Prevalence of Polycystic Ovary Syndrome among College Students in Thrissur, Kerala: A Cross-Sectional Study

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ABSTRACT

Purpose: The study on Polycystic Ovary Syndrome (PCOS) prevalence among college students in Thrissur, Kerala, is crucial for early diagnosis and targeted therapies, as the condition can cause severe long-term health issues like infertility and metabolic syndrome.

Methodology: A study in Kerala aimed to identify clinical features and lifestyle factors contributing to Polycystic Ovary Syndrome (PCOS) among 1,250 college students aged 18-21. The study stratified participants into risk categories based on Hirsutism and Risk Assessment scores. 10% of high-risk participants underwent ultrasound scanning for further ovarian health assessment.

Findings: The study found that 25.2% of participants had risk factors for PCOS, with 49 high-risk individuals. The predominantly Hindu population was predominantly underweight, with 30.32% underweight. Low risk individuals were 61.12% and 60.56% had low hirsutism scores. The study emphasizes the need for comprehensive screening and targeted interventions to improve health outcomes for young women.

Originality: This study focuses on college students in Thrissur, Kerala, who are vulnerable to lifestyle changes linked to academic pressures, potentially increasing the risk of Polycystic Ovary Syndrome (PCOS). It uses hirsutism, risk assessment tools, and ultrasound imaging to understand PCOS prevalence and associated factors..

Introduction

Polycystic ovary syndrome (PCOS) is one of the most prevalent endocrine disorders affecting women of reproductive age, characterized by a combination of symptoms including irregular menstrual cycles, hyperandrogenism, and polycystic ovaries (Christensen *et al*, 2013). PCOS often develops during adolescence and can lead to long-term complications such as infertility, metabolic syndrome, and cardiovascular disease if left untreated (Kumarapeli *et al*, 2008). The prevalence of PCOS varies significantly across different populations and regions, with studies indicating rates ranging from 2.2% to 26% in various cohorts. In India, the pooled prevalence of PCOS is estimated to be around 10-11% based on Rotterdam criteria, highlighting a significant public health concern that necessitates further investigation, particularly among young women in educational settings. In Kerala, the prevalence of PCOS has been reported to be around 9.13% among adolescents, with variations noted based on geographical and demographic factors. A study conducted at Karuna Medical College in Palakkad, Kerala, found that among 120 women diagnosed with PCOS, a substantial number presented with clinical features such as hirsutism and oligomenorrhea, underscoring the need for awareness and early

diagnosis in this population (Hameed *et al*, 2020). Furthermore, a systematic review indicated that the prevalence of PCOS among Indian women, including college students, is concerning, with estimates suggesting that lifestyle factors prevalent in this demographic may contribute to the rising incidence of the syndrome (Bharali *et al*, 2022).

College students in Thrissur, Kerala, represent a unique population that may be particularly vulnerable to the development of PCOS due to lifestyle changes, stress, and dietary habits associated with academic pressures. The transition to college often involves significant changes in physical activity, nutrition, and mental health, all of which can influence the risk of developing PCOS. Therefore, understanding the prevalence of PCOS among this group is crucial for developing targeted interventions aimed at improving health outcomes.

This study aims to assess the prevalence of PCOS among college-going students in Thrissur, Kerala, and to explore the associated clinical features and lifestyle factors. Identifying the prevalence and characteristics of PCOS in this population will contribute to the growing literature on PCOS in India and inform strategies for early diagnosis and management.

Methodology

To investigate the prevalence of polycystic ovary syndrome (PCOS) among college-going students aged 18 to 21 in Thrissur, Kerala, a cross-sectional study was conducted from June to August 2023. The study population comprised students from five colleges in the Thrissur area: Little Flower College Guruvayur, St. Joseph College Irinjalakkuda, Carmel College Mala, Vimala College Thrissur, and St. Mary's College Thrissur. Inclusion criteria focused on young adult women enrolled in these institutions who provided written consent to participate. Exclusion criteria included students with other health issues, pregnant or nursing women, and those who declined to participate.

