

CLINICAL STUDY

Clinical and psychological correlates of quality-of-life in polycystic ovary syndrome

Susanne Hahn, Onno E Janssen, Susanne Tan, Katja Pleger¹, Klaus Mann, Manfred Schedlowski², Rainer Kimmig³, Sven Benson¹, Efthimia Balamitsa¹ and Sigrid Elsenbruch¹

Division of Endocrinology, Department of Medicine, University of Duisburg-Essen, Germany, Hufelandstr. 55, 45 122 Essen, Germany, ¹Institute of Medical Psychology, University of Duisburg-Essen, Germany, ²Division of Psychology and Behavioral Immunobiology, Swiss Federal Institute of Technology, ETH-Zurich, Switzerland and ³Department of Obstetrics and Gynecology, University of Duisburg-Essen, Germany

(Correspondence should be addressed to O E Janssen; Email: onno.janssen@uni-essen.de)

Abstract

Objective: Polycystic ovary syndrome (PCOS) has been shown to cause a reduction in quality of life. This study examines the extent of different PCOS symptoms on quality-of-life, psychosocial well-being and sexual satisfaction.

Methods: Complete metabolic, hormonal, clinical and psychosocial data were obtained from a total of 120 women with PCOS. Patients were compared with 50 healthy women to establish reductions in quality-of-life and emotional well-being. In addition, the correlation between psychosocial variables and the major clinical PCOS features obesity (body mass index (BMI)), excessive body hair (hirsutism score), acne, hyperandrogenism (serum testosterone levels), disturbed insulin regulation (area under the insulin response curve and homeostasis model assessment of insulin resistance), menstrual cycle disturbances and infertility were analyzed.

Results: PCOS patients showed significant reductions in quality-of-life, increased psychological disturbances, and decreased sexual satisfaction when compared with healthy controls. BMI and hirsutism scores, but not the presence of acne, were associated with physical aspects of quality-of-life and sexual satisfaction. No clear effect of androgens or insulin resistance on psychosocial variables was detected. Similarly, the type of menstrual cycle disturbances or infertility had no impact on psychological well-being.

Conclusion: In PCOS, changes in appearance, particularly obesity and hirsutism, reduce physical dimensions of quality-of-life and decrease sexual satisfaction. The role of biochemical, endocrine and metabolic parameters as well as menstrual irregularities and infertility appeared to be less important. Clinicians should pay attention to the psychosocial dimensions of PCOS on an individual basis, regardless of symptom severity or treatment response.

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Introduction

Polycystic ovary syndrome (PCOS) predominantly affects women of reproductive age, who are likely to be concerned with their cycle abnormalities, hyperandrogenism and obesity (1–4). In addition to infertility, metabolic and cosmetic problems, the psychological sequelae of PCOS are receiving increasing attention by the scientific community. Decreased quality-of-life and mood disturbances including symptoms of depression, decreased sexual satisfaction, and problems with feminine identity have been reported (5–17). We have previously documented decrements in health-related quality-of-life, decreased sexual satisfaction and increased psychological disturbances in a German PCOS cohort compared with healthy women (14). Whereas these data clearly document the presence

and extent of psychological problems in this patient population, thus far little is known about the role of clinical symptoms in psychosocial functioning in PCOS. Obesity is clearly an important factor which can profoundly affect quality-of-life in itself, without the presence of any other clinical symptom in otherwise healthy subjects (18). In the context of PCOS, the few studies that exist do support the role of obesity (12, 14, 17, 19). However, it remains unclear whether and to what extent other PCOS features contribute to psychological problems in this patient population. Given the complex array of symptoms which the diagnosis entails, a number of clinical factors could very conceivably cause emotional distress and decrements in quality-of-life. These factors include changes in outer appearance (i.e. obesity, excessive body hair, acne), hormonal disturbances (i.e. hyperandrogenism),

metabolic changes (i.e. insulin resistance), menstrual cycle disturbances (i.e. amenorrhea, oligomenorrhea), infertility, and long-term complications associated with the diagnosis (e.g. increased risk for diabetes). Several previous studies in women with PCOS support the role of several individual PCOS symptoms, including obesity (11, 12, 14, 17, 19), infertility (10, 16, 17), hirsutism (20), hyperandrogenism (15) and insulin resistance (11) in the modulation of psychological variables. The aim of this study was to explore the correlation of major PCOS symptoms with quality-of-life, psychosocial well-being and sexual satisfaction.

