

# Sexual dysfunction in polycystic ovary syndrome: a systematic review and meta-analysis

Huai Heng Loh (✉ [hhloh@unimas.my](mailto:hhloh@unimas.my))

Universiti Malaysia Sarawak Faculty of Medicine and Health Sciences <https://orcid.org/0000-0002-6818-469X>

Anne Yee

Universiti Malaya

Huai Seng Loh

Newcastle University Medicine Malaysia

Sharmilla Kanagasundram

Universiti Malaya

Benedict Francis

Universiti Malaya

Lee-Ling Lim

Universiti Malaya

---

## Research article

**Keywords:** Polycystic ovarian syndrome; female sexual dysfunction; Female Sexual Function Index

**Posted Date:** August 3rd, 2019

**DOI:** <https://doi.org/10.21203/rs.2.11409/v1>

**License:**   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

**Version of Record:** A version of this preprint was published at Hormones on May 27th, 2020. See the published version at <https://doi.org/10.1007/s42000-020-00210-0>.

# Abstract

**Background** Polycystic ovarian syndrome is a common disorder characterized by clinical or biochemical hyperandrogenism and ovulatory dysfunction. Female sexual dysfunction can have adverse effects on quality of life and interpersonal relationship. **Methods** We conducted a meta-analysis to evaluate the prevalence and severity of sexual dysfunction in women with PCOS. **Results** Compared to women without PCOS, those with PCOS were younger ( $28.90 \pm 3.11$  versus  $31.42 \pm 3.37$  years;  $p < 0.0001$ ) and had higher body mass index ( $27.76 \pm 3.79$  versus  $24.95 \pm 3.71$  kg/m<sup>2</sup>;  $p = 0.002$ ), Ferriman-Gallwey score ( $9.90 \pm 3.37$  versus  $4.11 \pm 2.17$ ;  $p < 0.0001$ ) and serum total testosterone level ( $2.26 \pm 0.59$  versus  $1.51 \pm 0.49$  nmol/L;  $p < 0.0001$ ). There was no significant difference in mean total FSFI score ( $25.72 \pm 2.33$  versus  $26.62 \pm 3.38$ ;  $p = 0.608$ ) in women with and without PCOS. For the FSFI subscales, women with PCOS had a lower score for the pain subscale than women without PCOS ( $4.60 \pm 0.71$  versus  $5.24 \pm 0.39$ ;  $p < 0.001$ ). Other subscales were not significantly different between the two groups. Women with PCOS had a 1.39 higher odds (95% CI 1.13, 1.72;  $p = 0.002$ , I<sup>2</sup> 11.9%) of having FSD than women without PCOS. **Conclusion** FSD is a prevalent and disabling condition in young women with PCOS. Sensitive probing into the intimate aspects of their sex lives is needed to further understand the struggles that afflict women with PCOS. Parallel efforts should be undertaken to investigate the impact of new treatment strategies.

## Introduction

Polycystic ovary syndrome (PCOS) is a common disorder affecting women in their reproductive age. Its prevalence differs according to ethnicity and diagnostic criteria, which ranges from 5.5% among Caucasians by using the 1990 National Institute of Health (NIH) criteria to 16% among women in the Middle East by using the 2003 Rotterdam criteria (1). PCOS is characterized by clinical or biochemical hyperandrogenism (such as hirsutism, acne, alopecia and seborrhoea) and ovulatory dysfunction with or without polycystic ovaries (2). Notably, PCOS has been increasingly recognized as a complex illness that affects not only the medical aspects (such as insulin resistance, cardiovascular disease and endometrial cancer), but also the psychosocial aspects related to changes in physical appearance (3, 4). Apart from emotional disturbances, other important aspects of psychological well-being namely the sexual function and satisfaction in women with PCOS are often overlooked (5, 6).

