Research Article

Anxiety and depression states of adolescents with polycystic ovary syndrome

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Background/aim: Various studies have shown that adult patients with polycystic ovary syndrome (PCOS) have higher levels of anxiety and depression compared to their normal counterparts. However, it is still unclear whether these mood disorders already exist in adolescents affected by PCOS. The aim of the present study is to assess differences in anxiety and depression levels between adolescents with PCOS and age- and body mass index (BMI)-matched controls and to determine the possible factor(s) impacting these psychological parameters in adolescents with PCOS.

Materials and methods: The study included 80 adolescents with PCOS and 50 age- and BMI-matched controls. All participants completed standardized questionnaires assessing anxiety and depression. A multiple linear regression model was used to analyze the impact of potential variables on anxiety and depression scores of the adolescents with PCOS.

Results: Significantly higher levels of anxiety, specifically generalized and social anxieties, as well as depression were found in adolescents with PCOS compared to controls. Higher BMI was found to be associated with higher levels of depression and generalized anxiety, and higher modified Ferriman–Gallwey score with higher level of panic disorder in adolescents affected by PCOS.

Conclusion: Adolescents with PCOS experience significantly more emotional distress compared to adolescents without PCOS. This emotional distress may be related, at least in part, to certain clinical features of PCOS including obesity and hirsutism. PCOS in adolescents should be assessed not only for the gynecological and metabolic aspects but also for the emotional aspects of the disease.

Key words: Anxiety, depression, polycystic ovary syndrome, adolescents

1. Introduction

Polycystic ovary syndrome (PCOS) is a common endocrine disorder that occurs in 6%–10% of women of reproductive age with a higher prevalence in obese women (1). PCOS often presents during adolescence and is characterized primarily by ovulatory dysfunction and hyperandrogenism (2). The manifestations typically associated with PCOS, including hirsutism (excess facial and body hair), obesity, acne, and irregular menstrual cycles, can cause considerable concern and distress with regard to body image and feminine identity, which can impair the psychological well-being of adolescents with PCOS.

Numerous adult studies have revealed a higher prevalence of psychiatric disorders, notably increased depression, anxiety, and social phobia, in women with PCOS (3–6). Eating disorders and suicidal behavior

are also more common among women with PCOS (7). Furthermore, recent studies reported that comorbid psychiatric disorders challenge the quality of life of PCOS patients (8). While such psychological consequences of PCOS have been extensively documented, the underlying factors that may predispose women with PCOS to an increased risk of psychiatric disorders still remains unclear. Certain features of PCOS, such as obesity, hirsutism, infertility, and neuroendocrine dysfunction, have been suggested as causal factors, but research findings are not consistent (9).

Mood disorders associated with PCOS are well established in the adult population; however, it is not well known whether these emotional disturbances are already present in adolescents with PCOS. Adolescence may have a negative impact on the symptomatology of young patients with PCOS. It represents a period where the concerns about

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physical appearance are most distinct (10). Body image and related self-concept arise as important factors associated with health and well-being during this life stage (11). Any deviation from the ideal body figure can easily result in depressive symptomatology, anxiety, and lower self-esteem, contributing significantly to the higher overall rate of psychiatric disorders among adolescents. Given that the physical manifestations of PCOS start to become evident at younger ages, likely owing to the current childhood obesity epidemic worldwide, and that the sensitivity of girls to their body image is more prevalent during the teen years, evaluating mood disorders among adolescents with PCOS becomes notably pertinent. However, little attention has been paid so far to the psychosocial implications of PCOS in adolescents. Therefore, the aim of the present study was to assess anxiety and depression levels of adolescents with PCOS in comparison to age- and body mass index (BMI)-matched controls and to determine the possible factor(s) affecting these psychological parameters in adolescents affected by the syndrome.

