Sexuality and Psychological Well-being in Different Polycystic Ovary Syndrome Phenotypes Compared with Healthy Controls: A Cross-sectional Study

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Abstract

Introduction: Polycystic ovary syndrome (PCOS) is the most common endocrine disorder in women of reproductive age. The present study aimed to compare the women with different PCOS phenotypes with the healthy group in terms of sexual function, depression, anxiety and quality of life scale.

Materials and Methods: The present cross-sectional study was carried out on 192 infertile women with PCOS (classified on the basis of Rotterdam criteria into four categories) and 50 healthy controls. All participants were asked to fill out the valid and reliable questionnaires of FSFI (Female Sexual Function Index), HADS (Hospital Depression and Anxiety Scale) and SF-12.

Results: In the HADS questionnaire, phenotype B achieved the highest mean score in anxiety and depression domains, whereas, phenotype B had the lowest mean score in the FSFI and SF-12 questionnaires. Furthermore, there was a significant difference between the women with PCOS phenotypes and the control group in arousal, lubrication, pain, and mean total score of FSFI ($P < 0.05$). In regression logistic analysis, age, infertility and depression were predictors of sexual dysfunction ($P < 0.05$).

Conclusion: The results indicated significant differences in terms of sexual dysfunction, depression, anxiety and quality of life in the women suffering from different phenotypes of PCOS compared with the healthy group. These results provide evidence that care and recommendations for improving women's QoL and sexual function should be considered according to the relevant PCOS phenotypes.

Introduction

Polycystic ovary syndrome (PCOS) is the most common endocrine disorder in women of reproductive age. The estimated prevalence of PCOS in different population is 5-24% (1,2). PCOS is characterized by large ovaries, menstrual irregularities, clinical and biochemical hyperandrogenism. There are several studies assessing the impact of symptoms and treatment of PCOS patients on their quality of life (1,3-5).

PCOS is associated with significant short- and long-term health problems, including psychological disorders (6) such as depression, anxiety and social problems, which can affect a woman's identity and HRQoL.

Health-related quality of life (HRQL) has been defined as a person or group's perceived physical and mental health. The health risks associated with PCOS, as well as clinical findings eg., infertility, hirsutism, acne and obesity, significantly impact the HRQL of women with PCOS (7).

Also, sexual function is a multi-dimensional issue which is under influence of psychological, biological and interpersonal factors (8). In women with PCOS, the factors affecting sexual functioning include infertility, deranged hormone levels, especially androgens, obesity and associated problems like metabolic syndrome, body image issues and low self-esteem (9). Clinical interventions for treatment of PCOS, including hormonal drugs may also have an effect on women's sexual functioning.

The main objectives of the present study are as follows: determining the sexual function, QoL, anxiety, and depression in different phenotypes of PCOS and compare them with healthy individuals.

Since multiple factors can impair the sexual function and QoL of PCOS patients, it would seem essential to evaluate the importance of these problems and the related factors to them. For this purpose, the present study was set up to investigate the sexual function and QoL in different phenotypes of PCOS women and compare with the control group. We also investigated the possible factors associated in PCOS women with different domains.

Materials And Methods

The present study included five comparative groups (four phenotype groups) and one control group (lack of PCOS). Upon approval of the Medical Ethics Committee of Tabiat Modares University (IR.MODARES.REC.1397.153), the study was performed on 242 sexually active participants aged (18-40 years). The study group included women with PCOS referred to an infertility clinic in Arash Hospital in Tehran Province, Iran from May 2018 to February 2019. Also the control group included the patients referred to Arash Hospital, consistent with healthy fertile married women, who were non-pregnant, non-breastfeeding (parity ≥ 1) without PCOS (or other major gynecological conditions, e.g. endometriosis or chronic disease) and had a regular menstrual cycle. They were selected from the patients' companions by convenience. At first, a sample size was calculated based on taking 95% confidence interval and 85% power to test.

