶ It is stated that premenstrual syndrome is interlinked with abnormal sensitivity and excessive responses towards normal hormonal changes. There are various researches that states the different body systems like cardiovascular system, central nervous system, endocrine system and reproductive system are affected with the symptoms of premenstrual syndrome that can be emotional, cognitive and behavioural.⁷

The symptoms of premenstrual syndrome can get worse as the females reaches up to age of 30s or 40s and proceed towards menopause and are in the phase of transition to menopause which is known as perimenopause. It is obvious for the females whose moods are sensitive to changing hormonal levels especially during the menstrual cycle.⁸ Around 50%-80% of females suffered from mild to severe symptoms of Premenstrual syndrome (PMS) but the extensiveness of the Premenstrual Dysphoric Disorder (PMDD) is around 3-9%.⁵

The epidemiological studies show that up to 80% of women may experience mild to moderate emotional, behavioural or physical premenstrual symptoms and between 3% and 8% of women may experience severe premenstrual symptoms, according to reviews of epidemiological studies of retrospective reports of premenstrual symptoms.⁹ Premenstrual syndrome is a prevailing medical condition that affects about all the menstruating females worldwide. Broadly, in between 20% to 32% of premenopausal females and 30% to 40% of females of reproductive age are affected with PMS during menstrual cycle.¹⁰

According to World Health Organization (WHO) about 20-40% of women experiences more than one premenstrual symptom. A study showed that women with premenstrual symptoms have 27.5% of reduced work performance and 23.15% has impairment in their working field. University students also show significantly symptoms of premenstrual syndrome that disturbs their daily routine and education.³ The estimated prevalence of PMS in India has been reported to range from 14.3% to 74.4%. Likewise, the prevalence of PMDD in India has shown significant variation, with figures spanning from 3.7% to 65.7%. The factors affect prevalence encompass the diagnostic criteria or tools employed, along with socio-demographic and sub-cultural variations within a diverse nation like India, which influence the expression of symptoms.¹¹

There are not definitive causes of Premenstrual Syndrome, but there are various factors that can act as contributing factor to produce Premenstrual Syndrome.¹² There is abnormal functioning of hypothalamus-pituitary-adrenal axis (HPA), which further causes change in the secretion of hormones. the endocrine system plays the major role for defining the pathological features of premenstrual syndrome.¹³

Various research indicates that progesterone produced by the corpus luteum is a key factor in triggering PMS symptoms. Administering external progesterone or progestogen can also lead to similar symptoms. Moreover, postmenopausal women receiving hormone therapy that combines estrogen and progestogen may experience symptoms akin to PMS, including mood changes and physical symptoms.¹⁴

GABA is the primary inhibitory neurotransmitter which is widely distributed in CNS. It regulates stress, anxiety, vigilance, alertness and seizures. GABA is composed of glutamate by glutamic acid decarboxylase.

GABA is divided into following 3 categories: GABA-A, GABA-B and GABA-C but the main receptor is GABA-A where there is presence of site of action for both endogenous and exogenous agents. Serotonin is biochemically derived from tryptophan. It is mainly found in gastrointestinal tract, platelets and in CNS of both humans and animals. Serotonin is associated with feeling of well-being and happiness. The change in levels of serotonin i.e. reduction in the transmission of serotonin is showed in association with the conjoining symptoms.¹²

In luteal phase of menstrual cycle women with PMS shows alteration or variation in serotonergic functions. This decrease in serotonin levels results in anxiety and depressive symptoms. The ovarian sex steroids are regulated by the yield of serotonin. These ovarian sex steroids are very helpful in the yielding, binding and transporting of serotonin.¹²

