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Comparison of Core Strength Between girls with PCOS and Age-Matched healthy controls

Maitri Rajesh Shah [1,*] and Isha Sanjay Bakshi [2]

[1] *Assistant Professor, Department of Physiotherapy in Community Health, School of Physiotherapy, D.Y. Patil University, Navi Mumbai, India.*
[2] *Intern, School of Physiotherapy, D.Y. Patil University, Navi Mumbai, India.*

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Abstract

Background: Polycystic Ovary Syndrome (PCOS) is a prevalent endocrine disorder in adolescent girls. It occurs with hormonal and metabolic derangements that affect multiple physiological processes, including muscle strength, especially in the core. While some studies have examined the relationship between PCOS and muscle strength, there are not many with a specific aim to assess variation in core strength in this population.

Methods: A cross-sectional study was carried out on 60 participants, including 30 adolescent girls with polycystic ovary syndrome (PCOS) and 30 healthy age-matched individuals. Core strength was measured with a pressure biofeedback unit from Recorders & Medicare Systems Pvt. Ltd. (RMS India), which measures the function of deep abdominal muscles. The Mann-Whitney U test was used to compare core strength between the two groups since the data were not normally distributed.

Results: The results demonstrated that core strength was significantly reduced in adolescent girls with PCOS than in healthy controls ($p<0.001$). Contributing factors were hormonal imbalance, insulin resistance, and greater abdominal fat deposition, and these can compromise neuromuscular efficiency. The study indicates that core muscle dysfunction could be a clinically important but overlooked feature of PCOS.

Conclusion: PCOS seems to have a negative effect on core strength, and so there is a requirement for specific core-strengthening interventions in clinical care. Core stability training should be incorporated into rehabilitation protocols among people with PCOS in order to avoid possible musculoskeletal dysfunctions.

Keywords: PCOS; Core Strength; Adolescent Girls; Pressure Biofeedback Unit; Muscle Function

1. Introduction

Polycystic ovary syndrome (PCOS) is a prevalent endocrine disorder occurring in 6-10% of reproductive-aged women, with a high prevalence among Indian women.[1] It is marked by hyperandrogenism, ovulatory dysfunction, dyslipidemia, and insulin resistance (IR), all of which lead to enhanced metabolic and cardiovascular risks.[2] Furthermore, symptoms like fatigue, mood changes, and weakness in muscles are frequent among patients with PCOS.[3] Hyperandrogenism in PCOS has an important role in augmenting visceral adiposity, especially in the abdominal area, which leads to metabolic syndrome and insulin resistance.[4] Androgens, especially testosterone, are found to affect body composition and muscle strength, as observed in elite female athletes.[5] The impact of these hormonal disturbances on core muscle strength, however, remains unknown. Core muscles deliver stability and posture control, integral to overall functional movement

* Corresponding author: Maitri Shah

and preventing injury.[6] PCOS can impair the performance of core muscles through changes in biochemical and biomechanical properties and compromised abdominal muscles have been associated with conditions such as diastasis recti.[7] PCOS might impair core muscle function through biochemical and biomechanical profile modifications. Androgen excess, insulin resistance, and metabolic dysregulation could cause alterations in muscle mass, strength, and endurance. [8]There are inconsistent findings regarding muscle function in PCOS based on existing research. Some authors have reported heightened muscle strength through mild hyperandrogenism, [9] while others have described decreased muscle endurance secondary to metabolic disturbances. [10] Little has been explored regarding core strength specifically in PCOS women, though. A study by Kogure et al. reported that women with PCOS showed higher overall muscle strength, but the relationship with hyperandrogenism was inconclusive.[11] Lara et al. in another study reported no differences in muscle strength between PCOS and non-PCOS women, suggesting that the metabolic and hormonal effects on muscle function are multifaceted.[12] As there are few studies evaluating core strength in PCOS, especially in adolescent girls, this study seeks to compare core strength in adolescent girls diagnosed with PCOS and age-matched non- PCOS. An understanding of these differences can yield information on the role of metabolic and hormonal processes in muscle function and guide physiotherapy management for PCOS.

2. Materials and Methods

The study, designed as a cross-sectional comparison, took place at DY Patil University, Navi Mumbai. The study plan was approved by the Institutional Ethics Committee of DY Patil University, School of Physiotherapy, Navi Mumbai. The study procedure was explained to the participants, who were selected based on inclusion criteria. A total of 60 adolescent girls (30 with PCOS and 30 age-matched non-PCOS individuals) were recruited based on the Rotterdam criteria for PCOS diagnosis.

Written informed consent was obtained from each participant. Participants were females between 15-25 years old who had not given birth and agreed to take part in the research. Individuals who were pregnant, used tobacco, or were on drugs, impacting muscle activity, or declined to participate were excluded from the study.

