Original Research Article

Knowledge and Practice of Menstrual Hygiene Management: a cross-sectional study among Adolescents'schoolgirls in the Tamale Metropolis

Abstract

Introduction: Menstrual health is a critical aspect of adolescent well-being, yet knowledge and practices surrounding menstruation can vary significantly, especially in culturally diverse settings. Despite its undeniable significance, the nuanced landscape of adolescent menstrual hygiene practices remains obscured. The transition from childhood to adolescence is a transformative period marked by physical, emotional, and psychological changes, and understanding the intricacies of menstrual hygiene within this context is imperative. The study aims to assess menstrual hygiene knowledge and practice among adolescents in the Tamale Metropolis.

Methods: A cross-sectional survey was conducted with a sample of schoolgirls in the Northern Region of Ghana. A total of 363 adolescent schoolgirls were recruited using multistage sampling. A questionnaire was used to collect the data from the respondents. A significance level of $p < 0.05$ was employed to establish statistical significance.

Results: The study found that 90.9% of respondents recognized menstruation as a natural process, and 82.1% understood hormonal changes cause it. However, only 57.3% knew the typical duration of menstruation. Most girls (87.1%) identified the vagina as the source of menstrual blood, and 85.1% had prior knowledge of menstruation. While 95.6% used absorbent materials, and 87.3% used sanitary pads, some practices, such as improper storage and disposal of used pads, were identified. The study established a significant association between overall knowledge about menstruation and age (X^2=7.96, p=0.019), class of respondents (X^2=11.03, p=0.036), and ethnicity (X^2=15.4, p=0.002). The respondents mentioned the following as religious factors that could affect MHM: 85.7% mentioned prohibition from touching the holy books (Bible or Qur'an), 70.5% mentioned visiting religious places, 19.8% mentioned prohibition on attending religious ceremonies, and 18.2 mentioned others.

Conclusion: Most schoolgirls demonstrated good foundational knowledge and hygiene practices regarding menstruation. However, gaps remain in knowledge about menstrual duration and hygiene practices. Cultural factors and demographic variables also influence menstrual knowledge.

Keywords: Menstrual Health, Adolescents, Menstrual Hygiene Management, Cultural Influences, Educational Interventions, Northern Ghana.

Introduction

Menstrual hygiene management (MHM) is an essential component of adolescent health, playing a pivotal role in individuals' overall well-being and development [1]. Despite its undeniable significance, the nuanced landscape of adolescent menstrual hygiene practices remains obscured. The transition from childhood to adolescence is a transformative period marked by physical, emotional, and psychological changes, and understanding the intricacies of menstrual hygiene within this context is imperative. Nevertheless, a substantial number of adolescent girls aged between 10 and 19 years undergo the onset of puberty unprepared, primarily due to the lack of sufficient information[2, 3]. Discussing "menses" remains a social taboo, and many women feel discomfort, preventing adolescent girls from accessing the necessary knowledge[3–6]. Even the limited information they receive, often disseminated through religious institutions, peers, or family members, tends to be selective and clouded by misconceptions4. In certain developing nations,including Ghana, prevailing beliefs associate menstruation with curses, signs of diseases, punishments from God, or a lifelong process[4, 7–9]. Consequently, adolescent girls perceive menstruation as an embarrassing phenomenon that should be concealed[2, 9]. This perception heightens the vulnerability of teenage girls to mental, emotional, and physical issues[10, 11]. These challenges, in turn, negatively impact their daily activities, academic performance, school attendance, and social relationships[12, 13].

The way girls perceive menstruation significantly influences their hygienic practices during menstrual bleeding[14]. Women who possess a better understanding of menstruation tend to adopt safe and clean methods for managing their

menstrual bleeding, while the opposite holds [14]. It has been revealed that inadequate menstrual hygiene practices can lead to reproductive and genitourinary tract infections, cervical cancer, school absenteeism, dropout rates, poor academic performance, lower self-esteem, and a diminished quality of life[1, 15–17]. Additionally, girls often grapple with feelings of fear, confusion, and shame during menstruation due to concerns about odor, leakage, clothing stains, and the accidental dropping of sanitary materials during class sessions[18]. These challenges can adversely impact concentration, class participation, and overall confidence in their studies[2, 19]. Despite the considerable clinical implications of poor knowledge and unsafe menstrual hygiene practices for both girls and their potential future offspring, adolescent girls generally exhibit limited knowledge about menstruation, and their hygienic practices are often incorrect, particularly in lower socioeconomic contexts[7, 20].

While adopting safe menstrual hygiene practices can significantly benefit millions of women facing intricate health challenges[21], there is a missed opportunity in numerous developing countries, including Ghana, to address the comprehension and hygienic practices related to menstruation among girls from their adolescent years [22]. For instance, Tamale Metropolis, located in the heart of Northern Ghana, is a vibrant urban center where traditional customs coexist with contemporary dynamics. As adolescents navigate this multifaceted environment, the convergence of cultural norms, educational influences, and socioeconomic factors shapes their perspectives on menstruation and their adherence to hygienic practices.

