PHYSICAL ACTIVITY AND OBESITY WITH POLYCYSTIC OVARY SYNDROME

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Abstract

Background: *Polycystic ovary syndrome (PCOS) is an emerging endocrine condition that affects women of reproductive age all over the world. Physical activity (PA) is an evidence-based approach in the management of PCOS patients.*

Methods: *This hospital-based case-control study was conducted to find out the association between physical activity and obesity with PCOS among the conveniently selected 172 women.*

Results: *The mean age of PCOS women was 25.0±5.8 years and non-PCOS women was 28.1±7.5 years. The majority of cases (84.9%) were in the 15-30 age groups, in comparison to controls (64.0%). There was a significant association between age and PCOS (p<0.05). The chance of developing of PCOS was 3.1 times higher in the younger age group. More than half of cases (65.5%) had no child, in comparison to controls (72.4%) had a child. There was a significant association between the number of children and PCOS (p<0.05). The chance of infertility among PCOS women was 2.01 times higher than among non-PCOS women. About one-third of the cases (39.5%) had a normal BMI and 37.2% were overweight. In contrary among controls, about half (59.3%) had a normal BMI, and one-fourth (25.6%) were overweight. The association between BMI and PCOS was statistically significant (p<0.05). The chance of developing of PCOS was 3.38 times higher in overweight women. The mean total sitting time/week in PCOS women (3179.76±1511.46) was higher than in non-PCOS women (2647.67±1687.74). There was a statistically significant association between total sitting time and PCOS in women (p<0.05).*

Conclusion: *There was a significant association between PCOS and BMI, indicating that overweight women are at greater risk to develop PCOS. However, no association was found between physical activity and PCOS, whereas PCOS patients sitting longer per week.*

Keywords: *Physical activity, obesity, PCOS in women, Bangladesh.*

DOI: https://doi.org/10.3329/jdmc.v32i1.76416
J Dhaka Med Coll. 2023; 32(1) : 16-24

Introduction

Polycystic ovary syndrome (PCOS) is a complex endocrine disorder for a woman across her life span that causes anovulatory infertility. It is also a common risk factor for endometrial dysfunction and uterine cancer.[1] It affects 12-21% of reproductive-aged women, depending on diagnostic criteria, with many cases going undetected.[2] According to the current Rotterdam diagnostic criteria, PCOS is characterized by presence of any two clinical features out of oligomenorrhea or anovulatory menstrual pattern (cycle length ≥35 days), hyperandrogenism and polycystic ovaries.[3,4]

PCOS is the most prevalent cause of anovulatory infertility, accounting for 90-95% of women with

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Received: *10.08.2023* ***Revision:*** *10.12.2023* ***Accepted:*** *13.02.2024*

anovulation who visit infertility clinics. However, 60% of women with PCOS are fertile, even though the time to conceive is frequently extended. 90% of people with PCOS and infertility are overweight. Obesity, on its own, aggravates infertility treatment and increases the risk of miscarriage.[5] Appropriate screenings should rule out the aetiologies of hyperandrogenism and menstrual cycle disturbance. The morphology of the polycystic ovary has been classified as an ovary with 12 or more follicles measuring 2-9 mm in diameter and enlarged ovarian volume (>10 cm^3) on transvaginal ultrasonography.[6,7] Weight loss of at least 5% usually coincides with improvement in these disorders. Menstrual abnormalities and anovulation appear to be more common and severe in obese women with PCOS than in their non-obese counterparts.[8]

PCOS has reproductive, psychosocial, and cardio-metabolic features and is associated with a variety of chronic health conditions, including an increased risk of obesity, type 2 diabetes, metabolic syndrome, cardiovascular diseases, depression, and reduced quality of life, etc.[1,9-11] The first-line management method for PCOS is now lifestyle management, which includes a healthy diet and physical activity.[12,13] Physical activity (PA) is an effective therapeutic measure for the reproductive and metabolic features of PCOS.[14,15] In 2008, US Department of Health and Human Services (DHHS) provided guidelines for physical activity for all adults. For PCOS women who have normal weight, the guidelines recommend 150 minutes of moderate physical exercise and 75 minutes of strenuous activity per week. Obese PCOS women have been advised to engage in moderate exercise for 250 minutes each week, intense exercise for 150 minutes each week, or a combination of the two to help their reproductive health.[16]

