Efficacy of Swiss Ball Exercise and Resistance Training in Polycystic Ovarian Syndrome

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Abstract

Background: Women of reproductive age are frequently affected with Polycystic Ovarian Syndrome, an endocrine disorder that causes anovulation and infertility. There is a paucity in the evidence of comparing the effectiveness of the Swiss ball and resistance training among PCOS subjects.

Purpose: To compare the effect of Swiss ball exercise and Resistance training in symptoms females with Polycystic Ovarian Syndrome.

Materials and Method: A total of 30 subjects were selected from Private Institute. As outcome measures, the menstrual irregularity questionnaire (MIQ), BMI, and abdominal girth measurement were used. Subjects were divided randomly into resistance training group (n = 15) received exercises with dumbbells and Swiss ball training group (n = 15) received exercises with Swiss ball, in addition to aerobic exercise.

Results: Females with PCOS symptoms in RTG experienced statistically significant improvement in BMI from 28.3 ± 3.3 to 25.3 ± 3.3, in Abdominal girth 93.6 ± 4.6 to 88.8 ± 4.6, in MIQ 18.3 ± 3.8 to 13.5 ± 3.3, with a p value of < 0.05 than in SBG which had BMI from 28.3 ± 3.7 to 27.9 ± 3.5, Abdominal girth 93.6 ± 5.3 to 92.6 ± 5.3, MIQ 18.1 ± 3.5 to 16.4 ± 3.8, with a p value < 0.05.

Conclusion: In comparison to a Swiss ball exercise, resistance training programme combined with aerobic activity is more effective at helping women with PCOS symptoms.

Key Word: Stein-Leventhal syndrome, Menstrual Irregularities, PCOS, Resistance training, Hormonal Imbalance.

Introduction

4–12% of women of childbearing age have polycystic ovarian syndrome, a prevalent disorder that affects females¹. A diagnosis that consists of prolonged anovulation or hyperandrogenism without any adrenal or pituitary problems is known as polycystic ovarian syndrome². Hyperandrogenism and prolonged anovulation are the most common findings in individuals with Polycystic Ovarian Syndrome³.

A consensual definition of Polycystic Ovarian Syndrome was developed in Rotterdam, the
The Rotterdam criteria, which defines Polycystic Ovarian Syndrome, states that two of the following three factors must be present for a diagnosis to be made: oligo or anovulation, elevated circulating androgen concentrations (hyperandrogenemia; for example, elevated testosterone, dehydroepiandrosterone), or clinical manifestations of androgen excess (hyperandrogenism; for instance, hirsutism, acne, alopecia), and polycystic ovaries identified by ultrasound. The standard diagnosis of polycystic ovarian syndrome that is most frequently accepted is the Rotterdam version.

The aetiology of Polycystic Ovarian Syndrome has not been fully clarified because the source of the condition is uncertain. According to the current theory, an inherited disorder called polycystic ovarian syndrome is brought on by the combination of protecting and predisposing genetic variations, which are subsequently altered by environmental factors (such physical inactivity). The clustering of patients within families provides evidence for a genetic component and points to an autosomal dominant mode of inheritance. There have been numerous candidate genes examined for a potential causative role in Polycystic Ovarian Syndrome. These researches, however, are still conflicting and unconvincing. So far, no one gene has been definitively linked to the development of Polycystic Ovarian Syndrome.

Resistance exercise might be prescribed to Polycystic Ovarian Syndrome women for physiological reasons. The disease’s interconnected traits of insulin resistance and androgen excess lead to its aggravation. Given that individuals with Type II diabetes mellitus and Polycystic Ovarian Syndrome share several fundamental characteristics of insulin resistance, resistance training may also improve clinical outcomes in Polycystic Ovarian Syndrome. It has been repeatedly demonstrated that resistance exercise increases insulin responsiveness among these patients. Four studies that used resistance training as part of a lifestyle-based intervention indicate that it is possible to recommend this type of training. Despite the obvious knowledge gaps, resistance training can be used to treat Polycystic Ovarian Syndrome, according to sufficient empirical evidence exercise prescription guidelines.

