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A Case-control Study of Female Genital Measurements in Polycystic Ovary Syndrome and Their Relation to Sexual Function and Genital Perception

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ABSTRACT

Purpose: To analyze analyze differences in external genital measurements between women with polycystic ovary syndrome (PCOS) and healthy controls, and to evaluate how these anatomical differences relate to sexual function and genital self-image.

Methods: A prospective multicenter case-control study was conducted between January and December 2024. The study included 155 women with PCOS and a control group of women with mild male factor infertility or unexplained infertility, all 18-45 years old and evaluated at an infertility clinic. PCOS was diagnosed according to the Rotterdam criteria. Participants with a history of gynecological surgery, hormonal medication use, or endocrine disorders were excluded. External genital measurements, including clitoral size, labial dimensions, vaginal length, and anogenital distance (AGD), were recorded. The female sexual function index (FSFI) and the female genital self-image scale (FGSIS) were administered to assess sexual function and genital self-image.

Results: There were 155 women with PCOS and 155 women in the control group. Women with PCOS had a significantly higher body mass index (BMI) (26.5±6.2 vs. 24.6±4.7 kg/m^2, $p=0.003$) and later menarche (12.7±1.3 vs. 11.6±1.1 years, $p<0.001$) compared to controls. Genital measurements revealed that women with PCOS had a shorter clitoral prepuce length (18.3±7.02 vs. 20.7±4.9 mm, $p=0.001$), shorter AGD (21.2±13.3 vs. 26.1±7.7 mm, $p<0.001$), and reduced labia majora length (62.7±19.8 vs. 74.2±8.7 mm, $p<0.001$). In contrast, clitoral glans width was significantly larger in the PCOS group (6.5±2.8 vs. 5.8±1.5 mm, $p=0.008$). Women with PCOS also had higher FSFI subscale scores for arousal (3.8±1.6 vs. 3.3± 1.2, $p=0.002$) and orgasm (4.1±1.2 vs. 3.6±1.8, $p=0.003$) but lower FGSIS scores (18.2±3.8 vs. 22.8±4.1, $p<0.001$), indicating less positive genital self-image.

Conclusion: This study demonstrated marked differences in external genital measurements between women with PCOS and healthy controls, including shorter clitoral prepuce length, shorter AGD, and smaller labia majora in the PCOS group. These results imply that hormonal imbalances in PCOS may lead to distinct genital morphological changes that could influence sexual function and self-image. Despite higher arousal and orgasm scores, women with PCOS reported a lower genital self-image, highlighting a complex relationship between PCOS, body image, and sexual health. These findings provide new insights into the physical and psychological dimensions of PCOS and should inform future research and clinical strategies addressing sexual health in this population.

Keywords: Polycystic ovary syndrome, genital measurements, female genital anatomy, sexual function, genital self-image

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INTRODUCTION

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders in women of reproductive age, with an estimated prevalence of about 7-12% of the female population worldwide.[1] It is characterized by clinical or biochemical hyperandrogenism, chronic anovulation, and polycystic ovarian morphology.[2] Beyond its metabolic and reproductive implications, PCOS is associated with significant psychosocial and sexual health challenges, including sexual dysfunction and altered body image.[3,4]

Sexual dysfunction in women with PCOS has been widely studied, with multiple reports indicating higher rates of sexual dissatisfaction compared to women without the syndrome.[5] Women with PCOS frequently report reduced sexual desire, arousal, lubrication, and overall satisfaction.[6,7] Common symptoms of PCOS such as hirsutism, acne, and menstrual irregularities are often linked to body image concerns, which may negatively affect sexual self-esteem and genital perception.[4,8] However, the anatomical factors contributing to these issues remain poorly understood. Relatively few studies have examined how PCOS affects genital morphology and how these anatomical variations might relate to sexual function and genital self-image.

