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The parent(s) and/or legal guardian(s) of the adolescent participants provided informed consent for participation in this study. In addition, informed assent was obtained from the participants themselves before data collection.

Socio-economic Determinants of Menstrual Hygiene Practices among Adolescent Girls: A Rural-Urban Comparative Study in Bangladesh

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Abstract

Background: Menstrual hygiene management (MHM) remains a critical challenge for adolescent girls in low- and middle-income countries like Bangladesh, particularly in rural areas where socio-economic and cultural barriers limit access to hygienic products, knowledge, and facilities, adversely affecting health, education, and well-being. This study examines the socio-economic determinants of MHM practices among adolescent girls in rural and urban settings of Narsingdi District, Bangladesh.

Methods: A cross-sectional quantitative design was used, involving 250 adolescent girls aged 12–19 years (120 rural, 130 urban) selected via simple random sampling. Data were collected through structured face-to-face interviews assessing socio-demographic characteristics, menstrual hygiene practices, knowledge levels, and socio-cultural beliefs. Descriptive statistics and Pearson's Chi-Square tests ($p < 0.05$) were applied using SPSS version 27 to identify associations between socio-economic factors and MHM behaviors.

Results: Urban girls exhibited significantly better MHM practices than rural counterparts ($p < 0.001$ for key variables). Sanitary pad usage was higher in urban areas (84.6% vs. 53.3% rural), with urban girls also demonstrating more frequent pad changes (e.g., twice daily: 53.1% vs. 50.8%), safer disposal methods (household waste: 80.0% vs. 55.8%), and fewer cultural restrictions (e.g., avoiding outdoors: 15.4% vs. 42.5%). Maternal literacy and higher socio-economic status were positively associated with improved practices, while rural areas showed greater knowledge gaps and stigma-driven behaviors.

Conclusions: Socio-economic factors, including maternal literacy and household wealth, significantly influence MHM practices, with urban-rural disparities underscoring structural inequities. Targeted interventions emphasizing education, affordable product access, infrastructure improvements, and stigma reduction are essential to enhance MHM, particularly in rural Bangladesh, supporting Sustainable Development Goal 5 for gender equality.

Keywords: Menstrual hygiene management, socio-economic determinants, cultural stigma, adolescent girls, rural-urban disparities, Bangladesh.

1 Introduction

Adolescent[1] girls in low- and middle-income countries (LMICs) such as Bangladesh face heightened risks to their social well-being and health. Menstruation significantly contributes to this vulnerability, particularly where cultural norms and taboos treat it as a private, often shameful matter. This entrenched silence impedes girls' ability to learn about and access essential resources for managing their menstrual hygiene (MHM). While menstruation is a natural biological process occurring monthly for women from puberty until menopause, societal misconceptions frequently lead to stigma. In many contexts, the conversation of menstruation is perceived as unsuitable. As a result, many young girls are ignorant of important information about period hygiene. This creates societal norms in Bangladesh which frequently hinder girls' participation in regular activities like social gatherings and education [1].

Gynecological infections, urinary tract infections (UTIs), and other reproductive health issues can result from poor menstrual hygiene management (MHM), which presents serious health concerns [2]. In low-resource areas the access to clean sanitary items is restricted. Inadequate information and inadequate sanitation infrastructure made these issues worse. According to studies, in rural Bangladesh, girls often lack access to proper menstruation products than the urban areas. They are unable to obtain the information or assistance they need to properly manage their period health due to cultural taboos [3]. Though there are national and international efforts to educate people about healthy practices during menstruation, adolescent girls have very little knowledge about hygiene practices and in rural Bangladesh. By assessing the group's knowledge levels, challenges faced, and existing menstrual hygiene practices, this study fills this requirement. Important findings show that teens from low-income families are less likely to practice good hygiene on a regular basis, mostly because they have less access to sanitary products and disposal choices. Economic situation has a significant impact on the selection of menstruation products, the frequency of their replacement, and compliance with period-related limitations. Improved hygiene practices are greatly improved by increased knowledge and awareness, and better menstruation management is favorably correlated with higher maternal literacy [4]. Menstrual hygiene might be significantly improved by focused treatments that target these socioeconomic and educational aspects, especially for people with lower incomes.

Insights from this study will also improve understanding of the difficulties faced by teenage females in both urban and rural Bangladesh. These findings will guide future efforts to enhance menstrual hygiene management (MHM) practices in this group. Target 5.6 of the Sustainable Development Goals (SDG) agenda-5, which promotes gender equality, health, and education, is in line with this effort. Menstrual hygiene is a critical public health issue in rural Bangladesh. The effective management of menstrual hygiene is crucial as it significantly impacts adolescent girls' everyday life, health, and attendance at school. Cultural stigmas, a lack of awareness, and limited facilities and resources hamper girls' ability to manage their menstrual hygiene practice effectively, which carries detrimental effects on their physical and emotional health.

[1] The World Health Organization (WHO) defines an adolescent as any person between ages 10 and 19.

This study seeks to know the influence of socio-economic factors on adolescent girls' about MHM practices in both rural and urban areas of Bangladesh. Despite these rural-focused observations, urban settings in Bangladesh present a contrasting picture. Adolescent girls living in urban areas often have somewhat better access to information, products, and infrastructure, though persistent barriers remain. For example, studies in Dhaka's urban areas report that around 70 % of adolescent girls use sanitary pads, with changing practices and disposal behaviors notably better than their rural counterparts, yet many still face challenges around affordability, privacy, and adequate sanitation facilities in schools and homes [5]. Similarly, BMC Women's Health analysis of Rajshahi found urban girls were significantly more likely to report good menstrual hygiene management practices than rural peers (32.3 % vs. 27.7 %). These urban advantages reflect greater access to sanitary materials, improved awareness through media and peer networks, and more supportive school infrastructure [6].

