ORIGINAL ARTICLE

Comparison of lifestyle in women with Polycystic Ovary Syndrome (PCOS) and healthy women

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ABSTRACT

Background: While the precise causes behind PCOS are yet to be understood entirely, current evidence so far shows that environmental factors play a role in PCOS pathogenesis. Lifestyle interventions have been recommended as first-line treatment in women with PCOS. Most of these interventions focus on changing dietary patterns, physical activity, and weight loss.

Objectives: Evaluate the comparison of lifestyle in women with PCOS and healthy women.

Methods and Materials: A case-control study was carried out in the Department of Dermatology and Venereology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, over a period of two years from February 2019 to January 2021. For the study purpose, 100 PCOS patients were taken as cases, and 100 apparently healthy women or female patients without PCOS were included as controls.

Results: Regarding occupation, service-holders were more prone to have PCOS than the other occupations, 47% ($p = 0.001$). The mean BMI (29.3 ± 4.2) and the waist-hip ratio (0.80 ± 0.07) were significantly higher in the case group than in the control group ($p < 0.001$). Comparison of the food consumption behavior of the cases and that of the controls showed that consumption of rich food ≥ 2 times a week being 5.4-fold, women consuming fast-food ≥ 2 times a week carries 3.2 times, women who took soft-drinks ≥ 2 times a week are 6.4 times, taking fewer vegetables (≤ 4 times a week) and fewer fruits (≤ 4 servings a day) 2.3 and 5.8 times higher and women who consumed rice 3-times a day were 2.7 times more prone to have PCOS.

Conclusion: Based on study findings, we concluded that occupation like service-holders, the high mean BMI and high the waist-hip ratio, women consuming fast-food ≥ 2 times a week, rich food ≥ 2 times a week, soft-drinks ≥ 2 times a week, taking fewer vegetables (≤ 4 times a week) and fewer fruits (≤ 4 servings a day) and women who consumed rice 3-times a day were more prone to have PCOS, and there is a discrete difference in lifestyle between women with PCOS and healthy women.

KEY WORDS: Polycystic ovary syndrome, lifestyle, unhealthy diet behaviors and PCOS, physical activity and PCOS.

INTRODUCTION

Polycystic ovary syndrome (PCOS) has been described as an ovarian disease characterized by excessive androgen production.[1,2] Polycystic ovary syndrome (PCOS) is a common endocrine disorder primarily due to hormonal imbalances. There could be more than one predisposing factor that can contribute to the development of PCOS. Probable risk factors for the development of PCOS are fast food diet habits, lack of physical exercise, high body mass index, and waist circumference of patients. A recent study found

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that individuals with fast food diet habits and obesity are at higher risk of PCOS compared to participants without these predisposing factors.[3] Fast food usually contains high amounts of saturated fats and steroids. So, frequent consumption of fast food and irregular eating habits leads to fluctuations in glucose levels, insulin resistance and increases hormonal imbalance such as hyperandrogenism, adding to the risk for development of PCOS.[4,5]

Central obesity, characterized by increased waist circumference, is another risk factor for the development of metabolic diseases.[6] Obese women are at 1.74 times more risk for development of PCOS compared to women with normal BMI.[3] There are emerging pieces of evidence suggesting that many of the pathophysiological symptoms of PCOS can be improved by regular participation in physical activity.[7,8] Lifestyle modification, including physical activity, is recommended as the primary management strategy for PCOS as it reduces insulin resistance, improves metabolic and reproductive features of PCOS.[9-12]

More intake of whole grains, plant proteins, and seafood, and fewer intake of refined grains were associated with a lower risk of PCOS. Women with PCOS consumed considerably fewer dairy products than healthy women, and higher dairy intake was also associated with a lower risk of PCOS. Some mechanisms have been suggested to explain how a healthy eating index score can be associated with a lower risk of PCOS.[13] A possible mechanism is related to the effect of dairy intake on the Insulin growth factor-1 (IGF-1) level. Studies suggest that IGF-1 may have a role in ovarian cells disease pathogenesis through the induction of functional changes in the theca cells, and higher consumption of dairy products can enhance the IGF-1 level.[14] Plant and animal proteins have a differential effect on the IGF-1 level and can play a role in the development of PCOS. It has been documented that insulin resistance is decreased in consumers of dairy products, improving ovarian function. It has been shown that intake of more than three glasses of milk per day had a protective effect on female fertility.[15] In addition, more than two servings of low-fat dairy per day decreased the risk of developing infertility associated with reduced ovulation, reported by one study.[16] Obesity is associated with suppressed levels of sex hormone binding globulin (SHBG), leading to higher free androgen levels and massive weight loss in obese women with PCOS, in response to results from bariatric surgery, has been shown to improve multiple reproductive and metabolic abnormalities in the syndrome.[17] Literature emphasizes weight-loss strategies along with a calorie-restricted diet for better control of PCOS. Dietary modification is an integral part of any weight-loss program, with most studies suggesting that exercise alone is inadequate to improve symptoms relating to PCOS.[6] Some studies have suggested using a form of the Diabetes Prevention Program exercise schedule, whereby participants try to lose one pound a week.[11,18] These included changes in diet, exercise, and/or behavior that benefit general health, including weight loss and weight gain prevention.[9] However, there exists only limited data supporting the efficacy of lifestyle change in regard to PCOS.[10,19] Majority of the predisposing factors identified in the study participants were

