

Research Paper

Parental education, embarrassment, and sanitation facilities influence menstrual product choices among female nursing students in Bangladesh

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ABSTRACT

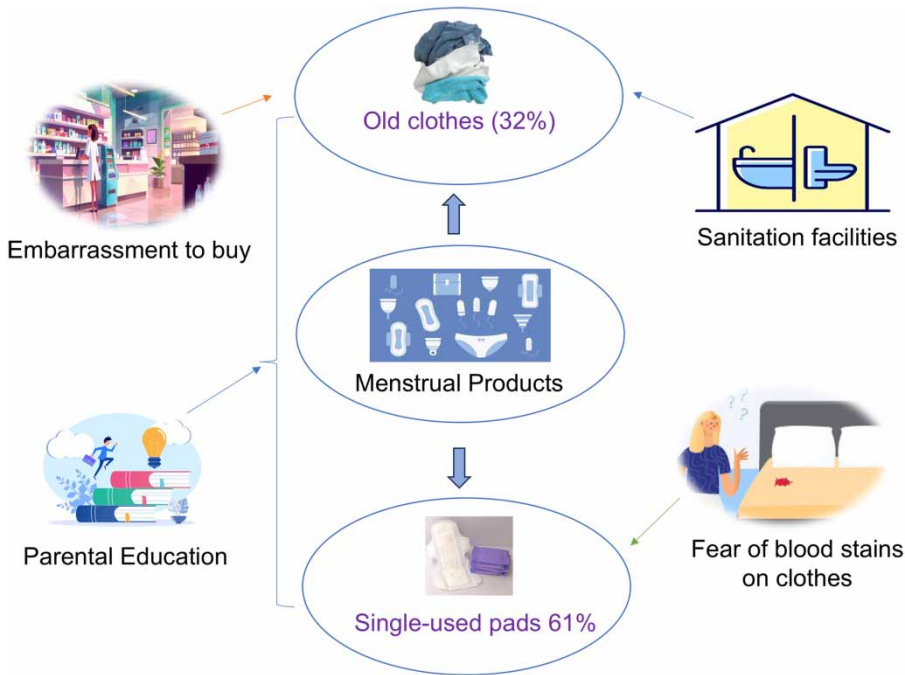
Understanding the factors that shape menstrual product choices is crucial for improving menstrual health and hygiene practices among young women in low-resource settings. This study investigates the influence of parental education, embarrassment, and sanitation facilities on the choice between hygienic menstrual products, like single-use pads, and unhygienic options, such as old clothes. A structured questionnaire was used to interview 366 nursing students in Bangladesh, with an average age of 23.3 ± 4.3 years. Descriptive statistics, Pearson's chi-square test, and multivariable logistic regression were performed using JMP Pro 17. The major products were single-use pads (61%) and old clothes (32%). Participants' family was the primary source of menstrual information, and product choices were influenced by both fathers' ($p < 0.05$) and mothers' ($p < 0.05$) education level. Additionally, the participants reported negative perceptions of the sanitation facilities, citing issues such as a lack of privacy, cleanliness, and the availability of water and soap. Embarrassment about buying (Adjusted Odds Ratio (AOR): 2.86 [1.16–7.07]) and privacy of bathroom facilities (AOR: 2.92 [1.12–7.63]) increased the odds of old clothes, while fear of staining blood (AOR: 2.95 [1.53–5.68]) increased the odds of having single-use pads. Better menstrual health and hygiene practices require improved parental education, reduced embarrassment, and better sanitation facilities.

Key words: Bangladesh, menstrual health and hygiene, menstrual hygiene products, nurses, women's health

HIGHLIGHTS

- We assess menstrual product preferences among nursing students.
- Parental education influenced menstrual product choices.
- The embarrassment of purchasing products influenced the use of old clothes.
- Sanitation facilities influenced product choices.

GRAPHICAL ABSTRACT



INTRODUCTION

Menstruation is a physiological process that usually occurs periodically in a cycle between 21 and 35 days and lasts for approximately 2–7 days, resulting in a blood flow of around 25–80 mL (Agampodi & Agampodi 2018). Although menstruation is a natural recurring event in the life of a woman or girl child, occurring between the ages of 12 and 50, more often than not, it is a subject that has been neglected worldwide. However, recent movements have propelled menstrual health to the forefront as an essential public health concern and a fundamental right to achieve the Sustainable Development Goals by 2030 (Sommer *et al.* 2021; Babbar *et al.* 2022). Hennegan and colleagues defined menstrual health as the absence of ailments and the overall state of physical, mental, and social well-being concerning the menstrual cycle (Hennegan *et al.* 2021).

It is of paramount importance that women and girls, particularly those residing in low- and middle-income countries (LMICs) and conflict zones, are empowered to manage their menstrual cycles privately, safely, and with dignity. This not only affects their health, both physically and mentally, but also their contribution to community development (Plesons *et al.* 2021). Poor menstrual health and hygiene (MHH) may lead to adverse health outcomes and adversely affect many parts of life, including education, social involvement, and psychological health (Balakrishnan *et al.* 2022). Every individual who is menstruating should be able to experience menstruation in a safe and dignified manner. Furthermore, gender equality, women's health, empowerment, education, and general well-being align with menstruation as factors that bring out the importance of menstrual hygiene management (MHM) in public health (UNICEF 2019). It, therefore, follows that the issue of menstruation has a strong bearing on the academic performance, class attendance, and general participation of the students in functions within the college or particularly in the university set-up (Munro *et al.* 2021).