Subjects and methods

Subject recruitment

Consecutive patients were recruited from the outpatient clinics of the Department of Medicine, University of Duisburg-Essen, Germany, based on referrals from gynecologists in the surrounding area or patients attracted by the clinic's homepage. Choice of sample size was arbitrary. Based on the criteria derived from the 1990 NIH conference, diagnosis of PCOS was established when oligomenorrhea (cycles lasting longer than 35 days) or amenorrhea (fewer than three cycles in the past 6 months) and either clinical signs of hyperandrogenism (hirsutism with a Ferriman–Gallwey (FG) score of more than 7 (21) or obvious acne or pronounced alopecia) or an elevated total testosterone (> 2.0 nmol/l) were found, and other pituitary, adrenal, ovarian, thyroid or metabolic diseases could be excluded (excluded patients: one with Graves' disease, three with type 2 diabetes mellitus, one with type 1 diabetes mellitus, two with pituitary insufficiency, and one with adrenal tumor). Previous psychiatric diagnoses and use of psychiatric medications including antidepressants were exclusionary (one patient was excluded due to a previous diagnosis of depressive disorder). PCOS patients were not taking any prescription medication (except allergy medications and occasional pain medications) for at least 3 months before entering the study (six patients discontinued use of oral contraceptive pills before entering the study).

As a comparison group, historical data from a previously studied healthy control group and for the Short-Form Health Survey (SF-36) and the Symptom Check List 90 (SCL-90-R) normative data from the appropriate German reference population were utilized (14). Women in the historical control group were recruited from a health-screening program for employees instituted at the University of Duisburg-Essen Medical Center and by public advertisement. The NIH-PCOS criteria were excluded in controls before entering the study. Other exclusionary criteria for controls were any known medical condition (except allergy medications and occasional pain medications) or psychological disorder. The study protocol was approved by the Ethics

Committee of the University of Duisburg-Essen. All participants gave informed written consent before entering the study.

Instruments and measures

Quality-of-life, psychological disturbances and sexual satisfaction were assessed with three standardized questionnaires. Quality-of-life was assessed with the German version of the SF-36 (22), a widely used and validated instrument containing a total of eight subscales, namely Physical Function, Physical Role Function, Bodily Pain, General Health, Vitality, Social Function, Emotional Role Function and Mental Health. In addition, the subscales are combined to yield two summary health status measures, the Physical Sum scale and the Psychological Sum scale (23–25). The German version (26, 27) of the SCL-90-R (28) was used to quantify psychological disturbances. This widely used screening tool contains 90 items with a five-point scale (0 = not at all, 4 = extremely), and assesses psychological distress in nine areas (Somatization, Obsessive-Compulsive, Interpersonal Sensitivity, Depression, Anxiety, Aggression, Phobia, Paranoid Ideation and Psychoticism), as well as on three global categories (Global Severity Index – fundamental indicator of overall distress, the Positive Symptom Distress Index – intensity of distress, Positive Symptom Total – number of distress-inducing symptoms). Higher scores on the scales of the SCL-90-R mean higher distress; individual scales cannot be interpreted in diagnostic categories.

In addition to these validated instruments, sexual satisfaction was assessed using 100 mm visual analog scales (VASs) ranging from 'not at all' at the 0 mm mark to 'very much' at the 100 mm mark as previously described (14). Included were items regarding the impact of hirsutism on sexuality and on the ability to make social contacts, the importance of a satisfying sex life, satisfaction with the sex life during the past month, sexual thoughts and fantasies during the past month, frequency of pain during sexual intercourse, and the feeling of being sexually attractive. Women were instructed to place a mark at the point that best corresponded with their feelings. In this context, there were also items documenting the partnership situation of the subjects, including information about marital status as well as number and duration of relationships. The frequency of sexual intercourse during the past month was also recorded. All patients completed the questionnaires without linguistic or cognitive difficulties.

