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Original Research

Comparative analysis of sexual function and psychological health in infertile patients with different ovarian dysfunctions

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Abstract

Background: Premature ovarian insufficiency (POI) and polycystic ovary syndrome (PCOS) are common reproductive disorders that negatively affect women's sexual and psychological health.
Aim: This study aims to compare sexual function and psychological well-being in women with POI, PCOS, and healthy controls.
Methods: A total of 340 women were recruited: 68 with POI, 104 with PCOS, and 168 healthy controls. Participants completed standardized questionnaires assessing sexual function (Female Sexual Function Index, FSFI), anxiety (Generalized Anxiety Disorder-7 [GAD-7]), and depression (Patient Health Questionnaire-9 [PHQ-9]). Descriptive statistics, Chi-square tests, and multivariable logistic regression were used to analyze the data.
Outcomes: The primary outcomes included sexual function, assessed via FSFI total and domain scores (desire, arousal, lubrication, orgasm, satisfaction, and pain), and psychological well-being, evaluated through GAD-7 and PHQ-9 scores.
Results: Women with POI and PCOS exhibited significantly lower FSFI total scores compared to controls (POI: 26.00 ± 3.50, PCOS: 26.13 ± 4.50, controls: 27.37 ± 3.24; $P < 0.01$). Women with POI had significantly lower scores in the arousal (3.83 ± 0.87) and satisfaction (4.44 ± 0.84) domains, while those with PCOS had significantly lower lubrication (4.92 ± 0.97) and arousal (3.92 ± 1.01) scores compared to controls (all $P < 0.05$). The prevalence of anxiety and depression were significantly higher in the POI and PCOS groups than in controls ($P < 0.05$). Multivariable logistic regression analysis demonstrated that POI was independently associated with a higher risk of coital pain (OR: 3.14, 95% CI: 1.19–8.26, $P < 0.05$) and lubrication disorder (OR: 4.93, 95% CI: 1.88–12.92, $P < 0.05$). Additionally, PCOS was independently linked to a significantly increased risk of lubrication disorder (OR: 8.57, 95% CI: 1.95–37.57, $P < 0.05$). Psychological factors, particularly anxiety and depression, were significant contributors to sexual dysfunction (all $P < 0.05$).
Clinical Implications: Women with POI and PCOS require a comprehensive approach to care, addressing both sexual and psychological health to improve clinical outcomes.
Strengths and Limitations: Strengths include a relatively large sample size and a comprehensive assessment of sexual and psychological health. Limitations include the case–control design and lack of long-term follow-up.
Conclusion: POI and PCOS are significantly associated with sexual dysfunction and psychological distress, underscoring the need for integrated healthcare strategies to improve overall well-being.

Keywords: premature ovarian insufficiency; polycystic ovary syndrome; sexual function; anxiety; depression.

Introduction

Infertility affects 10%–15% of couples of reproductive age, with ovarian dysfunction being a significant cause[1,2]. Among the various causes of infertility, ovarian dysfunction is particularly noteworthy due to its complex interactions with multiple aspects of women's health, including reproductive and sexual function[3]. The two most common forms of ovarian dysfunction are Premature Ovarian Insufficiency (POI) and Polycystic Ovary Syndrome (PCOS), both of which not only impair fertility but also have profound implications for sexual health[4,5].

POI, on the other hand, is characterized by ovarian failure before the age of 40, leading to amenorrhea, elevated follicle-stimulating hormone (FSH) levels, and estrogen deficiency[6]. Affecting approximately 1% of women under 40, POI can result from genetic factors, autoimmune conditions, or idiopathic causes, and is associated with long-term health risks, including osteoporosis and cardiovascular disease[7]. Given its hormonal consequences, POI is also believed to negatively impact sexual function, though the underlying mechanisms require further investigation[8,9].

PCOS is one of the most prevalent endocrine disorders, affecting 6%–12% of women worldwide[10]. It is diagnosed based on the Rotterdam criteria, which require at least two of the following: oligo- or anovulation, clinical or biochemical hyperandrogenism, and polycystic ovaries on ultrasound[11]. In addition to reproductive challenges such as irregular ovulation and infertility, PCOS is associated with metabolic disturbances (eg, insulin resistance, type 2 diabetes) and an increased

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risk of cardiovascular diseases[12]. Although PCOS is well recognized for its reproductive and metabolic consequences, its impact on sexual function remains underexplored[8,9].

Recent studies suggest that women with POI exhibit significant impairments in sexual function, but findings are heterogeneous, necessitating additional studies that consider psychological health and emotional support[4,5]. Similarly, women with PCOS experience lower sexual function scores compared to controls, with deficits in desire, arousal, lubrication, and pain[13]. However, the variability across studies limits definitive conclusions, highlighting the need for further research on the influence of treatment and lifestyle factors on sexual function in this population.