MHH is a crucial factor that significantly contributes to the physical, emotional, and empowerment well-being of adolescent girls and women (World Bank Group 2021). The effective MHM comprises the use of hygienic materials to collect or absorb menstrual blood, access to facilities safe for disposing of and changing materials, and information distribution to raise awareness about menstruation and the use of menstrual hygiene (UNICEF 2019). The quality and safety of menstrual products are essential because they come into direct contact with the body repeatedly each month over a woman's lifetime, which, on average, spans about 40 years (Choi *et al.* 2021). Most of these girls and women lack access to high-quality, appropriate, hygienic, and absorbent materials to manage menstruation (WHO/UNICEF Joint Monitoring Programme (JMP) 2012). Menstrual hygiene products include one-time-use products such as disposable pads and tampons, as well as reusable products such as clothes, menstrual cups, and washable cloth pads (Pednekar *et al.* 2022). Due to high costs and limited

knowledge, many women resort to using old clothes as menstrual products (Meher & Sahoo 2023). However, these reusable materials can be unhygienic because they are often cleaned without soap and with unclean water, and social taboos and restrictions further complicate matters by forcing women to dry these clothes indoors, away from sunlight and fresh air (Das *et al.* 2015).

In Bangladesh, a densely populated South Asian country, there is commendable development in infrastructure related to water, sanitation, and hygiene (WASH). However, the country has a huge gap in the extensive literature on the practice of menstrual hygiene in the country (Ministry of Health and Family Welfare 2019; Ministry of Local Government 2021). According to the Bangladesh National Hygiene Survey, only 41% of females aged 15–49 practiced hygienic menstrual management, with a mere 39% having access to sanitary pads (Bangladesh Bureau of Statistics 2020). Most studies have focused exclusively on adolescent girls, offering a gendered perspective on menstruation. They largely emphasise societal stigma, including embarrassment, misconceptions about menstruation, inadequate facilities in educational institutions, and familial restrictions that contribute to school absenteeism (Alam *et al.* 2017; Hennegan & Sol 2020). Most extant studies have concentrated on needs and practices concerning menstruation (Ha & Alam 2022; Hunter *et al.* 2022). However, limited studies have been undertaken on MHM among adult women, particularly those in specialised sectors such as nursing. Women in these fields are essential members of the female population and future healthcare professionals who tackle women's health concerns. This implies, therefore, that these MHH practices among women have to be well inculcated into the nursing programmes.

Based on the literature, many factors contribute to MHM, which play a vital role in the health, social involvement, and overall well-being of women. Despite progress in understanding MHH, there is still a notable gap in research that specifically addresses the factors influencing menstrual product choices among nursing students. Their choices and practices are shaped not only by personal preferences but also by the surrounding environment. This study thus sought to identify the parental education, embarrassment, and sanitation facilities that affect nursing students' choices of menstrual hygiene products in Bangladesh.

METHODS AND PARTICIPANTS

Study design and setting

A cross-sectional quantitative study of a descriptive nature was conducted among nursing students from four districts, named Dhaka, Rajshahi, Naogaon, and Satkhira, in three regions of Bangladesh (Figure 1). We selected these three regions including capital cities that represent diverse social, cultural, and economic backgrounds. Seven government nursing colleges within these regions were chosen: National Institute of Advanced Nursing Education and Research (NIANER), Dhaka; College of Nursing (CoN), Mohakhali, Dhaka; Dhaka Nursing College (DNC), Dhaka; CoN, Sher-E-Bangla Nagar, Dhaka; Rajshahi Nursing College (RNC), Rajshahi; Nursing Institute (NI), Naogaon; and Nursing and Midwifery College (NMC), Satkhira. The government nursing colleges were chosen as significant representatives of women for sensitive issues like menstruation because they are more accessible than other institutions for the researchers, allowing for easier data collection and engagement with participants.

Participants and sample size

All menstruating nursing students at these colleges were eligible to participate. The colleges comprised a total of 2,495 nursing students, among which 120 were found in NIANER; 290 in CoN, Mohakhali; 550 in DNC; 475 in CoN, Sher-E-Bangla Nagar; 550 in RNC; 225 in NI, Naogaon; and 285 in NMC, Satkhira. The sample size was calculated employing a single population proportion formula (Cochran 1977), considering specific assumptions as follows:

$$n_o = \frac{z^2 \times pq}{e^2} \quad (1)$$

where n_o is the expected sample size, z is equal to 1.96 for a 95% confidence level, p is equal to 0.50 (expressed as 50% in decimal form), $q = 1 - p$, and $e = 0.05$ (representing a 5% margin of error).

