

Polycystic Ovarian Syndrome Burden in Central India: A Cross-Sectional Study

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Abstract

Background: Polycystic Ovarian Syndrome (PCOS) is a common endocrine syndrome with the disproportionate activity of androgen. This study is intended to determine attitudes with respect to the present names for the syndrome and acuties held by women regarding the main clinical features of PCOS. The study compares the status of PCOS patients and reproductive-aged tribal women prone to PCOS in the population of Central India at Amarkantak.

Methods: A cross-sectional study was performed in which a sample size of 500 females by random sampling was considered for the study and a well-validated questionnaire following the Rotterdam criteria for the diagnosis of PCOS was administered. Data collected relating to PCOS risk factors and the status of disease burden in society were analyzed using SPSS v 25.

Results: The prevalence of the PCOS was around 6.6% owing to wretched lifestyle practices. Midst them, the risk factors were depression/anxiety in 32.2%, obesity in 28.4%, and diabetes in 7.6% and infertility in 1.8%. 86.6% of people were unaware of the disorder and 41.8% of them were prone to PCOS.

Conclusion: Early detection and tracking of risk factors can help in the management of PCOS symptoms. A population-based program of screening and awareness including treatment modalities may be beneficial for the management of the disease.

Keywords: Polycystic ovarian syndrome; PCOS; Infertility; Hirsutism; Hyperandrogenism.

Introduction

Polycystic Ovarian Disease (PCOD) stands for triad of 'Amenorrhoea', 'Obesity' and 'Hirsutism', relating to reproductive disorders [1]. Henceforth, it is also known as the hyper androgenic disorder, affecting nearly 6-10% of reproductive-aged women and is the most common endocrine metabolic disorder as it can be associated with metabolic concerns like obesity, insulin resistance, hyper-insulinemia and type 2 diabetes mellitus (TD2M) [2]. The disorder can be depicted by hyperandrogenemia (biochemical primarily) and polycystic ovaries (morphological) and PCOD can be associated to risk factors like cardiovascular problems, neuro-psychological effects, endometrial and breast cancers secondarily [3].

Over the last 15 years, the outline of disease status in India in general and mainly in rural India has endured a significant shift. Government of India report in 2001-2003 presented an early suspicion of this change on the causes of death in the country. Deaths in rural India due to communicable diseases (41%), according to the report, correspond to those due to non-communicable diseases (NCDs) (40%). It is evident from the data of WHO that, the total NCD mortality was approximately 40% whereas the premature NCD mortality was 48% [4]. PCOD is now considered as a lifestyle disorder and till date there has been no cause identified for this disorder. Thus, genetic and environmental aspect play a major role in etiology.

Clinical aspects in case of PCOS show a very broad-spectrum criteria for diagnosis. Ovulatory dysfunction cannot be confined by the presence of oligomenorrhoea only, as diagnosis shall be appropriate also when progesterone levels are <3-4ng/mL in 20-24 days of menstrual cycle. In contrast hyperprogesteronemia can also result in anovulation in

at least 2 cycles which can also make the patient anovulatory. Presence of acanthosis nigricans with symptoms of hyperandrogenism also shows to be criteria for diagnosis for PCOS [5]. According to the 2003 Rotterdam PCOS census, women with anovulation can be evaluated with early failure of ovarian considered for low E2 (estradiol test) and high FSH (Follicle stimulating hormone) concentrations and also serum FSH and E2 levels to exclude hypogonadotropic hypogonadism characterized according to the World Health Organization (WHO) classification [6]. Women with PCOS were observed with elevated levels of circulating LH (Luteinizing hormone) as well as it relates to FSH levels [7]. PCOS affected women with frequent risk of developing type 2 diabetes at an occurrence of 3-7 times [8, 9]. There is also a clear evidence of women with PCOS in high risk for developing cardiovascular diseases [10]. Abnormal vascular function (11) and the high chances of incidence to dyslipidemia (12) also risk women affected with PCOS. PCOS patients when assessed show an inverse correlation to metabolic risk factors that are; insulin resistance, BMI, triglycerides, waist-to-hip ratio and total testosterone to Vitamin D and positively correlates to insulin sensitivity (13-15).

Reasons of threat-

Cardiovascular problems

According to the global action plan for the precaution and control of NCDs 2013-2020, that includes 25% relative reduction in premature mortality from cardiovascular diseases, cancer, diabetes or chronic respiratory diseases by 2025 (16). In January 1997, a study held at New-Zealand reported that women who had heart diseases also with 8/>% ovarian cysts, was 42% when compared to women without heart diseases were 22% (17). Henceforth, the conditions in which they live and work

should be recognized and also the lifestyle that influences their health and quality of life should be monitored.