The study found that menstrual hygiene remains a serious health and socio-economic concern in rural Bangladesh; the urban context offers a partial counterpoint. Urban adolescent girls generally adopt safer menstrual behaviors due to relatively better socio-economic position, product access, information flow, and facility support. Yet, urban girls, especially in informal settlements, also struggle with high costs, privacy constraints, and lingering stigma. It also offers critical evidence to inform future programs. These efforts aim to enhance menstrual health and support progress toward the Sustainable Development Goals (SDGs). Addressing these layered urban–rural disparities is essential for designing effective, inclusive interventions that reach all adolescent girls across Bangladesh.

1.1 Literature Review

Socio-economic factors significantly shape menstrual hygiene practices. Economic constraints directly impact an individual's ability to purchase essential sanitary products. Empirical evidence consistently reveals wealth-based disparities in access to menstrual hygiene management (MHM) facilities and sanitary pads across diverse national contexts. Key drivers of these inequities include household wealth, educational attainment, rural-urban divides, and limitations in domestic infrastructure. Wealth emerges as a primary factor influencing unequal access to MHM resources [7]. This inequality often manifests as a critical shortage of safe, dedicated MHM facilities, which compromises the health, safety, and dignity of women and girls. Given the substantial potential physical, social, and economic repercussions of inadequate MHM, unequal access ultimately compounds existing socio-economic inequalities [8].

Adolescent girls frequently possess constrained knowledge and practical experience regarding Menstrual Hygiene Management (MHM). Societal taboos inhibiting open dialogue often result in insufficient or inaccurate understanding of their own bodies, especially concerning reproductive anatomy and function [9]. This knowledge deficit carries significant consequences: an inability to manage menstrual hygiene effectively jeopardizes physical, mental, and emotional well-being, alongside hindering social development and educational

attainment [10]. Consequently, promoting menstrual health and hygiene literacy among adolescent girls represents a critical public health priority for policymakers in low- and middle-income countries [11]. Within Bangladesh, cultural norms and women's restricted participation in household decisions contribute to the persistence of inadequate menstruation-related knowledge. Although mothers and female relatives serve as the primary information sources, the guidance they offer is typically minimal and occasionally incorrect. These knowledge gaps prevent adolescent girls from adopting hygienic menstrual practices, ultimately fostering adverse health outcomes and social difficulties [6]. Adolescent girls have limited information about menstruation. Research studies indicate a lack of awareness among girls regarding menstruation when they first encounter it. Adolescent females in rural and tribal communities have barriers to accessing relevant information due to social prohibitions and poor parental attitudes against open discussion of these matters [12]. Research indicates that many adolescent girls have insufficient and incorrect knowledge about menstrual hygiene, increasing their risk of infections. The findings further identified mothers, television, friends, teachers, and relatives as primary sources of menstrual health information dissemination to adolescent girls [13]. Adherence to optimal hygienic practices, including the utilization of sanitary pads and thorough genital hygiene, was underscored as critical for mitigating health risks and ensuring safe menstrual health management [14].

Effective menstrual hygiene management (MHM) lowers the risk of urinary and reproductive tract infections and improves women's overall health. However, cultural and religious norms impose significant constraints, including dietary restrictions and practices of untouchability during menstruation, which undermine adolescent girls' dignity and well-being. These taboos frequently result in inadequate education about menstruation and hygiene. Adolescent girls' perceptions of their periods are heavily shaped by their community's traditions and beliefs. Consequently, many feel too ashamed or uncomfortable to discuss menstrual matters openly with parents, peers, or educators, potentially harming their health [15]. Adherence to numerous rituals and restrictions often prevents girls from accessing scientific information about menstruation. This disconnect can compromise their ability to maintain hygiene, leading to negative health outcomes. Active engagement by healthcare providers (HCPs) is crucial for addressing these menstrual health challenges [16]. The large-scale urban–rural comparative study in Rajshahi Division of 586 girls aged 14–19 found that only 37.7 % continuously used sanitary pads. Among cloth users, approximately 71 % reused the material; nearly all washed cloths, but only 57 % used soap. Fewer than half changed absorbent materials three times or more per day, and proper genital hygiene was practiced by fewer than 40 %. Over 55 % buried menstrual materials and around 20 % disposed them in water bodies. Logistic regression revealed urban residence, younger age, smaller family size, and parental education were significant determinants of better menstrual hygiene practice [6].

The exclusive use of hygienic menstrual products among adolescent girls in urban India is strongly shaped by higher education, household wealth, access to private sanitation, media exposure, and socio-demographic identity (religion, caste), as well as regional location. The study focuses specifically on urban adolescent girls aged 15–19 at a population level and

provides evidence to inform policy interventions concerned with urban youth and underserved urban communities [17].
There is a limited study of the rural-urban comparison of menstrual practice. Again, there is a little study about the relationship of mothers' literacy in this context. This study aims to focus on socio-economic factors affecting menstrual hygiene practice in both rural and urban contexts. Again, there are a lot of qualitative studies in this concept, whereas this study focuses on the quantitative method to study this field empirically.

1.2 Theoretical Framework

1.2.1 Health Belief Model (HBM)

Originating in the 1950s through the work of Rosenstock and Becker, the Health Belief Model (HBM) links health behaviors directly to an individual's assessment of potential benefits. This framework posits that people are likeliest to adopt preventative health actions when three conditions align: 1) they perceive a health threat as severe, 2) they believe themselves personally vulnerable, and 3) they view the anticipated benefits of action as outweighing the associated costs or barriers [18]. Widely applied in health behavior research, the HBM helps explain decision-making by analyzing personal beliefs about health risks and the advantages of specific behaviors. Its focus on subjective perceptions makes it particularly valuable for understanding menstrual hygiene practices, as it illuminates how adolescent girls' interpretations of menstruation shape their hygiene behaviors.