Then, using the appropriate formula at 95% confidence interval and error 3 (d), it was found that a sample size of 215 women was needed with 10% sample loss:

Sample size estimation formula:

$$n = \frac{(z_{1-\frac{\alpha}{2}})^2 s^2}{d^2}$$

Finally, 55 patients with phenotype A, 30 patients with phenotype B, 56 patients with phenotype C, 51 patients with phenotype D, and 50 healthy women were entered into the study.

There are four phenotypes of PCOS according to Rotterdam criteria (10): phenotype A consists of hyperandrogenism, ovulatory dysfunction and polycystic ovarian morphology (PCOM), phenotype B is composed of hyperandrogenism and ovulatory dysfunction, phenotype C consists of hyperandrogenism and PCOM, and phenotype D consists of ovulatory dysfunction and PCOM. Phenotypes A and B are more associated with obesity, metabolic dysfunction and menstrual irregularities (11).

The inclusion criteria were as follows: aged 18-40 years, married, non-pregnant, Iranian race, giving personal consent to enter the study, and PCOS diagnosed by gynecologist based on Rotterdam criteria.

For the PCOS group, completion of primary school as the minimum level of education and no medication with hormones known to influence serum androgen levels, including anti-androgenic drugs and oral contraceptive pills during three months before the study were required. Due to the drug effect on the results, we should not include those PCOS patients who were consuming metformin due to PCOS (not because of the high blood glucose level). Those participants who were not eligible for the study such as patients with thyroid dysfunction, abnormal prolactin levels, congenital adrenal hyperplasia (CAH), Cushing's syndrome (CS), androgen-secreting tumors, and diagnosed cardiovascular disease (CVD), as well as those taking oral contraceptives and anti-androgenic drugs were excluded from this study.

Clinical and anthropometric assessment

All patients were examined for anthropometric parameters, menstrual cycles and hirsutism by a trained midwife, and were asked for demographic characteristics, as well as diagnosis and history of amenorrhea. Regularity of menstrual cycles was assessed in all patients. According to FIGO recommendations (12), patients who had intervals of menstrual cycle over 35 days were diagnosed as having infrequent menstrual bleeding, and cycle <23 days as frequent menstrual bleeding, and absence of menstrual periods for ≥ 6 months as amenorrhea (13,14). Modified Ferriman Gallwey (mFG) score was applied for determining the density of terminal hair at nine different body sites, including the upper lip, chin, chest, upper back, lower back, upper abdomen, lower abdomen, arm and thigh; this scoring system grades excess terminal body or facial hair growth based on a scale of 0 (absence of terminal hairs) to 4 (frank virilization), and a total score of 8 or more is considered as hirsutism (15).

Anthropometric measurements, which were performed for all participants in this study, included body weight, height, and waist circumference measurements. Height and weight were scaled with the subjects in light clothes and without shoes. Waist circumference was evaluated using a flexible tape at the midline between the lower rib border and the curved superior border of the ilium (at the level of the umbilicus) at the end of normal exhalation whereas the participants were in the standing position. BMI was computed based on the World Health Organization (WHO) guidelines. Calculation formula was weight (in kilograms) divided by height squared (in meters) (kg/m^2). We described ovulation disorder as the menstrual cycle duration of more than 35 days or lack of menstrual cycle for more than three months (oligo/anovulation).

Measures

Demographic questionnaire

A checklist related to demographic features, including age, weight, height, BMI, waist to hip circumference ratio (waist/hip circumference), occupation status, educational level, infertility status, and medical history.

FSFI

Female Sexual Function Index (FSFI) questionnaire is a validated test that evaluates all phases of the female sexual cycle in the past four weeks. The questionnaire consists of 19 items divided into six subscales (domains): sexual desire, sexual arousal, lubrication, orgasm, sexual satisfaction, and

dyspareunia. Each item is rated on a scale from 0 to 5 or from 1 to 5, where 0 indicates no sexual activity in the past month. Scores for each of the six domains are calculated by summing up individual domain question scores and multiplying the result by the domain factor (i.e., 0.6 for desire, 0.3 for arousal and lubrication, and 0.4 for orgasm, satisfaction, and pain). The minimum possible score to achieve is 2 and the maximum is 36. A higher score in each domain indicates a better status (16). The reliability and validity of this questionnaire have been confirmed in Iran (17).

