***Original Research Article***

**TO ASSES THE IMPACT OF PHARMACIST’S INTERVENTION ON KNOWLEDGE OF ADOLESCENT GIRLS REGARDING PCOS IN KALABURAGI CITY,INDIA**

**Abstract:**

**Aims:** Polycystic ovarian syndrome (PCOS) is a common endocrinopathy affecting 116 million women globally (3.4%), with one in every ten women affected in India. Despite its prevalence, PCOS remains underdiagnosed due to low awareness, especially among adolescents, leading to delayed medical intervention and increased risk of infertility. Pharmacists, as accessible healthcare professionals, play a crucial role in bridging the knowledge gap through structured health education programs. **Objective:** This study aimed to evaluate baseline awareness regarding PCOS and assess the impact of a pharmacist-led educational intervention among adolescent girls. **Study Design:** A pre-post prospective educational interventional study was conducted among 862 adolescent girls (12–16 years) from 13 different high schools in Kalaburagi city. Participants underwent a pre-test, followed by a two-week pharmacist-led awareness session, and a post-test after 14 days using the same structured questionnaire. Data were analyzed using IBM SPSS 20.0, with P < 0.05 considered statistically significant. **Results:** Of 862 participants, 87.6% (n=755) lacked prior PCOS knowledge. Among those who were already familiar, family (54.2%) was the most common source, followed by doctors (25.2%), the internet (21.5%), and friends (13.1%). A statistically significant improvement (P < 0.001) in knowledge scores was observed, with a mean increase of 51.06% post-intervention. Rural students and younger adolescents had lower baseline awareness, but showed significant improvements post-education, emphasizing the need for targeted awareness programs.

**Conclusion:** Our study identifies a critical gap in PCOS awareness among adolescent girls. However, pharmacist-led educational interventions significantly improved their knowledge, reinforcing the essential role of pharmacists in preventive healthcare. These findings emphasize the importance of integrating structured health education programs into school curriculums, ensuring long-term awareness and enabling young individuals to make informed choices for better health and well-being.

Keywords: PCOS, PCOD, endocrinopathy, menstrual cycle, adolescents, infertility, Obstetrics and gynecology.

**Introduction:**

Polycystic ovary syndrome (PCOS) is the most common chronic reproductive and metabolic endocrine disorder affecting women of childbearing age, with prevalence estimated to be 4%–21% worldwide. It was first described by Hippocrates in 377–460 BC as “women whose menstruation is less than 3 days or meager are robust, with a healthy complexion and a masculine appearance; yet they are not concerned about bearing children nor do they become pregnant” [1] PCOS is a heterogeneous multisystem endocrinopathy with the ovarian expression of various metabolic disturbances and a wide spectrum of clinical features such as obesity, menstrual abnormalities, and hyperandrogenism.[2] It was originally described in 1935 by Stein and Leventhal as a syndrome, though etiology of PCOS remains incompletely understood.[3,4] The current concept of the pathogenesis of PCOS is the unbalanced release of FSH and LH by the pituitary and insulin resistance.[5]  Girls with low birth weight as well as a family history of diabetes mellitus, premature birth, cardiovascular disease, hypertension, hormonal imbalance, genetic problem, endocrine disease, weakened immune system, environmental factors, and toxin effect are at risk for developing PCOS.[6] For the diagnosis of PCOS, the Rotterdam criteria are widely used worldwide, and its use is also recommended by the Endocrine Society in 2013, the American Academy of Family Physicians (AAFP) Guidelines in 2016, and the International Evidence-based Guideline for the assessment and management of polycystic ovary syndrome 2018.[7] PCOS is a never-ending hyperandrogenic condition that has so many vital short-period and long-period complications.[8] The short-term complications of PCOS include menstrual irregularities, hyperandrogenism, insulin resistance, hyperinsulinemia, obstructive sleep apnea, dyslipidemia, oligoovulation, and anovulation.[9] Long-term complications include heart disease, diabetes, and metabolic syndrome. Moreover, women with PCOS have a threefold increase in the risk of developing endometrial cancer compared to women without PCOS.[10] This syndrome is a leading cause of infertility, accounting for about 20% of cases and a higher miscarriage rate compared to other sub-fertile women.[2] In addition to the gynaecological, endocrine, and metabolic features of PCOS many mental complications are also associated with this condition.[11] A Brazilian research study concluded that 58% of women with PCOS exhibited at least one psychiatric disorder.[12] Thus, women with PCOS should be diagnosed early, treated correctly, and followed up carefully to avoid these detrimental effects.[1]

