Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/rxbscm96
Original Article

Effectiveness of a nurse-led education programme on knowledge regarding various menstrual devices among higher secondary school girls in Kanpur, India: a pre-experimental one-group pre-test–post-test study.

Smrati[1], Sonal Katiyar[1], Soumya[1], Saumya Agnihotri[1], Komal[1], Veena Sharma[2]*

[1] B.Sc. Nursing Students, Faculty of Nursing, Rama University, Kanpur, Uttar Pradesh, India
[2] Assistant Professor, Department of Child Health Nursing, Faculty of Nursing, Rama University, Kanpur, Uttar Pradesh, India

Abstract

Background

Inadequate knowledge of menstrual devices limits adolescent girls' ability to choose safe, hygienic and sustainable menstrual products. This study assessed the effectiveness of a nurse-led education programme on knowledge regarding various menstrual devices among higher secondary school girls in Kanpur, India.

Methodology

A pre-experimental one-group pre-test–post-test design was used at Shri Ram Narayan Pandey Inter College, Kanpur, Uttar Pradesh. Sixty eligible girls of Classes XI and XII were selected by non-probability purposive sampling. No randomisation or comparison group was used; all enrolled participants were allocated to a single intervention group and received an identical programme. Knowledge was measured with a validated 22-item self-structured questionnaire before and seven days after a single 60-minute nurse-led session comprising an illustrated lecture, demonstration of sanitary pads, tampons, menstrual cups and period panties, and discussion. Data were analysed using descriptive statistics, the paired t-test and the chi-square test ($\alpha = 0.05$).

Results

At pre-test, 31 (51.7%) girls had inadequate and 29 (48.3%) moderate knowledge; none had adequate knowledge. After the intervention, 54 (90.0%) had adequate and 6 (10.0%) moderate knowledge. The mean knowledge score rose from 11.70 ± 2.80 to 19.83 ± 1.14 (mean difference 8.13; $t = 20.85$, $df = 59$, $p < 0.001$). Pre-test knowledge was significantly associated with age and type of absorbent used, but not with the other demographic variables.

Conclusion

The nurse-led education programme was effective in improving knowledge regarding various menstrual devices among higher secondary school girls.

Recommendations

Structured nurse-led menstrual-device education should be integrated into school health programmes, and controlled studies with longer follow-up should evaluate knowledge retention and change in menstrual practices.

Keywords: *Adolescent girls; Health education; Menstrual cup; Menstrual hygiene; Menstrual devices; Nurse-led intervention; School health*
Submitted: *June 20, 2026* ***Accepted:*** *July 11, 2026* ***Published:*** *September 30, 2026*

Corresponding author: *Mrs. Veena Sharma*
E-mail: veenasharma.rcn@ramauniversity.ac.in
Assistant Professor, Department of Child Health Nursing, Faculty of Nursing, Rama University, Mandhana, Kanpur, Uttar Pradesh, India.

Introduction

Menstruation is the visible manifestation of cyclic physiological uterine bleeding resulting from shedding of the endometrium, under the coordinated control of the hypothalamic–pituitary–ovarian axis. For menstruation to occur, the endometrium must respond to ovarian oestrogen and progesterone and the genital outflow tract must be patent [1]. Menarche usually occurs during early adolescence, a unique developmental stage that calls for particular care, accurate information and supportive guidance.

Menstrual hygiene management (MHM) requires that women and girls use a clean material to absorb or collect menstrual blood, change it in privacy as often as necessary, wash with soap and water, and dispose of or reuse materials safely [2]. Menstrual devices are the products used for this purpose and include disposable and reusable sanitary pads, panty liners, tampons, menstrual cups and period panties. Each device differs in its mode of use, duration of wear, cleaning or disposal requirements, cost, environmental impact and safety

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considerations, so informed choice depends on correct knowledge [2,3].

In India, menstruation remains surrounded by cultural taboos, myths and restrictions, and many girls reach menarche without adequate information from parents or schools [4,5]. A systematic review and meta-analysis of Indian studies found that only about half of adolescent girls had prior knowledge of menstruation before menarche, mothers were the main source of information, and commercial pad use was considerably higher in urban than in rural settings [4]. Although the National Family Health Survey-5 (2019–21) reported a rise in the use of hygienic methods among women aged 15–24 years, a substantial proportion still rely on unhygienic materials [6]. Poor menstrual practices have been associated with lower reproductive tract infections [7], and lack of knowledge also restricts uptake of newer, cost-effective and environmentally sustainable options such as the menstrual cup, which a large meta-analysis found to be safe, acceptable and associated with leakage comparable to or lower than that of pads and tampons [8].

