

Original Research

Health-related quality of life and binge eating among adolescent girls with PCOS

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Abstract

Background: Polycystic ovary syndrome (PCOS) affects 3–8% of adolescents. It is characterized by hyperandrogenism and oligoovulation/anovulation. PCOS has a negative impact on health-related quality of life (HRQoL). However, the extents to which factors influence total HRQoL of adolescents are not known. Adult PCOS patients have a higher incidence of binge eating than the general reproductive-age female population. Limited data on binge eating in adolescents with PCOS are available. Aim of this study was to investigate how PCOS and its associated factors, including binge eating, affect the HRQoL of adolescent girls. **Methods:** This case-control study recruited 63 adolescent girls 13–18 years of age with PCOS and 66 age-matched healthy controls. The PCOS health-related quality of life questionnaire (PCOSQ) and Binge Eating Scale (BES) were used. Multiple linear regression was executed to establish exact predictors and their effect on total HRQoL. **Results:** HRQoL was significantly lower in adolescents with PCOS than controls (4.9 (interquartile range (IQR) 1.5) vs. 5.8 (IQR 0.9) points). The lowest scores were found in the body hair and weight domains. BES results were not significantly higher in the PCOS group than in the control group ($p = 0.727$). The main predictors for total HRQoL were PCOS diagnosis *per se* ($\beta = -1.002$; $p < 0.001$), BES score ($\beta = -0.27$; $p = 0.004$) and body mass index (BMI) percentile ($\beta = -0.007$; $p = 0.013$). **Conclusions:** The lower HRQoL in adolescents with PCOS is attributable to the diagnosis of PCOS, BES score and BMI percentile, confirming the importance of tailoring clinical interventions and counselling to address the domains (i.e., symptoms of hirsutism and weight concerns) causing distress and lowering HRQoL. Further implementation research is required to evaluate the impact of targeted interventions on the HRQoL of adolescent girls with PCOS.

Keywords: PCOS; Adolescents; Health-related quality of life; Binge eating; PCOSQ; Latvia

1. Introduction

Polycystic ovary syndrome (PCOS) is a common endocrinopathy among reproductive-age women, frequently manifesting during adolescence. It has a prevalence of 4.8% up to 16.6% in the general female population, depending on the population studied and diagnostic criteria applied [1]. Its prevalence among adolescents has been reported to be between 3.34% and 8.03% [2]. However, the precise prevalence among adolescents is difficult to establish as the syndrome is often masked by the normal signs of puberty [3].

According to the 2018 guidelines of the European Society of Human Reproduction and Embryology (ESHRE), the PCOS diagnostic criteria for adolescents are biochemical and/or clinical hyperandrogenism and oligomenorrhoea [4]. Additionally, patients often suffer from insulin resistance, metabolic syndrome, increased risk of type 2 diabetes, cardiovascular disease and impaired fertility [4].

PCOS has an impact on emotional wellbeing. Extensive research in adult populations has revealed an increased risk of suffering from a mental disorder (depression and anxiety) and a lower health-related quality of life [4]. Disordered eating and eating disorders (ED) have also been found to be more prevalent among adult PCOS patients than healthy adult females [4]. However, for adolescents, only limited data are available regarding the effect of PCOS on different aspects of health-related quality of life (HRQoL) and disordered eating [5].

The World Health Organization (WHO) defines quality of life as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns [6]. HRQoL is defined as the part of a person's happiness that is affected by their health [7]. Although numerous tools exist to measure HRQoL, the ESHRE 2018 guidelines advise using a disease-specific



questionnaire – the PCOSQ – to evaluate women’s subjective PCOS health concerns [4].

