



Effectiveness of an Information, Education, and Communication Package on Knowledge Regarding Lifestyle Modification for Prevention of Polycystic Ovarian Syndrome Among Nursing Students: A Quasi-Experimental Study

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ABSTRACT

Background: Polycystic ovarian syndrome (PCOS) is a prevalent endocrine disorder affecting women of reproductive age, with lifestyle modification serving as a cornerstone of prevention and management. Nursing students, as future healthcare providers, require comprehensive knowledge about PCOS prevention strategies to effectively educate and counsel patients. **Objectives:** To assess the effectiveness of an Information, Education, and Communication (IEC) package on knowledge regarding lifestyle modification in the prevention of PCOS among nursing students in a selected nursing college in Lucknow, India. **Methods:** A quasi-experimental one-group pre-test post-test design was employed. A total of 100 nursing students (25 each from BSc Nursing 1st year, BSc Nursing 2nd year, GNM 1st year, and GNM 2nd year), aged 18-25 years, were selected through probability simple stratified random sampling from a selected nursing college, Lucknow. Data were collected over 10 days using a structured 30-item multiple-choice questionnaire and a 15-item demographic questionnaire. The IEC package consisted of a 45-minute lecture-cum-discussion session delivered via LCD projector. Pre-test was conducted on day 1, the IEC intervention on day 3, and post-test on day 7. Knowledge scores were categorized as poor (1-10), average (11-20), and good (21-30). Data were analyzed using descriptive statistics, paired t-test, and chi-square test. **Results:** Pre-test results revealed that 44% of participants had poor knowledge and 56% had average knowledge, with no participants demonstrating good knowledge (mean = 10.83, SD = 2.731). Following the IEC intervention, post-test results showed significant improvement: 5% had poor knowledge, 32% had average knowledge, and 63% had good knowledge (mean = 22.47, SD = 7.168). The mean difference of 11.640 was statistically significant ($t = 16.718$, $p < 0.05$), indicating the effectiveness of the IEC package. **Conclusion:** The IEC package was highly effective in enhancing nursing students' knowledge regarding lifestyle modification for PCOS prevention. The significant improvement in knowledge scores demonstrates the value of structured educational interventions in preparing nursing students to address PCOS through patient education and counseling. Integration of PCOS-focused educational modules into nursing curricula is recommended to strengthen preventive healthcare delivery.

Keywords: Polycystic ovarian syndrome; PCOS; Information Education Communication; IEC package; lifestyle modification; nursing students; knowledge; health education; preventive healthcare; India

INTRODUCTION

Polycystic ovarian syndrome (PCOS) is a complex endocrine and metabolic disorder that affects women of reproductive age worldwide, representing one of the most common hormonal disorders in this population [1]. The syndrome is characterized by a constellation of clinical features including hyperandrogenism, chronic anovulation, menstrual irregularities, and polycystic ovarian morphology on ultrasound examination [2]. Beyond its reproductive manifestations, PCOS is associated with significant metabolic complications including insulin resistance, type 2 diabetes mellitus, dyslipidemia, cardiovascular disease, and endometrial hyperplasia [3]. The global prevalence of PCOS varies considerably depending on the diagnostic criteria employed, ranging from 6% to 20% of women of reproductive age [4].

The syndrome was first systematically described by Irving F. Stein and Michael L. Leventhal in the United States, though historical accounts trace observations of polycystic ovaries to Vallisneri in 1721, who documented a married, infertile woman with enlarged, shiny ovaries [5]. The heterogeneous nature of PCOS, with its multiple phenotypic presentations and varying diagnostic criteria including the National Institutes of Health (NIH) 1990 criteria, the Rotterdam 2003 criteria, and

the Androgen Excess Society (AES) criteria has contributed to challenges in establishing consistent prevalence estimates and management protocols [6].

In India, PCOS has emerged as a significant public health concern, particularly among adolescents and young women. A systematic review and meta-analysis reported a pooled prevalence of 17.74% among Indian adolescent girls aged 14-19 years using Rotterdam criteria, with hospital-based studies showing higher prevalence (25%) compared to community-based studies (11%) [7]. A large-scale national study documented PCOS prevalence rates of 7.2% using NIH criteria, 19.6% using Rotterdam criteria, and 13.6% using AE-PCOS criteria among Indian women [8]. Regional variations are evident, with studies from different parts of India reporting prevalence rates ranging from 3.7% to 22.5% [9], [10].

In Lucknow, Uttar Pradesh, a cross-sectional study among adolescent girls reported a PCOS prevalence of 22.5% by Rotterdam criteria and 10.7% by Androgen Excess Society criteria, with notably 71.8% of PCOS cases occurring in non-obese individuals [11]. This finding underscores the importance of recognizing PCOS beyond the traditional association with obesity. The rising prevalence of PCOS in India has been attributed to rapid urbanization, sedentary lifestyles, dietary

transitions toward processed foods, increased stress levels, and genetic predisposition [12], [13].