Emerging evidence suggests that hormonal imbalances in PCOS may lead to subtle anatomical variations in the genitalia that could influence sexual function.[9] Recent research has highlighted certain genital measurements, such as clitoral size and anogenital distance (AGD), as potential biomarkers of androgen exposure in women.[10,11] However, no comprehensive study has evaluated a broad range of external genital measurements in PCOS patients, nor the relationship between these anatomical features and measures of sexual function and genital self-image.

The aim of this study was to compare a wide array of external genital measurements between women with PCOS and healthy controls. In addition, we sought to evaluate how any anatomical differences correlate with sexual function and genital self-image in these two groups.

METHODS

A prospective case-control study was conducted as a multicenter study between January and December 2024.

The study included equal numbers of women with PCOS and women with mild male factor infertility or unexplained infertility, all between 18 and 45 years of age and attending an infertility clinic. Control cases were enrolled after being evaluated by an infertility specialist and determined to have either unexplained infertility or only a mild male factor contributing to infertility.

The Rotterdam criteria were used to diagnose PCOS[3]. Patients were identified as having PCOS if they had at least two of the following: 1) oligo- and/or anovulation, 2) clinical and/or biochemical signs of hyperandrogenism (e.g., hirsutism, acne, or alopecia) and (3) polycystic ovarian morphology on ultrasound, characterized by ≥12 follicles measuring 2-9 mm in diameter and/or an ovarian volume >10 cm^3. All ovarian ultrasound evaluations were performed transvaginally using a high-frequency transducer to assess for polycystic ovarian morphology. Of note, we primarily relied on clinical indicators of hyperandrogenism for PCOS diagnosis; serum androgen levels were not routinely measured.

The diagnosis of unexplained infertility was made by excluding other potential causes in couples who had not conceived after 12 months of regular, unprotected intercourse. This evaluation ruled out male factor infertility, oligo/anovulatory infertility, and anatomical issues such as bilateral fallopian tube occlusion (confirmed by hysterosalpingography), endometriosis, fibroids, uterine cavity abnormalities, or cervical/vaginal obstructions.[12] Mild male factor infertility was defined as being present when male factors were the sole cause of infertility and only one semen parameter was below the World Health Organization reference range for normal semen analysis.[13]

Exclusion criteria for both groups included: history of vaginal delivery or obstetric perineal trauma (e.g., episiotomy), pelvic organ prolapse surgery, or cosmetic gynecologic procedures (such as labiaplasty or clitoral hoodoplasty); presence of endocrine disorders such as Cushing's syndrome, congenital adrenal hyperplasia, androgen-secreting tumors, hyperprolactinemia, hyperthyroidism, or hypothyroidism; and use of hormonal medications (including contraceptives) or antidepressants within the six months prior to enrollment.

Detailed clinical histories were obtained, and physical examinations were performed for all participants. Recorded information included age, body mass index [(BMI) calculated as weight in kilograms divided by height in meters squared], parity, history of tobacco use, age at menarche, years of sexual activity, and menstrual regularity (regular menses defined as cycles lasting 25-35 days with bleeding for 4-6 days per cycle).

Signs of hyperandrogenism were assessed clinically. Hirsutism was evaluated using the modified Ferriman-Gallwey score (mFG).[14] Acne severity was assessed using the Investigator Global Assessment scale for acne vulgaris, which ranges from 0 (clear) to 4 (severe).[15] Alopecia (scalp hair thinning or hair loss) was evaluated on a scale from 0 (no alopecia) to 4 (severe alopecia), reflecting increasing degrees of androgenic alopecia.

