RBMO

REVIEW

Sexual function in women with polycystic ovary syndrome: a systematic review and meta-analysis

BIOGRAPHY

Hester Pastoor is a registered sexologist (2004) and psychotherapist (2012). She is director of the Dutch Sexological Educational Programme and President of the Dutch Scientific Society for Sexology. She is currently working on a PhD project about sexual function in women with endocrine disorders.

Hester Pastoor[1,*], Reinier Timman[2], Cora de Klerk[2], Wichor M Bramer[3], Ellen TM Laan[4], Joop SE Laven[1]

KEY MESSAGE

Arousal, lubrication, orgasm, sexual satisfaction and self-rated sexual attractiveness are compromised in women with polycystic ovary syndrome (PCOS). Yet, a satisfying sex life is as important as it is for women without PCOS. As PCOS is a common disorder with a potentially large psychosocial effect, these topics should be part of the clinical assessment.

ABSTRACT

We present the first systematic review and meta-analysis of sexual function in women with polycystic ovary syndrome (PCOS) compared with women without PCOS. Data on this topic are limited and often contradicting. Sexual function is influenced by endocrine, mental and social factors, which are often compromised in women with PCOS. The main outcome measures were validated sexual function questionnaires and visual analogue scales (VAS). We identified and assessed 1925 original articles; 18 articles were included. Significant small effect sizes were found on sexual function subscales (total score: $P = 0.006$; arousal: $P = 0.019$; lubrication: $P = 0.023$; satisfaction: $P = 0.015$; orgasm: $P = 0.028$), indicating impaired sexual function in women with PCOS. Large effect sizes for the effect of body hair on sex were shown on VAS ($P = 0.006$); social effect of appearance ($P = 0.007$); sexual attractiveness ($P < 0.001$). Satisfaction with sex life was impaired ($P < 0.001$), but sexual satisfaction was rated equally important in women with PCOS and controls. We conclude that a satisfying sex life is important for women with PCOS; however, sexual function and feelings of sexual attractiveness are impaired. The findings imply that sexual function, sexual satisfaction and psychosocial functioning need to be part of every clinical assessment of women with PCOS.

[1] Division of Reproductive Medicine, Department of Obstetrics and Gynecology, Erasmus MC, University Medical Center, Room Na-1516, 3000 CA Rotterdam 2040, The Netherlands
[2] Department of Public Health and Primary Care, Leiden University Medical Center, Postzone V0-P, 2300 RC, Leiden 9600, The Netherlands
[3] Medical Library, Erasmus MC, University Medical Center, Room Ae-324, 3000 CA Rotterdam 2040, The Netherlands
[4] Department of Sexology and Psychosomatic OBGYN, Academic Medical Center, University of Amsterdam, Room H4-140, Meibergdreef 9, Amsterdam, AZ 1105, The Netherlands

*Corresponding author. E-mail address: h.pastoor@erasmusmc.nl (H Pastoor). https://doi.org/10.1016/j.rbmo.2018.09.010
1472-6483/
Declaration: JL has received unrestricted research grants from the following companies (in alphabetical order): Dutch Heart Foundation, Ferring. He also received consultancy fees from Danone, Metagenics Inc., Titus Healthcare, Roche and Euroscreen.

KEYWORDS

Female sexual function index
Polycystic ovary syndrome
Sexual dysfunction
Sexual satisfaction
Sexuality

INTRODUCTION

Polycystic ovary syndrome (PCOS) is the most common endocrine disorder in women of reproductive age, with an estimated prevalence of 10–15% worldwide (*Azziz et al., 2016*). The main characteristics are oligomenorrhoea or amenorrhoea, hyperandrogenism (biochemical or clinical) and polycystic ovarian morphology. A diagnosis of PCOS is made when at least two characteristics are present (*Rotterdam, 2004*). It is a distressing disorder associated with obesity, insulin resistance, dyslipidaemia and metabolic syndrome (*Rotterdam, 2004; Fauser et al., 2012*). Women with PCOS are at risk of depression, anxiety and low self-esteem, and report a lower quality of life (*Elsenbruch et al., 2003; Hahn et al., 2005; Elsenbruch et al., 2006; Himelein and Thatcher, 2006; De Niet et al., 2010; Mansson et al., 2011; Fauser et al., 2012; Veltman-Verhulst et al., 2012*) than healthy women.

Treatment of PCOS is complex and varies according to symptoms and whether the woman has a desire to have children. In women who want to conceive, the first-line treatment is lifestyle modification, e.g. losing weight, exercise, healthy diet, followed by ovulation induction. Lifestyle changes contribute to optimizing success rates in establishing a pregnancy and reducing complication rates by normalizing weight and consequently insulin resistance (*Imani et al., 2000; Imani et al., 2002; Mulders et al., 2003; Panidis et al., 2013*). In women who do not want to become pregnant, treatment usually consists of oral contraceptive pill (OCP) usage and lifestyle changes if indicated (*Fauser et al., 2012*). Both interventions aim at improving endocrine features by normalizing weight and subsequently insulin resistance and androgen metabolism. Oral contraceptive pills increase sex hormone binding globulin (SHBG) levels and hence reduce free androgen levels. As androgens play an important role in female sexual function, increased as well as reduced levels might affect sexual function (*Bancroft, 2002; Davis et al., 2004; 2005; Graham et al., 2007; Caruso et al., 2009; Basson et al., 2010*). In both sexes, androgens mediate sexual function through cognitive processes such as sexual fantasies (*Bancroft, 2003*). Hence, elevated androgen levels might affect sexual function indirectly (*Bancroft, 2002; Basson et al., 2010*), as found with hormonal contraception treatment (*Zimmerman et al., 2014*).

Research into PCOS has focused mainly on improving treatment options and pregnancy outcome (*Thessaloniki, 2008*); however, research on the psychosocial aspects of PCOS or sexual function has only recently emerged. Data on sexual function in women with PCOS are limited and often contradicting.

Sexual function is a complex biopsychosocial phenomenon, as is PCOS. In women with PCOS, sexual function can be influenced by many factors. It is known that sexual function can be impaired by androgen levels (*Bancroft, 2002; Davis et al., 2004; Davis et al., 2005; Graham et al., 2007; Caruso et al., 2009; Basson et al., 2010*), obesity (*Shah, 2009; Kolotkin et al., 2012*), metabolic syndrome (*Borges et al., 2009; Miner et al., 2012*), subfertility (*Wischmann, 2010; Ferraresi et al., 2013a; Wischmann, 2013; Piva et al., 2014*), mental health (*Kalmbach et al., 2012; Kalmbach et al., 2014; Kalmbach et al., 2015; Waldinger, 2015*), body image (*Woertman and van den Brink, 2012; van den Brink et al., 2013*) and self-esteem (*Dove and Wiederman, 2000; Hartmann et al., 2002; Middleton et al., 2008*). These factors are commonly present in women with PCOS and could be contributing to their sexual dysfunction.

The aim of this systematic review and meta-analysis is to present a comprehensive overview of research on sexual function in women suffering from PCOS.

MATERIALS AND METHODS

Search strategy

The following electronic databases were searched from inception until 30 June 2017: *Embase*, *Medline* (via Ovid), *Web-of-Science Core Collection*, *Scopus*, *PsycINFO* (via Ovid), *Cinahl* (via EBSCOhost), *Cochrane CENTRAL* (via Wiley) and *Google Scholar*. Different relevant search terms (thesaurus terms and terms in title, abstract, or both) concerning PCOS and sexual function were used. To optimize the search, no restrictions on date, type of publication or language were applied. We present the used search strings in Supplementary **TABLE 1**. In addition to the electronic search, all reference lists of relevant reviews and included articles were reviewed to identify additional relevant articles.

Inclusion and exclusion criteria

After the electronic search, two authors independently selected the studies and considered all those addressing PCOS and sexual function for inclusion. To be selected for inclusion, the following criteria were used: diagnosis of PCOS by Rotterdam criteria, the former and current National Institutes of Health definition or the Androgen Excess and PCOS Society definition (*Zawadzki, 1990; Rotterdam, 2004; Azziz et al., 2009*); adequate definition of sexual function (operationalized as desire, arousal, lubrication, orgasm, frequency of intercourse, masturbation frequency, sexual dysfunction, sexual satisfaction, sexual self-image, sexual debut and sexual distress); the use of validated sexuality questionnaires or visual analogue scales (VAS); inclusion of a control group without PCOS; age 14 years and older. For inclusion, studies had to be original, available as full-text and written in English.

