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RESEARCH ARTICLE

To Compare the Effectiveness of Whole-Body Vibration and Aerobic Exercise Versus Aerobic Exercise Alone in Females with Polycystic Ovary Syndrome: A Comparative Study

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Abstract:

Background: Polycystic ovarian syndrome (PCOS) is one of the most common endocrine disorders in reproductive age of women. Depending on the diagnostic criteria, the prevalence rate in India is estimated to be between 8.2% and 22.5%. PCOS is also associated with factors such as increase in body weight and lifestyle changes. ***Objectives***: The objective of the study is the effectiveness of whole-body vibration and aerobic exercise in females with polycystic ovary syndrome (PCOS). The objective of the study is the effectiveness of aerobic exercise only in females with polycystic ovary syndrome (PCOS). ***Methodology***: Study design: Experimental design. Study type: pre and post type. Study setting: Faculty of occupational therapy and Faculty of Humanities and Science - MAHER University. Sampling design: Randomized control trial. Sample size: 60 subjects. ***Results***: On comparing the mean values of Group A and Group B on PCOS Questionnaire score, it shows significant increase in the post test mean values in both groups, but Group A (Whole body vibration + Aerobic exercise) which has higher mean value is effective than Group B (Aerobic exercise only). ***Conclusion***: The present study concluded that 12 weeks whole body vibration and aerobic exercise program was effective in subjects with PCOS in improving physical health. Both the group have shown improvement in outcome measure but Group A (whole body vibration + aerobic exercise group) was superior to group B (Aerobic exercise only group).

Keywords: PCOS, Whole body vibration, aerobic exercise, polycystic ovarian syndrome.

INTRODUCTION

Polycystic ovary syndrome (PCOS) is one of the endocrine disorders among reproductive age. It is characterized by irregular menstruation, hyperandrogenism and polycystic ovaries. It leads to numerous health complications, including insulin resistance, obesity and cardiovascular issues, which necessitate effective management strategies. PCOS decreases the chance of conception and increases the risk of complications during pregnancy [1]. PCOS is a major public health concern and one of the most common hormonal abnormalities affecting women in their reproductive years. Up to 70% of cases go undiagnosed, with the condition affecting 8–13% of women who are of reproductive age [2] . Before menopause, one in ten women are thought to experience pcos and deal with its complications. The fundamental reasons of PCOS are recognized to be the high ratio of luteinizing hormone (LH) to follicle-stimulating hormone (FSH) and the increased frequency of gonadotropin-releasing hormone (GnRH); however, the precise pathophysiology and causes are not fully understood. This syndrome is frequently linked to enlarged and dysfunctional ovaries, high testosterone levels, insulin resistance and other conditions [3].

Globally, women between the ages of 17 and 45 are predicted to have a 5.5% to 12.6% prevalence of pcos. Depending on the diagnostic standards, India's prevalence rate is estimated to be between 8.2% and 22.5%. In women, one of the main cause of infertility is polycystic ovary syndrome. A young girl may be predisposed to pcos by being overweight or obese, leading a sedentary lifestyle, or having a family history of the condition[4]. Signs and symptoms of PCOS have a substantial financial burden and is linked to infertility, hair loss, irregular menstruation and ovulation, and metabolic problems. While any age can experience pcos, starting at menarche, most cases are seen in people between the ages of 20 and 30 [5].

Insulin resistance, hormone imbalance, hyperandrogenism, and persistent low-grade inflammation are the main pathophysiological factors of polycystic ovarian syndrome (PCOS). These factors decrease folliculogenesis and raise the risk of associated comorbidities like type 2 diabetes and endometrial cancer. International guidelines state that ovarian morphology, anovulation, and hyperandrogenism are the three primary characteristics used to diagnose pcos. Sedentary lifestyle , high-calorie diets may be contributing factors to pcos aggravation. Diets high in sugar can cause chronic inflammation, change the gut flora and produce more testosterone, all of which can lead to pcos. The characteristic symptoms of this condition are exacerbated by obesity and weight increase [6].