Table 1 Risk Assessment Questionnaire

Risk Assessment Questionnaire
1. Do you have irregular periods?
2. Do you miss your period in your regular cycle?
3. Do you get your menstrual cycle for more than 35 days?
4. Do you have your menstrual flow for more than five days?
5. Are you changing more than 4 pads per day?
6. Do you experience Nausea/vomiting during menstruation?
7. Do you experience abdominal pain during menstruation?
8. Do you experience Pain/tenderness in the breast during menstruation?
9. Do you have heavy menstrual flow with clots?
10. Do you have pimples on your face?
11. Do you have hair fall?
12. Do you have a problem with hair growth over the chest, face or abdomen
13. Do you have any darkening and thickening of skin folds around the neck and axillae
14. Do you have the habit of eating junk food?
15. Do you have weight gain?
16. Do you have difficulty losing weight?
17. Do you have frequent thirst and urination?
18. Do you feel extremely hungry, irritable and sleepy?
19. Do you have symptoms of giddiness and fatigue
20. Do you have a stressful and depressive mind?

The sample size was calculated using the Daniel Formula (Harrini *et al*, 2020), resulting in a target of 1250 participants, based on a prevalence rate of 16% and a margin of error of 0.02 at a 95% confidence level. Purposive sampling was employed to select the colleges, while random sampling was utilized to choose participants from these institutions. Data collection involved evaluating hirsutism levels and PCOS risk using standardized tools: the Hirsutism Scoring Sheet (Kahraman and Erdogan, 2021) and a Risk Assessment Questionnaire (Selvaraj *et al*, 2020). The Hirsutism Scoring Sheet measures excessive hair growth, with scores indicating varying

levels of risk, while the Risk Assessment Questionnaire assesses factors such as menstrual irregularities and lifestyle habits.

Participants were stratified into four risk categories based on their scores from the assessment tools: no risk, low risk, medium risk, and high risk for PCOS. This systematic approach facilitated the identification of individuals who may benefit from early diagnosis and intervention, thereby enhancing awareness and management of PCOS among young women in the study population.

Table 2 Grading Samples Based on PCOS Risk Assessment Scores

Assessment tool	Scores			
	No Risk	**Low Risk**	**Medium Risk**	**High Risk**
Hirsutism Scoring Sheet	8>	8-15	16-25	26-36
Risk Assessment Questionnaire	15>	15-29	30-49	50-60

In the study, 10% of participants identified as having a high risk for polycystic ovary syndrome (PCOS) underwent ultrasound scanning to further assess their ovarian health. This imaging technique was performed on those who scored high on both the Hirsutism Scoring Sheet and the Risk Assessment Questionnaire, allowing for a more accurate diagnosis of PCOS.

Table 3 Rotterdam Criteria

Criteria	*Description*
Oligo-ovulation or Anovulation	Infrequent or absent ovulation, as evidenced by irregular menstrual cycles or amenorrhea.
Clinical or Biochemical signs of Hyperandrogenism	Clinical signs of excess androgen levels, such as hirsutism, acne, or male-pattern hair loss, OR biochemical evidence of androstenedione levels).
Polycystic Ovaries on Ultrasound	Presence of Polycystic Ovaries on Ultrasound examination, characterized by an increased number of follicles (=12 follicles measuring 2-9 mm in diameter) and/or an ovarian volume greater than 10mL

The inclusion of ultrasound aimed to enhance the overall understanding of PCOS prevalence among college-going women in Thrissur and facilitate timely interventions for those at higher risk.