2. Materials and methods

2.1. Subjects
This cross-sectional study was performed during the period from May 2013 to July 2014 and included 80 adolescent girls with the diagnosis of PCOS (17.23 ± 1.15 years, range: 16–19 years) who were recruited from the Outpatient Obstetrics and Gynecology Clinic and Outpatient Pediatric Clinic of Namık Kemal University Hospital in Tekirdağ and the Outpatient Pediatric Endocrinology Clinic of Gazi University Hospital in Ankara. An equal number of patients and controls from both centers participated in the study. All the patients were at least 3 years postmenarcheal and met the 2003 Rotterdam diagnostic criteria for PCOS (12). They had clinical and/or biochemical hyperandrogenism, chronic oligo- and/or anovulation, and/or polycystic ovaries on ultrasound. Nonclassic congenital adrenal hyperplasia, hyperprolactinemia, Cushing's syndrome, thyroid dysfunction, androgen-secreting tumors, language or cognitive difficulties preventing reliable completion of the questionnaire, and presence of any other coexisting acute or chronic illness unrelated to PCOS that may affect psychological test scores were the exclusion criteria of the study. A total of 50 age- and BMI-matched adolescent girls (17.00 ± 0.99 years, range: 16–19 years) from the general population, who had regular menses and were normoandrogenic, served as controls. The participants were not taking any medication for at least 3 months before the study. The study protocol was approved by the Clinical Trial Ethics Committee of the two centers. Informed consent and assent were obtained from all subjects and their parents.

2.2. Measurements

2.2.1. Clinical and laboratory measures
All the adolescent girls participating in this study were single high school students attending public schools and having health insurance. They were subjected to physical examination and laboratory tests. Anthropometric measurements including BMI, waist and hip circumferences, and waist-to-hip ratio were determined. Androgen levels [total testosterone and dehydroepiandrosterone sulfate (DHEAS)] and clinical evidence of androgen excess [modified Ferriman–Gallwey (mFG) score] were measured. Hirsutism was defined by a mFG score of >7. Other laboratory tests were fasting glucose, insulin, total cholesterol, high-density lipoprotein cholesterol, triglycerides, 17-hydroxyprogesterone, follicle-stimulating hormone, luteinizing hormone, estradiol, and 2-h plasma glucose after a standard 75-g oral glucose tolerance test. Homeostatic model assessment of insulin resistance (HOMA-IR) was also calculated for each participant according to the formula [fasting glucose (mg/L) × fasting insulin (mU/mL)]/405. All sampling procedures were performed between 0800 and 1000 hours after an overnight fast.

2.2.2. Psychological measures
All participants completed the Screen for Child Anxiety Related Emotional Disorders (SCARED) and the Child Depression Inventory (CDI).

2.2.2.1. Screen for Child Anxiety Related Emotional Disorders
SCARED is a 41-item self-report measure designed to screen for DSM-IV anxiety disorders. Birmaher et al. (13) developed the scale and it was adapted to Turkish by Çakmakçı (14). It includes 5 factors: somatic/panic (13 items), generalized anxiety (9 items), separation anxiety (8 items), social phobia (7 items), and school phobia (4 items). The participants rated the items of each factor on a 3-point scale (0 = not true or hardly ever true, 1 = sometimes true, and 2 = true or often true). The SCARED total score, derived by adding the score of the 41 items, ranges from 0 to 82. Higher total scores indicate a higher level of anxiety.

2.2.2.2. Child Depression Inventory
The CDI is a self-assessment scale for children aged between 6 and 17 years that is used in investigating childhood depression. Kovacs (15) developed the inventory based on the Beck Depression Inventory and it was adapted to Turkish by Öy (16). The CDI consists of 27 self-report items and each item of the scale contains 3 sentences, which are scored as 0, 1, or 2, depending on the severity of the symptom. Higher scores (max = 54) represent more severe depression.

2.3. Statistical analysis

After entering the data using SPSS 15.0 (SPSS Inc., Chicago, IL, USA), analysis of the results was performed using percentage distribution for qualitative data and median (25th and 75th) or mean (standard deviation) for quantitative data. The statistical tests used were the Shapiro–Wilk test for normality, the chi-square test for qualitative data comparison of groups, and the independent samples t-test and Mann-Whitney U test for quantitative data comparison of groups, as appropriate. A multiple linear regression model was used to determine the relationship between the independent variables including BMI score, mFG score, age, paternal education, maternal education, and family income and dependent variables including SCARED and CDI scores of the adolescents with PCOS. P < 0.05 was considered statistically significant.

3. Results

In total, 80 PCOS patients and 50 controls participated in the study and completed the required questionnaires. Clinical and biochemical characteristics of patients with PCOS and controls are displayed in Table 1. Age, BMI, parental education levels, and family income did not differ significantly between the groups (P > 0.05). The mFG score, total testosterone, DHEAS, and HOMA-IR values were higher for the patient group.