**Need for study**

PCOS is a leading endocrinological disorder.[13] Over 7 million individuals suffer from PCOS. That figure exceeds the combined totals for breast cancer, osteoarthritis, neurological disorders, and lupus.[14] It is one of the most common disorders, yet most neglected, conditions affecting one in 15 women worldwide.[15] According to a study by PCOS Society, one in every 10 women in India has PCOS. And out of every 10 women diagnosed with PCOS, six are teenage girls.[6] Some females reach menarche as early as 8-9 years. Due to lack of awareness, many menstrual problems including PCOS remain unidentified and untreated, especially among the rural population.[16] Thus, adolescents are more prone to health risks due to hormonal imbalances, lifestyle changes, and lack of knowledge.[17] The disease can be overlooked until severe complications arise, most commonly infertility, the point at which most patients seek medical attention secondary to difficulty conceiving.[18] This makes them humiliated and lowers their self-confidence, as a result, their social and interpersonal relationships are hampered.[11] Late diagnosis and no timely measures increase the risk of many gynecological cancers such as endometrial, ovarian, and breast cancers.[19] The lifetime risk of endometrial cancer that has been estimated in these women is 2.7 times more than that in women without this syndrome.[20] The societal taboos that prevent free discussion of the subject, particularly among the young group, are the main reason why research on teenagers' reproductive concerns remains limited.[21] Improving awareness and understanding of PCOS is regarded as a crucial first step in the management of the syndrome.

**AIM OF THE STUDY AIM & OBJECTIVES**

• To assess the knowledge and determine the effect of educational intervention among adolescent girls regarding PCOS

**OBJECTIVES**

• To assess the level of awareness and knowledge regarding PCOS among high school students.

• To improve the knowledge about PCOS among high school students.

• To enhance PCOS awareness and knowledge among high school students

• To find out the association between pre-test knowledge regarding PCOS and selected demographic variables

**MATERIALS AND METHODS**

**Study Design & Setting**

This educational interventional study was conducted among adolescent girls in higher secondary schools of Kalaburagi city to assess their baseline knowledge and evaluate the effectiveness of a structured teaching program on PCOS. The study was conducted over six months (March 2023 – August 2023). A pre-post interventional study was chosen as it provides a quantifiable measure of knowledge enhancement following pharmacist-led education, allowing for a clear assessment of the intervention's effectiveness.

The study was initiated after obtaining Institutional Review Board (IRB) approval, and informed assent was obtained from all participants, with explanations provided by their class teachers regarding the study’s purpose.

**Questionnaire Development & Structure**

A structured questionnaire was developed based on previously published articles, textbooks, and clinical guidelines and was validated by the IRB. The study included schools with different mediums of instruction, and the questionnaire was available in English, Kannada and Urdu.

The questionnaire was divided into two sections:

* **SECTION A (Demographic & Background Information)**
1. Name, age, grade, school
2. Attainment of menarche (if yes, age of onset; if no, proceed to the next section)
3. Prior awareness of PCOS/PCOD and the source of information
* **SECTION B (Knowledge Assessment – 20 Multiple-Choice Questions)**The knowledge-based questions were categorized into six key areas:
	+ Anatomy and Physiology (4 questions)
	+ Causes and Risk Factors (2 questions)
	+ Clinical Manifestations (3 questions)
	+ Management (5 questions)
	+ Prevention and Complications (2 questions)
	+ General Aspects (4 questions)

Each correct answer was awarded 1 point, while incorrect or unanswered responses received 0 points. The maximum possible score was 20, and knowledge levels were classified as follows:

