SSR Institute of International Journal of Life Sciences
ISSN (O): 2581-8740 | ISSN (P): 2581-8732
Bhargavi *et al*., 2025
doi: 10.21276/SSR-IIJLS.2025.11.6.12

Original Article

open access

Prevalence of Obesity, Menstrual Irregularities, and Hyperglycemia in Adolescent Girls with Polycystic Ovarian Syndrome

Sindhu Bhargavi[1], Tejeswini. P[1], M Abhigna[1]*

[1]Assistant Professor, Narayana Medical College, Chinthareddypalem, Nellore, India

***Address for Correspondence:** Dr. M Abhigna, Assistant Professor, Narayana Medical College, Chinthareddypalem, Nellore, India
E-mail: abhignareddy158@gmail.com

Received: 12 Jun 2025/ Revised: 24 Aug 2025/ Accepted: 17 Oct 2025

ABSTRACT

Background: Polycystic ovarian syndrome is the most common endocrine disorder in women of reproductive age and is increasingly identified among adolescents. It is characterised by menstrual dysfunction, obesity, and insulin resistance, which predispose affected individuals to metabolic and reproductive complications later in life. To determine the prevalence of obesity, menstrual irregularities, and hyperglycaemia among adolescent girls with PCOS in the communities surrounding Narayana Medical College, Nellore.

Methods: This prospective observational study included 100 adolescent girls aged 15–20 years diagnosed with PCOS based on the Rotterdam 2003 criteria. Anthropometric measurements, fasting blood glucose, and ultrasound examinations were performed. Data were analysed using SPSS version 25.0.

Results: The mean age was 18.18±1.15 years. Menstrual irregularities were present in 88% of subjects. Polycystic ovaries were detected in 55% on ultrasound. The mean BMI was 24.77±4.9 kg/m², with 46% of participants being overweight or obese. Elevated fasting glucose was noted in 10% of participants, including 8% with impaired fasting glucose and 2% with diabetes. Clinical findings included acne (30%), hirsutism (16%), and acanthosis nigricans (32%).

Conclusion: The study has concluded that late adolescence (19-20 years) is the predominant age group for PCOS presentation, with most participants being unmarried. The most common presenting complaints were irregular menstrual cycles and amenorrhea, while sonographic evidence of polycystic ovaries was found in 55% of participants.

Key-words: PCOS, Adolescents, Obesity, Menstrual Irregularities, Hyperglycemia, Insulin Resistance

INTRODUCTION

Polycystic ovarian syndrome is one of the most common endocrine and metabolic disorders affecting women of reproductive age and is increasingly diagnosed in adolescent girls. It is a heterogeneous condition characterised by oligo- or anovulation, clinical or biochemical hyperandrogenism, and polycystic ovarian morphology on ultrasound. First described by Stein and Leventhal in 1935, PCOS has since been recognised as a multifactorial disorder involving genetic, hormonal, metabolic, and environmental components. The syndrome not only manifests as a reproductive disorder but also represents a lifelong metabolic disease that can begin in adolescence and persist into menopause [1].

The global prevalence of PCOS varies widely between 5% and 15%, depending on ethnicity, population characteristics, and the diagnostic criteria employed, namely, the NIH 1990, Rotterdam 2003, or Androgen Excess Society 2006 guidelines [2]. The Rotterdam criteria remain the most widely used and require at least two of the following: oligo- or anovulation, clinical or biochemical signs of hyperandrogenism, and polycystic ovaries. However, in adolescents, diagnosis remains challenging due to the overlap of physiological pubertal changes such as irregular menstruation, acne, and mild hirsutism, which may mimic PCOS features [3].

Recent studies indicate that 6–18% of adolescent girls worldwide are affected by PCOS, and the prevalence is

How to cite this article
Bhargavi S, Tejeswini. P, Abhigna M. Prevalence of Obesity, Menstrual Irregularities, and Hyperglycemia in Adolescent Girls with Polycystic Ovarian Syndrome. SSR Inst Int J Life Sci., 2025; 11(6): 8685-8691.