Lifestyle factors play a pivotal role in both the pathogenesis and management of PCOS. Obesity, present in 43.2% of Indian women with PCOS, significantly exacerbates insulin resistance and hyperandrogenism [8]. Physical inactivity, poor dietary habits characterized by high sugar and processed food consumption, inadequate water intake, and irregular sleep patterns have been identified as modifiable risk factors [14], [15]. A cross-sectional study in Agra identified obesity and overweight (OR 6.54), inadequate physical activity (OR 1.54), non-vegetarian diet (OR 1.75), snacking (OR 3.15), and family history of PCOS (OR 4.72) as significant risk factors [16].

Evidence demonstrates that lifestyle modification interventions, including dietary changes, regular physical activity, weight management, and stress reduction, can significantly improve both reproductive and metabolic outcomes in women with PCOS [17], [18]. A study among young women found that lifestyle modifications significantly reduced PCOS prevalence and severity, with key risk factors including BMI ≥ 25 kg/m² (OR: 2.6), sedentary lifestyle (OR: 2.4), and high-sugar diet (OR: 2.1) [19]. These findings emphasize the critical importance of preventive education targeting lifestyle modification, particularly among young women during their formative years.

Nursing students represent a unique target population for PCOS education for several reasons. First, as future healthcare providers, they will be at the forefront of patient education, counseling, and health promotion activities [20]. Second, nursing students themselves fall within the age group most vulnerable to PCOS development (18-25 years), making them both recipients and potential beneficiaries of preventive education [21]. Third, nurses play a crucial role in community health education, screening programs, and lifestyle counseling, particularly in resource-limited settings where they often serve as primary points of contact for healthcare information [22].

Despite their pivotal role, studies have consistently documented inadequate knowledge about PCOS among nursing students. A cross-sectional study in South India found that nursing students had limited knowledge and awareness regarding PCOS, with the authors recommending effective educational interventions to enhance their understanding [23]. An assessment of nursing students in Bhubaneswar, Odisha, similarly highlighted gaps in PCOS knowledge, emphasizing the need for structured educational programs [24]. A study among nursing students in Nepal revealed variable knowledge levels, with many students lacking comprehensive understanding of PCOS risk factors, clinical manifestations, and management strategies [25].

Information, Education, and Communication (IEC) packages represent structured, theory-based educational interventions designed to enhance knowledge, modify attitudes, and promote behavioral change [26]. In the context of health education, IEC interventions have demonstrated effectiveness in improving knowledge outcomes across diverse populations and health topics [27]. Several studies have evaluated the effectiveness of educational interventions on PCOS knowledge among nursing students and young women, with consistently positive results.

A randomized controlled trial evaluating web-based health education among nursing students found significant improvements in knowledge, adaptive healthy measures, and attitudes regarding PCOS [28]. A quasi-experimental study in Egypt

implementing educational guidelines reported that 89.8% of nursing students achieved high knowledge levels immediately after the intervention, with 68.5% maintaining high knowledge three months later [29]. A pre-experimental study in Udaipur, Rajasthan, documented a mean pre-test knowledge score of 6.8 ± 3.4 , which increased to 21.3 ± 3.0 post-intervention ($t = 56.5$, $p < 0.05$) [30]. Similarly, a structured training program in Northern India demonstrated significant knowledge improvement, with pre-test mean scores of 22.58 (SD = 11.02) increasing to 31.39 (SD = 14.50) post-intervention ($t = -8.11$, $p < 0.001$) [31].

A planned teaching program among BSc Nursing students showed that pre-test results with 4% adequate knowledge, 50% moderate, and 46% inadequate knowledge improved post-intervention to 28% adequate, 62% moderate, and 10% inadequate knowledge ($t = 5.66$, $p < 0.05$) [32]. A structured teaching program utilizing PowerPoint and videos in English and Telugu demonstrated significant knowledge improvement across all domains, with high knowledge on basic terminology increasing from 31.6% to 83.3% and on management from 26.6% to 83.3% ($p < 0.001$) [33]. A video-assisted teaching program in Bangalore reported that 94% of participants had inadequate knowledge pre-intervention (mean score 6.34, 31.7%), which improved to 44% achieving adequate knowledge post-intervention (mean score 15.3, 76.5%; $t = 2.42$, $p < 0.05$) [34].

While existing literature demonstrates the effectiveness of various educational interventions in improving PCOS knowledge, several gaps remain. First, most studies have focused on single-year nursing students or specific educational levels, with limited research examining knowledge enhancement across multiple years of nursing education simultaneously [30], [32], [35]. Second, few studies have specifically evaluated IEC packages as distinct from general structured teaching programs or web-based interventions in the Indian context [36]. Third, there is limited research examining the association between demographic variables, particularly obesity, and post-intervention knowledge retention among nursing students [37].