1.2.2 Feminist Theory

Marxist and socialist ideas are incorporated into feminist theory, which is based on the critical tradition of opposing oppressive and power structures. Sex, gender, racism, prejudice, equality, diversity, and choice are among the constructs that it focuses on analytically. At its core, feminist research looks at social stratification, intersectionality, and strategies to bring about radical change [19]. This theoretical framework provides a critical analysis of sociocultural processes in relation to menstrual hygiene management (MHM). It demonstrates how girls' lived experiences and hygiene habits are influenced by a combination of menstruation stigmatization, ingrained gender inequality, and patriarchal structures. The societal stigma and silence surrounding menstruation are aggressively challenged by feminist theory, which promotes its acknowledgement as a human rights problem. This calls for making sure females have fair access to menstruation education, supplies, and secure spaces. The theory also criticizes the medicalization of menstruation, which is the portrayal of a normal biological function as a pathological "problem" that has to be addressed rather than as a normative bodily autonomy.

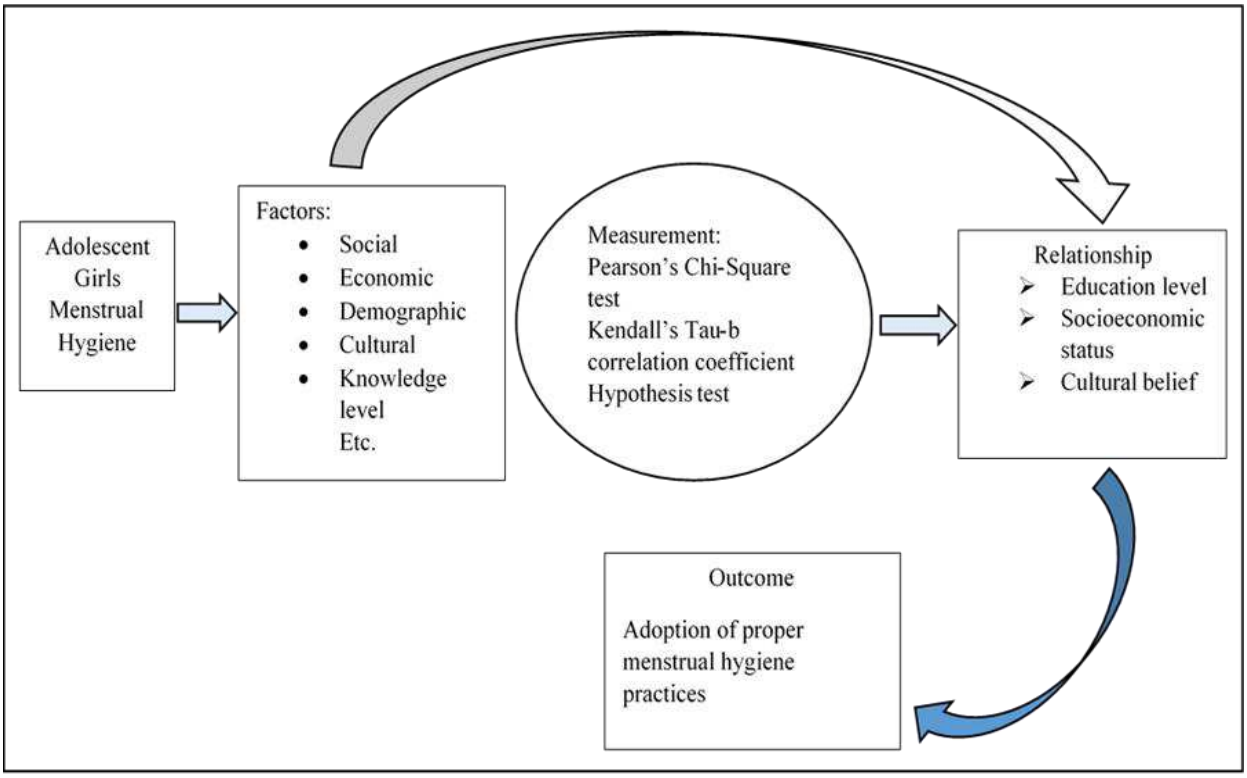


Figure 2. Conceptual Framework of the Study

2 Materials and Methods

2.1 Methodology

This study employed a cross-sectional quantitative research design to assess the socio-economic, cultural, educational, and demographic determinants of menstrual hygiene practices among adolescent girls. The cross-sectional approach allowed for a snapshot of data at a single point in time, enabling the identification of associations between various factors and menstrual hygiene behaviors. The study tested the null hypothesis (H_0: There is no significant association between socio-economic factors and menstrual hygiene behavior of adolescent girls in Rural and Urban Areas) against the alternative hypothesis (H_1: There is a significant association between socio-economic factors and menstrual hygiene behavior of adolescent girls in Rural and Urban Areas).



Figure 2: Geographical Location of the Study Area in Narsingdi, Bangladesh

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 27 and Microsoft Excel. Descriptive statistics were used to summarize socio-demographic characteristics, menstrual hygiene practices, and knowledge levels. Pearson's Chi-Square test was employed to assess significant associations between categorical variables, such as socio-economic status and hygiene practices. The significance level was set at $p < 0.05$. These statistical methods enabled the identification of patterns and influences on menstrual hygiene behaviors, testing the hypotheses regarding the impact of socio-economic, cultural, and educational factors.