In females who have a genetic susceptibility to developing pcos, obesity and gaining weight frequently causes biochemical and clinical symptoms. There is a connection between pcos and obesity. Between 38% and 88% of women with pcos are overweight or obese. The Northen Finland Birth Cohort (NFBC) 1996 data indicates a substantial relationship between body mass index and pcos characteristics across all age groups. In addition, small weight loss (about 5 percentage) frequently leads to clinically significant improvements in the

hyperandrogenism, metabolic, and reproductive aspects of PCOS[7]. Exercise is a cornerstone of pcos management, helping to improve insulin sensitivity, reduce hyperandrogenism and promote overall well-being. Traditional aerobic exercises have been widely recommended for their cardiovascular benefits and ability to aid in weight management. However, emerging evidence suggests that whole body vibration (WBV) exercise may offer unique benefits for women with pcos [8]. Potential processes that contribute to weight loss with whole body vibration therapy include decreased fat storage and suppression of adipogenesis, higher energy expenditure during exercise and enhanced muscle mass. In order to receive whole body vibration therapy, one must squat or stand on a vibrating plate that sends energy throughout the body and causes muscular contractions. This form of exercise is gaining attention for its potential to improve muscle strength, bone density and metabolic health with lower impact on the joints compared to conventional aerobic exercises [9]. It is characterized by ovulatory dysfunction, hyperandrogenism and polycystic ovaries. PCOS is a leading cause of infertility and a significant contributor to metabolic disturbances such as type 2 diabetes, obesity and insulin resistance [10]. Pathophysiology of PCOS is multifactorial, involving genetic, hormonal and environmental factors. Despite its prevalence and impact, the etiology of PCOS remains incompletely understood, necessitating ongoing research into effective management strategies [11].

Lifestyle modification, particularly exercise and diet, is a cornerstone in the management of PCOS. Regular physical activity has been shown to improve insulin sensitivity, reduce body weight and ameliorate cardiovascular risk factors, which are often exacerbated in women with PCOS [12]. Aerobic exercise, characterized by sustained activities that increase heart rate and improve cardiovascular fitness, is commonly recommended due to its well-documented benefits on metabolic health. However, the optimal type and intensity of exercise for managing PCOS symptoms remain subjects of investigation. Given the heterogeneous nature of PCOS and the varying responses to different forms of exercise, exploring alternative exercise modalities is crucial for developing personalized and effective treatment plans[13-14]. Whole body vibration exercise is relatively new intervention that has gained attention for its potential benefits in various health conditions. WBV involves standing, sitting or lying on a platform that oscillates at specific frequencies, transmitting mechanical vibrations through the body. These vibrations induce muscle contractions and stimulate mechanoreceptors, potentially leading to improvements in muscle strength, bone density and metabolic health with lower physical strain compared to traditional exercise [15-16]. Several studies have suggested that WBV may enhance physical performance, increase muscle mass and improve metabolic parameters such as insulin sensitivity and lipid profiles. Given these potential benefits, WBV exercise could be a promising intervention for women with PCOS, who often experience musculoskeletal and metabolic challenges [17-18]. The primary objectives of the current study is to analyse the effectiveness of whole-body vibration and aerobic exercises in females diagnosed with PCOS, and to analyse the effectiveness of aerobic exercise alone in females diagnosed with PCOS.

MATERIALS AND METHODS

Study design

This dissertation will employ a experimental study design to comparing the effectiveness of whole-body vibration and aerobic exercises versus aerobic exercises alone in women with PCOS. Participants will be randomly divided into2 groups: 1) Whole body vibration + Aerobic Exercise Group or 2) Aerobic Exercise Only Group. The intervention period will last 12 weeks, with assessments conducted at baseline, mid-intervention (1-6 weeks), and post-intervention (7-12 weeks). For this study, 60 subjects were chosen and divided as Group A (whole body vinration+Aerobic exercise group) - 30 Subjects, and Group B (Aerobic exercise group) - 30 Subjects under Pre and Post type studies for the period of 12 weeks.