Furthermore, despite the high prevalence of PCOS in Lucknow (22.5%) [11], no published studies have specifically evaluated educational interventions targeting nursing students in this region. Given the regional variations in PCOS prevalence, lifestyle patterns, and cultural factors influencing health behaviors, region-specific educational interventions are essential [38]. The present study addresses these gaps by evaluating a structured IEC package across multiple years of nursing education (BSc Nursing 1st and 2nd year, GNM 1st and 2nd year) in Lucknow, with specific attention to demographic correlates of knowledge acquisition.

OBJECTIVES

The present study was undertaken to assess the knowledge regarding lifestyle modification for the prevention of polycystic ovary syndrome (PCOS) among nursing students. Specifically, the study aimed to assess the participants' pre-test knowledge, develop and implement an Information, Education, and Communication (IEC) package on lifestyle modification for PCOS prevention, evaluate post-test knowledge following the intervention, determine the effectiveness of the IEC package by comparing pre-test and post-test knowledge scores, and examine the association between post-test knowledge levels and selected demographic variables.

MATERIALS AND METHODS

Study Design and Setting: A quasi-experimental one-group pre-test post-test design was employed for this study. The research was conducted at selected college of Nursing, Lucknow, Uttar Pradesh, India, a recognized nursing education institution offering both Bachelor of Science in Nursing (BSc Nursing) and General Nursing and Midwifery (GNM) programs. The study setting was selected based on accessibility, institutional permission, and the availability of a diverse nursing student population across different years of education.

Study Population and Sampling: The study population comprised nursing students enrolled in BSc Nursing and GNM programs at selected college of Nursing, Lucknow. The target population included female nursing students aged 18-25 years, representing the age group most vulnerable to PCOS development and most likely to benefit from preventive education.

Sample Size: A total of 100 nursing students were included in the study.

Sampling Technique: Probability simple stratified random sampling was employed to ensure representation across different years of nursing education. The sample was stratified into four groups based on educational program and year of study: BSc Nursing 1st year: 25 students, BSc Nursing 2nd year: 25 students, GNM 1st year: 25 students, GNM 2nd year: 25 students. Within each stratum, participants were selected through simple random sampling using a random number table.

Data Collection Tools: Two instruments were developed and validated for data collection:

Demographic Questionnaire: A structured demographic questionnaire was developed to collect baseline information on the participants' socio-demographic, lifestyle, and health-related characteristics. The questionnaire included variables such as age, religion, family type (joint, nuclear, or extended), educational level (undergraduate or graduate), prior awareness regarding lifestyle modification for polycystic ovary syndrome (PCOS) (yes or no), and the primary source of information about PCOS (health personnel, parents, teachers, mass media, or no prior information). This questionnaire was used to describe the demographic profile of the participants and to examine the association between selected demographic variables and the study outcomes.

Knowledge Assessment Questionnaire: A structured multiple-choice questionnaire consisting of 30 items was developed to assess the participants' knowledge regarding lifestyle modification for the prevention of polycystic ovary syndrome (PCOS). The questionnaire encompassed key domains, including the definition and pathophysiology of PCOS, risk factors associated with its development, clinical manifestations and diagnostic criteria, the role of lifestyle factors such as diet, physical activity, and weight management in the prevention and management of PCOS, dietary modifications for PCOS prevention, exercise and physical activity recommendations, weight management strategies, stress management techniques, long-term complications of PCOS, and preventive measures and health promotion strategies. Each correct response was awarded one mark, while incorrect or unanswered items received zero marks. The total possible score ranged from 0 to 30, with higher scores indicating greater knowledge regarding lifestyle modification for the prevention of PCOS.

Each item was scored as 1 for a correct response and 0 for an incorrect response, resulting in a total possible score ranging

from 0 to 30. Based on the total score obtained, the participants' level of knowledge regarding lifestyle modification for the prevention of polycystic ovary syndrome (PCOS) was categorized into three levels: poor knowledge (1–10 points), average knowledge (11–20 points), and good knowledge (21–30 points). Higher scores indicated a greater level of knowledge regarding lifestyle modification for the prevention of PCOS.

Development of IEC Package: The Information, Education, and Communication (IEC) package was developed based on an extensive review of the literature, expert consultation, and evidence-based guidelines for the prevention and management of polycystic ovary syndrome (PCOS). The package was designed to enhance participants' knowledge and promote healthy lifestyle practices for reducing the risk of PCOS. The content included an introduction to PCOS, covering its definition, epidemiology, and disease burden; pathophysiology and associated risk factors; clinical manifestations and diagnostic criteria; the role of lifestyle factors in the development of PCOS; dietary modifications, including balanced nutrition, glycaemic index, and portion control; recommendations for physical activity with emphasis on the type, frequency, duration, and intensity of exercise; weight management strategies; stress management and mental health; the importance of adequate sleep hygiene; long-term complications of PCOS and preventive measures; and guidance on when to seek medical consultation. The IEC package was validated by experts in obstetrics and gynaecological nursing, community health nursing, nutrition, and endocrinology to ensure the accuracy, relevance, and appropriateness of the content for the target population.

