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Prevalence of pelvic floor dysfunction among women with polycystic ovarian syndrome: a case-control study

Mohamed Gamil Omar[1*], Amel Mohamed Yousef[2], Hossam El-din Hussein Kamel[3] and Mahitab Mohamed Yosri[2]

Abstract

Background Pelvic floor dysfunction (PFD) is a wide term, involving a large array of conditions that negatively impact many women around the world. Polycystic ovarian syndrome (PCOS) is another disorder with long-term serious consequences. Being a disease of hormonal imbalances, PCOS may possibly affect the function of the pelvic floor muscles leading to PFD. Thus, the current study aimed to explore the prevalence of PFD among women with PCOS.

Methods This is an observational, case-control study. A total of 368 women, aged from 20 to 35 years, with a body mass index (BMI) range of 20 to 30 kg/m^2 recruited from Kasr El-Ainy teaching hospital shared in the study. They were classified into case group (PCOS patients; $n=184$) and control group (non-PCOS participants; $n=184$), with matched age and BMI for comparison. All case-group women were diagnosed with PCOS, based on Rotterdam diagnostic criteria, while the control group women had regular menstrual cycles. Pelvic Floor Distress Inventory-20 (PFDI-20) was used to identify PFD in the tested groups. The demographic features of the two groups were compared using the unpaired *t* test, while the chi-squared test was used to determine the prevalence of PFD among women with PCOS. Also, multiple linear regression was done to asses other PFD risk factors in both groups.

Results Out of 380 women, 368 were involved in the study with mean ± standard deviation (SD) for the age and BMI of 28.48±4.87 years and 25.9±5.8 kg/m^2, respectively, for the control group, and 28.76±5.33 years and 27±6.1 kg/m^2, respectively, for the PCOS group, without a significant difference in either of the age and BMI between groups ($P > 0.05$). The frequency distribution of women with and without PFD in both groups revealed that the PCOS group included 68 (37%) women with PFD. While the control group included 12 (6%) women with PFD, with a significant difference ($P=0.03$) in the prevalence between both groups. Also, multiple regression revealed that PCOS condition significantly affected PFD.

Conclusion PFD was prevalent among women with PCOS, compared to the control group, suggesting a possible link between both conditions.

Keywords Pelvic floor disorders, Polycystic ovary syndrome, Hyperandrogenism

*Correspondence:
Mohamed Gamil Omar
Mohamed.gamil2810@gmail.com
[1] Physical Therapy for Women's Health, Faculty of Physical Therapy, Delta University, Mansoura, Egypt
[2] Physical Therapy for Women's Health, Faculty of Physical Therapy, Cairo University, Giza, Egypt
[3] Obstetrics and Gynecology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

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Introduction

Pelvic floor dysfunction (PFD) refers to a group of disorders that are connected to abnormal functioning of the pelvic floor structures. This abnormality in function results from impaired coordination of the pelvic floor musculature, increased muscular activity named hypertonicity), or, on the contrary, decreased activity (i.e., hypotonicity) [1].

The PFD problems resulting from the pelvic floor muscles' hypotonicity involve urine and/or fecal incontinence, as well as pelvic organ prolapse [2]. The prevalence of PFD is estimated to be between 23 and 49% of women around the world [3], with a possible increase in its incidence by 2050, according to Walker et al. Though pelvic floor diseases often go unnoticed, either because they are socially stigmatized or due to a lack of access to resources, as a result, the true scope of the problem remains unknown, especially among women of poor nations [4].

Several causes were proposed for the weakness of the pelvic floor structures. A long-term consequence of obesity, metabolic syndrome [5], mechanical injuries and ischemia [6], aging, and age-related hormonal changes [7] are among those causes. Furthermore, inflammation may affect collagen fibers, leading to structural changes in the pelvic floor muscles (PFMs) [5].