Quality of life (QoL)

The Short Form Health Survey (SF-12) includes 12 questions related to eight dimensions (sexual performance, physical role, physical pain, general health, energy and vitality, social performance, emotional role, and mental health), which is divided into two subscales of physical and mental health. The greatest score obtained for each section or subscale is 100 and the least score is zero with a higher score indicating a better health status (18). The validity and reliability of this questionnaire have previously been confirmed in Iran (19).

Anxiety and Depression:

The Hospital Anxiety and Depression Scale (HADS) is used to assess depression and anxiety. The instrument has two subscales including anxiety (HADS-A) and depression (HADS-D). It is a self-administered instrument consisting of 14 questions. The instrument has two subscales including anxiety (seven items) and depression (seven items). All items are rated from 0 to 3. Sum scores <8 indicate normal range, scores 8-10 reflect mild alterations and scores ≥ 11 indicate clinical relevance of symptoms (20). A study on the Persian version of the HADS has shown that this scale has satisfactory reliability and validity for measuring psychological symptoms in Iranian patients (21).

Laboratory assessment

All participants in the present study underwent abdominal ultrasonography. Ovaries containing 12 or more follicles measuring 2–9 mm in diameter and/or enlarged ovarian volume ($>10 \text{ mm}^3$) on abdominal ultrasonography were considered to have a positive polycystic sonographic view. Blood samples were also drawn for assessment of sex hormone-binding globulin (SHBG) and total testosterone (TT) levels. Free androgen index (FAI) was computed by $\text{TT (nmol/L)}/\text{SHBG (nmol/L)} \times 100$ by commercial kits (Pars Azmoon Inc, Tehran, Iran) using Auto-analyzer BT2000 device. Biochemical measurement of TT and SHBG levels was performed based on the electro-chemiluminescence method (Roche Instr Kit, Germany) by Cobas E411 device.

Statistical analysis

Normal and non-normal quantitative variables were reported as Mean $\pm$ Standard Deviation (SD). Qualitative variables were presented as number (percentage). Primarily, the quantitative variables were checked for normality using Kolmogorov–Smirnov's (KS) test. One-way ANOVA was applied for the normal variables and Kruskal-Wallis (KW) test was used for the non-normal and ordinal variables. If there

was a significant group effect, a pairwise comparison of the groups was performed using Mann-Whitney's U test (MW). Then Bonferroni's correction performance ($P < 0.005$) was considered significant. Qualitative variables were compared using the Chi-square test. In order to compare normal variables between two PCOS subgroups. Also, to examine the relationship between sexual function and independent variables (quantitative and qualitative variables), binary logistic regression (cut-off point 28) was used. In this study, considering the cut-off point of 28 in terms of sexual function, the participants were divided into appropriate (≥ 28) and inappropriate groups (< 28), and sexual function was considered as two state dependent variable. Considering this state, Binary logistic regression was used to control confounder variables and simultaneously examine the independent variables. Regression logistic coefficient was calculated. Statistical significance was set at $P < 0.05$. The obtained data were analyzed by the SPSS software (Statistical Package for the Social Sciences, version 22.0, SPSS Inc., Chicago, IL, USA).

Results

Table 1 shows an overview of the demographic characteristics of women with different phenotypes of PCOS and the control group. The age of the participants ranged from 18 to 40 years. As can be seen, there is a significant difference between the PCOS subgroups and the control group in terms of age, WHR, education level, number of children, number of abortion and infertility status ($P < 0.05$), but no significant difference is observed in occupation and BMI ($P > 0.05$).