2.2 Methods

The study was conducted in Narsingdi district of Dhaka division, Bangladesh. As the rural area, Monohordi Upazila and for urban area, Narshindi Sadar Upazila were selected. This rural setting was chosen to investigate menstrual hygiene practices among adolescent girls, as rural areas often face unique socio-economic and cultural challenges that impact health behaviors. On the other hand, Narsingdi Sadar Upazila was selected as the urban area to access hygiene practices in urban setting. We collected data through survey method with a closed-ended questionnaire. Our sample size was 250. 120 participants were from rural area and the other 130 participants were from urban area. The study utilized simple random sampling to select participants from the target population. Data were collected through face-to-face interviews using a structured, pre-tested questionnaire with closed-ended questions. The questionnaire was designed to capture quantitative data on socio-demographic characteristics (age, education level, maternal literacy), menstrual hygiene practices (material use, disposal methods, frequency of changing pads), knowledge levels (awareness of hygiene necessity), and socio-cultural beliefs (taboos, restrictions). The use of closed-ended questions, including Likert scales, categorical classifications, and frequency scales,

ensured standardized responses suitable for quantitative analysis. According to the 2022 Population and Housing Census, in Chandanbari village at Monohordi Upazila under Narshindi district has a total 855 female among them adolescent girls number is nearly 180.[2] And in Chinishpur village Lebutala union in Narsingdi Sadar Upazila has a total 1245 females among them adolescent girls number is nearly 200. The sample size was calculated using Morgan's Sample Size Formula[3]

2.3 Sample Size Estimation Formula (Rural Area)

$$n = \frac{X^2 * N * P * (1 - P)}{\left(ME^2 * (N - 1)\right) + \left(X^2 * P * (1 - P)\right)}$$

Where,
n= sample size
X^2 = Chi-square for the specified confidence level at 1 degree of freedom
N= population size
P= population proportion
ME= desired margin of error
In Chandanbari village, there are 180 adolescent girls, which is our target population.
The total population size (N) is =180
Margin of error (ME) = 0.05 (for 5%)
P = 0.5
X^2 = 3.841
So,
n = X2* N * P * (1-P)/ (ME2* (N-1)) + (X2* P * (1-P))
= 3.841* 180 * 0.5 * 0.5 / {(0.05)2 * (180-1)} + {3.841 * 0.5 * 0.5}
= 122.78
= 123
= 120 (taken 120 as a round figure)

Sample Size Estimation Formula (Urban Area)

$$n = \frac{X^2 * N * P * (1 - P)}{\left(ME^2 * (N - 1)\right) + \left(X^2 * P * (1 - P)\right)}$$

Where,
n= sample size
X^2 = Chi-square for the specified confidence level at 1 degree of freedom
N= population size
P= population proportion
ME= desired margin of error
In Narshindi Sadar Upazila, there are 200 adolescent girls, which is our target population.
The total population size (N) is =200
Margin of error (ME) = 0.05 (for 5%)

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[2]Bangladesh Bureau of Statistics (2022)"Population and Housing Census 2022" (PDF). Bbs.portal.gov.bd. Bangladesh Bureau of Statistics. Archived from the original (PDF) on 25 September 2024.

[3]This formula is the one used by Krejcie & Morgan in their 1970 article "Determining Sample Size for Research Activities" (Educational and Psychological Measurement, #30, pp. 607–610). BOX 123. 279 E. Central Street. Franklin, MA 02038. info@research-advisors.com Copyright 2004–2023 The Research Advisors, 2006.

P = 0.5
X^2 = 3.841
So,
n = X2* N * P * (1-P)/ (ME2* (N-1)) + (X2* P * (1-P))
= 3.841* 200 * 0.5 * 0.5 / {(0.05)2 * (200-1)} + {3.841 * 0.5 * 0.5}
= 131.744
= 130 (taken 130 as a round figure)

2.4 Ethical statement

This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethical Committee of Noakhali Science and Technology University (NSTU) (Reference no: NSTU/SCI/EC/2025/232, dated January 15, 2025). Written informed consent was obtained from all participants prior to data collection. Participants were informed of the study's purpose, procedures, potential risks, and their right to withdraw at any time without consequences. To ensure confidentiality, no personal identifiers (e.g., names, student IDs) were collected, and each participant was assigned a unique anonymized ID. Physical questionnaires were stored in a locked, secure facility at NSTU, accessible only to the research team. Digital data were encrypted and stored on password-protected servers at NSTU, with access restricted to authorized researchers (principal investigator and co-authors). Data will be retained for five years post-publication, in line with NSTU ethical guidelines, after which they will be securely destroyed (paper records shredded, digital files permanently deleted). All procedures adhered to ethical standards for protecting participant privacy and data security, as outlined by the World Medical Association [20]. Participants reporting severe psychological distress during data collection were referred to NSTU's counseling services, ensuring ethical management of vulnerable cases.

3 Results and Discussions

3.1 Socio-economic Characteristics of Rural-Urban Adolescent Girls

This study reveals important rural-urban differences in menstrual hygiene practices and highlights socio-economic, behavioral, and perceptual factors influencing these practices among adolescent girls in Bangladesh. The findings contribute to understanding how infrastructural disparities and cultural beliefs manifest in menstrual hygiene management. Socio-economic class emerged as a significant factor in univariate analysis but was not retained in the adjusted model, suggesting that other mediating factors like knowledge and restriction practices may play a stronger role. However, the disproportionate representation of lower-class girls in rural areas underscores structural inequities.

Table 1 shows a total of 250 respondents participated in the study, including 52.0 percent from urban areas and 48.0 percent from rural areas. Age distribution differed significantly between urban and rural settings ($\chi^2 = 7.179$, $p = 0.028$). While the largest age group for both settings was 14–16 years old, 60.8 percent, rural respondents had a notably higher

proportion in the 17–19 category, 25.0 vs. 13.1 percent, and a lower proportion in the 11–13 category, 15.8 vs. 24.6 percent.