One of the conditions that can greatly affect the structure and function of PFMs is polycystic ovarian syndrome (PCOS), a common endocrine disorder that largely affects women in their reproductive age, with a prevalence reaching 5 to 15% [8]. According to the Rotterdam criteria, PCOS can be diagnosed with the presence of two out of the following three criteria: (1) oligomenorrhea/ anovulation, (2) clinical or biochemical hyperandrogenism, and (3) polycystic ovaries [9].

PCOS is known to have a long-term negative impact on endocrine, metabolic, and cardiovascular health, as well as the quality of life [10]. Whether PCOS can negatively or positively affect pelvic floor structures remains elusive. Being a disease of hyperandrogenemia [11], some studies have found a positive effect of PCOS on PFM thickness due to the presence of androgenic receptors abundantly within the pelvic floor structure. As a result, PFMs are hormonally sensitive [12].

On the other hand, PCOS is closely related to a persistent low-grade inflammation that gradually affects the collagen fibers and, thus, increases the liability of the pelvic floor structure to injury [5]. Nevertheless, another study by Antônio et al. found no difference in PFM strength between PCOS women and those who did not have the syndrome [13]. Contradictory findings necessitated further research regarding the effect of PCOS on PFMs, in the form of causing PFD. Yet, no study was conducted to explore the prevalence of PFD in Egyptian women with PCOS. As a result, the purpose of this study was to see how common PFD was among Egyptian women who had been diagnosed with PCOS. Based on the previous literature, it was hypothesized that PFD would be prevalent in Egyptian women with PCOS.

Materials and methods

Study design and ethical approval

This study was designed as an observational, case-control study to assess the presence of PFD in women with PCOS, compared to a control group that included women free of the condition. The study was approved by the Ethics Committee of the faculty of physical therapy, Cairo university (No: P.T.REC/012/003686). All the participants were provided with a full explanation of the study aims and rationale as well as a declaration about the questionnaire used for collecting the data to gain their confidence and cooperation. They were assured of their rights to withdraw from the study at any time and their data confidentiality. Following that, an informed consent form was signed by each woman before joining the study. The research study was conducted from January to July 2022.

Participants and study settings

A non-probability, convenience sampling technique was used to initially recruit 380 women from the women's health outpatient clinic of Kasr El-Ainy teaching hospital, Giza. The recruitment process was done by directly interviewing women. They were, then, screened according to the eligibility criteria.

The women were included in the case group when their age ranged from 20 to 35 years, with a body mass index (BMI) range of 20 to 30 kg/m^2. They had PCOS, diagnosed by the gynecologist, according to Rotterdam diagnostic criteria [9]. The women in the control group were included when they had matched age and BMI, were nulliparous, had normal ovulatory menstrual cycles (i.e., an inter-cycle interval of 26 to 33 days), and had no signs or symptoms of PCOS or hyperandrogenism. The exclusion criteria included pregnant, multiparous, and postmenopausal women, an avulsion of the levator ani muscles, and receiving hormonal treatment within three months of the study's beginning. Women having non-PCOS hormonal disturbances that could cause PCOS-like symptoms (e.g., hypothyroidism, hyperprolactinemia) were also excluded.

The demographics of all women in both groups involving age, weight, height, and BMI were obtained. Additionally, the past, present, and menstrual histories were taken and recorded on a sheet for data collection.

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Assessment of the PFD presence in both groups

The main study outcome, represented by PFD presence, was evaluated using the Pelvic Floor Distress Inventory-20 (PFDI-20). The PFDI-20 is an instrument that was originally developed and validated by Barber et al. [14]. It is one of the well-known condition-specific questionnaires used to assess PFD and quality of life in women. The PFDI-20 consists of three scales to measure three different aspects of the PFD: (1) the urinary distress inventory, (2) the pelvic organ prolapse distress inventory, and (3) the colorectal-anal distress inventory.

