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RESEARCH ARTICLE

The association between female sexual function and metabolic features of the polycystic ovary syndrome in Turkish women of reproductive age

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ABSTRACT

Objective: To investigate the association between female sexual function and metabolic features among women with polycystic ovary syndrome (PCOS) during reproductive age.

Method: This was a cross-sectional study in which 288 women with PCOS and 180 women without PCOS between the ages of 20 and 40 years were evaluated. All women had serum total testosterone, androstenedione, DHEA-S, fasting glucose, total cholesterol, HDL-C, LDL-C, and triglyceride levels analyzed. The McCoy Female Sexual Questionnaire (MFSQ) was applied to all studied women. Exploratory factor analysis and reliability analysis were done after data collection. The factor loadings of MFSQ domains were compared between women with PCOS and controls.

Results: Average factor loadings of the MFSQ sexuality domain and MFSQ sexual partner domain were significantly lower in the PCOS group when compared to controls. There was no correlation between the two sexual function domains of the MFSQ and the PCOS features either in the PCOS group or the controls.

Conclusion: PCOS is a heterogeneous disease with different metabolic components, such as insulin resistance, obesity, and hyperandrogenism. Although sexual function among women with PCOS was lower than controls, no differences were found in metabolic features of the PCOS and non-PCOS groups with relation to sexual function determined by the MFSQ.

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KEYWORDS
Polycystic ovary syndrome; female sexual dysfunction; sexual satisfaction; sexuality; questionnaire; McCoy female sexual questionnaire

Introduction

Women with the polycystic ovary syndrome (PCOS) have a different spectrum of complaints which demands medical care. This disorder is associated with insulin resistance, obesity, dyslipidemia and the metabolic syndrome [1,2]. Sexual function is determined by the complex interaction of cultural, biological, psychological and social determinants [3,4]. Sexual function can be influenced by many factors in women with PCOS. Subfertility [5–8], impaired by androgen levels [9–14], metabolic syndrome [3,15,16], obesity [17,18], body image [19–21], mental health [22–25], and self-esteem [26–28] are factors more commonly present in women with PCOS and could be linked to their sexual dysfunction. Women with PCOS have a high functional activity of testosterone, which might be associated with increased sexual functioning. Androgens seem deeply involved in the modulation of sexual function by positively acting on sexual desire, thoughts, and fantasies. However, the exact role of androgens in sexual arousal function remains controversial and not completely understood [29].

The Female Sexual Function Index (FSFI), the Changes in Sexual Functioning Questionnaire (CSFQ), the Sexual Quotient-Female (SQ-F), the Female Sexual Desire Questionnaire (FSDQ), the Multidimensional Sexuality Questionnaire (MSQ), the Index of Sexual Satisfaction (ISS) and the McCoy Female Sexuality Questionnaire (MFSQ) have been used to evaluate the effects of PCOS symptoms on female sexual function [30]. MFSQ measures several sexual function indices (enjoyment, satisfaction, sexual thoughts, arousal, orgasm, lubrication, pain) [31].

In this study, we aimed to investigate whether PCOS status has an influence on female sexual function in relation to metabolic parameters in Turkish women during reproductive age.

Methods

This cross-sectional study was conducted on 466 women between the ages of 20–40 years who were attended in the Gynecology Outpatient Clinics of Pendik Training and Research Hospital affiliated with Marmara University between April 2018 and September 2020. The flow chart of participants is shown in Figure 1. The study was approved by the Institutional Review Board of the University and the Local Ethics Committee. All women were informed of the study, its aims, used tools and then gave written informed consent of participation.

