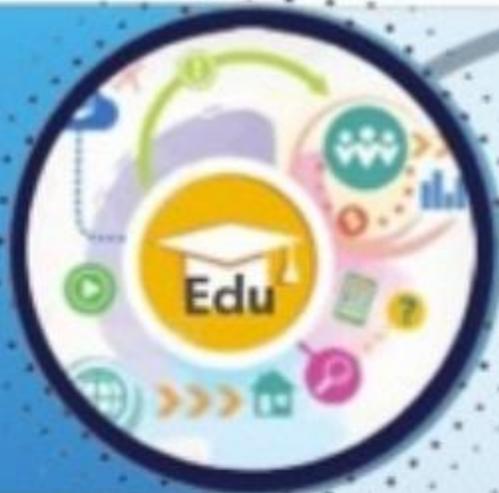




TASHKENT MEDICAL ACADEMY



# Journal of Educational and Scientific Medicine



## Issue 5 | 2025

OAK.UZ  
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Science Education Commission of the Cabinet  
Ministry of the Republic of Uzbekistan

ISSN: 2181-3175

## BURDEN OF POLYCYSTIC OVARIAN SYNDROME AMONG ADOLESCENTS AND YOUNG WOMEN IN INDIA: A COMPREHENSIVE SYSTEMATIC REVIEW

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### Abstract

**Background:** Polycystic ovarian syndrome (PCOS) is one of the most common endocrine and metabolic disorders among adolescent girls and young women. Characterized by hyperandrogenism, menstrual dysfunction, and polycystic ovarian morphology, PCOS is associated with long-term health complications such as insulin resistance, type 2 diabetes mellitus, cardiovascular diseases, and psychological disturbances. Despite its growing prevalence, awareness and early diagnosis of PCOS in India remain inadequate. **Objective:** This systematic review aims to assess the prevalence, risk factors, clinical presentations, and awareness levels of PCOS among adolescent girls and young women in India. **Methods:** A systematic literature search was conducted following PRISMA 2020 guidelines across PubMed, Scopus, ScienceDirect, and Google Scholar databases. Studies published between 2010 and 2024 involving Indian populations aged 11 to 30 years were included. Data were extracted regarding study characteristics, diagnostic criteria, PCOS prevalence rates, associated risk factors, and levels of awareness. **Results:** Seven studies involving 267 to 1068 participants each were included. The reported prevalence of PCOS among Indian adolescents varied widely, ranging from 6% to 77.1%, depending on diagnostic criteria and study methodology. Obesity (odds ratio [OR]: 3.09), insulin resistance (OR: 2.12), hypertension (OR: 4.46), family history, and psychological stress were consistently identified as significant risk factors. Awareness regarding PCOS was found to be critically low, with over 78% of adolescents unaware of the syndrome's symptoms and long-term complications in some studies. Menstrual irregularities, hyperandrogenic features, and emotional disturbances were common clinical presentations across studies. **Conclusion:** PCOS presents a substantial public health challenge among Indian adolescents and young women. There is an urgent need for improved awareness initiatives, early metabolic screening, lifestyle interventions, and standardized diagnostic protocols to facilitate timely identification and management of PCOS. Future research should focus on longitudinal studies and targeted public health strategies to mitigate the rising burden of PCOS-related complications in India.

## РАСПРОСТРАНЕННОСТЬ СИНДРОМА ПОЛИКИСТОЗНЫХ ЯИЧНИКОВ СРЕДИ ПОДРОСТКОВ И МОЛОДЫХ ЖЕНЩИН В ИНДИИ: ВСЕСТОРОННИЙ СИСТЕМАТИЧЕСКИЙ ОБЗОР