$$n_o = \frac{(1.96)^2 \times 0.5 (1 - 0.5)}{(0.05)^2} \quad (2)$$

$$n_o = 384 \quad (3)$$

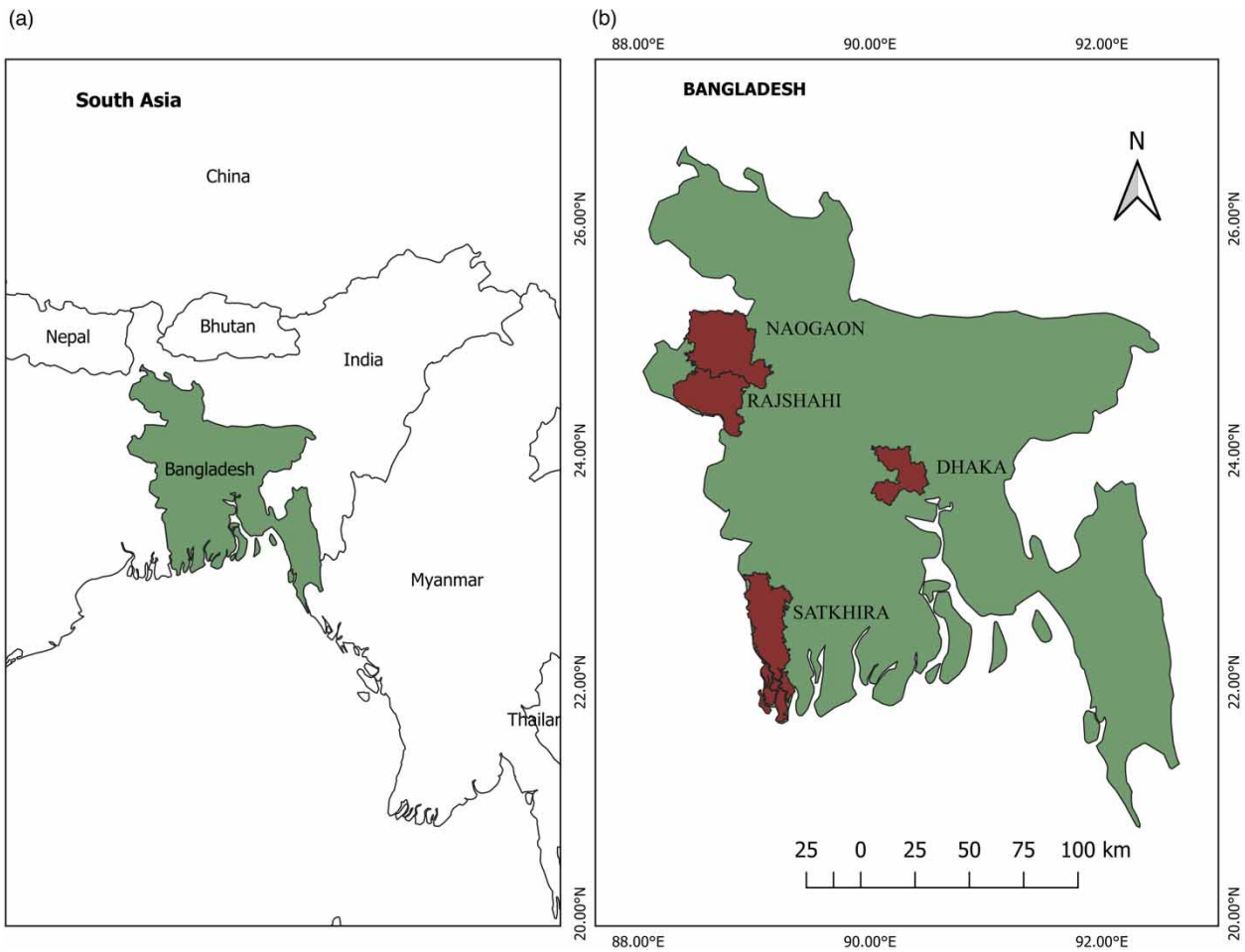


Figure 1 | Geographic distribution of the study site.

The final sample size (n) was determined using the correction formula, where n_o represents the initial sample size (384), and N represents the number of women at these colleges (2,495):

$$n = \frac{n_o}{[1 + \{(n_o - 1)/N\}]} \tag{4}$$

$$n = \frac{384}{[1 + \{(384 - 1)/2,495\}]} \tag{5}$$

$$n = 333 \tag{6}$$

Accounting for a non-response rate of 10%, the total sample size was calculated.

$$n = 333 + 33 = 366 \tag{7}$$

Therefore, 366 nursing students were included in this study after the sample size was calculated. Following the allocation of students from seven selected nursing colleges using proportional allocation to size (PAS), the participants were chosen through simple random sampling.

Instruments and data collection

The research instrument was a rigorously structured questionnaire that contained 64 questions from the Menstrual Health Questionnaire (Medina-Perucha *et al.* 2020; Hassan *et al.* 2023) and a recent study about confidence in managing menstruation (Munro *et al.* 2022). The research instrument underwent translation into Bangla and subsequent revision by the research team. The questionnaire gathered data on socio-demographic and menstrual characteristics, menstrual information and education, menstrual hygiene products and supplies, and perceptions of the sanitation facilities. The questionnaire included multiple-choice questions, yes/no questions, and Likert scale items. For example, one question asked, 'Are you embarrassed to buy menstrual products?', with response options on a Likert scale ranging from 1 (I do not know) to 5 (Always). The data were gathered through face-to-face interviews held on campus every weekday, except Friday, spanning from June to July 2023. The data collection process was facilitated by the first author and six trained research assistants, all of whom are professional nurses and midwives.