Inclusion criteria

- Female in the age between 18-25 years with
- Hyperandrogenism
- Anovulation
- Polycystic ovaries

Exclusion criteria

- Anemia
- Cardiovascular disease
- Lung disease
- History of chronic disease

Chronic medical conditions unrelated to PCOS

A total of 60 subjects with polycystic ovarian syndrome were randomly assigned into two groups. The purpose and importance of the study was elaborated and explained to the patients. Informed consent was obtained then they were assessed and grouped into two, Group A with 30 subjects and Group B with 30 subjects.

Group A -Whole-body vibration technique and Aerobic exercises

Group A (Whole-body vibration+Aerobic exercise) received whole body vibration combined with aerobic exercise (for example-cycling, jump rope, step Aerobic) for 3 times a week, 45 minutes per session for 12 weeks. The subjects will standing on whole body vibration with maintaining spine straight and squatting position while keeping their trunk extended. Advance position- one leg stance, lunges. The training session will be divided into three sets of one minute each, with 1 minute of standing break in between. Intensit-1mm, given for 20 minutes after this 5 minutes rest and then start aerobic exercise for 20 minutes.

Standing position:

Basic stance: Stand with feet shoulder-width apart on the platform (Fig 1). Knees slightly bent: Maintain a slight bend in your knees to absorb vibrations and protect your joints. Core engaged: Tighten your abdominal muscles to support your spine. Duration: Start with 1-2 minutes per session and gradually increase to 10-15 minutes.

Frequency: 2-3 times per week is recommended initially.

Fig 1. Standing on whole body vibration

Fig 2. Squatting - whole body vibration

Exercise positions: Squatting position: standing with feet shoulder-width apart, lower your body into a squatting position, and hold or perform repetitions (Fig 2).

Advanced positions: One-leg stance: Stand on one leg to challenge your balance and core stability (Fig 3).

Fig 3. One leg stance on the whole body vibration. Fig 4. Lunges on the whole body vibration

Lunges: Place one foot on the platform and the other on the floor behind you, lowering into a lunge position (Fig 4).

Post-procedure

1. Cool down: Perform light stretching to help your muscles relax and reduce any potential soreness.
2. Hydration: Drink plenty of water to stay hydrated.
3. Monitoring: Pay attention to how your body feels. If you experience any discomfort or adverse effects, reduce the intensity or consult a professional.

Group B - Aerobic exercise only

Group B (Aerobic exercise only) received moderate-intensity aerobic exercises in form of treadmill walking with other aerobic exercises for three times a week, 45 minutes per session for 12 weeks. The subjects engaged to perform moderate intensity aerobic exercise for 45 minutes for three times per week for 12 weeks. 20 minutes of tread mill 5 minutes rest and 20 minutes of aerobic exercise.

Walking on a treadmill

Warm-up: Start with a 5- minute warm-up, walking at a slower pace to prepare your muscles. Pace: Increase your pace to a brisk walk, aiming for a moderate intensity where you can talk but not sing. Duration: Aim for at least 20 minutes of continuous walking. Cool-down: End with a 5-minute cool-down, gradually slowing your pace to bring your heart rate back to resting levels. Frequency: Aim for at least 150 minutes of moderate aerobic activity per week, spread over most days of the week (Fig 5).

Fig 5. Treadmill walking

Aerobics exercises for group A and group B

Cycling

Warm-up: Cycle at a low resistance and a moderate pace for 5-10 minutes. Pace and resistance: Increase resistance and speed to reach a moderate intensity level. Aim for 60-80 revolutions per minute (RPM). Duration: Cycle for 10 minutes, depending on your fitness level. Cool-down: Gradually decrease resistance and pace for the last 5-10 minutes. Frequency: three times per week (Fig 6).

Fig 6. Cycling

Step aerobics

Warm up: Start with a 5-minute warm-up of light stepping or marching in place.