Laboratory and clinical parameters

For biochemical analyses, automated chemiluminescence immunoassay systems were used for the determination of luteinizing hormone (LH), follicle-

stimulating hormone (FSH), testosterone, blood glucose (ADVIA Centaur; Bayer Vital, Fernwald, Germany) and insulin (IMMULITE 2000; DPC Biermann, Bad Nauheim, Germany). Intra-assay variation was < 5% and inter-assay variation was < 8% for all parameters. Parameters of insulin resistance and hyperinsulinemia were evaluated using a 2 h oral glucose tolerance test. Insulin resistance was defined by the homeostasis model assessment of insulin resistance (HOMA-IR) (29) and hyperinsulinemia by calculating the area under the insulin response curve (AUC-I). Except for amenorrhoeic women, all laboratory parameters were determined in the early follicular phase of the menstrual cycle.

In PCOS subjects and control women, clinical parameters were assessed by physical examination, including a subjective determination of the presence or absence of acne and the degree of hirsutism by evaluating the FG score and anthropometric measurements including body weight in kg and body mass index (BMI) calculated as weight/(height)² (kg/m²). FG scores were routinely evaluated by two physicians independently and never differed by more than 2, and when not identical were re-evaluated by a third physician and the median value used.

Data analysis

The SCL-90-R and SF-36 were scored and analyzed according to the published guidelines (22, 26, 27). For VAS scales, the distance from 0 mm to the patient's mark was measured in mm. For statistical group comparisons of PCOS patients vs controls, independent-sample *t*-tests were computed. The results are reported in the text without adjustment of alpha for multiple comparisons. However, in the Tables, adjusted alpha levels are also provided. For this, the conservative Bonferroni method was utilized, which applies an adjusted alpha level that is calculated based on the number of scales in each questionnaire (30). For analysis of PCOS subgroups based on BMI, ANOVAs followed by Scheffe tests were computed. For analyses of frequency distributions, chi-square tests were utilized. Pearson's *r* was computed for correlational analyses. Data are presented as means ± s.d., unless otherwise indicated.

Results

Participants

Metabolic, hormonal, clinical and psychosocial data were obtained from a total of 120 PCOS patients and previously studied healthy controls (14). The groups did not differ in sociodemographic characteristics, including age, family status, education and employment (Table 1). As expected, parameters characteristic for PCOS were elevated in affected women (Table 1). A significantly greater proportion

of PCOS women were clinically obese, corresponding to an elevated mean BMI. In the PCOS cohort, 33 patients presented with a BMI ≤ 24.9 kg/m², 24 patients with a BMI between 25 and 29.9 kg/m² and 63 patients with a BMI ≥ 30 kg/m². Mean hirsutism score, LH/FSH ratio, and serum testosterone and parameters of insulin resistance were also significantly elevated in PCOS patients. A greater proportion of PCOS patients reported currently have an unfulfilled wish to conceive a child (Table 1), and a substantial proportion of patients reported anxiety regarding the possibility that they may remain without children (62%, 74 patients).

Quality-of-life, psychological disturbances and sexual satisfaction in PCOS patients compared with healthy controls

PCOS patients reported significantly lower quality-of-life, measured with the SF-36 (22, 26). Compared with controls, women with PCOS had significantly decreased scores, indicating lower quality-of-life, on the SF-36 scales Physical Role Function, Bodily Pain, Vitality, Social Function, Emotional Role Function and Mental Health (Table 2). Evaluation of psychological disturbances with the SCL-90-R (26–28) revealed significantly higher scores, indicating greater disturbances, on the dimensions Obsessive-Compulsive, Interpersonal Sensitivity, Depression, Aggression and Psychoticism in PCOS patients (Table 3). Accordingly,

Table 1 Characteristics of women with PCOS and healthy controls.