Data analysis

Numbers and percentages were utilised for the analysis of categorical variables. Pearson's chi-square was employed to evaluate the bivariate relationships between types of sanitary products and socio-demographic factors. Multivariable logistic regression analysis was employed to ascertain the potential factors linked to using single-use pads and old clothes. We created dummy variables for Likert scale data (e.g., lacked money to buy menstrual products) to input our regression models. Responses to items with 'always', 'sometimes', and 'few times' response options were recorded as '1' meaning yes and 'never', and the 'I don't know' response option was recorded as '0' meaning no. We similarly treated responses to each item on the perception of sanitation facilities, with 'always', 'most of the time', and 'sometimes' response options recorded as '1' meaning good and 'rarely' and 'never' response options recorded as '0' meaning poor conditions. The stepwise regression technique was used to select the best predictive model. In the stepwise regression variable selection, the bivariate odds ratio was calculated between each dependent and independent variable. Only those with an odds ratio less than 0.25 were incorporated into the multilevel model (Sun *et al.* 1996). For entry and removal into the adjusted odds ratio model, the respective *p*-value thresholds were set at 0.25 and 0.1. The significance level was established at $p < 0.05$, maintaining a confidence interval of 95% using JMP version 17 Pro (SAS Institute Inc., Cary, NC, USA).

Ethical considerations

Ethical approval was obtained from the Directorate General of Nursing and Midwifery, Dhaka (45.03.0000.008.14.097.2021-354), NIANER, Dhaka (NIA-OS-2023-09), and the Ethical Review Committee of the Faculty of Health Sciences, Hokkaido University in Japan (23-52). An information sheet was provided to the participants before the survey, explaining in clear terms the voluntary nature of their participation and their ability to withdraw from participation at any point. We obtained consent by affirming their willingness to participate with a response of 'yes'.

RESULTS

Socio-demographic characteristics

The mean age of participants was recorded as 23.3 ± 4.3 years (Table 1), and the average age at menarche was 13.2 ± 2.3 years. The majority of participants were first-year (54.1%), and 37.7% were enrolled in the B.Sc. in Nursing (4 years) course. Notably, 35.8% of participants' mothers had received a secondary education, whereas 29.9% of participants' fathers had received a higher secondary education. Additionally, it revealed that most of the participants' religions were Islam (86.1%), they were born in rural areas (75.7%), they lived in hostels (74.6%), and their monthly family income was between 10,000 and 20,000 BDT (36.6%).

Menstrual characteristics and sources of menstrual information and education

The research revealed that 15.8% of the participants had irregular menstrual periods (Table 2). Over half of the participants (51.9%) reported fear of blood leakage, which is a proxy for the severity of bleeding. The participants expressed a combination of favourable and unfavourable emotions while menstruating. The unfavourable emotions reported by participants were tired (54.9%), sensitivity (31.4%), anger (40.2%), sadness (32.5%), dirty (21.6%), and embarrassment (22.4%). Some participants reported feeling happy (1.1%) and relaxed (1.4%) during their periods. The key information source about menstruation for the participants was their family (80.6%), followed by school (24.9%) and friends (25.4%). More than half of the participants

Table 1 | Socio-demographic characteristics

Characteristics	<i>n</i>	%
Current age	366	Mean = 23.3 (SD = 4.3)
Age of menarche	366	Mean = 13.2 (SD = 2.3)
Category of studentship		
Master's in nursing	18	4.9
B.Sc. in Midwifery (Post Basic)	33	9
B.Sc. in Nursing (4 years)	138	37.7
B.Sc. in Nursing (Post Basic)	35	9.6
Diploma in Midwifery	87	23.8
Diploma in Nursing Science and Midwifery	55	15
Year of college		
First year	198	54.1
Second year	115	31.4
Third year	35	9.6
Fourth year	18	4.9
Religion		
Islam	315	86.1
Hinduism	45	12.3
Buddhism	1	0.3
Christian	5	1.4
Fathers' education level		
Graduate or above	63	17.3
Higher secondary	109	29.9
Secondary	94	25.8
Primary	78	21.4
Illiterate	21	5.8
Mothers' education level		
Graduate or above	28	7.7
Higher secondary	84	23
Secondary	131	35.8
Primary	104	28.4
Illiterate	19	5.2
Birthplace status		
Rural	277	75.7
Urban	89	24.3
Resident status		
Hostel	273	74.6
Own house	93	25.4
Monthly family income		
Below 10,000/- BDT	55	15
10,000–20,000/- BDT	134	36.6
20,000–30,000/- BDT	93	25.4
More than 30,000/- BDT	84	23

SD, standard deviation; BDT, the currency symbol for the Bangladesh taka.

Table 2 | Menstrual characteristics and sources of menstrual information and education

Characteristics	<i>n</i>	%
Is your menstrual cycle regular? (<i>N</i> = 366)		
The same every month	160	43.7
Varies each month slightly	148	40.4
Never the same each month	58	15.8
Fear of staining clothes with blood when menstruating? (<i>N</i> = 366)		
Yes	190	51.9
No	176	48.1
Do you suffer from menstrual pain? (<i>N</i> = 366)		
Always	81	22.1
Sometimes	226	61.7
Very few times	39	10.7
Never	20	5.5
How do you feel during menstruation? ^a <i>N</i> = 366 (for each choice, multiple response)		
Tired	201	54.9
Sensitive	115	31.4
Angry	147	40.2
Sad	119	32.5
Dirty	79	21.6
Embarrassed	82	22.4
Happy	4	1.1
Relaxed	5	1.4
Sources of menstrual information ^a <i>N</i> = 366 (for each choice, multiple response)		
Family	295	80.6
School	91	24.9
Friends	93	25.4
Internet	23	6.3
Social network	20	5.5
College	13	3.6
Magazine/books	22	6
Others	9	2.5
Did you know about menstruation before its first onset? (<i>N</i> = 366)		
Yes	151	41.3
No	215	58.7
When you got your first period, did you feel ready for it? (<i>N</i> = 366)		
Yes	71	19.4
No	276	75.4
I do not know	19	5.2
Do you need more information on menstruation? (<i>N</i> = 366)		
No, I have enough information/not interested	60	16.4
Yes	306	83.6
<i>Menstrual delays</i> ^b	169	55.2
<i>Impact of menstruation on daily life</i> ^b	179	58.5

(Continued.)