Obesity

It is observed that, 50% of PCOS women are affected by obesity. As per the WHO data till 2016, 39 % of women aged 18 and above are overweight (18). Typically, present in patients who get affected with upper body obesity are found to be linked with menstrual instabilities (19). Earlier the condition of obesity was found to be a cause of PCOS, but now it has been observed to be a modifier of the disorder (20).

Infertility

PCOS has another ambiguous difficulty of infertility as it affects the ovulation and fertility with 75 % < anovulation infertility in women (21). American Society for Reproductive medicine reports that after six months of pregnancy attempt failure once the couple had sexual intercourse more than two times deprived of any contraceptive measures, then infertility in women with PCOS should be examined (22).

This survey depicts the assessment and analysis of PCOS burden in the middle aged-women in Central India. Furthermore, the risk factors related to the disease was evaluated based on the comparative study and the burden of the disease was summarized among the population.

Methods-

The cross-sectional study was performed in the tribal population of Amarkantak region, district Anuppur, Madhya Pradesh, India. Survey material was developed by strictly following the 2003 Rotterdam consensus in this consensus group of scientists and medical practitioner decided that PCOS is a syndrome of ovarian dysfunction, and also shows some key features like polycystic ovary (PCO) morphology and hyperandrogenism. For PCOS single clinical diagnosis criteria is not sufficient such as hyperandrogenism or PCO. Menstrual irregularities, signs of androgen excess, and obesity are some of its clinical manifestations. Insulin resistance and elevated serum LH levels along with risk of having type 2 diabetes and cardiovascular problems are also common features in PCOS (23). After the development of questionnaire, it was tested by presurvey analysis before going for the final administration. A total of 22 questions were asked to 500 female subjects from age group between 15-45 years. This is a survey-based study for the assessment, analysis and awareness program of PCOS in the tribal population. The participants who were included in the survey are students of higher secondary school, colleges/university and women working to earn their living. The reason to select this age group for study is that adolescent girls, and middle-aged women have developed reproductive abilities so chance of getting diagnosed or having PCOS are more in this age group. Children's and women's after menopause, are excluded from the study as they are not having menstrual disturbances or any symptoms of PCOS. The questionnaire prepared was utilized to take interview for data collection by random sampling method and for the study, the local tribal population of Pondki and Lalpur village of Amarkantak region was selected. The study was steered from February to June of 2019. In the first month the questionnaire was framed and validated. Subsequent four months were for the data collection and data analysis. Before going for the survey few hypotheses were framed as follows

- 1) PCOS have become a very major health problem among the young girls as more than 50 % of reproductive-aged girls are prone to PCOS.
- 2) Most of the women suffering from PCOS are associated with infertility, diabetes etc.

- 3) Lack of knowledge and less awareness about PCOS is prevalent in this area.

After hypothesis was framed data was collected by conducting personal interviews and spreading awareness among the population was also carried out simultaneously to the respondents regarding PCOS risk factors after interview. For this study the ethical approval was taken from the institutional ethics committee as ethics are the prime concern, as the data collected regarding the personal aspect of an individual is very confidential and in this project the data was utilized only for analysis and assessment of PCOS, the surveyor obtained consent from the subjects prior to the data collection by assuring confidentiality, to the subject to get their cooperation and explained the purpose of the study and the results were kept confidential. Data regarding socio-demographic profile (sex, date of birth, weight, and height), lifestyle status, nutritional habits, menstrual cycle status (oligomenorrhea), chronic anovulation, diabetes, anxiety/depression, obesity, hirsutism, hyperandrogenism and awareness of PCOS among the population was collected.