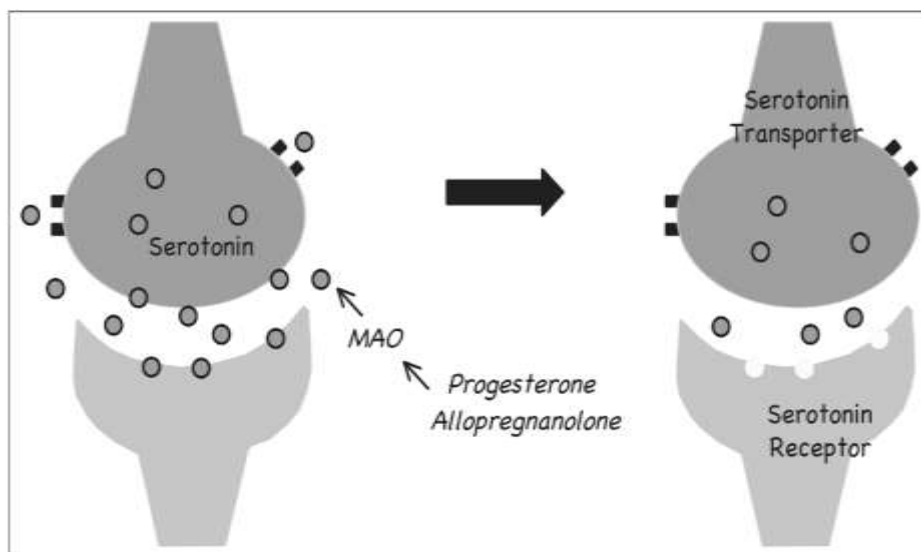


Figure. 1: Shows reduction in the serotonin which is compensated by turnover over by progesterone. The metabolite of progesterone which is allopregnanolone increases the monoamine oxidase activity which in-turns decreases the availability of serotonin which ultimately leads to depressive states.¹²

The symptoms of Premenstrual Syndrome vary in female to female depending upon the various factors like their environment, occupation, food habits, living style, education, and family conditions. All symptoms are not necessary to be found in every female. Sometimes only one or two symptoms found and sometimes a group of symptoms found in the female. Along with the symptoms the degree of symptoms also varies in female to female. The symptoms can be present in mild, moderate and severe forms. Some symptoms can be resolved without medications whereas for some symptoms the female have to seek medical help. Following are the main clinical presentations shown by a female suffering from premenstrual syndrome. There can be one symptom or combination of two or more than two symptoms together.²

Irritability, mood swings, depression, anxiety, headache, tension, fatigue, insomnia, poor concentration, tiredness, abdominal bloating, breast tenderness, weight gain, swelling of extremities.

A Diagnostic-criteria for charting the Premenstrual Symptoms is developed as Premenstrual Dysphoric Disorder (PMDD) in the 4th edition of Diagnostic and Statistical Manual of Mental Disorder (DSM-IV) which is a main method to chart the symptoms on the basis of severity. The criteria mainly focus on the

timing of symptoms that is the symptoms should occur prior to the menstrual cycle and subsides after the menstrual cycle, degree of severity of the symptoms that is the severity should be enough to disturb the daily routine functioning of a female, 5 of 11 particular symptoms were required to fulfil the dysphoric nature of the disorder and keeping out of other physical and emotional disorders.¹⁵

The treatment of the Premenstrual Syndrome is done via various treatment protocols but most of the treatment studies focused on the suppression of ovulation phase with the help of oral contraceptives. The available treatment for the premenstrual syndrome and PMDD for both the pharmacological and non-pharmacological methods

Pharmacological Treatment¹⁶

1. Serotonergic antidepressants (SSRI's)
2. Serotonergic-norepinephrine reuptake inhibitors (SNRI's)
3. Gonadotropin-releasing hormone (GnRH) agonists
4. Oral Contraceptives
5. Calcium supplementation
6. Vitamins supplementation
7. Psychotherapeutic agents

Non-Pharmacological Treatment¹⁶

1. Herbal preparations
2. Dietary modifications
3. Lifestyle modifications
4. Cognitive behaviour therapy

2. Methodology

2.1 Study Design

The study design is Pre-test Post-test Experimental design which is comparative in nature. The Convenient sampling technique will be used.

2.2 Protocol

All the subjects meeting the inclusion criteria will be enrolled in the study. A written informed consent will be undertaken from each participating subject. The required screening and assessment of the subjects will be done. A total of 60 subjects will be selected for the study divided into 3 groups that is Group A, Group B and Group C, each group containing 20 subjects. According to DSM-IV-TR criteria of Premenstrual Symptom Screening Tool (PSST) will be used as a screening tool to assess the severity of premenstrual symptom as moderate to severe.¹⁷ The total duration of the study will be 9 weeks, 4 sessions per week with a minimum duration of 60 minutes per day for all the groups. The total sessions of the groups will be 36 sessions. The exercises will be performed between two menstrual cycles. The females will be abstained from performing exercises during first three menstruating days. The subjects will be assessed at baseline and post intervention 9 weeks for Premenstrual Symptoms using Premenstrual Syndrome Scale respectively.