modifiable; hence careful monitoring and proper corrective steps may help in the prevention and adequate management of PCOS.

METHODS AND MATERIALS

A case-control study was carried out in the Department of Dermatology and Venereology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, over a period of two years from February 2019 to January 2021. The study population was divided into case and control. Patients with PCOS (diagnosed by revised Rotterdam consensus 2003 criteria) attending during the study period to seek treatment for their conditions were considered as case, while the accompanying relatives and friends of women with PCOS and other women attending at the same hospital for seeking treatment for conditions other than PCOS were taken as control. PCOS patients were diagnosed on the basis of revised Rotterdam consensus 2003 criteria. Patients having 2 out of 3 following criteria were included as cases.

- Chronic oligo/ anovulation
- Clinical hyperandrogenism
- Polycystic ovarian morphology (by USG) and exclusion of other related disorders.

Patients who were unwilling to participate and aged less than 18 years or more than 40 years were excluded. For the study purpose, 100 PCOS patients were taken as cases, and 100 apparently healthy women or female patients without PCOS were included as controls. The required number of cases and controls were selected by consecutive type of sampling technique. A semi-structured questionnaire (research instrument) was used to collect data. All the participating subjects (cases and controls) were informed about the purpose of the study and their rights to withdraw themselves from the study at any time, for any reason. They were assured that their withdrawal would not hamper their treatment or care anyway. Strict confidentiality and security of data related to study subjects were maintained. As the procedure (history taking and clinical examination) was entirely noninvasive, there was no risk or safety concern for the participating subjects. There was no potential conflict of interest in this study, and the study was done only for academic purpose. Informed written consent was obtained from each subject who voluntarily participated in the study.

The collected data were processed and analyzed using SPSS (Statistical Package for Social Sciences), version 23.0. The test statistics used to analyze the data were descriptive statistics (frequency and corresponding percentage for categorical data and mean, median, and standard deviation for continuous data). While categorical data were compared between patients using Chi-square ($\chi 2$) test and continuous data were compared between groups with the help of unpaired t-Test. The level of significance was set at 5%, and p-value < 0.05 was considered significant.

RESULT

This case-control study was undertaken to determine the risk factors of PCOS, included 100 cases of PCOS and 100 women without PCOS. The findings obtained from data analysis are presented below:

Table I Relationship between demographic characteristics

Demographic characteristics	Group		P-value
	Case (n = 100)	Control (n = 100)	
Age (years)# Socio economic status*	29.3±4.2	0.099	0.099[ns]
Poor	18(18.0)	20(20.0)	
Middle class	69(69.0)	70(70.0)	0.777[ns]
Rich	13(13.0)	10(10.0)	
Marital status*			
Married	87(87.0)	91(91.0)	0.366[ns]
Unmarried	13(13.0)	9(9.0)	
Occupation*			
Service holder	47(47.0)	56(56.0)	
Daily labor	8(8.0)	0(0.0)	
Housewife	36(36.0)	2(21.0)	0.001[s]
Students	9(9.0)	22(22.0)	
Others	0(0.0)	1(1.0)	

Data were analyzed using Unpaired t-Test and were presented as mean ± SD

*Chi-squared Test ($\chi 2$) was done to analyze the data; figures in the parentheses indicate corresponding %; s = significant, ns = not significant.

Demographic characteristics and PCOS:

There was no significant difference between case and control groups in terms of age, socio-economic status, and marital status. In the case of occupation, service-holders 47% were more prone to have PCOS than the other occupations (p = 0.001).

Table II Distribution of anthropometric variables between case and control groups

Anthropometric measurements	Group		P-value
	Case (n = 100)	Control (n = 100)	
BMI (kg/m^2)	29.3 ± 4.2	24.9 ± 2.7	< 0.001[s]
Waist Circumference (cm)	89.9 ± 5.3	89.1 ± 4.5	0.418[ns]
Waist Hip Ratio	0.80 ± 0.07	0.73 ± 0.06	< 0.001[s]

#Data were analyzed using Unpaired t-Test and were presented as mean ± SD.

s=significant; ns=not significant.