Disordered eating encompasses a wide range of abnormal eating behaviours (e.g., binge eating (BE), fasting, purging, obsessive calorie counting, etc.) with different levels of severity. Disordered eating can be a symptom of an ED. ED are mental disorders defined by abnormal eating habits that negatively affect a person’s physical or mental health [8]. BE is defined as recurrent episodes of excessive food consumption in a discrete period of time, accompanied by a sense of lack of control over one’s eating during the binge. BE is one of the diagnostic criteria of binge eating disorder (BED). BED is the most common ED and PCOS patients have a higher incidence of BED and other ED that include BE (e.g., bulimia nervosa, anorexia nervosa binge-purging type) than the general reproductive-age female population [9]. BE can exacerbate PCOS symptoms. Both PCOS patients and people exhibiting BE tend to be overweight with an increased risk of metabolic complications, infertility and impaired mental health [10]. The BES assesses the extent to which a person experiences BE problems [11].

PCOS starts to manifest at a particularly vulnerable stage of life – adolescence. As this is a period of extreme developmental physical, social and emotional changes, it presents additional challenges for health care providers (HCP) who manage adolescent PCOS patients. Lifestyle modifications are the main treatment for PCOS [4]. Thus, an HCP’s ability to motivate their patient to follow these modifications is extremely important. The best way to achieve this goal is to understand and address the individual needs of a patient and, concomitantly, improve their most important HRQoL domains. It is of the utmost importance to diagnose ED, particularly BE-related ones, as BE behaviour can sabotage a patient’s weight reduction plans. However, when managing patients with disordered eating, it should be borne in mind that an HCP’s insistence on weight reduction may cause worsening of disordered eating symptoms and provoke an even greater impairment of HRQoL and escalation of mental health problems [9,10]. Limited evidence exists in the literature regarding HRQoL and BE in adolescent PCOS patients [12–15].

The aim of this study was to investigate how PCOS and its associated factors, including BE, affect the HRQoL of adolescent girls in Latvia.

2. Methodology

For this case-control study, we recruited adolescents between 13 and 18 years of age, at least a year after menarche, who attended the out-patient paediatric gynaecology clinic at the Children’s Clinical University Hospital, Riga, Latvia. The Children’s Clinical University Hospital is the only specialized children’s hospital in Latvia, providing a whole spectrum of services – both in-patient and out-patient – designed specifically for children up to 18 years

of age. All services are financed by the state budget and gynaecologists are accessible without a referral from general practitioners or other specialists. This allows utilization of services by patients from different regions and socioeconomic backgrounds, thus encapsulating the whole population. Recruitment took place between 1 January 2017 and 30 March 2019. Patients attending the out-patient paediatric gynaecology clinic with oligomenorrhoea were thoroughly examined and recruited into the PCOS group if they fulfilled the diagnostic criteria of PCOS according to the 2018 guidelines of the ESHRE [4]. Patients who had no apparent symptoms were thoroughly examined to eliminate the exclusion criteria (see below). Control group participants were healthy adolescents who attended the same clinic for non-disease reasons, such as seeking contraception counselling or regular health control. The exclusion criteria for both groups were other serious comorbidities (including gynaecological and endocrinological) and use of hormonal medication within the previous six months (as it can impair the clinical symptoms and consequently HRQoL). Meticulous questioning of patient and parent was performed to exclude possible comorbidities. Additionally, revision of available hospital and out-patient electronic medical records for at least last ten years was carried out to exclude possible confounding health factors.

As the diagnostic criteria for PCOS in adolescents were updated during the course of the study – the latest ESHRE PCOS guidelines were published in July 2018 – patients who did not fulfil the new diagnostic criteria were excluded from the study. The study was approved by the Central Medical Ethics Committee of Latvia (protocol no. 1/16-04-12 and 3/21-02-17) and follows Helsinki declaration. All participants gave their signed informed consent. For adolescents under the age of 16, permission was received from their legal guardians (the age of consent for this research was established in conjunction with the Central Medical Ethics Committee of Latvia).