	PCOS (n = 120)	Controls (n = 50)	P
Age, mean (s.d.)	29 (5.4)	30 (5.7)	NS
BMI, mean (s.d.)	31 (9.3)	24 (5.3)	<0.001
Elevated BMI (≥25 kg/m ²), % (n)	72.5 (87)	24 (11)	<0.001
Hirsutism score, mean (s.d.)	9.2 (5.8)	3.0 (2.0)	<0.01
LH/FSH ratio, mean (s.d.)	2.7 (1.2)	1.3 (0.6)	<0.01
Serum testosterone, nmol/l, mean (s.d.)	2.7 (0.9)	1.3 (0.6)	<0.01
HOMA-IR, mean (s.d.)	4.9 (4.3)	2.1 (1.3)	<0.001
AUC-I, mean (s.d.)	369 (364)	160 (101)	<0.001
College degree (German 'Abitur'), % (n)	44 (53)	48 (24)	NS
Family status			
Married, % (n)	53 (64)	38 (19)	NS
Divorced, % (n)	3 (4)	6 (3)	NS
Single, % (n)	42 (50)	54 (27)	NS
With children, % (n)	17 (20)	30 (15)	<0.05
Current wish to conceive, % (n)	56 (63)	6 (3)	<0.001
Full-time job, % (n)	54 (57)	46 (23)	NS
Part-time job, % (n)	13 (15)	20 (10)	NS
General health rated 'good' or 'very good'	79 (85)	86 (43)	NS

Table 2 Health-related quality-of-life in women with PCOS and healthy controls, measured with the SF-36. Data are shown as means \pm s.d. ((median) 25th percentile/75th percentile). In addition, normative data (means \pm s.d.) from the female German reference population are shown. Reported *P*-values are results of independent-sample *t*-tests between PCOS and healthy controls.

SF-36 scales	PCOS (n = 120)	Controls (n = 50)	<i>P</i>	Normative data
Physical Function	81 \pm 21 ((90) 70/99))	88 \pm 20 ((95) 90/100)	< 0.05	94 \pm 13
Physical Role Function	76 \pm 32 ((100) 50/100)	90 \pm 21 ((100) 100/100)	< 0.001*	88 \pm 29
Bodily Pain	74 \pm 28 ((82) 51/100)	85 \pm 26 ((100) 63/100)	< 0.05	84 \pm 27
General Health	62 \pm 20 ((62) 45/77)	62 \pm 18 ((70) 53/80)	NS	74 \pm 18
Vitality	43 \pm 20 ((40) 30/60)	60 \pm 20 ((65) 50/70)	< 0.001*	62 \pm 20
Social Function	67 \pm 24 ((63) 50/88)	80 \pm 27 ((88) 63/100)	< 0.001*	89 \pm 18
Emotional Role Function	62 \pm 40 ((67) 33/100)	87 \pm 27 ((100) 100/100)	< 0.001*	91 \pm 22
Mental Health	57 \pm 20 ((56) 40/72)	70 \pm 19 ((70) 60/84)	< 0.001*	72 \pm 19

* Comparison remains statistically significant following alpha adjustment using the conservative Bonferroni method (adjusted alpha for accepting statistical significance: 0.05/8 = 0.0065).

patients' scores were significantly elevated on two of the questionnaire's three global indices (Table 3).

Sexual satisfaction was assessed in patients and controls with VASs. PCOS patients and controls did not differ in the amount of sexual thoughts and fantasies (mean \pm s.d. for PCOS: 49 \pm 30 vs 58 \pm 29 mm for controls), and the groups rated a satisfying sex life as equally important (mean \pm s.d. for PCOS: 76 \pm 23 vs 76 \pm 24 mm for controls). In addition, no differences were found in the frequency of sexual intercourse and in the number of sexually active women between PCOS patients and controls. Also, in this regard, no differences were found between lean and obese PCOS patients. However, women with PCOS were significantly less satisfied with their sex life (mean \pm s.d. for PCOS: 46 \pm 30 vs 74 \pm 27 mm for controls, *P* < 0.001), and found themselves significantly less sexually attractive (mean \pm s.d. for PCOS: 40 \pm 26 vs 59 \pm 29 mm for controls, *P* < 0.001). Further, women with PCOS believed to a significantly greater extent than controls that body hair negatively affects their

sexuality (mean \pm s.d. for PCOS: 39 \pm 35 vs 12 \pm 33 mm for controls, *P* < 0.001), and that their outer appearance makes it difficult to form social contacts (mean \pm s.d. for PCOS: 27 \pm 30 vs 13 \pm 25 mm for controls). Using an adjusted alpha level (adjusted *P*: 0.05/6 = 0.0083) did not affect the reported results (all *P* < 0.001), except for the scale on difficulties forming social contacts (*P* < 0.05).