Core strength was assessed using a pressure biofeedback unit (PBU) from Recorders & Medicare Systems Pvt. Ltd. (RMS India). Participants were positioned lying on their backs with their knees bent at a 90-degree angle. The pressure biofeedback device was placed below the lumbar region, specifically around the L3 vertebra, to record baseline pressure; the cuffs were inflated at 40 mmHg to record the initial pressure reading.

Participants were then instructed to perform the abdominal drawing-in manoeuvre (ADIM), engaging their deep core muscles. The examiner ensured that the pressure increased to 40 mmHg while participants maintained spinal stability. Participants maintained the muscle contraction for 10 seconds while breathing in a relaxed manner. This test was performed three times, and the average pressure change was recorded. A greater pressure drop indicated weaker core strength, while minimal changes suggested better core stability.

Statistical analysis was conducted using the Mann-Whitney U test, as the data were not normally distributed.

2.1. Pressure biofeedback unit

Figure 1 Pressure Biofeedback Unit

2.2. Technique of using pressure biofeedback unit for assessment of core strength

Figure 2 Core strength assessment in participants using Pressure Biofeedback Unit

3. Results

3.1. BMI of the Participants

It was observed that most of the girls (both PCOS and non-PCOS) were categorized as overweight (50%), then obese (32%), and the least number of them were underweight (2%) based on the Asian BMI scale. As can be seen from the figure, the X-axis the Non-PCOS and PCOS groups while the Y-axis shows the percentage of girls within each BMI category.

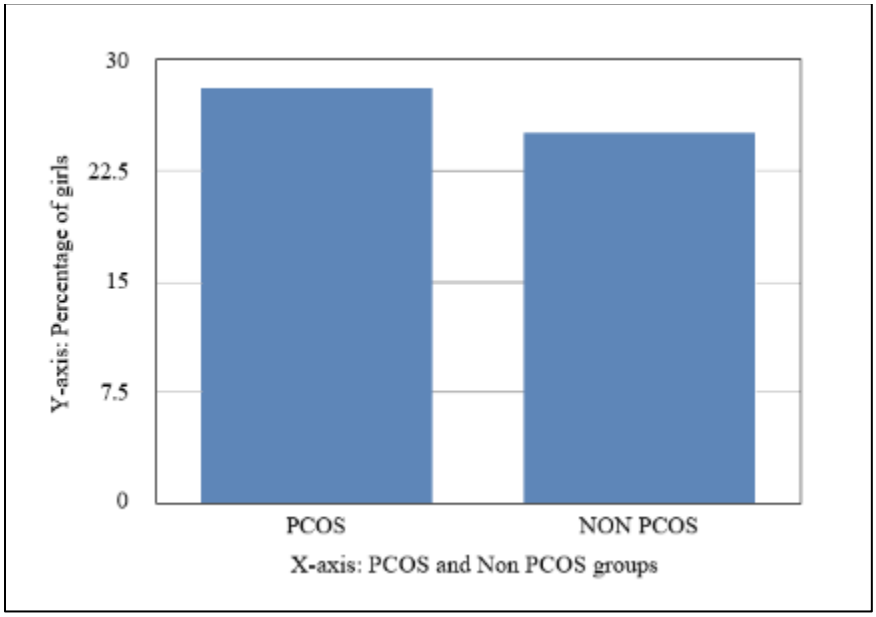

Figure 3 Body mass index of Participants

3.2. Core strength between PCOS and Non PCOS group-

The figure given below shows, a comparison of core strength between two groups: PCOS and Non-PCOS- mean scores.

The PCOS group has a lower average core strength score (≈ 67.44).

The Non-PCOS group shows a higher average score (≈ 70.11).

Therefore, Individuals without PCOS demonstrate better core strength on average compared to those with PCOS, suggesting a possible negative impact of PCOS on core muscle performance.

