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Original Research Article

Unfolding the Socio-Demographic Determinants and Risk Factors for Polycystic Ovarian Syndrome among Adolescent Girls to Design Social Vaccine in a Tertiary Care Hospital

Sadhika Ganni[1], Ramamani Poluri[2], V.V. Jagadeesh Settem[3], Jayasree Palla[4], Ravi Babu K[5], Satya Saka[6]

[1]Assistant Professor, Department of Dermatology, GSL Medical College & General Hospital, Rajamahendravaram, Andhra Pradesh.
[2]Associate Professor, Department of Dermatology, GSL Medical College & General Hospital, Rajamahendravaram, Andhra Pradesh.
[3]Associate Professor, Department of Psychiatry, GSL Medical College & General Hospital, Rajamahendravaram, Andhra Pradesh.
[4]Associate Professor, Department of Community Medicine, GSL Medical College & General Hospital, Rajamahendravaram, Andhra Pradesh.
[5]Professor & HOD, Department of Pharmacology, GSL Medical College & General Hospital, Rajamahendravaram, Andhra Pradesh.
[6]Professor, Department of Dermatology, GSL Medical College & General Hospital, Rajamahendravaram, Andhra Pradesh.

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Corresponding author: Dr. Jayasree Palla
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Abstract

Background: PCOS is a complex endocrine disorder, most common in women of reproductive age. It may first present in adolescence, and there could be more than one predisposing factor that can contribute for development of PCOS. The aim of the study is to assess the factors associated with PCOS, and relevant risk factors of PCOS among adolescent girls.

Methods: A hospital based cross-sectional study was conducted between March 2022 to May 2022, among adolescent girls, aged 15 to 19 years, attending out-patient departments (OPDs) of Dermatology, Obstetrics and Gynaecology, and Psychiatry, GSL Medical college & General hospital, Rajamahendravaram. An open and closed ended questionnaire was used for the collection of data. Statistical analysis was done by applying Chi-square test and Odds ratio.

Results: The prevalence of PCOS in this study was 10.87 %. Urban residents, undergraduates, youngest born and those belonging to upper socio-economic status, family history of PCOS, childhood overweight or obesity, fast food consumption, less physical exercise and those with waist: hip ratio > 0.85 were significantly associated to PCOS. The odds of exposure to these factors among PCOS group is greater than Non-PCOS group.

Conclusions: PCOS is increasingly encountered during adolescence. Socio-demographic factors associated with PCOS and the risk factors identified should be utilized in designing a social vaccine for modification in diet and life style, to prevent long term metabolic and reproductive complications.

Keywords: Adolescence, Polycystic ovary syndrome, Risk factors

Introduction

Adolescence is the period of transition between puberty and adulthood, and adolescents comprise nearly one-fifth (22%) of the India's total population; The country also has the world's largest adolescent girl population (20%).[1] Polycystic ovary syndrome (PCOS) is a common endocrine disorder with a global prevalence of 5-10% and is an important cause of chronic anovulation in young women.[2] The primary underlying defect in PCOS remains unknown, but key features include insulin resistance, impaired gonadotropin dynamics, and androgen excess.[3] It affects 2.2 to 20% of women in reproductive age group.[4] In India the prevalence ranges from 3.7 to 22.5 % depending on the population studied and the criteria used for diagnosis. The diagnosis of PCOS is difficult as it manifests as a spectrum of symptoms rather than a specific one. The symptoms occur gradually and coincide with the changes that occur in the normal pubertal development, so it is difficult to identify the disorder in young girls.[5] Hence PCOS often goes unnoticed and undiagnosed during adolescent period, except when it manifests as irregular cycles after menarche. PCOS is very diverse in its presentation, it starts at an early age with anovulation, oligomenorrhea, weight gain, hirsutism, and acne, later leads to obesity, insulin resistance, and hyperandrogenism in late puberty.[6] PCOS is associated with long term health disorders such as cardiovascular diseases and diabetes. The exact cause of PCOS is unknown, but it is thought to be multifactorial. It is mostly due to hormonal imbalances that result in altered LH/FSH ratio. The clinical features of hyperandrogenism are related to hyperinsulinemia and insulin resistance. It is not clear to state what are the factors that may predispose a women for development of PCOS, however it was observed in some cases that PCOS is genetic in nature and obesity was found to contribute for hyperinsulinemia there by predisposing individuals for PCOS. [7-9] Risk assessment is the most useful and valuable method in identifying this condition at the earliest. Identification of modifiable risk factors help in the primordial level of prevention of PCOS among adolescent girls, and those with PCOS can seek timely treatment and can prevent the long term complications. Mere identification of factors associated with PCOS is not enough, it has to be followed by a social vaccine, in order to reduce the burden of this challenging silent syndrome among adolescent girls. Many studies estimated the prevalence, and assessed the common clinical features of PCOS in different geographical areas, but there are launae in the area of socio-demographic factors and relevant risk factors associated with PCOS. Through this study an attempt has been made to identify and understand the factors that may predispose an adolescent for development of PCOS; This further helps in designing and administering social vaccine among adolescent girls. Hence, the present study was conducted with an aim to identify the factors associated with PCOS among adolescent girls.