Within this context, the interplay between knowledge and practice in menstrual hygiene management emerges as a critical area requiring meticulous examination. Despite global efforts to destigmatize menstruation and enhance MHM education, the unique socio-cultural fabric of the Tamale Metropolis may present distinctive challenges and opportunities.A shortage of comprehensive studies[12, 19, 23] addressing the specific needs of adolescents in Tamale Metropolis regarding menstrual hygiene management perpetuates the existing gaps in our understanding. Thus, despite the many problems on this subject, issues of poor menstrual hygiene practices still exist. The potential ramifications of inadequate MHM practices are vast, ranging from compromised physical health to perpetuating gender disparities and hindering educational attainment.

This research aims to unravel the intricate layers of menstrual hygiene knowledge and practice among adolescents in the Tamale Metropolis, probing into the factors that shape their perceptions and behaviors. As we embark on this exploration, our goal is not only to bridge the existing knowledge gap but also to lay the foundation for targeted interventions, educational initiatives, and policy recommendations that empower adolescents in Tamale Metropolis to embrace menstrual health with confidence, dignity, and informed choices.

Methods and material

Study setting

This study was done in Tamale Metropolis, which was formed by a legislative instrument (LI 2068) to elevate it to the metropolis status in 2004 from the Municipal Assembly. Tamale serves as both the regional capital of the Northern Region and the metropolitan capital of the Northern Region (GSS, 2014). The Metropolis is positioned between latitudes 9o16 and 9o34 North and 0o36 and 0o57 West. The Tamale Metropolis is typically about 180 meters above sea level. The terrain is primarily rolling, with a few lone hills(GSS, 2014).

Study design

The study used an exploratory cross-sectional design, which focused on the quantitative method. This design enables us to collect data from two separate spots at once to determine whether there are any disparities between the study parameters and information compared to groups that represent individuals at various ages or developmental stages[25].

Study population

The study's targeted population includes all Junior High School girls in the Tamale Metropolis who have seen their first menses (Menarche).

Inclusion &and exclusion criteria

To be recruited into this study, participants ought to be schoolgirls in Junior High Schools who have seen her menses, resided in the Tamale Metropolis for at least six months, are not critically sick or mentally ill, and must have voluntarily agreed to participate in this study.

Sample size and sampling

Using the formula developed by Snedecor and Cochran in 1989, sample size (N) was calculated. The researcher's margin of error was 5.0%, the good menstrual hygiene habits among schoolgirls in Northern Ghana are 31.1%, and the z score at 95.0% is 1.96 (Boakye-Yiadom et al., 2018). The predicted sample size was 330 based on these factors. A total of 363 sample units were to be recruited for the quantitative data using a 10% non-response rate. As a result, 363 junior high school girls in the Tamale Metropolis were selected for the study.

The study used multistage sampling techniques to recruit the sampling units. In the first stage, the list of all junior high schools will be obtained from the metropolitan director of education. Each school would be written on a small paper and folded carefully. This was done for all schools. All the papers were kept in an open space. Eight people were made to pick a paper each. The papers picked would be opened, and the schools picked were selected for this study.

In the second stage, the study employed systematic sampling. The list of all students who meet the inclusion criteria for this study was obtained from the head of the schools. The sample size was distributed proportionately to the size or number of people who meet the inclusion criteria. The sample frame was then determined, and sample units were recruited for this study.

Data collection instruments

Data gathering involved the use of a standardized questionnaire. Questionnaires were created and used to gather quantitative data for the study. The questionnaire was then made after a study of the pertinent literature [26–28], which also included questionnaires that had already been utilized in earlier studies. Both open-ended and closed-ended questions were included in the survey. The questionnaire was designed with the goals of this study in mind. Section A of the questionnaire asked about the sociodemographic information of the respondents; Section B asked about the knowledge of schoolgirls regarding menstruation; Section C asked about the management of menstrual hygiene among adolescents; and Section D asked about the variables affecting the management of menstrual hygiene among schoolgirls in the Tamale metropolis.

Pretesting/Pilot study

The survey was pretested at St. Joseph R/C JHS in the city of Tamale. Thirty kids from this school were chosen for the research. Pre-testing's main goal was to help the questionnaire be more consistent and to obtain the necessary data. Additionally, pre-testing lets the enumerators practice using the tools and procedures for gathering data. In two data sets that were compared during the analysis stage, data were double-entries. This helped find several omissions made throughout the data-entering process.

Data collection procedure

Data from respondents was collected using a structured questionnaire. The researchers helped all respondents with their responses by reading the questions first and choosing the best response. Some respondents were discouraged from asking researchers for help by having them read the questions so they may understand them better, while others responded independently, depending on how well they understood it. To feel at ease and articulate freely, all respondents could select the language they preferred and wished to speak throughout the interview.

The researchers were not expected to explain or use additional words to describe any subject; instead, they simply repeated the question and let the participants reflect on their responses. This method ensures that all respondents have an equal opportunity to respond fairly to inquiries. Extra information was only collected if it was necessary.