Table1: Comparison of demographic characteristics between different PCOS phenotypes and the control group

Variable	HA+PCOM+OD (A) n =55	HA+OD (B) n = 30	HA+PCOM (C) n = 56	OD+PCOM (D) n = 51	Control (CO) n =50	P- value
Age (year)*	29.18+5.71	31.55+5.68	31.67+5.05	31.28+5.5	34.18±4.13	<0.001
BMI (Kg/m ²)*	27.21+4.80	26.59+3.85	25.60+3.67	26.45+3.75	26.96±3.12	0.13
Number of children						<0.001
0	45	17	42	37	0	
1	9	11	11	12	41	
2	1	1	3	2	9	
3	0	1	0	0	0	
Number of abortion						0.02
0	46	22	38	44	40	
1	5	5	12	5	10	
2	4	3	4	0	0	
3	0	0	2	2	0	
WHR*	0.87±0.021	0.88±0.023	0.87±0.026	0.87±0.016	0.85±0.51	<0.001
Occupation status**						0.11
Housewife	51(92.7)	28(93.3)	53(94.6)	45(88.3)	41(82)	
Employed	4(7.3)	2(6.7)	3(6.4)	6(11.7)	9(18)	
Educational level**						<0.001
Primary	16(29.09)	9(30.01)	5(8.93)	17 (33.33)	3(6)	
Secondary	22(40.01)	10 (33.33)	24 (42.85)	16 (31.37)	20(40)	
Higher	17(30.9)	11 (36.66)	27 (48.21)	18 (35.29)	27(54)	
Infertility Status**						<0.001
Yes	47 (85.71)	25(73.68)	48(85.29)	43(85.71)	0(0)	
No	8 (14.28)	5(26.31)	8(14.7)	8(14.28)	50(100)	

HA: Hyperandrogenism, OD: Ovulatory Dysfunction, PCOM: Polycystic Ovarian Morphology BMI: Body Mass Index. WHR: Waist Hip Circumference Ratio, PCOS: Polycystic Ovary Syndrome

* Values are given as mean $\pm$ SD using Kruskal-Wallis test.

** Values are given as number (%) by using Chi-square test.

Table 2 presents the statistics for FSFI in different phenotypes of PCOS and the control group. As shown, there is no statistically significant difference between different PCOS subgroups and the control group in the scores of desire, orgasm and satisfaction ($P>0.05$). However, there is a significant difference between the PCOS phenotypes and the control group in the mean total score of FSFI, arousal, lubrication and pain. In the arousal domain, in addition, there is a significant difference between the score of phenotype B and other categories and the control group in the arousal group ($P<0.05$). In the pain domain, there are significant differences between the scores of phenotypes A, B, C and D and the control group, but in total score, there are significant differences between the scores of phenotypes A and B with the control group. Also, in the domains of arousal, lubrication and pain and total score, phenotype B expresses the lowest score and the control group expresses the highest score.

Table 2: Scores and total scores for the domain subgroups of FSFI between the different groups

Variable	HA+PCOM+OD (A) n =55	HA+OD (B) n = 30	HA+PCOM (C) n = 56	OD+PCOM (D) n = 51	Control (CO) n =50	P-value
Desire	3.75 $\pm$ 0.85	3.48 $\pm$ 0.72	3.69 $\pm$ 0.94	3.69 $\pm$ 0.73	3.75 $\pm$ 0.77	0.642
Arousal	4.12 $\pm$ 0.87	4.51 $\pm$.85	4.01 $\pm$ 1.04	4.08 $\pm$ 0.84	4.51 $\pm$.85	0.002
Lubrication	4.69 $\pm$ 0.82	4.32 $\pm$ 1.15	4.63 $\pm$ 0.91	4.95 $\pm$ 0.99	4.89 $\pm$ 0.86	0.032
Orgasm	4.68 $\pm$ 0.903	4.106 $\pm$ 1.22	4.43 $\pm$ 1.02	4.66 $\pm$ 0.92	4.66 $\pm$ 0.912	0.192
Satisfaction	4.90 $\pm$ 1.02	4.45 $\pm$ 1.18	4.71 $\pm$ 1.14	4.95 $\pm$ 0.84	4.79 $\pm$ 0.905	0.313
Pain	2.99 $\pm$ 1.06	3.09 $\pm$ 1.206	3.17 $\pm$ 0.96	3.16 $\pm$ 1.26	6.59 $\pm$ 9.01	<0.001
Total FSFI	25.16 $\pm$ 3.33	22.7 $\pm$ 4.2	24.66 $\pm$ 4.16	25.51 $\pm$ 3.29	28.78 $\pm$ 9.49	<0.001