Table 2 | Continued

Characteristics	<i>n</i>	%
<i>Menstrual products</i> ^b	80	26.1
<i>What is menstruation</i> ^{a,b}	29	9.5
<i>Menstruation duration</i> ^b	40	13.1
Do you feel embarrassed talking about menstruation? (<i>N</i> = 366)		
Always	58	15.8
Sometimes	200	54.6
Never	108	29.5

^aThe total adds up to more than 100 because this was a multiple-response question.

^bPercentages out of those who said yes (*N* = 306) and total adds up to more than 100 due to multiple-response question.

(58.7%) did not have any knowledge about menstruation before they experienced their first period. Most participants (83.6%) expressed a need for more information on different topics related to menstruation. The majority (71.5%) of the participants experience feelings of embarrassment while discussing menstruation (always 15.8% and sometimes 54.6%).

Menstrual hygiene product choices

About 61% of participants preferred single-use pads, which are considered hygienic, while 32% relied on old clothes, which are deemed unhygienic due to improper cleaning and drying practices. A small portion (3%) used toilet paper, which is also considered unhygienic. Additionally, 2% used nappies, and another 2% opted for more hygienic alternatives like tampons, menstrual cups, or menstrual underwear (Figure 2).

Access to menstrual hygiene products and supplies

Almost all participants (98.9%) reported being unable to get free menstrual hygiene products in hostels (Supplementary material, Table S1). Most of them (85%) reported that menstrual hygiene products were expensive. Most of them (86.6%)

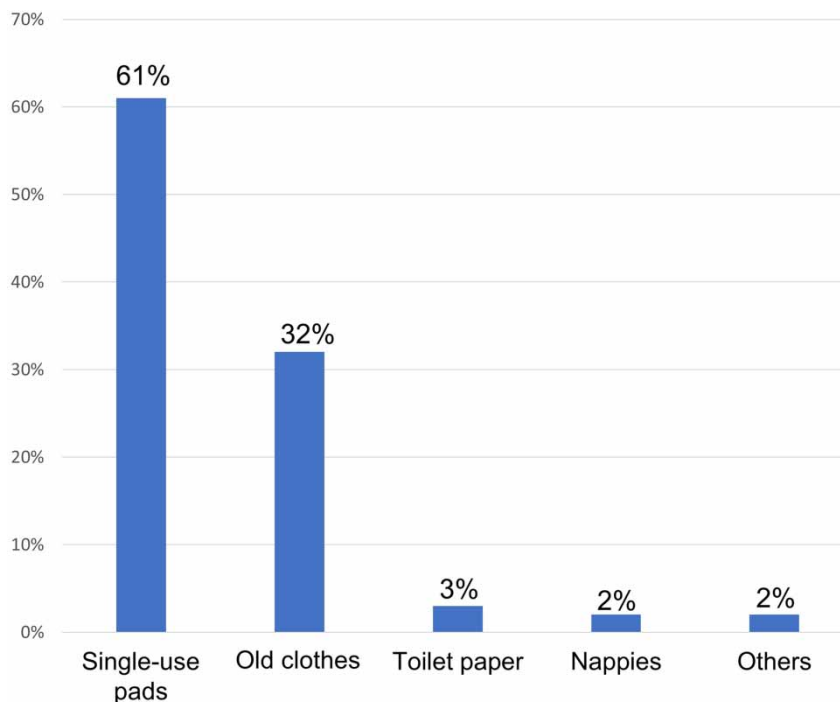


Figure 2 | Types of menstrual hygiene products reported to be used by women (*N* = 366). Other includes tampons, menstrual cups, and menstrual underwear.

stated that they obtain their menstrual products from pharmacies while on campus. The pharmacy was identified as the most preferred location for purchasing menstrual products due to comfort (71.3%). A large majority (86.3%) of those surveyed mentioned using menstrual products for an extended duration beyond recommendations due to inadequate access to suitable washing facilities. Among them, 5.8% answered 'always', while 64.8% replied 'sometimes', and 15.7% answered 'few times'. More than two-thirds (76.5%) of the participants also reported experiencing embarrassment when purchasing menstrual products. Among them, 10.1% answered 'always', 57.9% replied 'sometimes', and 8.5% answered 'few times'.

Perception of sanitation facilities

A minimal proportion (15.3%) always noted the presence of disposal bins for menstrual products in their regular bathrooms (Supplementary material, Table S2). Slightly more (15.6%) confirmed the consistent availability of clean running water and soap always for handwashing. Participants reported 'always' when asked if they had consistent privacy (22.1%), functional toilets (13.9%), cleanliness (13.4%), functional door locks (30.1%), and toilet paper availability (9.3%) in the bathrooms.

