

Impact of Health Education on Menstrual Hygiene among Adolescent Girls in Selected Rural Schools of Bihta Block, Patna, Bihar: A Pre-Post Interventional Study

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Abstract

Background: Menstrual hygiene plays a pivotal role in safeguarding the health and dignity of adolescent girls. In rural settings, inadequate awareness and persistent misconceptions often influence menstrual hygiene behaviours. This study examined baseline menstrual hygiene knowledge and practices among school-going adolescent girls and evaluated the impact of a structured educational intervention. **Materials and Methods:** A pre-post interventional study was conducted among 300 menstruating adolescent girls aged 12-17 years enrolled in selected government and private schools of rural Bihta block of Patna. Participants were selected using a multistage random sampling technique. Baseline information on menstrual knowledge and hygiene practices was collected using a pre-tested structured questionnaire. Subsequently, a planned health education session was conducted. The same tool was administered after two months to assess changes attributable to the intervention. Median scores were computed. McNemar's test and Wilcoxon signed-rank test were applied for statistical analysis. **Results:** Post-intervention assessment demonstrated a marked improvement in menstrual hygiene knowledge and a modest but statistically significant improvement in hygiene practices. Both knowledge and practice scores improved significantly following the intervention, with median scores increasing from 7.0 to 10.0 and 8.0 to 8.5, respectively ($p < 0.001$). However, the results should be interpreted in light of the reliance on self-reported hygiene practices which may be prone to reporting bias. **Conclusion:** Structured educational sessions can effectively improve awareness related to menstruation and contribute to healthier menstrual hygiene behaviours among adolescent girls. However, sustained behavioural change may require continued educational reinforcement with supportive social and environmental conditions.

Keywords: Adolescent girls, menstrual hygiene, health education, intervention, menstruation

Introduction

According to the World Health Organization (WHO), adolescence encompasses the age group of 10-19 years and constitutes a critical transitional period between childhood and adulthood characterized by profound physical, psychological, and behavioural changes. One of the most significant biological events in this period for girls is the onset of menstruation, which signifies reproductive maturity[1]. Despite its physiological nature, menstruation is frequently surrounded by social taboos and cultural restrictions, particularly in rural communities, leading to limited awareness and inadequate preparation among adolescent girls. As a result, many girls enter menarche without accurate

information regarding menstrual physiology or appropriate hygienic practices.[2,3]

In rural and resource-constrained settings, menstrual hygiene management remains a persistent challenge for school-going adolescent girls.[4] Factors such as misinformation, prevailing social stigma, lack of privacy, poor sanitation infrastructure, and restricted access to safe absorbent materials contribute to suboptimal menstrual practices. International agencies such as the World Health Organization and UNICEF emphasize that effective menstrual hygiene management (MHM) includes the use of clean absorbents, availability of privacy for changing, access to water and soap for personal hygiene, and safe disposal mechanisms.[5] Failure to

maintain adequate menstrual hygiene may result in discomfort, foul odor, embarrassment, and increased susceptibility to reproductive tract infections. Repeated use of unclean or improperly dried absorbent materials can further facilitate microbial growth, thereby increasing the risk of gynecological morbidity.[6,7]

Recognition of the adverse impact of unmet menstrual health needs on the physical, psychological, and social well-being of adolescent girls has led to growing global and national attention.[8] In India, initiatives such as the Menstrual Hygiene Scheme were introduced to improve awareness and promote the use of hygienic menstrual products among adolescent girls, particularly in rural areas.[9] However, national surveys continue to reveal substantial gaps in menstrual hygiene practices. Findings from the National Family Health Survey-5 indicate that the use of hygienic menstrual protection methods remains suboptimal among young women in rural India (72.3%) with considerably lower coverage reported in Bihar (56%).[10,11] Within Bihar, the use of hygienic menstrual protection methods is also considerably lower in rural areas (51.6%) than in urban areas (81.8%). This disparity suggests that adolescent girls in rural Bihar may face additional barriers to optimal menstrual hygiene management including limited awareness, sociocultural taboos, inadequate sanitation facilities, and restricted access to menstrual products.

While numerous studies have documented menstrual hygiene knowledge and practices among adolescents, most have been descriptive and cross-sectional in nature. Evidence regarding the effectiveness of structured health education particularly in rural Bihar remains limited. Therefore, generating local evidence on the impact of such interventions is important for informing context-specific school health strategies and menstrual hygiene promotion programmes. Against this backdrop, the present study was undertaken to assess baseline menstrual hygiene knowledge and practices and to evaluate the effectiveness of a structured health education intervention by comparing pre- and post-intervention outcomes after a two-month follow-up period.