Studies unrelated to PCOS, PCOS induced by valproate use, or PCOS in combination with other illness or disease, were excluded. Moreover, studies solely concerning health-related quality of life, quality of life or mental health, and studies concerning idiopathic hyperandrogenism or hyperandrogenism caused by other diseases than PCOS, were also excluded. Review articles, PhD theses, abstracts and posters were also excluded. Initially, a selection was made based on title and abstract. Then, inclusion and exclusion criteria that were determined in advance were applied. Finally, all discrepancies in choices were discussed.

Data extraction

The following data were extracted from identified studies: study design, publication date, study period, country, sample size, diagnostic criteria for PCOS, patient and control selection procedures, response or participation rate, inclusion and exclusion criteria for cases and controls, age of population, outcome measures and intervention.

Quality assessment

We used the Newcastle–Ottawa Quality Assessment Scale (NOS), designed to

assess study quality of non-randomized studies, including case-control and cohort studies. The selection of study groups, comparability of groups and ascertainment of either exposure or outcome of interest for case-control or cohort studies were assessed in each study (*Wells, 2010*). A maximum of 10 stars can be awarded using the NOS. As the NOS does not measure quality of outcome measures and of statistical analysis and reporting, two scales taken from the Quality in Prognostic Studies (QUIPS) tool were included in our quality assessment (*Hayden et al., 2013*). The QUIPS awards bias ratings (low, medium, high) using several prompting items for each domain. Two authors independently assessed the quality of the included studies.

Outcome measures

Sexual function was measured using validated questionnaires. Here, we present the questionnaires and, in square parenthesis, names of (sub)scales that were used in the statistical analysis. The Female Sexual Function Index (FSFI) consists of 19 items measuring six domains [total score, desire, arousal, lubrication, orgasm, satisfaction, pain] (*Rosen et al., 2000; Wiegel et al., 2005*). The Changes in Sexual Functioning Questionnaire (CSFQ) measures changes in sexual functioning related to illness and medication, with five domains [total score, desire/interest, desire/frequency, arousal/excitement, orgasm/completion, pleasure/satisfaction] (*Clayton et al., 1997a; 1997b*). The Sexual Quotient-Female (SQ-F) evaluates female sexual function with 10 questions in six domains [total score] (*Abdo, 2006*). The McCoy nine-item Female Sexuality Questionnaire (MFSQ) measures several sexual function indices [enjoyment, satisfaction, sexual thoughts, arousal, orgasm, lubrication, pain] (*McCoy, 2000*). The Female Sexual Desire Questionnaire (FSDQ) has 50 items divided over six domains [dyadic desire] (*Goldhammer and McCabe, 2011*). The Multidimensional Sexuality Questionnaire has 12 subscales [sexual satisfaction] (*Snell, 1993*). For all scales, higher scores are indicative of better sexual function. Finally, the Index of Sexual Satisfaction (ISS) measures sexual satisfaction [total score], with a lower total score indicating more satisfaction (*Hudson et al., 1981*).

Seven questions scored with VAS were available for our analysis: (1) how important is a satisfying sex life for you? (2) How many sexual thoughts and fantasies did you have in the past 4 weeks? (3) Do you find yourself sexually attractive? (4) How much does excessive body hair impact your sexuality? (5) Does your appearance make it difficult to engage in social contact? (6) How often did you experience pain during intercourse in the past 4 weeks? (7) How satisfied were you with your sex life in the past 4 weeks? (*Elsenbruch et al., 2003; Hahn et al., 2005; Tan et al., 2008; Caruso et al., 2009*).

Statistical methods and meta-analysis

Meta (*Schwarzer, 2015*) in R (version 3.4.0 (2017-04-21) was used for meta-analyses. Differences between PCOS and control women are expressed in standardized mean differences (SMD) and presented in forest plots (Supplementary **FIGURE 1A**; Supplementary **FIGURE 1B**; Supplementary **FIGURE 2**; and Supplementary **FIGURE 3**). For studies reporting medians and quartiles, the median was applied as a best estimate of the mean, and the SD was estimated as 34/50 of the interquartile range (34/60 for a study reporting an interquintile range). Reported standard errors were multiplied by √n to obtain the standard deviation. For studies that used the same control group, the number of participants in the control group was adjusted to prevent an unduly heavy weight of this one control group. For sensitivity analysis, studies were excluded one-by-one (*Sutton AJ, 2000*), and outliers were defined when changes in the direction or the significance of the effect were detected.

In line with Cohen's evaluation of effect sizes, a SMD of 0.20 is considered a small effect, 0.50 a medium effect and 0.80 a large effect (*Cohen, 1992*). Heterogeneity is reported with the I^2 statistic. The significance of heterogeneity was determined with Cochran's Q statistic. In case of heterogeneity, Baujat plots were evaluated to determine which studies caused the heterogeneity (*Baujat et al., 2002*). Conclusions were based on random effect procedures to correct for unexplained heterogeneity of the studies. The random effects model uses a weighted average resulting in assigning more equal weights to all studies.

In the included case intervention studies, only baseline scores were used in the statistical analysis.

RESULTS

Search results

The result of the systematic literature search is presented in **FIGURE 1**. Eighteen studies were eligible, representing a total number of 3903 participants. Eight studies used the FSFI (*Gateva and Kamenov, 2012; Ercan et al., 2013; Ferraresi et al., 2013b; Benetti-Pinto et al., 2015; Lara et al., 2015; Noroozzadeh et al., 2016; Shafti and Shahbazi, 2016; Diamond et al., 2017*). Other studies used different scales: the CSFQ (*Stovall et al., 2012*), the SQ-F (*Zueff et al., 2015*), the MFSQ (*Mansson et al., 2011*), the FSDQ (*Elkhiat et al., 2015*), the ISS (*Drosdzol et al., 2007*) and the MSQ (*Kowalczyk et al., 2015*). Four studies used VAS to assess sexual function and effect of clinical characteristics on sexual function (*Elsenbruch et al., 2003; Hahn et al., 2005; Tan et al., 2008; Caruso et al., 2009*). Study characteristics are presented in **TABLE 1** and Supplementary **TABLE 2**. Reasons for exclusion are presented in Supplementary **TABLE 3** and Supplementary **TABLE 4**.

Quality assessment

The quality assessment of the included studies using NOS and QUIPS is presented in **TABLE 2**. The included studies are of medium to low quality. The main problems are as follows: comparability of cases and controls, ascertainment of the PCOS exposure, reporting of response rate and the quality of the statistical analyses.

META-ANALYSIS

Sexual function

The sexual function scales showed small but significant differences between women with PCOS and controls (**TABLE 3**). The complete analysis showed no significant differences on the total scale score and on most subscales, except satisfaction, in women with PCOS compared with control women. Baujat plots (not presented) indicated that the study by *Mansson et al. (2011)* was an outlier for orgasm. Also, the study by *Diamond et al. (2017)* was an outlier for the total score as well as for the subscales arousal and lubrication. Therefore, we also conducted a sensitivity analysis without these studies (**TABLE 3**). The results on the four scales changed. Women with PCOS scored significantly lower on total score (SMD = –0.21; P = 0.006), arousal (SMD = –0.16;