Access this article online
https://iijls.com/

doi: 10.21276/SSR-IIJLS.2025.11.6.12

even higher in South Asian populations, including India [4,5]. In Indian adolescents, prevalence rates range from 9% to as high as 22%, reflecting urbanisation, sedentary lifestyles, obesity, and dietary transitions [6]. The early onset of PCOS during adolescence is of particular concern because it can lead to reproductive issues such as anovulation and infertility, as well as metabolic complications like insulin resistance, dyslipidaemia, and type 2 diabetes mellitus later in life.

The pathophysiology of PCOS is complex and multifactorial. At its core lies insulin resistance, which contributes to compensatory hyperinsulinemia, promoting ovarian theca cell androgen production and suppressing hepatic sex hormone-binding globulin synthesis. This cascade leads to increased circulating free testosterone levels, disrupted folliculogenesis, and chronic anovulation [7]. Genetic predisposition, abnormal gonadotropin-releasing hormone pulsatility, and alterations in adipokines and inflammatory mediators further exacerbate the condition [8]. The hypothalamic-pituitary-ovarian axis dysregulation seen in PCOS results in elevated luteinizing hormone relative to follicle-stimulating hormone, contributing to follicular arrest and ovarian cyst formation.

Obesity plays an important role in aggravating the clinical and metabolic manifestations of PCOS. Around 50–80% of PCOS patients are either overweight or obese, and central obesity particularly worsens insulin resistance and hyperandrogenism [9]. In adolescents, obesity not only amplifies menstrual irregularities but also increases the risk of early-onset metabolic syndrome. Equally, lean PCOS phenotypes, though less common, also exhibit insulin resistance and cardiovascular risk factors; the intrinsic metabolic nature of the disease is independent of body weight.

Menstrual irregularities are often the earliest clinical signs of PCOS in adolescents, typically manifesting as oligomenorrhea, amenorrhea, or menorrhagia. Although menstrual irregularities are expected during the first 1–2 years post-menarche due to HPO axis immaturity, persistence beyond this period should prompt evaluation for PCOS [10]. Studies have reported that 60–80% of adolescents with PCOS present with abnormal cycles, and about one-third have amenorrhea as their primary complaint [11]. Persistent anovulation may lead to unopposed oestrogen exposure, increasing the risk of endometrial hyperplasia and carcinoma in later years.

Hyperglycaemia and other metabolic abnormalities are increasingly recognised in adolescents with PCOS, even among those with normal BMI. Insulin resistance in PCOS leads to impaired fasting glucose and type 2 diabetes mellitus at a younger age compared to non-PCOS peers. Studies by Bennal and Kerure (2017) and Dumitrescu et al. (2015) reported impaired fasting glucose in 10–30% of PCOS adolescents [12,13]. The clustering of insulin resistance, obesity, hypertension, and dyslipidemia in PCOS mirrors the metabolic syndrome, contributing to heightened cardiovascular risk in adulthood [14].

In recent years, India has witnessed a surge in PCOS cases among adolescents, driven by lifestyle factors such as physical inactivity, increased consumption of calorie-dense foods, and psychosocial stress. The condition poses a growing public health concern as it affects not only fertility but also metabolic and psychological well-being. The early recognition of PCOS in adolescence offers an opportunity for timely lifestyle interventions, nutritional counselling, and prevention of long-term difficulties such as type 2 diabetes and cardiovascular disease.

The present study was designed to assess the prevalence of obesity, menstrual irregularities, and hyperglycaemia in adolescent girls with PCOS in the communities surrounding Narayana Medical College, Nellore. Understanding these associations in the adolescent age group is critical for developing preventive methods, early diagnosis, and individualised management methods that can improve reproductive health outcomes and reduce metabolic morbidity in later life.