Objectives of the study

1. To determine the baseline level of knowledge and menstrual hygiene practices among adolescent girls studying in rural schools of Patna district, Bihar.
2. To assess the impact of a structured health education intervention on menstrual hygiene-related knowledge and practices among the study participants.

Material & Methods

Study Setting: The study was conducted in secondary and

higher secondary schools located in the Bihta block of Patna district, Bihar. A complete list of all 23 schools (government and private) in the study area was obtained from the Block Education Office and served as the sampling frame for selection of the study schools from which two government and two private co-educational schools were selected using simple random sampling.

Study population and recruitment: The study population comprised school-going adolescent girls enrolled in the selected schools who met the eligibility criteria.

Inclusion Criteria: The study included adolescent school girls studying in Classes VI-XII who had attained menarche at the time of survey and were present on the day of data collection.

Exclusion Criteria: Adolescent girls who had not attained menarche at the time of the study were excluded.

Study design: A school-based interventional (pre-post) study design was adopted.

The study was implemented in three sequential phases:

1. **Pre-intervention Phase (Baseline Assessment):** Baseline data were collected using a pre-designed and pre-tested structured questionnaire to assess existing knowledge and menstrual hygiene practices. The questionnaire was initially developed in English, translated into Hindi, and subsequently back-translated into English to ensure linguistic consistency. The questionnaire was reviewed by subject experts in Community Medicine for face validity and was pre-tested among a comparable group of participants to assess clarity, comprehensibility and feasibility. Necessary modifications were made prior to data collection.

2. The questionnaire consisted of four domains:-

Socio-demographic profile, including personal and menarche-related characteristics

Knowledge domain covering menstruation and its physiological basis such as source of menstrual blood, characteristics of the normal menstrual cycle like frequency and duration, myths and misconceptions related to menstruation and fertility and reproductive health-related aspects.

Practice domain which included type of menstrual absorbents used, frequency of changing absorbents, genital hygiene practices, handwashing & bathing habits during menstruation, disposal methods and management of reusable absorbents.

3. **Intervention Phase:** Following baseline assessment, a structured health education program was delivered to the participants through interactive sessions lasting approximately two hours. Audio-visual aids were used to explain menstrual physiology, hygienic practices, and common myths related to menstruation. Emphasis was placed

on correct usage and disposal of sanitary absorbents, hand hygiene, bathing practices, washing and sun-drying of undergarments, genital hygiene, and non-pharmacological measures for relief of menstrual discomfort. Interactive question-answer sessions were conducted to clarify doubts and misconceptions. To ensure uniformity and minimize inter-session variation, all educational sessions were conducted by the same investigator using a standardized teaching plan and identical audio-visual materials.

4. Post-intervention Phase: The effectiveness of the health education intervention was assessed two months after the intervention using the same questionnaire administered during the baseline survey. Knowledge was assessed using 11 items and practices were evaluated using 10 items. Each correct response was assigned one point, while incorrect or "don't know" responses scored zero. Total scores were calculated separately for knowledge and practice domains. Participants scoring below the median were categorized as having poor knowledge/practice, while those scoring at or above the median were classified as having good knowledge/practice.

Study Duration: The study was conducted from January 2023 to April 2023. Baseline assessment was carried out in January 2023 followed by the health education intervention in February 2023. The post-intervention assessment was conducted after a two-month follow-up period in April 2023.

Sample Size and Sampling Technique

The required sample size was estimated to be 265 paired observations to achieve a power of 90% at a 5% level of significance for detecting an effect size of 0.20, using the 'Statulator' online sample size calculator[12] A small effect size was considered appropriate given the educational nature of the intervention and the anticipated modest change in behavioural outcomes over a relatively short follow-up period. After accounting for a 10% non-response rate, the final sample size was rounded to 300 participants.

A multistage random sampling technique was employed. In the first stage, two government and two private co-educational schools were selected through simple random sampling from the line list comprising of all 23 schools in the study area. In the second stage, five classrooms were selected from each study school using simple random sampling. Subsequently, a sampling frame of eligible adolescent girls was prepared from the attendance registers of the selected classroom, and 15 participants per classroom were selected using computer-generated random numbers.