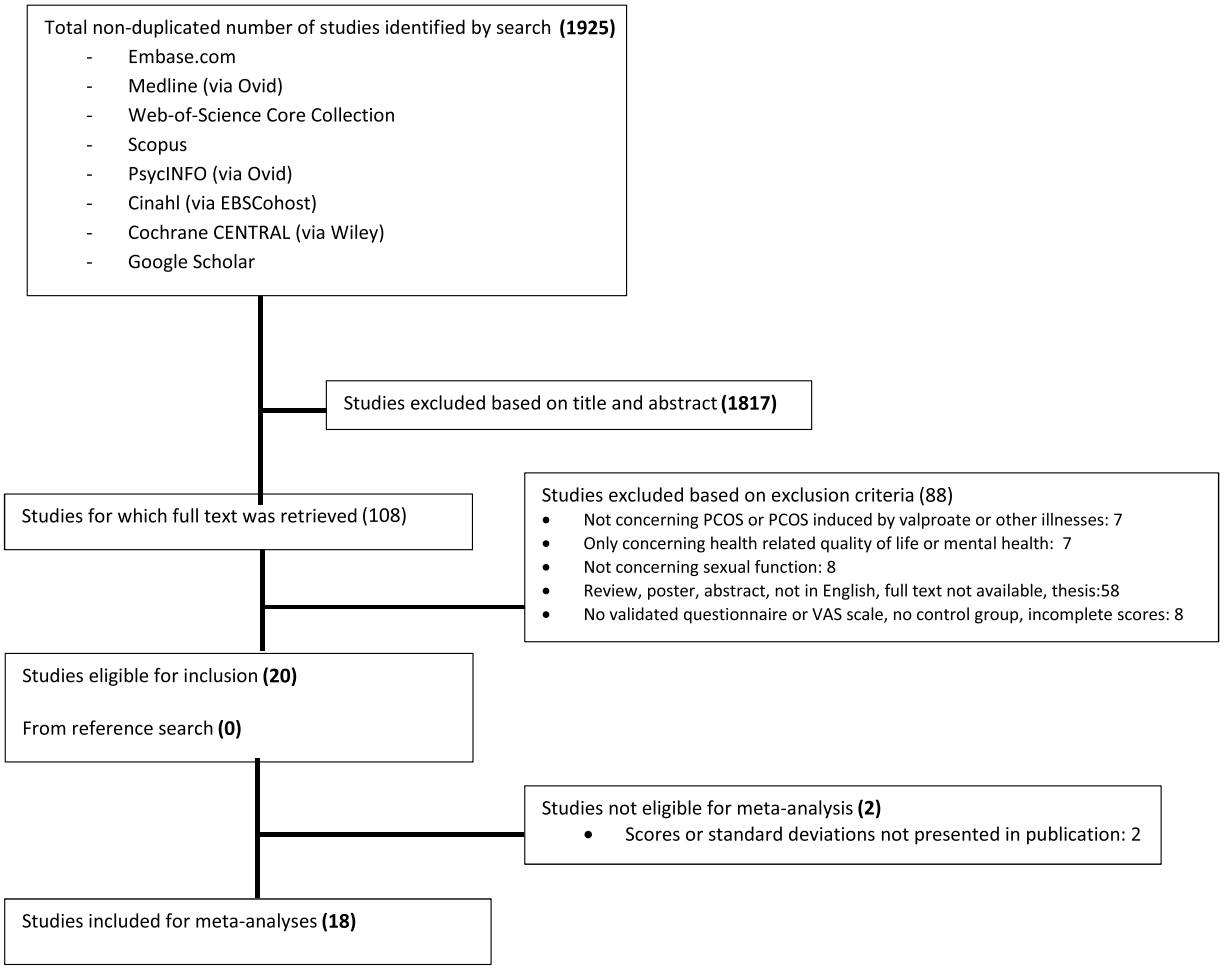

FIGURE 1 Literature search.

$P = 0.019$), lubrication (SMD = –0.15; $P = 0.023$) and orgasm (SMD = –0.17; $P = 0.028$).

Using VAS scores, women with PCOS reported significantly fewer sexual thoughts (SMD = –0.29; $P = 0.004$) than controls. No differences in the experience of pain during intercourse were found (TABLE 3).

Sexual satisfaction

The subscale satisfaction showed a significant small sized difference between PCOS and control women (SMD = –0.26; $P = 0.015$); women with PCOS were less satisfied with their sex life than control women (Table 3). This result did not change in the sensitivity analysis. The studies that caused heterogeneity were *Mansson et al. (2011)* and Benetti *Pinto et al. (2015)*, which showed larger differences.

Using VAS scores, no differences in the importance of a satisfying sex life were found between women with PCOS and control women (SMD = 0.03; $P = 0.544$). Satisfaction with sex life, however, showed a significant large sized difference (SMD = –0.96; $P < 0.001$), with women with PCOS scoring lower than controls (TABLE 3).

Effect of clinical characteristics

On all three VAS scales, significant differences were found, showing disadvantages for women with PCOS: Do you find yourself sexually attractive? (SMD = –0.80; $P < 0.001$); how much does excessive body hair impact your sexuality? (SMD = 1.01; $P < 0.006$); does your appearance make it difficult to engage in social contact? (SMD = 0.65; $P < 0.007$) (Table 3). Baujat plots indicated that the study that caused heterogeneity for body hair and attractiveness was *Caruso et al. (2009)*, with women with PCOS scoring exceptionally worse.

Effect of treatment interventions

Three included studies were intervention studies. It was not possible to assess the effect of interventions on sexual function in women with PCOS because all studies used different treatments: chlormadinone acetate (*Caruso et al., 2009*), metformin (*Gateva and Kamenov, 2012*) and resistance training (*Lara et al., 2015*).

DISCUSSION

This meta-analysis shows impaired sexual function in women with PCOS compared with control women; effect sizes were small to large. Sexuality questionnaires show small impairments, particularly arousal, lubrication, orgasm and sexual satisfaction.

In addition, based on VAS scores, women with PCOS reported fewer sexual thoughts and fantasies and less chance of establishing relationships compared with control women. Large impairments were reported on sexual attractiveness, satisfaction with their sex life and the effect of their physical appearance and body hair on sexuality. The effect sizes

TABLE 1 STUDY CHARACTERISTICS OF THE INCLUDED STUDIES.

Study	Design	PCOS definition	Outcome measure	Intervention	Year	Country	Age / range	*n*	Selection population; response rate
Elsenbruch et al., 2003	Cross-sectional	NICHD	VAS	NA	–	Germany	20–40	PCOS 50	Outpatient endocrine clinic; website clinic
								Controls 50	Health screening programme; university
Hahn et al., 2005	Cross-sectional	NICHD	VAS	NA	–	Germany	PCOS	PCOS 120	Outpatient endocrine clinic;
		Rotterdam criteria					M = 29		website clinic
							Controls M = 30	Controls 50	Health screening programme; university
Drosdzol et al., 2007	Cross-sectional	ESHRE, Rotterdam criteria	ISS	NA	–	Poland	19–40	PCOS 50	University Hospital: Obstetrics and Gynaecology and Gynaecological Endocrinology
								Controls 40	Outpatient Gynaecological Clinics
Tan et al., 2008	Cross-sectional	NICHD Rotterdam criteria	VAS	NA	–	Germany	PCOS M = 28	PCOS 115	Outpatient endocrine clinic; response rate near 100%
							Controls M = 30	Controls 50	Health screening programme; university
Caruso et al., 2009	Prospective intervention	Rotterdam criteria	VAS	Oral contraceptive	–	Italy	18–32	PCOS 94	Family planning centre; response rate 79%
								Controls 50	Health screening programme; university
Mansson et al., 2011	Case control	Rotterdam criteria	McCoy-FSQ	NA	2002-2005	Sweden	–	PCOS 49	Linné Infertility Clinic, Department of Obstetrics and Gynaecology and Medicine University Hospital, support community homepage
								Controls 49	Population registry
Gateva and Kamenov, 2012	Cross-sectional	ESHRE	FSFI	Metformin	–	Bulgaria	18–45	PCOS 57	Hospitalized patient endocrine clinic
		ASRM						Controls 22	Other hospital population
Stovall et al., 2012	Cross-sectional	NICHD	CSFQ	NA	2006–2009	USA	18–43	PCOS 92	Convenient; hospital
								Controls 82	Waiting room university gynaecological department
Ercan et al., 2013	Cross-sectional	Rotterdam criteria	FSFI	NA	–	Turkey	20–40	PCOS 32	Not specified; hospital; response rate 93%
								Controls 32	University hospital; routine check up
Ferraresi *et al.*, 2013	Cross-sectional	Rotterdam criteria	FSFI	NA	2008–2010	Brazil	18–38	PCOS 48	Consecutive sample; tertiary; hospital; response rate 83/87 total population
								Controls 35	Primary care same hospital; regular menses
Zueff 2 *et al.*, 2014	Case control	Rotterdam criteria	SQ-F	NA	2009–2010	Brazil	18–40	PCOS 43	Outpatient gynaecology; contraception programme
								Controls 44	Outpatient gynaecology; contraception programme
Benetti-Pinto et al., 2015	Cross-sectional	Rotterdam criteria	FSFI	NA	–	Brazil	18–40	PCOS 56	Gynaecology department university hospital; response rate 100%
								Controls 102	Gynaecology department university hospital; response rate 100%
Elkhiat et al., 2015	Cross-sectional	Medical screening according to Rotterdam criteria	FSDQ	NA	–	Egypt	21–45	PCOS 85	Gynecology and Obstetrics Clinic
								Controls 63	Gynecology and Obstetrics Clinic