Data management and analysis

The information was gathered, mechanically inputted, and kept on a personal computer, cloud storage, and Google Drive. Subsequently, the data was mirrored on a few external hard drive systems. A password was developed to guarantee sufficient privacy and security on a computing device.

The data was manually adjusted to remove duplicates and incorrect entries. The Scientific Package for Social Sciences (SPSS) version 24.0 was used to code the altered data and perform statistical analysis. Results were exhibited using graphs and tables, and data was presented using descriptive and inferential statistics. The statistical relationship between background factors and MHM practices was determined using chi-square analysis. All statistical analyses were conducted with a 95% confidence level, and a P value of 0.05 or below was deemed significant.

Results

Socio-demographic characteristics of respondents

Most respondents (60.6%) were between the ages of 15 to 19years, 94.8% were Muslims, 50.4% attended private schools, and 64.5% lived with both parents (i.e., mother and father). About 44.5% of the respondents were in Junior High School (JHS) 2. Regarding the respondents' mothers' education, the majority (56.2%) have never been to school, and 37.7% of the respondents' fathers have never been there. The majority of the respondents' mothers (81.3%) and fathers (74.1%) were self-employed. Table 1 below shows the socio-demographic characteristics of the respondent.

Table 1: Socio-demographic characteristics of respondents (n=363)

Variables	Categories	Frequency(N)	Percentage (%)
Age			
	Below 15 years	139	38.3
	15 to 19 years	220	60.6
	20 to 24 years	4	1.1
Class			
	JHS 1	75	20.7
	JHS 2	161	44.3
	JHS 3	127	35
Ethnicity			
	Dagomba	283	78
	Gonja	40	11
	Mamprusi	14	3.9
	Others	26	7.1
Religion			
	Christianity	16	4.4
	Islam	344	94.8
	Traditionalist	3	0.8
Category of schools			
	Private	183	50.4
	Public	180	49.6
Whom do you live with at present?			
	Father only	11	3
	Mother only	60	19
	Relatives	49	13.5
	With both parent	234	64.5
Father's level of education			
	No formal education	137	37.7
	Basic education	110	30.3
	Senior High School	72	19.8
	College diploma and above	44	12.1
Mother's level of education			
	No formal education	204	56.2
	Basic education	101	27.8
	Senior High School	38	10.5
	College diploma and above	20	5.5
Mother's occupation			
	Private sector employment	8	2.2
	Public sector employment	31	8.5
	Self-employed	295	81.3
	Unemployed	29	8
Father's occupation			
	Private sector employment	12	3.3
	Public sector employment	66	18.2

	Self-employed	269	74.1
	Unemployed	16	4.4

Knowledge of schoolgirls on menstruation hygiene management

Most respondents (90.9%) knew that menstruation is a natural process, 82.1% of the schoolgirls knew that menses are brought about by natural processes (hormones), and 57.3% knew that the average duration is between 2 to 7 days.Many of the girls (87.1%) thought that the vagina was the source of menstrual blood, and 85.1% had heard about menstruation before their first menses. Out of those who have listened about menstruation,(60.8%) have heard of menstruation from their parents, (56.6%) have listened about menses from their teachers, (19.7%) have heard from friends, (19.7%) have heard about menses from books, (3.2%) have heard of menses from the media (TV and Radio) and (12.05%) have heard menstruation from other sources other than above sources.

Most respondents (60.1%) disagreed that menstrual blood was unclean, and 62.0%think that sometimes the menses havea foul odor. Table 2, as shown below, represents the details of the above narrations. Many of the respondents, 285(78.5%), had good knowledge of menstruation, while 78(21.5%) had poor knowledge.

Table 2: Knowledge of schoolgirls on menstrual hygiene management (n=363)

Variables	Categories	Frequency(N)	Percentage (%)
What is menstruation			
	Curse	3	0.8
	Illness	3	0.8
	Natural process	330	90.9
	Other	5	1.4
	Don't know	22	6.1
Causes of menstruation			
	Caused by disease	6	1.7
	Curse of gods	15	4.1
	Hormones	298	82.1
	Don't know	42	11.6
	Other	2	0.6
Origin of menstrual blood			
	Abdomen	8	2.2
	Bladder	4	1.1
	Uterus	16	4.4
	Vagina	316	87.1
	Don't know	19	5.2
The average duration of normal menses			
	Less than five days	118	32.5
	2 to 7 days	208	57.3
	3 to 9 days	28	7.7
	About two weeks	9	2.5
Heard about menstruation before menarche			
	Yes	309	85.1
	No	54	14.9
Source of information (n=309)			
	Parents	188	60.8
	Teacher	175	56.6
	Friends	61	19.7
	Books	16	5.2
	Media (TV/Radio)	10	3.2
	Others	37	12.0
Do you think menstrual blood is unclean?			
	Yes	145	39.9
	No	218	60.1

How is menstrual blood unhygienic (n=145)		
Putting one sanitary pad on the whole day	103	71.0
No washing hands after changing pad	55	37.9
Using the same underwear after bathing	43	29.7
Type of menstrual material used	49	33.8
Do you think there is a foul odor during menstruation?		
Always	35	9.6
Not at all	92	25.3
Sometimes	225	62
Others	11	3
Overall knowledge		
Good knowledge	285	78.5
Poor knowledge	78	21.5

Association between the socio-demographic characteristics and the overall knowledge of menstrual hygiene management.