Patient selection

The study group was composed of women with PCOS between the ages of 20 and 40 years. PCOS was diagnosed by using

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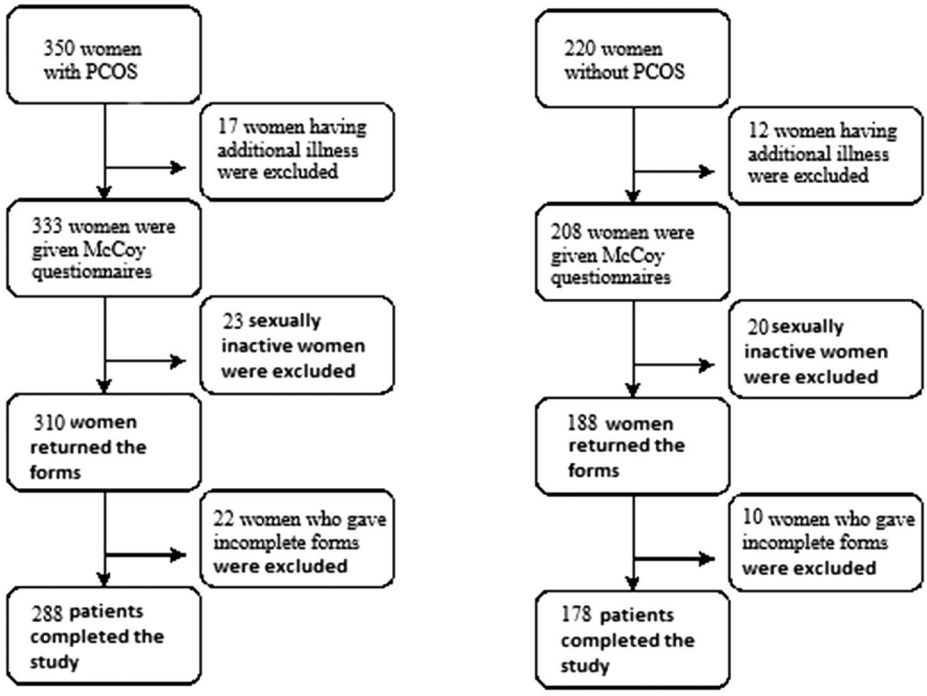

Figure 1. Flowchart diagram of the patients.

ASRM/ESHRE (Rotterdam) 2003 criteria [32]. The control group was composed of the women who attended the outpatient clinics with the complaint of menstrual irregularity or infertility who did not meet PCOS criteria. We excluded patients with systemic diseases such as non-classical adrenal hyperplasia (21-hydroxylase deficiency), Cushing's syndrome, thyroid dysfunction, parathyroid diseases, hyperprolactinemia, androgen-secreting tumor and diabetes mellitus as well as PCOS women who had received medical treatment within the last 6 months.

Study protocol

Detailed obstetric, gynecologic, medical and surgical history data were taken. Oligo/anovulation diagnosis was made when there was either a history of oligomenorrhea (less than 6–9 cycles per year), amenorrhea (no menstruation during consecutive 3 cycles at a minimum) or when mid-luteal phase serum progesterone level in a woman with regular menstrual cycle was less than 5 ng/dL.

The height and weight of each patient were obtained with them wearing indoor clothing and without shoes. Body mass index (BMI) was then calculated as weight (kg) divided by square of height (m). A soft measuring tape placed halfway between the lowest rib and top of the hipbone was done to measure women's waist circumference and the widest part of the hip was the measurement for the hip circumference. The modified Ferriman Gallwey scoring method was used for hirsutism scoring. Women with scores of 8 and above were accepted to have clinical hirsutism [33].

Laboratory studies

Venous blood samples of the participants were taken during the early follicular phase between the 3rd and the 5th days of their spontaneous or gestagen induced menstrual cycles.

Serum follicle stimulating hormone (FSH), luteinizing hormone (LH), estradiol, total testosterone, dehydroepiandrosterone sulfate (DHEA-S), androstenedione, sex hormone binding globulin (SHBG), fasting glucose, total cholesterol, high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), triglyceride levels were analyzed as described previously [1]. Evaluation for insulin resistance was carried out using the Homeostatic Model Assessment of Insulin Resistance (HOMA-IR) [34]. Free Androgen Index (FAI) was calculated with the formula previously described [33].