Delivery Method: The Information, Education, and Communication (IEC) package was administered through a 45-minute lecture-cum-discussion session using an LCD projector. The educational session was designed to facilitate active learning and participant engagement. It included PowerPoint presentations supported by visual aids, diagrams, and photographs to enhance understanding of key concepts related to PCOS. Real-life case scenarios and practical examples were incorporated to improve the relevance of the information presented. An interactive discussion and question-and-answer session was conducted to clarify participants' doubts and encourage active participation. Printed educational materials, including pamphlets and handouts summarizing the key messages, were distributed for future reference. In addition, participants were provided with demonstrations of simple physical exercises and stress-reduction techniques to promote the adoption of healthy lifestyle practices for the prevention of polycystic ovary syndrome (PCOS).

Data Collection Procedure: Data collection was carried out over a period of 7 days following a structured protocol. On Day 1, the participants were assembled in a classroom setting, where the purpose and procedure of the study were explained in detail. Written informed consent was obtained from all participants before the commencement of data collection. A structured demographic questionnaire was first administered, followed by the pre-test using the knowledge assessment questionnaire. The pre-test required approximately 30 minutes to complete, and participants were instructed not to discuss the questionnaire with others to minimize information contamination. On Day 3, the Information, Education, and Communication (IEC) package was administered to all participants simultaneously through a 45-minute lecture-cum-discussion session. The session included interactive discussions, clarification

of participants' queries, and distribution of printed educational materials. Participants were encouraged to review the educational materials and incorporate the recommended lifestyle modification practices into their daily routine. On Day 7, the post-test was conducted using the same structured knowledge assessment questionnaire administered during the pre-test. The post-test required approximately 20 minutes to complete, after which the participants were thanked for their valuable participation and cooperation throughout the study. A 4-day interval between the IEC intervention and the post-test was maintained to provide sufficient time for knowledge consolidation while minimizing the possibility of knowledge decay or contamination from external sources.

Ethical Considerations: Ethical approval was obtained from the Institutional Ethics Committee, prior to commencement of data collection. Participants were provided with detailed information about the study purpose, procedures, potential benefits, and their right to withdraw at any time without penalty. Written informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the study by assigning unique identification codes to participants and storing data in password-protected electronic files. No personal identifiers were included in the dataset or publications.

Data Analysis: The collected data were coded, entered, and analyzed using appropriate statistical software. Both descriptive and inferential statistics were employed to address the study objectives and test the hypotheses. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize the demographic characteristics of the participants and their knowledge scores regarding lifestyle modification for the prevention of polycystic ovary syndrome (PCOS). Inferential statistics included the paired t-test,

which was used to compare the pre-test and post-test knowledge scores of the participants as the same group of participants was assessed before and after the intervention. The Chi-square test was employed to determine the association between post-test knowledge levels and selected demographic variables, as it is appropriate for examining relationships between categorical variables. For all statistical analyses, a two-tailed p-value of less than 0.05 ($p < 0.05$) was considered statistically significant.

RESULTS

Demographic Characteristics of Participants: The majority of participants were aged 18-20 years (66%), Hindu (90%), and from nuclear families (54%). Most participants were undergraduates (76%). Prior awareness of PCOS lifestyle modification was present in 52% of participants, with teachers being the most common source of information (50%).

Pre-test Knowledge Scores: Pre-test knowledge scores regarding lifestyle modification in prevention of PCOS are presented in Table 1.

Pre-test results revealed that 44% of nursing students had poor knowledge (scores 1-10) and 56% had average knowledge (scores 11-20) regarding lifestyle modification in prevention of PCOS. Notably, no participant demonstrated good knowledge (scores 21-30) at baseline. The mean pre-test score was 10.83 (SD = 2.731), indicating overall inadequate knowledge prior to the IEC intervention.

Post-test Knowledge Scores: Post-test knowledge scores following the IEC intervention are presented in Table 2.

Table 1: Pre-test Knowledge Scores of Nursing Students (n= 100)

	Score Range	Frequency (n)	Percentage (%)	Mean	Standard Deviation
Poor	1-10	44	44.0	10.83	2.731
Average	11-20	56	56.0		
Good	21-30	0	0.0		

Table 2: Post-test Knowledge Scores of Nursing Students (n = 100)

Knowledge Level	Score Range	Frequency (n)	Percentage (%)	Mean	Standard Deviation
Poor	1-10	5	5.0	22.47	7.168
Average	11-20	32	32.0		
Good	21-30	63	63.0		

Post-test results demonstrated substantial improvement in knowledge levels. Only 5% of participants had poor knowledge, 32% had average knowledge, and 63% achieved good knowledge regarding lifestyle modification in prevention of PCOS. The mean post-test score was 22.47 (SD = 7.168), representing a marked increase from the pre-test mean of 10.83.

Effectiveness of IEC Package: Comparison of Pre-test and Post-test Scores

The effectiveness of the IEC package was evaluated by comparing pre-test and post-test knowledge scores using paired t-test. Results are presented in Table 3.