Table 01: Socio-economic Characteristics of Rural-Urban Adolescent Girls (Sample Size 250)

Variables	Urban, (n=130) (%)	Rural, (n=120) (%)	Total, (n=250) (%)	Chi-Square (χ^2)	P-value
Age Categories (12-19)					
11-13	32 (24.6%)	19 (15.8%)	51 (20.4%)	7.179	**0.028**
14-16	81 (62.3%)	71 (59.2%)	152 (60.8%)		
17-19	17 (13.1%)	30 (25.0%)	47 (18.8%)		
Education Levels					
PSC	17 (13.1%)	32 (26.7%)	49 (19.6%)	12.407	**0.006**
JSC	53 (40.8%)	50 (41.7%)	103 (41.2%)		
SSC	55 (42.3%)	38 (31.7%)	93 (37.2%)		
HSC	5 (3.8%)	0 (0.0%)	5 (2.0%)		
Mother's Literacy Level					
Illiterate	0 (0.0%)	32 (26.7%)	32 (12.8%)	47.139	**<0.001**
Primary School	12 (9.2%)	20 (16.7%)	32 (12.8%)		
High School	105 (80.8%)	60 (50.0%)	165 (66.0%)		
Graduation	13 (10.0%)	8 (6.7%)	21 (8.4%)		
Socio-economic Class					
Lower Class	14 (10.8%)	60 (50.0%)	74 (29.6%)	46.602	**<0.001**
Middle Class	102 (78.5%)	55 (45.8%)	157 (62.8%)		
Upper Class	14 (10.8%)	5 (4.2%)	19 (7.6%)		

Source: Author's Computation from the Field Data

Education level was also significantly different across settings ($\chi^2 = 12.407$, $p = 0.006$). Urban respondents were more likely to have completed SSC, nearly 42.3 percent or HSC 3.8 percent, than their rural counterparts, while rural respondents were more represented at the PSC level. Concerning mother's literacy level, a striking disparity emerged ($\chi^2 = 47.139$, $p < 0.001$). Urban mothers were almost universally literate, with 80.8 percent having at least high school education and none classified as illiterate, whereas 26.7 percent of rural mothers were illiterate and just 50 percent had secondary or higher education. Similarly, socio-economic class varied significantly between the two cohorts ($\chi^2 = 46.602$, $p < 0.001$). The majority of urban respondents, almost 78.5 percent, belonged to the middle-income group, with far smaller proportions in lower or upper classes; in contrast, rural respondents were disproportionately concentrated in the lower class nearly 50.0 percent and had minimal representation in the upper class 4.2 percent.

These results indicate urban–rural differences in age, education, maternal education, and socio-economic status each statistically significant. These socio-demographic divides may underpin differences in adolescent knowledge, attitudes, and access to reproductive and sexual health (RSH) resources. For instance, urban girls born to more educated mothers and middle-class families are likely to benefit from better knowledge, delayed marriage or pregnancy, and greater autonomy. In contrast, rural girls may face barriers: early dropouts, limited household resources, and maternal illiteracy.

3.2 Menstrual Hygiene Practices among Rural-Urban Adolescent Girls

The use of sanitary pads was significantly higher in urban areas, 84.6 percent compared to rural 53.3 percent, aligning with past research that links access and affordability to better hygiene practices (Dasgupta & Sarkar, 2008). Pad-changing frequency and method of disposal were also significantly different, reflecting the urban advantage in terms of water access, sanitation, and hygiene facilities.

Table 02: Preferences of Menstrual Hygiene Practices among Rural-Urban Adolescent Girls (Sample Size 250)

Variables	Urban, (n=130) (%)	Rural, (n=120) (%)	Total, (n=250) (%)	Chi-Square (χ^2)	P-value
Hygiene Practice					
Rarely	4 (3.1%)	8 (6.7%)	12 (4.8%)	11.643	**0.009**
Sometimes	10 (7.7%)	25 (20.8%)	35 (14.0%)		
Often	93 (71.5%)	68 (56.7%)	161 (64.4%)		
Very Often	23 (17.7%)	19 (15.8%)	42 (16.8%)		
Material Used for Menstrual Soaking					
Cloth	20 (15.4%)	56 (46.7%)	76 (30.4%)	28.860	**<0.001**
Sanitary Pad	110 (84.6%)	64 (53.3%)	174 (69.6%)		
Frequency of Changing Pads					
Once Daily	19 (14.6%)	34 (28.3%)	53 (21.2%)	9.207	**0.027**
Twice Daily	69 (53.1%)	61 (50.8%)	130 (52.0%)		
Thrice Daily	32 (24.6%)	21 (17.5%)	53 (21.2%)		
More Than Thrice	10 (7.7%)	4 (3.3%)	14 (5.6%)		
Restrictions Practiced During Menstruation					
Avoid Going Outside	20 (15.4%)	51 (42.5%)	71 (28.4%)	33.001	**<0.001**
Do Not Attend School	1 (0.8%)	7 (5.8%)	8 (3.2%)		
Do Not Go to Kitchen	4 (3.1%)	6 (5.0%)	10 (4.0%)		
Not Practiced	105 (80.8%)	56 (46.7%)	161 (64.4%)		
Disposal Method for Used Pad					

In the Toilet Pan	13 (10.0%)	13 (10.8%)	26 (10.4%)	21.896	**<0.001**
In the Open Field	13 (10.0%)	38 (31.7%)	51 (20.4%)		
Burn	0 (0.0%)	2 (1.7%)	2 (0.8%)		
With Other Waste	104 (80.0%)	67 (55.8%)	171 (68.4%)		