Correlations between clinical and psychosocial variables in PCOS patients

The following clinical variables were identified as potential contributors to psychological problems in women with PCOS: obesity (BMI), excessive body hair (hirsutism score), acne, hyperandrogenism (serum testosterone levels), disturbed insulin regulation (AUC-I, HOMA-IR), menstrual cycle disturbances (amenorrhea, oligomenorrhea), and infertility (unfulfilled wish to conceive, anxiety to remain without child). We analyzed the correlation between these clinical parameters

Table 3 Psychological disturbances in women with PCOS and healthy controls, measured with the SCL-90-R. Data are shown as means \pm s.d. ((median) 25th percentile/75th percentile). In addition, normative data (means \pm s.d.) from the female German reference population are shown. Reported *P*-values are results of independent-sample *t*-tests between PCOS and healthy controls.

SCL-90-R scales	PCOS (n = 120)	Controls (n = 50)	<i>P</i>	Normative data
Somatization	0.75 \pm 0.66 ((0.5) 0.3/1.1)	0.56 \pm 0.69 ((0.3) 0.08/0.9)	NS	0.51 \pm 0.5
Obsessive-Compulsive	0.75 \pm 0.66 ((0.6) 0.3/1.0)	0.44 \pm 0.46 ((0.3) 0.1/0.7)	< 0.01*	0.50 \pm 0.5
Interpersonal Sensitivity	0.85 \pm 0.68 ((0.7) 0.4/1.1)	0.48 \pm 0.44 ((0.3) 0.1/0.9)	< 0.001*	0.47 \pm 0.5
Depression	0.88 \pm 0.72 ((0.8) 0.3/1.3)	0.49 \pm 0.55 ((0.4) 0.2/0.6)	< 0.001*	0.52 \pm 0.6
Anxiety	0.57 \pm 0.61 ((0.4) 0.2/0.8)	0.40 \pm 0.60 ((0.1) 0.0/0.6)	NS	0.41 \pm 0.5
Aggression	0.65 \pm 0.69 ((0.5) 0.0/0.4)	0.41 \pm 0.47 ((0.2) 0.0/0.7)	< 0.05	0.40 \pm 0.5
Phobia	0.31 \pm 0.56 ((0.1) 0.0/0.4)	0.22 \pm 0.54 ((0.0) 0.0/0.3)	NS	0.28 \pm 0.4
Paranoid Ideation	0.58 \pm 0.59 ((0.5) 0.0/0.9)	0.42 \pm 0.52 ((0.3) 0.0/0.6)	NS	0.48 \pm 0.6
Psychoticism	0.35 \pm 0.42 ((0.2) 0.0/0.5)	0.22 \pm 0.40 ((0.1) 0.0/0.2)	NS	0.25 \pm 0.4
Global Severity Index	0.66 \pm 0.54 ((0.6) 0.3/0.9)	0.41 \pm 0.44 ((0.3) 0.1/0.6)	< 0.01	0.45 \pm 0.4
PSDI	1.66 \pm 0.77 ((1.5) 1.3/2.0)	1.23 \pm 0.37 ((1.2) 1.0/1.51)	< 0.01	1.36 \pm 0.5
PST	33.8 \pm 18.6 ((34) 20.0/46.0)	27.4 \pm 22.8 ((18.5) 11/42)	NS	26.6 \pm 20

* Comparison remains statistically significant following alpha adjustment using the conservative Bonferroni method (adjusted alpha for accepting statistical significance: 0.05/12 = 0.0042).