Imaging studies

The polycystic ovary was defined according to the polycystic ovary definition stated in the ESHRE/ASRM 2003 Rotterdam Convention [32]. Ovarian ultrasonography was assessed by using a 10-Mhz vaginal or 6-MHz abdominal probe.

McCoy Female Sexuality Questionnaire (MFSQ)

The MFSQ is a 19-item questionnaire of which 18 items are answered on a 7-point Likert scale and one item evaluates the intercourse frequency over the past 4 weeks. The MFSQ consists of five subdomains: sexual interest (4 items), vaginal lubrication (3 items), orgasm (4 items), satisfaction with frequency of sexual activity (3 items) and sex partner (3 items on satisfaction with the partner as friend and lover and erectile problems of the partner). A higher MFSQ total score indicates better sexual function. The MFSQ is able to discriminate between women with and without sexual dysfunction [35].

Statistical analysis

Statistical analysis was performed with SPSS v26.0 (IBM, Chicago, IL USA). Data are presented as mean, standard deviations,

median, minimum, maximum values, frequencies and percentages. The normality of distribution of variables was evaluated with the Kolmogorov-Smirnov test. According to this, independent sample Student's *T* or the and Mann-Whitney *U* test were used for the comparison of quantitative data. The chi-square test was used for the comparison of qualitative data. Pearson correlation was used for correlation analysis. A p value of <0.05 was considered as statistically significant.

Results

The exploratory factor analysis divided the MFSQ questionnaire into 2 domains: (sexuality: 9 items) and (sexual partner: 3 items). Kaiser-Meyer-Olkin Measure of Sampling Adequacy was found to be 0.927. The internal consistency measured with Cronbach's α were shown to be adequate for both domains (sexuality and sexual partner: α = 0.913 and α = 0.737, respectively). Demographic characteristics were found to be similar across the groups, except body weight, BMI, waist and hip circumferences which were significantly higher in the PCOS group ($p < 0.05$) (Table 1). Mean serum LDL-C, DHEA-S and androstenedione levels were significantly higher in the PCOS group (Table 1). HOMA-IR and FAI were higher in the PCOS women compared to non-PCOS women. Mean serum LH level was higher and mean serum estradiol level was lower in the PCOS group.

There were significant differences between the PCOS and non-PCOS group when both MFSQ- sexuality domain and MFSQ sexual partner domain were compared (Table 2). There was no correlation between the two sexual function domains and the PCOS metabolic features (Table 3).

Table 1. Demographic and laboratory test results of PCOS and non-PCOS women.

	PCOS (n = 288)		Non-PCOS (n = 178)		p value
Age (years)	27.26	± 4.59	29.78	±5.05	0.09
Weight (kg)	75.29	± 16.24	65.34	± 13.70	0.001
BMI (kg/m^2)	28.77	± 6.14	24.90	± 5.08	0.001
Waist circumference (cm)	93.27	± 11.75	84.60	± 13.92	0.001
Hip circumference (cm)	108.85	± 15.69	98.92	± 13.41	0.001
Waist hip ratio	0.86	± 0.07	0.86	± 0.06	0.35
Total cholesterol (mg/dL)	190.91	± 40.43	180.51	± 39.22	0.14
LDL-C (mg/dL)	118.16	± 34.49	108.01	± 28.87	0.004
HDL-C (mg/dL)	50.09	± 10.36	56.16	± 12.62	0.06
Triglyceride (mg/dL)	107.31	± 57.29	95.92	± 60.53	0.86
Total testosterone (ng/mL)	0.61	± 0.26	0.48	± 0.25	0.17
Androstenedione (ng/ml)	3.53	± 1.70	2.41	± 1.33	0.001
FSH (µIU/mL)	6.37	± 3.53	7.24	± 2.67	0.15
LH (µIU/mL)	10.41	± 6.87	8.68	± 5.62	0.003
Estradiol (pg/mL)	71.81	± 54.52	89.82	± 68.04	0.003
SHBG (nmol/dL)	41.08	± 36.73	61.17	± 39.44	0.06
DHEA-S (µg/dL)	219.11	± 97.48	186.37	± 82.51	0.001
Fasting glucose (mg/dL)	91.66	± 19.66	90.01	± 13.48	0.78
Fasting insulin (µIU/mL)	16.52	± 12.65	10.95	± 7.78	0.001
HOMA-IR	3.97	± 4.84	2.51	± 2.06	0.001
FAI	2.44	± 2.13	1.11	±0.95	0.001
Ferriman Galwey score	6.24	± 4.87	1.24	±0.88	0.001