Sexual health is a fundamental aspect of overall well-being, intimately linked to emotional and psychological states[14]. For women with ovarian dysfunction, hormonal imbalances, body image concerns, and infertility-related distress can contribute to significant sexual dysfunction[15]. However, most studies investigating sexual health in these populations fail to directly compare different types of ovarian dysfunction, potentially overlooking key distinctions[16,17].

To address these gaps, this study aims to evaluate and compare sexual function in women diagnosed with POI, PCOS, and those with normal ovarian function, using the Female Sexual Function Index (FSFI). Specifically, we hypothesize that women with POI and PCOS will exhibit significantly lower FSFI scores compared to those with normal ovarian function. Does ovarian dysfunction, particularly POI and PCOS, significantly impact sexual function and psychological well-being in infertile women compared to those with normal ovarian function? By addressing these objectives, we aim to enhance the understanding of sexual health impacts associated with ovarian dysfunctions and improve clinical care for affected women.

Materials and methods

Study design and setting

This case–control study was conducted at the Reproductive Medical Centre of Shengjing Hospital affiliated to China Medical University. The data collection period was from March 2022 to June 2024, and the recruitment period was from January 2022 to March 2024. Patients with different ovarian functions were grouped into three groups: POI, PCOS, and normal ovarian function (Control). The study involved a survey of female sexual function and psychological health among patients with infertility.

Participants

Inclusion criteria

Women aged 20 to 44 years were included in the study. This age range was selected to focus on women of reproductive age, allowing for a comprehensive assessment of gynecological and reproductive health issues. POI was diagnosed based on the 2016 ESHRE Guideline, which includes clinical symptoms of amenorrhea for at least 4 months, an elevated serum FSH level greater than 25 IU/L on two separate occasions, and an age of under 40[18]. PCOS was diagnosed according to the Rotterdam criteria, which require the presence of at least two of the following: oligo- or anovulation, clinical or biochemical hyperandrogenism, and polycystic ovaries on ultrasound[11]. The control group consisted of infertile women with normal ovarian function, whose infertility was attributed to tubal factors.

Clarification on participant inclusion

To ensure accurate classification, all participants underwent clinical examination and laboratory testing. POI was diagnosed according to ESHRE guidelines, requiring persistent amenorrhea, elevated FSH levels (>25 IU/L), and low estradiol. PCOS diagnosis was based on the Rotterdam criteria, including menstrual history, hyperandrogenism assessment (clinical/biochemical), and pelvic ultrasound findings. Control participants had normal ovarian function, confirmed by regular menstrual cycles, normal ovarian reserve markers, and tubal factor infertility diagnosis via hysterosalpingography or laparoscopy. All assessments were conducted by experienced reproductive endocrinologists.

Sexual activity criteria clarification

We specifically included women who were sexually active, as determined by self-report. Women who indicated they were sexually inactive were excluded from the study. This inclusion criterion was based on the assumption that sexual function is closely linked to sexual activity. To ensure consistency in assessing sexual function, only women who reported engaging in regular penile-vaginal intercourse (PVI) were considered eligible. This approach aligns with the FSFI questionnaire, which primarily evaluates sexual function in the context of penetrative intercourse. Consequently, women who did not engage in PVI or who reported being sexually inactive were excluded from the study.

Exclusion criteria

Women diagnosed with endometriosis, diabetes, hypertension, lower genital tract abnormalities, genitourinary infections, genital prolapse, or whose partners had severe male infertility or were diagnosed with sexual dysfunction were excluded from the study. Additionally, women with psychiatric conditions that could contribute to sexual dysfunction or those using medications known to affect sexual function (eg, selective serotonin reuptake inhibitors, serotonin and norepinephrine reuptake inhibitors) were excluded. Women with a total FSFI score below 8 were also excluded, as this score indicates insufficient sexual activity for a meaningful evaluation of sexual function.

During recruitment, participants were initially screened for sexual activity, and only those who self-reported engaging in regular PVI were invited to participate. To ensure data validity, a post-assessment exclusion criterion was applied, which removed participants with an FSFI total score below 8 from the final analysis. Participants who did not complete the questionnaire or provided inconsistent responses (eg, selecting "did not attempt intercourse" in one question but not in others) were excluded. Women who self-reported menopausal symptoms were also excluded to minimize the potential impact of perimenopause on the results.

Assessment tools

Female sexual function index

The FSFI serves as a validated and comprehensive instrument for assessing female sexual function across six domains: desire, arousal, lubrication, orgasm, satisfaction, and coital pain. It includes 19 items, specifically designed to evaluate the individual's sexual health status over the previous 4 weeks.