Source: Author's Computation from the Field Data

Table 2 data expose clear urban–rural divides in menstrual hygiene among adolescent girls. Rural adolescents' girls were significantly more likely than urban peers to report less frequent hygiene practices nearly 0.8 vs. 7.7 percent said sometimes and 'rarely' 6.7% vs. 3.1 percent and fewer 'often' 56.7% vs. 71.5 percent or 'very often' 15.8% vs. 17.7 percent sanitary behaviors ($\chi^2 = 11.643$, $p = 0.009$). Use of sanitary pads was high in urban areas almost 84.6 percent but considerably lower in rural ones 53.3 percent, where nearly half still rely on cloth 46.0 percent versus 15.4 %; $\chi^2 = 28.860$, $p < 0.001$). Frequency of changing pads also differed: 28.3percent of rural girls changed pads only once per day compared with 14.6 percent of urban girls, while more urban girls changed pads multiple times daily, though overall, more than 75 percent of both groups changed pads at least twice per day ($\chi^2 = 9.207$, $p = 0.027$). Restrictive norms were markedly more prevalent in rural areas 42.5 percent avoided going outside and 5.8 percent skipped school during menstruation, compared with just 15.4 percent and 0.8 percent in urban settings, respectively (overall restrictions applied to 28.4 percent of respondents; $\chi^2 = 33.001$, $p < 0.001$). Disposal methods further underscored the gap: rural respondents disposed of used pads in open fields nearly three times more often than urban ones 31.7 vs. 10.0 percent, whereas the majority of urban girls almost 80.0 percent used household waste disposal methods ($\chi^2 = 21.896$, $p < 0.001$).

These patterns reflect broader national trends: UNICEF and UNFPA data show that in Bangladesh over 50 percent of adolescent girls still rely on cloth during menstruation, particularly in rural settings, rooted in cultural stigma and affordability barriers. (unfpa.org, 2025) The widespread rural reliance on cloth—and less frequent pad changing—can elevate the risk of reproductive tract infections, as extended wear (more than 6–8 hours) and cloth reuse without proper washing have been linked to bacterial vaginosis, candidiasis, and urinary tract infections. (healthshots.com, 2023)

3.3 Knowledge and Attitudes of Adolescent Girls toward Menstrual Hygiene Practices

Behavioral restrictions during menstruation—like avoiding going outside or skipping school—were much more prevalent in rural communities. These restrictions were strongly associated with lower hygiene practice scores in both unadjusted and adjusted models, pointing to entrenched socio-cultural norms. Similar findings were reported in Indian

studies (Garg et al., 2012), which emphasized how stigma and taboo reduce hygienic behavior.

Table-03: Knowledge and Attitudes of Adolescent Girls toward Menstrual Hygiene Practices (Sample Size 250)

Variables	Urban, (n=130) (%)	Rural, (n=120) (%)	Total, (n=250) (%)	Chi-Square (χ^2)	P-value
Hygienic Practice is Necessary During Menstruation					
Neutral	1 (0.8%)	36 (30.0%)	37 (14.8%)	60.552	**<0.001**
Agree	80 (61.5%)	75 (62.5%)	155 (62.0%)		
Strongly Agree	49 (37.7%)	9 (7.5%)	58 (23.2%)		
Bathing During Period is Necessary					
Strongly Disagree	1 (0.8%)	12 (10.0%)	13 (5.2%)	41.230	**<0.001**
Disagree	0 (0.0%)	21 (17.5%)	21 (8.4%)		
Neutral	0 (0.0%)	2 (1.7%)	2 (0.8%)		
Agree	74 (56.9%)	46 (38.3%)	120 (48.0%)		
Strongly Agree	55 (42.3%)	39 (32.5%)	94 (37.6%)		
Washing Hands After Changing Menstrual Products is Necessary					
Strongly Disagree	1 (0.8%)	6 (5.0%)	7 (2.8%)	69.016	**<0.001**
Disagree	0 (0.0%)	33 (27.5%)	33 (13.2%)		
Neutral	2 (1.5%)	17 (14.2%)	19 (7.6%)		
Agree	70 (53.8%)	37 (30.8%)	107 (42.8%)		
Strongly Agree	57 (43.8%)	27 (22.5%)	84 (33.6%)		
Reuse of Sanitary Pads is a Good Practice					
Strongly Disagree	9 (6.9%)	51 (42.5%)	60 (24.0%)	76.774	**<0.001**
Disagree	23 (17.7%)	37 (30.8%)	60 (24.0%)		
Neutral	0 (0.0%)	2 (1.7%)	2 (0.8%)		
Agree	45 (34.6%)	23 (19.2%)	68 (27.2%)		
Strongly Agree	53 (40.8%)	7 (5.8%)	60 (24.0%)		
Menstrual Blood is Unhygienic					
Disagree	9 (6.9%)	10 (8.3%)	19 (7.6%)	31.011	**<0.001**
Neutral	4 (3.1%)	29 (24.2%)	33 (13.2%)		
Agree	75 (57.7%)	65 (54.2%)	140 (56.0%)		
Strongly Agree	42 (32.3%)	16 (13.3%)	58 (23.2%)		
Poor Menstrual Hygiene Predisposes to Infection					
Strongly Disagree	0 (0.0%)	16 (13.3%)	16 (6.4%)	40.891	**<0.001**
Disagree	5 (3.8%)	25 (20.8%)	30 (12.0%)		
Neutral	0 (0.0%)	1 (0.8%)	1 (0.4%)		
Agree	76 (58.5%)	48 (40.0%)	124 (49.6%)		
Strongly Agree	49 (37.7%)	30 (25.0%)	79 (31.6%)		
Discussion About Menstrual Hygiene is a Matter of Shame					
Strongly Disagree	14 (10.8%)	22 (18.3%)	36 (14.4%)	38.969	**<0.001**
Disagree	42 (32.3%)	36 (30.0%)	78 (31.2%)		
Neutral	6 (4.6%)	28 (23.3%)	34 (13.6%)		
Agree	62 (47.7%)	21 (17.5%)	83 (33.2%)		
Strongly Agree	6 (4.6%)	13 (10.8%)	19 (7.6%)		