Note: Data are presented as mean ± standard deviations. p value <0.05 is considered as statistically significant). BMI: Body mass index; SHBG: sex hormone-binding globulin; DHEA-S: dehydroepiandrosterone sulfate; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; HOMA-IR: Homeostatic Model Assessment of Insulin resistance; FAI: Free androgen index; FSH: follicle-stimulating hormone; and LH: luteinizing hormone.

Discussion

In the present study average factor loadings of MFSQ sexuality domain (9 items) and MFSQ sexual partner domains (3 items) were significantly lower in the PCOS group when compared to controls. Likewise, the study by Elsenbruch et al. [36] showed that women with PCOS were less satisfied with their sex life, but the frequency of intercourse, or frequency of sexual thoughts and fantasies did not differ than controls. They used visual analog scale for measuring sexual satisfaction among 50 women with PCOS and 50 controls.

In the study by Batagglia et al. [37], lean PCOS women did not show any differences in sexual functioning in relation to controls. They used the 2-factor Italian MFSQ. Twenty-five (n = 25) lean PCOS women and 18 non hirsute controls were included in this study. Similarly, another study that compared adolescent patients with and without PCOS (controls), found no differences of sexual function between the groups [38]. The Child Health Questionnaire was used in that study. This study was conducted on 97 adolescent girls with PCOS and 186 healthy adolescents. In contrast, a Dutch study including 480 patients found that menstrual irregularities might be related to sexarche [39].

The exact biochemical and physiological role of androgens in female sexual function is poorly understood and remains controversial. Whether androgens exert their effects on the genital system or by a direct action on the nervous system or both, remains a mystery. The synthesis and metabolism of androgens is taking place throughout the ovaries, the adrenal glands, and the peripheral tissue. Besides, active androgens may be produced, on demand, in peripheral target tissues by tissue specific steroidogenic enzymes according to the intracrine process [40].

The levels of circulating androgens may not provide the correct information on the bioavailability of their metabolites. Davis and Tran have suggested that androgen insufficiency is associated with impaired sexual function [41]. However, two studies did not find any correlation between sexual function and circulating androgen levels measured as total testosterone, free testosterone, and the FAI [42,43]. Our results were in accordance with these findings. It was suggested that androgens have no effects on sexual arousal *per se* but may influence other aspects of sexual desire, such as thoughts and fantasies. Furthermore, Rellini et al. [43] demonstrated that the clinical signs of hyperandrogenism are predictors of levels of sexual desire. In our study Ferriman Gallwey scores both in the PCOS and control groups were not correlated with the sexual function domains.

In PCOS, disease-related changes in body appearance, particularly hirsutism, may contribute to reducing the feminine identity of patients. Consequently, the incidence of sexual dysfunction may increase. Since our country is located in the Mediterranean region where the increased body hair is quite frequent, the moderate hirsutism found in our PCOS population could be

Table 2. The comparison of the McCoy Sexuality domain and sexual partner domain scores between PCOS and non-PCOS women.

	PCOS (n = 288)	Non-PCOS (n = 178)	p value
McCoy – Sexuality domain	3.40 ± 1.26	4.47 ± 1.39	0.001
McCoy – Sexual partner domain	5.10 ± 1.31	5.94 ± 1.10	0.001

Note: p value <0.05 is considered as statistically significant.

Table 3. Correlation of scores of female sexual function domains, and PCOS parameters in patients with and without PCOS.