Research Questions:

1. What is the extent of PCOS among adolescent girls attending OPDs (Dermatology, Gynaecology, Psychiatry) in a tertiary care hospital?
2. Is there any association between socio-demographic factors and PCOS; identified risk factors and PCOS among adolescent girls?

Research Hypothesis:

Among adolescent girls with PCOS, certain socio-demographic factors and risk factors will be associated with PCOS.

Objectives

1. To estimate the prevalence of PCOS among adolescent girls aged 15-19 years

2. To determine the socio-demographic factors associated with PCOS

3. To determine the relevant risk factors associated with PCOS

Materials and Methods

Study design: Hospital based cross-sectional study

Study setting: Out-patient departments (OPDs) of Dermatology, Obstetrics and Gynaecology, and Psychiatry, GSL Medical College & General Hospital, Rajamahendravaram.

Study population: Adolescent girls, aged 15 to 19 years

Study participants:

Inclusion criteria: Adolescent girls, aged 15 to 19 years, unmarried, and had attained menarche 2 years before the study.

Exclusion criteria: Adolescents suffering from Thyroid disorders, Cushings syndrome, Hyperprolactinemia, Congenital adrenal hyperplasia, and those not consenting for the study were excluded.

Sample size: A total of 138 adolescent girls attended the OPDs during the study period

Sampling technique: The study participants were recruited by consecutive sampling technique

Study period: March 2022 to May 2022 (3 months)

Study tools

A structured, open and closed ended questionnaire was given to all the participants. The questionnaire consisted of three sections. First section consists of questions on socio-demographic characteristics, second section consists of questions on clinical history, third section includes questions on risk factors, followed by anthropometric measurements. Stadiometer, bathroom weighing scale and measuring tape were used to measure the height, weight, waist and hip circumference of the study participants.

Data collection

A total of 138 adolescent girls were enrolled for the study. The purpose of the study and the process involved in the study was explained to the participant, and the parent or guardian accompanying them. They were assured of the anonymity and confidentiality of the information. Written informed consent was obtained from the study participants with age more than 18 years; assent to participate in the study was given by the adolescents less than 18 years. A pre-designed, pre-validated and pre-tested structured questionnaire was used to collect information from the study participants. At the end, the participants were invited for anthropometric assessment.

Data analysis Descriptive statistics was computed to describe the socio-demographic characteristics of the study participants. Chi-square test was applied to assess the association between: PCOS and socio-demographic factors; as well as PCOS and identified risk factors among the study participants. Odds ratio was calculated to measure the strength of association.

Ethical approval: Permission was obtained from Institutional Ethics Committee of GSL Medical College & General Hospital, Rajamahendravaram.

Operational definition for PCOS: The study subjects were categorized into PCOS-group based on Rotterdam's criteria; It

requires presence of any two of the three features:

1. Oligo/amenorrhea: Absence of menstruation for 45 days or more and/or less than 8 menses per year
2. Clinical hyperandrogenism: Modified Ferriman and Gallway (mFG) score of 8 or higher
3. Polycystic ovaries: Presence of more than 10 cysts, 2-8 mm in diameter, usually combined with increased ovarian volume of more than 10 cm^3, and an echo-dense stroma in pelvic ultrasound scan [3].