The study established a significant association between overall knowledge about menstruation and age (X^2=7.96, p=0.019), class of respondents (X^2=11.03, p=0.036), and ethnicity (X^2=15.4, p=0.002).Table 3 demonstrates the association between overall knowledge of menstruation and socio-demographic characteristics.

Table 3: Association between the socio-demographic characteristics and the overall knowledge of menstruation

Variables	categories	Overall knowledge of menstruation		Statistical test
		Good Knowledge	Poor knowledge	
Age				X^2=7.96
	Below 15 years	106(76.3%)	33(23.7%)	p=0.019
	15 to 19 years	178(80.9%)	42(19.1%)	
	20 to 24 years	1(25.0%)	3(75.0%)	
Class				X^2=11.03
	JHS 1	60(80.0%)	15(20.0%)	P=0.036
	JHS 2	121(75.2%)	40(24.8%)	
	JHS 3	104(81.9%)	23(18.1%)	
Ethnicity				X^2=15.40
	Dagomba	229(80.9%)	54(19.1%)	P=0.002
	Gonja	34(85.0%)	6(15.0%)	
	Mamprusi	7(50.0%)	7(50.0%)	
	Others	15(57.7%)	11(42.3%)	
Religion				X^2=1.22
	Christianity	11(68.8%)	5(31.3%)	P=0.544
	Islam	272(79.1%)	72(20.9%)	
	Traditionalist	2(66.7%)	1(33.3%)	
Category of schools				X^2=0.29
	Private	144(78.7%)	39(21.35)	P=0.866
	Public	141(78.8%)	39(21.2%)	
Whom do you live with at present				X^2=4.89
	Father only	6(54.5%)	5(45.5%)	P=0.180
	Mother only	52(75.4%)	17(24.6%)	
	Relatives	38(77.6%)	11(22.4%)	
	With both parent	189(80.8%)	45(19.2%)	
Father's level of education				X^2=1.96
	No formal education	104(75.9%)	33(24.1%)	P=0.580
	Basic education	85(77.3%)	25(22.7%)	
	Senior High School	59(81.9%)	13(18.1%)	

College diploma and above	37(84.1%)	7(15.9%)	
Mother's level of education			X^2=3.41
No formal education	152(74.5%)	52(25.5%)	p=0.341
Basic education	83(82.2%)	18(17.8%)	
Senior High School	32(84.2%)	6(15.8%)	
College diploma and above	18(90.0%)	2(10.0%)	

Menstrual hygiene management practices among adolescent schoolgirls

Most respondents (95.6%) reported using absorbent material, 87.3% used sanitary pads during menses, and 80.4% did not reuse absorbent materials.

Most of the respondents (41.6%) stored absorbent material with other clothes, 72.7% washed their absorbent material with soap and water, 76.9% of the respondents wrapped their used absorbent material before disposing of them during the menstrual flow,63.9% changed their absorbent material two times,and 47.9% disposed of their used pads in the dustbin. All participants bathed during menses, with most respondents (79.1%) bathing twice daily. Table 4 shows the MHM practices among the schoolgirls.

Table 4: Menstrual hygiene management practices among adolescent schoolgirls

Variables	Categories	Frequency(N)	Percentage (%)
Do you use absorbent material during periods or menses?			
	Yes	347	95.6
	No	16	4.4
What absorbent material do you use (n=347)			
	Cloth	39	11.2
	Sanitary pad	303	87.3
	Tissue paper	4	1.2
	Others	1	0.3
Do you reuse absorbent materials?			
	Yes	292	80.4
	No	71	19.6
Place absorbent materials are stored in between use			
	In the bathroom	70	19.3
	Separately	134	36.9
	With other cloth	151	41.6
	Others	8	2.2
How do you clean your absorbent materials?			
	Only water	7	9.9
	Soap and water	56	78.9
	Others	8	11.3
Where do you dry the absorbent materials?			
	Inside the room	17	23.9
	Sunlight	34	47.9
	Others	20	28.2
Types of pad wrap used before disposing of pad it			
	Not wrap	29	8
	Paper	22	6.1
	Plastic bags	279	76.9
	Others	33	9.1
How many times do you change clothes/pads in a day?			
	Once	15	4.1
	Twice	232	63.9
	Three & More	116	32
Where do you dispose of your pads?			
	Drains	23	6.3
	Dustbin	174	47.9

	Open field	24	6.6
	Toilet	76	20.9
	Others	66	18.2
Do you bathe during menses?			
	Yes	363	99.7
How often do you bath during menstruation?			
	Daily	13	3.6
	Twice daily	287	79.1
	Three times	59	16.3
	More than three times	4	1.1
What do you use to clean your genital (private part) during your menses			
	Only with water	151	41.6
	Tissue paper	13	36
	Towel	3	0.8
	Water and soap	196	54

Factors influencing menstrual hygiene management practices

Most respondents (69.1%) said their mothers bought sanitary pads for them, and 57.3% were educated about menstrual hygiene management (MHM) from the school health.The respondents mentioned the following as religious factors that could affect MHM: 85.7% mentioned prohibition from touching the holy books (Bible or Qur'an), 70.5% mentioned visiting religious places, 19.8% mentioned prohibition on attending religious ceremonies, and 18.2 mentioned others. Table 5 shows the details of the factors influencing MHM practices.