HA: Hyperandrogenism, OD: Ovulatory Dysfunction, PCOM: Polycystic Ovarian Morphology PCOS: Polycystic Ovary Syndrome

P-values refer to the Kruskal-Wallis test.

Anxiety and depression:

Table 3 compares the mean scores of different domains of HADS in different phenotypes of PCOS and the control group. In depression domain, there is a significant difference between subgroup B and the control group. Phenotype B with (8.43±3.91) and the control group with (5.32±3.75) express the highest and the least scores, respectively. In anxiety domain, there is a significant difference between subgroups A and B and the control group. Phenotype B with (11.73±3.39) and the control group with (8.46±3.78) express the highest and the least scores, respectively.

Table 3: Comparing the scores of HADS between different PCOS phenotypes and the control group

Variable	HA+PCOM +OD (A) n =55	HA+OD (B) n = 30	HA+PCOM (C) n = 56	OD+PCOM (D) n = 51	Control (CO) n=50	P-value
Anxiety	10.74±4.21	11.73±3.39	10.5.±3.61	10.00±4.13	8.46.±3.78	0.004
Depression	6.74±3.73	8.43±3.91	6.37±3.78	6.31±3.47	5.32.±3.7	0.02

HA: Hyperandrogenism, OD: Ovulatory Dysfunction, PCOM: Polycystic Ovarian Morphology PCOS: Polycystic Ovary Syndrome

P-values refer to the Kruskal-Wallis test.

Quality of life (QoL)

Table 4 provides the results obtained from summing up of the mean scores of SF-12 domains in different PCOS phenotype categories. As shown, in the MCS subgroup, there is a significant difference between phenotypes A, B, C and D and the control group. In this domain, phenotype B expresses the lowest score (39.11±8.83) and the control group expresses the highest score (48.44±8.84).

Table 4: Comparison of the SF-12 mean scores between different PCOS phenotypes and the control group

Variable	HA+PCOM+OD (A) n =55	HA+OD (B) n = 30	HA+PCOM (C) n = 56	OD+PCOM (D) n = 51	Control (CO) n =50	P-value
MCS	41.70±10.40	39.11±8.83	41.40±9.66	40.89±10.18	48.44±8.84	<0.001
PCS	43.72±7.75	43.66±6.50	43.77±7.51	45.73±7.40	45.61±7.38	0.397

HA: Hyperandrogenism, OD: Ovulatory Dysfunction, PCOM: Polycystic Ovarian Morphology, PCOS: Polycystic Ovary Syndrome, SF-12: The 12-item Short Form Health Survey, PCS: Physical Component Summary, MCS: Mental Component Summary.

Values are given as M± SD using One-way ANOVA.

Table 5 presents the relationship between sexual function and demographic variables in the study subjects. As shown, the odds ratio (OR) is not significant in $P < 0.05$ for BMI and WHR. The odds ratio (OR) for BMI is equal to 0.959 with the confidence interval(CI 95%) (0.864,1.064) and 1.018 for WHR with the confidence interval(CI 95%) (0.989,1.048). Because an OR higher than 1 in this study means that, no significant relationship is observed between BMI ,WHR and sexual function. However, the coefficients are significant for the age variable. The value of the odds ratio for age is equal to 1.085 with the confidence interval(CI 95%) (1.002,1.174). As a result, a significant relationship is observed between age and sexual function, and with increasing one year of age, the chance of developing sexual dysfunction increases by 8.5%.