Even where products are available, knowledge regarding their safe use is often limited. In a nationwide survey of Korean nurses, disposable pads accounted for 89.0% of products used, followed by cloth pads (4.5%), tampons (4.2%) and menstrual cups (1.6%); awareness of toxic shock syndrome (TSS) was low and anxiety about product safety was common [9]. Such gaps are likely to be wider among adolescent school girls, whose knowledge is frequently derived from mothers, peers and advertisements rather than from trained health professionals [4].

School-based education is a feasible and effective route to address these gaps. Educational and product-based MHM interventions in low- and middle-income countries have improved knowledge, attitudes and school participation among girls [10–13]. Nurses, as trusted health professionals and educators, are well placed to deliver such programmes, combining scientific accuracy with demonstration and culturally sensitive communication. However, evidence on nurse-led education focusing specifically on the range of available menstrual devices among higher secondary school girls in Uttar Pradesh is scarce.

Therefore, the present study aimed to assess the existing level of knowledge regarding various menstrual devices among higher secondary school girls, to evaluate the effectiveness of a nurse-led education programme on this knowledge, and to determine the association between pre-test knowledge and selected demographic variables in a selected higher secondary school of Kanpur, Uttar Pradesh, India.

Materials and methods

Study design and reporting

A quantitative evaluative research approach with a pre-experimental one-group pre-test–post-test design was adopted [14]. The study is reported in accordance with the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement [15].

Hypotheses

The following research hypotheses were tested at the 0.05 level of significance:

- H_1: There is a significant difference between the mean pre-test and post-test knowledge scores regarding various menstrual devices among higher secondary school girls.
- H_2: There is a significant association between the pre-test knowledge score regarding various menstrual devices and selected demographic variables of higher secondary school girls.

The corresponding null hypotheses (H_{01} and H_{02}) stated that no significant difference and no significant association, respectively, would be found.

Study setting

The study was conducted at Shri Ram Narayan Pandey Inter College, Kanpur, Uttar Pradesh, India, a co-educational intermediate college offering classes up to Class XII and affiliated to the Board of High School and Intermediate Education, Uttar Pradesh. The school draws students from urban and peri-urban neighbourhoods of Kanpur, predominantly from lower-middle and middle socioeconomic families. Data collection and the educational session were carried out in a spacious, well-ventilated classroom of the school, equipped with seating for all participants and facilities for audiovisual display, during regular school hours with the permission of the principal. The classroom was arranged to ensure privacy, and no male staff or students were present during the sessions.

Study population and participants

The target population comprised higher secondary school girls of Kanpur, and the accessible population comprised all girls enrolled in Classes XI and XII of the selected school.

Inclusion criteria

(i) girls enrolled in Classes XI or XII of the selected school; (ii) girls who had attained menarche; (iii) girls present in school on the days of pre-test, intervention and post-test; and (iv) girls able to read and understand Hindi or English.

Exclusion criteria

(i) girls who had previously attended any structured education programme on menstrual devices; and (ii) girls

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who were ill or otherwise unable to attend the full educational session.

Only girls who met the eligibility criteria were invited to participate, and written informed assent from the girls and written informed consent from their parents or guardians were obtained before enrolment.

Sample size and sampling technique

A sample of 60 girls was studied, a size considered adequate for a one-group pre-test–post-test design in undergraduate nursing research and sufficient to detect a moderate within-subject change in mean knowledge score with a paired t-test at $\alpha = 0.05$ and 80% power [14]. A non-probability purposive sampling technique was used. With the help of the principal and class teachers, attendance registers of Classes XI and XII were used to list all girls enrolled. The investigators then screened the listed girls against the eligibility criteria in their classrooms. Eligible girls were consecutively approached, given an information sheet in Hindi and English, and invited to participate until the required sample of 60 girls with completed assent and parental consent was obtained.

Assignment method

The unit of assignment was the individual student. Because a one-group design was used, there was no comparison group, and no randomisation, blocking, stratification or minimisation was applied; all 60 enrolled girls were assigned to the single intervention condition and received the same programme. To minimise potential bias, (i) the same standardised questionnaire, instructions and time allowance were used at pre-test and post-test; (ii) the pre-test was administered before any teaching to avoid contamination; (iii) the same lesson plan, teaching aids and educators were used for all participants; (iv) questionnaires were not discussed and answers were not disclosed after the pre-test; (v) participants were asked not to discuss the questionnaire among themselves; and (vi) responses were scored against a predetermined answer key.