PCOS is a depressive psychological condition for adolescents and early young women.[17,18] PA play a significant role in improving quality of life and progression of PCOS.[19] Several tools for observation, such as the 'International Physical Activity Questionnaire' (IPAQ), have been developed primarily to estimate an individual's physical activity levels and energy expenditure. The IPAQ short version is an internationally recognized tool that estimates energy expenditure by assessing the frequency, duration, and intensity of activities.[20]

Methods

Study design and settings

This case-control study was commenced to find out the association between physical activity and obesity with polycystic ovarian syndrome. The study was conducted at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka 1000, Bangladesh.

Selection of case and control

A total of 172 (case 86 and control 86) women of reproductive age (15-45 years) conveniently selected who attended the Gynaecology outpatient department, BSMMU were included in the study. A woman was considered a case, who was diagnosed with PCOS by the doctor as per Rotterdam criteria, and those who had no symptom was considered as controls. All essential pathological tests were done to diagnose PCOS and exclude other hormonal imbalances. Woman with a history of menstrual disorder or hirsutism due to other hormonal imbalance, menarche within 2 years, or premenopausal pregnant woman was excluded from the study. The sample size was calculated with a 95% CI and a relative precision of 5%.

Data collection procedures

Data was collected from the participants through a pretested semi-structured questionnaire. Participants were interviewed according to their convenience through face-to-face interviews, during the study period from January to December 2019. This questionnaire was constructed with-

A. A semi-structured questionnaire to evaluate the socio-demographic characteristics: The questionnaire included questions related to socio-demographic and economic, anthropometric measurements, PCO signs and symptoms, and family history of the respondents.

B. Physical activity was assessed by the 'International physical activity questionnaire' (IPAQ): Data collected with

the IPAQ long form can be reported as median MET-minutes. Median values and inter-quartile ranges can be computed for walking (W), moderate-intensity activities (M), and vigorous-intensity activities (V) within each domain using the formulas below. Total scores may also be calculated for walking (W), moderate-intensity activities (M), and vigorous-intensity activities (V); for each domain (work, transport, domestic and garden and leisure) and an overall total scores.

Statistical analysis

Data were coded, entered, edited, and cleaned cautiously and then exported into SPSS version-25. Continuous variables were summarized using measures of central tendency and dispersion such as mean, percent, and standard deviation. The Chi-square test and Fisher exact test was carried out to assess the relationship of qualitative variables. For significance, the independent sample 't' test was used to compare the mean of continuous variables in two groups, and the Odds Ratio (OR) was done to assess the strength of associations with a 95% confidence level were computed and the p-value <0.05 was considered as having a significant association. The results were presented in tables and charts.

Ethical approval

Informed written assent and consent were obtained from concerned authorities and each participant. Confidentiality of data was ensured and unauthorized access to data was not allowed. The Institutional Review Board (IRB) at the National Institute of Preventive and Social Medicine (NIPSOM), Dhaka 1212, Bangladesh. (Reference: NIPSOM/IRB/2019/111)

Results:

Table 1 depicts the socio-demographic characteristics of the cases and controls. The mean age of PCOS women was 25.0±5.8 years and non-PCOS women was 28.1±7.5 years. Two-thirds of the PCOS and non-PCOS women (66.3%) were equally married. Nearly one-fourth of the cases (23.3%) and one-third of the controls (31.4%) completed their education upto SSC levels. Regarding occupation, about half of the PCOS women were students (44.2%) and one-third of the non-PCOS women were service holders (33.7%). About two-thirds of the cases (70.9%) and controls (64.1%) resided in urban areas. The mean monthly family income of PCOS women was 55050.0±68907.1 taka and non-PCOS women were 48321.4±40211.4 taka.