(Continued)

TABLE 1 (CONTINUED)

Study	Design	PCOS definition	Outcome measure	Intervention	Year	Country	Age / range	*n*	Selection population; response rate
Kowalczyk et al., 2015	Cross-sectional	Rotterdam criteria	MSQ	NA	2009	Poland	23–42	PCOS 73	University hospital: department of Gynaecologic Endocrinology
									Response rate 117/128
								Controls 45	Outpatient clinic of Women's Health Diagnostic Centre; response rate 45/50
Lara et al., 2015	Case control	Rotterdam	FSFI	Physical resistance training	2010–2013	Brazil	18–37	PCOS 43	Endocrine gynaecology outpatient clinic, academic medical centre
								Controls 51	Endocrine gynaecology outpatient clinic; academic medical centre
Noroozzadeh et al., 2016	Cross-sectional population based	Rotterdam criteria	FSFI	NA	–	Iran	18–45	PCOS 63	Stratified-cluster sampling method in four provinces of various geographic regions of Iran, no response rate, flowchart with number of participants
								Controls 216	Stratified-cluster sampling method in four provinces of various geographic regions of Iran; no response rate; flowchart with number of participants
Shafti and Shahbazi, 2016	Casual comparative study	Rotterdam criteria	FSFI	NA	2013–2014	Iran	18–45	PCOS 129	Hospital and women infertility clinics
								Controls 125	Convenient sample
Diamond et al., 2017	Clinical trial	Rotterdam criteria	FSFI	Letrozole or clomiphene/ gonadotropins	–	USA	18–39	PCOS 733	PPCOS II trial; response rate 97.7%
							18–40	Controls 865	AMIGOS trial; response rate 96.1%

ASR, American Society of Reproduction; CSFQ, Changes in Sexual Function Questionnaire; ESHRE, European Society of Human Reproduction and Embryology; FSFI, Female Sexual Function Index; FSDQ, Female Sexual Desire Questionnaire; ISS, Index of Sexual Satisfaction; M, mean; McCoy-FSQ, McCoy Female Sexuality Questionnaire; NA, not applicable; NICHD, National Institute of Child Health and Human Development; MSQ, Multidimensional Sexuality Questionnaire; PCOS, polycystic ovary syndrome; SQ-F, Sexual Quotient- Female; VAS, visual analogue scale.

suggest that these concerns are clinically relevant.

Anxiety, depression (*Kalmbach et al., 2012; Kalmbach et al., 2014*) and poor body image (*Woertman and van den Brink, 2012*) are recognized psychosocial risk factors for sexual dysfunction and impaired sexual satisfaction. The VAS scores in our analysis also suggests that a poor body image in women with PCOS may make them more prone to sexual dysfunction compared with women without PCOS.

The finding that arousal, lubrication, orgasm and sexual satisfaction were impaired in women with PCOS but that dyspareunia (pain during intercourse) was not more common than in controls is intriguing. An explanation for this discrepancy may be that dyspareunia is also highly prevalent in women without a medical condition (*Mitchell et al., 2017*). Dyspareunia is not associated with one's capacity to become genitally and subjectively aroused (*Brauer et al., 2006*) but seems related to the habit of prioritizing a partner's pleasure over one's own (*Elmerstig et al., 2013; Kontula and Miettinen, 2016*), resulting in engaging in intercourse before being fully sexually aroused (*Brauer et al., 2014*). The net result of such behaviour dominates a possible worse dyspareunia rate in women without PCOS.

The study by *Diamond et al. (2017)*, with a proportionately high number of participants relative to the other studies, significantly dominated the overall pattern of results. The analyses, including the latter study (*Diamond et al., 2017*), found fewer differences in sexual function and sexual satisfaction between women with PCOS and controls than the analyses excluding this study. The women with PCOS in this study (*Diamond et al., 2017*) represented a selected group of infertile individuals who were highly motivated to conceive, and who participated in a clinical trial to evaluate fertility treatment outcome. Study design characteristics may have artificially increased sexuality indices in women with PCOS. Participants were instructed to have intercourse at least two to three times a week (*Legro et al., 2012; Legro et al., 2014*). Combined with being highly motivated to conceive, this might have directly enhanced intercourse frequency. Additionally, the main outcome measure, the FSFI, is designed such that women who do not engage in intercourse in the 4 weeks before assessment, even if this is unrelated to

TABLE 2 QUALITY ASSESSMENT OF SELECTED PUBLICATIONS APPLYING THE NEWCASTLE–OTTAWA QUALITY ASSESSMENT SCALE AND THE QUALITY IN PROGNOSTIC STUDIES.[a,b]

	Adapted from NOS[c]								Adapted from QUIPS[a]	
Study	Adequate case definition	Case representativeness	Controls selection	Controls definition	Comparability cases /controls	Exposure ascertainment	Same method ascertainment	Non-response rate	Outcome measurement	Statistical analysis and reporting
Elsenbruch *et al.*, 2003	*	*	-	*	*	-	*	-	MB	MB
Hahn *et al.*, 2005	*	*	-	*	-	-	*	-	HB	MB
Drosdzol *et al.*, 2007	*	*	-	-	*	-	-	-	LB	MB
Tan *et al.*, 2008	*	*	-	*	-	-	*	-	HB	MB
Caruso *et al.*, 2009	*	*	-	*	-	-	*	-	HB	MB
Mansson *et al.*, 2011	*	*	*	*	*	-	-	-	LB	HB
Gateva *et al.*, 2012	*	-	*	-	**	-	*	-	LB	MB
Stovall *et al.*, 2012	*	*	-	-	**	-	*	-	LB	MB
Ercan *et al.*, 2013	*	*	*	*	*	-	*	-	LB	MB
Ferraresi *et al.*, 2013	*	*	-	-	*	-	*	-	LB	MB
Zueff *et al.*, 2014	*	-	*	-	**	-	*	-	LB	MB
Benetti Pinto *et al.*, 2015	*	*	*	-	*	-	*	-	LB	LB
Elkhiat *et al.*, 2015	*	-	-	-	*	-	*	-	LB	MB
Kowalczyk *et al.*, 2015	*	*	-	*	**	-		*	LB	MB
Lara *et al.*, 2015	-	*	-	*	*	-		-	LB	LB
Noroozzadeh *et al.*, 2017	*	*	*	*	*	-	*	-	LB	LB
Shafti and Shahbazi, 2016	*	*	-	-	*	-	*	-	LB	HB
Diamond *et al.*, 2017	*	-	-	*	**	-	*	*	LB	LB

/

[a]Outcome category: High bias: The measurement of the outcome is likely to be different related to the baseline level of the prognostic factor; Moderate bias: the measurement of the outcome may be different related to the baseline level of the prognostic factors; low bias: the measurement of the outcome is unlikely to be different related to the baseline level of the prognostic factor

[b]Statistical analysis and reporting: High bias: the reported results are likely to be spurious or biased related to analysis or reporting; Moderate bias: the reported results may be spurious or biased related to analysis or reporting; Low bias: the reported results are unlikely to be spurious or biased related to analysis or reporting.

[c]NOS: a study can be awarded a maximum of one star for each item, except for the Comparability category and Exposure ascertainment (a maximum of two stars).