Table 3: Comparison of Pre-test and Post-test Knowledge Scores (n= 100)

Assessment	Mean	Standard Deviation	Mean Difference	t-value	p-value
Pre-test	10.83	2.731	11.640	16.718*	<0.05
Post-test	22.47	7.168			

*Significant at $p < 0.05$ level (df = 99)

The paired t-test revealed a statistically significant difference between pre-test and post-test knowledge scores ($t = 16.718$, $p < 0.05$). The mean difference of 11.640 points represents an increase in knowledge scores following the IEC intervention. This finding indicates that the IEC package was highly effective in enhancing nursing students' knowledge regarding lifestyle modification in prevention of PCOS.

Association Between Post-test Knowledge Scores and Demographic Variables: Chi-square analysis revealed a statistically significant association between post-test knowledge scores and obesity status ($\chi^2 = 7.323$, $df = 2$, $p < 0.05$). The calculated chi-square value (7.323) exceeded the table value (5.99) at 0.05 level of significance with 2 degrees of freedom, indicating that obesity status was significantly associated with post-intervention knowledge acquisition.

All other demographic variables including age, religion, family type, educational level, prior PCOS awareness, and source of information showed no statistically significant association with post-test knowledge scores ($p > 0.05$).

DISCUSSION

Baseline Knowledge and Educational Gaps: The present study revealed that prior to the IEC intervention, 44% of nursing students had poor knowledge and 56% had average knowledge regarding lifestyle modification in prevention of PCOS, with no participants demonstrating good knowledge (mean = 10.83, SD = 2.731). This finding is consistent with previous research documenting inadequate baseline knowledge among nursing students. A cross-sectional study in South India similarly reported limited knowledge and awareness of PCOS among nursing students [23]. An assessment study in Delhi found that nursing students had variable knowledge levels, with many lacking comprehensive understandings of PCOS management [39].

The inadequate baseline knowledge observed in the present study is concerning given that nursing students are future healthcare providers who will be responsible for patient education and counseling. This knowledge gap may be attributed to insufficient coverage of PCOS in nursing curricula, limited clinical exposure to PCOS cases during training, and lack of structured educational programs specifically addressing lifestyle modification for PCOS prevention [40]. The finding that 48% of participants had no prior awareness of PCOS lifestyle modification further underscores the need for targeted educational interventions in nursing education.

Effectiveness of the IEC Package: The IEC package demonstrated significant effectiveness in enhancing knowledge, with post-test results showing that 63% of participants achieved good knowledge, 32% had average knowledge, and only 5% retained poor knowledge (mean = 22.47, SD = 7.168). The mean difference of 11.640 points between pre-test and post-test scores was statistically significant ($t = 16.718$, $p < 0.05$), representing a 107.4% improvement in knowledge scores.

These findings are consistent with multiple studies evaluating educational interventions for PCOS knowledge among nursing students. A quasi-experimental study in Udaipur, Rajasthan, reported similar effectiveness, with mean pre-test scores of 6.8 ± 3.4 increasing to 21.3 ± 3.0 post-intervention ($t = 56.5$, $p < 0.05$) [30]. A structured training program in Northern India demonstrated pre-test mean scores of 22.58 (SD = 11.02) increasing to 31.39 (SD = 14.50) post-intervention ($t = -8.11$, $p < 0.001$) [31]. A planned teaching program among BSc

Nursing students showed improvement from 4% adequate knowledge pre-test to 28% adequate knowledge post-test ($t = 5.66$, $p < 0.05$) [32].

The effectiveness of the present IEC package can be attributed to several factors. First, the intervention was grounded in the Health Belief Model, which addresses key determinants of health behavior change including perceived susceptibility, perceived severity, perceived benefits, and self-efficacy [41]. Second, the 45-minute lecture-cum-discussion format allowed for interactive learning, clarification of doubts, and engagement with the material [42]. Third, the use of multimedia presentation (LCD projector with PowerPoint slides) enhanced information retention through visual learning [43]. Fourth, the distribution of printed educational materials provided participants with reference resources for continued learning [44].

The present study's findings can be compared with studies employing different educational modalities. A randomized controlled trial evaluating web-based health education among nursing students found significant improvements in knowledge, adaptive healthy measures, and attitudes regarding PCOS [28]. While web-based interventions offer advantages of accessibility and self-paced learning, the present study's face-to-face IEC package allowed for immediate clarification of doubts and interactive discussion, which may enhance comprehension and retention [45].

A video-assisted teaching program in Bangalore reported that 94% of participants had inadequate knowledge pre-intervention (mean score 6.34, 31.7%), improving to 44% achieving adequate knowledge post-intervention (mean score 15.3, 76.5%; $t = 2.42$, $p < 0.05$) [34]. The present study achieved higher post-intervention knowledge levels (63% good knowledge), possibly due to the combination of lecture, discussion, and printed materials, which addresses multiple learning styles [46].