MATERIALS AND METHODS

Research design- This is a prospective, observational, and cross-sectional study conducted for a period of one year, from 2021–2022. The study was conducted in the selected communities and in different primary health care centres, Narayana Medical College and Hospital, Chintareddypalem, Nellore. The random allocation of the adolescent girls was done based on several inclusion and exclusion criteria. 100 adolescent girls have been selected in the age group of between 15 to 20 years who were diagnosed with PCOS. Informed consent was obtained from the participants.

doi: 10.21276/SSR-IIJLS.2025.11.6.12

Inclusion criteria

- Women who were diagnosed with PCOS according to the Rotterdam revised criteria were included in the study.
- The oligo or the presence of Anovulation has been included in the study.
- The patient with the clinical or biochemical symptom of hyperandrogenism has been considered for the study.
- The patients having >=12 antral follicles in the polycystic ovaries in any one of the ovaries or the volume of the ovary is >=10cm^3 were considered.

Exclusion criteria

- The Patient with the incidence of type 2 Diabetes Mellitus was not included in the study.
- Any diagnosed tumour in the ovary or the tumour in the adrenal gland was excluded from the study.
- Patients with Congenital adrenal hyperplasia have been excluded.
- If any patient was diagnosed with Hypothyroidism or Hyperprolactinaemia were not considered for the study.

Sample size- The study group consists of the selected girls based on certain inclusion or exclusion criteria. The well-informed consent had been taken from the adolescent girls. Total clinical history has been taken from the patient along with the clinical investigation. Personal interviews have been conducted for each of the participants. The women were subjected to the collection of information regarding the history of the patients, the general investigation, the examination of the abdomen, and various laboratory examinations.

Study tools and data collection- All of the patients had been enrolled after the proper informed consent, both verbal and written. The demographic parameters like the age, the sex, the socioeconomic factors and the educational or marital status had been investigated and collected based on a certain questionnaire. The history of the menstrual cycle, obesity or the history of any pre-surgical process had been investigated. Other physical examinations had been done. All of the information had been recorded in the proforma.

Statistical Analysis- The data analysis was done by standard statistical processes. The data entry was done by Microsoft Excel 2013 and different charts or diagrams were used. The analysis was done by the use of the SPSS Ver. 25 software.

Ethical consideration- The study is not associated with an ethical violation. The ethical approval has been obtained from the Institutional Ethical Committee of Narayana Medical College, Nellore.

RESULTS

Most participants (54%) were aged 19–20 years, indicating late adolescence as the predominant age group for PCOS presentation. The majority (76%) were unmarried (Table 1).

Table 1: Age Distribution and Marital Status

Parameters	Category	Frequency	Percentage (%)
Age (years)	15–16	6	6
	16–17	5	5
	17–18	8	8
	18–19	27	27
	19–20	54	54
Marital status	Unmarried	76	76
	Married	24	24

The most frequent presenting complaints were irregular menstrual cycles (45%) and amenorrhea (35%), together representing 80% of all cases. Hirsutism and acne were observed in a smaller proportion. Sonographic evidence of polycystic ovaries was found in 55% of subjects, confirming the high prevalence of morphological changes among adolescent PCOS patients (Table 2).

doi: 10.21276/SSR-IIJLS.2025.11.6.12

Table 2: Complaints and Sonological findings

Parameters	Category	Frequency	Percentage (%)
Presenting complaints	Irregular cycles	45	45
	Amenorrhea	35	35
	Hirsutism	9	9
	Dysmenorrhea	8	8
	Menorrhagia	3	3
Sonological findings	PCOS	55	55
	Normal	45	45

The average BMI (24.77±4.92 kg/m²) falls within the overweight range, and 46% of the participants were overweight or obese. The mean waist-hip ratio (0.86) indicates a predominance of central obesity, a known risk factor for insulin resistance in PCOS. Blood pressure readings were generally within normal limits. The mean fasting blood glucose level (96.84 mg/dL) was within the normal range, but a subset of participants exhibited early glycaemic changes (Table 3).

Table 3: Vitals and Various Parameters among the Study Group

Variable	Minimum	Maximum	Mean	Standard Deviation
Pulse rate (bpm)	66	101	83	7.31
Systolic BP (mmHg)	90	152	116.6	13.32
Diastolic BP (mmHg)	60	100	77.2	9.77
Height (cm)	137	165	153.91	6.36
Weight (kg)	32.8	91	58.63	11.73
BMI (kg/m²)	14.2	40.4	24.77	4.92
Hip circumference (cm)	72	128	99.71	9.12
Waist circumference (cm)	56	118	86.86	12.49
Waist-Hip Ratio	0.61	1.12	0.86	0.08
Fasting Blood Sugar (mg/dl)	68	138	96.84	15.74

A total of 10% of adolescents with PCOS showed impaired fasting glucose or diabetes mellitus. These early glycemic abnormalities highlight the metabolic nature of PCOS even in young individuals. Regular monitoring and lifestyle interventions are crucial to prevent the progression to type 2 diabetes (Table 4).