Female sexual dysfunction (FSD) is very common with a prevalence of 21-28% among pre-menopausal women (7). It is defined as persistent or recurrent problems with sexual response, desire, orgasm or pain, which can have adverse effects on quality of life and inter-personal relationship (8). The Sexual Function Health Council of the American Foundation for Urologic Disease (AFUD) classified FSD into five main categories namely hypoactive sexual desire disorder, sexual aversion disorder, sexual arousal disorder, orgasmic disorder and sexual pain disorders (9). The risk factors of FSD include local genitourinary abnormalities (such as pelvic organ prolapse and urinary incontinence), ageing and hormonal and psychogenic disturbances (9, 10).

In women with PCOS, androgen excess and psychosocial changes may affect their sexual functions, although existing data are limited for drawing definitive conclusions (11). In the present meta-analysis, we compared the prevalence and severity of sexual dysfunction in women with and without PCOS. The primary outcome of this study was the prevalence of sexual dysfunction in women with PCOS compared to those without. The secondary outcome was the total and sub-scale scores of Female Sexual Function Index among women with PCOS and those without.

## Methods

### Data sources and extraction

We performed a systematic search of all English-language medical literature published from inception till May 2018 from PubMed, CINAHL and Medline using the following Medical Subject Headings: “sexual dysfunction”, “polycystic ovary”, “polycystic ovary syndrome” and “polycystic ovarian syndrome”. We also looked into references of the selected articles. When the articles were not available or information of the study cohort was inadequate, we attempted to contact the respective authors via e-mail to obtain the full articles and detailed data. Two independent reviewers (HHL and HSL) screened the titles and abstracts obtained through the electronic search and analysed the full-text articles. All duplicates were removed. Wherever data were not provided numerically, they would be read off graphs. Data from eligible studies were extracted by HHL and all extracted data were reviewed by AY and SK.

Structured interviews and self-reported questionnaires such as the Female Sexual Function Index (FSFI) and Changes in Sexual Functioning Questionnaire (CSFQ), have been widely used to assess FSD. FSFI is a validated 19-item self-report scale that evaluates sexual function of women within a 4-week window, based on six subscales namely sexual desire, arousal, lubrication, orgasm, satisfaction and degree of pain. The maximum score of each subscale is 6 and the maximum total score is 36. A score of <26 defines FSD (12).

### Quality assessment

HHL and AY independently assessed the quality of the methodology and reporting of all studies using the Newcastle-Ottawa Scoring (NOS) Scale for Case-Control Studies or the NOS Scale adapted for Cross-Sectional Studies, as appropriate. Any discrepancies were discussed with the third reviewer (LLL). The NOS scale was developed to assess the quality of non-randomized case-control studies for the interpretation of meta-analysis results. Based on a “Star-graded” system, each study is assessed in three broad categories namely the group selection, group comparability and ascertainment of the outcome of interest (Exposure). In the original NOS Scale for Case-Control Studies, each study can be awarded a maximum of one star for every numbered item (four in the “Selection” category and three in the “Exposure” category) and a maximum of two stars in the “Comparability” category. In the NOS Scale adapted for cross-sectional studies, each study can be awarded a maximum of five stars in the “Selection” category, two stars for the “Comparability” category and three stars for the “Outcome” category. Both scales have a maximum score of 10.

## Statistical analysis

### Qualitative

All abstracted information was tabulated. A qualitative meta-analysis was conducted to summarize, compare and contrast the abstracted data.

### Quantitative

All data analyses were performed using Stats Direct (version 2.7.9). The presence of heterogeneity between the trials was tested using the  $I^2$  statistic. An  $I^2$  of more than 40% indicated significant heterogeneity. If the  $I^2$  was significant, we pooled the data by using random-effects (DerSimonian-Laird). Conversely, we pooled the data by using fixed-effects (Mantel-Haenszel, Rothman Boice). We also assessed publication bias with Begg-Mazumdar and Egger test. For dichotomous outcomes, we estimated the relative risk (RR) with 95% confidence intervals (CI) using the random-effects model. For continuous outcomes, we estimated the weighted mean difference in FSFI score with 95% confidence interval (CI) if the mean and standard deviation (SD) of the outcomes were presented in the original articles.

## Results

The initial search identified a total of 2135 articles: 288 from PubMed, 324 from CINAHL and 1523 from MEDLINE. After the screening of titles and abstracts, removal of duplicate publications and screening of full-texts, we included 21 full-text articles in the present systematic review and meta-analysis (Figure 1).