Socio-demographic characteristics of types of menstrual hygiene products

Table 3 shows the association between different menstrual hygiene products and socio-demographic backgrounds. Statistically noteworthy variations existed in the selection of menstrual hygiene products among the categories of studentship ($p \leq 0.0001$), fathers' education level ($p = 0.0307$), mothers' education level ($p = 0.0050$), and monthly family income ($p \leq 0.0001$). Interestingly, there were no statistically significant differences in types of menstrual hygiene products between the year of college ($p = 0.5687$), religion ($p = 0.3419$), birthplace status ($p = 0.9615$), and resident status ($p = 0.9562$).

Factors associated with the use of single-use pads and old clothes

Table 4 presents the multivariable logistic regression analysis for assessing the factors affecting single-use pads and old clothes. These were significantly predicted by menstrual characteristics, access to menstrual hygiene products, and perceptions of sanitation facilities. However, the utilisation of single-use pads and old clothes did not show significant prediction by menstrual information and education. The significant independent predictors that increased odds for single-use pads were fear of staining clothes with blood (AOR: 2.95; 95% CI: 1.53–5.68), having a clean and sanitary bathroom (AOR: 3.17; 95% CI: 1.20–8.39), and the bathroom having functional locks on doors (AOR: 4.45; 95% CI: 1.67–11.85). The odds of having single use pads were less for those who lacked the money to buy menstrual products (AOR: 0.26, 95% CI: 0.09–0.68), were embarrassed to buy menstrual products (AOR: 0.37, 95% CI: 0.16–0.86), and had privacy in their bathroom (AOR: 0.33, 95% CI: 0.14–0.77). Therefore, the significant independent predictors that increased odds for old clothes were being embarrassed to buy menstrual products (AOR: 2.86, 95% CI: 1.16–7.07) and having privacy in their bathroom (AOR: 2.92, 95% CI: 1.12–7.63). The significant independent predictors that had reduced odds for old clothes were the bathroom being clean and sanitary (AOR: 0.20, 95% CI: 0.07–0.58), the bathroom having functional door locks (AOR: 0.21; 95% CI: 0.07–0.67), and the bathroom having a supply of water and soap (AOR: 0.23; 95% CI: 0.07–0.77).

DISCUSSION

Family is the primary source of menstrual information (Table 2), and choices of menstrual hygiene products are significantly influenced by parental education, as given by Pearson's chi-square test (Table 3). In other related studies carried out in different nations, the family was the primary source of information on menstruation: Egypt (53–92.2%) (Chandra-Mouli & Patel 2017), Saudi Arabia (66.8%) (Alharbi *et al.* 2018), India (50.3%) (Tshomo *et al.* 2021), and Indonesia (almost half) (Assa *et al.* 2024). This suggested the importance of family as an educational resource for girls who are menstruating and the need for proper menstrual hygiene practices. The resulting lack of information about menstruation can lead to the use of unhygienic materials, which have significant implications for women's health, including an increased risk of infections and other health issues. The unique educational and professional context of the participants as nursing students does not directly affect their product choices, as these decisions are often influenced more by their surrounding environment than by personal preference. This indicated that not only are menstrual information and education important, but parental education is also significant for the participants.

Most participants experienced embarrassment both in discussing menstruation (Table 2) and purchasing menstrual products (Supplementary material, Table S1). This embarrassment significantly increased the likelihood of using old clothes rather than single-use pads in multivariable logistic regression (Table 4). Similar levels of embarrassment were observed in studies from Bangladesh, India, and Australia (Hennegan & Sol 2020; Munro *et al.* 2022; Kumar *et al.* 2024), in contrast

Table 3 | Association between socio-demographic characteristics with types of menstrual hygiene products