Table 5: Factors Influencing Menstrual Hygiene Management Practices

Variable	Categories	Frequency(N)	Percentage (%)
How do you buy your sanitary pad?			
	Father	34	9.4
	Mother	251	69.1
	Friends	6	1.7
	NGO	6	1.7
	Self	66	18.2
How were you educated about the menstrual hygiene management?			
	Family	140	38.6
	Media	2	0.6
	School Health	208	57.3
	Workshop	3	0.8
	Others	10	2.8
Cultural factors that affect MHM?			
	My culture does not talk about menses	77	21.2
	Belief	145	39.9
	Taboos	44	12.1
	Prohibition from cooking in the home	98	27
	No sex with husband	161	44.4
	Others	53	14.6
Religious factors that affect MHM?			
	Prohibition on attending religious ceremonies	72	19.8
	Prohibition from touching the holy books (Bible or Qur'an)	311	85.7
	Visiting religious places	256	70.5
	Others	66	18.2

Discussion

To discuss the variables extensively, we will analyze the findings related to knowledge about menstruation, menstrual hygiene management (MHM) practices, and factors influencing these variables among schoolgirls.

Most respondents (90.9%) recognized menstruation as a natural process, with 82.1% understanding that hormonal changes bring it about. This reflects good foundational knowledge among the schoolgirls and is comparable to findings from other studies in similar settings. For instance, Asumah et al. [12]found that 92.6% of schoolgirls knew menstruation was a biological process, emphasizing a strong awareness in Northern Ghana about the natural cause of menstruation. The consistency in these results across studies shows that education on basic menstrual biology is effective in these regions.

However, only 57.3% of the respondents were aware of the average duration of menstruation (2 to 7 days). This gap in knowledge about the duration is also reported in Asumah's study, where a similar proportion (59%) correctly identified the typical menstrual duration. The lack of clarity on this aspect of menstruation suggests a potential weakness in menstrual education that should be addressed, as knowing the usual duration is essential for understanding menstrual health and identifying abnormalities.

The study also revealed that 87.1% of the respondents correctly identified the vagina as the source of menstrual blood, which is consistent with various studies [29–32], where the majority of participants gave the same answer. These results align with global research, such as these studies[30, 33]; they emphasize the importance of anatomical knowledge in menstrual health education. However, differences may occur in more rural or under-resourced areas, where such knowledge may be less prevalent due to limited access to education or cultural taboos that prevent open discussion about reproductive health.

Regarding the sources of menstrual education, most respondents learned about menstruation from their parents (60.8%) and teachers (56.6%). A smaller proportion (19.7%) reported receiving information from friends and books, and only 3.2% from media such as TV and radio. Asumah et al. [17]similarly reported that most girls learned about menstruation from their parents (65%) and teachers (53%), with a minor role played by the media. These findings suggest that schools and families play a crucial role in disseminating menstrual knowledge, but the relatively low use of media is surprising, given its potential reach. Other studies, such as Sommer et al. [34], have emphasized the role of mass media in providing health education, suggesting that it may be underutilized in these communities. Media campaigns targeting menstrual health could significantly improve knowledge in areas where parents and teachers may lack comprehensive information.

Furthermore, the data shows that 85.1% of the respondents had prior knowledge of menstruation before their first experience, a finding supported by the study of Bharadwaj et al. [35], which showed that early education helps reduce anxiety and ensures better menstrual management among adolescent girls. However, the relatively low proportion of respondents hearing about menstruation from friends (19.7%) or books (19.7%) may indicate a social or cultural stigma attached to discussing menstruation among peers, a barrier that has been documented in several African settings [36–39].

A noteworthy finding is that many respondents (60.1%) disagreed with the misconception that menstrual blood is unclean, while 62% believed that menses sometimes have a foul odor. This finding aligns with the work of Asumah et al. [4], where most girls (62%) also rejected the idea that menstrual blood was inherently dirty. This suggests a positive shift in attitudes towards menstruation, potentially reflecting the impact of educational initiatives aimed at debunking menstrual myths. However, the belief about foul odor remains persistent and is likely tied to cultural stigmas or concerns about improper menstrual hygiene management[40]

Addressing these myths is essential for promoting a positive menstrual experience and ensuring that girls do not feel ashamed or ostracized during menstruation. Public health campaigns should focus not only on the biological facts but also on challenging deep-rooted taboos and misconceptions surrounding menstruation[41–43].