Using Unhygienic Sanitary Products is Harmful					
Strongly Disagree	4 (3.1%)	22 (18.3%)	26 (10.4%)	116.970	**<0.001**
Disagree	2 (1.5%)	62 (51.7%)	64 (25.6%)		
Agree	76 (58.5%)	21 (17.5%)	97 (38.8%)		
Strongly Agree	48 (36.9%)	15 (12.5%)	63 (25.2%)		
Using Clean Water, Toilets, and Disposal Facilities is Essential					
Strongly Disagree	4 (3.1%)	5 (4.2%)	9 (3.6%)	46.150	**<0.001**

Source: Author's Computation from the Field Data

Adolescent girls' knowledge and attitudes regarding menstrual hygiene varied significantly by residence across every dimension assessed (all $p < 0.001$). Only 0.8 percent of urban girls felt neutral on whether hygiene during menstruation is necessary, compared with a striking 30.0 percent among rural girls a far larger share of urban girls held a strong-agreement stance 37.7 vs 7.5 percent, while agreement 65 percent was comparable across groups ($\chi^2 = 60.552$). Regarding the statement "bathing during period is necessary," urban respondents again more frequently "strongly agreed" 42.3 vs 32.5 percent and agreed 56.9 vs 38.3 percent, whereas 28 percent of rural girls expressed disagreement, none urban respondents reflecting notable skepticism in rural areas ($\chi^2 = 41.230$). Hand-washing after changing menstrual products was judged "necessary" by almost 97 percent of urban girls (combining agree and strongly agree), but just 53 percent of rural girls, with 32.5 percent of rural respondents actively disagreeing or strongly disagreeing ($\chi^2 = 69.016$). When asked whether "reuse of sanitary pads is a good practice," urban girls overwhelmingly rejected that idea: nearly 58 percent strongly disagreed, and another 17.7 percent disagreed; in rural areas, just 6 percent "strongly disagreed," while 42.5 percent "strongly agreed" or "agreed" that reuse is acceptable ($\chi^2 = 76.774$). Finally, views of menstrual blood as unhygienic and poor hygiene as a risk factor for infection also showed stark contrasts 32 percent of urban girls "strongly agreed" that menstrual blood is unhygienic, versus 13 percent rural, and no urban respondent "strongly disagreed" that poor hygiene predisposes to infection compared with 13.3 percent rural ($\chi^2 = 31.011, 40.891$, respectively).

Table 03 reveal a persistent urban–rural hierarchy in menstrual hygiene attitudes, which likely sustains behavioral disparities. Breaking this cycle will require simultaneous attention to knowledge gaps, social norms, and enabling environments, especially in rural communities where mothers, schools, and health systems may lack the tools to support hygienic menstrual management.

4 Discussion

This study highlights substantial rural-urban disparities in menstrual hygiene management (MHM) among adolescent girls in the Narsingdi district of Bangladesh. It underscores how socio-economic, educational, and cultural factors shape menstrual outcomes. The urban cohort demonstrated significantly better practices 84.6% sanitary pad usage in urban versus 53.3% in rural settings, reflecting the advantages of greater access, literacy, and infrastructure. Urban girls exhibited superior MHM behaviors, including higher sanitary pad

usage, more frequent pad changes, and safer disposal methods, which align with previous research indicating that urban environments facilitate better access to affordable products and sanitation infrastructure [21]. These differences can be attributed to broader structural factors, such as improved educational opportunities and media exposure in urban settings, which enhance knowledge and reduce adherence to restrictive cultural norms [22].

Our results affirm that maternal literacy and higher socio-economic status are positively associated with improved MHM behaviours. This aligns with prior work in Bangladesh and other LMICs: a flood-affected rural Bangladesh study found that adolescent girls whose mothers had secondary or higher education were more than 1.6 times as likely to report good hygiene practices [23]. In the urban–rural comparative study in Rajshahi division, urban residence, smaller family size and parental educational attainment were identified as key determinants of better MHM [24]. These parallels strengthen our interpretation that socio-economic advantage empowers girls with better material access (sanitary pads, disposal) and knowledge. Nevertheless, our finding that socio-economic class did not remain significant in the adjusted model suggests that other mediating factors such as knowledge levels, taboos or infrastructure may exert stronger influence in the pathway from wealth to practice. This echoes the argument that wealth alone is insufficient unless combined with awareness and an enabling environment.

Maternal literacy emerged as a key predictor of better hygiene practices, with urban mothers being universally literate compared to 26.7% illiteracy in rural areas. This intergenerational effect supports the Health Belief Model (HBM), where perceived susceptibility to health risks (e.g., infections from poor hygiene) and cues to action from educated family members encourage positive behaviors [25]. In rural contexts, lower maternal education perpetuates knowledge gaps, leading to practices like cloth reuse (46.7% vs. 15.4% urban) and less frequent handwashing, which increase risks of reproductive tract infections (RTIs) and urinary tract infections (UTIs) [26]. Similarly, SES disparities— with 50% of rural girls from lower-class households versus 10.8% urban—exacerbate inequities, as economic constraints limit access to sanitary products, consistent with national patterns of wealth-based inequalities in MHM [27].