Each domain's score ranges between 1.2 to 6, with some domains allowing a minimum score of 0, culminating in a total possible score ranging from 2 to 36[19]. The FSFI demonstrates robust psychometric properties, evidenced by a Cronbach's alpha of demonstrates robust psychometric properties, evidenced by assessing female sexual function across six domains: desire, arousal, lubrication, orgasm, satisfaction, and pain. In a Chinese cohort, a total FSFI score of ≤23.45 is indicative of potential sexual dysfunction[20]. Specific domain-related cut-off scores are as follows: evidenced by assessing female sexual function across six domains: desire, arousal, lubrication, orgasm, satisfaction, and coital pain. It includes 1[20,21]. These thresholds aid clinicians and researchers in diagnosing and evaluating the severity of sexual dysfunction among women.

General Anxiety Disorder-7

The General Anxiety Disorder-7 (GAD-7) is a widely used self-administered questionnaire designed to assess symptoms of general anxiety. It consists of seven items rated on a 4-point Likert scale (0 = not at all, 3 = nearly every day), with total scores ranging from 0 to 21. The score is categorized as follows: 0–4 (minimal anxiety), 5–9 (mild anxiety), 10–14 (moderate anxiety), and 15–21 (severe anxiety)[22]. The GAD-7 is valued for its simplicity, reliability, and psychometric strength, making it a valuable tool in clinical and research settings for screening and monitoring anxiety[23].

Patient Health Questionnaire-9

The Patient Health Questionnaire-9 (PHQ-9) is a widely used tool designed to assess the presence and severity of depression symptoms, recognized for its reliability, validity, and efficiency in screening across diverse populations. Comprising nine items that align with the DSM diagnostic criteria for major depressive disorder, the PHQ-9 prompts respondents to rate the frequency of depressive symptoms over the past two weeks on a four-point scale from 0 (not at all) to 3 (nearly every day), with total scores ranging from 0 to 27[24]. These scores categorize depression severity from minimal (0–4) to severe (20–27). The PHQ-9's straightforward administration makes it ideal for various settings, including primary care and mental health clinics, and its successful application in similar populations underscores its effectiveness as a diagnostic and monitoring tool for depression[25].

Sample size calculation

The sample size was determined using Cohen's d effect size method, assuming an expected effect size of 0.5, a statistical power of 80%, and a significance level of 0.05. Based on the clinically available sample size, the required number of participants was calculated to ensure the study's statistical power was adequate. Ultimately, a total of 340 participants were included across all groups to meet these criteria.

Statistical analysis

Data analysis was carried out using IBM SPSS Statistics (version 26.0; IBM Corp., Armonk, NY, USA). The FSFI, GAD-7, and PHQ-9 scores were computed using Microsoft Excel (Microsoft Corp., Redmond, WA, USA). Categorical variables were summarized with counts (n) and percentages (%), and continuous variables were described using counts, means, and standard deviations (SDs). The chi-square test was utilized to compare categorical variables, while one-way analysis of variance (ANOVA) was employed to analyze numerical data across three groups: POI, PCOS, and controls. Moreover, multivariable logistic regression was used to explore the factors affecting sexual function and related disorders, including arousal, lubrication, and coital pain. Statistical significance was established at a two-tailed p-value of less than 0.05, and results were reported including p-values, OR, and 95% confidence intervals (CI). Missing data were handled using multiple imputation to minimize the bias due to missing values and preserve the integrity of the analysis. No sensitivity analysis was conducted, as this study was case–control in design and did not involve long-term follow-up.

Ethical approval

This study was approved by the Review Board for Research on Human Subjects (2021PS018F). All procedures adhered strictly to the guidelines of the Declaration of Helsinki.

Results

Participant demographics and characteristics

A total of 340 participants were included in the study, consisting of 68 women in the POI group, 104 women in the PCOS group, and 168 women in the control group. The mean ages were 32.87 ± 3.97 years for the POI group, 33.39 ± 4.19 years for the PCOS group, and 32.74 ± 4.45 years for the control group, with no significant age differences across groups ($p > 0.05$). The oldest participants were 44 years old (n = 4) and 43 years old (n = 4), accounting for only a small proportion of the total sample. The mean body mass index (BMI) was similar across groups: 23.88 ± 3.29 kg/m^2 for POI, 23.12 ± 3.33 kg/m^2 for PCOS, and 23.67 ± 3.33 kg/m^2 for control ($p > 0.05$). Additionally, no significant differences were found in infertility duration, smoking status, income, education, stress levels, physical exercise, or alcohol consumption between groups ($p > 0.05$). These findings suggest comparable demographic characteristics across the three groups (Table 1).