External genital measurements were obtained with participants in the lithotomy position. To minimize inter-observer variability, two gynecology specialists conducted all measurements, and the examiners were blinded to each participant's group. For consistency, the two examiners underwent joint training and a calibration session for the measurement techniques prior to the study, although no formal inter-rater reliability analysis was performed. Measurements were taken using a digital stainless-steel Vernier caliper; vaginal depth measurements were obtained using a hysterometer. The clitoral glans length was measured by gently retracting the clitoral prepuce. The lengths and widths of the labia minora and labia majora were measured bilaterally. Additionally, the AGD [the distance from the anus to the posterior fourchette (AGD_{AF})] was measured with the caliper to represent the perineal body length. The measurement protocol followed a standardized template

(Figure 1) as described in a previous study.[16] Each distance was measured three times, and the average of the three values was used for analysis.

After the physical examination, all participants completed validated Turkish versions of the female sexual function index (FSFI)[17] and the female genital self-image scale (FGSIS)[18] in a private setting, with a research nurse available for assistance if needed. The FSFI is a 19-item questionnaire assessing sexual function over the prior four weeks, evaluating domains of desire, arousal, lubrication, orgasm, satisfaction, and pain.[19] Female sexual dysfunction was defined as a total FSFI score ≤26.55.[20] The FGSIS is a 7-item questionnaire that assesses a woman's feelings and perceptions about her genitalia; higher scores indicate a more positive genital self-image, with a maximum score of 28.[21]

This study was approved by the Non-Interventional Research Ethics Committee of the University of Health Sciences Turkey, Şehit Prof. Dr. İlhan Varank Sancaktepe Training and Research Hospital (approval number: 178, date: 12.06.2024). Written informed consent was obtained from all participants. The research was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical Analysis

The data were analyzed using IBM SPSS Statistics, version 25 (IBM Corporation, Armonk, NY, USA). Categorical data are presented as numbers and percentages, and continuous variables as mean ± standard deviation. For comparisons between the PCOS and control groups, the chi-square test (or Fisher's exact test when appropriate) was used for categorical variables. Continuous variables were compared using an independent samples *t*-test for normally distributed data, or the Mann-Whitney U test for non-parametric data. A <0.05 was considered statistically significant.

RESULTS

The study included 155 women with PCOS and 155 controls. The mean age of the participants was 30±6.3 years for the PCOS group and 31.2±6.4 years for the control group ($p=0.1$). The mean BMI was significantly higher in the PCOS group (26.5±6.2 kg/m²) compared to the control group (24.6±4.7 kg/m²) ($p=0.003$). No statistically significant difference was found between the groups in the comparison made in terms of characteristics such as parity, sexually active years, and tobacco use.

However, the PCOS group experienced delayed menarche compared to the control group, with a mean age of 12.7±1.3 years versus 11.6±1.1 years, respectively ($p<0.001$). In addition, only 45.8% of women in the PCOS group reported regular menstruation, compared to 95.5% in the control group, indicating a higher prevalence of menstrual irregularities in the PCOS group, as expected ($p<0.001$).