A total of 5366 women with PCOS from 21 studies were included. The sample size ranged from 16 to 1594. There were 14 case-control studies, of which 13 were cross-sectional (5, 6, 13-23) and one prospective. (24) The remaining seven were cross-sectional single cohort studies. (25-31)

Table 1 described the study characteristics. All included studies evaluated FSD among women with PCOS, albeit using different scoring scales. Most studies used FSFI. Other sexual function scales used were Visual Analogue Score of sexual satisfaction (13), Index of Sexual Satisfaction (14), Italian McCoy Female Questionnaire (15, 16, 20), CSFQ (17), Arizona Sexual Experience Scale (25), Maudsley Marital Questionnaire (21) and the Polish version of Mell-Krat Scale (SFK/K scale) (23). The assessment method, rating, score range and interpretation of these scorings are listed in the Supplementary table. A total of 16 studies reported the proportion of women with PCOS and coexistent FSD (5, 6, 14-19, 24-31). Compared to women without PCOS, those with PCOS were younger (mean $\pm$ SD: age 28.90 $\pm$ 3.11 versus 31.42 $\pm$ 3.37 years;  $p<0.0001$ ) and had higher body mass index (BMI; 27.76 $\pm$ 3.79 versus 24.95 $\pm$ 3.71 kg/m<sup>2</sup>;  $p=0.002$ ), Ferriman-Gallwey score (9.90 $\pm$ 3.37 versus 4.11 $\pm$ 2.17;  $p<0.0001$ ) and serum total testosterone level (2.26 $\pm$ 0.59 versus 1.51 $\pm$ 0.49 nmol/L;  $p<0.0001$ ).

There was no significant difference in mean total FSFI score ( $25.72 \pm 2.33$  versus  $26.62 \pm 3.38$ ;  $p=0.608$ ) in women with and without PCOS (Figure 2A). For the FSFI subscales, women with PCOS had a lower score for the pain subscale than women without PCOS ( $4.60 \pm 0.71$  versus  $5.24 \pm 0.39$ ;  $p<0.001$ ) (Figure 2B). Other subscales were not significantly different between the two groups (Figures 2C-2G). In the fixed-effects model, women with PCOS had a 1.39 higher odds (95% CI 1.13, 1.72;  $p=0.002$ ,  $I^2$  11.9%) of having FSD than women without PCOS (Figure 3).

## Discussion

In the present meta-analysis of 21 observational studies, we have shown that women younger than 30 years with PCOS are 40% more likely to have FSD than women without PCOS. One-third of women with PCOS have FSD, suggesting that this coexistence is more common than expected and should not be overlooked in routine clinical practice. Although our findings of an increased likelihood of dyspareunia were different from another meta-analysis of 18 studies which showed decreases in the arousal, orgasm and satisfaction subscales, both had consistently demonstrated an excess risk of FSD in women with PCOS (32). Given the adverse impact on sexual satisfaction and quality of life, our results have indicated the need for a greater understanding of FSD in women with PCOS in order to identify new treatment strategies for improved care.

To date, the exact mechanisms of FSD in PCOS are not entirely clear, although changes in the sex hormones and psychosocial well-being have been hypothesised (11, 33). Menstrual irregularities and subfertility could have led to low self-esteem and emotional distress such as depression and anxiety that might impair sexual function and interpersonal relationships with their partners. (33-37) In addition, women with PCOS might find themselves less attractive due to body dissatisfaction and potential loss of feminine identity as a consequence of obesity and androgen excess (38). In a case-control study involving 200 Italian premenopausal women, 45% of women with metabolic syndrome had FSD, compared to only 23% in age- and body-weight matched controls (39). On the other hand, androgen excess was associated with high levels of miRNA-21, miRNA-27, miRNA-103 and miRNA-155 that might influence the expression of several genes responsible for hormonal cellular and sexual reproduction processes in PCOS and thus, an increased risk of FSD (40).