Table 4: Glycaemic Status of Participants

Glycaemic Category	Fasting Blood Glucose	Frequency	Percentage (%)
Normoglycemia	<110 mg/dL	90	90
Impaired Fasting Glucose	110–126 mg/dL	8	8
Diabetes Mellitus	>126 mg/dL	2	2

DISCUSSION

This prospective study of 100 adolescent girls with PCOS found a high burden of menstrual dysfunction (88%), a substantial prevalence of overweight/obesity, and impaired glucose metabolism in 10%. These findings reinforce the concept that PCOS in adolescence is not solely a reproductive disorder but an early metabolic disease with measurable cardio-metabolic risk even at a young age. Prevalence (88%) of menstrual disturbances observed here is consistent with many adolescent PCOS

doi: 10.21276/SSR-IIJLS.2025.11.6.12

cohorts that report menstrual dysfunction as the dominant presenting complaint. Persistent oligomenorrhea/ amenorrhea beyond the first 1–2 years after menarche is a classical red flag for adolescent PCOS; epidemiologic reports and guideline documents emphasise that menstrual irregularity is the commonest early manifestation. Our rate is even with reports from [15] (adolescent Indian cohort) and other clinical series that document abnormal cycles in 60–90% of affected adolescents. This high prevalence underlines the need for clinicians to evaluate persistent cycle abnormalities promptly rather than attributing them solely to pubertal immaturity.

The mean BMI of 24.77 kg/m² and a combined 46% overweight/obesity in our sample mirror the strong association between adiposity and PCOS severity noted in the literature. Several large PCOS cohorts and reviews report that approximately one-third to one-half of PCOS patients are overweight or obese, with central adiposity being particularly deleterious to insulin sensitivity and androgen excess. Comparisons with earlier Indian and international studies [16, 17]. show similar ranges of obesity prevalence, although prevalence varies by geography, urbanisation, and selection factors that likely explain some differences. Importantly, while obesity amplifies PCOS phenotypes, lean PCOS phenotypes still show metabolic dysfunction, so BMI alone should not exclude metabolic screening.

In our cohort, 10% had abnormal fasting glycemia, which is comparable to some reports (e.g., Bennal and Kerure reported ~10% impaired fasting glucose) but lower than others (Dumitrescu et al. and several regional studies reporting IFG prevalence up to ~30%). Such heterogeneity across studies can be attributed to differences in age distribution, diagnostic criteria for PCOS, methods used to assess glycemia, and population characteristics. Our relatively lower prevalence compared with some large cohorts may reflect (a) a younger mean age and earlier disease stage, (b) community-based sampling versus tertiary referral bias, or (c) the sole use of fasting glucose rather than more sensitive tests such as oral glucose tolerance testing or measures of insulin resistance. However, the detection of even 10% with deglycation during adolescence supports guideline recommendations for metabolic screening in young women diagnosed with PCOS.

Clinical features in this study, acne (30%), hirsutism (16%), and acanthosis nigricans (32%), reflect typical adolescent manifestations. Hirsutism prevalence is lower than in some adult PCOS series, consistent with the concept that hirsutism often develops gradually with cumulative androgen exposure. Acanthosis nigricans, present in almost one-third, supports a link between hyperinsulinemia and cutaneous markers of insulin resistance, consistent with older metabolic studies [18]. These clinical signs are useful screening clues in resource-limited settings where biochemical testing for insulin resistance may not be immediately available.