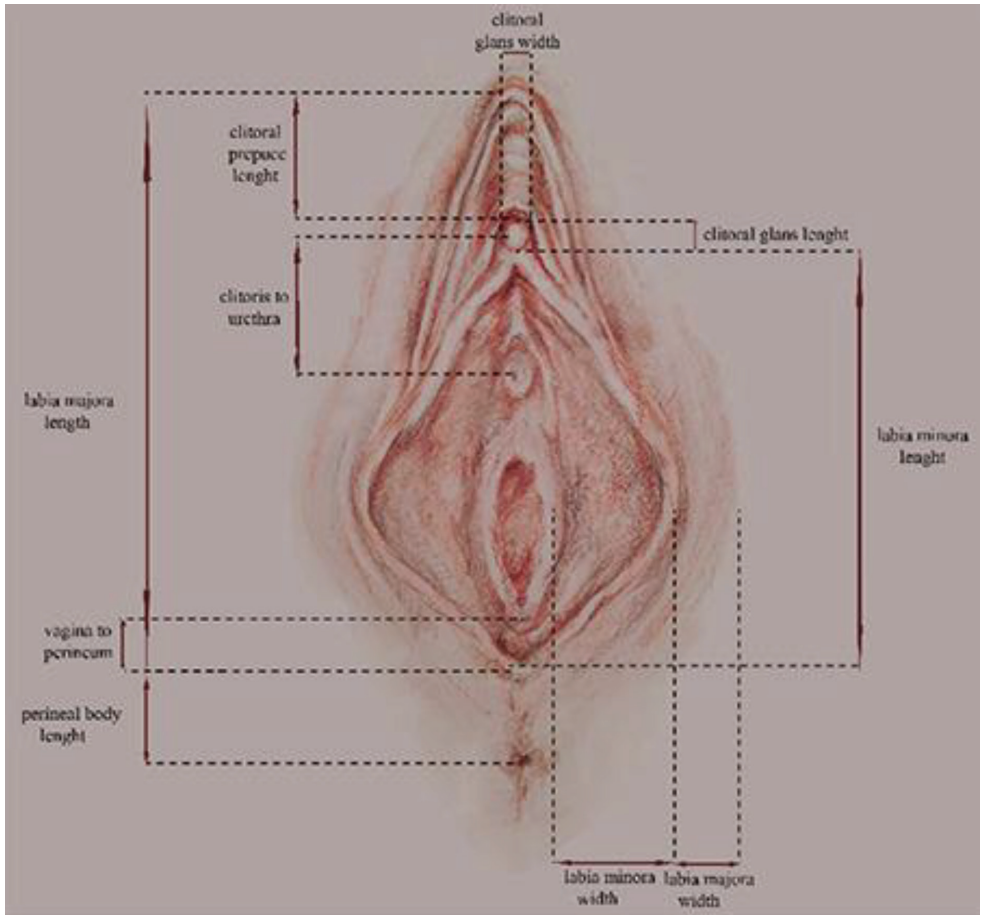


Figure 1. A schematic drawing of a part of the female external genitalia measurements

The distribution of mFG scores, acne scores, and alopecia scores between the groups is shown in Table 1. In the PCOS group, the average mFG score was 13.6±7.8, with values ranging from 1 to 30. Conversely, the control group had an average score of 3.5±4.1, ranging from 1 to 9, showing a markedly higher level of hirsutism in the PCOS group, with a statistically significant difference ($p<0.001$).

Furthermore, the PCOS group had significantly higher acne scores compared to the control group, with a mean of 1.2±1.1 (range 0-4) versus 0.2±0.3 (range 0-4) ($p<0.001$). Similarly, alopecia scores were elevated in the PCOS group, with a mean of 2.2±0.9 (range 0-4), whereas the control group had a mean score of 0.4±0.5 (range 0-2) ($p<0.001$).

The genital measurements of the subjects are displayed in Table 2. The PCOS group had a significantly shorter clitoris prepuce length (18.3±7.02 mm) in comparison to the control group (20.7±4.9 mm) ($p=0.001$). The clitoral length tended to be slightly longer in the PCOS group (18.5±7.1 mm) compared to the control group (17.1±6.7 mm), ($p=0.07$). The clitoris glans width was significantly larger in the PCOS group (6.5±2.8 mm) compared to the control group (5.8±1.5 mm) ($p=0.008$).

The PCOS group exhibited a shorter distance between the clitoris and the urethra (20.8±7.5 mm, 22.4±5.7 mm respectively) compared to the control group ($p=0.03$). Similarly, the AGD was significantly shorter in the group with PCOS (21.2±13.3 mm) compared to the control group (26.1±7.7 mm) ($p<0.001$). There was also a significant decrease in vaginal length in the PCOS group (83.5±17.2 mm) compared to the control group (92.7±8.1 mm) ($p<0.001$).

Comparison in terms of the measurements of the labia majora and minora between the groups is summarized as follows.