Results

Table 1: Socio-demographic profile of the study participants

Socio-demographic variables	n=138	%
Age (Years)		
15-16	26	18.84 %
17-19	112	81.16 %
Place of residence		
Rural	79	57.25 %
Urban	59	42.75 %
Education		
Primary	4	2.90 %
Secondary	49	35.51 %
Higher secondary	45	32.61 %
Undergraduate	40	28.98 %
Religion		
Hindu	96	69.57 %
Muslim	21	15.22 %
Christian	18	13.04 %
Others	3	2.17 %
Caste		
OC	58	42.03 %
BC	48	34.78 %
SC	26	18.84 %
ST	6	4.35 %
Family type		
Nuclear	118	85.51 %
Joint	14	10.14 %
Three generation	6	4.35 %
Family size		
≤ 4	112	81.16 %
5 - 8	26	18.84 %
>8	0	
Birth order		
First born	102	73.91 %
Middle child	12	8.70 %
Last born	24	17.39 %

Socio-economic status		
Upper	29	21.01 %
Upper middle	31	22.46 %
Middle class	37	26.81 %
Lower middle	28	20.29 %
Lower	13	9.42 %

Table 1 shows that majority (81.16%) of the participants were between 17 to 19 years of age, and more than half (57.25%) were from rural area. Only 2.90 % had primary education, and majority (69.57%) were from Hindu background. Major percent (85.51 %) were from nuclear families, and first born were the best part (73.91 %). Socio-economically only 9.42 % belonged to lower class.

Table 2: Clinical features among study participants

Clinical features	**PCOS group (n=15)**	**Non-PCOS group (n=123)**
	n (%)	**n (%)**
Menstrual irregularity	11 (73.33 %)	26 (21.14%)
Alopecia	3 (20%)	13 (10.57%)
Acne vulgaris	10 (66.67%)	42 (34.15%)
Hirsutism	5 (33.33%)	28 (22.76%)
Acanthosis nigricans	4 (26.67%)	23 (18.69%)
Psychological co-morbidity	3 (20%)	9 (7.32%)

Table 2 represents that out of total 138 participants, 15 (10.87%) has PCOS; among PCOS group, majority presented with menstrual irregularity (73.33%) and acne (66.67%). Among Non-PCOS group, most common presentation was acne (34.15%)

Table 3: Comparison of socio-demographic factors between PCOS and Non-PCOS groups

Variables	**PCOS group (n=15)**	**Non-PCOS group (n=123)**	**Chi-square statistic**	**p-value**
Age (Years)				
15-16	2 (13.3%)	24 (19.51%)	0.3338	0.5634
17-19	13 (86.7 %)	99 (80.49%)		
Place of residence				
Rural	1 (6.67%)	78 (63.41%)	17.59	0.00002
Urban	14 (93.33%)	45 (36.59%)		
Education				
Primary	1 (6.67%)	3 (2.44%)	13.83	0.0031
Secondary	1 (6.67%)	48 (39.02%)		
Higher secondary	3 (20%)	42 (34.15%)		
Undergraduate	10 (66.67%)	30 (24.39%)		
Religion				
Hindu	9 (60%)	87 (70.73%)	2.03	0.5645
Muslim	3 (20%)	18 (14.63%)		
Christian	2 (13.33%)	16 (13.01%)		
Others	1 (6.67%)	2 (1.63%)		

Family type				
Nuclear	12 (80%)	106 (86.18%)	0.4365	0.8039
Joint	2 (13.33%)	12 (9.76%)		
Three generation	1 (6.67%)	5 (4.06%)		
Family size				
≤ 4	10 (66.67%)	102 (82.93%)	2.31	0.1284
5 - 8	5 (33.33%)	21 (17.07%)		
Birth order				
First born	5 (33.33%)	97 (78.86%)	21.39	0.00002
Middle child	1 (6.67%)	11 (8.94%)		
Youngest	9 (60%)	15 (12.20%)		
Socio-economic status				
Upper	8 (53.33%)	21 (17.07%)	11.22	0.0241
Upper middle	3 (20%)	28 (22.76%)		
Middle class	2 (13.33%)	35 (28.46%)		
Lower middle	1 (6.67%)	27 (21.95%)		
Lower	1 (6.67%)	12 (9.76%)		

Table 3 depicts Chi-square analysis; it can be interpreted that among adolescent girls, urban residents, undergraduates, youngest born and those belonging to upper socio-economic status were significantly associated with PCOS.

