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Prevalence of PCOS among female young adults in Coimbatore and its association with age, BMI, physical activity and energy intake

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Abstract
PCOS stands for Polycystic Ovary Syndrome, which is a hormonal disorder in women of reproductive age. Polycystic ovarian syndrome (PCOS) is a leading cause of infertility among women throughout the world. The study was aimed to assess the prevalence and create an awareness among young adult women to prevent from PCOS. This was a prospective study that included 400 young adult women aged between 17 to 25 years. The validated questionnaire was used to find out the sociodemographic profile, anthropometry, menstrual history, dietary pattern and physical activity. Results indicated that 30% were underweight, 20% overweight, and 5% obesity grade I category. Dietary assessment for selected subjects 50% skips their meals due to lack of time, 21% due to lack of appetite, 20% due to food aversion, 9% due to lack of availability. The subjects had the habit of doing physical activity 23% weekly 5days, 9% weekly twice or thrice, 4% rare, 64% no physical activity. The mean nutrient intake of energy, carbohydrate, protein, fat, iron, fibre and calcium was compared with RDA which shows that calcium & iron were found to be deficit whereas intake of fat found to be excess. I was evidenced that age, Body Mass Index (BMI), physical activity and energy intake are not significant (P<0.005) for developing PCOS. By using the prepared PCOS pamphlet as an educational tool, personalized counselling given to the study subjects to create awareness and to help the subjects with PCOS to manage the symptoms.

Keywords: anthropometry, dietary assessment, PCOS, personalized counselling, and physical activity

Introduction

Polycystic ovary syndrome (PCOS) is a complex endocrine disorder affecting 8% to 13% of reproductive-aged women globally (Bozdag *et al*., 2016) [4] making it a key public health burden. Women with PCOS are at an increased risk of adverse reproductive, metabolic, psychological, oncological, pregnancy, and long-term offspring metabolic and developmental disorders, which impair their quality of life (Dokras *et al*., 2018; Wattar *et al*., 2020) [6, 1] in addition to straining health and economic resources. Despite the adverse outcomes associated with PCOS, it is estimated that up to 70% of PCOS cases remain undiagnosed (March *et al*., 2010) [15].

Although the high ratio of luteinizing hormone (LH) to follicle-stimulating hormone (FSH) and increased frequency of gonadotropin-releasing hormone (GnRH) is known as the underlying causes of PCOS, the exact etiology and pathology have not been comprehensively well-known. Evidence suggests the role of different external and internal factors, including insulin resistance (IR), hyperandrogenism (HA), environmental factors, genetic, and epigenetics (Glueck and Goldenberg, 2019. In addition, it is worth mentioning that PCOS increases the risk of further complications like cardiovascular diseases, type 2 diabetes mellitus, metabolic syndrome, depression, and anxiety (Damone *et al*., 2019) [5].

PCOS remains a syndrome and as such, no single diagnostic feature is sufficient in itself to establish the clinical diagnosis. Jabeen *et al*., (2022) [9] in their study out of the total 250 participants included, the mean age was 16.96 years and most participants (78%) belonged to the age group of 13 to 19 years. Most (78%) of the study participants had normal BMI (18-24.9 kg/m2), 17.6% were underweight (BMI < 18), and 4.4% were overweight (BMI > 25). A PCOS prevalence rate of 6.8% was noted among the study participants. A majority (78.4%) of the study participants were unaware of PCOS, and 6.8% were being treated for PCOS. The source of knowledge of PCOS was majorly teachers (37%), followed by doctors (31.5%), the internet (11%), and friends (7.5%). Lack of information and publicity (63%) were found to be the most significant reason for low levels of awareness.

The clinical features of PCOS are heterogeneous and may change throughout the lifespan, starting from adolescence to postmenopausal age. Polycystic ovary syndrome consist of chronic anovulation, menstrual disturbance, hyperandrogenism, polycystic ovaries, obesity and metabolic syndrome. 10-11 Most of the late complications of PCOS are related to insulin resistance (Azziz, 2007) [3]. The exact prevalence of PCOS is not known and not defined precisely as well as depends on the choice of diagnostic criteria. The study was planned with the objectives to find out the prevalence of PCOS amongst college girls from selected colleges of Coimbatore and to study the association between body mass index (BMI), dietary intake and PCOS.