Psychological health outcomes

The mean GAD-7 scores did not differ significantly among the groups: 6.09 ± 2.16 for POI, 5.93 ± 2.53 for PCOS, and 6.08 ± 2.41 for the control group ($p > 0.05$). However, the incidence of mild anxiety was significantly higher in the POI and PCOS groups, at 79.41% and 74.04%, respectively ($P < 0.05$). Similarly, the mean PHQ-9 scores did not differ significantly across the groups: 7.93 ± 2.71 for POI, 7.46 ± 3.16 for PCOS, and 7.35 ± 3.01 for the control group ($p > 0.05$). The incidence of mild depression was significantly higher in the POI and PCOS groups, at 79.41% and 71.15%, respectively ($P < 0.05$) (Table 2).

Sexual health outcomes

The frequency of sexual intercourse did not differ significantly among the groups, with an average of 4.76 ± 3.00 times per month in the POI group, 4.89 ± 2.82 in the PCOS group, and 4.93 ± 2.78 in the control group ($p > 0.05$). However, FSFI scores varied significantly ($P < 0.05$), with the control group reporting higher scores. Despite these differences, the

Table 1. Demographic characteristics of the study participants.

Characteristics	POI (n = 68) Mean ± SD/n (%)	PCOS (n = 104) Mean ± SD/n (%)	Control (n = 168) Mean ± SD/n (%)	*P*- value
Age (years)	32.87 ± 3.97	33.39 ± 4.19	32.74 ± 4.45	0.47
BMI (kg/m^2)	23.88 ± 3.29	23.12 ± 3.33	23.67 ± 3.33	0.27
Infertility duration	4.72 ± 3.43	3.94 ± 3.17	3.74 ± 2.69	0.08
Smoking status:				0.13
Smoker	7 (10.29)	6 (5.77)	6 (3.57)	
Non-smoker	61 (89.71)	98 (94.23)	162 (96.43)	
Annual income (ten thousand yuan)				0.07
< 5	39 (57.35)	38 (36.54)	86 (51.19)	
5-10	19 (27.95)	38 (36.54)	43 (25.60)	
10-15	6 (8.82)	15 (14.42)	18 (10.71)	
15-20	4 (5.88)	4 (3.85)	7 (4.17)	
> 20	0	9 (8.65)	14 (8.33)	
Education				0.57
≤ High school	27 (39.71)	32 (30.8)	58 (34.53)	
College	18 (26.47)	21 (20.2)	41 (24.40)	
undergraduate	20 (29.41)	41 (39.4)	54 (32.14)	
≥ Postgraduate	3 (4.41)	10 (9.6)	15 (8.93)	
Stress in work and life				0.38
Very high	4 (5.88)	7 (6.73)	13 (7.74)	
High	8 (11.76)	23 (22.12)	33 (19.64)	
General	42 (61.76)	50 (48.08)	83 (49.40)	
Low	9 (13.25)	21 (20.19)	26 (15.48)	
None	5 (7.35)	3 (2.88)	13 (7.74)	
Physical exercise frequency				0.74
None	23 (33.82)	30 (28.85)	54 (32.14)	
< 1 time a week	26 (38.24)	46 (44.23)	58 (34.52)	
1 time a week	10 (14.71)	12 (11.54)	24 (14.29)	
≥ 2 times a week	9 (13.23)	16 (15.38)	32 (19.05)	
Drinking alcohol				0.16
Usually	1 (1.47)	0	0	
Sometimes	3 (4.41)	8 (7.69)	11 (6.55)	
Rarely	23 (33.83)	45 (43.27)	53 (31.55)	
Never	41 (60.29)	51 (49.04)	104 (61.90)	

Data was described as mean ± SD or n (%). Abbreviations: SD, standard deviation; BMI, body mass index

Table 2. Female psychological health among patients with different ovarian function.

	POI (n = 68) Mean ± SD/n (%)	PCOS (n = 104) Mean ± SD/n (%)	Control (n = 168) Mean ± SD/n (%)	*P*-value
GAD-7 score	6.09 ± 2.16	5.93 ± 2.53	6.08 ± 2.41	0.87
Incidence of anxiety				0.05
Minimal	9 (13.24)	23 (22.12)	51 (30.36)	
Mild	54 (79.41)	77 (74.04)	105 (62.50)b,c	
Moderate	5 (7.35)	2 (1.92)	9 (5.36)	
Moderately-Severe	0	2 (1.92)	3 (1.79)	
PHQ-9 score	7.93 ± 2.71	7.46 ± 3.16	7.35 ± 3.01	0.41
Incidence of depression				0.06
Minimal	1 (1.47)	11 (10.58)	27 (16.07)	
Mild	54 (79.41)	74 (71.15)a	110 (65.48)b,c	
Moderate	10 (14.71)	17 (16.35)	28 (16.67)	
Moderately-Severe	3 (4.41)	2 (1.92)[a]	3 (1.79)b	