Table II describes the gynaecological history of cases and controls. Among the married women, about one-third of the PCOS women (34.5%) had a child and three-fourths (72.4%) of the

Table-I

Socio-demographic characteristics of the cases and controls (N=172)

Attributes		PCOS(n=86) n(%)	Non-PCOS(n=86) n(%)
Age groups (years)	15-30	73(84.9)	55(64.0)
	>30	13(15.1)	31(36.0)
	Mean±SD	25.0±5.8	28.1±7.5
Marital condition	Unmarried	28(32.6)	28(32.6)
	Married	57(66.3)	57(66.3)
	Divorced	1(1.2)	1(1.2)
Education	Upto SSC	20(23.3)	27(31.4)
	Above SSC	66(76.7)	59(68.6)
Occupation	Student	38(44.2)	26(30.2)
	Housewife	26(30.2)	25(29.2)
	Service holder	19(22.1)	29(33.7)
	Self employed	2(2.3)	6(7.0)
Residence	Rural	25(29.1)	30(24.9)
	Urban	61(70.9)	55(64.1)
Monthly family income (taka)	≤50,000	61(72.6)	56(70.0)
	>50,000	23(27.4)	24(30.0)
	Mean±SD	55050.0±68907.1	48321.4±40211.4

non-PCOS women had a child. Regarding the BMI, 58.1% of PCOS women had above normal BMI and 39.5% of women had normal BMI; and among non-PCOS women, 59.3% had normal BMI and 29.1% had above normal BMI. Above half of the PCOS women (57.0%) had PCO features in ovaries, in ultrasonography.

Figure 1: portrays that among the PCOS women, 16.3% had a history of oligomenorrhea, 62.8% had amenorrhea, 12.8% had irregular menstruation and only 8.1% had no menstrual problem.

Figure 2: illustrates that about three-fourths of the PCOS women (73.0%) had features of hyperandrogenism.

Table III demonstrates the physical activity of the cases and controls. The mean total walking MET of PCOS women was 553.7±1113.9 and for non-PCOS women was 645.4±1069.3 minutes/ week. The mean total moderate MET of PCOS women was 2174.2±2966.7 and for non-PCOS women was 2202.1±3833.1 minutes/ week. The mean total vigorous MET of PCOS women was 91.2±557.9 and for non-PCOS women was 231.6±563.5 minutes/ week. The mean total physical activity MET of PCOS women was 2819.1±3319.7 and for non-PCOS women was 3079.1±4156.9 minutes/ week. The mean total sitting time of PCOS women was 3179.7±1511.4 and for non-PCOS women was 2647.6±1687.7 minutes/ week. Regarding the levels of physical activity, about one-third of the PCOS women (34.9%) had equally moderate and high physical activity; and 38.4% of the non-PCOS women had moderate physical activity and 32.6% had high physical activity.

Table IV interprets the comparison of different variables within cases and controls. The majority of cases (84.9%) were in the 15-30 age group, in comparison to controls (64.0%). There was a significant association between age and PCOS (p=0.002). The chance of developing of PCOS was

Table-II

Gynaecological history of the cases and controls (N=172)

Attributes	PCOS (n=86) n(%)	Non-PCOS (n=86) n(%)	
Number of child (n=58)	No child	38(65.5)	16(27.6)
	Had child	20(34.5)	42(72.4)
Body mass index (BMI)	<18.5	2(2.3)	10(11.6)
	18.5-24.9	34(39.5)	51(59.3)
	25-29.9	32(37.2)	22(25.6)
	>30	18(20.9)	3(3.5)
	Mean±SD	26.4±4.7	23.1±4.1
Ultrasonographic PCO features in ovaries among the cases	Present	49(57.0)	
	Absent	30(34.0)	
	Had not done	7(8.0)	
Family history of PCOS among the cases (n=86)	Mother (n=86)	8(9.3)	
	Sister (n=67)	12(17.9)	

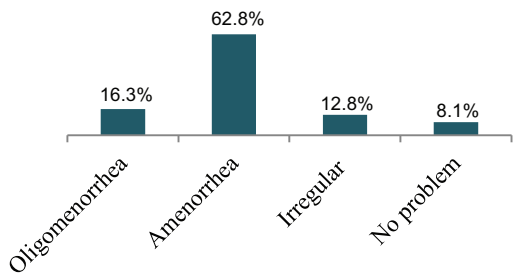

Figure 1: *Menstrual history of PCOS women (n=86)*

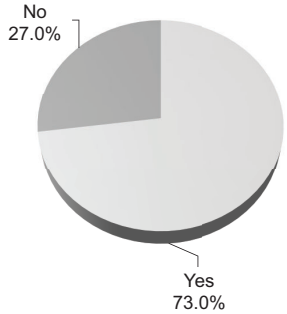

Figure 2: *Features of Hyperandrogenism of PCOS women (n=86)*

3.1 times higher in the younger age group. More than half of cases (65.5%) had no child, in comparison to controls (72.4%) had a child. There was a significant association between the number of children and PCOS (p=0.000). The chance of infertility among PCOS women was 2.01 times higher than among non-PCOS women. About one-third of the cases (39.5%) had a normal BMI and 37.2% were overweight. In contrary among controls, about half (59.3%) had a normal BMI, and one-fourth (25.6%) were overweight. The association between BMI and