Methodology

The study was a cross-sectional study, conducted on girls aged 17–25 years for a duration of 6 months from July 2022 to December 2022. This study included 400 college girls around Coimbatore using purposive sampling. All the girls aged 17–25 years, who had attained menarche before the study, who were unmarried and willing to participate, were included in the study. Informed consent was taken from all the study participants. Study participants were screened for PCOS using a semi-structured questionnaire using

Rotterdam criteria. Rotterdam criteria include presence of two of the following three criteria, i.e., (i) oligo/anovulation, (ii) hyperandrogenism-clinical (hirsutism or less commonly male pattern alopecia) or biochemical (raised FAI or free testosterone), (iii) polycystic ovaries on ultrasound. Other etiologies must be excluded such as congenital adrenal hyperplasia, androgen secreting tumors, Cushing syndrome, thyroid dysfunction, and hyperprolactinemia. Data regarding sociodemographic information, menstrual history, acne and facial hair were entered in the questionnaire. Anthropometric assessment was done by using a measuring tape, weighing scale, and stadiometer. The students were sensitized about PCOS and importance of diagnosing PCOS using pamphlet. Non-invasive sonographic scanning was done to identify polycystic ovaries. Data was compiled using MS Excel and analyzed using appropriate statistical test (chi-square test) using SPSS version 20.

Results and Discussion

1. Sociodemographic profile of the college going girls.

The mean age of the study group came out to be 21.6 years, out of which 40% belong to 17-19 years, 52.5% were 20-22 years and 7.5% were between 23-25 years of age. Nearly 43.75% were undergraduates, 51.25% postgraduates and only 5% were research scholars. In our study almost 60% were hostellers and 40% were day scholars.

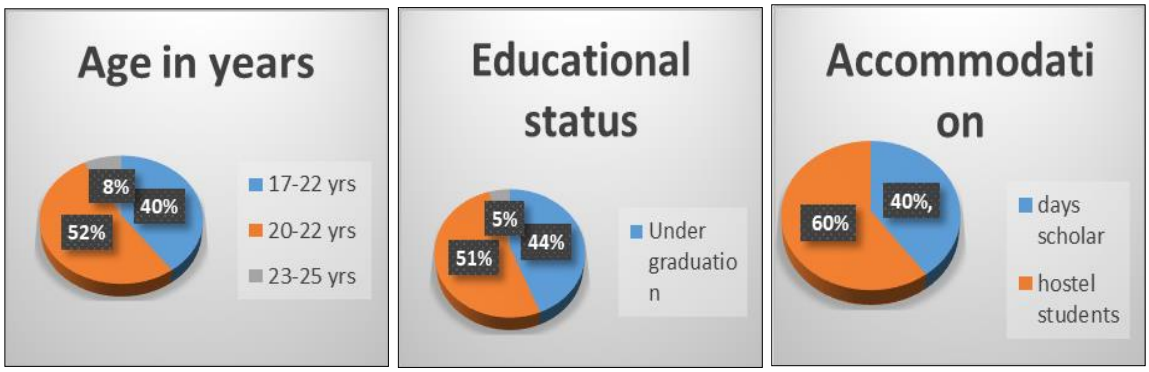

Fig 1: Sociodemographic profile of the college going girls

2. Anthropometric Status of all the Selected Subjects as Indicated by BMI

The mean height of the selected subjects was 152.6 ± 4.75cm, weight 54.21 ± 8.47kg and the computed mean BMI 24.17 ± 3.04 kg/m2. The subjects were with mean waist circumference 93.6 ± 4.08cm, hip circumference 99.65 ± 4.59cm and waist to hip ratio was 0.94 ± 0.04. Obesity is one of the major risk factors for diabetes, yet there has been little research focusing on this risk factor across India. Despite having lower overweight and obesity rates, India has a higher prevalence of diabetes compared to western countries suggesting that diabetes may occur at a much lower body mass index (BMI) in Indians compared with Europeans. Therefore, relatively lean Indian adults with a lower BMI may be at equal risk as those who are obese.