Table 5: Relationship between the participants'sexual function and demographic variables in logistic regression analysis.

Variables	Beta	SE	P-value	OR*	(95%CI)
Age	0.081	0.40	0.044*	1.085	(1.002,1.174)
BMI	-0.042	0.015	0.428 ^{NS}	0.959	(0.864,1.064)
WHR	0.018	0.015	0.23 ^{NS}	1.018	(0.989,1.048)

*: Significant if $P < 0.05$, NS: Non significant if P value > 0.05

BMI: Body Mass Index, WHR: Waist Hip Circumference Ratio

* Regression Logistic Analysis

Table 6 presents the relationship between sexual function and independent variable. As can be seen, the difference was not statistically significant in some of the regression models that controlled for the FSFI score as well as education level, occupation, quality of life(QoL) and anxiety. However, it was found that there is a significant relationship between sexual dysfunction with depression, infertility and different groups.

Table 6: Logistic regression coefficients for sexual function in relation to independent variables

Variable	Beta	SE	P-value	OR*	(95%CI)
Group					
Group A (HA+PCOM+OD)	1.013	0.673	0.132	2.755	(0.736,10.308)
Group B (HA+OD)	2.139	0.946	0.024	8.490	(1.329,,54.23 1)
Group C (HA+PCOM)	1.287	0.683	0.06	3.623	(0.941,13.829)
Group D (OD+PCOM)	1.213	0.688	0.078	3.362	(0.873,12.946)
Group5 (Control)				1	
HADS					
Anxiety	-0.011	0.052	0.830	0.989	(0.893,1.095)
Depression	0.189	0.059	0/001	1.208	(1.076,1.356)
Infertility					
Infertility1 (yes)	0.849	0.308	0.006	2.338	(1.277,4.279)
Infertility2 (no)				1	
Education					
Education1 (primary)	0.530	0.416	0.203	1.669	(0.751,3.840)
Education2 (secondary)	0.400	0.336	0.234	1.491	(0.773,2.879)
Education3 (higher)				1	
Occupation					
Occupation1 (housewife)	0.556	0.423	0.181	1.762	(0.768,4.038)
Occupation2 (employed)				1	
Quality of Life					
In mental field (MCS)	-0.017	0.021	0.405	0.983	(0.943,1.024)
In physical field (PCS)	-0.035	0.024	0.149	0.966	(0.922,1.012)

* Regression Logistic Analysis

So that depressed subjects are about 1.2 time more likely to have sexual dysfunction than nondepressed subjects. As a result, a significant relationship is observed between infertility and sexual function and infertile women are about 2.3 time likely to have sexual dysfunction. Also about groups, it is found that the chance of developing sexual dysfunction in phenotype B is 8.5 times higher than other phenotypes and controls.

Table 7 compares the variable scores in the fertile and infertile groups. As shown, there is a significant difference in depression score between the fertile and infertile groups.

Table 7: Comparison of the variable scores in the fertile and infertile groups

Variable	Fertile (n = 79)	Infertile (n = 163)	P
	Mean (SD)	Mean (SD)	
FSFI	25.04±3.60	24.58±4.12	0.57*
Anxiety	10.10±3.72	10.66±3.98	0.48
Depression	5.48±3.50	7.01±3.76	0.04

FSFI: Female Sexual Function Index

*Values are given as mean SD using Student's t-test

Discussion

The aim of this study was to evaluate sexual function, anxiety, depression and QoL in different phenotypes of PCOS compared with healthy fertile women referred to the Infertility Clinic of Arash Hospital in Tehran, Iran. Polycystic ovary syndrome is one of the most common fertility problems in women, which can lead to many psychological disorders such as anxiety and depression (22). Numerous studies confirm psychological disorders such as sexual function, anxiety and depression in women with PCOS.