GAD-7: General Anxiety Disorder-7; PHQ-9: Patient Health Questionnaire-9 [a]There is a significant difference between the POI group and the PCOS group. [b]There is a significant difference between the POI group and the control group. [c]There is a significant difference between the PCOS group and the control group.

prevalence of low sexual function was comparable across the POI (20.59%), PCOS (19.23%), and control groups (13.69%) ($p > 0.05$). Significant differences were observed in arousal scores, with the POI and PCOS groups scoring lower than the control group ($P < 0.05$). Additionally, the prevalence of lubrication disorder was significantly higher in the PCOS group compared to both the POI and control groups ($P < 0.05$). Satisfaction scores also differed significantly, with the control group reporting higher scores than the POI group ($P < 0.05$). Furthermore, the incidence of coital pain varied significantly among the groups ($P < 0.05$) (Table 3).

Factors associated with low sexual function

The multivariable-adjusted analysis identified several factors associated with sexual problems among the participants. Compared to the control group, both POI and PCOS were associated with an increased likelihood of specific sexual

Table 3. Female sexual health of the study participants.

	POI (n = 68)	PCOS (n = 104)	Control (n = 168)	*P*-value
	Mean ± SD/n (%)	Mean ± SD/n (%)	Mean ± SD/n (%)	
Sexual intercourse frequency (per month)	4.76 ± 3.00	4.89 ± 2.82	4.93 ± 2.78	0.92
FSFI score	26.00 ± 3.50	26.13 ± 4.50	27.37 ± 3.24[b,c]	< 0.01[e]
Incidence of sexual dysfunction	14 (20.59)	20 (19.23)	23 (13.69)	0.32
Sexual desire score	3.19 ± 0.72	3.28 ± 0.87	3.40 ± 0.72	0.15
Incidence of low desire	20 (29.41)	25 (24.04)	30 (17.86)	0.13
Arousal ability score	3.83 ± 0.87	3.92 ± 1.01	4.15 ± 0.87[b,c]	0.02[d]
Incidence of arousal disorder	16 (23.53)	23 (22.16)	21 (12.50)	0.05[d]
Vaginal lubricity score	5.20 ± 0.71	4.92 ± 0.97a	5.23 ± 0.71c	< 0.01[e]
Incidence of lubrication disorder	3 (4.41)	20 (19.23)a	9 (5.36)c	< 0.01[e]
Orgasm score	4.48 ± 0.93	4.48 ± 1.02	4.71 ± 0.92	0.10
Incidence of orgasm disorder	18 (26.47)	24 (23.08)	25 (14.88)	0.08
Satisfaction score	4.44 ± 0.84	4.61 ± 0.98	4.79 ± 0.85b	0.02[d]
Coital pain score	4.86 ± 0.86	4.92 ± 1.02	5.10 ± 0.76	0.10
Incidence of coital pain	7 (10.29)	17 (16.35)	10 (5.95)	0.02[d]

FSFI: Female Sexual Function Index. [a]There is a significant difference between the POI group and the PCOS group. [b]There is a significant difference between the POI group and the control group. [c]There is a significant difference between the PCOS group and the control group. [d]$P < 0.05$. [e]$P < 0.01$

problems, particularly coital pain and lubrication disorders. In the POI group, coital pain (OR = 3.14, $P < 0.05$) and lubrication disorder (OR = 4.93, $P < 0.05$) were significantly associated with the diagnosis. Notably, PCOS showed a strong association with lubrication disorder (OR = 8.57, $P < 0.05$), indicating a higher prevalence of this issue in affected individuals. Longer infertility duration was significantly associated with increased risk of sexual problems across all domains (arousal disorder: OR = 1.45, $P < 0.05$; coital pain: OR = 1.51, $P < 0.05$; lubrication disorder: OR = 1.33, $P < 0.05$; low sexual function: OR = 1.74, $P < 0.05$). Less frequent sexual activity was significantly associated with lubrication disorder (OR = 1.31, $P < 0.05$), but not with arousal disorder, coital pain, or sexual function. Higher GAD-7 scores were significantly associated with arousal disorder (OR = 2.91, $P < 0.05$), coital pain (OR = 3.77, $P < 0.05$), lubrication disorder (OR = 2.02, $P < 0.05$), and low sexual function (OR = 4.84, $P < 0.05$). Higher levels of depression were significantly associated with all sexual problem domains, with the strongest associations for overall sexual problems (OR = 5.92, $P < 0.05$), coital pain (OR = 4.31, $P < 0.05$), lubrication disorder (OR = 2.46, $P < 0.05$), and arousal disorder (OR = 3.48, $P < 0.05$) (Table 4).