The study found that most respondents (95.6%) reported using absorbent materials during menstruation, with 87.3% specifically using sanitary pads and 80.4% not reusing absorbent materials. This is a critical indicator of good menstrual hygiene practices and aligns with Asumah et al. [17], where 89.3% of girls reported using sanitary pads. Such data aligns with global recommendations for menstrual hygiene management [44, 45], emphasizing that disposable sanitary products are preferred for effective menstrual health.

However, 41.6% of the respondents stored their absorbent materials with other clothes, which is not recommended due to potential hygiene concerns. This practice is inconsistent with findings from studies in urban settings, such as Sharma et al. ([46], where more girls followed safer storage practices. The fact that nearly half of the respondents are storing menstrual products improperly highlights an area for improvement, particularly in regions with lower access to proper storage facilities or where education on best practices may be lacking.

Another notable finding is that 72.7% of the respondents washed their absorbent materials with soap and water, and 76.9% wrapped used absorbent materials before disposal, which shows adherence to recommended menstrual hygiene practices [47, 48]. However, the fact that only 47.9% of girls disposed of their used pads in dustbins, while others may rely on less hygienic methods like open disposal or burning, indicates that waste management infrastructure may not adequately support menstrual hygiene practices. This aligns with findings from El-Gilany et al. [49], who reported that poor waste disposal infrastructure in many rural areas often forces girls to resort to environmentally unsafe practices.

Additionally, all participants reported bathing during menstruation, with the majority (79.1%) bathing twice daily. This is a positive finding as it aligns with recommendations for maintaining personal hygiene during menstruation, as frequent washing helps to prevent infections and promotes comfort [38]. This practice is also consistent with the findings of Asumah et al. [4], where most participants (75%) also reported bathing regularly during menstruation.

The study found significant associations between knowledge of menstruation and age (X^2=7.96, p=0.019), class (X^2=11.03, p=0.036), and ethnicity (X^2=15.4, p=0.002). Older and more educated respondents had higher knowledge about menstruation, consistent with previous research. For instance, Kuhlmann et al. [38] also found that older girls and those with higher educational levels were more likely to have accurate information about menstruation. This suggests that continuing to provide menstrual education throughout adolescence is crucial to increasing knowledge and promoting better MHM practices.

Interestingly, the association between ethnicity and knowledge is a notable finding. Asumah et al. [17] also observed similar associations, suggesting that certain ethnic groups may have more or less exposure to menstrual education due to cultural factors. This highlights the need for tailored menstrual health programs that consider cultural sensitivities and barriers that may limit access to accurate information in specific communities.

The study's strengths include comprehensive data collection on menstrual knowledge, attitudes, and practices, along with a large sample size that enhances the reliability and generalizability of the findings. Its focus on adolescents provides crucial insights for early interventions, and the study's cultural relevance highlights the impact of local beliefs and ethnicity on menstrual health. However, potential weaknesses may include reliance on self-reported data, which could introduce bias, and a focus on a specific population that might limit the broader applicability of the findings to other regions or age groups.

Conclusion and recommendation

The study reveals that while most schoolgirls possess sound knowledge about menstruation, significant gaps remain in areas such as menstrual hygiene practices and the understanding of its biological processes. Cultural factors, such as ethnicity, also play a role in shaping menstrual knowledge. Although most girls use sanitary pads and maintain good hygiene, some practices, such as storing absorbent materials with other clothes, need improvement.

Educational interventions should be developed to improve further knowledge of menstruation and hygiene practices, targeting schoolgirls and their communities to address cultural influences. Schools and parents should be actively involved in disseminating accurate menstrual health information. Additionally, health programs should emphasize

proper menstrual hygiene management and provide access to sanitary materials for all girls. The government should subsidize the cost of sanitary pad to enable adolescent girls to be able to buy.

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1.

2.

3.

Ethical Approval and Consent

The University of Development Studies (UDS) ethics review committee was contacted for approval with reference number (UDS/RB/025/23). Following an explanation of the research procedure to each participant, informed permission was obtained. By employing IDs rather than participant names, the confidentiality of the data obtained was guaranteed. Hardcopies were fiercely safeguarded, and recorded data files had password protection.

Data Availability

Data used to support this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declared that they have no competing interests.

Disclaimer (Artificial intelligence)

Authors at this moment declare that generative AI (ChatGPT) has been used during the editing(grammar) of manuscripts.

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Authors' Contributions

All authors contributed equally.

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References

[1] Sood S, Stevens S, Okumura M, et al. A systematic review of menstrual health and hygiene management (MHHM) as a human right for adolescent girls. *Int J Sex Heal* 2022; 34: 483–502.

[2] Belayneh Z, Mekuriaw B. Knowledge, and menstrual hygiene practice among adolescent school girls in southern Ethiopia: A cross-sectional study. *BMC Public Health* 2019; 19: 1595.

[3] Asumah MN. DETERMINANTS OF MENSTRUAL HYGIENE MANAGEMENT PRACTICES AMONG ADOLESCENT GIRLS IN BASIC SCHOOLS IN THE WEST GONJA MUNICIPALITY OF THE SAVANNAH REGION OF GHANA.

[4] Asumah MN, Abubakari A, Aninanya GA, et al. Perceived factors influencing menstrual hygiene management among adolescent girls: a qualitative study in the West Gonja Municipality of the Savannah Region, Ghana. *Pan Afr Med J*; 41.