Sonological confirmation of polycystic ovarian morphology in 55% of participants is comparable with several adolescent cohorts. However, caution is warranted because ultrasound criteria developed for adults may over- or under-diagnose PCOS in adolescents; ovarian morphology can evolve after menarche [12]. This caution explains why expert guidelines recommend combining clinical, biochemical, and sonographic data and applying adolescent-specific thresholds when making a diagnosis.

Taken together, our results are concordant with Indian and international literature showing substantial overlap between reproductive and metabolic abnormalities early in life among adolescents with PCOS. Compared with studies that report higher rates of deglycation, our cohort may be relatively less metabolically affected, but the presence of measurable metabolic derangements even at a mean age of 18 the necessity of early screening and primordial prevention through lifestyle modification. Several studies and guidelines advocate lifestyle involvement as first-line therapy in adolescents, an approach supported by our observation that nearly half of the participants are overweight/ obese [13].

Important limitations temper interpretation: single-centre/community sampling, modest sample size (n=100), reliance on fasting glucose rather than OGTT or insulin assays to define deglycation, and potential misclassification due to overlap with normal pubertal physiology. Upcoming larger, longitudinal studies using standardised adolescent diagnostic criteria and comprehensive metabolic testing would clarify the natural history and progression risk from IFG to frank diabetes [18].

The study confirms a high prevalence of menstrual irregularity and a considerable burden of

doi: 10.21276/SSR-IIJLS.2025.11.6.12

overweight/obesity and early deglycation in adolescent PCOS. These findings echo prior reports and reinforce recommendations for early, multidisciplinary screening and intervention to mitigate long-term reproductive and cardio-metabolic complications.

SUMMARY

This prospective study evaluated the prevalence of obesity, menstrual irregularities, and hyperglycaemia among 100 adolescent girls aged 15–19 years from communities and PHCs around Narayana Medical College (2021–2022). Clinical history, examination, BMI, fasting glucose, and ultrasound were performed, and PCOS was diagnosed according to the Rotterdam 2003 criteria. The mean age was 18.18 years, and 45% reported irregular cycles. Mean BMI was 24.77; 36% were overweight and 10% obese. Waist–hip ratio exceeded 0.85 in 56%. Menstrual irregularities were present in 88%, acne in 30%, hirsutism in 16%, and acanthosis in 32%. Polycystic ovaries were detected in 55%, and 10% showed impaired glucose levels.

CONCLUSIONS

The study has concluded that late adolescence (19-20 years) is the predominant age group for PCOS presentation, with most participants being unmarried. The most common presenting complaints were irregular menstrual cycles and amenorrhea, while sonographic evidence of polycystic ovaries was found in 55% of participants. A significant proportion of the sample was overweight or obese, with central obesity being a key risk factor for insulin resistance. Although fasting blood glucose levels were generally normal, 10% of adolescents displayed early glycaemic abnormalities, underlining the metabolic implications of PCOS. These findings emphasize the importance of early diagnosis, monitoring, and lifestyle interventions.

CONTRIBUTION OF AUTHORS

Research Concept- Dr. Sindhu Bhargavi
Research Design- Dr. Tejeswini P
Supervision- Dr. Sindhu Bhargavi
Materials- Dr. M. Abhigna
Data Collection- Dr. Tejeswini P
Data Analysis and Interpretation- Dr. M. Abhigna
Literature Search- Dr. Sindhu Bhargavi
Writing – Original Draft- Dr. Tejeswini P
Critical Review- Dr. Sindhu Bhargavi
Article Editing- Dr. M. Abhigna
Final Approval- Dr. Sindhu Bhargavi, Dr. Tejeswini P, Dr. M. Abhigna

REFERENCES

[1] Legro RS, Arslanian SA, Ehrmann DA, Hoeger KM, Murad MH, et al. Diagnosis and treatment of polycystic ovary syndrome: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab., 2013; 98(12): 4565-92. doi: 10.1210/jc.2013-2350.

[2] Lizneva D, Suturina L, Walker W, Gavrilova-Jordan L, Azziz R, PCOS Task Force. Criteria, prevalence, and phenotypes of polycystic ovary syndrome. Fertil Steril., 2016; 106(1): 6-15. doi: 10.1016/j.fertnstert.2016.05.003.