2.1 Diagnostic process

The participants underwent a clinical examination, pelvic ultrasound and blood hormone level measurements. Reproductive and general medical histories were obtained. Body mass index (BMI), waist-hip ratio, modified Ferriman-Gallwey (mFG) score to evaluate the degree of hirsutism, Global Acne Grading System (GAGS) score [16] and menstrual cycle characteristics were assessed in both groups. Oligo/anovulation, hyperandrogenism, PCOM (polycystic ovarian morphology on ultrasound) and hirsutism were defined according to the ESHRE 2018 guidelines [4]. Gynaecological ultrasound was performed by a single examiner using either an HD11 XE (Philips, Amsterdam, Netherlands) or Logiq P5 (General Electric, Boston, MA, USA) ultrasound machine. WHO AnthroPlus software (version 1.0.4., Geneva, Switzerland) was used to calculate BMI and its percentile according to

the normal range for adolescent girls [17]. Weights and heights were measured using standardized measuring devices.

2.2 Measures

After fulfilling the inclusion criteria for one of the two groups, all participants were asked to complete a standardized questionnaire – PCOSQ measuring HRQoL – in either Latvian or Russian, depending on the participant's preference [18]. PCOSQ is a 26-item questionnaire that consists of five domains: emotions (eight items), body hair (five items), weight (five items), infertility (four items) and menstrual problems (four items). The questions are structured to assess PCOS-specific symptoms within the preceding two weeks. Each question requires an answer on a 7-point Likert scale, with lower scores indicating greater impairment of wellbeing. For example, Likert point 1 indicates that the issue addressed in the question is perceived as severe or persists constantly, while point 4 denotes that the issue causes some problems or is problematic some of the time. The highest point 7 signifies that the issue does not cause any problems or is never a concern. PCOSQ has been validated in different patient populations in different languages [19–21]. Cronbach's alpha = 0.912.

BES was used to evaluate BE [11]. It is one of the most widely used and tested questionnaires for BE behaviours in different study populations [15]. BES has previously been validated in the Latvian language in the general population and different patient groups [22]. It consists of 16 questions measuring key behavioural and affective symptoms related to bingeing episodes. Each item contains three or four statements (e.g., I feel capable to control my eating urges when I want to) from which a respondent can choose the single most appropriate answer. Weight is assigned to each response option, reflecting a range of severity for each measured attribute. The total score was interpreted as follows: no or minimal BE (score ≤ 17), mild to moderate BE (score 18–26) and severe BE (score ≥ 27) [23]. Cronbach's alpha = 0.87. The questionnaire was translated from English to Latvian by a native-speaker translator and then corrected by a Latvian native-speaking HCP. The wording of questions was piloted in an adolescent sample, both healthy and PCOS adolescents were included ($n = 20$). Additionally, the questionnaire was translated from English to Russian by a native-speaker translator and then corrected by a Russian native-speaking HCP.

2.3 Statistics

IBM SPSS Statistics 22.0 version (IBM Corp., Chicago, IL, USA) was used for statistical calculations. Medians were used to describe the central tendency as the data were not normally distributed (Kolmogorov-Smirnov test $p < 0.05$). The Mann-Whitney U test and Pearson's χ^2 test were used to evaluate the statistical significance of differences of median values or proportions of independent

variables between the strata of dependent variables. Multivariate analysis was performed using linear regression to detect factors independently associated with HRQoL. Statistical significance was set at $p < 0.05$. The Spearman correlation coefficient (r_s) was used to describe correlations between the groups: $r_s < 0.20$ was considered to be insignificant, $0.20 \leq r_s < 0.40$ a weak correlation, $0.40 \leq r_s < 0.70$ a moderately strong correlation and $r_s \geq 0.70$ a strong correlation [24]. Multiple linear regression analysis with stepwise method (p for entry < 0.05 , p for removal < 0.10) was used to find predictive variables for total HRQoL in the whole study sample. Multicollinearity between variables was excluded by using a correlation matrix; no variables showed an r_s equal to or above the critical value of 0.70 [25]. The variables that showed statistically significant differences between the groups in the univariate analysis were included in the multivariate analysis. Unstandardized β coefficients were calculated as a measure of the effect on the dependent variable. Additionally, R^2 was used to report the percent of the variance explained by the model. Independent predictors entered into the model for total HRQoL were PCOM, sexual activity, GAGS score, BMI percentile, waist-hip ratio, BES score, PCOS diagnosis.