[5] Ramaiya, A. (2018). "Time of the month": A mixed-method study to understand and improve menstrual health and hygiene management in rural north india (Order No. 10826057). Available from ProQuest Dissertations & Theses Global; ProQuest Dissertations & Theses Global Closed Collection. (2061065946). Retrieved from https://proxy.lib.umich.edu/login?url=https://www.proquest.com/dissertations-theses/time-month-mixed-method-study-understand-improve/docview/2061065946/se-2

[6] Mason L, Sivakami M, Thakur H, et al. 'We do not know': a qualitative study exploring boys perceptions of menstruation in India. *Reprod Health* 2017; 14: 174.

[7] Sommer M, Ackatia-Armah N, Connolly S, et al. A comparison of girls' menstruation and education experiences in Tanzania, Ghana, Cambodia, and Ethiopia. *Comp A J Comp Int Educ* 2015; 45: 589–609.

[8] Shanbhag D, Shilpa R, D'Souza N, et al. Perceptions regarding menstruation and practices during menstrual cycles among high school going adolescent girls in resource-limited settings around Bangalore city, Karnataka, India. *Int J Collab Res Intern Med Public Heal* 2012; 4: 1353.

[9] Johnston-Robledo I, Chrisler JC. The menstrual mark: Menstruation as social stigma. *Palgrave Handb Crit menstruation Stud* 2020; 181–199.

[10] Goel MK, Kundan M. Psycho-social behavior of urban Indian adolescent girls during menstruation. *Australas Med J* 2011; 4: 49.

[11] Takeda T, Koga S, Yaegashi N. Prevalence of premenstrual syndrome and premenstrual dysphoric disorder in Japanese high school students. *Arch Womens Ment Health* 2010; 13: 535–537.

[12] Asumah MN, Adnani QES, Dzantor EK, et al. Menstruation-Related School Absenteeism: An Urban Centre Study in the Northern Region of Ghana. *Women* 2023; 3: 497–507.

[13] Shah V, Nabwera H, Sonko B, et al. Effects of Menstrual Health and Hygiene on School Absenteeism and Drop-Out among Adolescent Girls in Rural Gambia. *Int J Environ Res Public Health* 2022; 19: 3337.

[14] UM L, Yusuf MW, Musa AB. Menstruation and menstrual hygiene amongst adolescent school girls in Kano, Northwestern Nigeria. *Afr J Reprod Health* 2010; 14: 201–207.

[15] Tegegne TK, Sisay MM. Menstrual hygiene management and school absenteeism among female adolescent students in Northeast Ethiopia. *BMC Public Health* 2014; 14: 1–14.

[16] Grant M, Lloyd C, Mensch B. Menstruation and school absenteeism: evidence from rural Malawi. *Comp Educ Rev* 2013; 57: 260–284.

[17] Asumah MN, Abubakari A, Aninanya GA. Determinants of Menstrual Hygiene Management Practices among Schoolgirls: A Cross-Sectional Study in the Savannah Region of Ghana. *Infect Dis Obstet Gynecol*. Epub ahead of print 2022. DOI: 10.1155/2022/7007117.

[18] Fakhri M, Hamzehgardeshi Z, Golchin NAH, et al. Promoting menstrual health among Persian adolescent girls from low socioeconomic backgrounds: a quasi-experimental study. *BMC Public Health* 2012; 12: 193.

[19] Mohammed, S., Larsen-Reindorf, R. E., & Awal, I. (2020). Menstrual hygiene management and school absenteeism among adolescents in Ghana: Results from a school□based cross□sectional study in a rural community. International journal of reproductive medicine, 2020(1), 6872491.

[20] Sommer M, Hirsch JS, Nathanson C, et al. Comfortably, safely, and without shame: defining menstrual hygiene management as a public health issue. *Am J Public Health* 2015; 105: 1302–1311.

[21] Nair MKC, Chacko DS, Darwin MR, et al. Menstrual disorders and menstrual hygiene practices in higher secondary school girls. *Indian J Pediatr* 2012; 79: 74–78.

[22] Chandra-Mouli V, Patel SV. Mapping the knowledge and understanding of menarche, menstrual hygiene, and menstrual health among adolescent girls in low-and middle-income countries. *Reprod Health* 2017; 14: 30.

[23] Ameade EPK, Garti HA. Relationship between Female University Students' Knowledge of Menstruation and Their Menstrual Hygiene Practices: A Study in Tamale, Ghana. *Adv Prev Med* 2016; 2016: 1–10.

[24] Service GS. *2010 population and housing census report*. Ghana Statistical Service, 2014.

[25] Polit DF, Beck CT. *Nursing research: Generating and assessing evidence for nursing practice*. Lippincott Williams & Wilkins, 2008.

[26] Asumah MN, Abubakari A, Aninanya GA. Determinants of Menstrual Hygiene Management Practices among Schoolgirls: A Cross-Sectional Study in the Savannah Region of Ghana. *Infect Dis Obstet Gynecol*; 2022.