Discussion

This study highlights the sexual and psychological health challenges faced by women with POI and PCOS. Our findings reveal that both groups exhibit significantly lower sexual function compared to controls, with POI women experiencing particularly severe impairments in arousal and sexual satisfaction. Similarly, women with PCOS reported significant difficulties in arousal and vaginal lubrication. Additionally, both groups had a higher prevalence of anxiety and depression, which may further exacerbate their sexual health issues.

In our study, we found that patients in the POI group had the lowest total FSFI scores, with particularly pronounced impairments in sexual arousal and satisfaction. Although we did not observe significantly lower lubrication disorder scores in POI patients compared to the control group, multivariable regression analysis identified POI as an independent risk factor for lubrication disorder (OR: 4.93, 95% CI: 1.88–12.92, $P < 0.01$). These findings are consistent with those of Javadpour et al., who reported significant sexual dysfunction across all domains in women with POI, including arousal, lubrication, and satisfaction[26]. Similarly, Laguna Benetti-Pinto et al. observed comparable impairments, highlighting arousal and satisfaction as key areas of dysfunction in POI[27]. A systematic review further confirmed these associations, demonstrating reduced sexual arousal and satisfaction in women with POI[5]. A recent study by Farahmand and Tehrani comparing sexual function between women with POI and healthy controls found significantly lower FSFI scores across all domains in the POI group[28]. They suggested that the abrupt decline in estrogen levels associated with POI contributes to genitourinary symptoms such as vaginal dryness and dyspareunia, which in turn exacerbate sexual dysfunction. Additionally, the sudden onset of menopause in POI may lead to considerable psychological distress, further compounding sexual health issues. These findings underscore the critical need for comprehensive care that addresses both hormonal imbalances and sexual health disturbances in women with POI, further reinforcing our own observations of significant impairment in these areas.

In our study, we found that the incidence of lubrication disorders was significantly higher in the PCOS group compared to the control group, further supporting the challenges faced by women with PCOS in terms of sexual health. Notably, our findings indicate that lubrication issues were closely linked to anxiety and depression. Recent research aligns with our results, showing that women with PCOS report significantly worse sexual function, higher sexual distress, and a greater incidence of sexual dysfunction compared to controls[29]. This study suggests that psychosexual counseling may be an essential component in managing these women clinically[29]. Additionally, another study on sexual function in women with PCOS reported significant impairments, particularly in lubrication, sexual desire, and sexual satisfaction[30]. However, a meta-analysis by Pastoor et al. did not identify lubrication problems in women with PCOS[13]. This discrepancy may stem from differences in study populations and methodologies. Pastoor et al. included participants diagnosed with PCOS based on varying criteria, some of whom may not have exhibited hyperandrogenism—a factor potentially associated with sexual dysfunction. Furthermore, their study encompassed

Table 4. Factors associated with sexual dysfunction, multivariable-adjusted odds ratios and 95% confidence intervals.

Independent variable	Arousal disorder	Coital pain	Lubrication disorder	Low sexual function
Infertility diagnosis				
Control	1.00	1.00	1.00	1.00
POI	1.97 (0.92-4.23)	3.14 (1.19-8.26)	4.93 (1.88-12.92)	1.34 (0.59-3.07)
	$P = 0.08$	$P = 0.02$[a]	$P < 0.01$[b]	$P = 0.48$
PCOS	0.89 (0.38-2.10)	2.25 (0.73-6.98)	8.57 (1.95-37.57)	0.88 (0.34-2.30)
	$P = 0.79$	$P = 0.16$	$P < 0.01$[b]	$P = 0.80$
Age (years)	0.93 (0.85-1.01)	0.96 (0.86-1.08)	0.99 (0.88-1.10)	0.92 (0.84-1.01)
	$P = 0.09$	$P = 0.52$	$P = 0.82$	$P = 0.09$
Body mass index	1.04 (0.93-1.15)	0.97 (0.85-1.12)	1.01 (0.88-1.17)	0.97 (0.86-1.09)
	$P = 0.52$	$P = 0.69$	$P = 0.86$	$P = 0.57$
Income level	0.89 (0.67-1.17)	1.21 (0.81-1.80)	1.07 (0.74-1.54)	0.98 (0.72-1.34)
	$P = 0.40$	$P = 0.34$	$P = 0.73$	$P = 0.91$
Infertility duration	1.45 (1.23-1.72)	1.51 (1.20-1.90)	1.33 (1.07-1.65)	1.74 (1.42-2.15)
	$P < 0.01$[b]	$P < 0.01$[b]	$P < 0.01$[b]	$P < 0.01$[b]
Sexual intercourse frequency (per month)	0.96 (0.85-1.09)	1.00 (0.85-1.18)	1.31 (1.06-1.61)	1.03 (0.89-1.19)
	$P = 0.52$	$P = 0.98$	$P = 0.01$[a]	$P = 0.69$
Education level	1.29 (0.91-1.84)	0.94 (0.60-1.47)	1.33 (0.83-2.13)	1.21 (0.83-1.78)
	$P = 0.16$	$P = 0.78$	$P = 0.23$	$P = 0.32$
Stress level	1.25 (0.87-1.81)	0.87 (0.56-1.35)	1.22 (0.77-1.94)	1.31 (0.88-1.95)
	$P = 0.226$	$P = 0.52$	$P = 0.40$	$P = 0.19$
Physical exercise frequency	0.85 (0.61-1.17)	0.85 (0.55-1.29)	0.97 (0.63-1.49)	1.00 (0.69-1.44)
	$P = 0.32$	$P = 0.44$	$P = 0.90$	$P = 0.98$
Smoking status				
Smoker	1.00	1.00	1.00	1.00
Non-smoker	0.38 (0.09-1.72)	0.03 (0.00-0.36)	0.11 (0.01-0.95)	0.08 (0.01-0.53)
	$P = 0.21$	$P < 0.01$[b]	$P = 0.04$[a]	$P < 0.01$[b]
Drinking status	0.77 (0.45-1.34)	2.87 (1.47-5.60)	1.43 (0.73-2.82)	1.06 (0.59-1.91)
	$P = 0.36$	$P < 0.01$[b]	$P = 0.30$	$P = 0.85$
GAD-7	2.91 (1.74-4.89)	3.77 (1.88-7.56)	2.02 (1.05-3.91)	4.84 (2.62-8.95)
	$P < 0.01$[b]	$P < 0.01$[b]	$P < 0.01$[b]	$P < 0.01$[b]
PHQ-9	3.48 (2.10-5.53)	4.31 (2.29-8.09)	2.46 (1.38-4.40)	5.92 (3.33-10.51)
	$P < 0.01$[b]	$P < 0.01$[b]	$P < 0.01$[b]	$P < 0.01$[b]