While collecting the data medical history was recorded, with clinical, anthropometric, and biochemical (LH, FSH, triglycerides ≥ 150 mg/dL, HDL-C < 50 mg/dL, etc.) parameters and subjects already diagnosed with PCOS on these parameters were assessed to get prevalence of this syndrome in tribal society. As there is no validated tool available for making clinical diagnosis of PCOS in the study, Rotterdam criteria of PCOS was considered and by seeing the clinical report of already suffering patients from PCOS and the symptoms of PCOS in population, we have come to conclusion for prevalence of PCOS and Prone to PCOS among the population. After the analysis the participant likely to have PCOS were asked to go for further clinical and ovarian ultrasound examination under the supervision of gynecologist for detailed diagnosis of the disease and the girls with BMI more than 23 kg/m^2 were asked for dietary interventions along with counselling for PCOS. The data of weight and height was analyzed to get BMI (Body Mass Index) of the population using the formula of BMI preferred by CDC (Centers for Disease Control & Prevention) (24) as given below:

Formula: $\text{weight (kg)} / [\text{height (m)}]^2$

Calculation: $[\text{weight (kg)} / \text{height (cm)} / \text{height (cm)}] \times 10,000$

After the BMI calculation using the formula given by CDC, it was analysed according to CDC criteria for Adult BMI range the BMI Less than 18.5 kg/m^2 was considered as underweight; 18.5 kg/m^2 to 24.9 kg/m^2 , it falls within the normal or Healthy Weight range; 25.0 kg/m^2 to 29.9 kg/m^2 , falls within the overweight range; 30.0 kg/m^2 or higher is within the obese range (25). The data was entered in MS Excel spreadsheet as well as in SPSS spreadsheet and analyzed based on comparison of age with hirsutism, menstrual cycle, and disease status; comparison of risk factors with disease status; and finally validation of the framed hypothesis using mean and proportion, Chi square test, ANOVA (One way ANOVA), and Student t-test (Independent sample t-test) analysis was performed with the help of statistical software SPSS v.25 and p-value of < 0.05 was examined as significant.

Results

The study shows a socio-demographic profile of 500 women, from which the mean age and mean BMI of the participants were $23.6 (\pm 1.4)$ years and $22.5 (\pm 4.6) \text{ kg/m}^2$ respectively. A total of 10 patients claim to have PCOS with an average BMI of $30.85 \text{ kg/m}^2 (\pm 2.8)$. With respect to further investigation $28.4\% (\pm 0.4\%)$ were reported to be obese. Depression and anxiety were present in $32.2\% (\pm 0.4\%)$, diabetes existed in $7.6\% (\pm 0.2\%)$ and $1.8\% (\pm 0.1\%)$ was reported with infertility (Table 1).

Variables	Mean	
Age	23.6 years	
BMI	22.5 kg/m ²	
PCOS Patients BMI	30.85 kg/m ²	
Risk Factor	Frequency (%)	P-value
Obesity	142 (28.4%)	.000*
Depression/anxiety	161 (32.2%)	.000*
Diabetes	38 (7.6%)	.000*
Infertility	9 (1.8%)	.000*

*Statistically significant difference

Table. 1- Socio-demographic and distribution of PCOS risk factors profile

From the study, it was estimated that 14.8% ($\pm 0.5\%$) were adolescent girls in the age group of 15-20 years whereas 24.4% ($\pm 0.5\%$) of young girls were in the group of 21-25 years who were prone to PCOS. It was also evident from the study that the frequencies of subjects having PCOS were 1.8% ($\pm 0.9\%$) in the group of 15-20 years of age and 3.2% ($\pm 0.9\%$) in the age group of 21-25 years which was comparatively higher to other sets of age (Table 2).

Age		Frequency (%)	P-value
15-20	Has PCOS	9 (1.8%)	.000*
	Prone to PCOS	74 (14.8%)	
21-25	Has PCOS	16 (3.2%)	
	Prone to PCOS	122 (24.4%)	
26-30	Has PCOS	3 (0.6%)	
	Prone to PCOS	13 (2.6%)	
31-35	Has PCOS	3 (0.6%)	
	Prone to PCOS	--	
36-45	Has PCOS	--	
	Prone to PCOS	--	

*Statistically significant difference

Table. 2- Comparative analysis of Age group with PCOS status

From our analysis 12.6% ($\pm 0.8\%$) of girls in the age group of 15-20 years and 23.8% ($\pm 0.8\%$) of girls in the age group of 21-25 years suffer from menstrual disturbances. It is also evident that a very less proportion do suffer from menstrual problems in the age group of 26-30 years, that is just 5.8% ($\pm 0.8\%$) and much less in case of 31-35 and 36-45 years of age group, 1.6% ($\pm 0.8\%$) and 1.2% ($\pm 0.8\%$) respectively (Table 3).