[27] Boakye-Yiadom A, Aladago DA, Beweleyir J, et al. Assessing the Knowledge, Attitude, and Practice of Menstrual Hygiene Management Among Junior High Schools Adolescent Females in the Yendi Municipality in the Northern Region of Ghana. *Eur Sci Journal, ESJ* 2018; 14: 467.

[28] Asumah MN, Abubakari A, Aninanya GA, et al. Perceived factors influencing menstrual hygiene management among adolescent girls: a qualitative study in the West Gonja Municipality of the Savannah Region, Ghana. *Pan Afr Med J*. Epub ahead of print 2022. DOI: 10.11604/pamj.2022.41.146.33492.

[29] Sudeshna R, Aparajita D. Determinants of menstrual hygiene among adolescent girls: a multivariate analysis. *Natl J Community Med* 2012; 3: 294–301.

[30] Daniel N, Kejela G, Fantahun F, et al. Menstrual hygiene management practice and its associated factors among in-school adolescent girls in Western Ethiopia. *Contracept Reprod Med* 2023; 8: 1–12.

[31] Thurairasu V. Menstrual Hygiene Management (MHM) and the Way Forward-A Brief Review. *Eur J Med Heal Sci* 2023; 5: 1–5.

[32] Armah-Ansah EK, Osei D, Seidu A-A, et al. Challenges and coping strategies adopted for effective menstrual hygiene management among intellectually disabled adolescents and their caregivers: A qualitative study. *J Disabil Stud* 2023; 9: 25–30.

[33] Arora A, Mittal A, Pathania D, et al. Impact of health education on knowledge and practices about menstruation among adolescent school girls of the rural part of district Ambala, Haryana. *Indian J Community Heal* 2013; 25: 492–497.

[34] Sommer M, Caruso BA, Sahin M, et al. A time for global action: addressing girls' menstrual hygiene management needs in schools. *PLoS Med* 2016; 13: e1001962.

[35] Bharadwaj S, Patkar A. Menstrual hygiene and management in developing countries: Taking stock. *Junction Soc*; 3.

[36] Korir E, Okwara FN, Okumbe G. Menstrual hygiene management practices among primary school girls

from a pastoralist community in Kenya: a cross-sectional survey. *Pan Afr Med J*; 31.

[37] Kumbeni MT, Otupiri E, Ziba FA. Menstrual hygiene among adolescent girls in junior high schools in rural northern Ghana. *Pan Afr Med J*; 37.

[38] Kuhlmann AS, Henry K, Wall LL. Menstrual Hygiene Management in Resource-Poor Countries. *Obstet Gynecol Surv* 2017; 72: 356–376.

[39] Sumpter C, Torondel B (2013) A Systematic Review of the Health and Social Effects of Menstrual Hygiene Management. PLoS ONE 8(4): e62004. https://doi.org/10.1371/journal.pone.0062004.

[40] Sommer M, Caruso BA, Torondel B, et al. Menstrual hygiene management in schools: midway progress update on the "MHM in Ten" 2014–2024 global agenda. *Heal Res Policy Syst* 2021; 19: 1–14.

[41] Sangra S, Choudhary N, Kouser W, et al. Assessment of knowledge, attitude, and practice about menstruation and menstrual hygiene among adolescent girls in a rural area of district Kathua, Jammu, and Kashmir. 2019; 6: 5215–5218.

[42] UNICEF. The Role of WASH in Menstrual Hygiene Management (MHM), Unite for Children, Bolga – UER.

[43] Divakar, H., Singh, R., Narayanan, P., Divakar, G. V., & Suvarna, R. (2020). Menstrual health and hygiene-study of knowledge attitudes and practices of obgyns on usage of menstrual cups. *J Evid Based Med Healthc*, *7*(8), 372-6..

[44] Sudeshna R, Aparajita D. Determinants of menstrual hygiene among adolescent girls: a multivariate analysis. *Natl J Community Med* 2012; 3: 294–301.

[45] Asumah , M. N., Iddrisu , O. A., Yariga , F. Y., Atuga , A. A., & Abdulai AM. The Increasing Cost of Sanitary Products and the Potential Impact on Menstrual Hygiene Management Practices in Ghana. *Asian J Med Heal* 2023; 21: 20–22.

[46] Sharma S, Mehra D, Brusselaers N, et al. Menstrual Hygiene Preparedness Among Schools in India: A Systematic Review and Meta-Analysis of System-and Policy-Level Actions. *Int J Environ Res Public Health* 2020; 17: 647.

[47] Mishra Y. Menstrual Hygiene Management: An Overview of Global Awareness. In: *BIO Web of Conferences*. EDP Sciences, 2024, p. 1022.

[48] Tomlinson MM, Wallis AB, Harris MJ, et al. Menstrual hygiene management among adolescent girls in West Africa: A systematic review. *Afr J Reprod Health*; 28.

[49] El-Gilany A-H, Badawi K, El-Fedawy S. Menstrual hygiene among adolescent schoolgirls in Mansoura, Egypt. *Reprod Health Matters* 2005; 13: 147–152.