Table 1: Anthropometric status of all the selected subjects indicated by BMI

S. No	BMI status	Criteria	No of subjects (n=400)	
			No	%
1.	Underweight	< 18.5	122	30.5
2.	Normal	18.5-24.9	176	44
3.	Over weight	25-29.9	82	20.5
4.	Obesity grade I	30-34.9	20	5
5.	Obesity grade II	35-39.9	-	-
6.	Obesity grade III	>40	-	-
Total			400	100

From the above table-1 it was clear that 30.5% of the selected subjects were underweight, 44% were under normal BMI category, 20.5% were overweight and five percent were grade I obesity. Deepika *et al*., (2020) [13] in their study revealed that out of total, 18 percent girls were overweight followed by 24 percent who were grade I obese then 12 percent who were grade II obese whereas, 32 percent of girls were having normal BMI.

Dietary assessment of the selected girls

1. Diet pattern

Among the selected subjects 18% (72) were vegetarian, 70% (278) non-vegetarian, five percent (21) lactovegetarian and 7% (29) were ova vegetarian. Nearly 52% (108) of the students skips a meal per day. Among 108 students 44% skipped breakfast, 8% skipped lunch and 48% skipped dinner. The reason for skipping meals was displayed and discussed below in table-2 depicts that among the 208 subjects who skipped their meals recorded the reasons as lack of time by 50%, lack of appetite 21%, lack of availability 9% and nearly 20% reported as food aversion. The information regarding frequency of skipping meals was also recorded for 208 subjects. It reveals that nearly 11% skipped meals daily, 52% skipped meals weekly 3-4 times, 31% skipped weekly once and six percent skipped meals rarely.

Table 2: Reason for skipped meals

S. No	Reason for skipped meals	No of subjects (n=208)	
		No	%
1	Lack of time	104	50
2	Lack of appetite	44	21
3	Lack of availability	18	9
4	Food aversion	42	20
Total		208	100

2. 24 hours diet recall

The selected subjects were interviewed their food intake by 24hrs diet recall, the information was collected and the daily nutrients energy, protein, fat, carbohydrates and fibre was calculated which is presented in table-3 which reveals that the mean daily intake of calories, protein, fat, fiber, calcium and iron of the participants which were assessed using 24 hour's recall method.

Table 3: Nutrient intake per day by 24hr diet recall of selected subjects (n = 400)

S. No	Nutrients	*RDA	Nutrient intake (Mean ±SD)	Consumption excess or deficit
1	Energy (Kcals)	1660	1553± 342	Deficit 107
2	Protein (g)	45.7	40±9.5	Deficit 5.7
3	Fat (g)	20	28±8.4	Excess 8
4	Carbohydrate(g)	130	201±26	Deficit 71
5	Fibre (g)	25	11.5±3.4	Deficit 13.5
6	Iron (mg)	29	18±2.3	Deficit 11
7	Calcium (mg)	1000	285±102	Deficit 715

*Recommended Dietary Allowances (2020) for Indian sedentary woman and man

Compared with Recommended Dietary Allowance, the average intake of calories (1553±342 kcal), protein (40 ±9.5 g), fiber (10±3.2g), calcium (285±102 mg) and iron (18±2.3mg) were found to be deficit whereas intake of fat (28±8.4g) was found to be excess. Hence, the mean nutrient intake among the subjects was very low than RDA. Similar study by Kaur (2021) [11] revealed the nutrient intake of the college girls. The daily mean intake of carbohydrates, protein and fat was found to be 168.2gm, 30 gm and 20 gm respectively. These figures did not satisfy the RDA standards and attributed to the low-calorie intake by the subjects i.e. 973 kcal per day. The observation showed that the daily Iron, Vitamin C and calcium intake of the subjects was 17.4 mg, 32.1 mg and 204 mg respectively which was very less than RDA. The low consumption of nutrients was the root cause of the prevalence of anemia and low weight among these girls. Saxena *et al*. (2016) in a study on college girls also found that daily intake of nutrients like calories, protein, iron, calcium, vitamin A, vitamin C, vitamin B1 and vitamin B2 was statistically and significantly low as compared to RDA.

Physical activities and lifestyle pattern of the study subjects

It was found that 92 subjects (23%) were involved in regular physical activity for 20 to 30 minutes. Additionally, 34 subjects (9%) undergo physical activity twice or thrice in a week, 16 subjects (4%) rarely involve in physical activity and it was awful that about 258 subjects (64%) were not involved in any of the physical activities. Among 92 subjects who involve in regular physical activity, 42 subjects were engaged in walking, 12 subjects undergo brisk walking, 18 subjects were involved in exercises, 16 subjects done yoga practices and only 2 subjects were involved in gym workouts and dancing respectively.