Table 1. Demographic variables in women with polycystic ovary syndrome and controls

Variable	Polycystic ovary syndrome cases (n=155)	Control group (n=155)	*p*
Age (years)	30±6.3	31.2±6.4	0.1
Body mass index (kg/m^2)	26.5±6.2	24.6±4.7	0.003*
Parity	0.3±0.7	0.4±1	0.3
Tobacco use Current user Past user	 29 (18.7%) 12 (7.7%)	 32 (20.6%) 20 (12.9%)	0.1
Age at menarche (year)	12.7±1.3	11.6±1.1	<0.001*
Sexually active (years)	4.9±4.3	5.1±5.2	0.7
Ferriman-gallway score	13.6±7.8 (1-30)	3.5±4.1 (1-9)	<0.001*
Regular menstruation	71 (45.8%)	148 (95.5%)	<0.001**
Acne score	1.2±1.1 (0-4)	0.2±0.3 (0-4)	<0.001*

Statistically significant, independent samples t-test, $p<0.05$
Statistically significant, chi-square test, $p<0.05$

Table 2. Genital measurements polycystic ovary syndrome and controls

Variable	Polycystic ovary syndrome cases (n=155)	Control group (n=155)	*p*
Clitoris prepuce length (mm)	18.3±7.02	20.7±4.9	0.001*
Clitoris length (mm)	18.5±7.1	17.1±6.7	0.07
Clitoris glans width (mm)	6.5±2.8	5.8±1.5	0.008*
Clitoris to urethra (mm)	20.8±7.5	22.4±5.7	0.03*
AGD/perineal body length (mm)	21.2±13.3	26.1±7.7	<0.001*
Vaginal Length (mm)	83.5±17.2	92.7±8.1	<0.001*
Labia minora width (mm)			
Left	17.4±10.3	22.5±9.6	<0.001*
Right	16±9.4	21.5±7.9	<0.001*
Labia minora length (mm)			
Left	36.5±12.6	37.9±12.9	0.28
Right	34.4±12.6	35.9±12	0.26
Labia majora length (mm)	62.7±19.8	74.2±8.7	<0.001*
Labia majora width (mm)	29.6±8.4	29.6±6.3	0.9

*Statistically significant, independent samples t-test, $p<0.05$

In the PCOS group, the widths of both the left and right labia minora were significantly smaller (left: 17.4±10.3 mm, right: 16±9.4 mm) compared to the control group (left: 22.5±9.6 mm, right: 21.5±7.9 mm) ($p<0.001$ for both). However, there was no substantial difference in the labia minora lengths among the groups ($p=0.28$, $p=0.26$, respectively). The labia majora in the PCOS group had a significantly reduced length (62.7±19.8 mm) compared to the control group (74.2±8.7 mm) ($p<0.001$). In contrast, there were no noticeable differences in the width 29.6±8.4 mm for PCOS compared to 29.6±6.3 mm for the control group ($p=0.9$).

The comparison of FSFI and FGSIS measurements between the PCOS and control groups is presented in Table 3. The groups did not show any statistically significant differences in terms of desire, lubrication, satisfaction, or pain subdomain scores ($p=0.2$, $p=0.4$, $p=0.1$ and $p=0.3$, respectively) (3.8±1.6 vs 3.3±1.2, $p=0.002$). However, the PCOS group had significantly higher arousal and orgasm scores (4.1±1.2 vs 3.6±1.8, p=0.003) compared to the control group (3.3±1.2 and 3.6±1.8, respectively) ($p=0.002$ and $p=0.003$, respectively). Consequently, the overall FSFI score was significantly higher in the PCOS group (24.4±6.6) compared to the control group (21.9±9) ($p=0.005$). In contrast, the FGSIS score exhibited a substantial decrease in the PCOS group (18.2±3.8) compared to the control group (22.8±4.1) ($p<0.001$). The study showed that 55.5% of the individuals in the PCOS group (86 out of 155) and 58.7% of the individuals in the control group (91 out of 155) had FSFI scores below 26.55