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### Аннотация

**Справочная информация:** Синдром поликистозных яичников (СПКЯ) является одним из наиболее распространенных эндокринных и метаболических нарушений среди девочек-подростков и молодых женщин. СПКЯ, характеризующийся гиперандрогенией, нарушением менструального цикла и морфологией поликистозных яичников, связан с долгосрочными осложнениями для здоровья, такими как резистентность к инсулину, сахарный диабет 2 типа, сердечно-сосудистые заболевания и психологические расстройства. Несмотря на растущую распространенность СПКЯ, осведомленность о нем и ранняя диагностика в Индии остаются недостаточными. **Цель:** Этот систематический обзор направлен на оценку распространенности, факторов риска, клинических проявлений и уровня осведомленности о СПКЯ среди девочек-подростков и молодых женщин в Индии. **Методы:** В соответствии с рекомендациями PRISMA 2020 был проведен систематический поиск литературы по базам данных PubMed, Scopus, ScienceDirect и Google Scholar. В исследование были включены исследования, опубликованные в период с 2010 по 2024 год с участием населения Индии в возрасте от 11 до 30 лет. Были получены данные, касающиеся характеристик исследования, диагностических критериев, показателей распространенности СПКЯ, сопутствующих факторов риска и уровня осведомленности.

**Результаты:** В исследование были включены семь исследований, в каждом из которых приняли участие от 267 до 1068 человек. Распространенность СПКЯ среди индийских подростков, по имеющимся данным, варьировалась

в широких пределах, от 6% до 77,1%, в зависимости от диагностических критериев и методологии исследования. Ожирение (отношение шансов [OR]: 3,09), резистентность к инсулину (OR: 2,12), артериальная гипертензия (OR: 4,46), семейный анамнез и психологический стресс были последовательно определены в качестве значимых факторов риска. В некоторых исследованиях было установлено, что осведомленность о СПКЯ критически низка: более 78% подростков не знают о симптомах этого синдрома и долгосрочных осложнениях. Нарушения менструального цикла, гиперандрогения и эмоциональные расстройства были общими клиническими проявлениями во всех исследованиях. **Заключение:** СПКЯ представляет собой серьезную проблему для общественного здравоохранения среди индийских подростков и молодых женщин. Существует настоятельная необходимость в повышении осведомленности, раннем скрининге нарушений обмена веществ, изменении образа жизни и стандартизированных диагностических протоколах, способствующих своевременному выявлению СПКЯ и ведению его пациентов. Будущие исследования должны быть сосредоточены на лонгитюдных исследованиях и целенаправленных стратегиях общественного здравоохранения, направленных на смягчение растущего бремени осложнений, связанных с СПКЯ, в Индии.

### HINDISTONDAGI O'SMIRLAR VA YOSH AYOLLAR ORASIDA TUXUMDON POLIKISTOZ SINDROMINING TARQALGANLIGI: KENG QAMROVLI TIZIMLI TAHLIL

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#### Annotatsiya

Tuxumdon polikistoz sindromi (TPS) o'smir qizlar va yosh ayollar orasida eng keng tarqalgan endokrin va metabolik kasalliklardan biridir. Giperandrogenizm, hayz ko'rish disfunktsiyasi va polikistoz tuxumdon morfologiyasi bilan tavsiflangan TPS insulin pezistentligi, 2-toifa diabet, yurak-qon tomir kasalliklari va psixologik buzilishlar kabi uzoq muddatli sog'liq asoratlari bilan bog'liq. Uning keng tarqalishiga qaramay, Hindistonda TPS haqida xabardorlik va erta tashxis qo'yish etarli emas.