Exercise and nutrition programs are thought to be useful in the management of Polycystic Ovarian Syndrome, especially in obese people. This improves their psychological well-being, self-esteem, anxiety, and so on. As a result, exercises are beneficial to clinical and metabolic health in both the short and long term. In the study by Pitchai et al, 62 percent of the participants were aware of the benefits of exercise in the management of PCOS, and 39 percent were doing so on a regular basis. 95% of the participants in the study agreed to make lifestyle changes as part of their Polycystic Ovarian Syndrome treatment. Weight loss strategies adopted by subject’s aid in the normalization of androgen, gonadotropin, and insulin levels, as well as the restoration of menstrual functions.

Exercise also has beneficial effects in reproductive function and cardiorespiratory fitness according to Maiya et al., aerobic activities are useful in reducing weight in obese infertile women with Polycystic Ovarian Syndrome by reducing cyst size and boosting ovulation and pregnancy chances. Although there is evidence to support the use of aerobic workouts in Polycystic Ovarian Syndrome management, there is little evidence to support the use of Swiss ball and resistance exercises.

**Aim**

The aim of this study is to compare the effectiveness between Swiss Ball Exercise and Resistance Training on improving BMI, Abdominal girth and Menstrual Irregularity Questionnaire (MIQ) in females with Polycystic Ovarian Syndrome.

**Materials and Method**

A total of forty-two subjects were chosen by convenient sampling method and were randomly assigned into two groups using concealed envelope method. The study was conducted from the month of September to December 2022 at Private institute, Chennai. Baseline characteristics (age, age of Menarche and average cycle length) were similar for both the groups. BMI, abdominal girth and menstrual irregularity questionnaire (MIQ) was recorded for
pre and post-test and evaluated after 8 weeks of intervention. Each subject was monitored both in person and through video calls based upon their convenience.

Inclusion criteria:
- Between the ages of 18 and 35 years
- Subjects with confirmed diagnosis of Polycystic Ovarian Syndrome
- BMI ranging from 23-35 kg/m²
- Subjects having at least two of three Rotterdam criteria.

Exclusion criteria:
- Subjects who exercised regularly
- Subjects who had recent abdominal surgery
- Subjects with a history of systemic illness.
- Subjects who were receiving treatment like oral contraceptives and Nutritional therapy for PCOS.

Outcome measures:
BMI (Body Mass Index), Abdominal girth, and Menstrual Irregularity Questionnaire (MIQ) were used as outcome measures. It measures obesity, waist circumference and menstrual activity respectively.

Procedure
A total of 42 females between the age group of 18-35 years with the symptoms of Polycystic Ovarian Syndrome were selected for the study. Out of 42 females 8 females did not meet the inclusion criteria and 4 females declined to participate in the study. Following a thorough explanation of the study and informed consent, using inclusion and exclusion criteria, 30 subjects were selected, and the consent was obtained prior to the commencement of the intervention. The selected subjects were randomly assigned to the Resistance training group (RTG) (n = 15) and Swiss ball group (SBG) (n = 15) using concealed envelope methods. In addition to the structured exercises both the groups received aerobic exercises, warm up and a cool down session. Resistance training was performed using dumbbells.

Intervention Protocol
The resistance training group’s exercise protocol and the Swiss ball training group’s exercise protocol both have three phases: warm-up, dynamic phase, and cool-down. Both groups underwent a warm-up and cool-down period of 10 minutes. The warm phase includes breathing exercise, stretching of major muscle groups (Pectoralis Major, Triceps, Biceps, Calf, Hamstrings and Quadriceps). In the warm up phase diaphragmatic breathing was done for 3 minutes and each stretch for 10 second hold with 3 repetitions. The cool down phase includes breathing exercise (diaphragmatic breathing) for 3 minutes and ankle-toe movements, 4 sets with 8 repetitions for both the groups.