*, adequate; -, not adequate; green, no risk or low risk of bias; orange, medium risk of bias; red, high risk of bias; HB, high risk of bias LB, low risk of bias; MB, medium risk of bias; NOS, Newcastle–Ottawa Quality Assessment Scale QUIPS, Quality in Prognostic Studies;

TABLE 3 AGGREGATED POLYCYSTIC OVARY SYNDROME AND CONTROL GROUP ESTIMATES BASED ON FSFI, ISS, MCCOY–FSQ, CSQF, SQ–F, FSDQ & MSQ SCALES AND VAS SCALES.

	K	N		Random effects			Heterogeneity	
Questionnaires scales		**PCOS**	**Controls**	**SMD**	**95% CI**	***P*-value**	**$Q_{(df)}$**	***P*-value**
Total	10	1097	1444	−0.12	[−0.24 to 0.00]	NS	$10.9_{(9)}$	NS
Desire	10	1263	1596	−0.02	[−0.52 to 0.47]	NS	$90.4_{(9)}$	<0.001
Arousal	9	1177	1535	−0.07	[−0.17 to 0.03]	NS	$8.4_{(8)}$	NS
Lubrication	8	1081	1449	−0.05	[−0.14 to −0.04]	NS	$5.6_{(7)}$	NS
Orgasm	9	1177	1532	−0.11	[−0.36 to 0.13]	NS	$23.9_{(8)}$	0.002
Satisfaction	11	1305	1622	−0.26	[−0.46 to −0.06]	0.015	$32.3_{(10)}$	<0.001
Pain intercourse	8	1085	1450	−0.06	[−0.21 to 0.09]	NS	$9.9_{(7)}$	NS
Outliers excluded								
Total[a]	9	363	584	−0.21	[−0.34 to −0.08]	0.006	$5.1_{(8)}$	NS
Arousal[a]	8	446	675	−0.16	[−0.28 to 0.04]	0.019	$4.6_{(7)}$	NS
Lubrication[a]	7	350	589	−0.15	[−0.26 to −0.03]	0.023	$2.8_{(6)}$	NS
Orgasm[b]	8	1135	1490	−0.17	[−0.23 to −0.03]	0.028	$12.4_{(7)}$	NS
VAS scales[c]								
Importance of satisfactory sex life	4	282	50	0.03	[−0.10 to 0.16]	NS	$0.21_{(3)}$	NS
Thoughts	4	282	50	−0.29	[−0.40 to −0.17]	0.004	$0.16_{(3)}$	NS
Attractive	5	354	50	−0.80	[−0.92 to −0.68]	<0.001	$0.31_{(4)}$	NS
Body hair	5	354	50	1.01	[0.49 to 1.52]	0.006	$5.49_{(4)}$	NS
Social impact	5	354	50	0.65	[0.30 to 1.01]	0.007	$2.71_{(4)}$	NS
Pain intercourse	3	162	50	0.23	[−0.23 to 0.70]	NS	$0.89_{(2)}$	NS
Satisfaction with sex life	4	282	50	−0.96	[−1.06 to −0.85]	<0.001	$0.13_{(3)}$	NS

CSFQ, Changes in Sexual Function Questionnaire; FSDQ, Female Sexual Desire Questionnaire; FSFI, Female Sexual Function Index; ISS, Index of Sexual Satisfaction; K, number of entries; McCoy–FSQ, McCoy Female Sexuality Questionnaire; MSQ, Multidimensional Sexuality Questionnaire; N, number of participants; PCOS, polycystic ovary syndrome; Q(df), Cochran's Q; SMD, standardized mean difference; SQ–F, Sexual Quotient–Female; VAS, visual analogue scale.

[a] Diamond *et al*., (2017) excluded.

[b] Manson *et al*. (2011) excluded.

[c] Numbers of control groups adjusted to avoid an unduly heavy weight of the one control group.

sexual dysfunction, have significantly lower FSFI total scores than women who do engage in intercourse within this time frame. The study's instructions to have sexual intercourse, together with the high proportion of FSFI items that refer to sexual intercourse,inflate FSFI total scores. For these reasons, we conclude that the analysis excluding *Diamond et al. (2017)* may provide a better estimation of the sexual function status of women with PCOS than the analysis including this study.

To date, it is unclear if, and to what extent, androgen levels of women with and without PCOS are related to sexual function. In several studies, normalizing androgen levels in women with PCOS was found to be unrelated to changes in levels of sexual desire (*Conaglen and Conaglen, 2003; Caruso et al., 2009*). This may suggest that androgen levels are irrelevant for the sexual function of women with PCOS. Alternatively, perhaps an optimal balance of hormonal milieu is required for sex-hormones to influence sexual function or, perhaps, critical levels of other hormones such as oestradiol and progesterone are also required for normal sexual functioning (*Wierman et al., 2010*). Finally, there may be a normal hormonal range between which women show normal sexual function (*Wierman et al., 2010*). Women with PCOS might well exceed this range.

Although the influence of endocrine factors in women with PCOS is far from elucidated, treatment with OCP is regarded standard clinical care, even though OCP may not decrease androgen levels to the normal hormonal range. In women with PCOS, progesterone feedback and progesterone serum levels are also compromised (*Burt Solorzano et al., 2012*), potentially adding to the effect that different sex steroids may have on sexual function.

Several studies have shown that use of OCP is related to a decrease in androgen levels in healthy women, potentially impairing sexual function (*Burrows et al., 2012; Davis et al., 2013; Zimmerman et al., 2014; Higgins and Smith, 2016*), whereas others did not (*Graham et al., 1995; Sanders et al., 2001; Graham et al., 2007*). Perhaps no single androgen level is predictive of low female sexual function (*Davis et al., 2005*). The scope of this study was not on the effect

of endocrine factors. Also, it was not possible to stratify for OCP use or endocrine factors potentially obscuring the results.

Sexual function studies in women with other hyperandrogenic disorders are relatively scarce. Several studies in women with congenital adrenal hyperplasia (CAH) have been published over the past 2 decades, with many of them focusing on gender identity, gender role behaviour, sexual orientation and age of sexual debut (*Dittmann et al., 1992; Zucker et al., 1996; Jaaskelainen et al., 2001; Hines et al., 2004; Wisniewski et al., 2004; Zucker et al., 2004; Meyer-Bahlburg et al., 2008; Frisen et al., 2009*). Studies in women with CAH focus on sexual function reported impaired sexual function as assessed with the FSFI (*Gastaud et al., 2007; van der Zwan et al., 2013; Krysiak et al., 2016*). These women were found to have significantly lower FSFI total and subscale scores compared with healthy controls. Although some discrepant findings were observed between studies, overall, women with CAH did report impaired sexual function.

An important strength of the present study is that it represents the first systematic quantitative analysis of the relationship between PCOS and sexual function. The studies included in this meta-analysis were carefully assessed for quality using well-known Cochrane tools (*Wells, 2010; Hayden et al., 2013*).

The main limitation of this study is the relatively low number of publications that could be used for the meta-analysis. Also, study quality is limited, which may negatively affect the reliability of the findings. This limitation may be particularly relevant for the studies that used VAS scores (*Elsenbruch et al., 2003; Hahn et al., 2005; Tan et al., 2008; Caruso et al., 2009*). These four studies used the same control group of 50 women that participated in the study by *Elsenbruch et al. (2003)* (**TABLE 1** and Supplementary **TABLE 2**). In this control group, PCOS was explicitly excluded, but the control group may not have been fully matched with the PCOS group in all four studies. We prevented this specific control group having an unduly heavy weight in the analysis by entering a total of 50 controls, but also conducted a sensitivity analysis in which each control group counted separately for each entry. Changes in results were negligible.

Another limitation is the diversity between the studies; for example four studies were from Islamic countries, including only married women (*Ercan et al., 2013; Elkhiat et al., 2015; Noroozzadeh et al., 2016; Shafti and Shahbazi, 2016*). Other studies did not mention relationship status or sexual activity of participants (*Gateva and Kamenov, 2012; Stovall et al., 2012; Lara et al., 2015*). This diversity might imply that groups are not comparable.

More studies of sexual function in women with PCOS are warranted. As PCOS and sexual function are both biopsychosocial phenomena, studies should also use a biopsychosocial design. This would mean assessing psychosocial aspects using questionnaires, evaluating endocrine and genetic features and measuring genital responses to sexual stimuli, using psychophysiological measurements. Also, ideally, partners' sexual function and sexual satisfaction should be included.