Characteristics	Types of menstrual hygiene products <i>n</i> (%)					<i>p</i> -value
	Nappies	Other	Old clothes	Single use pad	Toilet paper	
Category of studentship						
Master's in nursing	1 (0.27)	1 (0.27)	2 (0.55)	14 (3.83)	0 (0.00)	<0.0001*
B.Sc. in Midwifery (Post Basic)	0 (0.00)	0 (0.00)	4 (1.09)	25 (6.83)	4 (1.09)	
B.Sc. in Nursing (4 years)	4 (1.09)	3 (0.82)	43 (11.75)	84 (22.95)	4 (1.09)	
B.Sc. in Nursing (Post Basic)	1 (0.27)	5 (1.37)	7 (1.91)	21 (5.74)	1 (0.27)	
Diploma in Midwifery	2 (0.55)	0 (0.00)	21 (5.74)	64 (17.49)	0 (0.00)	
Diploma in Nursing Science and Midwifery	1 (0.27)	0 (0.00)	39 (10.66)	14 (3.83)	1 (0.27)	
Year of college						
First year	5 (1.37)	7 (1.91)	62 (16.94)	119 (32.51)	5 (1.37)	0.5687
Second year	3 (0.82)	0 (0.00)	34 (9.29)	74 (20.22)	4 (1.09)	
Third year	1 (0.27)	2 (0.55)	15 (4.10)	16 (4.37)	1 (0.27)	
Fourth year	0 (0.00)	0 (0.00)		13 (3.55)	0 (0.00)	
Religion						
Islam	6 (1.64)	9 (2.46)	94 (25.68)	198 (54.10)	8 (2.19)	0.3419
Hinduism	3 (0.82)	0 (0.00)	20 (5.46)	20 (5.46)	2 (0.55)	
Buddhism	0 (0.00)	0 (0.00)	1 (0.27)	0 (0.00)	0 (0.00)	
Christian	0 (0.00)	0 (0.00)	1 (0.27)	4 (1.09)	0 (0.00)	
Fathers' education level						
Graduate or above	0 (0.00)	3 (0.82)	11 (3.01)	48 (13.15)	1 (0.27)	0.0307*
Higher secondary	5 (1.37)	1 (0.27)	43 (11.78)	55 (15.07)	5 (1.37)	
Secondary	2 (0.55)	2 (0.55)	33 (9.04)	55 (15.07)	2 (0.55)	
Primary	0 (0.00)	3 (0.82)	21 (5.75)	52 (14.25)	2 (0.55)	
Illiterate	2 (0.55)	0 (0.00)	8 (2.19)	11 (3.01)	0 (0.00)	
Mothers' education level						
Graduate or above	2 (0.55)	3 (0.82)	3 (0.82)	20 (5.46)	0 (0.00)	0.0050*
Higher secondary	3 (0.82)	1 (0.27)	36 (9.84)	41 (11.20)	3 (0.82)	
Secondary	2 (0.55)	0 (0.00)	41 (11.20)	83 (22.68)	5 (1.37)	
Primary	1 (0.27)	3 (0.82)	31 (8.47)	67 (18.31)	2 (0.55)	
Illiterate	1 (0.27)	2 (0.55)	5 (1.37)	11 (3.01)	0 (0.00)	
Birthplace status						
Rural	7 (1.91)	6 (1.64)	89 (24.32)	167 (45.63)	8 (2.19)	0.9615
Urban	2 (0.55)	3 (0.82)	27 (7.38)	55 (15.03)	2 (0.55)	
Resident status						
Hostel	6 (1.64)	7 (1.91)	88 (24.04)	164 (44.81)	8 (2.19)	0.9562
Own house	3 (0.82)	2 (0.55)	28 (7.65)	58 (15.85)	2 (0.55)	
Monthly family income						
Below 10,000/- BDT	1 (0.27)	0 (0.00)	25 (6.83)	28 (7.65)	1(0.27)	<0.0001*
10,000–20,000/- BDT	5 (1.37)	0 (0.00)	51 (13.93)	75 (20.49)	3 (0.82)	
20,000–30,000/- BDT	1 (0.27)	1 (0.27)	29 (7.92)	61 (16.67)	1 (0.27)	
More than 30,000/- BDT	2 (0.55)	8 (2.19)	11 (3.01)	58 (15.85)	5 (1.37)	

Significance level **p* < 0.05.

Table 4 | Multivariable logistic regression analysis of factors associated with single-use pads and old clothes

		Single-use pad			Old clothes		
		n (%)	AOR (95% CI)	p-value	n (%)	AOR (95% CI)	p-value
Menstrual characteristics							
Fear of staining blood	No	89 (24.32)	Ref.	–	68 (18.58)	Ref.	–
	Yes	133 (36.34)	2.95 (1.53–5.68)	0.0012*	48 (13.11)	0.62 (0.30–1.27)	0.1906
Access to menstrual hygiene products and supplies							
Lacked money	No	170 (46.45)	Ref.	–	105 (28.69)	–	–
	Yes	52 (14.21)	0.26 (0.09–0.68)	0.0064*	11 (3.01)	–	–
Expensive	No	39 (10.66)	Ref.	–	7 (1.91)	–	–
	Yes	183 (50)	3.06 (0.74–12.66)	0.1235	109 (29.78)	–	–
Washing facilities	No	41 (11.20)	Ref.	–	8 (2.19)	–	–
	Yes	181 (49.45)	0.51 (0.18–1.46)	0.2111	108 (29.51)	–	–
Embarrassed to buy	No	67 (18.31)	Ref.	–	15 (4.10)	Ref.	–
	Yes	155 (42.35)	0.37 (0.16–0.86)	0.0218*	101 (27.60)	2.86 (1.16–7.07)	0.0230*
Perceptions of sanitation facilities on campus							
Privacy	Poor	45 (12.30)	Ref.	–	23 (6.28)	Ref.	–
	Good	177 (48.36)	0.33 (0.14–0.77)	0.0101*	93 (25.41)	2.92 (1.12–7.63)	0.0286*
Clean and sanitary	Poor	53 (14.48)	Ref.	–	77 (21.04)	Ref.	–
	Good	169 (46.17)	3.17 (1.20–8.39)	0.0198*	39 (10.66)	0.20 (0.07–0.58)	0.0032*
Functional door locks	Poor	38 (10.38)	Ref.	–	74 (20.22)	Ref.	–
	Good	184 (50.27)	4.45 (1.67–11.85)	0.0028*	42 (11.48)	0.21 (0.07–0.67)	0.0080*
Toilet paper	Poor	140 (38.25)	–	–	85 (23.22)	Ref.	–
	Good	82 (22.40)	–	–	31 (8.74)	1.96 (0.59–6.52)	0.2719
Water and soap	Poor	75 (20.49)	Ref.	–	81 (22.13)	Ref.	–
	Good	147 (40.16)	2.29 (0.99–5.33)	0.0536	35 (9.56)	0.23 (0.07–0.77)	0.0167*

CI, confidence interval; Ref., reference.