Intervention

What was the intervention: The intervention was a structured nurse-led education programme on various menstrual devices, developed by the investigators from standard textbooks and published literature [1–3,8] and validated by subject experts in obstetric and gynaecological nursing and child health nursing. Its content covered: (i) menstruation and the menstrual cycle; (ii) menstrual hygiene and its importance; (iii) types of menstrual devices—disposable and reusable cloth sanitary pads, panty liners, tampons, menstrual cups and period panties; (iv) correct method of use, duration of wear and frequency of change of each device; (v) cleaning, sterilisation, storage and safe disposal; (vi) advantages, disadvantages, cost and environmental impact; (vii) myths and misconceptions; and (viii) complications of improper use, including reproductive tract infection and toxic shock syndrome, and when to seek help.

How it was given: The programme was delivered as an interactive illustrated lecture supported by a PowerPoint presentation, charts and posters, followed by a live demonstration using real samples of a sanitary pad, cloth pad, tampon, menstrual cup and period panty. Participants were allowed to handle the devices, and the correct folding and insertion technique of the menstrual cup and tampon was demonstrated with a model. A question-and-answer session clarified doubts, and an information leaflet summarising key points was distributed at the end.

Who delivered it and where: The session was delivered by the five B.Sc. Nursing student investigators, who had been trained beforehand in the content and delivery of the module, under the direct supervision of the faculty guide (Assistant Professor, Child Health Nursing). It was delivered face-to-face in the classroom described under Study setting.

Grouping, number and duration of sessions: Participants were taught in two groups of 30 girls each to allow adequate interaction and closer viewing of the demonstration. Each participant received a single session lasting approximately 60 minutes (40 minutes of lecture and demonstration followed by 20 minutes of discussion and questions). Delivery of the intervention to the full sample was completed on a single day, immediately after the pre-test.

Activities to increase compliance: The session was scheduled within school hours in consultation with the principal so that it did not clash with examinations; class teachers reminded participants of the session and post-test dates; the interactive format, use of local language and hands-on demonstration were used to sustain interest; and the leaflet was provided for revision. Attendance was recorded, and all 60 participants attended the full session and the post-test.

Outcomes and data collection instrument

The independent variable was the nurse-led education programme. The primary outcome (dependent variable) was knowledge regarding various menstrual devices, measured as the total score on a self-structured knowledge questionnaire. Socio-demographic variables included age, class, type of family, educational status, source of information on menstruation, economic status, age at menarche and type of absorbent currently used.

The instrument consisted of two sections. Section A was a socio-demographic proforma. Section B comprised 22 multiple-choice questions on menstrual devices, each with one correct answer scored 1 and incorrect or unanswered items scored 0, giving a total score range of 0–22.

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Knowledge was categorised as inadequate (0–11; ≤50%), moderate (12–17; 51–77%) and adequate (18–22; >77%).

Measures to enhance quality of measurement

Content validity of the tool was established by five experts in obstetric and gynaecological nursing, child health nursing and community health nursing, and items were modified according to their suggestions. The tool was translated into Hindi and back-translated to English to ensure equivalence. A pilot study was conducted on six girls from a comparable school who were not part of the main study to assess clarity, feasibility and time required; reliability was assessed by the test–retest method ($r = 0.82$), indicating acceptable reliability. During data collection, the same standardised instructions were read aloud to all participants, the questionnaire was self-administered under supervision in 30 minutes, and completed questionnaires were checked for missing responses before collection. Each questionnaire carried a unique code so that pre-test and post-test responses could be paired without recording names.

Data collection procedure and recruitment period

Formal written permission was obtained from the principal of the school. Participants were recruited and the pre-test and intervention were conducted on 3 March 2026; the post-test was administered with the same questionnaire seven days later, on 10 March 2026, which marked the end of follow-up.

Blinding

Blinding was not feasible because of the nature of the educational intervention and the one-group design; participants, educators and investigators were aware of the intervention. To limit assessment bias, knowledge was measured with an objective multiple-choice tool scored mechanically against a fixed answer key, and questionnaires were identified only by code at the time of scoring.

Unit of analysis

The unit of analysis was the individual student, which was also the unit of assignment; each girl's pre-test and post-test scores were paired for analysis.