Each scale of the PFDI-20 is scored from 0 (least distress) to 100 (greatest distress). The PFDI-20 total score, which ranges from 0 to 300, is the sum of the scores of these three scales. The PFDI-20 total score classified the intensity of the distress caused by the presence of PFD symptoms as mild (1–15 points), moderate (16–34 points), and severe (35–40 points) [14]. The questionnaire was administered in the form of a personal interview by an independent single examiner, who was not aware of the participants' allocation.

Sample size and statistical analysis

The sample size calculation was performed using G*POWER statistical software (version 3.1.9.2; Franz Faul, Universität Kiel, Germany), based on a previous study by Thais et al. [15], and revealed that the appropriate sample size for this study was $N = 380$, which gave observed power equal to 0.8. Calculations were made using $\alpha = 0.05$ and an effect size of 0.29.

The statistical analysis was performed by utilizing SPSS for Windows, type 26 (SPSS, Inc., Chicago, IL). Information was checked for normality, heterogeneity of dispersion, and the existence of outliers before the last analysis of the data, as a prerequisite for parametric measurement. Data were distributed normally, as determined by the Shapiro-Wilk test ($p > 0.05$). According to Levene's test of homogeneity of variances, there was a homogenization of variances ($p > 0.05$) and covariances ($p > 0.05$). The demographic features of the two groups were compared using the unpaired t test. The chi-squared test was used to determine the prevalence of PFD among women with PCOS. Multiple regression was done to asses other PFD risk factors in both groups. A significant level was indicated at an alpha level of 0.05.

Results

Overall, 380 women were primarily selected and explored for eligibility. A total of 368 women met the inclusion criteria, accepted to participate in the study, and were included during the 5-month enrolment. Twelve women were excluded, 5 women were less than 20 years, 6 had a BMI more than 29.99 kg/m^2, and a woman received hormonal therapy (Fig. 1).

Regarding the general characteristics of the participants, as presented in Table 1, there were no statistically significant differences ($p<0.05$) in the mean values of any of these characteristics between women in the PCOS and the control groups.

For the PFDI-20 scores, as presented in Table 2, the mean scores ± SD of pelvic organ prolapse distress inventory-6, colorectal-anal distress inventory-8, and urinary distress inventory-6 scales, as well as the total PFDI-20 scores were 7.51±5.34, 5.33±4.12, 13.41±12.77, and 26.25 ± 22.23, respectively, for the PCOS group, and 8.08 ± 12.10, 2.82 ± 5.94, 5.95 ± 11.67, and 17.11 ± 26.50, respectively, for the control group.

The unpaired t test results between groups have shown that there were statistically significant differences in the mean scores between groups for both, the urinary distress inventory-6 ($P=0.001^*$) and pelvic organ prolapse distress inventory-6 ($P=0.07^*$). Using the chi-square test, the frequency distribution of women with and without PFD in both groups revealed that the PCOS group included 68 (37%) women with PFD. While the control group included 12 (6%) women with PFD, showing a statistically significant difference ($P=0.03$) in the prevalence between both groups.

Multiple linear regression was conducted for analyzing the factors that significantly affected PFD. PCOS condition was indicated to be a significate factor that was associated with PFD ($P= 0.002^*$) (Table 3).

Discussion

The current study aims to investigate the presence of PFD among PCOS women compared to women without the condition. The results of the present study confirmed the hypothesis that hyperandrogenic women with PCOS had a significantly higher prevalence of PFD than the control group. More specifically, the women of the PCOS group reported urinary incontinence more than the women of the control group did, while no statistically significant differences were noticed between both groups regarding the reporting of fecal incontinence or pelvic organ prolapse. These findings could be explained on the basis that PFMs contain collagen that could be greatly altered by the effect of the persistent state of low-grade inflammation that is concomitant with PCOS [5].