**Maqsad:** ushbu tekshiruvda Hindistondagi o'smir qizlar va yosh ayollar orasida TPSning tarqalishi, xavf omillari, klinik kechishi va xabardorlik darajasini baholashga qaratilgan. **Usullari:** PubMed, Scopus, ScienceDirect va Google Scholar ma'lumotlar bazalari bo'yicha PRISMA 2020 ko'rsatmalariga binoan tizimlashgan adabiyotlar qidiruvi o'tkazildi. 2010 yildan 2024 yilgacha 11 yoshdan 30 yoshgacha bo'lgan Hind aholisi ishtirokida nashr etilgan tadqiqotlar o'rganildi. Tadqiqot xususiyatlari, diagnostika mezonlari, TPS tarqalish darajasi, olib keluvchi xavf omillari va xabardorlik darajasi to'g'risida ma'lumotlar olindi. **Natijalar:** har biri 267 dan 1068 gacha ishtirokchilarni o'z ichiga olgan ettita tadqiqot tahlil qilindi. Hindistonlik o'spirinlar orasida TPS tarqalishi diagnostik mezonlari va o'rganish metodologiyasiga qarab 6% dan 77,1% gacha o'zgarib turdi. Semirib ketish (koeffitsientlar nisbati OR: 3.09), insulin rezistentligi (OR: 2.12), gipertoniya (OR: 4.46), nasliy moyillik va psixologik stress doimiy ravishda muhim xavf omillari sifatida aniqlandi. TPS haqida xabardorlik juda past ekanligi aniqlandi, o'smirlarning 78% dan ortig'i ba'zi tadqiqotlarda sindrom belgilari va uzoq muddatli asoratlaridan bexabarligi aniqlandi. Hayz ko'rishning buzilishi, giperandrogenik xususiyatlar va hissiy buzilishlar tadqiqotlar davomida keng tarqalgan klinik ko'rinishlari sifatida tasdiqlandi.

**Xulosa:** TPS hindistonlik o'spirinlar va yosh ayollar orasida sog'liqni saqlashning jiddiy muammolarini keltirib chiqaradi. TPS o'z vaqtida aniqlash va boshqarishni osonlashtirish uchun xabardorlik chora-tadbirlarini yaxshilash, erta metabolik skrining, to'g'ri turmush tarzi va standartlashtirilgan diagnostika protokollariga shoshilinch ehtiyoj mavjud. Kelajakdagi tadqiqotlar Hindistonda TPS bilan bog'liq asoratlarning tarqalish xavfini kamaytirish uchun ko'plab tadqiqotlar va maqsadli sog'liqni saqlash strategiyalariga qaratilishi kerak.

**Introduction.** Polycystic ovarian syndrome (PCOS) is one of the most common endocrine and metabolic disorders affecting women of reproductive age worldwide. Characterized by hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology, PCOS not only leads to reproductive challenges such as infertility but is also associated with serious long-term health risks, including insulin resistance, type 2 diabetes mellitus, cardiovascular diseases, and psychological disorders such as anxiety and depression (Azziz et al., 2004; Teede et al., 2011). According to the World Health Organization (WHO), PCOS affects between 8% and 13% of women globally, though many cases remain undiagnosed due to variations in diagnostic criteria and lack of awareness (World Health Organization, 2023).

In the Indian context, the burden of PCOS appears particularly concerning. Recent studies estimate that the prevalence of PCOS among Indian women varies widely, ranging from 3.7% to 22.5% depending on geographic region, diagnostic criteria applied, and study design (Bharathi et al., 2017; Jabeen et al., 2022). Urbanization, sedentary lifestyles, poor dietary habits, stress, and genetic predisposition have been identified as significant risk factors contributing to the rising incidence of PCOS among Indian adolescents and young women (Mehreen et al., 2021; Joseph et al., 2016). Notably, Bharathi et al. (2017) reported higher odds of PCOS among urban women compared to rural populations, highlighting the role of lifestyle transitions in disease manifestation.

Despite its high prevalence, awareness of PCOS among adolescents and young adults in India remains alarmingly low. Ayesha Jabeen et al. (2022) found that over 78% of participants were unaware of PCOS symptoms, complications, and management options before educational interventions. Furthermore, emotional health issues such as mood disturbances and fatigability, closely linked with PCOS, are often under-recognized in clinical practice (Joseph et al., 2016).