3. Results

In total, 63 adolescent girls with PCOS and 66 healthy adolescent girls participated in the study. The median age of participants in the PCOS and control groups was 16.0 (interquartile range (IQR) 2.0) and 17.0 (IQR 1.0) years, respectively. This difference was not statistically significant ($p = 0.067$). The time from menarche was 4 years in both groups (IQR 3 in case group and 2 in control group, $p = 0.240$). The clinical signs of hyperandrogenism, prevalence of PCOM and characteristics of body composition of all the study participants are summarized in Table 1. PCOS patients had a significantly higher level of hirsutism, median GAGS score and incidence of moderate acne than control subjects. Unfavourable body composition (significantly higher BMI and waist-hip ratio) was observed in PCOS patients. Specifically, approximately one half of PCOS patients (49.2%) were overweight/obese and slightly more than one third (34.9%) had a waist-hip ratio above the critical value of 0.85.

The results of PCOSQ and BES are presented in Table 2. The total PCOSQ score and the results in all the subscales, with the exception of one (menstrual problems), were significantly lower in the PCOS group than in the control group. Despite the PCOS group showing a significantly lower quality of life for the infertility domain than the control group, both groups recorded a high score in this domain (above 6), indicating this particular domain to be of fairly low concern in our adolescent population. The body hair domain had the lowest result (4.0) in the PCOS group. The total BES score and the proportions of girls in all the

Table 1. Clinical signs of hyperandrogenism, prevalence of PCOM and body composition of all study participants (n = 129).

Variable	PCOS group (n = 63)	Control group (n = 66)	p value
mFG score, median (IQR)	10.0 (6.0)	1.0 (2.3)	< 0.001
PCOM, n (%)	22 (34.9)	4 (6.1)	< 0.001
BMI, median percentile (IQR)	89.9 (46.7)	46.9 (46.3)	< 0.001
Overweight, n (%)	6 (9.5)	4 (6.1)	0.090
Obese, n (%)	25 (39.7)	3 (4.5)	< 0.001
Waist-hip ratio, median (IQR)	0.83 (0.1)	0.75 (0.8)	< 0.001
Waist-hip ratio >0.85, n (%)	22 (34.9)	5 (7.6)	< 0.001
Acne gradation	(n = 60)	(n = 64)	
GAGS score, median (IQR)	15.5 (16.0)	6.0 (10.0)	< 0.001
No acne, n (%)	2 (3.3)	7 (10.9)	
Mild acne, n (%)	38 (63.3)	54 (84.4)	0.313
Moderate acne, n (%)	18 (30.0)	3 (4.7)	0.002
Severe acne, n (%)	2 (3.3)	0	0.109

mFG, modified Ferriman-Gallwey scale; PCOM, polycystic ovarian morphology; BMI, body mass index; GAGS, Global Acne Grading System; Statistically significant results are bolded.

BES levels were not significantly different between the two groups.

There was a significantly higher number of sexually active girls in the control group than in the PCOS group; 58.7% (37/63) and 22.6% (14/62), respectively ($p < 0.001$). The age of sexual debut was not significantly different between the two groups; median (years) 15.5 (IQR 2) in PCOS group and 16.0 (IQR 1) in control group ($p = 0.493$). In the PCOS group, the PCOSQ total score did not differ between girls who were sexually active and those who were not.

Possible correlations between PCOSQ domains and their appropriate objective measurements were investigated. Analysing the whole study sample, a significant correlation of moderate strength was found between mFG scores and the body hair domain ($r_s = -0.627$; $p < 0.001$). When the two groups were analysed separately, the correlation persisted in the PCOS group ($r_s = -0.664$; $p < 0.001$), but was absent in the control group ($r_s = 0.007$; $p = 0.959$). Another significant correlation of moderate strength was found between BMI percentile results and the weight domain in the whole study sample ($r_s = -0.633$; $p < 0.001$), the PCOS group ($r_s = -0.561$; $p < 0.001$) and the control group ($r_s = -0.524$; $p < 0.001$). Furthermore, a weak but significant correlation was found between BES scores and the weight domain in the whole study sample ($r_s = -0.288$, $p = 0.001$), the PCOS group ($r_s = -0.342$; $p = 0.007$) and the control group ($r_s = -0.287$; $p = 0.025$).