	McCoy-sexuality domain			
	PCOS ($n=288$)		Non-PCOS ($n=178$)	
	p value	PCC	p value	PCC
Age	0.11	−0.09	0.41	−0.06
Weight	0.65	−0.03	0.28	−0.08
Waist circumference	0.67	−0.03	0.03	−0.16
BMI	0.64	−0.03	0.10	−0.12
Waist hip ratio	0.07	0.11	0.05	−0.15
Total cholesterol	0.88	−0.01	0.73	0.03
LDL-C	0.94	0.01	0.52	0.05
HDL-C	0.78	0.02	0.70	0.03
Triglyceride	0.71	−0.03	0.06	−0.14
Estradiol	0.03	−0.13	0.05	0.15
Total testosterone	0.87	−0.01	0.72	−0.03
Androstenedione	0.15	0.11	0.39	0.07
SHBG	0.33	0.08	0.87	0.01
DHEAS	0.39	0.05	0.30	0.08
Fasting glucose	0.61	−0.03	0.03	−0.16
Fasting insulin	0.83	0.01	0.34	−0.07
HOMA-IR	0.83	0.01	0.09	−0.13
FAI	0.95	0.01	0.52	−0.05
Ferriman Gallwey score	0.65	0.03	0.13	−0.12
	McCoy-sex partner domain			
	PCOS ($n=288$)		Non-PCOS ($n=178$)	
	p value	PCC	p value	PCC
Age	0.05	−0.11	0.01	−0.19
Weight	0.09	−0.10	0.95	0.01
Waist circumference	0.15	−0.09	0.48	−0.05
BMI	0.93	0.01	0.94	0.01
Waist hip ratio	0.50	0.04	0.20	−0.10
Total cholesterol	0.11	0.13	0.25	0.09
LDL-C	0.32	0.08	0.45	0.06
HDL-C	0.23	0.10	0.29	0.08
Triglyceride	0.45	0.06	0.60	−0.04
Estradiol	0.27	−0.07	0.39	0.07
Total testosterone	0.96	−0.01	0.62	0.04
Androstenedione	0.92	0.01	0.09	0.13
SHBG	0.15	0.11	0.53	0.05
DHEAS	0.31	0.06	0.25	0.09
Fasting glucose	0.81	−0.01	0.31	−0.08
Fasting insulin	0.18	−0.08	0.34	−0.07
HOMA-IR	0.25	−0.07	0.22	−0.09
FAI	0.31	−0.08	0.14	0.11

Note: BMI: Body mass index; SHBG: sex hormone-binding globulin; DHEA-S: dehydroepiandrosterone sulfate; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; HOMA-IR: Homeostatic Model Assessment of Insulin Resistance; FAI: Free androgen index; and PCC: Pearson correlation coefficient.

acceptable by women and might not change their female sex appeal. This could be seen in our study, where the sexual partner domain of MSFQ was not linked to either FAI or Ferriman Gallwey score in women with PCOS. The satisfactory relationship between PCOS women and their partners was shown to be lower than that in controls.

In our study, there was no relationship between the serum levels of total testosterone and sexual function domains neither in the control group nor the PCOS group. However high testosterone levels have been linked to higher rates of intercourse in married women [44,45]. Moreover, testosterone supplementation in oophorectomized women, as well as women suffering from hyposexuality consistently improved self-rated satisfaction of sex [46–49]. In our study even though total testosterone and SHBG levels were similar between the groups, the scores of sexual function domains were lower in the PCOS group than the controls. However, the scores of sexual function domains were not correlated with either total testosterone levels or FAI.

Lower sexual satisfaction is commonly considered to be associated with obesity [50–52], even if reported objective measures of sexual activities were similar in obese and non-obese women of reproductive age [53]. In our study, PCOS women had higher body weight and BMI than non-PCOS women. The sexual domain scores were statistically lower in the PCOS women when compared to controls. Nevertheless, the sexual domain scores were not correlated with body weight or BMI in either the PCOS or the control group.