Statistical methods

Data were coded, entered into Microsoft Excel and analysed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequency, percentage, mean and standard deviation) were used to describe socio-demographic characteristics and knowledge levels. Because each participant served as her own control, pre-test and post-test mean knowledge scores were compared using the paired t-test. The association between pre-test knowledge level and selected demographic variables was assessed using the chi-square test (with Fisher's exact test where expected cell counts were below five). A p-value < 0.05 was considered statistically significant.

Ethical considerations

The study protocol was approved by the Institutional Ethics Committee, Faculty of Nursing, Rama University, Kanpur. Permission was obtained from the school principal. Written informed assent was obtained from each participant and written informed consent from her parent or guardian after explaining the purpose, procedures, benefits and voluntary nature of participation. Participants were free to withdraw at any time without consequence. Confidentiality and anonymity were maintained by coding questionnaires, and the study was conducted in accordance with the Declaration of Helsinki.

Results

Participant flow and recruitment

A total of 60 eligible girls were enrolled, assigned to the intervention group, completed the pre-test, received the full intervention and completed the post-test. There were no losses to follow-up or exclusions from analysis; thus, data from all 60 participants were analysed (Figure 1). Recruitment, pre-test and intervention took place on 3 March 2026 and the post-test on 10 March 2026.

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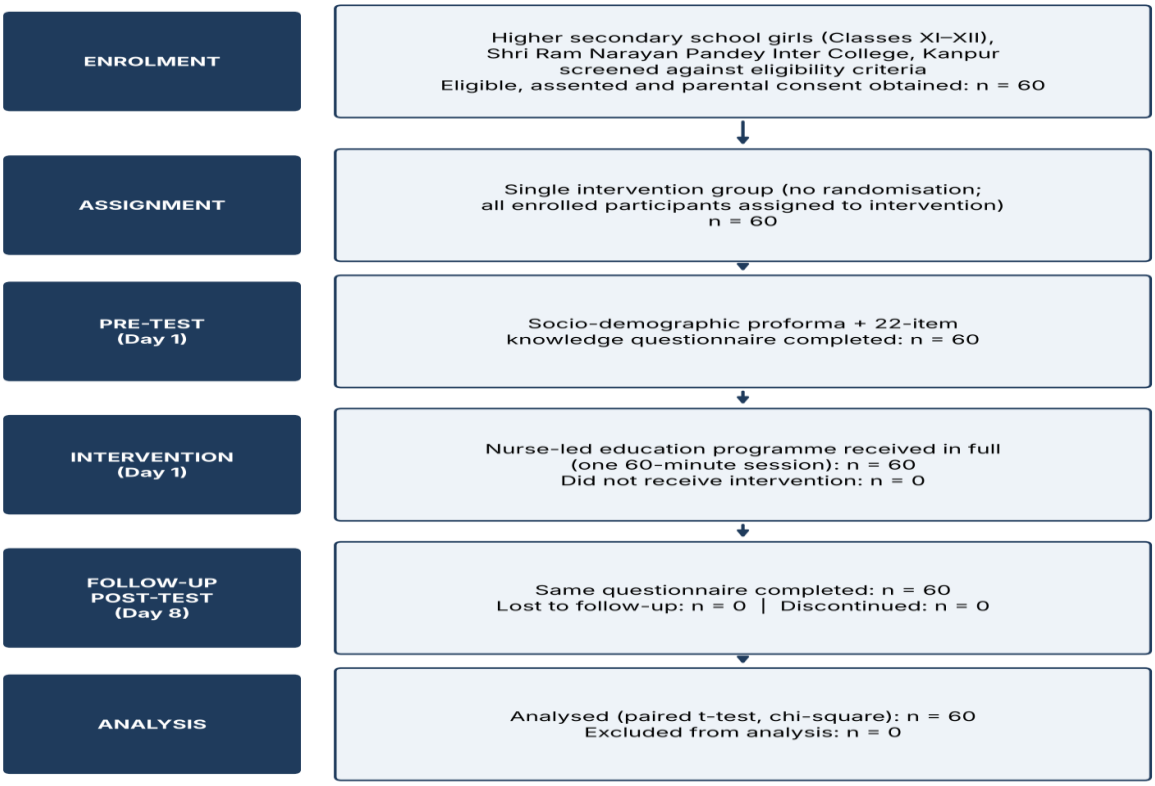


Figure 1. Flow diagram of participants through each stage of the study (TREND format)

Socio-demographic characteristics

Most participants (76.7%) were aged 15–16 years, 60.0% belonged to joint families, 70.0% were from families above the poverty line, and 53.3% had attained menarche at 12 years. Mothers were the main source of information about menstruation (61.7%), and 91.7% were currently using sanitary pads (Table 1).