The SCARED total score was higher in the PCOS group compared to the control group (P = 0.030, Table 2). Among the subscales of SCARED, the PCOS group had higher scores than the control group for generalized anxiety disorder and social anxiety disorder (P = 0.042, P = 0.035, respectively). There was no significant difference between the groups for the remaining subscale scores of

Table 1. Clinical and biochemical characteristics of patients with PCOS and controls.

	PCOS n = 80	Controls n = 50	P-value
Age (years)	17.3 ± 1.15	17.0 ± 0.99	0.22
Body mass index (kg/m²)	24.7 (21.0–29.6)	24.3 (20.1–27.3)	0.10
Waist-hip ratio	0.85 (0.80–0.91)	0.82 (0.77–0.90)	0.07
mFG score	14 (12–16)	5 (4–6)	<0.001
Total testosterone (ng/dL)	42.5 (31.6–53.4)	29.6 (23.8–45.0)	0.001
DHEAS (µg/dL)	250.6 (170.0–329.0)	202 (144.5–261.5)	0.009
Luteinizing hormone (U/L)	5.2 (3.9–7.9)	4.0 (2.6–7.9)	0.007
Follicle-stimulating hormone (U/L)	5.1 (4.0–6.3)	5.0 (3.9–6.9)	0.540
Estradiol (pmol/L)	38.0 (29.3–48.9)	39.1 (28.7–54.1)	0.860
FPG (mg/dL)	87.0 (83.9–93.7)	85.5 (82.0–90.3)	0.07
Two-hour plasma glucose (mg/dL)	98.0 (84.0–116.0)	89.5 (79.7–100.0)	0.005
Total cholesterol (mg/dL)	159.8 (141.2–183.5)	153.0 (136.0–165.0)	0.06
HDL-C (mg/dL)	47.6 (42.0–53.8)	46.5 (41.8–55.1)	0.90
Triglycerides (mg/dL)	87.1 (64.2–107.9)	78.0 (63.0–104.0)	0.35
Fasting insulin (µIU/mL)	11.2 (7.0–14.9)	7.0 (5.1–11.8)	0.007
HOMA-IR	2.3 (1.4–3.4)	1.6 (1.0–2.4)	0.008
Mother's education level (%)			
Elementary	20	24	0.83
High school	59	54	
University	21	22	
Father's education level (%)			
Elementary	11	16	0.74
High school	58	54	
University	31	30	
Family income (%)			
<300 €	21	26	0.79
300–1000 €	49	48	
>1000 €	30	26	

mFG score: modified Ferriman–Gallwey score, DHEAS: dehydroepiandrosterone sulfate, FPG: fasting plasma glucose, HOMA-IR: homeostatic model assessment of insulin resistance.

Table 2. Comparison of SCARED and CDI scores between PCOS and control groups.

Scales	PCOS n=80	Controls n = 50	P-value
SCARED total	24 (19.0–31)	21 (16–26)	0.030
Panic disorder	6 (4–7)	5.5 (4–7)	0.337
Generalized anxiety disorder	6 (5–9)	5 (4–7)	0.042
Separation anxiety disorder	4 (3–5)	4 (3–5)	0.152
Social anxiety disorder	7 (4–8)	5.5 (4–7)	0.035
Significant school avoidance	1.5 (1–3)	1 (0–2)	0.054
CDI	19 (13–22)	16 (12–20)	0.047

SCARED: Screen for Child Anxiety Related Emotional Disorders, CDI: Child Depression Inventory.

panic disorder, separation anxiety disorder, and significant school avoidance (P > 0.05 for all). Regarding CDI scores, the PCOS group displayed a higher level of depression in comparison to the control group (P = 0.047, Table 2).

Multiple linear regression analysis was performed using SCARED and CDI scores of patients as dependent variables and BMI, mFG score, age, paternal education, maternal education, and family income as independent variables. BMI remained independently associated with depression (β-coefficient = 0.240, P = 0.04) and generalized anxiety (β-coefficient = 0.263, P = 0.018), and mFG score with panic disorder (β-coefficient = 0.310, P = 0.006).