2.3 Procedure

All the subjects included in the study for each group will undergo anthropometric measurements at baseline for weight (kg), height (m) and BMI (kg/m²). Subjects will attend one day of practice to get familiarized with training and testing protocol. Subjects will be advised to avoid caffeine and maintain normal hydration. The exercises will be followed as per the moderate intensity exercises guidelines as

prescribed by American College of Sports Medicine (ACSM). The guidelines described moderate intensity exercises as 65% to 75% of maximal heart rate.¹⁸

Group 'A' Intervention

Nintendo Wii Fit Aerobic Training

Aerobic games in Nintendo Game console will be played by the subjects on the alternate days in two cycles.

Before initiating the game intervention, a warm session for 8 minutes will be performed which includes Bilateral arm movements, leg movements, trunk rotations.

The pattern of the games will be as follows:

Session I

Free run *10 minutes

- Free run is one of the aerobic exercises of Nintendo Wii Fit.
- It allows the subject to score over 3.2 miles or 2 full island laps in 10 minutes.
- The distance is measured in kilometres or meters.

Rest period* 7 minutes

Basic step* 10 Minutes

- Basic step is also one of the aerobic exercises of Nintendo Wii Fit.
- In this game the subject has to step on and down off the Wii Balance Board syncing with the on-screen steps performed by other mii characters.
- The game has Red-steps (stepping forwards and backwards) and Blue-steps (stepping left and right).

Rest period* 7 minutes

Rhythmic-boxing* 10 Minutes

- It is another aerobic exercise of Nintendo Wii Fit.
- For Rhythmic Boxing the subject will use the Nunchuk and the Wii Remote and the nunchuk will always be in the left hand side.
- It is a game of Rhythm in which a mii instructor on the screen will give what moves the subject has to perform.

Session II

Free run *10 minutes

- Free run is one of the aerobic exercises of Nintendo Wii Fit.
- It allows the subject to score over 3.2 miles or 2 full island laps in 10 minutes.
- The distance is measured in kilometres or meters.

Rest period* 7 minutes

Advance step* 10 min

- The advance step is an aerobic game of Nintendo Wii Fit which can be play alternatively to the basic step.
- In this game the subject has to step on the Wii Balance Board in coordination with the steps on the screen performed by the other mii characters.
- It includes Green-steps (Kicking forward and backwards) and Purple-steps (Stepping forward and backwards sideways).

Rest period* 7 minutes

Super Hula loop* 10 min

- It is another aerobic exercise game of Nintendo Wii Fit game console.
- In this game the subject has to shift hips from side to side to align their pelvis for holding the hula-loop.
- The hips will spin twice, once right and once left.

After the training session, the subject will perform the gentle stretching's for 8 minutes in cool down phase which will include stretching of bilateral wrist extensors, legs, ankles, wrists and neck.

Group 'B' Intervention**Conventional Aerobic Training**

The subject will perform 8 minutes of warm up, 44 minutes of aerobic training session and 8 minutes of cool down, leading to a total of 60 minutes (minimum) per training session.

I. Warm Up Period

- Bilateral Arm movements (flexion, extension, abduction)
- Bilateral Leg movements (flexion, extension, abduction)
- Trunk rotations

II. Conventional Aerobic Training

Aerobic training will be performed by the subjects on the alternate days in two cycles.

Session I**Treadmill + Jump rope**

The subjects will be instructed to perform 20 minutes of treadmill (walk) and then take 4 minutes of rest. After it the subject will perform 20 minutes of jump rope. The subject had the rope go around once per jump and will perform 5 cycles. Each cycle consists of 2 minutes of jumping and 2 minutes of rest. 20 minutes will be required for completion of 5 cycles.¹⁹

Session II**Static Cycling + Jump rope**

The subject will be instructed to perform 20 minutes of static cycling and then take 4 minutes of rest. Thereafter, the subject will perform 20 minutes of jump rope. The subject had the rope go around once per jump and will perform 5 cycles. Each cycle consists of 2 minutes of jumping and 2 minutes of rest. 20 minutes will be required for completion of 5 cycles.¹⁹

After the training session, the subject will perform the gentle stretching's includes stretches of Biceps brachii, Wrist flexors and extensors, Calf muscle, Hamstrings muscle, Quadriceps muscle, Quadratus lumborum

3. Results

Data analysis was done by SPSS software version 18. This chapter gives out the thorough explanation of the result of the study by changing the raw data into useful information. To determine the efficacy of Nintendo Wii Fit aerobic games versus Conventional aerobic training in the collegiate females on Premenstrual symptoms was the aim of the investigation. Within the group analysis was carried out using paired t-test premenstrual symptoms among three groups (Group A, Group B, and Group C) baseline and post-intervention (9th week). The level of significance was $p < 0.05$ applied. To demonstrate the results of the study, the data was arranged and analysed as tables and graphs.