**Grading of knowledge based on scores:**

Poor 1-4

Moderate 5-9

Adequate 10-14

Excellent 15-20

**Study Phases**

The study was conducted in three phases:

1. Phase 1: Pre-Test
	* A baseline knowledge assessment was conducted using the questionnaire.
2. Phase 2: Educational Intervention
	* Participants received pharmacist-led education through:
		+ PowerPoint presentations
		+ One-on-one interactions
		+ Distribution of PCOS awareness leaflets
3. Phase 3: Post-Test (Knowledge Retention Assessment)
	* A post-test was conducted 14 days later using the same structured questionnaire.
	* The 14-day interval was chosen to evaluate knowledge retention and effectiveness of the educational intervention beyond immediate recall.

**Data Analysis**

The collected data from different schools were compiled and analyzed using Microsoft Excel and SPSS-20. A Student-paired t-test was used to assess statistical significance in knowledge improvement following the intervention.

**RESULTS**

The study assessed the impact of pharmacist intervention on adolescent girls knowledge regarding Polycystic Ovarian Syndrome (PCOS) across 13 different schools in Kalaburagi city. A total of 949 adolescent girls participated in the pre-test phase. However, 87 participants were absent on the post-test day, leaving 862 girls for the final analysis.

**Table No.1: Depicting the details of age, medium of school, class, area of residence, attainment of menarche, prior source of information regarding PCOS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Demographic details** | **Categories** | **Number of adolescent girls** | **Percentage** |
| **Age in years** | **Age interval****12 years****13 years****14 years****15 years** **16 years****Total** | 1516828031485**862** | 1.719.532.536.49.9**100.0** |
| **Total** | 862 | 100.0 |
| **Medium of School** | **English****Kannada****Urdu** | 546171145 | 63.419.816.8 |
| **Total** | 862 | 100.0 |
| **Class** | **8th****9th****10th** | 215296351 | 24.934.440.7 |
| **Total** | 862 | 100.0 |
| **Area of residence** | **Urban****Rural** | 744118 | 86.313.7 |
| **Total** | 862 | 100.0 |
| **Attainment of menarche** | **Yes** | 92551121 | 10.663.914.0 |
| **10 – 11****12 – 13****14 – 15** |
| **No** | 98 | 11.3 |
| **Total** | 862 | 100.0 |
| **Prior information** | **Yes** | 58272314 | 54.225.221.513.1 |
| **Family members****Doctors****Internet/mass media****Friends** |
| **No** | 755 | 87.6 |

The age distribution of participants showed that the majority (36.4%) were 15 years old, followed by 32.5% aged 14 years, 19.5% aged 13 years, 9.9% aged 16 years, and only 1.7% aged 12 years.

Regarding the medium of instruction, most adolescent girls (63.4%) belonged to English-medium schools, while 19.8% were from Kannada-medium schools, and 16.8% were from Urdu-medium schools.

The academic level of participants indicated that 40.7% were studying in the 10th standard, followed by 34.4% in the 9th standard and 24.9% in the 8th standard.

In terms of residential background, the majority (86.3%) of participants resided in urban areas, while 13.7% belonged to rural areas.

Menstrual history analysis revealed that 88.6% of the adolescent girls had attained menarche, with the majority (72.1%) experiencing it between the ages of 12 and 13 years.

Awareness about PCOS/PCOD was found to be significantly low among participants. Out of 862 adolescent girls, 87.6% had no prior knowledge about PCOS, while only 12.4% had some awareness. Among those who were aware, the primary source of information was family members (54.2%), followed by doctors (25.2%), internet/mass media (21.5%), and friends (13.1%).