Jumping jacks, hopping up onto chairs, wall sits, running in place, high knees and lunges are among aerobic activities included in the first half of the dynamic phase in both groups. Aerobic exercises were performed for 15 minutes, each exercise 4 sets with 8 repetitions. In addition to that resistance training subjects received abdominal curl ups, abdominal oblique curl up, bridging, half-kneeling wood chop, leg raise and dumbbell deadlift up and squats during the second half of the dynamic phase for another 15 minutes, 4 sets with 8 repetitions. The resistance was prescribed according to Delorme’s 10RM theory and progressed each week. The second half of the dynamic phase in the Swiss ball training group was given abdominal curl ups, abdominal oblique curl ups, bridging, lower trunk rotation, back extension, side plank and front plank for 15 minutes.

![Fig 1: Abdominal curl ups with swiss ball](image-url)
Data analysis

SPSS version 27.0 was the software used in this study’s statistical analysis. Normality was assessed using the Shapiro-Wilk test. Independent t test and paired t test was used for normal distributed variables BMI and Menstrual irregularity questionnaire. Mann Whitney and Wilcoxon tests were used for non-normal distributed variable abdominal girth measurement. The significant results were confirmed if p < 0.05.

Result

The mean age of the subjects in the Resistance Training group (RTG) was 25.56 ± 4.7 years and in the Swiss ball training group (SBG) was 25.4 ± 4.8 years respectively. The baseline variables (age, age of menarche and average length of cycle) were assessed for normality. Normality was assessed using the Shapiro-Wilk test. Independent t test and paired t test was used for normal distributed variable age. Mann Whitney and Wilcoxon tests were used for non-normal distributed variable age of menarche and average length of cycle. The p value for age was 0.852, for age of menarche was 0.982 and for average length of cycle was 0.403 indicating that the baseline variables had statistically no difference between the (p>0.05).

In this study, Table 1 shows the mean and standard deviation (SD) values of both the experimental groups [Resistance Training group (RTG) and Swiss ball training group (SBG)] for BMI, abdominal girth and menstrual irregularity questionnaire. The mean
value of BMI was 28.3 ± 3.32 kg/m² at the baseline and 25.31 ± 3.3 kg/m² post intervention for Resistance Training group (RTG) and was 28.3 ± 3.73 kg/m² at the baseline and 27.94 ± 3.5 kg/m² post intervention for Swiss ball training group (SBG) (Graph 1). The abdominal girth measured by inch tape had a mean value of 93.64 ± 4.62 pre intervention and was 88.86 ± 4.6 post intervention for Resistance Training group (RTG) and for Swiss ball training group (SBG) it was 93.9 ± 5.3 pre-intervention and was 92.66 ± 5.32 post intervention (Graph 1). The mean value of the menstrual irregularity assessed by menstrual irregularity questionnaire for Resistance Training group (RTG) was 18.33 ± 3.8 at the baseline and 13.53 ± 3.3 at the end of the study, and for Swiss ball training group (SBG), the mean value was 18.13 ± 3.5 at the baseline and 16.40 ± 3.8 at the end of the study (Graph 1).

After the completion of the intervention, the mean and SD values of BMI for the Resistance Training group (RTG) was 25.31 ± 3.3 and for Swiss ball training group (SBG) was 27.94 ± 3.5. The mean ± SD values of abdominal girth measurement for the Resistance Training group (RTG) was 88.86 ± 4.6 and for the Swiss ball training group (SBG) was 92.66 ± 5.3. Similarly, the mean ± SD values of the menstrual irregularity questionnaire for the Resistance Training group (RTG) was 13.53 ± 3.3 and for Swiss ball training group (SBG) was 16.40 ± 3.8. The p values of BMI were 0.045, for abdominal girth measurement was 0.032 and for the menstrual irregularity questionnaire was 0.039 thereby indicating the statistically significant difference between the groups as p <0.05 for all the three variables. The differences in the mean ± SD of the three variables indicated that the participants who received resistance training along with aerobic exercise (Resistance Training group (RTG)) were highly benefitted than those who received swiss ball exercise along with aerobic exercise protocol (Swiss ball training group (SBG)).