Table 1. The comparison of outcome measures on Baseline and 9thWeek in Intra-group for GA, GB and GC

	Group	Baseline (Day “0”)	9 th Week	Paired T test	T-Value	P-Value
Premenstrual Syndrome Scale	GA	130.50±19.877	105.90±18.890	5.351	2.09	<0.001
	GB	119.10±12.769	90.90±18.427	6.287	2.09	<0.001
	GC	120.00±32.638	119.30±32.766	0.840	2.09	0.412

The results showed statistical difference in mean score for Premenstrual symptoms reduces from 130.50 to 105.90, with a mean difference of 24.60. The SD decreased from 19.877 to 18.890, indicating more consistent improvements after intervention. The paired t-test value of 5.351 with a p-value of <0.001 confirms a statistically significant improvement.

The results showed statistical difference in mean score for Premenstrual symptoms reduces from 119.10 to 90.90, with a mean difference of 28.20. The SD increased from 12.769 to 18.427, indicating more consistent improvements after intervention. The paired t-test value of 6.287 with a p-value of <0.001 confirms a statistically significant improvement.

The results reduction in Premenstrual symptoms from 120.00 to 119.30, with a mean difference of 0.70. The SD increased from 32.638 to 32.766, indicating slight improvements. The paired t-test value of 0.840 with a p-value of 0.412 confirms a non-significant improvement (Shown in Table1).

Table 2. The comparison for Premenstrual Syndrome Scale between GA, GB and GC

	Group	Baseline (Day “0”)	9 th Week
Premenstrual Syndrome Scale	GA	130.50±19.877	105.90±18.890
	GB	119.10±12.769	90.90±18.427
	GC	126.00±16.398	125.35±16.916
F test		2.395	18.219
Table Value		3.159	3.159
P Value		0.100	<0.001

The results showed (Table 2) statistically significant results for the analysis the **Premenstrual Syndrome Scale** comparison between the groups at baseline revealed no significant differences, with an F-test value of 2.395 and a p-value of 0.100. This result indicates that all groups had similar levels of premenstrual syndrome symptoms before the intervention. However, at the 9th week, a significant difference was detected, with an F-test value of 18.219 and a p-value of <0.001. Specifically, Groups A and B demonstrated significant reductions in premenstrual syndrome symptoms, while Group C showed no notable improvement. This suggests that the intervention was effective in alleviating premenstrual symptoms for Groups A and B, but not for Group C.

4. Discussion

The present study was done with the main goal of investigating the efficacy of Nintendo Wii Fit aerobic

games versus Conventional aerobic training in collegiate females. A total of 60 subjects participated in the study and were divided into three different groups Group A, Group B and Group C. Group A participants performed Nintendo Wii Fit training, while on the other side Group B participants were instructed to perform Conventional Aerobic training. Group C was taken as control group. The parameter was checked at baseline and at 9th week post treatment.

The obtained data was analysed by the SPSS software version 18. The statistical significance was determined with 0.05 as level of significance. Paired t-test was used to analyse the results of within the group and ANOVA was used to compare the results of the Group A and Group B and Group C for the dependant variable Premenstrual symptoms.

The purpose of the study is to determine the efficacy of Nintendo Wii Fit aerobic games versus Conventional aerobic training on premenstrual symptoms in the collegiate females. It was hypothesized that there would have been statistically significant difference for Nintendo Wii Fit aerobic games in adjunct to Conventional aerobic training. In accordant with the study hypothesis, the Nintendo Wii Fit aerobic games were found to be efficient and had significant difference in the variables relative to the conventional aerobic training. The aerobic exercises performed with the Nintendo Wii Fit shows marked significant differences on all the dependent variables of the study.

Consistent with the study hypothesis, the aerobic exercises were found to be equally efficient to conventional aerobic training and had significant difference in improving premenstrual symptoms. The present study provided the significant results in relieving of premenstrual symptoms in the collegiate females with the help of aerobic exercises for 9- weeks with 4 sessions per week. The baseline data was assessed with the help of Premenstrual Syndrome Scale (PMSS). Groups A and B demonstrated significant decrease in premenstrual syndrome symptoms, while Group C showed no improvement.