Table-III

Physical activity of the cases and controls (N=172)

Attributes		PCOS (n=86)	Non-PCOS (n=86)
Comparison of physical activity (minutes/week)			
Total walking MET	Mean±SD	553.7±1113.9	645.4±1069.3
Total moderate MET		2174.2±2966.7	2202.1±3833.1
Total vigorous MET		91.2±557.9	231.6±563.5
Total physical activity MET		2819.1±3319.7	3079.1±4156.9
Total sitting time		3179.7±1511.4	2647.6±1687.7
Levels of physical activity	n(%)	n(%)	
Levels of physical activity	Low (<600)	26(30.2)	25(29.1)
(MET- minutes/week)	Moderate (600-3000)	30(34.9)	33(38.4)
	High (>3000)	30(34.9)	28(32.6)

Table-IV

Comparison of different variables with the cases and controls (n=172)

Attributes	PCOS (n=86) n(%)	Non-PCOS (n=86) n(%)	OR (95% CI)	χ^2 value	p-value
Age groups (years)					
15-30	73(84.9)	55(64.0)	0.316 (0.151-0.66)	9.890	*0.002
>30	13(15.1)	31(36.0)			
Marital condition					
Unmarried	28(32.6)	28(32.6)		†0.278	0.987
Married	57(66.3)	57(66.3)			
Divorced	1(1.2)	1(1.2)			
Education					
Upto SSC	20(23.3)	27(31.4)		1.435	0.231
Above SSC	66(76.7)	59(68.6)			
Occupation					
Student	38(44.2)	26(30.2)		†7.157	0.118
Housewife	26(30.2)	25(29.15)			
Service holder	19(22.1)	29(33.7)			
Self employed	2(2.3)	6(7.0)			
Residence					
Rural	25(29.1)	30(24.9)		1.765	0.414
Urban	61(70.9)	55(64.1)			
Monthly family income (taka)					
≤50,000	61(72.6)	56(70.0)		0.137	0.711
>50,000	23(27.4)	24(30.0)			
Number of child (n=58)					
No child	38(65.5)	16(27.6)	0.201(0.09-0.44)	16.791	*0.000
Had child	20(34.5)	42(72.4)			
BMI (kg/m^2)					
<18.5	2(2.3)	10(11.6)	3.380(1.80-6.30)	†21.701	*0.000
18.5-24.9	34(39.5)	51(59.3)			
25-29.9	32(37.2)	22(25.6)			
>30	18(20.9)	3(3.5)			
Levels of physical activity (MET- minutes/week)					
Low (<600)	26(30.2)	25(29.1)		0.231	0.891
Moderate (600-3000)	30(34.9)	33(38.4)			
High (>3000)	30(34.9)	28(32.6)			

†Fisher's exact test value, *Statistically significant value

Table-V

Association of physical activity scores with the cases and controls (n=172)

Attributes	PCOS Mean±SD	Non-PCOS Mean±SD	t-value	p-value
Total walking MET	553.7±1113.9	645.4±1069.3	0.551	0.583
Total moderate MET	2174.2±2966.7	2202.1±3833.1	0.053	0.958
Total vigorous MET	91.2±557.9	231.6±563.5	1.640	0.102
Total sitting time	3179.7±1511.4	2647.6±1687.7	2.178	*0.031

Independent sample 't' test was done, *Statistically significant value

PCOS was statistically significant (p=0.000). The chance of developing of PCOS was 3.38 times higher in overweight women.

Table V interprets the association of physical activity scores with the cases and controls. The mean total sitting time/week in PCOS women (3179.76±1511.46) was higher than in non-PCOS women (2647.67±1687.74). There was a statistically significant association between total sitting time and PCOS in women (p=0.031).