**Table No.2: Comparison of knowledge score with demographical profile of adolescent girls**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Demographical****Profile**  | **Categories**  | **Number of girls**  | **Pre-Test****Mean ± SD** | **Mean %** |  **Test- values****P-value**  |
| **Age**  | 12 | 15 | 6.67 ± 2.74 | 33.35% | **F = 4.501****P =0.001, HS** |
| 13 | 168 | 6.33 ± 2.52 | 31.65% |
| 14 | 280 | 7.32 ± 3.00 | 36.60% |
| 15 | 314 | 7.43 ± 3.06 | 37.15 |
| 16 | 85 | 7.42 ± 2.99 | 37.10 |
| **Study class**  | 8th std. | 215 | 6.49 ± 2.59 | 32.45% | **F = 13.797****P =0.000, HS** |
| 9th std. | 296 | 7.62 ± 2.94 | 38.10% |
| 10th std. | 351 | 7.54 ± 3.16 | 37.7% |
| **Residential area**  | Urban  | 744 | 7.68 ± 2.86 | 38.40% | **F = 17.153****P =0.000, HS** |
| Rural  | 118 | 6.27 ± 2.93 | 31.35% |
| **Source of information**  | Doctors  | 27 | 9.92 ± 2.85 | 49.60% | **F = 24.756****P =0.000, HS** |
| Friends  | 14 | 8.35 ± 2.23 | 41.75% |
| Family members  | 58 | 8.75 ± 3.16 | 43.75% |
| Internet/mass media  | 23 | 11.08 ± 2.64 | 55.50% |
| No sources  | 755 | 6.86 ± 2.81 | 34.30% |
| **Attainment of menarche**  | Yes  | 764 | 7.34 ± 3.01 | 36.6% | **t = 4.786****P =0.000, HS** |
| No | 98 | 5.98 ± 1.92 | 29.9% |

Age: Adolescent girls aged 12 and 13 had significantly lower knowledge of PCOS compared to those aged 14, 15, and 16 (P<0.001).

Study class: 8th standard girls demonstrated lower knowledge of PCOS compared to 9th and 10th standard girls, showing a statistically significant difference (P<0.001).

Residence: Rural adolescent girls had significantly lower knowledge of PCOS compared to urban girls (P<0.001).

Source of Information: A highly significant difference in knowledge scores was observed based on the source of information (P<0.001).

Menarche: A highly significant difference in knowledge scores was found based on the attainment of menarche (P<0.001).

**Table No.3: Comparison of knowledge scores of PCOS between Pre and Post-test**

|  |  |  |  |
| --- | --- | --- | --- |
| **knowledge scores** | **Categories**  | **Pre-test**  | **Post-test** |
| No. | % | No | % |
| **0—4**  | **Poor** | 163 | 18.9 | 0 | 0.0 |
| **5—9**  | **Moderate** | 521 | 60.4 | 93 | 10.8 |
| **10—14**  | **Adequate**  | 172 | 20.0 | 288 | 33.4 |
| **15—20**  | **Excellent**  | 6 | 0.7 | 481 | 55.8 |
| **Total** | **---** | **862** | **100.0** | **862** | **100.0** |
| **Mean ± SD** | **----** | **7.16 ± 2.95** |  **14.63 ± 3.72** |
| **Diff. of mean**  | **---** | **7.47 (51.06%)** |
| **Paired t-test and p-value**  | **t = 28.53, P = 0.0001, HS**  |

The study reveals that adolescent girls aged 12 and 13 had significantly lower knowledge of PCOS compared to those aged 14, 15, and 16 (P < 0.001). Similarly, 8th standard students had lower knowledge than 9th and 10th standard students (P < 0.001). Rural adolescent girls demonstrated significantly lower knowledge of PCOS compared to urban girls (P < 0.001). Additionally, knowledge scores were significantly associated with the source of information about PCOS (P < 0.001) and the attainment of menarche (P < 0.001).

The significant post-intervention improvement (P = 0.0001) signifies the effectiveness of structured pharmacist-led educational programs in bridging knowledge gaps. These findings emphasize the need for targeted awareness initiatives in younger adolescents and rural communities, ensuring equitable access to essential reproductive health education.