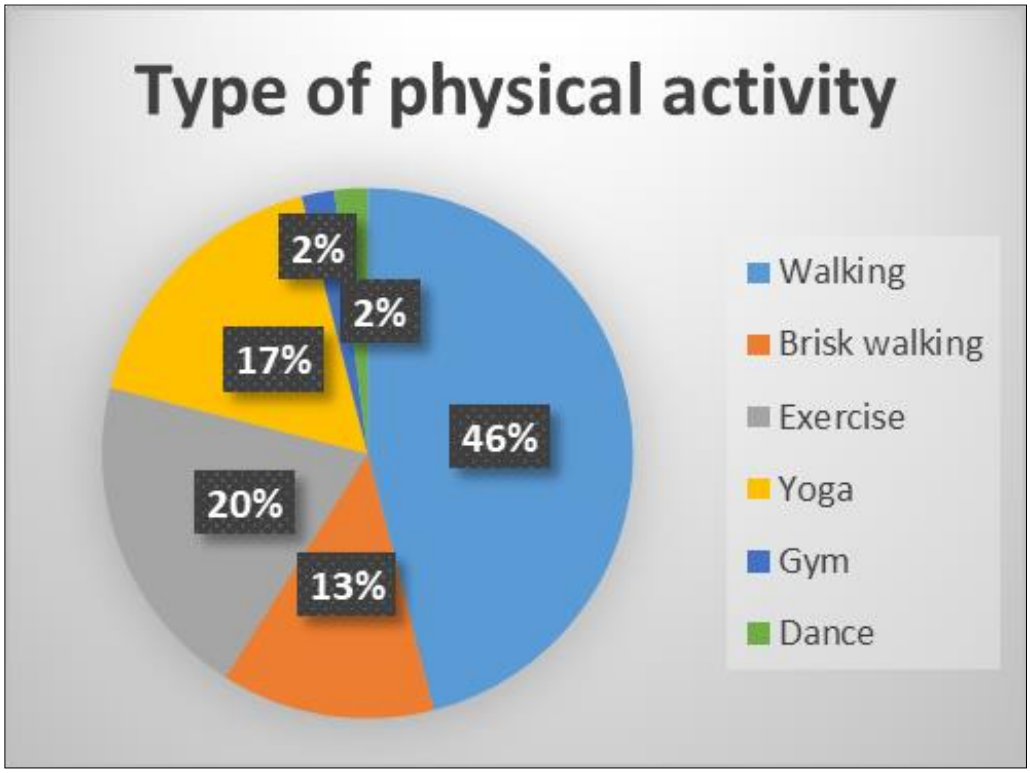

Fig 2: Physical activities pattern of the study subjects

Menstrual history of selected subjects

The mean age of menses among the selected girls was 12.2±1.8 years. Majority of the girls (64%) were unaware of PCOS. Only two percent of the selected subjects were with hypothyroidism, one percent with fatty liver, four percent with hypertension and three percent reported that they had sinus problems. The below table depicts the menstrual symptoms faced by the selected college girls during menses.

Table 4: Menstrual symptoms of the college going girls

S. No	Symptoms	No of subjects (n=400)	
		Frequency	Percentage
1	Tolerable pain during menses	209	52
2	Intolerable pain during menses	191	48
3	Irregular Cycles	154	39
4	Excessive gain in weight	54	14
5	Excessive facial hair	85	21
6	Acne	124	31

From the above table-4, it is as clear that 52% of the girls experienced tolerable pain during menses, 48% of the subjects experienced intolerable pain during menses. Nearly 39% of them had irregular menstrual cycles, 14% of them suffered with excessive weight gain, 21% of the subjects developed excessive facial hair and 31% of them had acne problems. Gupta *et al*, (2017) in their study among the 840 girls, 217 (25.5%) complained of irregular menses, out of 217 only 96 (44%) were approached for ultrasonography (USG) screening. PCOS was present in 77 (80.2%) girls out of 96 girls screened with USG. Also, PCOS was present in 43.2% girls with BMI >25 and 50.8% girls having waist-hip ratio more than 0.96.