In conclusion, our findings indicate that women with PCOS have a compromised sex life. Yet, a satisfying sex life is as important for women with PCOS as for women without PCOS. This implies that women with PCOS aspire the same goals of sexuality as women without PCOS, but that they are less able to reach these goals. The findings imply that sexual function, sexual satisfaction and psychosocial functioning need to be part of the clinical assessment of every woman with PCOS.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.rbmo.2018.09.010.

REFERENCES

Abdo, H.C.N. **Development and validation of female sexual quotient - questionnaire to assess female sexual function. (Elaboracao e validacao do quociente sexual - versae feminina: uma escala para avaliar a funcao sexual da mulher).** RBM Revista Brasileira de Medicina 2006; 63

Azziz, R., Carmina, E., Chen, Z., Dunaif, A., Laven, J.S., Legro, R.S., Lizneva, D., Natterson-Horowtiz, B., Teede, H.J., Yildiz, B.O. **Polycystic ovary syndrome.** Nat Rev Dis Primers 2016; 2: 16057

Azziz, R., Carmina, E., Dewailly, D., Diamanti-Kandarakis, E., Escobar-Morreale, H.F., Futterweit, W., Janssen, O.E., Legro, R.S., Norman, R.J., Taylor, A.E., Witchel, S.F. **Task Force on the Phenotype of the Polycystic Ovary Syndrome of The Androgen, E. and Society, P.. The Androgen Excess and PCOS Society criteria for the polycystic ovary syndrome: the complete task force report.** Fertil Steril 2009; 91: 456–488

Bancroft, J. **Sexual effects of androgens in women: some theoretical considerations.** Fertil Steril 2002; 77: S55–S59

Bancroft, J. **Androgens and sexual function in men and women.** Bagatell C.J.B., W. J. Androgens in health and disease Humana Press 2003: 259–290

Basson, R., Brotto, L.A., Petkau, A.J., Labrie, F. **Role of androgens in women's sexual dysfunction.** Menopause 2010; 17: 962–971

Baujat, B., Mahe, C., Pignon, J.P., Hill, C. **A graphical method for exploring heterogeneity in meta-analyses: application to a meta-analysis of 65 trials.** Stat Med 2002; 21: 2641–2652

Benetti-Pinto, C.L., Ferreira, S.R., Antunes, A.Jr., Yela, D.A. **The influence of body weight on sexual function and quality of life in women with polycystic ovary syndrome.** Arch Gynecol Obstet 2015; 291: 451–455

Borges, R., Temido, P., Sousa, L., Azinhais, P., Conceicao, P., Pereira, B., Leao, R., Retroz, E., Brandao, A., Cristo, L., Sobral, F. **Metabolic syndrome and sexual (dys)function.** J Sex Med 2009; 6: 2958–2975

Brauer, M., Laan, E., ter Kuile, M.M. **Sexual arousal in women with superficial dyspareunia.** Arch Sex Behav 2006; 35: 191–200

Brauer, M., Lakeman, M., van Lunsen, R., Laan, E. **Predictors of task-persistent and fear-avoiding behaviors in women with sexual pain disorders.** J Sex Med 2014; 11: 3051–3063

Burrows, L.J., Basha, M., Goldstein, A.T. **The effects of hormonal contraceptives on female sexuality: a review.** J Sex Med 2012; 9: 2213–2223

Burt Solorzano, C.M., Beller, J.P., Abshire, M.Y., Collins, J.S., McCartney, C.R., Marshall, J.C. **Neuroendocrine dysfunction in polycystic ovary syndrome.** Steroids 2012; 77: 332–337

Caruso, S., Rugolo, S., Agnello, C., Romano, M., Cianci, A. **Quality of sexual life in hyperandrogenic women treated with an oral contraceptive containing chlormadinone acetate.** J Sex Med 2009; 6: 3376–3384

Clayton, A.H., McGarvey, E.L., Clavet, G.J. **The Changes in Sexual Functioning Questionnaire (CSFQ): development, reliability, and validity.** Psychopharmacol Bull 1997; 33: 731–745

Clayton, A.H., McGarvey, E.L., Clavet, G.J., Piazza, L. **Comparison of sexual functioning in clinical and nonclinical populations using the Changes in Sexual Functioning Questionnaire (CSFQ).** Psychopharmacol Bull 1997; 33: 747–753

Cohen, J. **A power primer.** Psychol Bull 1992; 112: 155–159

Conaglen, H.M., Conaglen, J.V. **Sexual desire in women presenting for antiandrogen therapy.** J Sex Marital Ther 2003; 29: 255–267

Davis, S.R., Bitzer, J., Giraldi, A., Palacios, S., Parke, S., Serrani, M., Mellinger, U., Nappi, R.E. **Change to either a nonandrogenic or androgenic progestin-containing oral contraceptive preparation is associated with improved sexual function in women with oral contraceptive-associated sexual dysfunction.** J Sex Med 2013; 10: 3069–3079

Davis, S.R., Davison, S.L., Donath, S., Bell, R.J. **Circulating androgen levels and self-reported sexual function in women.** JAMA 2005; 294: 91–96

Davis, S.R., Guay, A.T., Shifren, J.L., Mazer, N.A. **Endocrine aspects of female sexual dysfunction.** J Sex Med 2004; 1: 82–86

De Niet, J.E., De Koning, C.M., Pastoor, H., Duivenvoorden, H.J., Valkenburg, O., Ramakers, M.J., Passchier, J., De Klerk, C., Laven, J.S.E. **Psychological well-being and sexarche in women with polycystic ovary syndrome.** Hum Reprod 2010; 25: 1497–1503

Diamond, M.P., Legro, R.S., Coutifaris, C., Alvero, R., Robinson, R.D., Casson, P.A., Christman, G.M., Huang, H., Hansen, K.R., Baker, V., Usadi, R., Seungdamrong, A., Bates, G.W., Rosen, R.M., Schlaff, W., Haisenleder, D., Krawetz, S.A., Barnhart, K., Trussell, J.C., Santoro, N., Eisenberg, E., Zhang, H. **Sexual function in infertile women with polycystic ovary syndrome and unexplained infertility.** Am J Obstet Gynecol. 2017

Dittmann, R.W., Kappes, M.E., Kappes, M.H. **Sexual behavior in adolescent and adult females with congenital adrenal hyperplasia.** Psychoneuroendocrinology 1992; 17: 153–170

Dove, N.L., Wiederman, M.W. **Cognitive distraction and women's sexual functioning.** J Sex Marital Ther 2000; 26: 67–78

Drosdzol, A., Skrzypulec, V., Mazur, B., Pawlinska-Chmara, R. **Quality of life and marital sexual satisfaction in women with polycystic ovary syndrome.** Folia Histochem Cytobiol 2007; 45: 93–97

Elkhiat, Y., Zedan, A., Mostafa, M., Elhalwagi, A. **Sexual desire in a sample of married Egyptian women with polycystic ovarian syndrome.** Human 2015

Elmerstig, E., Wijma, B., Swahnberg, K. **Prioritizing the partner's enjoyment: a population-based study on young Swedish women with experience of pain during vaginal intercourse.** J Psychosom Obstet Gynaecol 2013; 34: 82–89

Elsenbruch, S., Benson, S., Hahn, S., Tan, S., Mann, K., Pleger, K., Kimmig, R., Janssen, O.E. **Determinants of emotional distress in women with polycystic ovary syndrome.** Hum Reprod 2006; 21: 1092–1099

Elsenbruch, S., Hahn, S., Kowalsky, D., Offner, A.H., Schedlowski, M., Mann, K., Janssen, O.E. **Quality of Life, Psychosocial Well-Being, and Sexual Satisfaction in Women with Polycystic Ovary Syndrome.** J Clin Endocrinol Metab 2003; 88: 5801–5807

Ercan, C.M., Coksuer, H., Aydogan, U., Alanbay, I., Keskin, U., Karasahin, K.E., Baser, I. **Sexual dysfunction assessment and hormonal correlations in patients with polycystic ovary syndrome.** Int J Impotence Res 2013; 25: 127–132