PCOS is characterized by high levels of androgens (dehydroepiandrosterone, androstenedione and testosterone), luteinising hormone (LH) and increased LH/follicle stimulating hormone (FSH) ratio (41). While androgen deficiency is linked to reduced sexual drive (42, 43), data in women with PCOS are limited with conflicting results (11, 33, 44). Nevertheless, our findings were similar to a Brazilian study involving 88 women with PCOS (mean age 27 years), which showed a positive association of either androgen excess or an elevated LH level with FSD (45). Notably, PCOS arises from a vicious cycle of androgen excess which promotes insulin resistance and compensatory hyperinsulinemia, as well as an amplification of LH-stimulated androgen secretion by the ovarian theca cells and adrenal glands, that can worsen sexual function (2). In addition, due to the androgen-induced insensitivity of hypothalamic gonadotrophin (GnRH) pulse generator to suppression by estrogen and progesterone (46), there is a

persistent and rapid GnRH pulsatility with preferential synthesis and release of LH over FSH, in which FSH is physiologically regulated by a slow GnRH pulse frequency (47). The relatively low FSH level prevents ovarian follicular growth, resulting in estrogen deficiency with possible vaginal atrophy. This may explain the increased risk of FSD, particular dyspareunia, as reported in the present analysis (2, 33).

There is a paucity of data on the treatment effects of PCOS on FSD (11). In an open-label, observational study of 64 women with PCOS (mean age 29.3 years), six months of metformin treatment reduced dyspareunia and improved sexual satisfaction and frequency of sexual intercourse, presumably due to improved insulin resistance (48). Another observational study involving 72 women with androgen excess (mean age 24.3 years) treated with anti-androgenic oral contraceptive pills (OCP), reported significant improvement in hirsutism, sexual pain, orgasm and satisfaction as early as 6<sup>th</sup> cycle and sustained till 9<sup>th</sup> cycle of OCP administration (49). Further research with a larger sample size is required to validate these interesting findings.

Our results can be generalised to a number of populations given that the pooled cohort involved women from North and South America, Europe, Middle East and Asia, we can generalise our results to a number of populations. Despite this diversity, the pooled analysis was of low heterogeneity as evidenced by the  $I^2$  statistic. Our study has several limitations. First, all included studies used self-reported questionnaires which could be subjected to information bias. Second, given all studies were observational in design, we were unable to provide the causal inference. Last, we were unable to evaluate the intervention effect on FSD due to a limited number of studies.

## Conclusion

In conclusion, FSD, particularly dyspareunia, is a prevalent and disabling condition in young women with PCOS. Sensitive probing into the intimate aspects of their sex lives is needed to further understand the struggles that afflict women with PCOS. While more resources are to be directed toward the screening of FSD in these women, parallel efforts should be undertaken to investigate the impact of new treatment strategies.

## List Of Abbreviations

PCOS Polycystic ovarian syndrome

FSD Female Sexual Dysfunction

NOS Newcastle-Ottawa Scale

FSFI Female Sexual Function Index

## Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and material

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

Competing interests

The author(s) declared that they have no competing interests.

Funding

The project received funding from Geran Penyelidikan Universiti Malaya (UMRG Programme) – HTM (Wellness) RP012-2012C

Authors' contributions

HHL, HSL and AY performed systematic search and data extraction. HHL, AY and LLL assessed quality of methodology. AY and SK analysed the data. HHL, SK, BF and LLL drafted the manuscript. All authors read and approved the final manuscript.

Acknowledgement

Not applicable

## References

1. Ding T, Hardiman PJ, Petersen I, Wang FF, Qu F, Baio G. The prevalence of polycystic ovary syndrome in reproductive-aged women of different ethnicity: a systematic review and meta-analysis. *Oncotarget*. 2017;8(56):96351-8.
2. Escobar-Morreale HF. Polycystic ovary syndrome: definition, aetiology, diagnosis and treatment. *Nature reviews Endocrinology*. 2018;14(5):270-84.
3. Hemati T, Moghadami-Tabrizi N, Davari-Tanha F, Salmanian B, Javadian P. High plasma homocysteine and insulin resistance in patients with polycystic ovarian syndrome. *Iranian journal of reproductive medicine*. 2011;9(3):223-8.