4. Multivariate analysis

The multiple linear regression analysis for predictors influencing total HRQoL in the whole study sample is shown in Table 3. PCOS diagnosis was also used as one of the predictors. Three different models were generated by the stepwise linear regression analysis for total HRQoL.

Variables were entered into the regression model in the order of their explanatory power. One additional statistically significant variable was added at each step of the regression. Fisher's test (F) shows the overall significance of the model; β (unstandardized β coefficient) measures a unit change in the dependent variable when the independent variable changes by one unit; R^2 denotes the strength of the relationship between the model and the dependent variable; ΔR^2 (R^2 change) represents the proportion of variation in the outcome explained by the independent variable.

Three variables (PCOS diagnosis, BES score and BMI percentile) together explained 40.5% of the HRQoL variance ($R^2 = 0.405$, $F(3, 89) = 21.9$, $p = 0.013$). PCOS diagnosis *per se* ($\beta = -1.002$, $p < 0.001$), BES score ($\beta = -0.27$, $p = 0.004$) and BMI percentile ($\beta = -0.007$, $p = 0.013$) were significant negative predictors for total HRQoL. Other variables (PCOM, sexual activity, GAGS score, waist-hip ratio) added no statistically significant value. PCOS diagnosis was the main variable that explained 29.4% of the HRQoL variance, while BES score and BMI percentile added 7.5% and 3.6% of variance, respectively.

5. Discussion

The lower HRQoL in adolescents with PCOS is attributable to the diagnosis of PCOS, BES score and BMI percentile, confirming the importance of tailoring clinical interventions and counselling to address the domains (i.e., symptoms of hirsutism and weight concerns) causing distress and lowering HRQoL. Infertility showed high HRQoL scores in both groups, indicating that this aspect is of less concern to adolescent girls in Latvia. A significantly higher number of sexually active adolescent girls was found in the control group compared to the PCOS group.

Table 2. PCOSQ and BES results in the PCOS and control groups (among participants with valid answers).

Variable	PCOS group (n = 60)	Control group (n = 66)	p value
PCOSQ results			
PCOSQ total score, median (IQR)	4.9 (1.5)	5.8 (0.9)	< 0.001
Subscale: emotions, median (IQR)	5.1 (1.3)	6.3 (0.5)	< 0.001
Subscale: body hair, median (IQR)	4.0 (2.7)	6.4 (1.4)	< 0.001
Subscale: weight concerns, median (IQR)	4.3 (3.7)	5.6 (2.1)	0.013
Subscale: infertility concerns, median (IQR)	6.3 (1.6)	6.8 (0.5)	< 0.001
Subscale: menstrual problems, median (IQR)	4.5 (1.3)	4.8 (2.1)	0.350
BES results			
	(n = 61)	(n = 64)	
BES total score, median (IQR)	12 (14.5)	12 (17.0)	0.727
No or minimal BE, n (%)	38 (62.3)	41 (64.1)	0.455
Mild to moderate BE, n (%)	15 (24.6)	11 (17.2)	
Severe BE, n (%)	8 (13.1)	12 (18.8)	

PCOSQ, Health-Related Quality-of-Life Questionnaire for PCOS patients; BES, Binge Eating Scale; Statistically significant results are bolded.

Table 3. Multiple linear regression analysis for total HRQoL in PCOS patients and control subjects.

Predictive variable	β	95% CI	p	F	R ²	ΔR^2	p
1st step							
PCOS patients vs. control subjects	-1.162	-1.530; -0.794	<0.001	39.4	0.294	0.302	<0.001
2nd step							
PCOS patients vs. control subjects	-1.117	-1.466; -0.769	<0.001	27.9	0.369	0.080	0.001
BES score	-0.031	-0.049; -0.013	<0.001				
3rd step							
PCOS patients vs. control subjects	-1.002	-1.352; -0.651	<0.001	21.9	0.405	0.042	0.013
BES score	-0.27	-0.044; -0.009	0.004				
BMI percentile	-0.007	-0.013; -0.002	0.013				

BES, Binge Eating Scale; BMI, body mass index; β , unstandardized β coefficient; 95% CI, 95% confidence interval; F, Fisher's test; R², R squared; ΔR^2 , R squared change.