Age	Menstrual cycle	Frequency	Percentage (%)	P-value
15-20	Irregular	63	12.6	.037
	Regular	48	9.6	
21-25	Irregular	119	23.8	
	Regular	138	27.6	
26-30	Irregular	29	5.8	
	Regular	54	10.8	
31-35	Irregular	8	1.6	
	Regular	22	4.4	
36-45	Irregular	6	1.2	
	Regular	13	2.6	
Total		500	100	

Table. 3- Comparative analysis of Age group with Menstrual cycle

It was stated that girls had the occurrence of hirsutism in 10.32% ($\pm 0.8\%$) and 27.74% ($\pm 0.8\%$) in the age of 15-20 years and 21-25 years respectively. Comparatively a lesser section has hirsutism with 6.45% ($\pm 1.08\%$) and 1.93% ($\pm 1.08\%$) in the set of 26-30 and 31-35 years of age respectively. The lowest fraction was for the age group of 36-45 years which had only 0.64% for the occurrence of hirsutism (Table 4).

Table-4: Comparative analysis of Age group with Hirsutism

Age	Hirsutism	Frequency	Percentage
15-20	YES	52	10.4
	NO	58	11.6
21-25	YES	138	27.6
	NO	119	23.8
26-30	YES	32	6.4
	NO	54	10.8
31-35	YES	9	1.8
	NO	19	3.8
36-45	YES	3	0.6
	NO	16	3.2
Total		500	100

Table. 4- Comparative analysis of Age group with Hirsutism

Finally, our study results show that burden of PCOS status in this particular region is projected quite seriously as 6.6% ($\pm 0.6\%$) of the total population, and just 13.4% ($\pm 0.3\%$) of the total population has the

proper awareness about the PCOS when the majority of 86.6% ($\pm 0.3\%$), yet unaware about the pros and cons of this disorder, 41.8% ($\pm 0.6\%$) of the population is shown to be prone to PCOS (Table 5).

Table-5: PCOS burden and its awareness status among the population

Variables		Frequency	Percentage	P-value
PCOS Burden	YES	33	6.6	.000*
	PRONE	209	41.8	
	NO	258	51.6	
Awareness of PCOS	YES	67	13.4	.000*
	NO	433	86.6	

*Statistically significant difference

Table. 5- PCOS burden and its awareness status among the population

In the comparative analysis of lifestyle factor with PCOS it can be stated that the subjects with pathetic lifestyle practices are prevalent to PCOS (Figure 1).

Comparison of Lifestyle with PCOS burden in society.

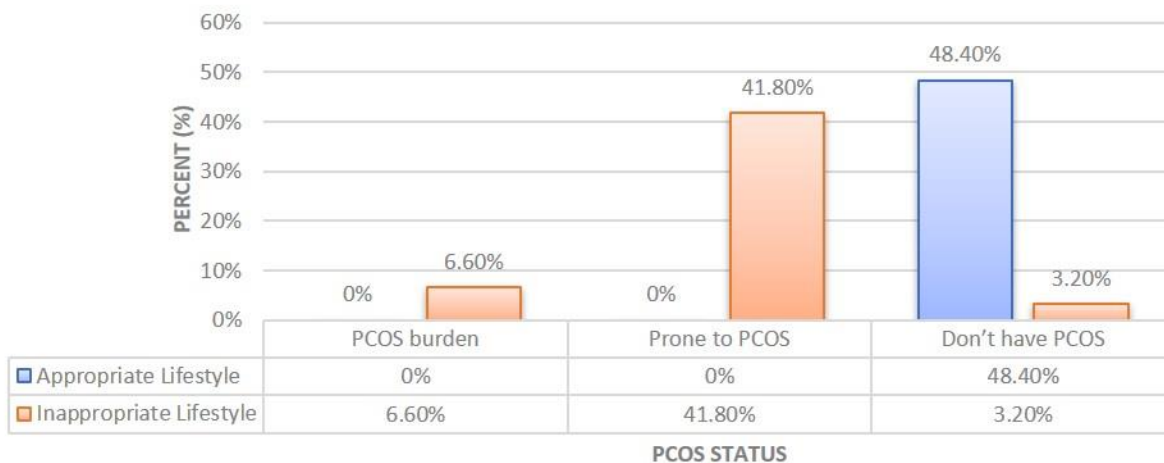


Fig. 1- Comparison of Lifestyle with PCOS burden in society.

Discussion

India has witnessed about 30% rise in PCOS cases in the last couple of years. Lack of knowledge and lifestyle changes are considered to be the major factor leading to this phenomenon (26). Hence, PCOS have startled more than half number of the adolescent and young aged girls who are becoming susceptible. Girls of adolescent age group (15-20 years) are likely to get affected with PCOS (27). The prevalence of PCOS was found generally in young and reproductive aged women was assessed (28).