4. Teede H, Deeks A, Moran L. Polycystic ovary syndrome: a complex condition with psychological, reproductive and metabolic manifestations that impacts on health across the lifespan. *BMC medicine*. 2010;8:41.
5. Diamond MP, Legro RS, Coutifaris C, Alvero R, Robinson RD, Casson PA, et al. Sexual function in infertile women with polycystic ovary syndrome and unexplained infertility. *Am J Obstet Gynecol*. 2017;217(2):191 e1- e19.
6. Noroozzadeh M, Tehrani FR, Mobarakabadi SS, Farahmand M, Dovom MR. Sexual function and hormonal profiles in women with and without polycystic ovary syndrome: a population-based study. *International journal of impotence research*. 2017;29(1):1-6.
7. Geiss IM, Umek WH, Dungl A, Sam C, Riss P, Hanzal E. Prevalence of female sexual dysfunction in gynecologic and urogynecologic patients according to the international consensus classification. *Urology*. 2003;62(3):514-8.
8. Basson R, Berman J, Burnett A, Derogatis L, Ferguson D, Fourcroy J, et al. Report of the international consensus development conference on female sexual dysfunction: definitions and classifications. *The Journal of urology*. 2000;163(3):888-93.
9. Aslan E, Fynes M. Female sexual dysfunction. *International urogynecology journal and pelvic floor dysfunction*. 2008;19(2):293-305.
10. Berman JR, Goldstein I. Female sexual dysfunction. *The Urologic clinics of North America*. 2001;28(2):405-16.
11. Worsley R, Santoro N, Miller KK, Parish SJ, Davis SR. Hormones and Female Sexual Dysfunction: Beyond Estrogens and Androgens—Findings from the Fourth International Consultation on Sexual Medicine. *J Sex Med*. 2016;13(3):283-90.
12. Rosen R, Brown C, Heiman J, Leiblum S, Meston C, Shabsigh R, et al. The Female Sexual Function Index (FSFI): a multidimensional self-report instrument for the assessment of female sexual function. *Journal of sex & marital therapy*. 2000;26(2):191-208.
13. Elsenbruch S, Hahn S, Kowalsky D, Offner AH, Schedlowski M, Mann K, et al. Quality of life, psychosocial well-being, and sexual satisfaction in women with polycystic ovary syndrome. *The Journal of clinical endocrinology and metabolism*. 2003;88(12):5801-7.
14. Drosdzol A, Skrzypulec V, Mazur B, Pawlinska-Chmara R. Quality of life and marital sexual satisfaction in women with polycystic ovary syndrome. *Folia histochemica et cytobiologica*. 2007;45 Suppl 1:S93-7.
15. Battaglia C, Nappi RE, Mancini F, Cianciosi A, Persico N, Busacchi P, et al. PCOS, sexuality, and clitoral vascularisation: a pilot study. *The journal of sexual medicine*. 2008;5(12):2886-94.