Step routine:

Basic step: Step up onto the platform with one foot, then the other, and step down in reverse order (Fig 7).

Fig 7. step aerobics - basic step

V-step: Step up wide with both feet, then step down close together (Fig 8).

Fig 8. Step aerobics - v step

- Pace: Maintain a steady rhythm, using arms for balance and additional movement.
- Duration: Continue the routine for 10 minutes.
- Cool-Down: End with a 5 minute cool-down of light stepping and stretching.
- Frequency: 3times per week.
- Jump rope
- Warm-Up: Start with a few minutes of light jumping or jogging in place.
- Form: Hold the handles of the jump rope at hip height, keeping your elbows close to your body. Jump on the balls of your feet with a slight bend in your knees.
- Pace: Jump at a steady pace. Begin with basic jumps and progress to more advanced techniques as you improve.
- Duration: Start with short intervals (e.g., 1-2 minutes), gradually increasing to 10 minutes.
- Cool-down: Slow your pace and finish with light jumping or jogging in place for a few minutes.
- Frequency: Three times per week (Fig 9).

Fig 9. Jump rope

Warm up& Cool down exercise was included to avoid injuries. Post test score was recorded after 12 weeks of intervention.

Table 1:

S.No.	Group	Weeks	Treatment	Duration	Frequency
1.	Group A	1st - 4th	Whole body vibration - Standing position	20 min Rest 1 min for every 3 minutes.	
			Aerobic exercise - cycling, step aerobic jump rope.	20 min	
		5th - 8th	Whole body vibration - squatting position	20 min Rest 1 min for every 3 sets.	
			Aerobic exercise - cycling, step aerobic jump rope.	20 min	
		9th - 12th	Whole body vibration - Lunges	20 min Res 1 min for every 3sets	3 Days per week
			Aerobic exercise - cycling, step aerobic jump rope.	20 min	
2.	Group B	1st - 4th	Treadmill walking	20 min	
			Aerobic exercise same as group A	20 min	
		5th - 8th	Treadmill walking	25 min	
			Aerobic exercise same as group A	20 min	
		9th - 12th	Treadmill walking	25 min	
			Aerobic exercise same as group B	20 min	3 Days per week

Statistical analysis

Data was analyzed using SPSS statistical software version 27 and student paired t test was adapted to comparing pre-intervention and post-intervention outcomes within and independent T test between groups. Graphs and data table was adopted by same statistical software. Statistical significance will be set at $p < 0.05$.

RESULT

On compare the pre-test mean values and post-test mean values between group A and group B, Group A - 30 subjects who undergone both Whole body vibration and aerobic exercise showed statistical significance (0.001) in reducing PCOS and it's symptoms also improve their quality of life. When Group A and Group B's PCOSQ mean values are compared, it is evident that both groups post-test mean values have significantly increased, but (Group A – Whole body vibration+ aerobic exercises) shows 163.97 ± 2.426 which has the higher mean value and more effective than (Group B – Aerobic exercises) 131.80 ± 25.668 at $P \leq 0.05$. Hence the null hypothesis is rejected.