From the current study the risk factors are found to be more prevalent in reproductive aged women comparatively in a higher proportion, especially in the case of overweight and obesity, have a higher negative impact on the quality of their life (29). This concern was indeed raised to be more fatal than other problems like the menstrual instabilities (30). In the present study, 28.4% girls of from the total count reported to be obese and 10.4% and 27.6% in the age of 15-20 years and 21-25 years respectively were hirsute which are linked to raise levels of testosterone

and presence of PCO on ultrasound (31). In case of overweight earlier studies prove that minimal loss of 5% of weight has shown to stabilize the menstrual disturbances and also accordingly alleviates the mental well-being. Hence, medical conditions of patients of PCOS can be enhanced by controlling the weight of individuals (32).

In the current study the problem of high incidence of hirsutism in most of the reproductive aged-women have shown to concern with greater emotional issues like mood swings, low esteem, worried and depressed feeling (33). Even though menstrual concerns (34, 35) and hirsutism (36) were risk factors for PCOS, but infertility too contributed to be a more cautious feature to the weakened quality of life (37).

The primary stage is proper awareness and diagnosis to improve the life of patients. Accurate alertness regarding the PCOS is much less as is only prevalent in 6.6% of the total population. Morbid lifestyle practices can be controlled to an extent by screening and inducing early

interventions and endorsing a healthy lifestyle approach to halt the rise of PCOS as an emerging disorder in adolescent and young girls (38).

Conclusion

PCOS is a common hyper androgenic disorder that are found in a large number of the Indian population with exact etiology unfamiliar but pathophysiology rooted in insulin resistance, hyperandrogenism, and chronic anovulation. From this study it can be concluded that young woman of the population is having higher prevalence of PCOS. Though the major part of population is not suffering from PCOS, but higher percent is prone to this disease just because they have bad lifestyle, the main reason of bad lifestyle is their socio-economic condition as demonstrated in other study conducted to access the lifestyle parameters in this same locality by Singh et al. in 2019 (39). Current study has spread awareness among the female population about PCOS and their risk factors. We have also tried to guide the women having the risk of developing PCOS for proper diagnosis and treatment under consultation of a gynecologist. To treat PCOS, consume healthy diet, stay physically active, and it's accompanied by added medications to treat the symptoms.

Periodic screening of the candidates with positive family history of PCOS and precise initial diagnosis at early age will help the girls to live healthy life and prevent them from further health hazard.

Hence emphasis should be given on spreading awareness among the girls for lifestyle modification intended for weight loss if BMI is more than 23, dietary interventions along with counselling of village women's for visiting government hospitals for regular checkups if they feel these symptoms of the disease. Further there are many biological materials (peptide nucleic acids (PNA), xeno-nucleic acids (XNA), threose nucleic acid, locked nucleic acid (LNA), morpholino, etc.) which can be used for making diagnostic devices for point of care diagnosis and treatment of this type of disorders (40, 41).

Limitations of the study-

Observatory study to identify menstrual intervals were not performed. The patients were not screened using clinical tools on biochemical parameters for PCOS such as LH, FSH, triglycerides, HDL-C, etc. This study is based on only questionnaire which is well validated and is strictly based on parameters to assess PCOS burden in society. Study has an issue relating to socio-cultural aspect as this problem is related with steroidal disturbance, infertility in women's, menstrual disturbances, etc. and these things in tribal societies are considered as taboo in the area, so collecting data was a very difficult task for the investigator along with this problem, language was also a barrier but both the problems were overcome by convincing the tribal women's of this region by talking to them in the language they are comfortable in, about this issue of PCOS by giving them knowledge about the world and Indian scenario of this syndrome, its unknown etiology, and it's pathophysiology. They were convinced to adopt a healthy lifestyle by consuming nutritious food and becoming physically active to overcome the symptoms which can later result into this syndrome.

Author Statements

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- **Author Contributions-** Dr. Parikipandla Sridevi has designed the study and helped in analysis of data and writing the manuscript. Kshitij RB Singh has contributed to collection of

data, data interpretation, literature search, and writing. Sree Lekshmi K. K. contributed to Literature search and writing. Diptimayee Manasingh and Srusti Badajena contributed to data collection.

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- **Informed consent-** Informed consent was obtained from all individual participants included in the study.

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