**Table 1: Analysis of differences between the groups for outcome measures**

<table>
<thead>
<tr>
<th>STATISTICAL ANALYSIS</th>
<th>GROUP</th>
<th>MEAN ± SD</th>
<th>p VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PRE-TEST VALUES</td>
<td>POST TEST VALUES</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>RTG</td>
<td>28.3 ± 3.3</td>
<td>25.3 ± 3.3</td>
</tr>
<tr>
<td></td>
<td>SBG</td>
<td>28.3 ± 3.7</td>
<td>27.9 ± 3.5</td>
</tr>
<tr>
<td>ABDOMINAL GIRTH (cm)</td>
<td>RTG</td>
<td>93.6 ± 4.62</td>
<td>88.8 ± 4.6</td>
</tr>
<tr>
<td></td>
<td>SBG</td>
<td>93.9 ± 5.3</td>
<td>92.6 ± 5.3</td>
</tr>
<tr>
<td>MENSTRUAL IRREGULARITY QUESTIONNAIRE</td>
<td>RTG</td>
<td>18.3 ± 3.8</td>
<td>13.5 ± 3.3</td>
</tr>
<tr>
<td></td>
<td>SBG</td>
<td>18.1 ± 3.5</td>
<td>16.4 ± 3.8</td>
</tr>
</tbody>
</table>

RTG – Resistance training group, SBG – Swiss Ball Training group * = statistically significant

**Graph No 1**
**INTERPRETATION:** Difference in the BMI (kg/m²) between the groups before and after the interventions

![Graph No 2](image)

**INTERPRETATION:** Difference in the Abdominal girth (cm) between the groups before and after the interventions

![Graph No 3](image)

**INTERPRETATION:** Difference in the MIQ between the groups before and after the interventions

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**Discussion**

The aim of our study was to compare the effect of resistance training program with swiss ball training program on reducing BMI, abdominal girth and menstrual irregularity in individuals with Polycystic Ovarian Syndrome. Around 30 participants received the resistance training along with aerobic exercise (resistance training group) and swiss ball training along with aerobic exercise (swiss ball training group). The participant BMI as measured by weight and height was found to be reduced with mean (SD) 25.31 (3.3) kg/m² in resistance training group when compared with mean (SD) 27.94 (3.5) kg/m² in swiss ball training group. Which indicates participants who received resistance exercise responded well compared with the swiss ball training group. The abdominal girth as measured by inch tape was reduced with a mean (SD) of 88.86 (4.6) cm in resistance training group and 92.66 (5.32) cm in swiss ball training group indicating the higher reduction in waist circumference in resistance training group than swiss ball training group. The menstrual irregularities measured by menstrual irregularity questionnaire was found to be reduced with a mean (SD) 13.53 (3.3) in resistance training group and 16.40 (3.8) in swiss ball training group which indicated that participants in resistance training group had better improvement when compared to those in swiss ball training group.

Analyzing resistance training and Swiss ball exercises in the treatment of PCOS among fertile females is not well supported by the available research. In PCOS sufferers, we discovered that including Swiss ball exercises in a routine of aerobic exercise dramatically reduced belly fat and menstrual abnormalities with just a minor impact on BMI. Resistance training exercises were observed to help people lose more body weight than their equivalents who received Swiss ball with aerobic exercises.

We discovered safe, enjoyable, moderately intense Swiss ball activities and resistance exercises that make people with PCOS feel better. Exercise-induced weight loss benefits people by boosting ovulation, restoring hormonal balance, and addressing irregular menstruation.