GAD-7: General Anxiety Disorder-7; PHQ-9: Patient Health Questionnaire-9. [a] $P < 0.05$. [b] $P < 0.01$.

adolescents as young as 14 years old, while our research focused exclusively on adult women, which may have allowed for a more specific evaluation of PCOS's impact on sexual function. Additionally, differences in assessment tools could contribute to these variations, as Pastoor et al. primarily employed the FSFI and visual analogue scales (VAS), whereas our study utilized a different set of evaluation methods. These methodological distinctions highlight the need for further research to clarify the relationship between PCOS and lubrication disorder.

Our study found that the incidence of anxiety and depression in women with POI and PCOS was significantly higher compared to the control group. Moreover, sexual dysfunction in both the POI and PCOS groups was closely associated with levels of anxiety and depression. These findings are consistent with previous research, which has demonstrated that anxiety and depression significantly contribute to sexual dysfunction by influencing mood, sexual desire, and physiological responses[26,31-34]. For example, Naumova et al. reported that women with PCOS exhibit higher levels of anxiety and depression, which in turn negatively impact their sexual function, particularly in domains such as arousal, lubrication, and satisfaction[35]. Given the observed differences in sexual function and the significant psychological distress in these populations, our research underscores the importance of individualized care that addresses not only hormonal imbalances but also the psychological challenges faced by women with POI and PCOS. Thus, integrating psychological support, such as cognitive-behavioral therapy or mindfulness-based interventions, alongside hormonal treatment, may be crucial in improving sexual health outcomes in these patients.

Our study aligns with the findings of Dong et al., who reported that prolonged infertility is associated with heightened sexual and psychological distress[36]. In our cohort, longer infertility duration was significantly correlated with lower sexual function, particularly in the domains of arousal disorder, coital pain, and lubrication disorder. This suggests that the duration of infertility may exacerbate specific aspects of sexual dysfunction, underscoring its profound impact on sexual health. However, it is important to acknowledge that the causal relationship between infertility duration and sexual dysfunction remains uncertain. Various confounding factors, such as hormonal imbalances, relationship dynamics, and pre-existing psychological conditions, may also contribute to these associations. Further research is needed to better understand the interplay between infertility and sexual health.

Several studies have explored the effects of smoking and alcohol consumption on sexual function in individuals facing infertility[37]. Smoking has been shown to negatively impact fertility and sexual health by reducing ovarian reserve, impairing sperm quality, and affecting hormonal regulation, which can lead to sexual dysfunction. For example, research has found that female smokers are at a higher risk of experiencing reduced sexual desire, arousal, and satisfaction, potentially due to the effects of smoking on blood flow and hormonal balance[38]. Similarly, excessive alcohol consumption has been

associated with increased sexual dysfunction in both men and women[37,39]. In women, heavy drinking can lead to hormonal imbalances, menstrual irregularities, and reduced libido. Studies have also linked alcohol consumption to increased anxiety and depression, which can further exacerbate sexual health issues in individuals with infertility[40]. In summary, smoking and alcohol use are important lifestyle factors to consider when evaluating sexual health in infertile individuals. These habits can worsen the psychological burden of infertility and contribute to sexual dysfunction, highlighting the need for lifestyle modifications as part of comprehensive infertility management.