According to the obtained results, in the FSFI questionnaire, there were significant differences in terms of arousal, lubrication, pain and total FSFI between the different phenotypes of PCOS and the health controls ($P<0.05$). It was also found that sexual symptoms' scores in phenotype B were significantly lower as compared with the other phenotypes and the control group. These results can be explained by hormonal difference. Lizneva et al. (11) found that phenotypes A and B were considered as classic PCOS and can possess more menstrual dysfunction, higher androgen and insulin levels, increased rate of insulin resistance and being at higher risk of metabolic syndrome and obesity comparing to non HA-phenotypes.

The results of our study confirmed the data of Veras et al. (23), who reported a negative correlation between the intensity of sexual dysfunction and the level of total testosterone, LH and DHEAS. Ercan et al.

(24) also reported a significant negative correlation between the scores of total FSFI and LH, total testosterone and free testosterone, which corresponded to the study of Bazarganipoor et al. (25), who reported more sexual dysfunction in the and menstrual irregularities in the HA group than in two other phenotypes.

The possible meaning of the negative correlation between sexual function and androgen levels might be linked to hirsutism, acne vulgaris and subsequent poor body image, leading to esthetic problems, which may affect the psychosexuality of PCOS patients.

The relationship between sexual function and infertility remains controversial. Diamond et al. (26) unlike us reported that sexual function in women with PCOS did not differ from those without PCOS, and therefore, there was no significant difference between sexual function in the infertile women. Kukur Suna K et al. (27) reported that sexual dysfunction was identical was between the infertile and healthy women, but depression scores were higher in the infertile women than the control group, which is consistent with the results of our study. Deniz et al. (28) reported that PCOS women with infertility had more problems in all sexual function subscales except arousal, indicating that infertility poses a significant risk of sexual dysfunction in PCOS women.

In the study of Hashemi et al. (29), infertile PCOS women showed significantly higher sexual dysfunction than fertile PCOS women, which confirmed the results of our studies and observed in all dimensions except pain and desire, while in our study, only the scores for the orgasm, pain, lubrication domains of the FSFI questionnaire were significantly higher in the healthy controls. In contrast to our study, in the study of Davari Tanha et al. (30), scores of all domains were statistically higher in the controls. It is worth noting that infertility affects different aspects of the couples' lives, including psychological well-being (31). Depression, anxiety, sexual dysfunction and impaired QoL have been reported in more infertile women comparing with fertile women (30, 32).

By means of the FSFI and core fertility QoL questionnaires, Lo et al. (33) showed that infertile women with sexual dysfunction had lower QoL score. Also Sezgin et al. (34) found that infertile had worse QoL than fertile women.

In the current study, phenotype B achieved the highest mean score in anxiety and depression domains. In depression domain, was observed a significant difference between subgroup B and the control group, as well as, in anxiety domain, was observed a significant difference between subgroups A and B and the control group.

Also, in the SF-12 questionnaire, phenotype B had the lowest score. Phenotypes A and B are classic PCOS that are classified based on chronic OD and HA. In addition, detection of PCOM with sonography leads to distinction between these two phenotypes.

Maria Sanchez et al. (35) identified that all women with PCOS and anovulatory PCOS presented lower score in PCS compared to the controls. Moreover lower scores were reported for five out of the eight

scales (role physical, bodily pain, general health, vitality and role emotional) and no significant differences were observed for MCS between women with or without PCOS or its phenotypic subtypes. However, we observed significant differences for general health, social function, role emotional and mental health. Unlike the above study, no significant differences were observed for PCOS between different phenotypes and the controls. In a nation-wide survey in Germany using SF-12 scale, Benson et al. (36) found that women with PCOS were at higher risk of common psychiatric disorders such as anxiety, depression or both, which were related to lower HRQL. In the study of Bazarganipoor et al. (24) using SF-36 scale, the psychologic dimension was found to be more affected than the physical domain, and psychologic impairment was higher in patients with HA and menstrual irregularities than in the two other phenotypes, This finding is consistent with the results of our study.