DISCUSSION

This study provides new insights into the anatomical differences in external genital measurements between women with PCOS and healthy controls, and discusses the implications for sexual function and genital self-image. The results suggested that women with PCOS exhibit notable differences in genital morphology, particularly in clitoral size, labial dimensions, and vaginal and perineal body length. Moreover, women with PCOS exhibited higher levels of sexual arousal and orgasm but reported lower genital self-image satisfaction as reflected by the FGSIS. This duality in sexual function and self-image highlights a complex interaction between anatomical and psychological factors in PCOS. While several studies have examined genital morphology and sexual function in PCOS patients, our study distinguishes itself with a larger sample size and a more comprehensive range of genital measurements, providing more robust results concerning the physical and psychosexual dimensions of PCOS.

Several studies have highlighted the role of prenatal androgen exposure in shaping the reproductive phenotype of females, including the development of PCOS in adulthood.[22] This association suggests that early hormonal imbalances may set the stage for later development of androgen-related disorders, including the distinct morphological changes observed in external genitalia among women with PCOS. AGD, a sexually dimorphic trait, has been used as a biomarker for intrauterine androgen exposure, with longer AGD in females indicating higher prenatal androgen levels.[23-25] Interestingly, our study observed a shorter perineal body length in PCOS women, measured using the same method employed in previous studies to assess AGD from the upper verge of the AGD_{AF}. This finding is in contrast with some earlier research that suggested a longer AGD could be a potential marker for PCOS.[11] Variations in study populations, ethnic backgrounds, or measurement techniques may influence this discrepancy. Moreover, factors such as amount of intrauterine androgen exposure and the timing of hormonal imbalances during development could play pivotal roles in determining AGD outcomes.

Despite the findings on AGD, the other morphological findings in the present study align with previous research indicating that even moderate elevations in androgen levels, as observed in women with PCOS, can result in subclinical changes in external genital morphology. Specifically, we found that women with PCOS exhibited a shorter clitoral prepuce length, and a larger clitoris glans width compared to the control group. These differences, though subtle, mirror the findings of Köşüş et al.[9], who reported significant increases in clitoral and labial dimensions in PCOS patients. Importantly, their study highlighted a strong correlation between clitoral size and hyperandrogenism, reinforcing the notion that genital measurements may serve as valuable markers of androgen excess in PCOS.

Table 3. Mean total and sub-dimension FSFI scores and FGSIS scores in polycystic ovary syndrome and controls

Variable (mean ± SD)	Polycystic ovary syndrome cases (n=155)	Control group (n=155)	*p*
Desire	3.7±1.4	3.5±1.3	0.2
Arousal	3.8±1.6	3.3±1.2	0.002*
Lubrication	4.1±1.2	4±1.3	0.4
Orgasm	4.1±1.2	3.6±1.8	0.003*
Satisfaction	3.9±1.4	3.7±1.1	0.1
Pain	4.3±1.6	4.1±1.8	0.3
Total score	24.4±6.6	21.9±9	0.005*
FSFI <26.55, (%)	86 (55.5%)	91 (58.7%)	0.3
FGSIS score	18.2±3.8	22.8±4.1	<0.001*

Statistically significant, independent samples t-test, $p<0.05$
SD: Standard deviation, FSFI: Female sexual function index, FGSIS: Female genital self-image scale

However, our study builds on this previous work by providing a more comprehensive analysis of genital morphology, as we evaluated a broader range of measurements beyond clitoral dimensions. We assessed labia minora and majora widths and lengths, along with vaginal length, offering a more detailed picture of the morphological changes associated with PCOS. Notably, we found that the labia minora were significantly smaller in width, and the labia majora were shorter in length in women with PCOS compared to controls-findings that have not been previously reported in such detail in the literature. This expanded dataset provides further evidence that moderate hyperandrogenism may impact various external genital structures, not just the clitoral area, suggesting that these changes may contribute to the broader phenotypic spectrum of PCOS.