In this study, we applied rigorous inclusion and exclusion criteria to ensure the validity and comparability of the three groups (POI, PCOS, and control). The POI and PCOS groups were selected based on well-established diagnostic criteria, ensuring that all participants met the clinical definitions of these conditions. Meanwhile, the control group consisted of women with infertility due to tubal factors, allowing for meaningful comparisons while minimizing the influence of differing reproductive health statuses. To further reduce potential biases, we utilized self-administered questionnaires (FSFI, GAD-7, and PHQ-9), which are well-validated tools for assessing sexual function and psychological health. Additionally, we took measures to minimize recall bias by ensuring participant anonymity and privacy protection throughout the study. This approach fostered a more comfortable environment, encouraging honest responses without the influence of social desirability or psychological pressure. These precautions, along with strict confidentiality measures, helped mitigate both recall and selection biases, thereby strengthening the integrity and reliability of our findings.

In summary, both POI and PCOS significantly impair sexual function, with specific domains like arousal, lubrication, and satisfaction being most affected. These impairments are closely linked to lifestyle factors and psychological distress. These findings have significant clinical implications. Healthcare providers should adopt a holistic approach when managing women with POI and PCOS, addressing both physical and psychological aspects of health. Routine screening for sexual dysfunction and mental health issues should be integrated into clinical practice for women with these conditions. Interventions such as counseling, cognitive-behavioral therapy, and appropriate medical treatments should be considered to improve overall well-being. Furthermore, patient education about the potential sexual and psychological impacts of POI and PCOS can empower women to seek help and advocate for their health. Developing tailored treatment plans that address individual needs and preferences can enhance the effectiveness of interventions and improve patient outcomes.

This study boasts several strengths, including its pioneering comparison of sexual and psychological health among patients with varying ovarian functions. It features a well-defined participant group and employs validated assessment tools such as the FSFI, GAD-7, and PHQ-9. The case–control design of the study allowed for a detailed snapshot of the sexual and psychological health conditions affecting women with POI, PCOS, and normal ovarian function, providing valuable insights into the interrelations of these variables. However, there are limitations to consider. The self-reported nature of the questionnaires may introduce response bias, as participants may underreport or overreport their symptoms. Additionally, the study population, being recruited from specialized reproductive clinics, may not be representative of the general population, limiting the generalizability of our findings.

Future research should focus on longitudinal studies to explore the causal relationships between reproductive health conditions and sexual dysfunction. Such studies could provide valuable insights into the progression of sexual and psychological health issues over time and identify critical intervention points. Furthermore, interventional studies are needed to evaluate the effectiveness of various treatment strategies in improving sexual and psychological health in these populations. Expanding research to include a more diverse population, including women from different socioeconomic backgrounds and ethnicities, will help generalize findings and develop tailored interventions for different demographic groups. Additionally, qualitative studies that explore women's personal experiences with POI and PCOS can offer deeper insights into the impact of these conditions on their lives, allowing for more empathetic and patient-centered care approaches.

Conclusion

In summary, both POI and PCOS significantly impair sexual function, with specific domains like arousal, lubrication, and satisfaction being most affected. These impairments are often associated with infertility, lifestyle factors, and psychological distress. The findings of this study have important clinical implications. Healthcare providers should adopt a holistic approach when managing women with POI and PCOS, addressing both physical and psychological aspects of health. Routine screening for sexual dysfunction and mental health issues should be incorporated into clinical practice for these patients. Interventions such as counseling, cognitive-behavioral therapy, and appropriate medical treatments should be considered to improve overall well-being. Moreover, patient education on the potential sexual and psychological impacts of POI and PCOS is essential to empower women to seek support and advocate for their health. Developing personalized treatment plans that take into account individual needs and preferences will further enhance the effectiveness of interventions and improve patient outcomes.

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None.

Author contributions

MD was responsible for the conceptualization of the study, data curation, formal analysis, and drafting as well as reviewing and editing the manuscript. YL contributed to data curation, formal analysis, and both drafting and revising the manuscript. JR participated in the review and editing of the manuscript. JT contributed to the study's conceptualization, methodology design, and manuscript review and editing. All authors have read and approved the final version of the manuscript.

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Conflicts of interest

All authors have no conflicts of interest to declare.

Data Availability

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

Consent for publication

Not Applicable.

Consent to participate

All subjects provided informed consent to participate in the study.

Code availability

Not applicable.

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