Anthropometric measurements:

The mean BMI (29.3 ± 4.2) was observed to be significantly higher in the case group than that in the control group (p < 0.001). The waist-hip ratio (0.80 ± 0.07) was also considerably higher in the case group than that in the control group (p < 0.001), although waist circumference was not significantly different between the groups (p = 0.418) (table II).

Table III Relationship between physical activity & exercise and PCOS

Physical activity and exercise	Group		P-value
	Case (n=100)	Control (n=100)	
Physical Activity			
No	60(60.0)	66(66.0)	0.380[ns]
Yes	40(40.0)	34(34.0)	
Exercise			
No	65(65.0)	63(63.0)	0.768[ns]
Yes	35(35.0)	37(37.0)	

*Chi-squared Test ($\chi 2$) was done to analyze the data; figures in the parentheses indicate corresponding; ns = not significant. #According to the rule of case-control study, if there is no association between a factor and an outcome, there is no need to compute Odds Ratio (OR).

Physical activity & exercise and PCOS:

Neither physical activity nor formal exercise was found to be associated with the development of PCOS (p = 0.380 and p = 0.768, respectively) (Table III).

Table IV Relationship between food behavior and PCOS

Food consumption	Group		Odds Ratio (95% CI of OR)	P-value
	Case (n=100)	Control (n=100)		
Rich food (times/week)				
≥ 2	45(45.0)	13(13.0)		
< 2	55(55.0)	87(87.0)	5.4(2.7-11.1)	< 0.001[s]
Fast food (times/week)				
≥ 2	56(56.0)	28(28.0)		
0 – 1	44(44.0)	72(72.0)	3.2(1.8 – 5.9)	< 0.001[s]
Soft drinks (times/week)				
≥ 2	39(39.0)	9(9.0)		
< 2	61(61.0)	91(91.0)	6.4(2.9 – 14.3)	< 0.001[s]
Vegetables (times/week)				
≤4	75(75.0)	56(56.0)		
>4	25(25.0)	44(44.0)	2.3(1.3 – 4.3)	0.005[s]
Fruits (servings/day)				
≤ 4	82(82.0)	44(44.0)		
> 4	18(18.0)	56(56.0)	5.8(3.0 – 11.1)	< 0.001[s]
Rice (times/day)				
3	59(59.0)	35(35.0)		
1 – 2	41(41.0)	65(65.0)	2.7(1.5 – 4 .7)	0.001[s]

*Chi-squared Test ($\chi 2$) was done to analyze the data; figures in the parentheses indicate corresponding %; s = significant.

Food behavior and PCOS:

Food consumption behavior of the cases and controls showed that consumption of rich food ≥ 2 times a week being 5.4-fold (95% CI = 2.7-11.1) higher than that with less consumption rich food (< 2 times a week) ($p < 0.001$). Likewise, women consuming fast-food ≥ 2 times a week carry 3.2(95% = 1.8-5.9) times more risk of acquiring the condition than those who took it < 2 times a week ($p < 0.001$). Women who took soft-drinks ≥ 2 times a week were 6.4(95% CI = 2.9–14.3) times more likely to develop PCOS than those who took it < 2 times a week ($p = 0.001$). Women taking fewer vegetables (≤ 4 times a week) and fewer fruits (≤ 4 servings a day) demonstrated their significant presence in the case group than those in their control counterparts with risk of having the condition (PCOS) being 2.3(95% CI = 1.3–4.3) and 5.8(95% CI = 3.0–11.1) times higher due to less consumption of vegetables and fruits respectively ($p = 0.005$ and $p < 0.001$ respectively). Similarly, women who consumed rice 3-times a day were 2.7(95% CI = 1.5–4 .7) more prone to have PCOS than those who consumed it 1-2 times a day ($p = 0.001$) (Table IV).

DISCUSSION

PCOS is a problem with hormones that affects women during their childbearing years of 15 to 44 years. Between 2.2 and 26.7 percent of women in this age group have PCOS, as shown in the study by March et al. and Tehrani & Andevani.[20,21] In the present study, the mean age of the case and control groups was 29.3 ± 4.2 years and 30.8 ± 4.5 years, respectively. In their study in the year 2019, Calzada and associates showed the age was similar in both groups (women with PCOS having mean age 28 ± 5 years and healthy controls 30 ± 6 years).[22] Similar mean ages were also observed by Javed et al.[23] In another study, Karadag and Yoldemir found the mean age to be 26.2 ± 4.8 years in PCOS and 27.1 ± 4.5 years in control.[24] The higher and lesser mean age and age range obtained by the above authors may be due to geographical variations, racial, ethnic differences, genetic causes, different lifestyle, and pathological differences may have significant impacts on polycystic ovary syndrome. Barkley showed that individuals with lower socioeconomic status are more at risk for engaging in adverse health behaviors, including smoking, lack of physical activity, and poor nutritional diet.[25] Shan and colleagues found unmarried to be 94.0% and 98.3% in case and control groups, respectively.[26] In another study, Ramanand et al.