4. Discussion
Abundant evidence from adult studies showed that women with PCOS face significantly higher rates of anxiety and depression (3–5). However, it is not clear whether such an escalation already exists in adolescents with PCOS. In this regard, the present study demonstrated that adolescent girls who suffer from PCOS experience greater anxiety, specifically generalized and social anxieties, as well as greater depression compared to age- and BMI-matched controls. In addition, analysis of all items with the multiple linear regression model revealed that higher BMI was associated with higher levels of depression and generalized anxiety, and higher mFG score with a higher level of panic disorder in adolescent girls with PCOS. This parallel rise implies a potential relationship of depression and some types of anxiety disorders with certain clinical features of PCOS including obesity and hirsutism.

Several studies from different regions of the world showed that women with PCOS are at an increased risk of mood disorders compared to women without PCOS (5). In a recent comprehensive metaanalysis, women affected by PCOS were reported to have about 4 times the odds of depressive symptoms and about 6 times the odds of anxiety symptoms than controls, confirming the potential detrimental effect of PCOS by itself on the psychological

well-being of women with the condition (6). However, most of the studies assessing psychiatric comorbidities of PCOS were conducted in adult populations and only a few studies involving small numbers of PCOS patients have so far assessed the psychological consequences of the syndrome in adolescent girls, with controversial results (17–19). In a quantitative study, Guidi et al. evaluated the psychological aspects of PCOS in girls aged 16–19 years and found that adolescents with PCOS have higher levels of psychological distress and impaired well-being and quality of life compared to their normal counterparts (18). In line with the results of that study, we found significantly higher levels of depression, social anxiety, and generalized anxiety disorders in adolescents with PCOS. Conversely, a study conducted by Ghazeeri et al. failed to demonstrate any relationship of PCOS with anxiety, depression, and psychiatric symptoms in adolescent girls (19). However, small sample size and absence of anthropometric and clinical assessments of participants in that study might have compromised its conclusions.

Typical clinical features of PCOS (e.g., hirsutism) or its comorbidities (e.g., obesity) have been perceived as stigmatizing and a cause of distress by many women with PCOS (4). However, it still remains unclear whether PCOS by itself or the related physical symptoms are the major contributors to the distressing symptoms in women with the condition (20). Previous metaanalyses investigated the impact of BMI and hirsutism on anxiety and depression and suggested that these symptoms have a small or moderate effect on anxiety and depression in women with PCOS (4,6,21). However, the contribution of these clinical symptoms to mood may be more distinct in adolescent girls affected by PCOS. Adolescents are more likely to be dissatisfied with their body and consequently to experience psychiatric problems related with their appearance or size. In this study, the results of multiple linear regression analysis for the PCOS group showed that BMI and mFG score were independently associated with scores of certain

items. BMI appears to have significant effects on depressive status and generalized anxiety disorder but not on the remaining 4 subscales of SCARED. On the other hand, mFG score was found to be associated only with panic disorder. In agreement with the results of adult studies, our findings showed that these manifestations seem to account partially for the association between PCOS and emotional distress in adolescent girls.

Some limitations exist in the current study. First, the study was cross-sectional in design, which may not provide definite information about cause-and-effect relationships. For example, we were not able to assess prospectively whether regression in PCOS or an improvement in the BMI or mFG score leads to a subsequent improvement in the anxiety and depressive states of the adolescent girls with PCOS. Second, psychological parameters were evaluated by self-rating scales; however, clinical interviews are usually considered more precise than self-rated questionnaires in determining the differences between groups. Third, enrollment of patients and controls from two sociodemographically distinct regions of Turkey might have affected the results of the study.

Our findings demonstrate that patients with PCOS exhibit higher levels of depression and certain types of anxiety disorders including social and generalized anxieties already in adolescence. These data suggest that routine evaluation of adolescents affected by PCOS should also entail assessment of mood disorders. Early recognition and proper management of such comorbid psychiatric illnesses in adolescents with PCOS would promote psychological well-being, adherence to required lifestyle changes, and medical treatment. Furthermore, the presence of higher levels of depression and generalized anxiety disorder in patients with higher BMI and the presence of higher levels of panic disorder in patients with higher mFG scores suggest, at least in part, an association between severity of clinical symptoms of PCOS and degree of anxiety and depression in adolescents with PCOS. In this regard, clinicians should take into consideration the effects of weight status and hirsutism on anxiety and depressive states of adolescents with PCOS while designing interventions to improve these mood disorders in young patients with the condition.

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