As mentioned above, we found a lower total HRQoL in adolescent PCOS patients than in healthy controls (4.9 (IQR 1.5) vs. 5.8 (IQR 0.9) points in PCOSQ). This is in line with the findings of a recent systematic review of studies examining adolescent PCOS patients [5]. Furthermore, a study by Trent and colleagues also found a lower quality of life in young PCOS patients (13–22 year olds) than healthy controls [26]. Nevertheless, a subsequent publication by the same group on the same study sample reported that HRQoL differences between the two groups disappeared when adjustment for BMI was performed, thus demonstrating the importance of weight in total HRQoL [27]. Two other studies in adolescent PCOS and healthy populations did not find any significant differences in the quality of life between populations [28,29]. Comparison amongst these studies is difficult due to the application of different diagnostic criteria. None of them used the most cited Rotterdam criteria and only this study used the most recent ESHRE criteria specifically devised for adolescent populations. Additionally, different tools were used to measure quality of life, namely Child Health Questionnaire

[26,27], Psychosocial Index [28] and Paediatric Quality of Life Inventory [29], none of which are disease-specific HRQoL questionnaires [4]. Only two small studies have used PCOSQ in adolescent PCOS populations; however, neither of these studies included a healthy control group nor reported the total HRQoL score of the patients' baseline evaluation [12,13]. Thus, total score comparison between the present study and these two studies is not possible.

In our PCOS group, the PCOSQ domains that showed the lowest scores were body hair and weight. Menstrual problems also showed a fairly low score in both groups, reflecting a similar importance to patients and controls (4.5 (IQR 1.3) and 4.8 (IQR 2.1) in the PCOS and control groups, respectively, $p = 0.350$). This is probably due to the young age of participants when menstruation is still a new entity and can cause a degree of distress and concern. The infertility domain score was high among our study participants. This is probably because fertility issues are not of great importance to females at this young age in Latvia. A negative body image, as demonstrated by low scores in the body hair and weight domains, is characteristic of the

Latvian adolescent population. Indeed, 43% of 15-year-old girls in Latvia think they are overweight, when in fact only 13% are overweight or obese (based on WHO growth reference) [30]. This discrepancy corresponds with our finding that more than one third of participants (37.7% and 35.9% in the PCOS and control groups, respectively) had mild to severe BE.

The PCOSQ domains have been reported to be diversely affected in different PCOS populations. For example, young women with PCOS in India disclosed infertility to be the most important domain, followed by body hair [13], whereas it was weight then menstrual problems for obese adolescent PCOS patients from the USA [12]. The low score in the weight domain corresponds with our multivariate analysis finding that BMI is a significant factor in reducing total HRQoL. BMI has been extensively studied as a variable influencing total HRQoL in adult populations [31]. However, only limited information exists regarding this issue in adolescent populations [12,27]. While Trent and colleagues showed that after adjustment for BMI the quality of life of adolescent PCOS patients did not differ from healthy peers [27], Harris-Glocker *et al.* [12] found that BMI was the lowest PCOSQ domain amongst adolescent PCOS patients and HRQoL improved with weight loss.

We found that BE was not more common amongst PCOS patients than healthy controls. However, BE contributed to the lower total HRQoL in PCOS patients even when the variance explained by PCOS diagnosis was controlled. This finding highlights the importance of disordered eating in relation to adolescents' HRQoL. Other researchers have found disordered eating and in particular BE to be more common in adult PCOS patients than healthy counterparts [32]. However, there is limited information regarding BE in adolescent PCOS populations. Mizgier and colleagues reported disordered eating attitudes to be five times more prevalent among 14–17-year-old PCOS patients with increased weight than in PCOS patients with normal weight. Healthy controls were not recruited in this study [14]. Another study examining young patients (15–24-year olds) did not find any differences between PCOS patients and healthy controls. The major limitation of this study was that only lean women were included in the study sample [33], though there is evidence of an increased risk of BE even in lean PCOS patients [34]. Although we did not find an increased BED prevalence in the PCOS group, we did find that if it was present it contributed to a significant decrease in total HRQoL. This emphasizes the importance of detecting BE and addressing it promptly to help improve the wellbeing of patients. Indeed, the high incidence of BE in both groups (37.7% and 35.9% in the PCOS and control groups, respectively) affirms the importance of careful evaluation of all girls in this particular age group.