Ethical Considerations: Prior approval for the study was obtained from the Institutional Ethics Committee before commencement of data collection. (Approval No. CREC/2022/28 dated 23/11/2022).

Consent to Participate: Oral assent from adolescent and written consent from parent/guardian was obtained prior to study through school authorities. Confidentiality of participant information was maintained and all data were anonymized throughout the study.

Data Analysis

Data were entered into Microsoft Excel, checked for completeness and analysed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Quantitative variables were summarized using appropriate descriptive statistics. The Kolmogorov-Smirnov test was applied to assess data distribution and indicated non-normality. Accordingly, knowledge and practice scores were summarized using median and range.

As knowledge and practice scores were not normally distributed based on the Kolmogorov-Smirnov test, non-parametric tests were considered appropriate. Pre- and post-intervention responses were compared using the McNemar test, and differences in median scores were analyzed using the Wilcoxon signed-rank test. A p-value of <0.05 was considered statistically significant.

Results

Socio-Demographic Profile: A total of 300 eligible adolescent girls were included in the study. Majority 71.7% of girls were 12-14 years old while 85 (28.3%) were in the age group of 15-17 years. Mean age was found to be 14+1.01 years. More than half i.e. 159 (53%) studied in 6th to 8th standard while 141 (47.0%) were studying in 9th grade and above. Maximum girls were Hindus (93.7%). 63% of girls lived in a nuclear family and family size was 5 or above in 246 (82%) of them. Nearly one-fourth (22%) of girls' mothers while 13% of their fathers were illiterate. Most i.e. 33.6 % belonged to V(lower) Socio-economic class according to the Modified BG Prasad Socioeconomic Status Scale (2022).[13]

Menorrhoeal Characteristics: Maximum of 239 (79.7%) of adolescent girls had attained menarche at 12-13 years of age. Mean age of menarche was found to be 12.37 ± 0.92 years. Most 82.3% of girls had a regular menstrual cycle with normal blood flow. Duration of flow ranged from 4 to 6 days in majority, 234 (78%) of girls. Dysmenorrhea was present in most, that is, 74.7%, while less than a quarter (18.7%) suffered from other related problems like vomiting, headache, mood swings, giddiness, and weakness.

Baseline and post-intervention responses were compared and the results were presented as proportions with corresponding p-values. Knowledge and practice outcomes are shown separately in Tables 1 and 2 respectively.

Knowledge domain: Following the intervention, significant improvements were observed across multiple domains of

menstrual hygiene knowledge. A significantly higher proportion of participants correctly identified menstruation as a normal physiological process, recognized the source and cause of menstrual bleeding, understood the normal duration & frequency of menstruation and were aware of the association between excessive menstrual bleeding and anaemia (all $p < 0.05$). Knowledge regarding fertility and

menopause also improved significantly ($p < 0.05$). Furthermore, common misconceptions related to menstruation including beliefs regarding impure blood, dietary restrictions and menstruation during pregnancy declined significantly following the health education (all $p < 0.001$) (Table 1).

Table 1: Distribution of study subjects according to their knowledge regarding menstruation (N=300)

VARIABLES (RESPONSE)	PRE- INTERVENTION N (%)	POST- INTERVENTION N (%)	McNEMAR TEST VALUE	P- VALUE
Menstruation is a natural phenomenon (Yes)	253 (84.3)	283 (94.3)	28.0	<0.0001
Origin of menstrual blood (Uterus)	162 (54.0)	221 (73.7)	53.4	<0.0001
Reason for menstruation (Hormones/Age-related)	169 (56.3)	230 (76.7)	44.4	<0.0001
Menstrual blood is impure (Yes)	268 (89.3)	43 (14.3)	221.0	<0.0001
Frequency of menstrual cycle (Monthly)	269 (89.7)	289 (96.3)	12.0	0.001
Normal duration of menses (upto 7 days)	275 (91.7)	286 (95.3)	115.1	0.007
Influence of hot and cold food on menses (Yes)	250 (83.3)	98 (32.7)	150.0	<0.0001
Excessive bleeding leads to Anemia (Yes)	137 (45.7)	258 (86.0)	119.0	<0.0001
Menses during pregnancy (Yes)	108 (36.0)	42 (14.0)	64.0	<0.0001
Menstruation is an indication of fertility (Yes)	243 (81.0)	273 (91.0)	23.2	<0.0001
Awareness regarding menopause (Yes)	217 (72.3)	268 (89.3)	49.0	<0.0001

* $P < 0.05$, statistically significant; ** $P < 0.001$, statistically highly significant

Hygiene practices: Menstrual hygiene practices improved significantly following the health education intervention. Notable improvements were observed in several menstrual hygiene practices including increased use of sanitary pads, more frequent changing of absorbents, safer disposal methods, wrapping of used absorbents before disposal, sun-drying of undergarments, improved genital hygiene during menstruation and regular bathing during menstrual periods. (all $p < 0.05$). Improvements were also noted in handwashing practices after changing absorbents and the use of soap and water for genital hygiene ($p < 0.05$). (Table 2)

Figure 1 presents a box-and-whisker plot depicting the distribution of knowledge scores among adolescent girls before and after the health education intervention. The

median knowledge score of students before health education (pre-test) was found to be 7.0 which increased to 10.0 after health education (post-test). The increase in knowledge scores following the intervention was statistically significant as determined by the Wilcoxon signed-rank test ($p < 0.001$) (Table 3).

Figure 2 illustrates the Box and Whisker plot showing the median practice scores of adolescent girls before and after the health education intervention. The median practice score of students before health education (pre-test) was found to be 8.0 which increased to 8.5 after health education (post-test). This improvement in practice scores of girls was found to be statistically significant by the Wilcoxon's Signed Rank Test ($p < 0.001$) as depicted in Table 3.

Table 2: Distribution of study subjects according to their menstrual hygiene practices (N=300)

VARIABLES (RESPONSE)	PRE- INTERVENTION N (%)	POST- INTERVENTION N (%)	McNEMAR TEST VALUE	P- VALUE
Absorbents used during menstruation (Sanitary pads)	216 (72.0)	250 (83.3)	32.0	<0.001
Frequency of changing sanitary pad/cloth (>2 times/day)	218 (72.7)	252 (84.0)	32.0	<0.001
Method of disposal of absorbents (Satisfactory)	241 (80.3)	270 (90.0)	27.0	<0.001
Wrapping the pad while disposing (Yes)	278 (92.7)	290 (96.7)	130.7	0.0005
Washing hand with soap after changing pad/cloth (Yes)	298 (99.7)	300 (100)	-	-
Sundrying undergarments (Yes)	279 (93.0)	292 (97.3)	109.2	0.0002
Washing genital area while changing pads/cloth (Yes)	271 (90.3)	278 (92.7)	221.9	0.02
Frequency of cleaning genitals during menses (>2times/day)	115 (38.3)	154 (51.3)	37.0	<0.001
Agents used for cleaning (Soap & water)	63 (21.0)	138 (46.0)	73.0	<0.001
Taking Bath daily (Yes)	267 (89.0)	286 (95.3)	100.5	<0.001
Agents used for cleaning (Soap & water)	63 (21.0)	138 (46.0)	73.0	<0.001
Taking Bath daily (Yes)	267 (89.0)	286 (95.3)	100.5	<0.001

*P < 0.05, statistically significant; **P < 0.001, statistically highly significant

Table 3: Distribution of scores on Knowledge and Practice domains (Pre and Post test)

DOMAINS	PRE- INTERVENTION	POST- INTERVENTION	Z (Wilcoxon's Signed Rank Test)	P- value
KNOWLEDGE				
Q1	5.0	9.0	-14.4	<0.001
Q2	7.0	10.0		
Q3	9.0	11.0		
PRACTICES				
Q1	7.0	7.0	-12.5	<0.001
Q2	8.0	8.5		
Q3	9.0	10.0		

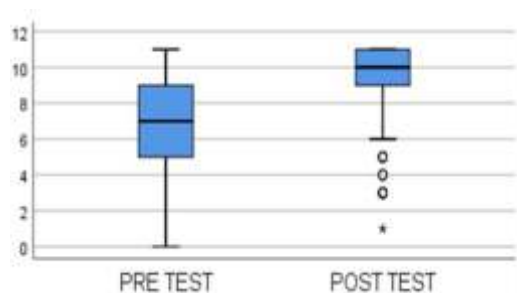


Fig 1: Box-and-whisker plot showing the distribution of median knowledge scores before and two months after the health education intervention among adolescent girls

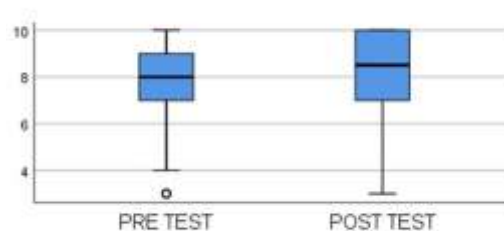


Fig 2: Box-and-whisker plot showing the distribution of menstrual hygiene median practice scores before and two months after the health education intervention among adolescent girls

Discussion

Adolescence is a particularly sensitive phase in a girl's life, characterized by rapid biological and psychosocial changes. While menstruation is a normal component of female reproductive health, persistent sociocultural taboos and erroneous beliefs often impede open discussion and dissemination of accurate information. This stigma often results in inadequate awareness and poor menstrual hygiene practices. The present interventional study was therefore undertaken not only to assess baseline knowledge and behaviors but also to determine whether structured health education could improve menstrual hygiene understanding and practices among adolescent school girls.

The mean age at menarche in the present study was 12.37 ± 0.92 years. This finding is comparable to the mean age reported by Lonimath et al. (12.34 ± 0.79 years), while Arora et al. documented a relatively higher mean age of 13.32 years[14,15.] Differences in age at menarche across regions may be influenced by variations in nutritional status, socioeconomic background, environmental factors, educational attainment and cultural practices.

A statistically significant enhancement in both knowledge and menstrual hygiene practices was observed following the intervention. Similar improvements have been documented in multiple intervention studies conducted across different regions of India.[14-19] These findings reinforce the effectiveness of structured educational programs in bridging knowledge gaps and promoting healthier menstrual behaviours.

Post-intervention, 94.3% of girls in the present study recognized menstruation as a normal physiological process, comparable to 98.2% reported by Iswarya S et al. Knowledge regarding the origin of menstrual blood (74%), duration (95%), and frequency (96%) was similar to the previous study (96%, 94%, and 93%, respectively). Follow-up assessment demonstrated improved understanding regarding the underlying cause of menstruation (74%), its association with fertility (91%), and awareness of menopause (89%) which corresponded with findings of 91%, 51%, and 71% in the referenced study.[17]

Importantly, the intervention contributed to a marked decline in prevalent misconceptions. A substantial proportion of girls (89.3%) initially believed that menstrual blood was impure; however, this misconception showed a marked reduction after the health education session, corroborating findings from previous intervention studies.[16,20] Cultural norms in many parts of India continue to label menstruation as "unclean," which perpetuates silence and misinformation. Addressing such misconceptions is essential to promote positive attitudes

toward menstruation. Likewise, erroneous beliefs regarding the influence of "hot" and "cold" foods on menstrual flow and the occurrence of menstruation during pregnancy declined substantially following the intervention. Comparable findings were reported by Dorle AS[16] and Jyothi B[20], although Arora et al.[15] observed the persistence of these dietary myths in 98% of participants during post-test possibly reflecting regional sociocultural differences.

A statistically significant rise in median knowledge scores was observed in the present study, increasing from 7 (pre-test) to 10 (post-test) following the health education intervention. Comparable findings were reported by Parasuraman et al., where median knowledge scores improved from 3.00 to 5.00, demonstrating a highly significant difference ($p < 0.0001$).[19] Similarly, Lonimath et al. documented a significant increase in mean knowledge scores from 4.88 ± 1.16 (pre-test) to 6.29 ± 0.87 (post-test) using a paired t-test ($p < 0.05$).[14] These consistent improvements indicate that structured educational interventions can effectively enhance menstrual knowledge and strengthen adolescents' ability to manage menstrual hygiene appropriately.

With respect to hygiene practices, the type and frequency of absorbent use are critical determinants of menstrual health, as unhygienic materials may predispose to infections. In the present study, the proportion of girls using sanitary pads and changing them more than twice daily increased notably after the intervention. Comparable improvements have been reported by Jyothi B and Kirthi Hurakadli.[20] In contrast, Iswarya Santhanakrishnan reported universal use of sanitary pads in their study setting while the frequency of changing (> 4 times/day) became 86% after the intervention, highlighting regional variation in baseline practices.[17]

Appropriate disposal of used absorbents improved significantly, with most participants (90%) adopting satisfactory disposal methods and wrapping pads prior to disposal (96.7%). Similar positive trends have been documented in other intervention studies.[16,18,20] Additionally, the practice of sun-drying undergarments, an important hygienic measure to reduce microbial contamination improved from 93% to 97.3% which is in agreement with other studies.[16,17,20]

Post-intervention assessment revealed universal (100%) handwashing with soap after changing absorbents, exceeding rates reported in certain other studies such as that by Vagha K et al. (82.8%).[18] Although genital cleansing during pad changes showed marginal improvement (90.3% to 92.7%), the proportion of girls washing the genital area at least twice daily during menstruation remained moderate (51.3%). Use of soap and water for genital hygiene increased

substantially but remained lower (46%) compared to another study from North India where higher compliance (91%) was observed.[15] Conversely, Iswarya S et al. reported that most girls relied solely on water for cleansing as only 10.5% used both soap and water for cleaning.[17] These variations suggest that menstrual hygiene practices are strongly influenced by local customs and girls should be specifically more informed on this practice. Cultural restrictions during menstruation, including avoidance of daily bathing, remain prevalent in some communities. In the present study, daily bathing practices improved following the intervention (89% to 95.3%) consistent with findings from previous research.[16]

Overall, a statistically significant improvement in median practice scores from 8.0 to 8.5 was observed after health education. These findings were corroborated by Parasuraman et. al. where the median scores increased from 10.00 to 14.00 and this was found to be statistically highly significant ($p < 0.0001$)[19]. These findings reiterate the critical role of school-based health education programs in promoting sustainable improvements in menstrual hygiene knowledge and behaviours among adolescent girls.

It is imperative to note that while the intervention resulted in considerable gains in menstrual hygiene knowledge, the magnitude of improvement in actual hygiene practices was relatively smaller. This finding is not unexpected as behavioural practices are often influenced by several factors beyond knowledge alone including socioeconomic conditions, prevailing sociocultural norms, family support, access to menstrual hygiene products and availability of sanitation facilities. While educational interventions can effectively improve awareness and dispel misconceptions, translating knowledge into sustained behavioural change often requires repeated reinforcement and a supportive environment. Furthermore, certain menstrual myths persisted despite the intervention, possibly reflecting deeply rooted cultural beliefs and practices that may not be amenable to change through a single educational session.

Public health Implications and Recommendations

From a public health perspective, the study findings support the role of school-based health education as an effective approach for improving menstrual hygiene awareness among adolescent girls. Incorporating periodic menstrual health education sessions within existing school health programmes may help promote informed menstrual hygiene practices and address prevailing misconceptions.

Continued efforts are needed to promote accurate menstrual health information and foster open communication regarding menstruation among adolescents. Further research is warranted to evaluate the effectiveness of community-based

approaches including parental sensitization programmes, community awareness campaigns, adolescent discussion groups, and peer-led educational models in addressing persistent menstrual misconceptions and promoting sustained behavioural change.

Conclusion

There was a significant improvement in menstrual hygiene-related knowledge and practices among adolescent school girls following the health education intervention with greater gains observed in knowledge than in practices. During the study, many participants exhibited hesitation and discomfort in discussing menstruation, indicating that social inhibition and stigma continue to be important barriers to open communication on this subject. These findings suggest that school-based health education may play an important role in improving menstrual hygiene awareness and promoting positive hygiene practices among adolescents. Periodic and structured menstrual health education along with supportive communication between students and teachers and between daughters and mothers may help address prevailing misconceptions and encourage informed menstrual hygiene practices. Further studies with longer follow-up periods are also needed to assess the sustainability of these improvements.

Limitations of the study: The study has certain limitations. Menstrual hygiene practices were assessed through self-reported responses and may therefore be subject to reporting and social desirability bias. Although the questionnaire was developed from published literature, reviewed by subject experts for face validity and pre-tested prior to administration, formal reliability testing was not performed. In addition, the absence of a control group limits the ability to attribute all observed changes solely to the intervention. The use of a pre-post assessment design with no control group may also have introduced a testing effect whereby exposure to the baseline questionnaire could have influenced participants' responses during the follow-up assessment. Also, the follow-up period of two months may not have been sufficient to assess the long-term sustainability of behavioural changes. Furthermore, as the study was conducted among school-going adolescent girls in selected rural schools, the findings may not be generalizable to out-of-school adolescents or to other settings.

Authors Contribution: GS: Conceptualization, Methodology, Resources, Data analysis, Writing-Original Draft Preparation, Review & Editing; AG: Conceptualization, Supervision, Writing-Review & Editing; PG: Resources, Data acquisition, Writing-Original Draft Preparation; SS: Data acquisition, Data Analysis, Writing-Original Draft Preparation.

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