The findings of the current study confirmed that there is no statistically significant difference in reporting pelvic organ prolapse among the women of both groups, based on the scores of the pelvic organ prolapse distress inventory-6 scale. These findings were not congruent with those of the study done by Taghavi et al., who found that
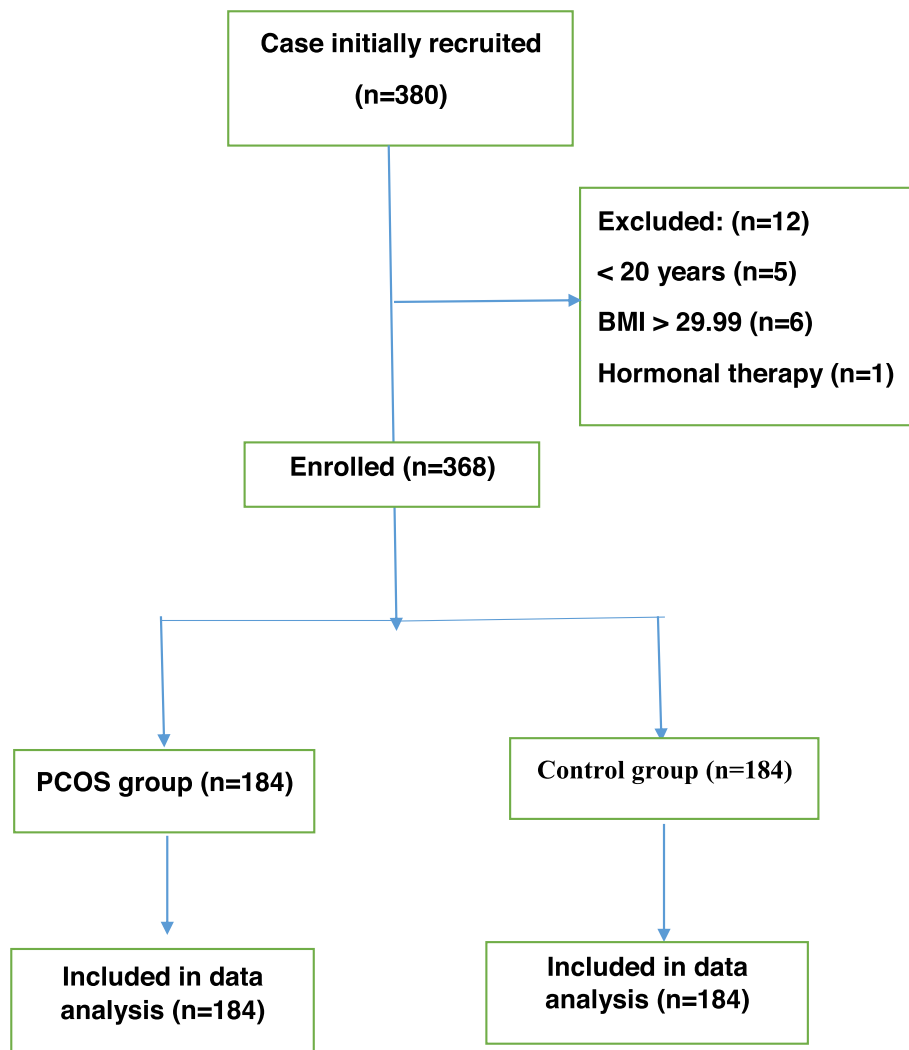
Fig. 1 Flow chart of participants across different study stages

Table 1 General characteristics of women in both groups

Variable	Mean ± SD		P value*
	PCOS group (n=184)	Control group (n=184)	
Age (years)	28.76±5.33	28.48±4.87	0.69
Height (cm^2)	165.5±15	168.4±17	0.4
Weight (kg)	70.2±6.1	73,4±5.8	0.2
BMI (kg/m^2)	27±6.1	25.9±5.8	0.2

SD standard deviation, *PCOS* polycystic ovary syndrome, *significant difference at P < 0.05

pelvic organ prolapse was more common in women with PCOS, particularly those with a hyperandrogenic phenotype, menstrual cycle abnormality, and polycystic ovary ultrasonography [16].