Table 4: Chi-square analysis of risk factors for PCOS

Risk factors	PCOS group (n=15)	Non-PCOS group (n=123)	Chi-square statistic	p-value
History of LBW				
Yes	2 (13.33 %)	13 (10.57 %)	0.1054	0.7453
No	13 (86.67 %)	110 (89.43 %)		
H/o childhood-over weight /obesity				
Yes	9 (60 %)	10 (8.13 %)	30.29	0.00001
No	6 (40 %)	113 (91.87 %)		
Family history of PCOS				
Yes	9 (60 %)	30 (24.39 %)	8.362	0.0038
No	6 (40 %)	93 (75.61 %)		
Diet				
Vegan	4 (26.67 %)	19 (15.45 %)	1.21	0.2709
Mixed	11 (73.33 %)	104 (84.55 %)		
History of fast-food consumption				
≤ 3 days/week	3 (20 %)	76 (61.79 %)	9.539	0.0020
>3 days/week	12 (80 %)	47 (38.21 %)		
No. of years of fast-food consumption				
≤ 1 year	3 (20 %)	83 (67.48 %)	14.03	0.0008
2 years	5 (33.33%)	22 (17.89 %)		
≥ 3years	7 (46.67 %)	18 (14.63 %)		
Physical exercise				
≤ 3 days/week	13 (86.67 %)	25 (20.33 %)	29.48	0.00001

>3 days/week	2 (13.33 %)	98 (79.67 %)		
Distribution according to BMI				
Normal weight	2 (13.33 %)	102 (82.93 %)	37.60	0.00001
Overweight	5 (33.33 %)	12 (9.75 %)		
Obese	8 (53.33 %)	9 (7.32 %)		
Waist / Hip ratio				
<0.85	7 (46.67 %)	114 (92.68 %)	26.20	0.00001
>0.85	8 (53.33 %)	9 (7.32 %)		

Table 4 demonstrates that Chi-square analysis revealed association of PCOS with family history, childhood overweight or obesity, fast food consumption more than 3 days per week, and for more than 3 years, physical exercise ≤ 3 days/week, obesity, and those with waist : hip ratio >0.85.

Table 5: Strength of association between identified Risk factors and PCOS

Risk factors	PCOS group (n=15)	Non-PCOS group (n=123)	Odds ratio	95% CI	p-value
History of childhood-over weight /obesity					
Yes	9 (60 %)	10 (8.13 %)	16.9	5.01- 57.33	0.0001
No	6 (40 %)	113 (91.87 %)			
Family history of PCOS					
Yes	9 (60 %)	30 (24.39 %)	4.65	1.52 -14.13	0.006
No	6 (40 %)	93 (75.61 %)			
History of fast-food consumption					
>3days/ wk	12 (80 %)	47 (38.21 %)	6.46	1.73 - 24.12	0.005
≤ 3days/ wk	3 (20 %)	76 (61.79 %)			
No. of years of fast-food consumption					
>1 year	12 (80%)	40 (32.52%)	8.3	2.21 to 31.07	0.001
≤1 year	3 (20%)	83 (67.48 %)			
Physical exercise					
>3days/ wk	2 (13.33 %)	98 (79.67 %)	25.48	5.39-120.30	0.0001
≤ 3days/ wk	13 (86.67 %)	25 (20.33 %)			
BMI					
Obese	8 (53.33 %)	9 (7.32 %)	14.47	4.27- 49.05	0.0001
Non-obese	7 (46.67 %)	114(92.68 %)			
Waist / Hip ratio					
>0.85	8 (53.33 %)	9 (7.32 %)	14.47	4.27- 49.05	0.0001
<0.85	7 (46.67 %)	114 (92.68%)			

Table 5 shows that there is greater odds of association of PCOS with: childhood-over weight or obesity, family history of PCOS, fast food consumption more than 3 days per week, and for more than 1 year duration, physical exercise ≤ 3days/week, obesity, and W:H ratio > 0.85.