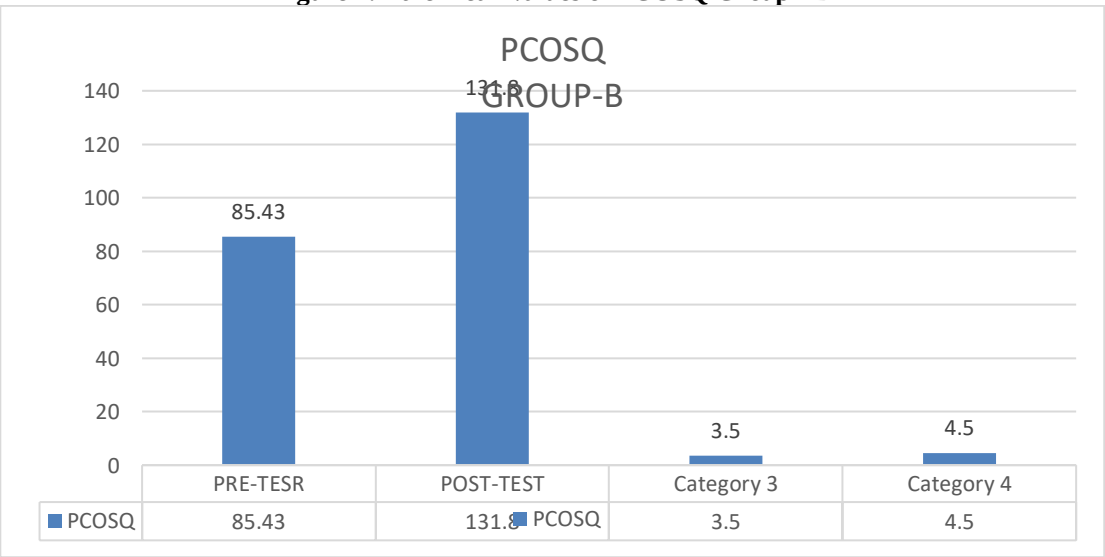
Table 2. Mean values of PCOSQ group - A

	PCOSQ	
Group - A	Pre-test	Post-test
Mean	85.93	163.67

SD	9.032	2.426
P value	0.0001	
t-test	0.22	
Significance	0.0001	

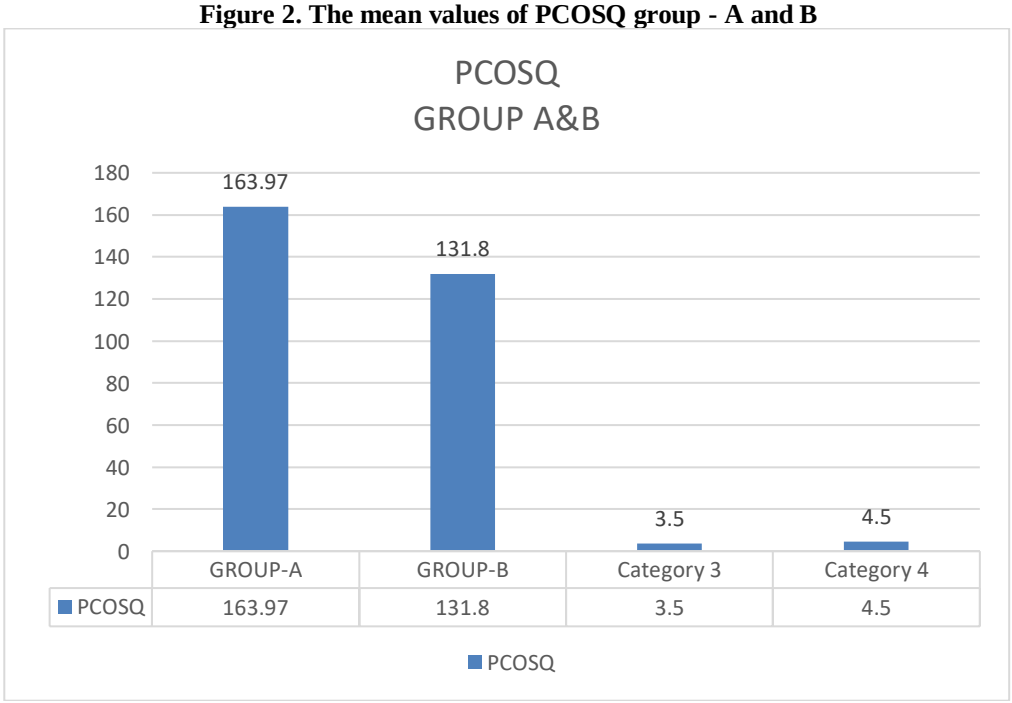
Table 2. shows mean values of PCOSQ group-A, the experimental groups mean ±SD of pre-test is 85.93±9.03 post-treatment is163.67±2.43. The difference between pre- and post-test is statistically significant with p =0.0001.