Though the level of hyperandrogenism in PCOS that would be protective against PFD was unknown, a study by Montezuma et al. claimed that PCOS might act as a protective factor against PFD due to the high number of androgen receptors in these structures [15]. That claim was supported by Micussi et al. who stated that women with PCOS had lower PFD than the general population and, surprisingly, reported a higher prevalence of urinary incontinence in the obese women of the control group compared to the PCOS group [17]. The findings of both studies were contradictory to the results of the present study. The PCOS group had a higher PFD, according to their higher scores on the PFDI-20, compared to the control group.

A different claim was reported by Antonio et al., who have shown no difference in the PFMs strength between PCOS women and those of the control group [13].

Table 2 The frequency distribution of women in both groups

Variable	PCOS group	Control group	*P* value*
Pelvic organ prolapse distress inventory-6	7.51±5.34	8.08±12.10	0.07
Colorectal-anal distress inventory-8	5.33±4.12	2.82±5.94	0.2
Urinary distress inventory-6	13.41±12.77	5.95±11.67	0.001*
Group	Women with PFD (*n*=184)	Women without PFD (*n*=184)	
PCOS	68 (37%)	116 (63%)	0.03*
Non–PCOS	12 (6%)	172 (94%)	

SD standard deviation, *PFD* pelvic floor dysfunction, *significant difference at *P* < 0.05

Another study found no difference in the frequency of reporting urine loss between PCOS and control groups with normal BMI and BMI > 25 [18]. On the contrary, this study showed that the women in the PCOS group had higher scores in the urinary distress inventory-6 domain of the PFDI-20 compared to the non-PCOS group (control) of a matched BMI.

The present study is the first to explore the prevalence of PFD among a large sample of women with PCOS. The study employed a valid and reliable instrument to test the hypothesis. Also, the assessor was blinded to the women's allocation, which provided a more accurate and unbiased evaluation. Moreover, the participants recruited in the study had similar backgrounds and were selected from the same settings. That minimized the selection bias which is common in observational studies. Also, confounding bias was limited by selecting women with matched socioeconomic, age, and BMI for the PCOS and the control groups.

Though this study provides objective findings with statistically significant differences, it has some limitations. The study outcome was assessed using a self-reporting questionnaire, so symptoms' reporting could be under or over-reported. Also, the bias of information recall could not be controlled, which is common in non-experimental studies. The PFDI-20 was administered in a non-validated Arabic translated version by the examiner, as the questionnaire has not been validated for use with the Egyptian population yet. This version, though not specifically validated, was more suitable than applying the questionnaire in English or asking the question every

time in a different way for each participant. For more accurate results, a validated Arabic translated version could be used. Future studies are recommended to investigate the correlation between PFD and PCOS through better sample representation and different study designs to overcome those unintentional biases and validate the current results. The study was concerned with confirming the higher prevalence of the PFD condition among women with PCOS compared to the control group. Further research is needed to investigate the prevalence of each PFD condition alone in women with PCOS. Other studies are needed to investigate the prevalence of each PFD across different PCOS phenotypes Also, more prospective studies on a large sample are required to explore the effects of PCOS on PFMs.

Conclusion

The findings of this study proved an increased incidence of PFD, especially urinary incontinence, in women with PCOS. This supports the role of PCOS in the development of PFD.

Table 3 Multivariate linear regression for the factors that significantly affect PFD (*n*=368)

Variable	S.E	*T*	*B*	*P* value
PCOS status	0.21	3.66	1.01	0.002
Age	0.28	−0.44	−0.18	0.72
Education	0.37	−1.33	−0.77	0.20
BMI	0.42	1.50	0.66	0.18

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Declarations

Ethics approval and consent to participate
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Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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