Discussion

In adolescents, the exact prevalence of PCOS in India is unknown due to scarcity of data. Different studies in India on PCOS have reported a lot of variation in prevalence among adolescents; This is due to lack of consensus on diagnostic criteria. In the

present study, the prevalence of PCOS among adolescent girls was found to be 10.87 %; while a study conducted in Hyderabad reported 11.96%; [3] and another study by Nidhi *et al*., [10] reported a prevalence rate of 9.13%. On further division of participants into early and late adolescence, majority (81.16%) were in the late adolescent period, between 17 to 19 years. A similar study done by Biradar and Shamanewadi reported that PCOS was more common in late adolescence.[11]

Among the participants of PCOS group, majority (93.33%) were from urban area. Research by Vidya Bharathi R *et al*., emphasized that the odds of urban women proned to acquiring PCOS are 0.1 times higher than women in rural India.[12] The reasons could be their life style and dietary factors.

Most common clinical presentation among the adolescents was menstrual irregularity (73.33%) and acne (66.67%). Reports indicate that menstrual irregularity in the early postmenarchal years may be an early sign of PCOS. [13] Previous study also found that menstrual irregularity (71%) and acne (64%) were the most common presentations among adolescent girls with PCOS; and further explained that acne is suggestive of androgenic activity.[3]

In the present study, adolescents belonging to upper socio-economic status were significantly associated with PCOS. This finding is consistent with a study conducted in Gujarat, who found that upper class girls are more prevalent to PCOS than other class. [14] Interestingly, Merkin SS *et al*., [15] found that women who experienced low childhood socioeconomic status are at increased risk of PCOS, but the risk is limited to those who have personally attained a high level of education. The association of PCOS with socioeconomic status might throw light on the role of environment in the development of PCOS.

Data regarding birth weight revealed that there is no association between PCOS and birth weight. In contrast to this finding, previous research on birth cohort reported that women with PCOS had lower birth weight compared to control group ($p< 0.001$).[16]

Our results indicate a strong association between childhood obesity and PCOS ($p=0.00001$) A nested case-control study in Northern Finland found that early timing of adiposity rebound, the second BMI rise in childhood at around the age of 6 years, was associated with PCOS diagnosis, independently of BMI.[16]

Questions on family history revealed that majority (60%) of the participants of PCOS group has family history of PCOS. A similar study conducted in Jodhpur reported that about 45.45% had positive family history in first degree relative. [17] Regarding history of fast food intake, consumption with frequency of more than 3 days per week, and for duration more than 1 year was found associated with PCOS. In a qualitative research in Iran, responses by adolescent girls with PCOS revealed history of high consumption of fatty foods, salty foods, unhealthy snacks and sugar-rich foods.[18]

A case control study conducted among Li population of Hainan province, China, found that there is greater odds of association of PCOS with lack of physical exercise (OR=1.8); [19] This finding is comparable with the present study, where PCOS was observed among those with less physical exercise (≤ 3days per week). A case control study from Kolkata reported that Body mass index revealed significantly higher obesity ($P< 0.0001$) in PCOS females compared to non-PCOS females; [20] which is consistent with the present study. Anthropometric measurements revealed that adolescents with

waist-hip ratio above 0.85 have 14.4 times higher risk of developing PCOS against the adolescents whose waist-hip ratio is within 0.85; comparable with this finding, a study in western Maharashtra also reported that the risk of PCOS was 3.59 times higher.[21]

Limitations

First, the sample size of PCOS group was small. Second, as this is a cross sectional study, long term health implications of PCOS cannot be studied. Third, the adolescents need laboratory investigations for further evaluation.

Conclusion

The study findings suggest that the prevalence of PCOS is increasing at a rapid pace in India, it is an emerging disorder associated with many health consequences like hirsutism, acne and menstrual irregularities.

Urban residents, undergraduates, youngest born and those belonging to upper socio-economic status, family history of PCOS, childhood overweight or obesity, fast food consumption more than 3 days per week, and for more than 3 years, physical exercise ≤ 3 days/week, obesity, and those with waist : hip ratio >0.85 were significantly associated with PCOS. Early detection of PCOS, special attention, health education and life style modification is recommended for the adolescents who present with symptoms suggestive of PCOS. A social vaccine which addresses Behaviour Change Communication can be designed, and tailored according to the needs of the adolescents who are at risk of PCOS.

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