Figure 1. Tthe mean values of PCOSQ Group - B



According to the given bar-graph of Group -B PCOSQ -the control groups mean of pre-test is 85.43, increases post-test values is 131.80.

Figure 2. The mean values of PCOSQ group - A and B



According to the given bar-graph of PCOSQ of the control group values is 131.8 increases eexperimental group values is 163.97

DISCUSSION

The main objective of this study is to reduce the symptoms and improve the quality of life among PCOS subjects, totally 60 subjects were enrolled on based on selection criteria consent was obtained assessed and separated into two groups, each group with 30 subjects. Group A was treated with Whole-body vibration and Aerobic exercises, Group B was treated with Aerobics exercises alone for 12 weeks. The purpose of this dissertation was to find whether there are any effects of whole body vibration and aerobic exercise versus aerobic exercise alone in females with polycystic ovarian syndrome among college students – PCOS individuals of age group 18-25. After 12 weeks of training for both groups, it was observed that there was a statistically significant improvement in the outcome measures of polycystic ovarian syndrome questionnaire and within the group. However, statistically significant improvement was seen in group A which performed whole body vibration and aerobic exercise. Then both groups are significant but GROUP-A which has the higher mean value and more effective than GROUP-B. When between group (A and B) analysis was done. Whole body vibration and aerobic exercises is most significantly improved than aerobic exercise alone. Whole body vibration and aerobic exercises showed more benefits in several key areas.

Body composition: Group A: there was a more significant reduction in body mass index and improvement in muscle mass in the group that combined with whole body vibration and aerobic exercise. Group B : while improvement were noted, but improvement is less than Group A,

Menstrual regularity: Group A: There was a notable improvement in menstrual regularity among participants, indicating better reproductive health. The enhanced hormonal balance likely played a role in this outcome. Group B : Improvement were noted but were comparatively moderate.

Physical fitness and quality of Life: Combining WBV with aerobic training exercises result in greater development in physical health, including muscle endurance and strength. This combination may also result in better overall well-being and quality of life due to the combined effects of improved metabolic health and physical fitness.

Mechanism of action:

1. Enhance muscle Activation: whole body vibration can lead to greater muscle activation, which might increase energy expenditure and improve muscle conditioning.
2. Hormonal modulation: whole body vibration and aerobic exercise may positively influence hormonal regulation, contributing to better management of PCOS symptoms.
3. Improved circulation: whole body vibration and aerobic exercise might improve blood flow and lymphatic drainage, which could aid in reducing inflammation and improving metabolic function. These study findings suggest that whole body vibration and aerobic exercise regimens could offer enhanced benefits for females with PCOS. According to Dokras et al. (2011), the findings showed a higher prevalence of depression and anxiety among women with PCOS, and that exercise significantly improved psychological well-being, supporting its inclusion in comprehensive treatment plans for PCOS [37]. Also, Orio et al., (2006) reported that that Aerobic exercise was found to reduce hyperandrogenism and improve menstrual regularity in women with PCOS, underscoring the endocrine benefits of physical activity [38]. In the study of, Baillot et al. (2014) found that WBV exercise was found to reduce visceral fat and improve insulin sensitivity in obese individuals, indicating that similar benefits could be expected in women with PCOS[40]. The study's results demonstrate the effect of whole body vibration and aerobic exercise in females with PCOS both practically and statistically. Our study only included limited samples; however, with more advanced approaches future research can include a large sample.

CONCLUSION

The present study reported that the advance understanding of exercise interventions in PCOS by comparing the effectiveness of Whole-body vibration and aerobic exercises versus aerobic exercises alone. The study's findings could have significant implications for optimizing the management of PCOS, improving metabolic, hormonal, and psychological outcomes for affected women. As the prevalence of PCOS continues to rise, innovative and evidence-based approaches to lifestyle modification are crucial for enhancing the quality of life and health outcomes for this population. Whole body vibration along with Aerobic exercises Group A has reduced PCOS significantly than the Group B who was treated with Aerobics exercises alone.

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