PSDI = Positive Symptom Distress Index; PST = Positive Symptom Total.

and the SF-36, SCL-90-R and VAS psychological scales using data from 120 PCOS patients.

BMI BMI was significantly correlated with the SF-36 scales representing physical aspects and general health, whereas no significant correlations were found between BMI and the SF-36 scales reflecting psychosocial functions (Physical Role Function, Emotional Role Function, Vitality, Social Function and Psychological Sum scale) (Table 4). BMI was also significantly correlated with several of the VAS sexual satisfaction scales (Table 4).

To further explore the relationship between obesity and quality-of-life, PCOS patients were grouped based on BMI and compared with regard to SF-36 Physical and Psychological Sum scales (Fig. 1). Patients with a normal BMI (<25, n = 33) had significantly higher Physical Sum scale scores, indicating better quality-of-life compared with patients with elevated BMI (≥25 and <30, n = 24, P < 0.05), and with obese patients (BMI ≥ 30, n = 63, P < 0.01). On the other hand, no significant group differences were found for the Psychological Sum scale (Fig. 1).

Hirsutism Hirsutism score was significantly correlated with several SF-36 scales representing physical aspects and general health status (Table 4). As for BMI, no significant correlations were observed between hirsutism score and the SF-36 scales representing psychosocial functions. Hirsutism score was further associated with sexual satisfaction VAS scales (Table 4).

Hyperandrogenism and disturbed insulin regulation Testosterone levels were not correlated with any psychological scale, and existing correlations

between AUC-I and HOMA-IR were abolished when BMI was used as a covariate (data not shown).

Intercorrelations of psychological scales Interestingly, neither BMI, hirsutism score nor any other relevant biochemical parameter was significantly correlated with psychological disturbances, measured with the SCL-90-R scales. The only exception was the SCL-90-R Somatization scale, which was significantly correlated with BMI (r = 0.22, P < 0.05) and hirsutism score r = 0.24, P < 0.05). All SCL-90-R scales were highly and significantly correlated with the psychological scales of the SF-36 (correlations between SF-36 Psychological Sum scale with SCL-90-R scales: Somatization: r = -0.39; Obsessive-Compulsive: r = -0.57; Interpersonal Sensitivity: r = 0.51; Depression: r = -0.7; Anxiety: r = -0.64; Aggression: r = 0.48; Phobia: r = -0.33; Paranoid Ideation: r = -0.49; Psychoticism: r = -0.47; Global Severity Index: r = -0.65, all P < 0.01), indicating that greater psychological disturbances were associated with decrements in psychological areas of quality-of-life (lower SF-36 scale scores). On the other hand, except for the Somatization scale (r = -0.48, P < 0.01), no associations were found between the SCL-90-R scales and the SF-36 scales representing physical functions.

Acne, menstrual cycle disturbances and infertility To study the impact of three dichotomous clinical symptoms of PCOS, namely acne, menstrual cycle disturbances and infertility, we compared the means of patients with and without the respective symptom for all psychosocial scales (SF-36, SCL-90-R, VAS). The results revealed no significant differences in any scale

Table 4 Correlations (r) of hirsutism score and BMI with VAS scales and SF-36.

	BMI r	P	Hirsutism score r	P
SF-36				
Physical Function	-0.57	<0.001	-0.14	NS
Physical Role Function	-0.17	NS	-0.04	NS
Bodily Pain	-0.29	<0.01	-0.20	<0.05
General Health Perception	-0.26	<0.001	-0.23	<0.05
Vitality	-0.16	NS	0.02	NS
Social Function	-0.05	NS	-0.04	NS
Emotional Role Function	0.06	NS	0.02	NS
Mental Health	-0.02	NS	-0.03	NS
Sum Physical	-0.48	<0.001	-0.12	<0.05
Sum Psychological	0.12	NS	0.04	NS
VAS				
Satisfaction with sex life	-0.05	NS	-0.04	NS
Sexual thoughts, fantasies	-0.02	NS	0.06	NS
Importance of satisfying sex life	0.22	<0.05	0.23	<0.05
Sexual attractiveness	-0.42	<0.001	-0.27	<0.01
Impact of body hair on sex life	-0.21	<0.05	0.46	<0.001
Pain during intercourse	-0.33	<0.001	0.07	NS
Difficulty with social contacts due to appearance	0.25	<0.01	0.34	<0.001

r = Pearson's correlation coefficient.