Table 5: Confirmed cases of PCOS

S. No	PCOS suspects finding	Present	Absent	Total
1	Irregular menses (>35 days)	154	246	400
2	Hirsutism	85	315	400
Out of 154 who had irregular menses, 107 were approached for screening				
1	USG finding of multiple cysts	86	21	107
Confirmed cases of PCOS found to be 86				

In the present study, it was found that, with respect to PCOS prevalence, 154 subjects had irregular menstrual cycles for more than 35 days and 85 subjects had hirsutism problem. From these 154 subjects who had irregular menses, 107 subjects were approached for screening poly ovarian cysts using USG. It was found from the screening that 86 subjects had multiple cysts and these subjects were the confirmed cases of PCOS. In a hospital-based study conducted by (Kalavathi *et al*.,2015) [10] in Bangalore, prevalence of PCOS was 23.8%. According to a prospective study conducted by Nidhi *et al*., (2011) [12] on 460 girls aged 15–18 years in a residential college in Andhra Pradesh, South India, the prevalence of PCOS was found to be 9.13% in adolescents.

Table 6: Association of PCOS with various factors

Factors	PCOS Present	PCOS Absent	Total	Correlation
Age 17-25 years	86	314	400	-0.345
BMI Overweight and obesity	54	48	102	-0.122
Normal	28	148	176	
Underweight	4	118	122	
Regular physical activity	8	138	146	-0.234
No physical activity	78	176	254	
Energy intake < 1900	55	151	206	-0.156
Energy intake >1900	31	163	194	

From the table 6, it was found that only 86 subjects were confirmed of having PCOS condition belonging to the age group of 17-25 years. Thus, age is not significant for developing PCOS. The subjects with BMI category of overweight and obesity found with PCOS were 54. Thus, BMI has little impact on developing PCOS ($P<0.005$). Additionally, it was observed that subjects with normal BMI found with PCOS. Although obesity is a common characteristic in PCOS, it is not present in all cases. At the same time, females with normal BMI and underweight condition are also prone to PCOS. Hoque *et al*., (2021) [2] reported in their study that the percentage of Insulin Resistance (IR) was 60% in the study. Mean age of PCOS patients was 30.6 ± 0.65 years. Obese PCOS patients with insulin resistance were 46% and overweight PCOS patients with IR were 48% in the study. There were also significant positive association of IR with increased BMI and waist hip ratio. Additionally, 0.6% non-obese PCOS patients showed IR in the study cases. In the present study only 8 subjects who are doing physical activity had developed PCOS condition. Regular physical activity may help in preventing PCOS. Lack of physical activity will have a huge impact on PCOS since 78 subjects with no physical activity had developed PCOS condition. The consumption of sufficient calories may contribute in escaping the prevalence of PCOS as 31 subjects who consumed more than 1900 calories had PCOS which is comparatively low than those who consumed less than 1900 calories as it was 55 subjects.

Provision of nutrition education to the selected subjects

The pamphlet designed by the investigators covers about the cause, symptoms, healthy lifestyle patterns, importance of diet and yoga asanas to be followed which was helpful for the subjects to manage PCOS symptoms. Dietary interventions as a first-line treatment for patients with polycystic ovary syndrome have been evaluated, but the optimal diet has not been determined. Proper diet and the maintenance of adequate nutritional status are of great importance in the prevention of this disorder, and therapeutics and dietary habits play an important role in the recovery of patients with PCOS. Diets that can reduce rates of obesity and insulin resistance are beneficial to women with PCOS, the status of obesity and IR should be determined at the early stage of the disease, so as to develop individualized and sustainable dietary intervention (Chea *et al*., 2021) [16].

Conclusion

PCOS can lead to a range of health issues, including infertility, obesity, insulin resistance, and cardiovascular disease. Early diagnosis and treatment are important to prevent the development of these complications. While there is no permanent cure for PCOS, lifestyle modifications and medications can help manage symptoms and improve quality of life. It's important for women who suspect they may have PCOS should consult with a health care provider to get an accurate diagnosis and develop an individualized treatment plan. However, every woman's nutritional needs are unique and it's important to work with a healthcare provider or registered dietitian to develop an individualized nutrition plan that meets their specific needs and goals.

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Conflict of Interest

All authors has no conflict of interest or any affiliation or involvement in any organization academic, commercial, financial, personal and professionally relevant to the work.

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