Significance level * $p < 0.05$.

to Palestine, which had lesser embarrassment (Hassan *et al.* 2023). This indicates that the issue of embarrassment during menstruation is not dependent on the country's affluence but is a relatively sensitive topic. The embarrassment nursing students feel about menstruation is particularly troubling, as they are future healthcare providers who will need to educate and support patients. It could hinder their ability to properly educate and care for patients, leading to missed opportunities for effective menstrual education and potentially perpetuating misinformation. Researchers recommend further investigations, including qualitative research to see the reasons behind this embarrassment.

The fear of blood stains on clothes was significantly associated with menstrual product choices. A high proportion of the participants (51.9%) feared staining clothes with blood (Table 2), and this fear was associated with increased odds of using single-use pads rather than old clothes in multivariable logistic regression (Table 4). These findings differ from another study where 85.3% found fear of staining clothes with blood, but no association was measured (Hassan *et al.* 2023). The fear of this blood is mental, not physical, as the participants are aware that they menstruate every month. The concern, therefore, is to avoid washing the menstrual products. From the preferences for single-use pads, it follows that the fear of staining clothing with blood from menstruation would guide the choice of menstrual products and the demand for proper sanitation facilities.

The participants had a poor perception of sanitation facilities for practicing menstrual hygiene. These findings indicated that privacy (22.1%), cleanliness (13.4%), and functional door locks (30.1%) were always reported as poor in the bathrooms (Supplementary material, Table S2). These findings align with previous research demonstrating inadequate menstrual hygiene facilities on college campuses, schools, and communities (Hennegan & Sol 2020; Munro *et al.* 2021, 2022; Bhakta *et al.* 2024). A possible cause is the lack of prioritisation of sanitation facilities within both these institutions and the community. A good perception of the need for privacy, cleanliness, and functionality of sanitation facilities points to a significant need for prioritizing infrastructure development for sanitation to improve menstrual hygiene and sanitation conditions.

Decisions were based on the sanitation facilities, either single-use pads or old clothes. The multivariable logistic regression of the above-indicated user showed that privacy was a predictor for reduced odds of using single-use pads and an increased likelihood of using old clothes, while the functionality of door locks was one of the predictors for increasing the odds of using single-use pads but decreasing the use of old clothes (Table 4). Similar findings include students using menstrual products longer than advised without water, privacy, and sanitary waste bins (Munro *et al.* 2021), as well as latrine types (Mudi *et al.* 2023) and sanitation facilities influencing menstruation management (Shannon *et al.* 2021; Sato *et al.* 2023; Sambo *et al.* 2024). The preference for using old clothes in private bathrooms, despite less sanitary conditions, likely stems from a strong cultural emphasis on privacy and avoiding stigma, which outweighs concerns about the bathroom's cleanliness or functionality. Thus, the physical environment is critical in MHM. It becomes clear that menstrual hygiene product choices are not only a matter of individual choice but are deeply connected with parental education, embarrassment, and sanitation facilities. Addressing these factors can lead to better health outcomes and empower women to manage their menstruation with hygienic products.

Limitations

This study was confined to government nursing colleges and focused solely on nursing students, which may limit the generalizability of the findings to a broader population of women. The use of proportional sampling might help reduce biases that could affect the representation of the entire student population. Secondly, the study relied on self-reported data, which could be subject to response bias. Participants' answers might have been influenced by recall bias or the desire to present themselves in a socially desirable manner. The use of self-reporting also allows for the collection of nuanced personal experiences and perceptions, which are invaluable for understanding subjective phenomena like menstruation. Thirdly, this study's use of multivariate logistic regression allowed for the identification of statistically significant factors associated with product choices. Due to the complex and multifaceted nature of MHM, some factors that were not statistically significant in our model may still have important social and personal influences that were not fully captured. Future research should consider qualitative approaches to explore these nuanced contributions further. Lastly, the sanitation facilities considered in this study were limited to perceptions of bathrooms and access to menstrual hygiene products. Other potential WASH influences, such as exposure to menstrual health education outside of formal schooling, broader community support systems, and household conditions, were not explored. Concentrating on these specific aspects of WASH facilities allowed for a detailed exploration of core environmental and resource-based factors, directly impacting menstrual hygiene practices.

CONCLUSION

This study provides important insights into MHH among nursing students, as well as crucial future healthcare professionals. The participants had minimal knowledge of menstruation before menarche and that family was a main source of menstrual information. Single-use pads and old clothes were major menstrual products used among the participants. The inhibition of the menstrual product choices was influenced by parental education, not participant knowledge level. The use of single-use pads and old clothes is influenced by embarrassment about purchasing products, fear of blood-staining clothes, availability of water and soap, privacy of bathrooms, and functional door locks for bathrooms. Better practice of MHH requires improved parental education, reduced embarrassment, and better sanitation facilities.

ACKNOWLEDGEMENTS

The authors are thankful to SmileLab (Laboratory of Human Ecology) members, Faculty of Health Sciences, Hokkaido University, Japan. The authors are also grateful to the respondents who participated in this study, the research assistants, the Japan International Corporation Agency (JICA), the Directorate General of Nursing and Midwifery, Bangladesh, and Principals of these seven nursing colleges for their support and cooperation in the field.

FUNDING

This research was supported by a JICA scholarship (Scholarship Number: D2202659).

DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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First received 28 June 2024; accepted in revised form 13 September 2024. Available online 27 September 2024