Diagnosis of PCOS during adolescence presents additional challenges, as clinical symptoms such as menstrual irregularities, acne, and mild hirsutism may overlap with normal pubertal changes (Singh et al., 2018). This diagnostic complexity often leads to delayed identification and missed opportunities for early intervention, thereby increasing the risk of long-term reproductive and metabolic complications.

Given these realities, there is a critical need to synthesize existing research on the prevalence, clinical presentation, risk factors, and awareness levels of PCOS among adolescent and young Indian females. By systematically reviewing available Indian studies, this paper aims to highlight gaps in knowledge, identify emerging risk patterns, and inform future strategies for early detection, prevention, and management of PCOS among India's young female population.

**Methodology:** A comprehensive search strategy was designed using multiple scientific databases, including PubMed, Scopus, Google Scholar, ScienceDirect, and Indian Medical Journals. Search terms combined Medical Subject Headings (MeSH) and keywords such as "Polycystic Ovary Syndrome," "PCOS," "Adolescents," "Young Women," "India," "Prevalence," "Awareness," and "Risk Factors," using Boolean operators ("AND," "OR") to optimize sensitivity and specificity. Additionally, grey literature sources and manually reviewed reference lists from relevant articles were screened to ensure completeness.

Two independent reviewers conducted the screening in three stages: title review, abstract screening, and full-text evaluation. Discrepancies in study selection were resolved through discussion or, where necessary, consultation with a third reviewer. Data were extracted independently using a pre-designed standardized form collecting information on study author, year, study design, sample size, geographic location (urban/rural), participant characteristics, diagnostic criteria used, prevalence rates, major associated risk factors, and key statistical outcomes.

Ethical approval was not required for this systematic review, as all data analyzed were obtained from publicly available published studies

**Results: Study Characteristics:** Seven studies conducted between 2016 and 2024 were included in this review, all based in various regions of India, involving adolescent girls and young women aged between 11 and 30 years. The study designs ranged from questionnaire-based cross-sectional surveys (Mathur and Tiwari, 2024; Ayesha Jabeen et al., 2022) to hospital-based prospective evaluations (Archana Singh et al., 2018; Mehreen et al., 2021) and large community-based surveys (Bharathi et al., 2017). Sample sizes varied notably, from 117 participants in Archana Singh et al. to 1068 participants in the multicentric study by Bharathi et al. Most studies adopted the Rotterdam criteria (2003) for diagnosing PCOS, although some, like Mathur and Tiwari, relied on symptom-based self-reported questionnaires without ultrasound confirmation, which may influence diagnostic accuracy.

**Prevalence of PCOS:**-The prevalence of PCOS across studies showed wide variation, ranging from 6% to 77.1%. Mathur and Tiwari (2024) reported the highest prevalence (77.1%) based on questionnaire responses among young women in the National Capital Region. Bharathi et al. (2017) found a prevalence of 6% in a large ethnographic study spanning urban and rural South Indian populations, employing stricter diagnostic criteria. Mehreen et al. (2021) reported a clinically confirmed prevalence of 8.1% through ultrasound and biochemical assessments. Among specific populations, Joseph et al. (2016) and Ayesha Jabeen et al. (2022) observed prevalence rates of 8.1% and 6.8%, respectively. In contrast, Archana Singh et al. (2018) found a higher prevalence of 11.96% among symptomatic adolescents attending gynecology clinics.

**Urban-Rural Differences:**-Differences in PCOS prevalence and presentation between urban and rural populations were explored by Bharathi et al. (2017) and Gupta et al. (2024). Bharathi et al. found slightly higher odds of PCOS among urban women, attributing it to factors such as sedentary lifestyles, unhealthy diets, and higher levels of psychological stress. However, Gupta et al. (2024) reported no statistically significant differences in hormonal profiles, age of onset, or family history between urban and rural girls, suggesting that while environment may contribute, genetic and individual lifestyle factors play equally significant roles.

**Risk Factors Associated with PCOS:** Several common risk factors for PCOS were identified consistently across the studies. Obesity was a major contributor, with Mathur and Tiwari (2024) noting that 8% of participants were obese. Mehreen et al. (2021) statistically confirmed obesity as a strong risk factor, with an odds ratio (OR) of 3.09. Insulin resistance (OR=2.12) and hypertension (OR=4.46) were also significantly associated with PCOS in the Chennai cohort studied by Mehreen et al. Family history of PCOS was emphasized as a critical genetic risk factor by both Bharathi et al. (2017) and Joseph et al. (2016). In addition, Bharathi et al. highlighted that psychological stress, particularly among urban women, served as a significant environmental trigger for symptom manifestation.

**Awareness and Knowledge about PCOS:** Awareness levels about PCOS varied considerably across the studies. Ayesha Jabeen et al. (2022) found that 78.4% of adolescent girls were unaware of PCOS before undergoing an educational

briefing, indicating a severe lack of baseline knowledge. Mathur and Tiwari (2024) reported that although 90% of participants had heard of PCOS, only a small proportion could correctly identify its symptoms, complications, and treatment options. The other studies either did not formally assess awareness or anecdotally mentioned low levels of knowledge among participants. These findings collectively underscore the urgent need for improved public health education programs targeting young women.

**Clinical Presentation of PCOS:**—Clinical manifestations of PCOS were broadly consistent across the studies. Menstrual irregularities, including oligomenorrhea and amenorrhea, were the most commonly reported symptoms. Hyperandrogenic features such as hirsutism, acne, and alopecia were also frequently observed. Mathur and Tiwari (2024) highlighted a high prevalence of acne and hirsutism among their participants, whereas Archana Singh et al. (2018) emphasized menstrual dysfunction as the primary clinical presentation among symptomatic adolescents. Additionally, emotional disturbances such as mood swings, fatigue, and irritability were frequently reported by PCOS patients, particularly noted by Joseph et al. (2016), where over 90% of PCOS-affected participants reported emotional problems impacting daily functioning.

**Table 1: Comparative Summary of Included Indian Studies on the Prevalence, Risk Factors, and Awareness of Polycystic Ovarian Syndrome (PCOS) among Adolescent Girls and Young Women.**

Study	Year	Location	Sample Size	PCOS Prevalence (%)	Diagnostic Criteria	Major Risk Factors Identified	Awareness Level
Mathur & Tiwari	2024	NCR (Urban India)	267	77.1	Rotterdam (Questionnaire based)	Obesity, Sedentary lifestyle	High superficial awareness, poor knowledge
Gupta et al.	2024	Bihar (Urban & Rural)	160	Not specified	Rotterdam + Clinical Hormonal Data	No urban-rural difference; Lifestyle factors	Not assessed
Aysha Jabeen et al.	2022	South India	250	6.8	Rotterdam (Pre/Post Awareness Survey)	Low awareness, BMI variations	Very low (78.4% unaware pre-intervention)
Bharathi et al.	2017	Tamil Nadu (Urban & Rural)	1068	6	Rotterdam Criteria	Urban lifestyle, Family history, Stress	Very low in rural areas
Mehreen et al.	2021	Chennai (Urban)	518	8.1	Rotterdam + USG & Biochemical Tests	Obesity, Insulin resistance, Hypertension	Not assessed
Joseph et al.	2016	South India (University Students)	480	8.1	Self-reported + Symptom Checklist	Family history, Urban living, Emotional stress	Not directly assessed
Archana Singh et al.	2018	Hyderabad (Hospital-based)	117	11.96	Rotterdam + Clinical & USG	Pubertal symptom overlap, Lifestyle factors	Not assessed

**Discussion:**—This systematic review highlights the considerable variation in reported prevalence rates of polycystic ovarian syndrome (PCOS) among adolescent girls and young women in India, ranging from 6% to as high as 77.1%. This wide variability can largely be attributed to differences in study design, diagnostic methods, population characteristics, and reliance on symptom-based versus clinical/ultrasound confirmation of diagnosis. Studies that employed self-reported questionnaires without clinical evaluation, such as Mathur and Tiwari (2024), demonstrated significantly higher prevalence rates compared to

studies utilizing stricter Rotterdam criteria and ultrasonographic confirmation, as seen in Mehreen et al. (2021) and Bharathi et al. (2017). This observation aligns with global patterns where reliance on symptomatology alone often leads to an overestimation of PCOS prevalence (Bozdogan et al., 2016).

Urbanization appears to play a modest role in influencing PCOS prevalence and clinical severity. Bharathi et al. (2017) reported slightly higher odds of PCOS among urban populations, linking it to sedentary lifestyles, dietary changes, and increased psychological stress. However, Gupta et al. (2024) found no statistically significant urban-rural differences in hormonal profiles or family history, indicating that environmental factors must be considered alongside genetic predisposition when analyzing PCOS risk patterns. These findings reflect the broader global understanding that PCOS is a multifactorial condition with both hereditary and environmental influences (Teede et al., 2018).

Obesity, insulin resistance, and family history emerged as the most consistent risk factors across all reviewed studies, corroborating global epidemiological findings (Azziz et al., 2016). Notably, Mehreen et al. (2021) quantified these risks by identifying obesity (OR 3.09), insulin resistance (OR 2.12), and hypertension (OR 4.46) as significant correlates with PCOS diagnosis among adolescents. These findings underline the need for early metabolic screening among adolescents presenting with menstrual abnormalities or hyperandrogenic features, particularly those with a family history of metabolic syndrome or PCOS.

An important concern raised by this review is the alarmingly low level of PCOS awareness among adolescents and young women in India. Studies like Ayesha Jabeen et al. (2022) and Mathur and Tiwari (2024) demonstrate that despite a general recognition of the term "PCOS," detailed understanding regarding symptoms, risk factors, long-term complications, and treatment options remains poor. This knowledge gap delays early diagnosis, prevents timely lifestyle interventions, and contributes to the progression of metabolic and reproductive complications. Public health initiatives and school-based educational programs are therefore urgently needed to bridge this critical awareness gap.

Finally, the clinical presentation of PCOS among Indian adolescents was consistent with international observations, with menstrual irregularities, acne, hirsutism, and psychological symptoms being the most frequently reported. Importantly, emotional health disturbances were underlined as a significant but often overlooked component of PCOS, echoing findings from other global reviews emphasizing the psychological burden associated with the disorder (Dokras et al., 2018).

While this review provides valuable insights, certain limitations must be acknowledged. The heterogeneity in diagnostic criteria, study design, and population characteristics precluded meta-analysis. Furthermore, reliance on self-reported data in some studies introduces the potential for recall bias. Despite these limitations, this systematic review presents a comprehensive synthesis of existing literature on PCOS among Indian adolescents and young women and highlights critical areas for future research and intervention.

### Conclusion

Polycystic ovarian syndrome represents a growing public health concern among adolescent girls and young women in India, with reported prevalence rates ranging from 6% to 77.1% across studies. Obesity, insulin resistance, psychological stress, and family history are consistently identified as key risk factors associated with PCOS development. Despite the high burden of disease, awareness levels among young women remain critically low, contributing to delayed diagnosis and management. Urbanization and changing lifestyle patterns appear to influence the increasing incidence of PCOS, though genetic predisposition remains a fundamental contributor. Clinical presentations are largely uniform, dominated by menstrual irregularities, hyperandrogenic symptoms, and significant emotional health disturbances. Addressing this burden requires a multi-pronged approach, including widespread awareness programs targeting adolescents, early lifestyle intervention strategies, routine metabolic screening in high-risk groups, and further research employing standardized diagnostic criteria. With the rising incidence of lifestyle-related disorders in India, early identification and management of PCOS are vital to preventing long-term metabolic, reproductive, and psychological complications in this vulnerable population.

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