16. Mansson M, Norstrom K, Holte J, Landin-Wilhelmsen K, Dahlgren E, Landen M. Sexuality and psychological wellbeing in women with polycystic ovary syndrome compared with healthy controls. *European journal of obstetrics, gynecology, and reproductive biology*. 2011;155(2):161-5.
17. Stovall DW, Scriver JL, Clayton AH, Williams CD, Pastore LM. Sexual function in women with polycystic ovary syndrome. *The journal of sexual medicine*. 2012;9(1):224-30.
18. Ercan CM, Coksuer H, Aydogan U, Alanbay I, Keskin U, Karasahin KE, et al. Sexual dysfunction assessment and hormonal correlations in patients with polycystic ovary syndrome. *International journal of impotence research*. 2013;25(4):127-32.
19. Ferraresi SR, Lara LA, Reis RM, Rosa e Silva AC. Changes in sexual function among women with polycystic ovary syndrome: a pilot study. *The journal of sexual medicine*. 2013;10(2):467-73.
20. Morotti E, Persico N, Battaglia B, Fabbri R, Meriggiola MC, Venturoli S, et al. Body imaging and sexual behavior in lean women with polycystic ovary syndrome. *The journal of sexual medicine*. 2013;10(11):2752-60.
21. De Frene V, Verhofstadt L, Loeys T, Stuyver I, Buysse A, De Sutter P. Sexual and relational satisfaction in couples where the woman has polycystic ovary syndrome: a dyadic analysis. *Human reproduction*. 2015;30(3):625-31.
22. Benetti-Pinto CL, Ferreira SR, Antunes A, Jr., Yela DA. The influence of body weight on sexual function and quality of life in women with polycystic ovary syndrome. *Archives of gynecology and obstetrics*. 2015;291(2):451-5.
23. Kowalczyk R, Skrzypulec-Plinta V, Nowosielski K, Lew-Starowicz Z. Sexuality in women with polycystic ovary syndrome. *Ginekologia polska*. 2015;86(2):100-6.
24. Lara LA, Ramos FK, Kogure GS, Costa RS, Silva de Sa MF, Ferriani RA, et al. Impact of Physical Resistance Training on the Sexual Function of Women with Polycystic Ovary Syndrome. *The journal of sexual medicine*. 2015;12(7):1584-90.
25. Veras AB, Bruno RV, de Avila MA, Nardi AE. Sexual dysfunction in patients with polycystic ovary syndrome: clinical and hormonal correlations. *Comprehensive psychiatry*. 2011;52(5):486-9.
26. Bazarganipour F, Ziaei S, Montazeri A, Foroozanfard F, Kazemnejad A, Faghihzadeh S. Sexual Functioning among Married Iranian Women with Polycystic Ovary Syndrome. *International journal of fertility & sterility*. 2014;8(3):273-80.
27. Eftekhar T, Sohrabvand F, Zabandan N, Shariat M, Haghollahi F, Ghahghaei-Nezamabadi A. Sexual dysfunction in patients with polycystic ovary syndrome and its affected domains. *Iranian journal of reproductive medicine*. 2014;12(8):539-46.

28. Hashemi S, Ramezani Tehrani F, Farahmand M, Bahri Khomami M. Association of PCOS and its clinical signs with sexual function among Iranian women affected by PCOS. *The journal of sexual medicine*. 2014;11(10):2508-14.
29. Dashti S, Latiff LA, Hamid HA, Sani SM, Akhtari-Zavare M, Abu Bakar AS, et al. Sexual Dysfunction in Patients with Polycystic Ovary Syndrome in Malaysia. *Asian Pacific journal of cancer prevention : APJCP*. 2016;17(8):3747-51.
30. Noroozzadeh M, Ramezani Tehrani F, Bahri Khomami M, Azizi F. A Comparison of Sexual Function in Women with Polycystic Ovary Syndrome (PCOS) Whose Mothers Had PCOS During Their Pregnancy Period with Those Without PCOS. *Archives of sexual behavior*. 2017;46(7):2033-42.
31. Nasiri Amiri F, Ramezani Tehrani F, Esmailzadeh S, Tohidi M, Azizi F, Basirat Z. Sexual function in women with polycystic ovary syndrome and their hormonal and clinical correlations. *International journal of impotence research*. 2018;30(2):54-61.
32. Pastoor H, Timman R, de Klerk C, Bramer WM, Laan ETM, Laven JSE. Sexual function in women with Polycystic Ovary Syndrome: a systematic review and meta-analysis. *Reproductive biomedicine online*. 2018.
33. Wierman ME, Nappi RE, Avis N, Davis SR, Labrie F, Rosner W, et al. Endocrine aspects of women's sexual function. *J Sex Med*. 2010;7(1 Pt 2):561-85.
34. Ching HL, Burke V, Stuckey BGA. Quality of life and psychological morbidity in women with polycystic ovary syndrome: body mass index, age and the provision of patient information are significant modifiers. *Clinical endocrinology*. 2007;66(3):373-9.
35. Månsson M, Norström K, Holte J, Landin-Wilhelmsen K, Dahlgren E, Landén M. Sexuality and psychological wellbeing in women with polycystic ovary syndrome compared with healthy controls. *European journal of obstetrics & gynecology and reproductive biology*. 2011;155(2):161-5.
36. Elsenbruch S, Hahn S, Kowalsky D, Öffner AH, Schedlowski M, Mann K, et al. Quality of life, psychosocial well-being, and sexual satisfaction in women with polycystic ovary syndrome. *The journal of clinical endocrinology & metabolism*. 2003;88(12):5801-7.
37. Fauser BCJM, Tarlatzis BC, Rebar RW, Legro RS, Balen AH, Lobo R, et al. Consensus on women's health aspects of polycystic ovary syndrome (PCOS): the Amsterdam ESHRE/ASRM-Sponsored 3rd PCOS consensus workshop group. *Fertility and sterility*. 2012;97(1):28-38. e25.
38. Janssen OE, Hahn S, Tan S, Benson S, Elsenbruch S. Mood and sexual function in polycystic ovary syndrome. *Semin Reprod Med*. 2008;26(1):45-52.
39. Esposito K, Ciotola M, Marfella R, Di Tommaso D, Cobellis L, Giugliano D. Sexual dysfunction in women with the metabolic syndrome. *Diabetes care*. 2005;28(3):756.