Table 1. Socio-demographic characteristics of higher secondary school girls (n = 60)

Variable	Predominant category	n (%)
Age	15–16 years	46 (76.7)
Class	Largest class subgroup	21 (35.0)
Type of family	Joint family	36 (60.0)
Educational status	Secondary level	33 (55.0)
Source of information on menstruation	Mother	37 (61.7)
Economic status	Above poverty line	42 (70.0)
Age at menarche	12 years	32 (53.3)
Absorbent currently used	Sanitary pad	55 (91.7)

Values are presented for the most frequent category of each variable

Level of knowledge before and after the intervention

At pre-test, 31 girls (51.7%) had inadequate and 29 (48.3%) moderate knowledge, and none had adequate knowledge. After the nurse-led education programme, 54 girls (90.0%) had adequate and 6 (10.0%) moderate knowledge, and none had inadequate knowledge (Table 2).

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Table 2. Distribution of pre-test and post-test knowledge levels regarding various menstrual devices (n = 60)

Level of knowledge	Score range	Pre-test n	Pre-test %	Post-test n	Post-test %
Inadequate	0–11	31	51.7	0	0.0
Moderate	12–17	29	48.3	6	10.0
Adequate	18–22	0	0.0	54	90.0
Total		60	100.0	60	100.0

Effectiveness of the nurse-led education programme

The mean post-test knowledge score (19.83 ± 1.14) was significantly higher than the mean pre-test score (11.70 ± 2.80), with a mean difference of 8.13 ($t = 20.85$, $df = 59$, $p < 0.001$) (Table 3). Hence, H_{01} was rejected and H_1 was accepted.

Table 3. Comparison of mean pre-test and post-test knowledge scores (n = 60)

Test	Mean	SD	Mean difference	Paired t (df = 59)	p-value
Pre-test	11.70	2.80	8.13	20.85	< 0.001*
Post-test	19.83	1.14			

*SD, standard deviation; *significant at $p < 0.05$*

Association of pre-test knowledge with demographic variables

The chi-square test showed a statistically significant association ($p < 0.05$) between the pre-test knowledge level and age, and between pre-test knowledge and the type of absorbent used. No significant association was found between pre-test knowledge and class, type of family, educational status, source of information, economic status or age at menarche. Hence, H_2 was partially accepted for age and type of absorbent used.

Discussion

This study evaluated a nurse-led education programme on various menstrual devices among higher secondary school girls in Kanpur. Before the intervention, more than half of the girls had inadequate knowledge and none had adequate knowledge, even though over 90% were already using sanitary pads. This indicates that use of a product does not guarantee understanding of its correct use, safe duration of wear or alternatives. Following the programme, nine in ten girls achieved adequate knowledge and the mean score increased by 8.13 points, a large and statistically significant gain. These findings support the research hypothesis (H_1) that the intervention would improve knowledge.

The low baseline knowledge is consistent with Indian evidence showing that many girls lack accurate information about menstruation and its management, and that mothers—who may themselves have limited or culturally restricted knowledge—remain the main source of information [4,5]. In the present study, too, mothers were the predominant source. The predominance of sanitary pads, with very limited familiarity with tampons, menstrual cups and period panties, mirrors patterns reported in both Indian and international surveys [4,9]. The association of pre-test knowledge with age and type of absorbent used suggests that older girls and those already exposed to a wider range of products had more opportunity to acquire knowledge, whereas family type, economic status and source of information did not independently explain differences in this relatively homogeneous sample.

The improvement observed is in line with earlier school-based interventions. In Bangladesh, a school-based educational intervention among adolescent girls significantly improved menstrual knowledge and practices [12]. Systematic reviews of MHM interventions in low- and middle-income countries have similarly reported gains in knowledge and psychosocial outcomes following education, with or without product provision [10]. Pilot and feasibility trials in Ghana and Kenya demonstrated that combining education with product provision, including menstrual cups, was acceptable and improved school-related outcomes [11,13], and a large meta-analysis supports the safety and acceptability of the menstrual cup when users are properly informed [8]. The present findings extend this evidence to a nurse-led, device-focused module in an urban Uttar Pradesh school.