**Figure No.1: Bar diagram represent comparison of mean knowledge score of PCOS**

**between Pre and Post-test**

**Table No.4: Area-wise mean, SD and mean percentage of girls of pre-test and post-test knowledge score regarding PCOS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Area of knowledge score** | **Max score** | **Pre-test**  | **Post –test**  | **Paired t-test and P-value** |
| **Mean**  | **SD** | **Mean%** | **Mean**  | **SD** | **Mean%** |
| **Anatomy & physiology**  | **4** | **1.62** | **1.32** | **40.5%** | **3.12** | **1.54** | **78.0%** | **t = 21.83****P = 0.000, HS** |
| **Risk factors and causes**  | **2** | **0.85** | **0.42** | **42.5%** | **1.61** | **0.45** | **80.5%** | **t = 27.13****P = 0.000, HS** |
| **Clinical manifestations**  | **3** | **1.02** | **0.43** | **34.0%** | **1.82** | **0.63** | **60.7%** | **t = 13.73****P = 0.000, HS** |
| **Management**  | **5** | **1.65** | **1.13** | **33.0%** | **3.52** | **1.34** | **70.4%** | **t = 23.52****P = 0.000, HS** |
| **Prevention & complications**  | **3** | **0.98** | **0.31** | **32.7%** | **2.30** | **0.93** | **76.7%** | **t = 30.17****P = 0.000, HS** |
| **General aspects**  | **3** | **1.01** | **0.45** | **33.7%** | **2.26** | **0.85** | **75.3%** | **t = 31.41****P = 0.000, HS** |
| **Overall**  | **20** | 7.16 | **2.95** | **35.8%** | **14.63** | **3.72** | **73.15%** | **t = 28.53****P = 0.000, HS** |

The study reveals that, among the different areas of knowledge on PCOS, the lowest scores were observed in the clinical manifestations section, while the highest scores were seen in the risk factors and causes section. A statistically highly significant improvement (P<0.001) was observed in all areas of knowledge between the pre-test and post-test. The post-test mean scores were significantly higher across all areas compared to the pre-test scores. This indicates that the standardized structured teaching program on PCOS was effective in enhancing knowledge across all assessed domains.

**Figure No.2: Multiple bar diagram shows area wise mean, SD and mean percentage of girls of pre-test and post-test knowledge score regarding PCOS**

**Discussion**

Adolescence is a crucial period marked by significant physiological and psychological changes, yet many girls lack proper guidance on menstrual health due to societal restrictions. PCOS is a growing concern, and to our knowledge, this is the first educational intervention study of its kind in Kalaburagi.

Our study found that younger adolescents (ages 12–13) had lower PCOS awareness compared to older girls (ages 14–16), aligning with findings by Mohammed HAA et al. (2016) and Batra B et al. (2018). Similarly, 8th-grade students exhibited significantly lower knowledge levels than 9th and 10th graders, emphasizing the need for early intervention in younger age groups. Rural participants also demonstrated lower awareness than urban students, consistent with Sayed SLME et al. (2020), reinforcing the urban-rural disparity in adolescent health education.

An important and previously unexplored aspect in our study is the impact of the medium of instruction on PCOS knowledge. We observed that English-medium students had higher knowledge scores compared to their Kannada and Urdu-medium counterparts, suggesting a possible language barrier in accessing health information. Additionally, 87.6% of participants had no prior PCOS awareness, with family members being the most common source of information. These findings align with Salama AM et al. (2019) and Sindhu S et al. (2021), highlighting the role of informal health education at home.

However, in our study, awareness of 35.8% was observed among the adolescent girls which is on the higher side in contrast to the result obtained by Jabeen A et al., (2022) who reported an awareness level of 21.6% and Kirthika V et al., (2019) with an awareness level of 3.6%. This may be because majority of our participants were from urban population and might have acquired knowledge regarding PCOS through socializing, family etc.

A unique contribution of our study is the significant association between menarche and PCOS knowledge adolescents who had attained menarche demonstrated higher baseline awareness. This relationship has not been previously explored, suggesting that personal experiences with menstruation may influence reproductive health knowledge.

Our results align with previous intervention studies, such as Rawat S et al. (2017), which reported a mean difference of 11.42 in pre- and post-test scores, and Varughese AK et al. (2018), where the mean difference was 9.91. While the magnitude of improvement differs, all studies, including ours, confirm the positive impact of structured educational programs on adolescent health literacy.

While prior studies have demonstrated the benefits of educational interventions, our study further strengthens the role of pharmacists in adolescent health education. By directly engaging with students through structured teaching, interactive sessions, and leaflet distribution, pharmacists played a key role in bridging knowledge gaps and promoting early awareness of PCOS. Additionally, our study addresses regional disparities in PCOS knowledge, particularly highlighting gaps related to language barriers, medium of instruction, and rural-urban differences.

Overall, our findings reinforce the importance of pharmacist-led educational initiatives in empowering adolescent girls with essential reproductive health knowledge, ultimately contributing to early detection, lifestyle modifications, and improved long-term health outcomes.

**Conclusions**

PCOS is a prevalent concern among adolescent females, with the potential to cause serious health complications and impact reproductive health when left unrecognized and untreated. Our study identified a significant gap in PCOS awareness, which may delay timely medical intervention and preventive care. However, the findings highlight that structured pharmacist-led educational programs can effectively bridge this knowledge gap, empowering adolescents with essential health information.

Prior to the intervention, only 12.4% of participants were aware of PCOS, while 87.6% lacked any knowledge of the condition. Following the pharmacist-led educational program, PCOS knowledge scores improved significantly, with an overall mean increase of 51.06%. These results demonstrate that pharmacists, as accessible healthcare professionals, play a crucial role in public health education, particularly in adolescent reproductive health.

**Long-Term Role of Pharmacists in PCOS Awareness**

Given the substantial improvement in knowledge post-intervention, integrating pharmacist-led awareness programs into school curriculums could ensure sustained adolescent health literacy. Pharmacists can serve as key educators by conducting regular school-based awareness campaigns, collaborating with healthcare providers, and guiding adolescents toward preventive healthcare measures.

Additionally, policy-level changes in adolescent health education are essential. Incorporating PCOS education into national reproductive health policies could help standardize awareness efforts, ensuring that all adolescents, regardless of their background, receive consistent, evidence-based information on reproductive health.

**Recommendations & Future Outlook**

1. Prevalence Study: Conducting large-scale studies on PCOS prevalence among adolescents would provide critical epidemiological data, helping healthcare providers develop targeted screening and intervention strategies.
2. Identifying High-Risk Adolescents: Implementing school-based screening surveys can help identify high-risk individuals early, enabling preventive lifestyle modifications and timely medical interventions.
3. Studies in Adult Women: Extending this research to adult women can help assess how PCOS knowledge and healthcare-seeking behavior evolve over time, contributing to long-term reproductive and metabolic health strategies.
4. Government Initiatives: Policy-driven awareness programs should be introduced at schools and community levels to enhance early detection, reduce stigma, and promote reproductive health literacy, ultimately easing the burden on healthcare systems.
5. Further Research: Multi-center studies are needed to validate the effectiveness of pharmacist-led interventions across different demographics and healthcare settings. These findings could shape future policies and enhance clinical practices in adolescent health education.

**Limitations**

1. We think the study can be carried out in large population, since the PCOS condition is a broad entity relevant to mass population.

2. The fact that 107 (12.4%) adolescent girls who were already familiar with PCOS may influence the accuracy of our findings.

**CONSENT**

Informed consent was obtained from the parents or legal guardians of all adolescent participants involved in this study. The consent included approval for participation and publication of the study findings. A copy of the signed consent forms is available for review by the journal’s editorial office upon request.

**ETHICAL APPROVAL**

All authors hereby declare that this study was reviewed and approved by the, Institutional Review Board (IRB) and conducted in accordance with the ethical standards of the 1964 Declaration of Helsinki. The ethical approval reference number is IRB003/PP/2022-23. A copy of the ethical approval document is available for review by the journal’s editorial office upon request.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that generative AI technologies were used in the writing/editing of this manuscript for language refinement and improving readability.

Details of the AI usage are given below:

1. AI Tool & Model: ChatGPT (GPT-4)

Source: OpenAI (<https://openai.com>)

Input Prompts Provided to AI:

*Enhance the readability of this section while keeping the scientific accuracy intact.*

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