observed a total of 120 patients with Polycystic Ovary Syndrome; of them, 39.2% and 60.8% were married and unmarried, respectively.[27]

In the present study, although BMI waist-hip ratio was significantly higher in women with PCOS than in control group women ($p < 0.001$), it is unclear whether these anthropometric findings are causes or effects of PCOS. Calzada et al. also found mean BMI to be 25.4 kg/m^2 (range: from 21.2–30.6 kg/m^2) in PCOS and 22.2 kg/m2 (range: 20.2–24.3 kg/m^2) in control group ($p < 0.05$).[22] Begum et al. did not observe any added risk for PCOS development among participants with more than 80 centimeters of waist circumference.[3] Calzada et al. found mean waist circumference to be 79.4 cm (range: from 68.7–89.1 cm) in the PCOS group and 72.9 cm (range: from 67.2–79.0 cm) in the control group. High levels of waist circumference and BMI contributes to the pathophysiology of PCOS and lipid accumulation, mainly abdominal, influence on the elevated 8-IsoP levels.[22] Begum et al. observed that obese participants are at 1.74 times more risk for development of PCOS compared to participants with normal BMI.[3] This is probably because of the aggregation of factors like lack of physical exercise and unhealthy diet habits. Also, it was observed that obesity augments the severity of hyperinsulinemia in women with PCOS.[4] A small study by Kirchengast and Huber showed a significantly greater amount of body fat and lower amount of lean body mass in women with PCOS compared to controls matched for age, weight, and BMI.[28] Similarly, a study by Mannerås-Holm et al. involving MRI and computed tomography scans of visceral adipose tissue in women with PCOS and BMI-matched controls found little evidence that fat distribution increased risk for PCOS (even in women with an increased waist: hip ratios).[29] Glueck et al. stated that if a patient had oligomenorrhea and hyperandrogenism in adolescence, there is an increased risk of developing obesity (BMI > 40 kg/m^2) and metabolic syndrome by age 24, suggesting a temporal association of PCOS with obesity, even if a primary predisposition does not exist.[30] Nonetheless, evidence by Berg et al. suggested that subcutaneous adipocyte size is increased in obese women with PCOS, along with functional abnormalities in their adipose tissue, including a decrease in the lipolytic effects of catecholamines and lower circulating levels of adiponectin.[31]

Although in our study, we did not find any association between physical activity/exercise and PCOS. PCOS might be associated with a number of physical and psychological disorders, but they do not necessarily mean that they are causal; instead, there may be a temporal association of these disorders with PCOS. The study by Begum et al. found that no statistically significant difference ($p>0.05$) exists between the individuals who are engaged in physical exercise less than 3 days a week with that of individuals engaged in physical exercise for more than 3 days a week. The risk was found to be almost equal between the two groups for the development of PCOS observed by the authors.[3] Teede et al. mentioned in their study that lifestyle modification, including physical activity, is recommended as the primary management strategy for PCOS as it reduces insulin resistance, improves metabolic and reproductive features of PCOS.[9]

Analyses of the food behavior between cases and controls showed that more consumption of rich food (≥ 2 times a week), fast food (≥ 2 times a week), soft drinks (≥ 2 times a week), carbohy-

drate (3 times a day), and fewer intake of vegetables (≤ 4 times a week) and fruits (≤ 4 servings a day) are more often associated with PCOS with odds of having the condition being more than 2-fold higher in those women who have had these food behaviors than those who are not accustomed to these food behaviors ($p < 0.05$). Begum et al. found that participants consuming fast food diet for more than 3 days/week have 1.7 times more risk of developing PCOS compared to those who consume fast food diet for less than 3 days/week.[3]

CONCLUSION

Based on study findings, we can conclude that occupation like service-holders, the high mean BMI and high the waist-hip ratio, women consuming fast-food ≥ 2 times a week, rich food ≥ 2 times a week, soft-drinks ≥ 2 times a week, taking fewer vegetables (≤ 4 times a week) and fewer fruits (≤ 4 servings a day) and women who consumed rice 3-times a day were more prone to have PCOS, and there is a discrete difference in lifestyle between women with PCOS and healthy women.

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