Exercises with a Swiss ball offer an unstable surface that causes the abdominal muscles to contract,
increasing the demands placed on proprioception and raising the strength of the core muscles to their highest possible degree. There will be a co-contraction of the pelvic floor muscles and the transverse abdominis muscle during abdominal activities that target the abdominal muscles, particularly the transverse abdominis. The fasting insulin and insulin resistance are thought to be decreased by aerobic exercise. Interval aerobic exercise raises testosterone levels and affects the central obesity index. Resistance training falls under the genre of anaerobic exercise, which involves making repeated motions against a certain resistance to cause the muscles to contract. The contraction of the muscle, which consists of both mechanical and metabolic qualities, is facilitated by resisted exercise. Exercise improves insulin sensitivity, increases glucose intake, and boosts functional strength.

A study done by Jayabalan Prakash (2021) has found the effect of similar swiss ball exercise protocol in reducing BMI, abdominal fat and menstrual irregularity with a mean difference of 2.9kg and -0.6kg post intervention\textsuperscript{12}. Subjects in their study had also undergone a 12-week aerobic exercise along with swiss ball training protocol. In comparison to their study, the subjects of our study have undergone either swiss ball exercise or resistance exercise protocol. Our findings were also supported by an experimental study reported by Gislaine Satyko Kogure (2016)\textsuperscript{13} to determine the impact of progressive strength training, waist circumference, muscle mass index and lean muscle mass which was found to have a p value < 0.01 post intervention.

Studies done by Almenning I\textsuperscript{14} and Pericleous P\textsuperscript{15} suggested that the performance of resistance exercises improves the overall endurance of the body, hormonal levels, insulin resistance and reduces obesity, thereby having an effect on Polycystic Ovarian Syndrome which supports our findings of strength training exercise also being effective in reducing BMI, abdominal girth and menstrual irregularities. In addition to the designated exercise protocol, all the subjects also received aerobic exercise which had a supplementary effect in reducing BMI. Along with abdominal girth and menstrual irregularity was also evaluated in our study using inch tape and menstrual irregularity questionnaire and the results state that performance of exercises along with aerobic exercise has an effect on reduction in the waist circumference i.e. the abdominal fat.

A Study by Narmadha M (2022)\textsuperscript{16} concluded that performance of resistance exercises majorly focusing on core and pelvic floor enhances body composition, skeletal muscle size, together with a decrease in visceral fat, and glycemic control. The major cause of PCOS, hyperandrogenemia, is shut down by this glycol-regulation, which also lowers androgen production. Regular exercise lowers insulin resistance and contributes to the reduction of visceral fat. In order to increase metabolic rate, exercise has an effect that controls insulin protein signaling in skeletal muscles. By managing menstrual cyclicity, increasing ovulation rate, and improving sex hormones, insulin levels, and waist circumference, proper exercise training combined with a hypocaloric high protein diet has addressed reproductive concerns thereby, supporting our findings of resistance training protocol being more effective than the swiss ball training protocol in reducing BMI, abdominal girth and menstrual irregularity.

Blood tests to examine the hormonal alterations due to the effect of exercises could be evaluated in future studies.

**Conclusion**

This study compared the effects of resistance training and swiss ball training on PCOS women, and it was shown that resistance training had a better effect than swiss ball training after 8 weeks. According to the study’s findings, resistance training with aerobic exercise is more effective than a Swiss ball exercise regimen with aerobic activity to help females with Polycystic Ovarian Syndrome to reduce weight, reduce fat around the abdomen, and address erratic periods. Resistance training has good impacts on PCOS-affected women’s health outcomes, but it also improves body composition in PCOS patients. Women with PCOS can benefit from the exercise protocols as a non-pharmacological approach to changing their lifestyle and managing their discomforts.

**ISRB approval:** This research work has been approved by the ISRB committee.

**Source of Funding:** Self

**Conflict of Interest:** No conflict of interest during this research.
References