A structured teaching program utilizing PowerPoint and videos in English and Telugu demonstrated significant knowledge improvement, with high knowledge on basic terminology increasing from 31.6% to 83.3% and on management from 26.6% to 83.3% ($p < 0.001$) [33]. The use of bilingual materials in that study may have enhanced comprehension among participants with varying language proficiency, suggesting that language accessibility is an important consideration in educational intervention design [47].

Knowledge Retention and Long-term Effectiveness: An important consideration in evaluating educational interventions is knowledge retention over time. A quasi-experimental study in Egypt reported that 89.8% of nursing students achieved high knowledge levels immediately after educational guidelines, with 68.5% maintaining high knowledge three months later [29]. This finding suggests that while immediate post-intervention knowledge gains are substantial, some decay occurs over time, highlighting the need for reinforcement and follow-up educational sessions.

The present study assessed knowledge seven days post-intervention, which represents short-term knowledge retention. Future research should incorporate longer follow-up periods (e.g., 3 months, 6 months) to evaluate sustained knowledge retention and the need for booster sessions. Additionally, assessment of behavioral outcomes such as adoption of healthy lifestyle practices would provide valuable information about the translation of knowledge into practice [48].

Absence of Association with Demographic Variables: Contrary to expectations, the present study found no significant association between post-test knowledge scores and other demographic variables including age, educational level, prior PCOS awareness, and source of information. This finding suggests that the IEC package was equally effective across diverse demographic subgroups, indicating good generalizability of the intervention.

The absence of association with prior PCOS awareness is particularly noteworthy. Despite 52% of participants reporting prior awareness of PCOS lifestyle modification, this did not translate into significantly higher post-intervention knowledge scores. This finding suggests that prior awareness may have been superficial or incomplete, and that structured educational interventions are necessary to achieve comprehensive knowledge regardless of baseline awareness levels [53].

The lack of association with educational level (undergraduate vs. graduate) indicates that the IEC package was appropriately designed for the target audience, with content complexity and delivery method suitable for nursing students at different educational stages [54]. This finding supports the feasibility of implementing standardized PCOS education across multiple years of nursing curricula.

Mechanisms of Knowledge Enhancement: The significant knowledge improvement observed in the present study can be understood through several theoretical and pedagogical mechanisms. First, the IEC package addressed multiple domains of PCOS knowledge including pathophysiology, risk factors, clinical manifestations, dietary modifications, physical activity recommendations, and preventive measures providing comprehensive coverage of the topic [55]. Second, the use of case scenarios and real-life examples enhanced the practical relevance of the information, facilitating application to clinical practice [56].

Third, the interactive discussion component allowed participants to ask questions, clarify misconceptions, and engage in peer learning, which has been shown to enhance knowledge retention [57]. Fourth, the distribution of printed educational materials provided participants with reference resources for continued learning and reinforcement of key concepts [58]. Fifth, the timing of the post-test (seven days post-intervention) allowed adequate time for knowledge consolidation while minimizing knowledge decay [59].

Implications for PCOS Prevention: The significant knowledge improvement demonstrated in the present study has important implications for PCOS prevention. Knowledge is a necessary, though not sufficient, precursor to behavior change [60]. By enhancing nursing students' knowledge of lifestyle modification for PCOS prevention, the IEC package equips them with the foundational understanding necessary to counsel patients, promote healthy behaviors, and implement preventive strategies in clinical practice [61].

Given the high prevalence of PCOS in India (ranging from 7.2% to 22.5% depending on diagnostic criteria and population) [8], [11], and the established role of lifestyle factors in PCOS pathogenesis [62], preventive education targeting modifiable risk factors is essential. Nursing students, as future healthcare providers, will play a crucial role in delivering this education to at-risk populations, including adolescents, young women, and individuals with PCOS risk factors [63].

The present study's findings support the integration of PCOS-focused educational modules into nursing curricula. By

ensuring that all nursing students receive comprehensive education on PCOS prevention and management, nursing education institutions can contribute to strengthening preventive healthcare delivery and reducing the burden of PCOS in the community [64].

The effectiveness of educational interventions for PCOS knowledge is well-documented in international literature. A systematic review of educational interventions for PCOS management found that structured education programs consistently improved knowledge, self-efficacy, and health behaviors among women with PCOS [65]. A randomized controlled trial in Australia evaluating a lifestyle intervention program for women with PCOS reported significant improvements in knowledge, dietary quality, and physical activity levels [66].

The present study's findings align with this global evidence base, demonstrating that structured educational interventions are effective across diverse cultural and healthcare contexts. However, the specific content and delivery methods of educational interventions must be tailored to local contexts, considering cultural beliefs, dietary patterns, healthcare systems, and educational infrastructure [67]. The present study's IEC package was specifically designed for the Indian context, incorporating culturally appropriate examples, dietary recommendations aligned with Indian food habits, and delivery methods suitable for the nursing education setting in Lucknow.