[3] Rosenfield RL, Ghai K, Ehrmann DA, Barnes RB. Diagnosis of the polycystic ovary syndrome in adolescence: comparison of adolescent and adult hyperandrogenism. J Pediatr Endocrinol Metab., 2000; 13: 1285-89.

[4] Kumarapeli V, Seneviratne R, Wijeyaratne CN, Yapa RMSC, Dodampahala SH. A simple screening approach for assessing community prevalence and phenotype of polycystic ovary syndrome in a semi-urban population in Sri Lanka. Am J Epidemiol., 2008; 168(3): 321-28. doi: 10.1093/aje/kwn137.

[5] Nidhi R, Padmalatha V, Nagarathna R, Amritanshu R. Prevalence of polycystic ovarian syndrome in Indian adolescents. J Pediatr Adolesc Gynecol., 2011; 24(4): 223-27. doi: 10.1016/j.jpag.2011.03.002.

[6] Sinha S, Patil MS, Halki S, Sharma SM. Prevalence of anaemia and factors influencing anaemia among school-going adolescents in urban and rural areas of North Karnataka: A comparative study. J Prev Med Holist Health, 2022; 8(2): 85-90. doi: 10.18231/j.jpmhh.2022.017.

[7] Dunaif A. Insulin resistance and the polycystic ovary syndrome: mechanism and implications for pathogenesis. Endocr Rev., 1997; 18(6): 774-800. doi: 10.1210/edrv.18.6.0318.

[8] Rosenfield RL, Ehrmann DA. The pathogenesis of polycystic ovary syndrome (PCOS): the hypothesis of PCOS as functional ovarian hyperandrogenism revisited. Endocr Rev., 2020; 37(5): 467-520. doi: 10.1210/edrv/bnaa010.

doi: 10.21276/SSR-IIJLS.2025.11.6.12

[9] Barber TM, Franks S. Obesity and polycystic ovary syndrome. Clin Endocrinol., 2013; 79(1): 13-18. doi: 10.1111/cen.12286.

[10]Apter D. How to define normal puberty and its disorders: lessons from polycystic ovary syndrome. Horm Res., 1998; 49(Suppl 2): 7-12. doi: 10.1159/000053075.

[11]Kumari R, Singh R, Rajender S. Impact of polycystic ovary syndrome on adolescents: a review. Indian J Endocr Metab., 2015; 19(6): 731-43. doi: 10.4103/2230-8210.167547.

[12]Bennal AS, Kerure SB. A study of fasting glucose and insulin resistance in adolescent girls with polycystic ovary syndrome. Int J Reprod Contracept Obstet Gynecol., 2017; 6(5): 1872-76. doi: 10.18203/2320-1770.ijrcog20171532.

[13]Dumitrescu R, Mehedintu C, Briceag I, Purcarea VL, Hudita D. The polycystic ovary syndrome: an update on metabolic and hormonal mechanisms. J Med Life, 2015; 8(2): 142-45.

[14]DeFronzo RA, Ferrannini E. Insulin resistance: a multifaceted syndrome responsible for NIDDM, obesity, hypertension, dyslipidemia, and atherosclerotic cardiovascular disease. Diabetes Care, 1991; 14(3): 173-94. doi: 10.2337/diacare.14.3.173.

[15]Kumari R, Singh R, Rajender S. Impact of polycystic ovary syndrome on adolescents: a review. Indian J Endocr Metab., 2015; 19(6): 731-43. doi: 10.4103/2230-8210.167547.

[16]Roger VL, Go AS, Lloyd-Jones DM, Benjamin EJ, Berry JD, et al. Heart disease and stroke statistics—2012 update: a report from the American Heart Association. Circ., 2012; 125(1): e2-e220. doi: 10.1161/CIR.0b013e31823ac046.

[17]Diamanti-Kandarakis E, et al. Insulin resistance and the polycystic ovary syndrome revisited: an update on mechanisms and implications. Endocr Rev., 2012; 33(6): 981-1030. doi: 10.1210/er.2011-1034.

[18]Phiske MM. An approach to acanthosis nigricans. Indian Dermatol Online J., 2014; 5(3): 239-49.