The review and meta-analysis by Pastoor et al. [30] showed small but significantly lower sexual function in women with PCOS compared to controls. In this meta-analysis five studies were controlled for BMI. The mean BMI of PCOS women was considerably lower (mean BMI varying from 21 to 27 kg/m^2) in each of the five studies as compared to our study group (mean BMI of PCOS group was 28.77 kg/m^2). Findings of these five individual studies suggest that BMI rather than PCOS is associated with lower sexual function scores. Furthermore, worse sexual function was associated with increasing degrees of obesity [54–58]. Drosdzol et al. [55] used ISS and included 50 PCOS and 40 controls in their study. Ercan et al. [54], Lara et al. [56], and Noozzadeh et al. [58] used the FSFI and included women with PCOS and controls with sample size distributions of 32/32, 43/51, and 63/216, respectively. Kowalczyk et al. [57] used MSQ and included 73 PCOS and 45 controls. Our study consists of more PCOS women than those of all these studies combined. When sexual domain scores were analyzed separately for both PCOS and controls, the correlations between BMI and the domains were found to be negligible.

Morotti et al. [59] used the MFSQ to measure sexual behavior of 33 lean women with PCOS and 22 healthy non hirsute women. They found similar MFSQ scores between the groups. Likewise, Stovall et al. [60], reported no significant differences in sexual function between women with 92 women with PCOS and 82 controls. The CSFQ was used in this study. Both studies had sample sizes less than our study. In contrast, Elsenbruch et al. reported that 50 patients with PCOS were less satisfied with their sexual life when compared to 50 controls. Additionally, their partners were also less satisfied [36]. They analyzed sexual satisfaction with visual analog scale. Similarly, our study revealed lower sexual satisfaction scores among PCOS women when compared to controls.

Ercan et al. [54] and Morotti et al. [59] reported similar estradiol levels between the PCOS and control groups; whereas in our study mean serum estradiol levels were lower in PCOS women than in non-PCOS controls. While Noroozzadeh et al. [58] found similar serum LH levels between PCOS and controls, Ercan et al. [54] detected higher serum LH in the PCOS group. Our results were similar to the latter.

One of the limitations of our study is that it was conducted in a tertiary health-care institution. Our results need to be confirmed at primary and secondary healthcare centers. Secondly, the study should be repeated to see results from other subcultures, social groups, and citizens from different cities in the same country. The third limitation was that sexual function was not compared across the PCOS phenotypes. Thus, it is unclear whether the results would change between different sub-types of PCOS.

The strength of our study is the sample size. We collected the largest data on MFSQ surveys among young reproductive aged women. Our data was shown to be adequate since the Kaiser Meyer Olkin value was 0.927. Furthermore, the factor loadings of each item in the two domains were over 0.63,

which corresponded to the 61.53% variance being explained by the two combined domains. The interitem consistency reliability is a test of the consistency of respondents' answers to all the items in a measure. Cronbach's alpha is a reliability coefficient that indicates how well the items in a set are correlated to one another. In general, reliabilities in the 0.70 range are acceptable, and those over 0.80 are good. Thus, the internal consistency reliability of the measures used in our study can be considered acceptable for the intention to leave measure and good for the other measures. Last but not least, the study was the validation of the MFSQ in a Turkish sample of premenopausal women.

In conclusion, different types of questionnaires have been used to investigate sexual function and dysfunction. Each questionnaire should be validated for a given population that is to be evaluated. A better understanding of sexual function in relation to regional culture, society, and religious belief in any particular country or region will then be possible. Esthetic standards, social norms, and family structure are determinants of sexual function. Although sexual function among women with PCOS was lower than controls, no differences were found in metabolic features of the PCOS and non-PCOS groups with relation to sexual function determined by the MFSQ.

Author contributors

MCD and TY were involved in the study conception and design. CMD carried out the surveys. TY performed the statistical analysis. MCD and TY performed drafting of the manuscript. All authors were involved in critically revising the manuscript for its intellectual content, and the final approval of the manuscript was performed by both authors.

Disclosure statement

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Data availability statement

All required information regarding the study protocol and collected data will be made available upon request to researchers who provide a methodologically sound proposal. Only the analysis required to achieve the aims in the approved proposal will be permitted.

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