We observed a significantly higher number of sexually active girls in the control group compared to the PCOS group (58.7% (37/63) and 22.6% (14/62), respectively ($p <$

0.001)). The age of sexual debut was not significantly different between the two groups ($p = 0.493$). A similar finding has been reported from the USA by Trent and colleagues who found that controls were 2.8 times more likely to have had sexual intercourse than PCOS patients, but with no significant difference in the age of sexual debut [35]. This is in line with the already established paradigm that women with PCOS have impaired sexual functioning and relationship building [36]. The sexuality of adolescents with PCOS has yet to undergo in-depth analysis.

This study has several strengths: (i) the composition of the study sample comprising of a rigorously examined adolescent PCOS population and an age-matched control group; (ii) the application of up-to-date diagnostic criteria for PCOS in adolescents; (iii) the mode of recruitment via free-of-charge gynaecologist consultations directly accessible at the national children's hospital, ensuring that the two groups were similar socio-economically and demographically, thereby minimizing the impact of other confounding variables.

The small size of the study sample may have impacted the results. However, as all participants were subjected to strict diagnostic criteria and examination, we believe that the study results are applicable to a broader population. All PCOS patients were newly diagnosed cases. Therefore, in order to validate the HRQoL results (total score and domain scores), the analysis should be repeated after a period of time.

6. Application in practice

The findings of our study demonstrate that PCOSQ should be used in both the research and clinical setting. This is because understanding the problematic aspects of each population and individual is particularly important in building a rapport with the patient and tailoring management of the syndrome to take into account the cultural background, traditions and values of their society. Furthermore, as adolescence is a crucial time for eliciting autonomous motivational systems and incorporating lifestyle habits into daily life [37], improvement of the most worrisome domains will empower young women to take control of their own health and its determinants, the ultimate goal in health education for every person. It is also important for HCP to be aware of the possibility of the presence of undiagnosed ED in PCOS. Overweight adolescents are more likely to use inappropriate weight-control behaviours such as vomiting or laxatives than their peers [38]. However, it should be borne in mind that perpetual counselling on the importance of weight loss can actually cause damage to a patient's mental or even physical health if an ED or inclination to disordered eating already exists. Therefore, HCP should involve a multi-disciplinary team in a patient's management if the slightest suspicion of disordered eating is detected.

7. Conclusions

Total HRQoL is lower in adolescent PCOS patients than healthy peers, with the lowest scoring domains being body hair and weight. The main aspect influencing total HRQoL of adolescents with PCOS is PCOS diagnosis *per se*. The BES score and BMI percentile are significant predictors of HRQoL even when the existence of PCOS diagnosis is controlled. Although BE is not more prevalent in PCOS patients, its effect on total HRQoL in our study sample is clearly demonstrated by multivariate analysis. Further research in this area is required.

Author contributions

Conceptualization—LL, IS, GL and LG; methodology—LL, GL, IS, LG and AK-U; software—LL and IS; formal analysis—LL and AK-U; data curation—LL, IS and AK-U; writing—original draft preparation—LL; writing—review and editing—GL, LG, AK-U, and ID-K; funding acquisition—LG. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The study was approved by the Central Medical Ethics Committee of Latvia (protocol no. 1/16-04-12 and 3/21-02-17) and follows Helsinki declaration. All participants gave their signed informed consent. For adolescents under the age of 16, permission was received from their legal guardians.

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Conflict of interest

The authors declare no conflict of interest.

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