40. Murri M, Insenser M, Fernández-Durán E, San-Millán JL, Escobar-Morreale HF. Effects of polycystic ovary syndrome (PCOS), sex hormones, and obesity on circulating miRNA-21, miRNA-27b, miRNA-103, and miRNA-155 expression. *The journal of clinical endocrinology & metabolism*. 2013;98(11):E1835-E44.
41. Blank SK, McCartney CR, Chhabra S, Helm KD, Eagleson CA, Chang RJ, et al. Modulation of gonadotropin-releasing hormone pulse generator sensitivity to progesterone inhibition in hyperandrogenic adolescent girls—implications for regulation of pubertal maturation. *J Clin Endocrinol Metab*. 2009;94(7):2360-6.
42. Shifren JL, editor *The role of androgens in female sexual dysfunction*. Mayo Clinic Proceedings; 2004: Mayo Foundation for Medical Education and Research.
43. Khera M. Testosterone therapy for female sexual dysfunction. *Sexual medicine reviews*. 2015;3(3):137-44.
44. Bhasin S, Enzlin P, Coviello A, Basson R. Sexual dysfunction in men and women with endocrine disorders. *The Lancet*. 2007;369(9561):597-611.
45. Veras AB, Bruno RV, de Avila MAP, Nardi AE. Sexual dysfunction in patients with polycystic ovary syndrome: clinical and hormonal correlations. *Comprehensive psychiatry*. 2011;52(5):486-9.
46. Pastor CL, Griffin-Korf ML, Aloï JA, Evans WS, Marshall JC. Polycystic ovary syndrome: evidence for reduced sensitivity of the gonadotropin-releasing hormone pulse generator to inhibition by estradiol and progesterone. *J Clin Endocrinol Metab*. 1998;83(2):582-90.
47. Taylor AE, McCourt B, Martin KA, Anderson EJ, Adams JM, Schoenfeld D, et al. Determinants of abnormal gonadotropin secretion in clinically defined women with polycystic ovary syndrome. *J Clin Endocrinol Metab*. 1997;82(7):2248-56.
48. Hahn S, Benson S, Elsenbruch S, Pleger K, Tan S, Mann K, et al. Metformin treatment of polycystic ovary syndrome improves health-related quality-of-life, emotional distress and sexuality. *Hum Reprod*. 2006;21(7):1925-34.
49. Conaglen HM, Conaglen JV. Sexual desire in women presenting for antiandrogen therapy. *J Sex Marital Ther*. 2003;29(4):255-67.