Fauser, B.C., Tarlatzis, B.C., Rebar, R.W., Legro, R.S., Balen, A.H., Lobo, R., Carmina, E., Chang, J., Yildiz, B.O., Laven, J.S., Boivin, J., Petraglia, F., Wijeyeratne, C.N., Norman, R.J., Dunaif, A., Franks, S., Wild, R.A., Dumesic, D., Barnhart, K. **Consensus on women's health aspects of polycystic ovary syndrome (PCOS): the Amsterdam ESHRE/ASRM-Sponsored 3rd PCOS Consensus Workshop Group.** Fertil Steril 2012; 97: e25

Ferraresi, S.R., Lara, L.A., de Sa, M.F., Reis, R.M., Rosa e Silva, A.C. **Current research on how infertility affects the sexuality of men and women.** Recent Pat Endocr Metab Immune Drug Discov 2013; 7: 198–202

Ferraresi, S.R., Lara, L.A.S., Reis, R.M., de Sa Rosa e Silva, A.C.J. **Changes in Sexual Function among Women with Polycystic Ovary Syndrome: A Pilot Study.** J Sex Med 2013; 10: 467–473

Frisen, L., Nordenstrom, A., Falhammar, H., Filipsson, H., Holmdahl, G., Janson, P.O., Thoren, M., Hagenfeldt, K., Moller, A., Nordenskjold, A. **Gender role behavior, sexuality, and psychosocial adaptation in women with congenital adrenal hyperplasia due to CYP21A2 deficiency.** J Clin Endocrinol Metab 2009; 94: 3432–3439

Gastaud, F., Bouvattier, C., Duranteau, L., Brauner, R., Thibaud, E., Kutten, F., Bougneres, P. **Impaired sexual and reproductive outcomes in women with classical forms of congenital adrenal hyperplasia.** J Clin Endocrinol Metab 2007; 92: 1391–1396

Gateva, A., Kamenov, Z. **Sexual Function in Patients with PCOS and/or Obesity before and after Metformin Treatment.** Advances in Sexual Medicine. 2012

Goldhammer, D.L., McCabe, M.P. **Development and psychometric properties of the Female Sexual Desire Questionnaire (FSDQ).** J Sex Med 2011; 8: 2512–2521

Graham, C.A., Bancroft, J., Doll, H.A., Greco, T., Tanner, A. **Does oral contraceptive-induced reduction in free testosterone adversely affect the sexuality or mood of women?.** Psychoneuroendocrinology 2007; 32: 246–255

Graham, C.A., Ramos, R., Bancroft, J., Maglaya, C., Farley, T.M. **The effects of steroidal contraceptives on the well-being and sexuality of women: a double-blind, placebo-controlled, two-centre study of combined and progestogen-only methods.** Contraception 1995; 52: 363–369

Hahn, S., Janssen, O.E., Tan, S., Pleger, K., Mann, K., Schedlowski, M., Kimmig, R., Benson, S., Balamitsa, E., Elsenbruch, S. **Clinical and psychological correlates of quality-of-life in polycystic ovary syndrome.** Eur J Endocrinol 2005; 153: 853–860

Hartmann, U., Heiser, K., Ruffer-Hesse, C., Kloth, G. **Female sexual desire disorders: subtypes, classification, personality factors and new directions for treatment.** World J Urol 2002; 20: 79–88

Hayden, J.A., van der Windt, D.A., Cartwright, J.L., Cote, P., Bombardier, C. **Assessing bias in studies of prognostic factors.** Ann Intern Med 2013; 158: 280–286

Higgins, J.A., Smith, N.K. **The Sexual Acceptability of Contraception: Reviewing the Literature and Building a New Concept.** J Sex Res 2016; 53: 417–456

Himelein, M.J., Thatcher, S.S. **Polycystic ovary syndrome and mental health: A review.** Obstet Gynecol Surv 2006; 61: 723–732

Hines, M., Brook, C., Conway, G.S. **Androgen and psychosexual development: core gender identity, sexual orientation and recalled childhood gender role behavior in women and men with congenital adrenal hyperplasia (CAH).** J Sex Res 2004; 41: 75–81

Hudson, W.W., Harrison, D.F., Crosscup, P.C. **A Short-Form Scale to Measure Sexual Discord in Dyadic Relationships.** Journal of Sex Research 1981; 17: 157–174

Imani, B., Eijkemans, M.J., de Jong, F.H., Payne, N.N., Bouchard, P., Giudice, L.C., Fauser, B.C. **Free androgen index and leptin are the most prominent endocrine predictors of ovarian response during clomiphene citrate induction of ovulation in normogonadotropic oligoamenorrheic infertility.** J Clin Endocrinol Metab 2000; 85: 676–682

Imani, B., Eijkemans, M.J., te Velde, E.R., Habbema, J.D., Fauser, B.C. **A nomogram to predict the probability of live birth after clomiphene citrate induction of ovulation in normogonadotropic oligoamenorrheic infertility.** Fertil Steril 2002; 77: 91–97

Jaaskelainen, J., Tiitinen, A., Voutilainen, R. **Sexual function and fertility in adult females and males with congenital adrenal hyperplasia.** Horm Res 2001; 56: 73–80

Kalmbach, D.A., Ciesla, J.A., Janata, J.W., Kingsberg, S.A. **Specificity of anhedonic depression and anxious arousal with sexual problems among sexually healthy young adults.** J Sex Med 2012; 9: 505–513

Kalmbach, D.A., Kingsberg, S.A., Ciesla, J.A. **How changes in depression and anxiety symptoms correspond to variations in female sexual response in a nonclinical sample of young women: a daily diary study.** J Sex Med 2014; 11: 2915–2927

Kalmbach, D.A., Pillai, V., Kingsberg, S.A., Ciesla, J.A. **The Transaction Between Depression and Anxiety Symptoms and Sexual Functioning: A Prospective Study of Premenopausal, Healthy Women.** Arch Sex Behav 2015; 44: 1635–1649

Kolotkin, R.L., Zunker, C., Ostbye, T. **Sexual functioning and obesity: a review.** Obesity (Silver Spring) 2012; 20: 2325–2333

Kontula, O., Miettinen, A. **Determinants of female sexual orgasms.** Socioaffect Neurosci Psychol 2016; 6: 31624

Kowalczyk, R., Skrzypulec-Plinta, V., Nowosielski, K., Lew-Starowicz, Z. **Sexuality in women with polycystic ovary syndrome.** Ginekol Pol 2015; 86: 100–106

Krysiak, R., Drosdzol-Cop, A., Skrzypulec-Plinta, V., Okopien, B. **Sexual Function and Depressive Symptoms in Young Women With Nonclassic Congenital Adrenal Hyperplasia.** J Sex Med 2016; 13: 34–39

Lara, L.A.S., Ramos, F.K.P., Kogure, G.S., Costa, R.S., Silva de Sá, M.F., Ferriani, R.A., dos Reis, R.M. **Impact of Physical Resistance Training on the Sexual Function of Women with Polycystic Ovary Syndrome.** J Sex Med 2015; 12: 1584–1590

Legro, R.S., Brzyski, R.G., Diamond, M.P., Coutifaris, C., Schlaff, W.D., Casson, P., Christman, G.M., Huang, H., Yan, Q., Alvero, R., Haisenleder, D.J.,

Barnhart, K.T., Bates, G.W., Usadi, R., Lucidi, S., Baker, V., Trussell, J.C., Krawetz, S.A., Snyder, P., Ohl, D., Santoro, N., Eisenberg, E., Zhang, H., Network, N.R.M. **Letrozole versus clomiphene for infertility in the polycystic ovary syndrome.** N Engl J Med 2014; 371: 119–129

Legro, R.S., Kunselman, A.R., Brzyski, R.G., Casson, P.R., Diamond, M.P., Schlaff, W.D., Christman, G.M., Coutifaris, C., Taylor, H.S., Eisenberg, E., Santoro, N., Zhang, H., Network, N.R.M. **The Pregnancy in Polycystic Ovary Syndrome II (PPCOS II) trial: rationale and design of a double-blind randomized trial of clomiphene citrate and letrozole for the treatment of infertility in women with polycystic ovary syndrome.** Contemp Clin Trials 2012; 33: 470–481