Cultural stigma and taboos further compound rural challenges, with 42.5% of rural girls avoiding outdoor activities during menstruation compared to 15.4% urban, reflecting entrenched patriarchal structures that frame menstruation as shameful or impure [28]. his silence aligns with feminist theory, which critiques how gender inequality and stigmatization intersect with socio-economic factors to restrict girls' bodily autonomy and access to education and resources [29]. In flood-prone or rural areas, these issues are amplified by environmental vulnerabilities, leading to poorer hygiene practices and heightened infection risks [30]. For instance, improper disposal in open fields (31.7% rural vs. 10% urban) not only poses environmental hazards but also reinforces social isolation, impacting school attendance and overall well-being [31].

Attitudes toward MHM also revealed stark divides, with urban girls more likely to recognize the necessity of hygiene measures (e.g., 97% agreeing on handwashing post-change vs. 53% rural) and reject harmful practices like pad reuse. These misconceptions in rural areas stem

from limited information sources, often reliant on mothers or relatives who may perpetuate inaccurate beliefs [30]. Such patterns echo studies in similar LMICs, where taboos hinder open discussions and contribute to adverse health outcomes [32]. Prolonged pad wear or cloth reuse, common in rural settings, has been linked to bacterial vaginosis and candidiasis, emphasizing the need for targeted education.

These results have critical implications for public health policy in Bangladesh, particularly in advancing SDG 5 (gender equality) by addressing MHM as a human rights issue [33]. Interventions should prioritize rural areas through school-based programs, subsidized products, and community campaigns to challenge stigma, involving healthcare providers and men to foster supportive environments [34]. Upgrading sanitation facilities and integrating MHM into curricula could mitigate disparities, especially in vulnerable regions affected by climate events [35].

Limitations include the cross-sectional design, which precludes causality, and reliance on self-reported data, potentially subject to social desirability bias. The sample, drawn from one district, may not generalize nationally, and qualitative insights could enrich understanding of cultural nuances. Future research should employ longitudinal designs to evaluate interventions, explore intersectional factors (e.g., disability, ethnicity), and assess climate impacts on MHM [36]. By bridging these gaps, Bangladesh can promote equitable menstrual health, enhancing adolescent girls' health, education, and empowerment.

5 Conclusion and Policy Recommendation

This study provides a quantitative comparison of menstrual hygiene practices among adolescent girls in rural and urban areas of Narsingdi District, Bangladesh. The results reveal significant disparities in pad usage, hygiene behaviours, disposal methods and restrictions. Maternal literacy and socio-economic status emerge as key determinants of hygienic practices, while cultural restrictions and knowledge gaps exacerbate rural disadvantages. The study contributes to the literature by demonstrating how socio-economic and cultural factors intersect to shape MHM and by highlighting the intergenerational role of maternal education. These insights can guide targeted interventions aimed at achieving gender equality under Sustainable Development Goal 5.

Develop community and school-based programmes that educate mothers and daughters about menstruation, hygiene practices, and health risks. Incorporate MHM into reproductive health curricula and provide training for teachers and community health workers. Improve access to sanitary products. Expand programmes that subsidise disposable sanitary pads or provide reusable options (e.g., menstrual cups or cloth pads) in rural areas. Support local production and distribution through women-led entrepreneurship initiatives [37]. Upgrade sanitation facilities in schools and communities, ensuring privacy, clean water, and disposal facilities. Implement waste management systems to handle used menstrual products, particularly in rural areas. Design public awareness campaigns that challenge taboos and engage men, boys and community leaders. Promote open dialogue about menstruation and normalise discussion in schools and households. Include menstrual health indicators in national WASH and health monitoring frameworks to track progress and inform policy.

Evaluate pilot programmes to identify scalable models. Conduct longitudinal studies to understand how interventions influence MHM over time and explore the impact of climate events on menstrual health. Prioritise research that examines intersectional factors such as disability, ethnicity, and disaster exposure. Implementing these recommendations will require collaboration between the government, NGOs, and communities. By addressing both material and cultural barriers, Bangladesh can ensure that all girls and women manage menstruation safely and with dignity, thereby improving health outcomes and advancing gender equity.

List of Abbreviations

LMIC: Low- and Middle-Income Countries

MHM: Menstrual Hygiene Management

UTI: Urinary Tract Infection

SDG: Sustainable Development Goals

HBM: Health Belief Model

SPSS: Statistical Package for the Social Sciences

PSC: Primary School Completion

JSC: Junior School Completion

SSC: Secondary School Completion

KAP: Knowledge, Attitudes, and Practices

HCP: Healthcare Provider

NGOs: Non-Governmental Organizations

MHH: Menstrual Health and Hygiene

SE: Standard Error

Df: Degrees of Freedom

Statements

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Author Contributions

Conceptualization-M.A.S. and A. O.; methodology- A.O. and S. U. S.; formal analysis- M.A.S. and A. O.; original draft preparation- A.O, S. U. S. and A. M. R.; writing- M.A.S., A.O. and S. U. S.; SPSS and testing- A.M.R. and A. O.; review and editing- M.A.S., and A. M. R. All the authors have read and agreed to publish this version of the manuscript.

Conflict of interest

The authors do not have any conflicts of interest.

Clinical Trial Number

Not applicable.

Declarations

Ethics statement

The authors affirm their unwavering commitment to ethical standards, ensuring that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2013. The study protocol was approved by the Ethical Committee of Noakhali Science and Technology University (Reference no: NSTU/SCI/EC/ 2025/232).

Consent to Participate

Informed consent was obtained from all individual participants included in the study, reaffirming the Authors' commitment to transparency and ethical conduct.

Consent to publish

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