Bazarganipoor et al. (24) observed that the patients in phenotype B (HA along with polycystic ovaries) had higher HADS scores (more depression and anxiety symptoms) than the two other phenotypes. This result confirms our findings.

Moran et al. (37), who compared different PCOS phenotypes based on the National Institute of Health (NIH) criteria (HA and OD), reported poorer HRQL in women with NIH PCOS compared with non-NIH PCOS women.

Asena Gokcay et al. (38) observed that the BDI-II scores of phenotype A were higher than those of phenotype D, and the BAI-II scores of phenotype A were higher than those of phenotype B, C and D. This indicates lower depression scores in the non-hyperandrogenic phenotype. Although the causes of depression in women with PCOS remain unknown, this can be hypothesized due to the effect of hyperandrogenism.

The results of the current study also showed a significant negative correlation between depression score and total FSFI score, indicating the negative effect of depression on sexual function. This finding is in agreement with the findings of Lakatos et al.(39) and Shahraki et al (40).

Women may experience emotional conditions such as depression, anxiety and lowered self-esteem that are known causative factors of sexual dysfunction. Marital distress may be created following the diagnosis of infertility. In these women, unsuccessful treatment attempts are known to be the main risk factor of psychological distress (41).

Depression is the most common psychological problem in women affected by infertility (31). This could be due to unsuccessful treatment of infertility and pressure on women as the sense of powerlessness (39, 42).

There is a polar relationship between depression and infertility treatment because depressed people do not follow treatment and couples seeking treatment become depressed after failure (43).

Furthermore, infertility is a medical situation that has various effects on women's lives. Depression, anxiety and marital distress are common in infertile women (30).

The main strengths of this study include classification of PCOS phenotypes and comparing them with the control group. Moreover, both groups of women (PCOS and the controls) were studied simultaneously. However, this study had some limitations. First, it was conducted in a tertiary center. Secondly, we did not collect comprehensive information of the control group. Thirdly, the number of subjects in each phenotype was limited. Finally, we had no information about the women's partners.

We suggest multi-center investigations with larger sample sizes and comprehensive evaluation of male partners and control group in future studies.

Conclusion

The results of the present study showed significant differences in terms sexual function, depression, anxiety and QoL in different phenotypes of PCOS and compared with the healthy group. The higher prevalence of depression and anxiety, and higher impairment in SF and QoL suggest that hyperandrogenism may have a causative effect on pathogenesis depression, anxiety and sexual dysfunction in women.

Abbreviations

FSFI: Female Sexual Function Index

HADS: Hospital Anxiety and Depression Scale

M-FG: Modified Ferriman Gallway

PCOS: Polycystic Ovary Syndrome

SF-12: Short Form Health Survey

NIH: National Institute Health

OD: Ovulatory Dysfunction

WC: Waist Circumference

BMI: Body Mass Index

HC: Hip Circumference

QoL: Quality of Life

MW: Mann-Whitney

FSD: Female Sexual Dysfunction

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of Tarbiat Modares University of Medical Sciences (IR.MODARES.REC. 1397.211). All procedures were in accordance with the ethical standards of the Regional Research Committee and with the Declaration of Helsinki 1964 and its later amendments. After explaining the study's purposes, the informed consent was collected from all participants and they were informed that their participation was voluntary, confidential, and anonymous. Furthermore, they were apprised of their right to withdraw from the research at any time.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare no conflict of interest.

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Authors' contributions

Sh.JS and F.B contributed to the conception and design of the study; Sh.JS and F.B did the literature search; M.N, A.M, and F.B performed the statistical analysis; Sh.JS, F.B, A.M, and M.N wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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