The Rotterdam criteria were employed in the present study as the diagnostic guidelines for polycystic ovary syndrome (PCOS). According to these criteria, a diagnosis of PCOS requires the presence of at least two of the following three features: oligo-ovulation or anovulation, clinical or biochemical signs of hyperandrogenism, and the presence of polycystic ovaries as observed through transvaginal ultrasound. The use of ultrasound in our methodology allowed for accurate visualization of ovarian morphology, which is essential for confirming the diagnosis. By utilizing the Rotterdam criteria, the study aimed to ensure a standardized approach to diagnosing PCOS among participants, facilitating the identification of individuals who may benefit from targeted interventions. This approach is consistent with current clinical guidelines and underscores the importance of a comprehensive assessment in managing PCOS effectively (Rotterdam Criteria, 2004).

Result and Discussion

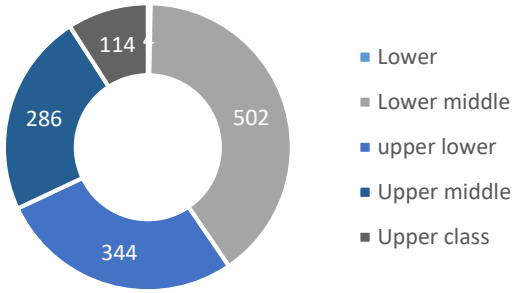
The demographic profile of the study population, consisting of 1250 participants, reveals important insights into their characteristics. The majority of participants were aged 19, comprising 45.6% (570 individuals), while those aged 18 accounted for 32% (400 individuals), indicating that younger students are more prevalent in this cohort. The age distribution shows a decline in frequency with increasing age, as only 5.52% (69 individuals) were aged 21. In terms of religion, the population is predominantly Hindu (59.6%), followed by Christians (21.6%) and Muslims (18.8%), reflecting the cultural demographics of the region. The family structure indicates a strong preference for nuclear families, with 87.6% of participants belonging to nuclear households, while only 12.4% came from joint families. Regarding family size, the majority (59.44%) had 1-4 members in their family, and 38.72% had 5-8 members, suggesting a tendency towards smaller family units. Educationally, an overwhelming 96.88% of participants were pursuing their graduate studies, with only 3.12% having completed their graduation.

Table 4 Demographic Profile of Selected Subjects

Demographic Profile	Frequency					Total Frequency (N=1250)	Per cent
	College 1	College 2	College 3	College 4	College 5		
Age							
18	86	116	104	95	169	**570**	**46**
19	34	50	32	38	57	**211**	**17**
20	25	6	5	14	19	**69**	**5**
21							
Religion							
Cristian	32	38	48	40	112	**270**	**22**
Hindu	138	102	121	143	241	**745**	**60**
Muslim	37	70	37	36	55	**235**	**18**
Type of family							
Joint	28	21	21	38	47	**155**	**12**
Nuclear	179	189	185	181	361	**1095**	**88**
Family Size							
8<	4	6	0	4	9	**23**	**2**
5-8	71	86	76	92	159	**484**	**39**
1-4	132	118	130	123	240	**743**	**59**
Education							
PG	26	2	2	6	3	**39**	**3**
UG	181	208	204	213	405	**1211**	**97**

This demographic profile underscores the youthful and predominantly graduate-seeking nature of the population, alongside significant insights into their religious background and family structures, which may influence their health and lifestyle choices (Demographic Research, 2012; Penn State University Libraries, 2024).