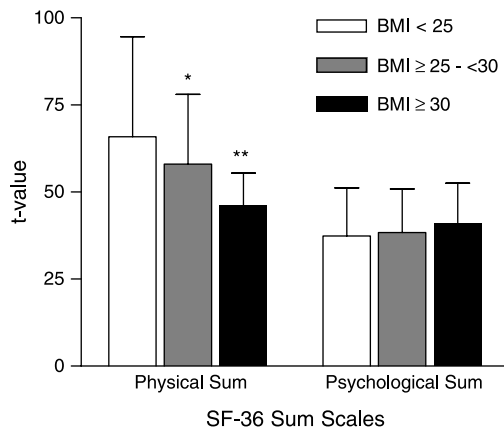


Figure 1 SF-36 Physical and Psychological Sum scales for PCOS patient groups based on BMI. Data are shown as means \pm s.d. * $P < 0.05$, ** $P < 0.01$.

between patients with acne ($n = 44$) and those without acne ($n = 76$) or between patients with amenorrhea ($n = 40$) vs oligomenorrhea ($n = 80$).

We had anticipated that PCOS patients with infertility may present with greater psychological distress. Unexpectedly, there were no differences in psychosocial variables between patients who reported currently having an unfulfilled wish to conceive and those who had not. Similarly, a comparison of means based on the presence or absence of anxiety about remaining without children did not reveal any effects. However, further analyses revealed that a significantly greater proportion of women with a current wish to conceive had a partner (62 vs 38%, $P < 0.01$). These patients were also significantly more satisfied with their sex life compared with patients who currently did not wish to conceive.

Discussion

Consistent with previous studies, the present results indicate decreased health-related quality-of-life, particularly in areas concerning social and emotional functioning, decreased sexual self-worth and sexual satisfaction, and increased emotional distress in women with PCOS. To explore the role of individual clinical PCOS symptoms in these psychological alterations, we analyzed the association between the major clinical PCOS symptoms and quality-of-life, psychological disturbances and sexual satisfaction in a sample of German PCOS patients. Changes in outer appearance, particularly obesity and excessive body hair, but not the presence of acne, were significantly associated with specific aspects of quality-of-life and sexual satisfaction. Higher BMI scores were associated with lower SF-36 scale scores, indicating decreased quality-of-life, for the scales Physical Function, Pain, General Health Perception and the Physical Sum

scale. Group comparisons of obese PCOS patients (BMI ≥ 30) showed significantly decreased scores on the SF-36 scales Physical Function, Pain, General Health perception and the Physical Sum scale compared with PCOS patients with lower BMI. Higher BMI was further associated with decreased sexual satisfaction and self-worth. Interestingly, there were no consistent associations between BMI and either the social and emotional aspects of quality-of-life or with psychological disturbances. This is of interest since the decrements in quality-of-life in PCOS were particularly pronounced in these areas. Together, these data are supportive of the notion that obesity is a major factor in decreased quality-of-life and impaired sexual self-worth in women with PCOS, which is consistent with the literature (12, 13, 17, 19). However, the effect appears to be limited to areas of quality-of-life concerning physical functions and general health. Obesity may not play a major role in emotional distress in PCOS, which is supported by two previous studies, including our own previous results showing that co-varying for BMI did not abolish significant differences between PCOS patients and healthy controls (14), as well as data by Weiner *et al.* who showed increased depression scores in a sample of PCOS patients matched for BMI with healthy controls (15). Epidemiological studies in the general population have also questioned a direct association between obesity and psychological distress, particularly with symptoms of depression, except for cases of severe obesity (31, 32).