Despite the PCOS group demonstrated higher levels of hirsutism, worse acne, higher BMI, and differences in genital appearance, which contributed to lower FGSIS scores and greater dissatisfaction with genital appearance, these factors did not result in overall impairment in sexual function. Indeed, in the present study, women with PCOS reported significantly higher scores in arousal and orgasm domains, which contrasts with the widely held belief that PCOS leads to generalized sexual dysfunction. Most studies, including a meta-analysis by Pastoor et al.[5], have reported lower sexual function scores in PCOS patients across domains such as arousal, lubrication, and orgasm.[7]

The paradox of enhanced sexual response despite a negative genital self-image raises intriguing questions. One possible explanation is that elevated androgen levels contribute to this heightened sexual response, particularly in terms of arousal and orgasm, as suggested by previous studies on androgenic effects on libido.[7,9] Elevated androgens are known to sensitize the brain and genitals to sexual stimuli, potentially amplifying arousal and orgasmic responses.[26] Additionally, we believe that although Ellibes Kaya et al.[18] reported no significant relationship between genital measurements and sexual function, shorter clitoral prepuce length and wider clitoral width could still be considered contributing factors to the heightened sexual response that we observed in women with PCOS.

Our study, while providing valuable insights, has several limitations. First, the genital measurements-particularly those involving soft tissues like skin and subcutaneous fat-may be subject to measurement variability. Despite standardized techniques and experienced examiners, reproducibility remains a concern due to inherent anatomical diversity. Second, the cross-sectional design limits our ability to infer causality or the progression of genital changes in PCOS. A longitudinal study could better reveal how these anatomical features evolve over time or with treatment. Third, the control group consisted of women with infertility (unexplained or mild male factor) rather than exclusively healthy fertile women. This selection could introduce bias, as infertility itself might affect genital anatomy or sexual function, potentially confounding the comparisons. Fourth, we did not adjust for potential confounders such as BMI or past long-term use of hormonal medications. The PCOS group had a higher BMI on average, which might influence both anatomical measurements and sexual function scores. Although we excluded recent use of hormones or antidepressants, we did not account for prior usage beyond six months, which could have lingering effects on androgen levels or sexual health. Future studies with multivariate analyses could clarify the independent effects of PCOS on outcomes when controlling for such factors. Fifth, although our study population was relatively homogenous in terms of ethnicity and clinical setting, the results may not be widely generalizable to other populations due to genetic and environmental differences. Lastly, we relied on self-reported questionnaires for sexual function and genital self-image; such measures are subjective and may be influenced by personal or cultural factors, which could introduce response bias.

CONCLUSION

This study found significant anatomical differences in genital morphology in women with PCOS, which may be linked to hormonal influences. Despite these anatomical differences, women with PCOS in our sample experienced higher arousal and orgasm scores, even as they reported a more negative genital self-image. These findings underscore the multifaceted nature of sexual health in PCOS, involving both biological and psychological components. Future research should include diverse populations to explore genetic and environmental contributions to these findings. In addition, studies examining different phenotypes of PCOS or the impact of treatments (such as androgen-lowering therapy) on genital anatomy and sexual function would further elucidate the connections observed here. Addressing body image concerns through counseling or therapy may be a useful component of holistic PCOS management, potentially improving quality of life and sexual satisfaction for these patients.

Ethics

Ethics Committee Approval: This study was approved by the Non-Interventional Research Ethics Committee of the Health Sciences University Turkey, Şehit Prof. Dr. İlhan Varank Sancaktepe Training and Research Hospital (approval number: 178, date: 12.06.2024).

Informed Consent: Written informed consent was obtained from all participants.

Authorship Contributions

Surgical and Medical Practices: Ö.D.S., E.K., Concept: E.A., Design: E.A., Data Collection or Processing: Ö.D.S., E.K., Analysis or Interpretation: E.A., Ö.D.S., E.K., Literature Search: E.A., Writing: E.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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