Discussion

The mean age of PCOS women was 25.0±5.8 years and non-PCOS women was 28.1±7.5 years. A study in Iran, the mean age of the case group was 23.5±5.2 and mean age of the control group was 27.1±5.9 years, which was similar to this study.[21] Nearly one-fourth of the cases (23.3%) and one-third of the controls (31.4%) completed their education upto SSC levels. This study's findings were almost identical.[22,23] Regarding occupation, about half of the PCOS women were students (44.2%) and one-third of the non-PCOS women were service holders (33.7%). A study in Tamilnadu revealed similar occupational status.[24] About two-thirds of the cases (70.9%) and controls (64.1%) resided in urban areas, which was similar to the study in India.[25] The mean monthly family income of PCOS women was 55050.0±68907.1 taka and non-PCOS women was 48321.4±40211.4 taka. The prevalence of PCOS was found to be high in higher income families.[22,23]

In this study, among the married women, about one-third of the PCOS women (34.5%) had a child and three-fourths (72.4%) of the non-PCOS women had a child. This finding was similar to the study.[23] Regarding the BMI, 58.1% of PCOS women had an above normal BMI and among non-PCOS women, 29.1% had an above normal BMI. Obesity was a key factor in PCOS in the early reproductive ages.[1,21,23] Among the PCOS women, 16.3% had a history of oligomenorrhea, 62.8% had amenorrhea, 12.8% had irregular menstruation and only 8.1% had no menstrual problem. About three-fourths of the PCOS women (73.0%) had features of hyperandrogenism and above half of the PCOS women (57.0%) had PCO features in the ovaries, on ultrasonography. These findings were similar to the study.[8]

Our study revealed that the mean total walking MET of PCOS women was 553.7±1113.9 and for non-PCOS women was 645.4±1069.3 minutes/ week. The mean total moderate MET of PCOS women was 2174.2±2966.7 and for non-PCOS women was 2202.1±3833.1 minutes/ week. The mean total vigorous MET of PCOS women was 91.2±557.9 and for non-PCOS women was 231.6±563.5 minutes/ week. The mean total physical activity MET of PCOS women was 2819.1±3319.7 and for non-PCOS women was 3079.1±4156.9 minutes/ week. The mean total sitting time of PCOS women was 3179.7±1511.4 and for non-PCOS women was 2647.6±1687.7 minutes/ week. Regarding the levels of physical activity, about one-third of the PCOS women (34.9%) had equally moderate and high physical activity; and 38.4% of the non-PCOS women had moderate physical activity and 32.6% had high physical activity. These findings were nearly comparable to the studies in Iran[26] and America.[27]

The majority of cases (84.9%) were in the 15–30 age group, and there was a significant association between age and PCOS (p=0.002). The chance of developing of PCOS was 3.1 times

higher in the younger age group. PCOS may begin in foetal life, although it becomes clinically evident during adolescence as the hypothalamic-pituitary-ovarian axis develops.[28] More than half of cases (65.5%) had no child, in comparison to controls (72.4%) had a child. There was a significant association between the number of children and PCOS (p=0.000). The chance of infertility among PCOS women was 2.01 times higher than among non-PCOS women. The correlation of infertility was nearly comparable to the studies.[9,29,30] About one-third of the cases (39.5%) had a normal BMI and 37.2% were overweight. Contrary to this, among controls, about half (59.3%) had a normal BMI, and one-fourth (25.6%) were overweight., and one-fourth (25.6%) were overweight. The association between BMI and PCOS was statistically significant (p=0.000). The chance of developing of PCOS was 3.38 times higher in overweight women. This finding was similar to the study.[31] The mean total sitting time/week in PCOS women (3179.76±1511.46) was higher than in non-PCOS women (2647.67±1687.74). There was a statistically significant association between total sitting time and PCOS in women (p=0.031), which was similar to the study.[32]

Conclusion:

There was a significant association between PCOS and BMI that signifies that the chance of developing PCOS is higher in overweight women. But no association was found between physical activity and PCOS, but sitting time per week was higher in PCOS. Given the positive impact of these activities on physical well-being, the current study recommends the adoption of healthy lifestyle and PA practices in PCOS patients.

Acknowledgments:

The authors are thankful to the hospital authorities for their heartfelt cooperation.

Competing interests: The authors declare no conflict of interest.

Funding: This research did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors.

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