The intervention was designed to work through several complementary mechanisms. First, it filled specific knowledge gaps with scientifically accurate information from trained nursing personnel. Second, demonstration and hands-on handling of actual devices converted abstract information into concrete, observable skills, which is particularly important for unfamiliar products such as menstrual cups and tampons. Third, an interactive question-and-answer format in a female-only, private environment reduced embarrassment and allowed myths to be openly addressed. Finally, the leaflet reinforced learning between the session and the post-test.

Factors that facilitated implementation included the support of the school principal and teachers, scheduling within school hours, the small-group format and the use

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Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/rxbscm96
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of the local language, which together resulted in complete attendance and no loss to follow-up. Barriers included the cultural sensitivity of discussing internal devices such as tampons and cups, the limited time available within the school timetable, which restricted the programme to a single session, and the lack of opportunity for girls to try reusable devices over a menstrual cycle. Cost and limited local availability of menstrual cups and period panties may also limit translation of knowledge into practice.

Generalisability

The study was conducted in a single school with a purposive sample, so the findings cannot be directly generalised to all adolescent girls. Nevertheless, the socio-demographic profile of participants—predominantly mid-adolescent girls from joint, lower-middle-class families relying on mothers for menstrual information—is typical of many urban and peri-urban schools in northern India. The intervention is simple, low-cost and deliverable by nursing students or school health nurses, and it is therefore likely to be transferable to similar school populations in Uttar Pradesh and other Indian states. Its effect may differ in rural schools, among girls with lower literacy, or in settings with stronger cultural restrictions on discussing menstruation, where adaptation and further evaluation would be needed.

Strengths and limitations

Strengths of the study include a structured and expert-validated intervention, use of real devices for demonstration, complete follow-up of all participants and reporting according to the TREND statement. The main limitation is the pre-experimental design without a control group, which cannot exclude the influence of history, maturation, testing effects or regression to the mean. Other limitations include purposive sampling from one school, a small sample, the short seven-day follow-up, which assessed immediate rather than long-term retention, the absence of blinding, and the assessment of knowledge only, without measurement of attitudes or actual menstrual practices.

Conclusion

Higher secondary school girls in this study had predominantly inadequate to moderate knowledge regarding various menstrual devices before the intervention. The nurse-led education programme significantly improved their knowledge, with 90% achieving adequate knowledge after a single session. Pre-test knowledge was associated with age and the type of absorbent used. Nurse-led education is an effective, feasible and low-cost strategy for improving adolescent girls' knowledge of menstrual devices.

Recommendations

- Nurse-led education on menstrual devices, including demonstration of reusable options, should be incorporated into school health and adolescent health programmes such as the Rashtriya Kishor Swasthya Karyakram.
- School health nurses and teachers should be trained to provide regular, age-appropriate menstrual health education, and parents—especially mothers—should be involved.
- Similar studies should be conducted using quasi-experimental or randomised designs with control groups, larger and more diverse samples, rural settings and longer follow-up.
- Future research should evaluate attitudes, actual practices, uptake of reusable devices and health outcomes after education.

Acknowledgements

The authors thank the principal, teachers and staff of Shri Ram Narayan Pandey Inter College, Kanpur, for permission and support; all the students who participated and their parents; the Dean and faculty of the Faculty of Nursing, Rama University, Kanpur, for guidance and encouragement; and the subject experts who validated the study tool and intervention.

List of abbreviations

Abbreviations used in this manuscript

Abbreviation	Full form
B.Sc.	Bachelor of Science
df	Degrees of freedom
H_0	Null hypothesis
H_1, H_2	Research hypotheses
IEC	Institutional Ethics Committee
MHM	Menstrual hygiene management
NFHS	National Family Health Survey
SD	Standard deviation
SPSS	Statistical Package for the Social Sciences
TREND	Transparent Reporting of Evaluations with Nonrandomized Designs
TSS	Toxic shock syndrome

Source of funding
This study did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors. The study was self-funded by the authors.

Conflict of interest
The authors declare that they have no conflict of interest.

Data availability
The de-identified dataset generated and analysed during the current study is available from the corresponding author on reasonable request.

Authors' contributions
Smrati, Sonal Katiyar, Soumya, Saumya Agnihotri and Komal contributed to study conception, tool development, data collection, delivery of the intervention and drafting of the manuscript. Veena Sharma supervised the study, guided the design and analysis, and critically revised the manuscript. All authors read and approved the final manuscript.

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Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/rxbscm96
Original Article

PUBLISHER DETAILS

Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
(ISSN 3006-1059) Print
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256 775 434 261
Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa