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Menstrual hygiene knowledge and practices among adolescent schoolgirls in flood-affected rural Bangladesh

Tamima Ahmed¹ , Md. Khalid Hasan^{1,2*} , Tanjin Kabir Aunto¹ , Taufique Ahmed¹ and Dilara Zahid¹

Abstract

Objectives This study aimed to evaluate the level of knowledge and practices related to menstrual hygiene among adolescent schoolgirls in a flood-affected rural area of Bangladesh and identify the factors influencing their menstrual hygiene knowledge and practices.

Methods A cross-sectional study was conducted in northern Bangladesh between May 25 and June 1, 2023, involving 448 adolescent girls in the flood-affected region. Data was collected through a self-administered descriptive questionnaire. The collected data was entered and analyzed using SPSS 26.0 (IBM SPSS, Chicago, IL, USA). Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were used to determine significant variables through multivariate binary logistic regression models.

Results The study found that more than half (69%) of the in-school adolescent girls had good knowledge about menstrual hygiene, while only one-fourth (28.6%) demonstrated good menstrual hygiene practices. Remarkably, only 1.6% of the girls disposed of their used sanitary napkins in dustbins. The results also indicated that girls aged 17 to 19 [AOR = 7.78, 95% CI: 1.83–32.99] and those from middle-class families [AOR = 0.51, 95% CI: 0.31–0.85] showed a significant positive association with menstrual hygiene knowledge. Additionally, the study revealed that the respondents' mothers' education level, particularly having secondary or higher education [AOR = 1.69, 95% CI: 1.04–2.77], was significantly associated with better menstrual hygiene practices.

Conclusions The findings underscore the low level of menstrual hygiene practices among the respondents, emphasizing the urgent need for action. This highlights the urgency of enhancing awareness about the significance of adopting good menstrual hygiene practices. Therefore, it is imperative to incorporate menstrual hygiene knowledge and practices into school curricula and to organize meetings and sessions with schoolgirls' parents, stressing the importance of community support in addressing this issue.

Highlights

- A total of 448 adolescent schoolgirls' data on menstrual hygiene knowledge and practices were collected from the flood-affected region in Bangladesh.
- 69% of adolescent girls had good knowledge about menstrual hygiene, while 28.6% demonstrated good practices.
- The respondents' age was significantly associated with good menstrual hygiene knowledge.

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- Mothers' education level was significantly associated with better menstrual hygiene practices.

Keywords Adolescent girls, Menstrual hygiene, Knowledge, Practices, Bangladesh

Introduction

Menstruation is a natural process inherent to all adolescent females, typically between the ages of 11 and 15 [1]. This age group is at greater risk of developing reproductive tract infections, skin irritations, and psychosocial stress due to inadequate menstrual hygiene knowledge and practice (MHKP) on an individual level [2, 3]. The main challenges are a lack of menstrual hygiene awareness and cultural or economic barriers to purchasing menstrual absorbents [4]. Factors such as poor-quality sanitary products, social stigma, insufficient WASH facilities, lack of knowledge about using and washing hygiene kits, and poor menstrual hygiene practices (MHP) have detrimental effects on health, academic performance, and financial well-being [5, 6]. In addition, adolescents in low- and middle-income nations reported a variety of adverse experiences associated with menstruation, such as low self-esteem, anxiety, frustration, disgrace, and difficulty in controlling menstrual bleeding [7, 8]. Menstruation also presents physical, social, and economic challenges for adolescent girls, potentially impacting their school attendance and classroom participation [9].

Research conducted on menstrual hygiene in underdeveloped and developing nations has shown that a significant number of women and girls consistently face difficulties in maintaining appropriate menstrual hygiene [10–12]. Among Nigerian schoolgirls, 17.1% reported using toilet paper, and 15.5% reported using clothes to absorb their period blood instead of sanitary napkins [13]. In India, researchers reported a correlation between menstrual hygiene practices and urogenital infections [14, 15]. Another study of Ethiopian and Rwandan adolescent girls linked poor menstrual hygiene to infertility, reproductive tract infections (RTIs), anemia, urinary tract discharge with odor, and discomfort [16]. Menstrual hygiene knowledge and practices (MHKP) are also influenced by cultural, social, and economic variables like the expense of commercial pads, insufficient WASH facilities in educational institutions, and the shortage of gender-specific toilets or private spaces for changing pads [17].

Adolescent girls in Bangladesh exhibit unfavorable attitudes regarding menstrual hygiene practices. The majority of females are unaware of the proper methods for managing menarche and menstrual hemorrhage [18]. They experience reluctance to engage in conversations about menstruation with their parents, family members, close acquaintances, and other individuals [19]. Ha and Alam revealed that only 37.7% of women

in Bangladesh consistently use sanitary pads [20]. On the contrary, of those who use cloth, approximately 75% reuse them, and nearly 57% wash them with water and soap. The majority of young female athletes in Bangladesh lack knowledge (56.6%) and practice (68.5%) addressing menstruation despite having a good attitude (67.1%) [21]. According to another study, 86% of girls cannot afford better menstrual products [22]. In 2015, the Government of Bangladesh (GoB) recognized a crucial need for menstrual hygiene practices among school adolescents. To address this issue, the GoB sent a circular to education officers at all levels, recommending improvements to school restrooms. These improvements included providing separate facilities for female students, such as soap, water, and waste bins, and appointing teachers to educate them about menstruation [23].

Due to its geographical features, complex topography, extensive river system, monsoonal climate, and coastal morphology, Bangladesh is among the most disaster-prone areas in South Asia and the world. In Bangladesh, floods and cyclones are the most prominent disasters, which cause widespread damage and destruction of infrastructure, properties, and environments [24]. Natural disasters worsen gender inequality for Bangladeshi women by limiting their access to emergency information, healthcare, hygiene, sanitation, and decision-making power. Most of Bangladesh's 36 million adolescents, particularly girls, live in flood-prone rural areas [25]. Limited knowledge, cultural and traditional practices, inadequate facilities and services, poverty, and insufficient healthcare hamper women from managing menstruation and maintaining menstrual hygiene in flood-affected areas [26]. Research indicates that humanitarian crises may aggravate menstrual hygiene management challenges, as girls and women frequently cannot access essential materials and disposal [27]. However, the current understanding of the relationship between MHKP and health outcomes among adolescents in flood-affected rural Bangladesh is limited, making it challenging to design appropriate interventions for this population, especially for adolescent girls. Therefore, this study aims to assess the knowledge and practices related to menstrual hygiene among schoolgirls in flood-affected rural areas of Bangladesh and investigate the factors influencing their MHKP. The findings of this study would help develop effective policies and programs for strengthening MHKP among rural adolescent girls.

Methods

Study design and setting

A cross-sectional study was conducted in northern Bangladesh from May 25 to June 1, 2023. The study targeted secondary and higher secondary schoolgirls from Gangachara and Pirgachha Upazila, both of which are flood-prone areas. Gangachara Upazila is located in the northernmost part of Rangpur District and is bordered by Rangpur City to the south. Pirgachha Upazila, on the other hand, is situated at the southeastern boundary of Rangpur City. The population of Gangachara Upazila is 259,856, with females accounting for 56% of the total population. In Pirgachha Upazila, the total population is 329,573, with females accounting for 48.5% (158,000) of the population [28, 29]. The study location was selected based on the high incidence of flood disasters in the Gangachara and Pirgachha upazilas of Rangpur district, which are situated along the Teesta River [30]. We selected schools based on their potential for having a large student population and their vulnerability to flooding. In Gangachara Upazila, we selected three government schools. In Pirgachha Upazila, we chose two government schools and three non-government schools. The study focused on schoolgirls aged 11 to 18 who had begun menstruating and were present at the schools during the survey.

Sample size and sampling procedures

We used the Raosoft software to determine the sample size for the study (<http://www.raosoft.com>). We calculated the sample size to be 384, taking into account a 5% margin of error, a 95% confidence interval (CI), and a 50% response rate for a population of approximately 600,000 female students. A non-response rate of 10% was also considered, resulting in the required sample size of 410. Our primary target was to collect at least 32 respondents from each grade (grades 6–12) from the selected schools in the two chosen upazilas (administrative units) to achieve the required sample size. We invited all female students present in those grades to participate voluntarily in the survey. Finally, we collected data from 501 schoolgirls; among them, 448 respondents' data were taken for the final analysis. Data from 53 girls (grades 6–8) were excluded from the study because they had not yet experienced their first menstrual period (menarche).

Data collection tools and procedure

A self-administered descriptive questionnaire was used to gather data in the survey. The questionnaire consisted of 63 items divided into five sections, developed by examining relevant literature, including studies by [31, 32]. The questionnaire was initially created in English and then translated into Bengali to gather data from the study

regions in the field. The translated questionnaire was an accurate representation of the original English questionnaire. Prior to executing a full-scale data collection, a pilot study ($n = 15$) was conducted to assess the questionnaire's effectiveness and suitability for the chosen population. Minor syntax adjustments were made to finalize the questionnaire based on the findings of the pilot test.

The data collection team consisted of six undergraduate female students who received two days of comprehensive training on data collection procedures, including the importance of maintaining confidentiality, the rights of the participants, and obtaining informed consent. The data collectors played a crucial role in scrutinizing the questions, maintaining a comprehensive tally of their assigned questionnaires, participating in morning meetings, and discussing the challenges they encountered while collecting participant data. Their steadfast assistance was invaluable.

The research assessed the MHKP of schoolgirls using two sets of eight questions. Correct answers were given one point for each set, while incorrect or "do not know" responses received no points. A total of 8 points were possible for each set. The average score for menstrual knowledge was found to be 6.02 ± 1.38 , with those scoring between 0 and 5 (below the mean) classified as having poor knowledge and those scoring between 6 and 8 (above the mean) classified as having good knowledge. The frequencies of respondents categorized as having *good* and *poor* knowledge are presented in Table 2.

Similarly, the average score for menstrual hygiene practices was calculated to be 3.93 ± 0.98 . Respondents who scored 4 to 8 (above the mean) points were considered good menstrual hygiene practices, while those who scored 0 to 3 (below the mean) points were considered poor menstrual hygiene practices. This methodology was derived from previous studies [31, 32]. Table 3 then presents the frequencies of respondents falling into *good* and *bad* menstrual hygiene practices.

Data processing and analysis

The data were entered and analyzed using SPSS 26.0 (IBM SPSS, Chicago, IL, USA). A descriptive analysis examined the frequency distribution, percentages, and measures of central tendency. Bivariate analysis was conducted to examine the relationship between independent variables (knowledge and practices) and individual socio-demographic characteristics. The multivariate analysis included only statistically significant variables at the bivariate level (with a p -value ≤ 0.20), controlling for confounding influences that could affect the analysis. The assumptions of the multiple logistic regression were tested before analysis, and no unexpected values were found for either model. The results of the multiple

logistic regression analyses were reported as unadjusted odds ratios (AOR) and 95% confidence intervals (CI). The statistical significance level was set at $p \leq 0.05$.

Ethical considerations

The Research Ethics Committee of the Institute of Disaster Management and Vulnerability Studies, University of Dhaka, approved the study (SN: ERC (EXT)–14/222024). Furthermore, we informed the school administration and female students about the study's objectives and relevance. The participants received self-administered questionnaires and a consent letter outlining the study's objectives. Participation in the survey was voluntary.

Results

Socio-demographic characteristics of the respondents

Table 1 presents the socio-demographic information of the respondents. Of the 448 surveyed girls, 71.9% were between 11 and 16. The mean age of the participants was 14.96 years (SD = 2.08). Approximately 93% of the participants identified themselves as Muslim, and around 71.0% belonged to secondary school. Only 3.3% of the respondents reported having been married before, while 96.7% were single. Among the respondents, 62.1% of their fathers were engaged in agriculture, while 88.2% of their mothers were homemakers. The data on parents' education revealed that 54.7% of the fathers and 55.1% of the mothers had completed their secondary education or higher. Based on their perceived socioeconomic status, most participants, 75.9%, belonged to middle-class families. Among all the participants, only 30.4% of the respondents' families were affected by the recent flood.

Menstrual hygiene knowledge (MHK) of the respondents

Table 2 presents the results of MHK among teenage school-going girls in flood-affected rural Bangladesh. It was found that 69% of the girls had a good MHK, and 88.2% knew that menstruation is a natural process. The data revealed that 66.5% of the participants were aware of the role of hormones in menstruation, and 53.6% correctly identified the uterus as the origin of menstrual blood. Moreover, 72.1% of respondents reported that they had knowledge of menstruation prior to their first menstrual period (menarche). Additionally, 41.5% of school-going adolescent girls knew that menstrual blood is not unhygienic, and almost all girls 97.5% knew the importance of a nutritious diet during menstruation. Regarding learning sources, the survey found that 53.9% of participants knew about periods from their mothers. Other sources included sisters, friends, books, schools, NGOs, aunts, sisters-in-law, and others (Fig. 1).

Table 1 Sociodemographic characteristics of the respondents ($n = 448$)

Characteristics	Numbers (%)
<i>Age (Years)</i>	
11–13	133 (29.7)
14–16	189 (42.2)
17–19	126 (28.1)
<i>Grade</i>	
Secondary (VI – X)	320 (71.4)
Higher Secondary (XI – XII)	128 (28.6)
<i>Religion</i>	
Islam	416 (92.9)
Hindu	32 (7.1)
<i>Marital status</i>	
Ever Married	15 (3.3)
Single	433 (96.7)
<i>Father's occupation</i>	
Agricultural day labor	278 (62.1)
Others ^a	170 (37.9)
<i>Mother's occupation</i>	
Homemaker	395 (88.2)
Others ^b	53 (11.8)
<i>Father's level of education</i>	
Below and primary	203 (45.3)
Secondary and above	245 (54.7)
<i>Mother's level of education</i>	
Below and primary	201 (44.9)
Secondary and above	247 (55.1)
<i>Perceived socioeconomic status</i>	
Lower class	108 (24.1)
Middle class	340 (75.9)
<i>Family affected by recent flood</i>	
Yes	136 (30.4)
No	312 (69.6)

^a indicates jobs, such as teaching, fish farming, duck/chicken/pigeon husbandry, non –agricultural day labor, rickshaw puller/van puller/driver/auto/car driver, mason, garment worker, businessman, sublease cultivation, painter, hawker, veterinarian, tailor, not working and retired

^b indicates jobs, such as government jobs, private jobs, teaching, small business, duck/chicken/pigeon husbandry, agricultural day labor, non –agricultural day labor, housekeeper, handcrafter, tailor, and doctor

Menstrual Hygiene Practices (MHP) of the respondents

Table 3 presents the findings on MHP among adolescent schoolgirls in flood-affected rural areas of Bangladesh. Only 28.6% of these girls in rural flood-affected regions had good MHP. More than half of the respondents (55.4% of the schoolgirls) used only sanitary napkins as an absorbent material, while 44.6% used sanitary napkins in combination with old or new clothes during menstruation. The high price of sanitary pads (10.9%), mothers suggesting the use of clothes (3.8%), and

Table 2 Knowledge about menstrual hygiene among the adolescent schoolgirls ($n = 448$)

Items	Number (%)
Aware that a more nutritious diet is required during menstruation	437 (97.5)
Knew how to wear a sanitary napkin	418 (93.3)
Knew where to dispose of a sanitary napkin	404 (90.2)
Aware that menstruation is a natural process	395 (88.2)
Heard about menstruation before menarche	323 (72.1)
Aware that menstruation is due to hormones	298 (66.5)
Aware that menstrual blood is from the uterus	240 (53.6)
Knew that menstrual blood is not unhygienic	186 (41.5)
Practice (summary index)	
Good knowledge	309 (69.0)
Poor knowledge	139 (31.0)

discomfort while using sanitary napkins (3.1%) were the primary reasons for not using sanitary pads (Fig. 2). Moreover, 29.0% of the girls washed their clothes with water and soap, and 30.1% dried them in an open, sunny place. Only 11.0% of the girls changed their sanitary napkins/clothes at least three times a day during menstruation, and 1.6% used dustbins to dispose of their sanitary napkins. Approximately 51.8% of the females washed their private parts only with water (Table 3).

Factors associated with menstrual hygiene knowledge among adolescent schoolgirls

Adolescent girls between 14 and 16 were 5.64 times more likely [AOR = 5.64, 95% CI: 3.39–9.36] to have good

MHK. Similarly, those between the ages of 17 and 19 were 7.78 times more likely [AOR = 7.78, 95% CI: 1.83–32.99] than girls between the ages of 11 and 13 to have good MHK. Furthermore, schoolgirls from middle-class families were 0.51 times more likely to have good MHK [AOR = 0.51, 95% CI: 0.31–0.85] compared to lower-class families (Table 4).

Factors associated with menstrual hygiene practices among adolescent schoolgirls

The study revealed that schoolgirls aged 14–16 were 1.71 times more likely to have good MHP [AOR = 1.71, 95% CI: 1.02–2.86] than their younger counterparts aged 11–13 years. Furthermore, among school adolescents, those whose mothers had a secondary education or higher were 1.69 times more likely to have good MHP [AOR = 1.69, 95% CI: 1.04–2.77] compared to those whose mothers had a primary education or lower (see Table 5).

Discussions

Menstrual Hygiene Knowledge (MHK)

Our study investigated the MHKP among school-going adolescent girls in flood-affected rural areas of Bangladesh. According to our research, 69% of adolescent school-going girls have good MHK. Previous research from various parts of the world has demonstrated the same result, including Bangladesh, Ethiopia, Ghana, and Kenya [33–36]. However, it is worth noting that this finding contradicts the results of studies conducted in Nepal, Saudi Arabia, and Bhutan. The study in Nepal involved a systematic random sampling method with secondary

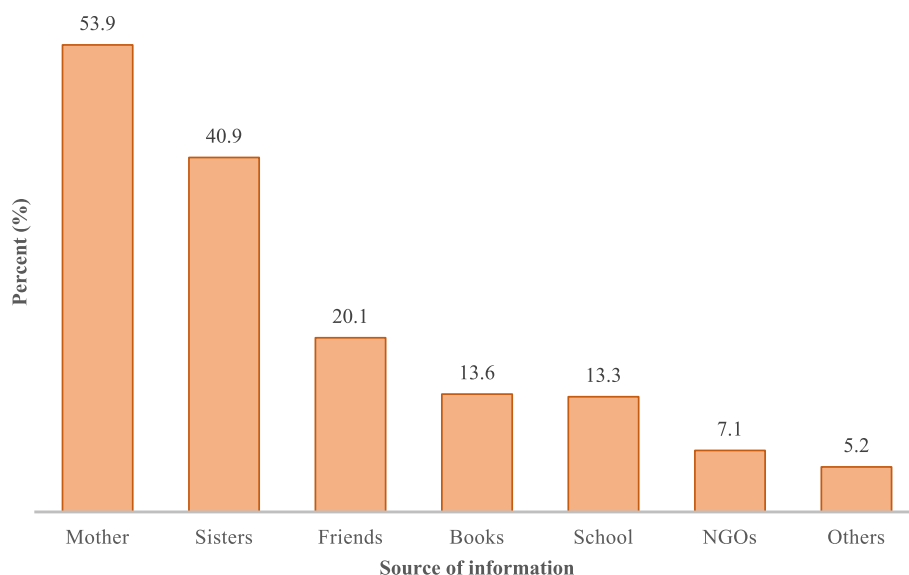
**Fig. 1** Sources of information on menstrual hygiene management

Table 3 Menstrual hygiene management practice among adolescent schoolgirls ($n = 448$)

Practices	Number (%)
Prefers to take a bath every day during menstruation	442 (98.7)
Wash external genitalia during menstruation	427 (95.3)
Uses sanitary napkins as absorbent materials during menstruation	248 (55.4)
Wash external genitalia with water only during menstruation	232 (51.8)
Dry clothes in an open, sunny place	138 (30.1)
Wash clothes with water and soap	130 (29.0)
Changing sanitary napkins or clothes at least three times during menstruation	49 (11.0)
Dispose of used sanitary napkins in a dustbin	7 (1.6)
Practice (summary index)	
Good practice	128 (28.6)
Poor practice	320 (71.4)

schoolgirls; 57.7% of girls needed improved knowledge about menstruation. In a study on 258 intermediate schoolgirls in Saudi Arabia, only 2.0% of the participants had good knowledge, with 36.3% having poor knowledge. Moreover, a cross-sectional study on female college and hostel students in Bhutan found that only 35.5% of the 1,010 participants fully understood menstruation

[37–39]. Therefore, community-based awareness, practical demonstrations, and school-based initiatives have the potential to address the existing knowledge gap and promote better sanitation practices.

Our research found that 72.1% of adolescent females are aware of menstruation before their first period. This figure is significantly higher than findings from a study conducted in Bangladesh, which revealed that only 36% of urban and rural girls were aware of menstruation prior to menarche. Similarly, a study in West Bengal, India, indicated that only 42% of rural secondary schoolgirls were informed about menstruation before their first period [40, 41]. Adolescent females must have access to comprehensive and accurate knowledge about menstruation prior to experiencing it. This information can help adolescent girls manage physical and mental changes during periods and improve their health. Our findings show that most girls learn about menstruation from their moms, then sisters, friends, literature, and schools. These findings give credence to previous research [42–44]. One potential reason for this similarity could be that girls are more comfortable discussing menstrual hygiene and related practices with their female family members due to their trust and strong bond, creating a safe and open environment for these conversations.

The extensive research findings indicate that most adolescent girls, around 88.2%, possess adequate knowledge

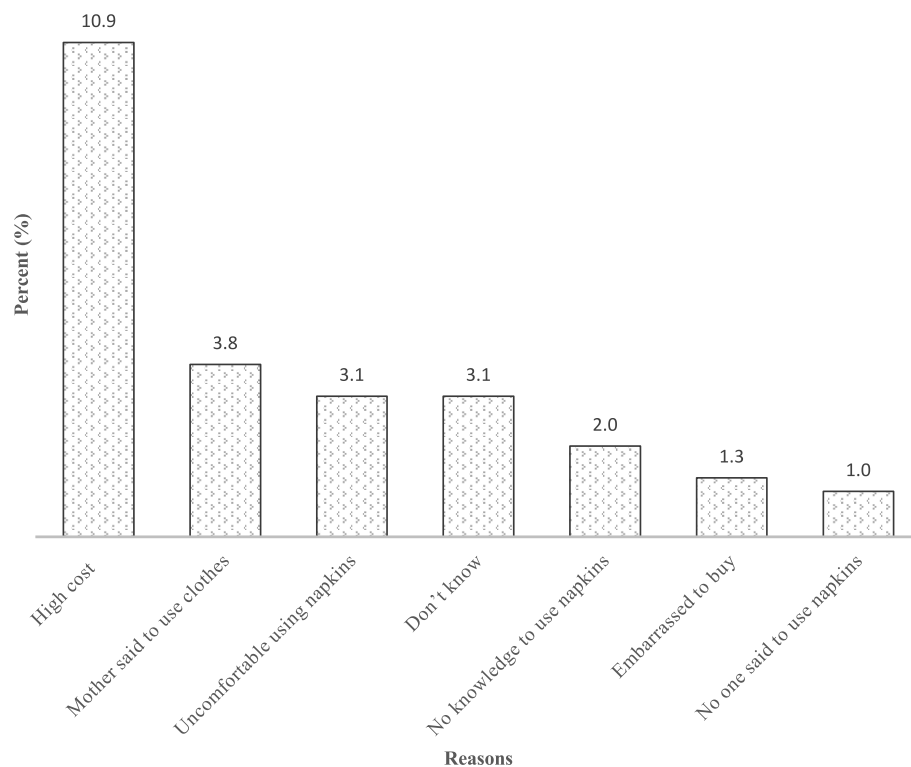
**Fig. 2** Reasons for not using sanitary napkins during menstruation

Table 4 Predictors of good menstrual hygiene management knowledge among adolescent schoolgirls

Covariates	Knowledge		Model 1		Model 2	
	Good (%)	Poor (%)	Crude OR (95% CI)	P-Value	Adjusted OR (95% CI)	P-Value
Age (Years)						
11–13	55 (41.4)	78 (58.6)	Ref		Ref	
14–16	149 (78.8)	40 (21.2)	5.28 (3.23–8.63)	.000*	5.64 (3.39–9.36)	.000*
17–19	105 (83.3)	21 (16.7)	7.09 (3.96–12.69)	.000*	7.78 (1.83–32.99)	.005*
Grade						
Secondary	203 (63.4)	117 (36.6)	Ref		Ref	
Higher secondary	106 (82.8)	22 (17.2)	0.36 (0.22–0.60)	.000*	1.08 (0.27–4.32)	.910
Religion						
Hindu	19 (59.4)	13 (40.6)	Ref		Ref	
Muslim	290 (69.7)	126 (30.3)	1.57 (0.75–3.29)	.226	1.66 (0.74–3.75)	.219
Marital status						
Single	298 (68.8)	135 (31.2)	Ref		Ref	
Ever married	11 (73.3)	4 (26.7)	0.80 (0.25–2.57)	.711	1.31 (0.35–4.83)	.685
Father's occupation						
Others	116 (68.2)	54 (31.8)	Ref		Ref	
Agricultural day labor	193 (69.4)	85 (30.6)	0.95 (0.63–1.43)	.792	1.06 (0.65–1.72)	.821
Mother's occupation						
Others	35 (66.0)	18 (34.0)	Ref		Ref	
Homemaker	274 (69.4)	121 (30.6)	1.16 (0.63–2.14)	.623	1.02 (0.51–2.05)	.945
Father's level of education						
Below and primary	135 (66.5)	68 (33.5)	Ref		Ref	
Secondary and above	174 (71.0)	71 (29.0)	0.81 (0.54–1.21)	.304	0.91 (0.55–1.50)	.704
Mother's level of education						
Below and primary	132 (65.7)	69 (34.3)	Ref		Ref	
Secondary and above	177 (71.7)	70 (28.3)	0.76 (0.51–1.13)	.173	0.86 (0.51–1.44)	.537
Perceived socioeconomic status						
Lower class	63 (58.3)	45 (41.7)	Ref		Ref	
Middle class	246 (72.4)	94 (27.6)	0.53 (0.34–0.84)	.006*	0.51 (0.31–0.85)	.010*
Family affected by recent flood						
No	215 (68.9)	97 (31.1)	Ref		Ref	
Yes	94 (69.1)	42 (30.9)	1.01 (0.65–1.56)	.965	0.10 (0.60–1.63)	.968

* $P < 0.05$; Ref. = Reference category; Model 1: Crude Model (Bivariate); Model 2: Adjusted Model (multivariate)

about menstruation as a natural biological process. Nonetheless, merely 66.5% of them are aware of the hormonal causes behind it. These findings are in line with earlier research from Egypt, Nepal, and Northwestern Nigeria [45–47]. It is encouraging to observe a global trend of young girls gradually accepting menstruation as a natural and healthy bodily function. According to the study by Micheal et al. [31], merely 19.80% of females in Pakistan believe that menstrual blood is not unhygienic. In contrast, our study found that 41.5% of girls recognized that menstrual blood is not unhygienic. Many detrimental practices and social stigmas are the result of traditional misconceptions that classify menstrual blood

as unhygienic. These perceptions can restrict daily activities, isolate menstruators, and prevent open conversation about menstruation [48]. This underscores the importance of educating young girls about menstrual hygiene to dispel taboos and promote healthy practices. Our survey revealed that most girls (97.5%) understand the importance of maintaining a nutritionally balanced diet during their menstrual cycle to support their health and well-being. This result is also consistent with comparable studies conducted in Pakistan by Michael et al. [31]. Eating a variety of nutrient-dense foods directly impacts the menstrual cycle and is essential for overall health.

Table 5 Predictors of good menstrual hygiene management practice among adolescent schoolgirls

Covariates	Practice		Model 1		Model 2	
	Good (%)	Poor (%)	Crude OR (95% CI)	P-Value	Adjusted OR (95% CI)	P-Value
Age (Years)						
11–13	30 (22.6)	103 (77.4)	Ref		Ref	
14–16	62 (32.8)	127 (67.2)	1.68 (1.01–2.78)	.046*	1.71 (1.02–2.86)	.043*
17–19	36 (28.6)	90 (71.4)	1.37 (0.78–2.41)	.268	1.64 (0.46–5.80)	.442
Grade						
Higher secondary	36 (28.1)	92 (71.9)	Ref		Ref	
Secondary	92 (28.8)	228 (71.3)	1.03 (0.65–1.62)	.895	1.25 (0.38–4.15)	.711
Religion						
Muslim	117 (28.1)	299 (71.9)	Ref		Ref	
Hindu	11 (34.4)	21 (65.6)	0.75 (0.35–1.60)	.452	0.75 (0.34–1.64)	.467
Marital status						
Single	123 (28.4)	310 (71.6)	Ref		Ref	
Ever married	5 (33.3)	10 (66.7)	0.79 (0.27–2.37)	.679	0.73 (0.24–2.27)	.588
Father's occupation						
Others	77 (27.7)	201 (72.3)	Ref		Ref	
Agricultural day labor	51 (30.0)	119 (70.0)	1.12 (0.73–1.70)	.601	0.92 (0.58–1.46)	.720
Mother's occupation						
Others	9 (17.0)	44 (83.0)	Ref		Ref	
Homemaker	119 (30.1)	276 (69.9)	2.11 (0.10–4.46)	.051	2.06 (0.95–4.44)	.067
Father's level of education						
Below and primary	66 (26.9)	179 (73.1)	Ref		Ref	
Secondary and above	62 (30.5)	141 (69.5)	1.19 (0.79–1.80)	.401	1.00 (0.62–1.63)	.985
Mother's level of education						
Below and primary	60 (24.3)	187 (75.7)	Ref		Ref	
Secondary and above	68 (33.8)	133 (66.2)	1.59 (1.05–2.41)	.027*	1.69 (1.04–2.77)	.035*
Perceived socioeconomic status						
Lower class	246 (72.4)	94 (27.6)	Ref		Ref	
Middle class	63 (58.3)	45 (41.7)	0.84 (0.51–1.37)	.485	0.74 (0.44–1.24)	.256
Family affected by recent flood						
No	88 (28.2)	224 (71.8)	Ref		Ref	
Yes	40 (29.4)	96 (70.6)	1.06 (0.68–1.65)	.795	0.93 (0.58–1.48)	.753

* $P < 0.05$; Ref. = Reference category; Model 1: Crude Model (Bivariate); Model 2: Adjusted Model (multivariate)

Specific nutrients in food contribute to hormonal balance by regulating ovulation and menstrual regularity [49, 50].

Moreover, the multivariate analysis results of this study showed that adolescent girls in the age groups of 14–16 and 17–19 years old exhibit significantly higher levels of MHK compared to their younger peers aged 11–13. Correspondingly, a study conducted in Northeast Ethiopia found that older school-going girls (age ≥ 19 years) had good MHK compared to their younger counterparts [51]. This association may be attributed to the greater access to services and information regarding menstruation among older girls. Furthermore, our findings highlighted that girls from middle-class backgrounds are more likely

to possess better MHK than those from lower socioeconomic backgrounds. This contradicts Mamilla and Goundla's study, which reported that school-going girls from lower socioeconomic backgrounds had an awareness of ideal menstrual hygiene practices even though they lacked knowledge of other areas of reproductive health (such as STDs and contraception) [52]. Middle-class families generally have better access to information, healthcare services, and education, which improves their understanding and awareness of menstrual hygiene. In contrast, girls from low-income households often encounter various challenges that limit their knowledge about menstrual health.

Menstrual Hygiene Practices (MHP)

A study on MHP among school-going adolescents revealed that only 28.6% of the respondents had good MHP. This percentage is lower than that of similar research conducted in Western Ethiopia and Nigeria, which reported 39.9% and 88.7% of good menstrual hygiene practices, respectively [32, 53]. Maintaining good hygiene during menstruation is crucial as it reduces the risk of infections in the reproductive system, urinary tract, and perineum [6].

The study found that 55.4% of participants utilized sanitary pads as absorbent materials during menstruation, which is higher than previous studies in Bangladesh [20, 40, 54]. Adolescent females who used sanitary pads were more conscientious of menstruation and personal hygiene compared to non-users [55]. However, 10.9% of the participants in our study did not use sanitary pads due to their steep price. This result is in line with earlier studies that found between 11.25% and 22% of participants had lower levels of practice in using sanitary napkins [33, 56, 57]. Moreover, previous research identified a significant association between the use of sanitary pads and the participants' ages, monthly incomes, and higher levels of mother's education [58]. These findings suggest the need for targeted interventions to promote better MHP among adolescent girls, ensuring access to affordable menstrual hygiene products and comprehensive education on menstrual health and hygiene.

The present study's findings shed light on a concerning fact: only 1.6% of girls use bins to dispose of their used menstrual hygiene items. In contrast, a study conducted in rural Bangladesh revealed that 25% of girls utilize bins for this purpose [59]. Disposing used menstrual pads, which contaminate water and soil and provide breeding grounds for microbes and pathogens, may pose severe environmental risks. Infections like hepatitis and HIV/AIDS can persist in soil for six months, posing a threat to nearby residents [60]. Communities should implement interventions such as using sanitary bins in public restrooms, schools, and other public places.

Furthermore, our study revealed that only 11% of school-going adolescents change their sanitary pads or clothing at least thrice daily during menstruation. This finding aligns with previous studies [20, 32, 40], which suggest that changing pads at least three times a day is the best practice. Effective menstrual hygiene practices necessitate the timely replacement of sanitary products. Additionally, most of our study participants (approximately 98.7%) reported bathing daily during menstruation, consistent with findings from prior research [61–63]. However, 51.8% of the respondents indicated they only use water to wash their external genitalia during menstruation. Similarly, a previous study found that

73% of girls adopted the same practice [62]. Addressing issues such as inconsistent bathing, insufficient care of private parts, and improper washing of reusable apparel requires separate toilet facilities in both homes and schools [64, 65].

The current study indicated that only 29% of participants wash their clothes with water and soap, while 30% of girls dry their clothes in an open, sunny place. Other studies have corroborated these findings [55, 62, 66]. Additionally, 30.1% of school-going adolescents dry their clothes in open, sunny places, while a previous study found that most rural girls dry their reused clothing in a dark room at home [67]. Notably, washing reusable sanitary clothing with soap or antiseptic can prevent infections and genitourinary complications [14], and inadequate drying of reusable cloths can lead to contamination and (RTIs) [68].

Furthermore, the multivariate analysis results indicated that adolescent girls in the 14–16 age group demonstrated significantly higher levels of MHP compared to their younger counterparts aged 11–13 years. Previous studies have also reported similar findings [20, 32]. As they transitioned from elementary to secondary school, older adolescents (ages 14–16 years) in Bangladesh typically learned about menstrual hygiene practices as part of their curriculum [33]. Educating adolescent females about menstruation can positively influence their behavior [69]. Workshops and seminars for younger girls and underprivileged people in flood-prone regions can provide knowledge, resources, and practical menstrual hygiene solutions. Moreover, our study, consistent with prior research [12, 32, 70], demonstrated that girls whose mothers had at least a secondary or higher school education were significantly more inclined to adhere to proper menstrual hygiene than their counterparts. This underscores the role of maternal education in providing knowledge and guidance to daughters about MHP. Mothers with higher levels of education often discuss openly with their daughters. Additionally, improved maternal education is frequently linked to a better socioeconomic status, which can lead to increased access to menstrual hygiene products and sanitation facilities [59].

Limitations of the study

While this study sheds light on the menstrual hygiene knowledge and practices (MHKP) among adolescent schoolgirls in flood-affected rural Bangladesh, it is essential to acknowledge its limitations. The study's cross-sectional design restricts its ability to establish a comprehensive cause-and-effect relationship between MHKP and adolescent schoolgirls. The study's focus on a single geographic location (Rangpur District) within a

flood-affected area of Bangladesh significantly limits the generalizability of the findings to adolescent females in the country, particularly those residing in flood-prone areas. Disparities in the cognitive knowledge levels of the girls also influenced the results. Girls from different socioeconomic backgrounds, age groups, and schools may have different levels of MHKP, as those from lower socioeconomic backgrounds in flood-prone areas may have limited access to menstrual hygiene education and resources. Although we performed a pilot test to ascertain the questionnaires' relevance to the local context, they were not formally validated in Bangladesh. An extensive psychometric validation process could benefit future studies. Lastly, the study faced challenges in obtaining permission from school authorities and addressing the sensitive nature of the topic when approaching them for data collection.

Conclusions

In summary, our study revealed that while 69.0% of the respondents displayed a strong understanding of menstrual hygiene, only 28.6% actually practiced proper menstrual hygiene management. The research also uncovered a significant positive correlation between good menstrual hygiene knowledge and the age and socioeconomic status of schoolgirls, particularly among those from middle-class families. Moreover, we noted a noteworthy positive association between the educational level of the schoolgirls' mothers and the practice of good menstrual hygiene. We recommend community-based workshops for mothers to teach how to manage menstrual hygiene during and after floods, including appropriate sanitation practices and maintaining hygiene despite limited resources, which could subsequently benefit their daughters. These findings highlight the pressing need to incorporate menstrual hygiene education and practices into school curricula. Furthermore, we recommend that schools organize meetings and sessions with schoolgirls' parents to underscore the importance of menstrual hygiene management. It is crucial to promote hygiene maintenance and foster open communication between mothers and daughters, as well as between teachers and students.

Abbreviations

MHK	Menstrual Hygiene Knowledge
MHKP	Menstrual Hygiene Knowledge and Practices
MHP	Menstrual Hygiene Practices
WASH	Water, Sanitation, and Hygiene

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Authors' contributions

Tamima Ahmed: Conceptualization, Methodology, Investigation, Formal Analysis, Visualization, Writing – Original Draft. Md. Khalid Hasan: Conceptualization, Methodology, Investigation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, Supervision. Tanjin Kabir Aunto: Methodology, Visualization, Writing – Original Draft, Writing – Review & Editing. Taufique Ahmed: Methodology, Visualization, Writing – Original Draft, Writing – Review & Editing. Dilara Zahid: Conceptualization, Methodology, Writing – Review & Editing, Supervision.

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Data availability

Data will be made available on request.

Declarations

Competing interests

The authors declare no competing interests.

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