Plate 1 Socio Economic Status of the Participants



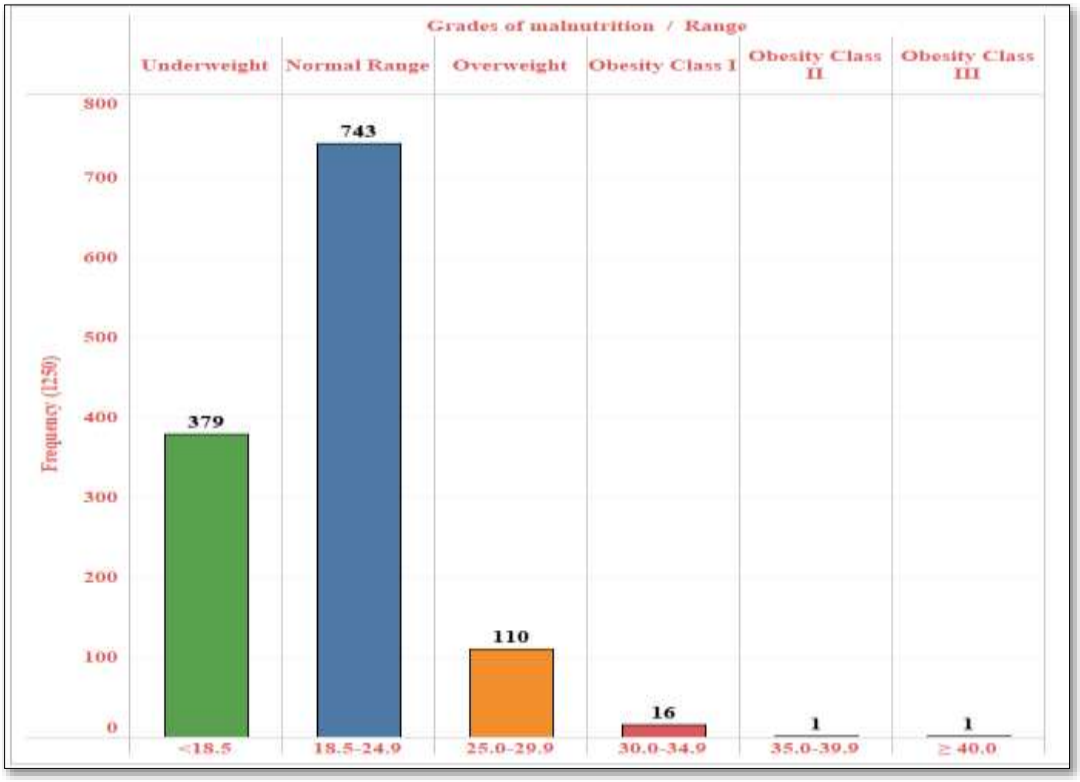
The data presented on the Kuppuswamy socioeconomic scale classifies the participants into various socioeconomic classes based on their family income, education, and occupation. Among the 1250 subjects, a significant proportion, 40.16% (502 individuals), fall into the lower middle class, indicating a substantial segment of the population that may experience economic challenges. The upper lower class accounts for 27.52% (344 individuals), while 22.88% (286 individuals) are classified as upper middle class. Only 9.12% (114 individuals) belong to the upper class, and a minimal 0.32% (4 individuals) are categorized as lower class. This distribution highlights that the majority of the population resides in the lower to middle socioeconomic strata, which is consistent with findings that suggest socioeconomic status significantly influences health outcomes and access to healthcare services. The Kuppuswamy scale, originally developed to assess individual socioeconomic status, has been modified to evaluate families, taking into account the combined income from all sources, thus providing a more comprehensive understanding of the socioeconomic landscape within the studied population (Radhakrishnan *et al*., 2023).

The analysis of the Body Mass Index (BMI) distribution among the study participants reveals significant insights into their nutritional status. A substantial 30.32% (379) of subjects were classified as underweight (BMI < 18.5), indicating a noteworthy proportion that may be at risk for health issues associated with low body weight, such as nutritional deficiencies and weakened immune function. The majority of participants, 59.44% (743), fell within the normal BMI range (18.5–24.9), suggesting a generally healthy weight status for most individuals in this population. Only 8.8% (110) were categorized as overweight (25.0–29.9), while a minimal number were classified as obese, with 1.3% (16) in Obesity Class I (30.0–34.9) and just 0.08% in both Obesity Class II (35.0–39.9) and Obesity Class III (≥ 40.0). This distribution indicates that extreme obesity is rare, highlighting a predominantly healthy population with low prevalence rates of overweight and obesity. However, the significant proportion of underweight individuals warrants further investigation into their nutritional health and lifestyle factors affecting their weight status. Such findings align with global trends indicating varying BMI

distributions across populations and emphasize the importance of addressing both underweight and overweight issues in public health initiatives (WHO 2000; NCBI 2015).

Table 5 present the grouping of participants based on their Risk Assessment scores and Hirsutism scores, which were used to evaluate their risk of polycystic ovary syndrome (PCOS). The Risk Assessment Questionnaire assessed various factors associated with PCOS, including menstrual irregularities, family history, and lifestyle habits. Among the participants, 61.12%

Plate 2 Body Mass Index of Participants



were classified as low risk, while 21.68% had no risk. A smaller proportion, 17.04%, fell into the moderate-risk category, and only 0.16% (2 individuals) were considered high-risk. These results suggest that a significant majority of the study population may not be at substantial risk for PCOS based on the assessed factors, which is consistent with findings from other studies that have reported similar distributions of risk levels in college-aged women

Table 5 Grouping of selected participants based on RA Scores and Hirsutism Scores

Grouping of selected subjects based on Risk Assessment Scores					
Study Area	High Risk (50-60)	Moderate Risk (30-49)	Low Risk (15-29)	No Risk (<15)	Total
1	1	69	245	93	408
2	-	42	119	46	207
3	-	38	119	49	206
4	1	31	133	45	210
5	-	33	148	38	219
Total	**2**	**213**	**764**	**271**	**1250**
Per cent	**0.16**	**17.04**	**61.12**	**21.68**	**100**
Grouping of selected subjects based on Hirsutism Scores					
College	High Risk (26 – 36)	Moderate Risk (16 -25)	Low Risk (8 -15)	No Risk (8>)	Total
1	1	52	233	122	408
2	2	21	113	71	207
3	-	22	118	66	206
4	1	25	144	40	210
5	3	22	149	45	219
Total	**7**	**142**	**757**	**344**	**1250**
Per cent	**0.56**	**11.36**	**60.56**	**27.52**	**100**

In terms of hirsutism, the Hirsutism Scoring Sheet indicated that 60.56% of participants had low hirsutism scores, suggesting minimal risk for hyperandrogenism, while 27.52% reported no signs of hirsutism at all. Only 11.36% were categorized as moderate risk, and a mere 0.56% (7 individuals) fell into the high-risk category. The low prevalence of high hirsutism scores in the current study reflects a similar trend observed in other populations, reinforcing the notion that while PCOS is prevalent, many affected individuals may not exhibit pronounced symptoms of hyperandrogenism, thus necessitating a comprehensive approach to diagnosis and management.

Table 6 presents the prevalence rates of participants with high Risk Assessment (RA) and Hirsutism scores across five colleges, revealing important insights into the potential incidence of polycystic ovary syndrome (PCOS) among the study population. A total of 49 participants (3.92%) were identified as having high scores on both the RA and Hirsutism assessments, indicating a small proportion at significant risk for PCOS. Additionally, 166 participants (13.28%) had high RA scores alone, suggesting that many individuals may be at risk based on factors such as menstrual irregularities and family history, despite not exhibiting overt symptoms of hirsutism. Furthermore, 100 participants (8%) were classified as having high Hirsutism scores, reflecting a notable prevalence of hyperandrogenism symptoms. Overall, 315 individuals, or 25.2% of the study population, were identified across these categories, underscoring the substantial prevalence of risk factors associated with PCOS and highlighting the need for comprehensive screening and early intervention strategies in college-aged women, as supported by existing literature (Azziz *et al.*, 2016; Gibson-Helm *et al.*, 2017).

Table 6 Prevalence of PCOS

College	Both RA & Hirsutism Scores High	RA Scores High	Hirsutism Scores High	Total
Vimala	20	50	33	**103**
Carmel	10	32	13	**55**
St. Joseph	6	32	16	**54**
LF	5	27	21	**53**
St Mary's	8	25	17	**50**
Total	**49**	**166**	**100**	**315**
Percentage	**3.92**	**13.28**	**8**	**25.2**

Table 7 presents the correlation coefficients (r values) and their associated p-values for various questions related to menstrual health, hirsutism, and Body Mass Index (BMI) among study participants, aiming to explore the relationships between these factors and the risk assessment for polycystic ovary syndrome (PCOS). Notably, the question regarding missing periods in a regular cycle shows a significant positive correlation with hirsutism scores ($r = 0.087$, $p = 0.002$), indicating that participants who miss their periods may also experience higher levels of hirsutism. Additionally, the presence of hair fall demonstrated a significant positive correlation with risk assessment scores ($r = 0.070$, $p = 0.01$), suggesting that individuals with hair loss may be at higher risk for PCOS. Conversely, symptoms such as nausea or vomiting during menstruation had a significant negative correlation with hirsutism scores ($r = -0.075$, $p = 0.008$), indicating that those experiencing these symptoms might have lower levels of hirsutism.

Furthermore, weight-related questions revealed significant correlations, with weight gain showing a strong positive correlation with hirsutism scores ($r = 0.347$, $p = 0.000$) and difficulty losing weight also correlating positively ($r = 0.191$, $p = 0.000$). This suggests that participants struggling with weight management are likely to experience higher levels of hirsutism, aligning with the metabolic and endocrine disruptions commonly associated with PCOS. Additionally, darkening and thickening of skin folds around the neck and axillae showed a strong positive correlation with hirsutism scores ($r = 0.241$, $p = 0.000$), further indicating that these skin changes are associated with higher levels of hyperandrogenism. Overall, these findings highlight the interconnectedness of menstrual health, hirsutism, and weight management in the context of PCOS, underscoring the importance of comprehensive assessment and management strategies for affected individuals (Azziz *et al.*, 2016; Gibson-Helm *et al.*, 2017).

Table 7 Correlation of Risk Assessment Score with Hirsutism Score and BMI

Risk Assessment	Hirsutism Score		BMI	
	r value	**p value**	**r value**	**p value**
Had irregular periods	0.022	0.44	0.011	0.69
Missed periods in the menstrual cycle	0.001	0.97	0.087**	0.002
Delayed menstrual cycle (35 days)	-0.41	0.14	0.000	0.99
Menstrual flow for more than five days	-0.006	0.83	-0.020	0.47
Changing more than 4 pads per day	0.013	0.64	0.013	0.657
Experiencing Nausea/vomiting during menstruation	-0.002	0.94	-0.075**	0.008
Experiencing abdominal pain during menstruation	0.050	0.08	-0..21	0.46
Experiencing Pain/tenderness in the breast during menstruation	-0.10	0.72	0.027	0.34
Heavy menstrual flow with clots	0.020	0.48	0.015	0.60
Having pimples on your face	0.000	0.99	-0.004	0.88
Having hair fall	0.070*	**0.01**	0.040	0.16
Having a problem with hair growth over the chest, face or abdomen	0.034	0.23	0.036	0.20
Having any darkening and thickening of skin folds around the neck and axillae	-0.037	0.19	0.241**	0.000
Having the habit of eating junk food	0.019	0.51	0.032	0.26
Having weight gain	-0.034	0.23	0.347**	0.000
Having difficulty losing weight	-0.051	**0.07**	0.191**	0.000
Having frequent thirst and urination	-0.034	0.23	0.006	0.82
Feeling extremely hungry, irritable and sleepy	-0.008	0.79	-0.028	0.33
Having symptoms of giddiness and fatigue	0.009	0.76	-0.002	0.95
Having a stressful and depressive mind?	-0.024	0.39	0.014	0.611

Table 8 presents the correlation coefficients (r values) and their associated p-values for various locations of hair growth in relation to Risk Assessment Scores and Body Mass Index (BMI) among the study participants. The data highlights significant relationships between the presence of hirsutism in specific areas and both risk assessment for polycystic ovary syndrome (PCOS) and BMI.

All locations of hair growth exhibited significant positive correlations with Risk Assessment Scores, indicating that increased hair growth in these areas is associated with a higher risk of PCOS. The strongest correlation was observed in the lower abdomen ($r = 0.262$, $p = 0.000$), followed closely by the upper lip ($r = 0.239$, $p = 0.000$) and upper abdomen ($r = 0.238$, $p = 0.000$). Other areas, such as the chin ($r = 0.196$, $p = 0.000$) and thighs ($r = 0.254$, $p = 0.000$), also showed significant correlations. These findings suggest that hirsutism in these specific areas may serve as important clinical indicators of PCOS risk. The correlations

between hair growth locations and BMI were less pronounced but still significant in certain areas. The upper lip (r = 0.080, p = 0.005) and chin (r = 0.095, p = 0.001) showed positive correlations with BMI, indicating that individuals with higher BMI may also experience increased hair growth in these areas. However, other locations, such as the chest and arms, did not show significant correlations with BMI. This suggests that while there is some relationship between hirsutism and BMI, the association is stronger between hirsutism and the risk assessment for PCOS. Overall, these results emphasize the relevance of specific hair growth patterns as indicators of both PCOS risk and potential metabolic implications in affected individuals.

Table 8 Correlation of Hirsutism Scores with Risk Assessment Score and BMI

Location of the hair growth	Risk Assessment Score		BMI	
	r value	p-value	r value	p-value
Upper lip	0.239**	0.000	0.080**	0.005
Chin	0.196**	0.000	0.095**	0.001
Chest	0.213**	0.000	0.023	0.031
Upper Abdomen	0.238**	0.000	0.031	0.27
Lower Abdomen	0.262**	0.000	0.050	0.077
Arms	0.219**	0.000	-0.001	0.96
Thigh	0.254**	0.000	0.046	0.10
Upper Back	0.181**	0.000	0.007	0.82
Lower Back	0.187**	0.000	0.018	0.53

The two tables provide valuable insights into the relationships between various factors associated with polycystic ovary syndrome (PCOS), focusing on menstrual health, hirsutism, and Body Mass Index (BMI), highlighting the importance of assessing both menstrual irregularities and specific patterns of hirsutism as part of a comprehensive PCOS evaluation, while also emphasizing the interconnectedness of metabolic issues and hyperandrogenism in this condition, with weight-related factors strongly correlating with hirsutism scores and hair growth on the upper lip and chin positively correlating with BMI, underscoring the necessity for a multifaceted approach to diagnosis and management that considers various clinical features, including menstrual health, hirsutism, and metabolic factors (Azziz *et al*., 2016; Gibson-Helm *et al.*, 2017).

Conclusion

This Cross-Sectional Study reveals a prevalence rate of 25.2% among the participants, indicating a significant proportion of college students may be affected by risk factors associated with polycystic ovary syndrome (PCOS). This finding is particularly important given that 49 participants were identified as having high scores on both Risk Assessment and Hirsutism assessments, while 166 participants exhibited high-Risk Assessment scores alone. The data suggests that while a majority of the population may not present with overt symptoms, a notable

percentage experiences underlying risk factors that warrant further investigation and intervention.

In conclusion, the findings emphasize the need for comprehensive screening and management strategies tailored to college-aged women, particularly in light of the interconnectedness of menstrual health, hirsutism, and metabolic factors associated with PCOS. The significant prevalence rate of 25.2% underscores the importance of addressing both physical and psychological aspects of the condition, as well as promoting awareness and education regarding PCOS among young women. By implementing targeted interventions and support systems, healthcare providers can better assist this demographic in managing their reproductive health and mitigating potential long-term consequences associated with PCOS.

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