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.** Eur J Obstet Gynecol Reprod Biol 2011; 155: 161–165

McCoy, N.L. **The McCoy Female Sexuality Questionnaire.** Quality of Life Research 2000; 9: 739–745

Meyer-Bahlburg, H.F., Dolezal, C., Baker, S.W., New, M.I. **Sexual orientation in women with classical or non-classical congenital adrenal hyperplasia as a function of degree of prenatal androgen excess.** Arch Sex Behav 2008; 37: 85–99

Middleton, L.S., Kuffel, S.W., Heiman, J.R. **Effects of experimentally adopted sexual schemas on vaginal response and subjective sexual arousal: a comparison between women with sexual arousal disorder and sexually healthy women.** Arch Sex Behav 2008; 37: 950–961

Miner, M., Esposito, K., Guay, A., Montorsi, P., Goldstein, I. **Cardiometabolic risk and female sexual health: the Princeton III summary.** J Sex Med 2012; 9: 641–651

Mitchell, K.R., Geary, R., Graham, C.A., Datta, J., Wellings, K., Sonnenberg, P., Field, N., Nunns, D., Bancroft, J., Jones, K.G., Johnson, A.M., Mercer, C.H. **Painful sex (dyspareunia) in women: prevalence and associated factors in a British population probability survey.** BJOG 2017; 124: 1689–1697

Mulders, A.G., Eijkemans, M.J., Imani, B., Fauser, B.C. **Prediction of chances for success or complications in gonadotrophin ovulation induction in normogonadotrophic anovulatory infertility.** Reprod Biomed Online 2003; 7: 170–178

Noroozzadeh, M., Tehrani, F.R., Mobarakabadi, S.S., Farahmand, M., Dovom, M.R. **Sexual function and hormonal profiles in women with and without polycystic ovary syndrome: a population-based study.** Int J Impotence Res. 2016

Panidis, D., Tziomalos, K., Papadakis, E., Vosnakis, C., Chatzis, P., Katsikis, I. **Lifestyle intervention and anti-obesity therapies in the polycystic ovary syndrome: impact on metabolism and fertility.** Endocrine 2013; 44: 583–590

Piva, I., Lo Monte, G., Graziano, A., Marci, R. **A literature review on the relationship between infertility and sexual dysfunction: does fun end with baby making?.** Eur J Contracept Reprod Health Care 2014; 19: 231–237

Rosen, R., Brown, C., Heiman, J., Leiblum, S., Meston, C., Shabsigh, R., Ferguson, D., D'Agostino, R.Jr. **The Female Sexual Function Index (FSFI): a multidimensional self-report instrument for the assessment of female sexual function.** J Sex Marital Ther 2000; 26: 191–208

Rotterdam, E.A.-S.P.c.w.g. **Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome (PCOS).** Hum Reprod 2004; 19: 41–47

Sanders, S.A., Graham, C.A., Bass, J.L., Bancroft, J. **A prospective study of the effects of oral contraceptives on sexuality and well-being and their relationship to discontinuation.** Contraception 2001; 64: 51–58

Schwarzer, G. **Package 'meta' - General Package for meta-analysis.** CRAN. 2015

Shafti, V., Shahbazi, S. **Comparing sexual function and quality of life in polycystic ovary syndrome and healthy women.** J Fam Reprod Health 2016; 10: 92–98

Shah, M.B. **Obesity and sexuality in women.** Obstet Gynecol Clin North Am 2009; 36: 347–360

Snell, W.E., Fisher, T.D., Walter, A.S. **The Multidimensional Sexuality Questionnaire: An objective self-report measure of psychological tendencies associated with human sexuality.** Annals of Sex Research 1993: 27–55

Stovall, D.W., Scriver, J.L., Clayton, A.H., Williams, C.D., Pastore, L.M. **Sexual function in women with polycystic ovary syndrome.** J Sex Med 2012; 9: 224–230

Sutton, A.J., A., K., Jones, D.R., Sheldon, T.A., Song, F. **Methods for Meta-Analysis in medical research.** 2000John Wiley & Sons, LtdChichester

Tan, S., Hahn, S., Benson, S., Janssen, O.E., Dietz, T., Kimmig, R., Hesse-Hussain, J., Mann, K., Schedlowski, M., Arck, P.C., Elsenbruch, S. **Psychological implications of infertility in women with polycystic ovary syndrome.** Hum Reprod 2008; 23: 2064–2071

Thessaloniki, E.A.-S.P.C.W.G. **Consensus on infertility treatment related to polycystic ovary syndrome.** Hum Reprod 2008; 23: 462–477

van den Brink, F., Smeets, M.A., Hessen, D.J., Talens, J.G., Woertman, L. **Body satisfaction and sexual health in Dutch female university students.** J Sex Res 2013; 50: 786–794

van der Zwan, Y.G., Janssen, E.H., Callens, N., Wolffenbuttel, K.P., Cohen-Kettenis, P.T., van den Berg, M., Drop, S.L., Dessens, A.B., Beerendonk, C. **Dutch Study Group on, D.S.D.. Severity of virilization is associated with cosmetic appearance and sexual function in women with congenital adrenal hyperplasia: a cross-sectional study.** J Sex Med 2013; 10: 866–875

Veltman-Verhulst, S.M., Boivin, J., Eijkemans, M.J., Fauser, B.J. **Emotional distress is a common risk in women with polycystic ovary syndrome: a systematic review and meta-analysis of 28 studies.** Hum Reprod Update 2012; 18: 638–651

Waldinger, M.D. **Psychiatric disorders and sexual dysfunction.** Handb Clin Neurol 2015; 130: 469–489

Wells, G.A., Shea, B., O'Connel, D., Peterson, J., Welch, V., Losos, M. & Tugwell, P., 2010. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses.

Wiegel, M., Meston, C., Rosen, R. **The female sexual function index (FSFI): cross-validation and development of clinical cutoff scores.** J Sex Marital Ther 2005; 31: 1–20

Wierman, M.E., Nappi, R.E., Avis, N., Davis, S.R., Labrie, F., Rosner, W., Shifren, J.L. **Endocrine aspects of women's sexual function.** J Sex Med 2010; 7: 561–585

Wischmann, T. **Sexual disorders in infertile couples: an update.** Curr Opin Obstet Gynecol 2013; 25: 220–222

Wischmann, T.H. **Sexual disorders in infertile couples.** J Sex Med 2010; 7: 1868–1876

Wisniewski, A.B., Migeon, C.J., Malouf, M.A., Gearhart, J.P. **Psychosexual outcome in women affected by congenital adrenal hyperplasia due to 21-hydroxylase deficiency.** J Urol 2004; 171: 2497–2501

Woertman, L., van den Brink, F. **Body image and female sexual functioning and behavior: a review.** J Sex Res 2012; 49: 184–211

Zawadzki, J.K., Dunaif, A. **Diagnostic criteria for polycystic overy syndrome: towards a rational approach.** 1990National Institute of Child Health and Human Development. Blackwell Scientific Publications

Zimmerman, Y., Eijkemans, M.J., Coelingh Bennink, H.J., Blankenstein, M.A., Fauser, B.C. **The effect of combined oral contraception on testosterone levels in healthy women: a systematic review and meta-analysis.** Hum Reprod Update 2014; 20: 76–105

Zucker, K.J., Bradley, S.J., Oliver, G., Blake, J., Fleming, S., Hood, J. **Psychosexual development of women with congenital adrenal hyperplasia.** Horm Behav 1996; 30: 300–318

Zucker, K.J., Bradley, S.J., Oliver, G., Blake, J., Fleming, S., Hood, J. **Self-reported sexual arousability in women with congenital adrenal hyperplasia.** J Sex Marital Ther 2004; 30: 343–355

Zueff, L.N., Lara, L.A., Vieira, C.S., Martins Wde, P., Ferriani, R.A. **Body composition characteristics predict sexual functioning in obese women with or without PCOS.** J Sex Marital Ther 2015; 41: 227–237

Received 16 February 2018; refereed 10 September 2018; accepted 13 September 2018.