A similar study was done by **Zinat Ghanbari, M.D. et al. (2008)**²⁰ in which 91 subjects were taken with a consistent menstrual cycle and no prior history of gynaecological, endocrinological, or psychological conditions. The participants were categorized into two groups: the exercise group and the non-exercise group. The exercise sessions lasted for one hour and were conducted three times a week over a period of three months. Various symptoms of premenstrual syndrome (PMS), including emotional, behavioural, electrolyte, autonomic, neurovegetative, and skin symptoms, were compared between the two groups. The findings indicated a notable decrease in the intensity of PMS symptoms, with significant variations observed in electrolyte levels, neurovegetative and cognitive symptoms, as well as skin-related issues.

One more study described as significant by **Zahra Mohebbi Dehnavi et al. (2018)**²¹ showed that engaging in aerobic exercise is an effective method for alleviating the physical symptoms associated with premenstrual syndrome. This research was conducted as a randomized clinical trial involving 65 students residing in the dormitories of Mashhad University of Medical Sciences in Iran during 2016. Participants were randomly divided into control and intervention groups. The intervention group participated in aerobic exercises for eight weeks, with sessions held three times a week, each lasting 20 minutes. The study utilized several tools, including a research unit selection questionnaire, midwifery and personal details, a temporary assessment of premenstrual syndrome, the Beck Depression Inventory, daily symptom logs for premenstrual syndrome, and the Borg scale. At the outset of the study, both the control and intervention groups were similar in characteristics. The results from the independent t-test indicated that, by the conclusion of the study, the intervention group experienced a significant reduction in several physical symptoms of premenstrual syndrome compared to the control group. Specifically, there was a notable decrease in headache, nausea, constipation, and diarrhoea, as well as swelling. Furthermore, when

comparing the mean differences in symptoms from the beginning to the end of the study, bloating, vomiting, hot flashes, and increased appetite also showed significant reductions.

Muntaha Virk et al. (2019)²² also concluded in their study that the 8- weeks of aerobic exercise training is useful to decrease the symptoms of Premenstrual syndrome in the girls of non-athlete background. The methods and tools employed for identifying and revealing PMS symptoms included the Premenstrual Symptoms Screening Tool for Adolescents (PSST). Pain symptoms were evaluated and recognized through a visual analog scale. A diverse group of females was invited to engage in aerobic exercises, including walking, jumping, jogging, and hamstring-quadriceps stretching, over a period of 8 weeks. The connection between physical activity and mental health has been explored, revealing that exercise can effectively alleviate psychological issues such as stress, anxiety, and depression. Many women have reported enhanced self-confidence and greater engagement in social activities, along with significant improvements in their social skills. This positive impact is attributed to exercise's ability to boost the production of endorphins, which act as the body's natural pain relievers. Engaging in exercises helps to correct hormonal imbalances, thereby reducing psychological symptoms such as stress, anxiety, and depression. The initiation of aerobic exercise yielded favourable results, as it was evident and relatable that the symptoms of PMS were markedly different before and after exercise. Engaging in aerobic activity reduced both the psychological and physical symptoms associated with PMS, suggesting its potential as an effective treatment to alleviate and lessen these symptoms.

The proposed mechanisms that can help women with the symptoms of PMS are documented as follows: Estrogen and Progesterone in the late luteal phase of menstruation cycle are at lower levels in order to prepare for menstruation. One of the confounding factors in the occurrence of PMS symptom is low hormonal levels.^{23,24} Aerobic training exercises momentarily improves the concentration of estrogen and progesterone. The increase in ovarian hormones have an effect on concentration of aldosterone and renin.²⁵ Exercise improves the elasticity of blood vessels increase production of nitric oxide which causes the vessels to dilate and promotes angiogenesis. Aerobic training has proven to have better effect on stroke volume and lowering resting heart rate and the combination of both leads to increase cardiac output.

5. Future Scope

Further study can be carried out to prove the efficacy of Nintendo Wii Fit versus Conventional training on sedentary and non-sedentary female population with PMS. Future areas to explore could incorporate various combination of exercise modalities along with follow-ups and cultural influences context.

6. Conclusion

The current study concludes that aerobic training is efficacious among females suffering from PMS. Physical activity and exercise training have been proven as non-pharmacological intervention for alleviating the symptoms of PMS. Nintendo Wii Fit was found to be efficient in adjunct to the Conventional training in providing the aerobic strength to the females with premenstrual symptoms along with the visual feedback that helps the subject to more indulge in the intervention.

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