STRENGTHS

The study possessed several methodological strengths. The use of stratified random sampling ensured representative participant selection, thereby enhancing the generalizability of the findings. The Health Belief Model provided a strong theoretical foundation for the IEC package, while the study instruments were validated for content and reliability to ensure accurate measurement. The intervention offered comprehensive coverage of PCOS prevention through a multimodal teaching approach, including lectures, visual presentations, interactive discussions, and printed educational materials, catering to different learning styles. The quasi-experimental one-group pre-test–post-test design and an adequate sample size of 100 participants enabled effective evaluation of the intervention and sufficient statistical power. Ethical standards were maintained through institutional ethics approval, informed consent, and confidentiality of participants. Furthermore, the study addressed an important educational need by enhancing nursing students' knowledge of PCOS prevention and examining the association between post-test knowledge and selected demographic variables, providing valuable insights for future educational interventions and nursing practice.

LIMITATIONS

The study had several limitations. The single-group pre-test–post-test design without a control group limited the ability to attribute improvements solely to the IEC intervention. The short follow-up period assessed only immediate knowledge retention and did not evaluate long-term retention or behavioral change. Conducting the study in a single nursing institution with a relatively homogeneous sample limited the generalizability of the findings. The study focused exclusively on knowledge outcomes and relied on self-reported data, which may be influenced by recall and social desirability bias. The use of the same questionnaire for both pre-test and post-test may have introduced a testing effect. In addition, the study did not include qualitative exploration of participants' experiences or domain-wise analysis of knowledge, which could have

provided deeper insights into the effectiveness of the IEC package. Finally, the timing of data collection may have been influenced by concurrent academic activities, potentially affecting participants' engagement and performance.

NURSING IMPLICATIONS

Nursing Education: The findings of the present study have important implications for nursing education. The effectiveness of the IEC package supports the integration of structured PCOS education into undergraduate and postgraduate nursing curricula. Nursing institutions should incorporate comprehensive content on PCOS, including its pathophysiology, risk factors, clinical manifestations, prevention, and management, while emphasizing lifestyle modification strategies such as healthy diet, regular physical activity, weight management, and stress reduction. The use of multimodal teaching approaches, including lectures, multimedia presentations, case studies, demonstrations, and interactive learning, can enhance knowledge retention. In addition, providing clinical exposure to PCOS screening and counseling, developing educational resources such as pamphlets, videos, and mobile-based learning materials, and conducting periodic knowledge assessments can further strengthen nursing students' competency in PCOS prevention and health promotion.

Nursing Practice: The findings of the present study have important implications for nursing practice. Nurses play a pivotal role in the prevention and management of PCOS through health education, early screening, counseling, and health promotion activities. They should educate adolescent girls and women of reproductive age about PCOS risk factors, early symptoms, and preventive lifestyle modifications, while routinely assessing individuals at risk in clinical and community settings. Nurses should provide individualized counseling on healthy diet, physical activity, weight management, and stress reduction, facilitate support groups to encourage self-management, and collaborate with multidisciplinary healthcare teams to deliver comprehensive care. Furthermore, nurses should advocate for increased awareness, early detection, and accessible preventive services to improve women's reproductive health outcomes.

Nursing Research: The findings of the present study provide several directions for future nursing research. Longitudinal studies with extended follow-up are recommended to assess long-term knowledge retention and behavioral changes following educational interventions. Randomized controlled trials involving larger and more diverse populations should be conducted to strengthen the evidence regarding the effectiveness of IEC packages. Future research should also evaluate the impact of educational interventions on lifestyle behaviors and clinical outcomes, compare different educational approaches to identify the most effective teaching methods, and develop tailored interventions for specific population groups. In addition, qualitative studies exploring participants' experiences, barriers, and facilitators to lifestyle modification, as well as implementation research focusing on the integration and sustainability of PCOS education in nursing curricula and clinical practice, would further enhance the evidence base for nursing education and practice.

Health Policy and Administration: The findings of the present study have important implications for health policy and nursing administration. Standardized PCOS education modules should be incorporated into nursing curricula to ensure

consistent competency among nursing graduates. Continuing education programs should be organized to update practicing nurses on current evidence-based guidelines for PCOS prevention and management. Adequate resources should be allocated for the development of educational materials, faculty training, and the implementation of PCOS screening and health promotion programs. Furthermore, PCOS education and counseling can be included as quality indicators in nursing practice and healthcare accreditation, while public health policies should support community-based awareness campaigns in which nurses play a central role as educators and advocates.

RECOMMENDATIONS

Based on the findings of the present study, the following recommendations are proposed:

For Nursing Education Institutions: Based on the study findings, it is recommended that nursing institutions develop standardized IEC packages on PCOS to ensure uniformity and quality in education. Regular faculty development programs should be conducted to strengthen educators' knowledge and teaching skills related to PCOS prevention and management. Institutions should also establish clinical collaborations with gynecology, endocrinology, and community health centers to provide students with practical exposure to PCOS screening and counseling. Additionally, the integration of technology-enhanced learning, including web-based modules, mobile applications, and virtual simulations, can improve the accessibility, effectiveness, and engagement of PCOS education.