Here, the X-axis is core strength And Y-axis is mean pressure in mmHg

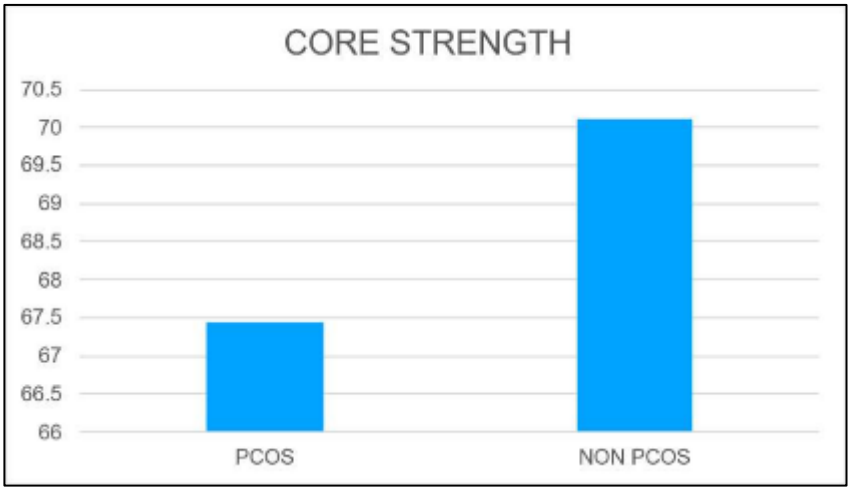

Figure 4 Mean core strength comparison between PCOS and Non PCOS participants

3.3. Lastly, On performing the Shapiro-walk test for normality, P value found was 0.0001 i.e <0.05

Therefore, Data is not normally distributed. Hence Mann Whitney U test is performed. Result found is there is significant difference seen in core strength between PCOS and Non PCOS group.

Table 1 Mann Whitney U test between groups for significance

Mann whitney test	
P value	<0.001
Exact or approximate P value?	Exact
Significant different (P <0.05)?	Yes
One-or two-tailed P value?	Two-tailed
Sum of ranks in column A,B	1207, 62
Mann whitney U	158

4. Discussion

This study analysed and compared core strength among 30 PCOS girls and 30 age matched normal girls. Results from the test showed that majority of PCOS girls were between the age group of 21-23 years and lowest age group seen is 15-17 years. A key sign of PCOS is irregular periods or missed periods and PCOS cannot be diagnosed until 2–3 years after a girl's first menstrual cycle because it can take up to 2 years after a first period for any girl's cycle to become regular.[13]

Menarche is defined as the first menstrual period in a female adolescent. Menarche typically occurs between the ages of 10 and 16, with the average age of onset being 12.4 years.[7] The determinants of menarcheal age are continuously being researched; socioeconomic conditions, genetics, general health, nutritional status, exercise, seasonality, and This study analysed and compared core strength among 30 PCOS girls and 30 age matched normal girls. Results from the test showed that majority of PCOS girls were between the age group of 21-23 years and lowest age group seen is 15-17 years. A key sign of PCOS is irregular periods or missed periods and PCOS cannot be diagnosed until 2–3 years after a girl's first menstrual cycle because it can take up to 2 years after a first period for any girl's cycle to become regular.[14]

Participation in physical activity and sport, both in and out of school, decreases during adolescence, particularly for girls. Diet also undergoes significant changes in many individuals consistent with the development of greater autonomy over food intake. Changes in body size, shape, and composition during the pubertal and adolescent periods may trigger body dissatisfaction and unhealthy eating and weight control practices, such as skipping meals, severely restricting intake of carbohydrate, protein or dairy foods, laxative use and smoking.[15] Promoting healthy lifestyle behaviors, such as physical activity and exercise, along with healthy dietary choices, could modify obesity risk and improve the health of future generations. The identification of effective methods of intervention at this time may reduce the cycle of intergenerational weight gain, as offspring born to healthy-weight mothers have less risk of becoming overweight and developing chronic diseases later in life.[16]

PCOS can potentially impact core strength in several ways like Hormonal imbalances associated with PCOS, such as elevated levels of androgens (male hormones) and insulin resistance and may contribute to increased body fat, particularly around the abdomen and excess body fat can affect muscle function and strength.[4] A study conducted in 2020 by S. Martin, K. Channing in London stated that Altered muscle mass may affect insulin resistance (IR) that can lead to difficulties in effectively utilising glucose for energy, potentially affecting overall energy levels during physical activities, including those targeting core muscles.[9] Additionally, hormonal imbalances may influence the body's response to exercise and muscle development.[10] The Relationship between muscle and PCOS have been found to be contradictory in certain studies that is due to PCOS appendicular muscle strength may or may not get affected. A study conducted in 2020 found out that Upper limb strength was higher in PCOS female as compared to non PCOS women.[9] On contrarily it was found that Lower limb strength was reduced in PCOS as compared to to Non PCOS, (2021 study).[12] However, there are no studies that have assessed core strength in PCOS women as core being the important part in women during reproductive period and it is found in PCOS that there is major deposition of fat in abdominal area thus, giving higher possibility of affecting the core strength. In this study Non PCOS girls have better core strength than girls with PCOS.

Limitations

This research has limited weaknesses, they are:

- Parental obesity and genetic component were not considered.
- It failed to examine physical activity and routine physical activity levels for work and leisure
- Psychological issues and nutritional practices were not assessed
- The field test was not utilised to assess core endurance

5. Conclusion

This study highlights the impact of PCOS on core muscle function, suggesting that targeted exercise interventions may be beneficial for improving musculoskeletal health in this population. Addressing core strength deficits may enhance overall functional capacity and reduce long-term health risks associated with PCOS.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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