Besides obesity, the most pronounced changes in physical appearance in PCOS are related to excessive body hair. In our patient sample, more severe hirsutism was associated with lower SF-36 scale scores for Pain, General Health Perception and the Physical Sum scale, as well as with decreased sexual self-worth and sexual satisfaction. On the other hand, there was no association between hirsutism and psychosocial distress, or with areas of quality-of-life representing emotional and social functioning. These results are consistent with previous data documenting the lack of a relationship between extent of hirsutism and degree of psychological distress (20, 33–35). Together, these data support that hirsutism does indeed affect women with PCOS, but this appears to be limited to specific areas of quality-of-life, including the sexual domains, possibly linked with problems concerning female identity and sexual self-worth (7, 8, 13, 20).

Women with PCOS fail to conform with societal norms for outer appearance. Although the notion that PCOS patients feel stigmatized appears reasonable, the concept of a loss of 'feminine identity' in PCOS is as such difficult to assess using standardized measures (8). Nevertheless, in our set of measures, this concept may be represented as a combination of sexual self-worth and self-esteem, measured by the VAS scales, which proved sensitive to changes in outer appearance,

particularly obesity and excessive body hair. In addition, as major components of feminine role expectations, loss of regular menstruation and infertility may also cause or contribute to emotional distress in women with PCOS. Therefore, we compared patients with oligomenorrhea with those with amenorrhea, but detected no differences. Obviously, both oligomenorrhea and amenorrhea represent menstrual irregularities, and the lack of differences may simply reflect that both types of irregularities are equally bothersome to patients. Against our expectations, we found no effects of either the present wish to conceive or anxiety about remaining without children. Except for two studies (10, 16), little is known about the role of infertility in psychosocial functioning and quality-of-life in PCOS. One of these studies (10) documented that concerns about infertility were associated with reductions in quality-of-life in adolescent girls with PCOS. These data are at odds with our results, which could suggest that worries regarding infertility may be more pronounced in younger patients, irrespectively of any current desire to conceive. Unlike some previous studies in infertile couples (36–38), we did not find evidence of emotional distress in our PCOS patients with infertility, with a number of possible explanations. The emotional consequences of infertility are modulated by several factors, including duration of infertility (39–41), history of previous treatment failure (41–43), and the cultural, ethnic and societal background (16). Hence, the results of psychological assessment in infertile woman are heavily dependent on the treatment history and medical setting. In addition, in our cohort, a greater percentage of patients with infertility were married or had a partner, a factor that can positively influence emotional well-being and quality-of-life. Finally, at our hospital we offer patients treatment with metformin, and although the actual treatment is not initiated until after the completion of the questionnaire assessment, we cannot exclude that treatment expectations affected responses on the questionnaires. However, the clinical and biochemical characteristics of our study population were comparable with other European cohorts (44).

There was no correlation between serum testosterone levels and psychological variables, and the association of parameters indicating insulin resistance was explained by BMI. Hence, hyperandrogenism and insulin resistance appear to be of minor importance for quality-of-life and psychosocial functions in PCOS. A disease-specific instrument (45, 46) may be more sensitive to change than the generic instruments we used. However, no validated disease-specific questionnaire exists for German patients, and the disease-specific Polycystic Ovary Syndrome Health-Related Quality of Life Questionnaire (PCOSQ) has been shown to correlate with the SF-36 (47). It is further important to consider that the discontinuation of treatment in our setting (i.e. patients

completed questionnaires before the initiation of metformin treatment) may have led to a worsening of psychosocial symptoms. Therefore, the present results cannot easily be generalized to treated PCOS patients. Taken together, our data of untreated PCOS patients suggest that obesity and excessive body hair play a major role in those areas of quality-of-life which concern limitations in physical functions, poor general health perception, increased bodily pain, and lower sexual self-worth. On the other hand, in our data set, correlations between the degree of physical symptoms or endocrine disturbances and psychological distress and/or impairment of well-being were weak. Psychological distress appears to be common in many endocrine disorders (48, 49). However, in any one individual, it may not be possible to predict the degree of psychological distress based on the presence or absence of individual symptoms or a specific symptom constellation alone. Therefore, clinicians should pay attention to the psychosocial dimension of PCOS on an individual basis, regardless of symptom severity or treatment response.

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