For Healthcare Facilities: Healthcare facilities should strengthen PCOS prevention and management by implementing routine risk screening programs in primary care, gynecology, and community health settings, with nurses playing a key role in screening and early identification. Culturally appropriate patient education materials should be developed and distributed to promote awareness of PCOS and healthy lifestyle practices. Healthcare institutions should also establish nurse-led lifestyle counseling services to provide individualized guidance and follow-up for women at risk of or diagnosed with PCOS. Regular community awareness programs targeting adolescents, young women, and their families should be organized to promote early prevention, while multidisciplinary collaboration among gynecologists, endocrinologists, dietitians, nurses, and mental health professionals should be encouraged to ensure comprehensive and coordinated care for women with PCOS.

For Researchers: Future researchers should conduct longitudinal studies with extended follow-up periods to evaluate the long-term retention of knowledge, lifestyle modifications, and clinical outcomes following educational interventions. Research should extend beyond knowledge assessment to examine changes in attitudes, behavioral intentions, and actual health practices such as diet, physical activity, and weight management. Developing and evaluating tailored educational interventions for different population groups based on age, obesity status, and geographical settings may improve intervention effectiveness. Further studies should also explore strategies for successfully integrating PCOS education into nursing curricula and clinical practice while assessing implementation barriers, facilitators, and cost-effectiveness. Additionally, investigating the effectiveness of culturally adapted educational interventions across diverse populations would help improve the applicability and impact of PCOS education programs.

For Policy Makers: Policy makers should support continuing education programs for practicing nurses by providing adequate funding and policy initiatives to strengthen their competency in PCOS prevention and management. Sufficient resources should be allocated for the implementation of PCOS screening and prevention programs, particularly in underserved healthcare settings. In addition, national and state-level public awareness campaigns should be promoted to improve knowledge regarding early detection and lifestyle modification. Developing and enforcing quality standards for PCOS education and counseling in healthcare facilities, along with regular monitoring and evaluation, will help ensure the delivery of consistent, evidence-based care.

For Nursing Students: Nursing students should actively seek additional learning opportunities on PCOS through continuing education programs, workshops, webinars, and evidence-based self-learning resources. They should apply their knowledge during clinical postings by providing supervised patient education and lifestyle counseling, participate in community health promotion activities to raise awareness about PCOS prevention, and remain updated with current evidence-based guidelines through continuous professional development. Furthermore, nursing students should advocate for comprehensive patient education in clinical settings, emphasizing the importance of healthy lifestyle practices and preventive healthcare for reducing the risk of PCOS.

CONCLUSION

The present study demonstrates that an Information, Education, and Communication (IEC) package is highly effective in enhancing nursing students' knowledge regarding lifestyle modification for prevention of polycystic ovarian syndrome. The significant improvement in knowledge scores from pre-test (mean = 10.83, SD = 2.731) to post-test (mean = 22.47, SD = 7.168), with a mean difference of 11.640 ($t = 16.718$, $p < 0.05$), confirms the effectiveness of structured educational interventions in addressing knowledge gaps among nursing students.

The finding that 63% of participants achieved good knowledge following the IEC intervention, compared to 0% at baseline, represents a substantial enhancement in preparedness to deliver PCOS prevention education and counseling in clinical practice. The significant association between obesity status and post-test knowledge scores highlights the importance of considering individual risk factors in educational intervention

design and suggests potential benefits of tailored education for high-risk subgroups.

Given the high prevalence of PCOS in India (ranging from 7.2% to 22.5%) and the established role of lifestyle factors in PCOS pathogenesis, preventive education is essential for reducing disease burden and improving women's health outcomes. Nursing students, as future healthcare providers, are ideally positioned to deliver this education to at-risk populations, including adolescents, young women, and individuals with PCOS risk factors.

The present study's findings support the integration of comprehensive PCOS education modules into nursing curricula at both undergraduate and graduate levels. By ensuring that all nursing students receive evidence-based education on PCOS prevention and lifestyle modification, nursing education institutions can contribute to strengthening preventive healthcare delivery and reducing the burden of PCOS in the community.

Future research should focus on evaluating long-term knowledge retention, behavioral outcomes, and clinical effectiveness of educational interventions, as well as developing and testing tailored interventions for specific subgroups. Implementation science research is needed to identify effective strategies for integrating PCOS education into nursing curricula and clinical practice across diverse settings.

In conclusion, the IEC package represents a feasible, acceptable, and effective intervention for enhancing nursing students' knowledge regarding lifestyle modification for PCOS prevention. Widespread implementation of such interventions in nursing education has the potential to improve the quality of PCOS prevention and management services, ultimately contributing to better health outcomes for women of reproductive age in India and globally.

CONFLICT OF INTEREST

The authors declare no conflict of interest related to this study. No financial or personal relationships exist that could inappropriately influence or bias the work presented in this manuscript.

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AUTHORS' CONTRIBUTIONS

All authors contributed significantly to the conception, design, execution, analysis, and reporting of this study.

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