## Figure 3

Figure 3, Proportion of female sexual dysfunction, was not included with this version of the manuscript

## Figures

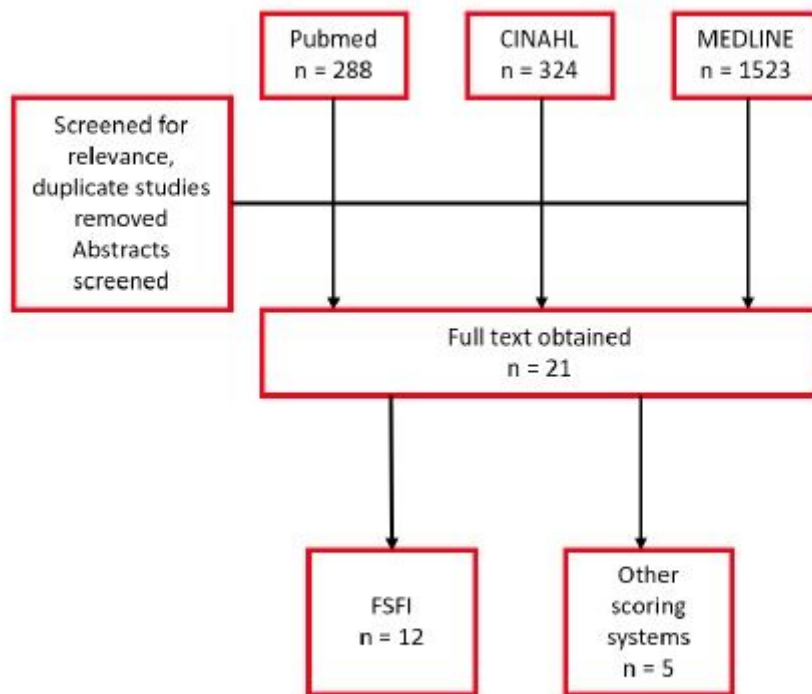


Figure 1

## Figure 1

### Search Strategy

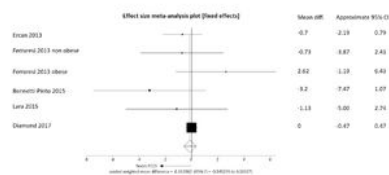


Figure 2A

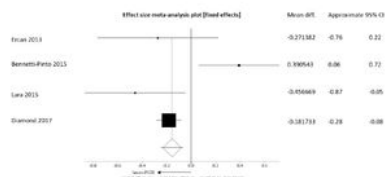


Figure 2B

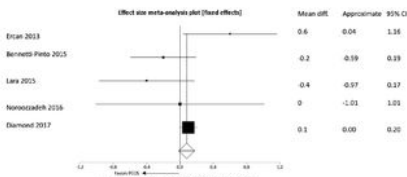


Figure 2C

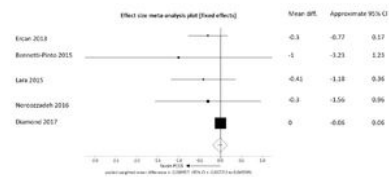


Figure 2D

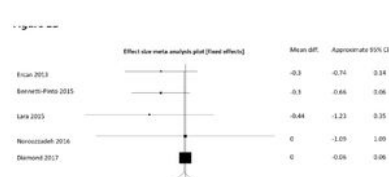


Figure 2E

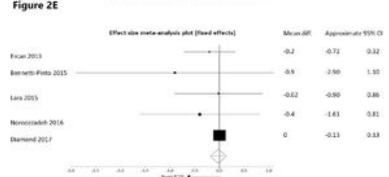


Figure 2F

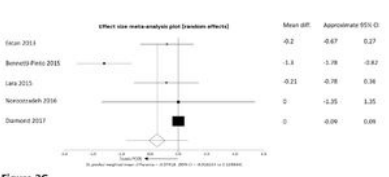


Figure 2G

Figure 2

A Total score of Female Sexual Function Index. B Pain subscale of Female Sexual Function Index. C Desire subscale of Female Sexual Function Index. D Lubrication subscale of Female Sexual Function Index. E Arousal subscale of Female Sexual Function Index. F Orgasm subscale of Female Sexual Function Index. G Satisfaction subscale of Female Sexual Function Index

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Supptablequestionnaire.pdf](#)
- [PRISMAchecklist.pdf](#)
- [Table1Studycharacteristics.pdf](#)