Original Research Article
Journal of Kathmandu Medical College, Vol. 14, No. 2, Issue 52, Apr.-Jun., 2025

Menstrual pattern among schoolgirls in Bhaktapur District, Nepal: A cross-sectional study

Shrestha A[1], Chandyo RK[2], Stæhr CS[3], Shrestha S[4]

[1]Ahana Shrestha, Department of Forensic Medicine, [2]Ram Krishna Chandyo, Department of Community Medicine, Kathmandu Medical College, Sinamangal, Kathmandu, Nepal; [3]Christina Seefeldt Stæhr, Department of Obstetrics and Gynaecology, Herlev Hospital University of Copenhagen, Herlev, Denmark; [4]Samip Shrestha, Department of Radiology, Kathmandu University School of Medical Sciences, Dhulikhel, Nepal.

ABSTRACT

Introduction: Menarche is a physiological milestone in adolescent development, with timing influenced by genetic, nutritional, and socioeconomic factors. Understanding menstrual patterns and knowledge among schoolgirls is vital for developing targeted public health planning and clinical care in Nepal.

Objectives: This study aimed to synthesize current evidence on menstrual patterns, including age at menarche, cycle regularity, common menstruation problems, hygiene practices and associated factors among school-going adolescent girls in Bhaktapur district, Nepal.

Methodology: A descriptive cross-sectional study was conducted among 375 adolescent girls (10-19 years) from public and private schools, selected via stratified random sampling. Data were collected through self-administered questionnaire using a pre-tested structured questionnaire and anthropometric measurements. Statistical analysis included descriptive statistics, Pearson's correlation, Chi-square tests, and ordinal logistic regression analysis.

Results: The mean age at menarche was 12.08 ± 1.12 years, with 310 (82.7%) attaining menarche between 11-13 years. Most participants 248 (66.1%) reported regular menstrual cycles (21-35 days). Dysmenorrhea was highly prevalent 335 (89.3%), with 208 (62.1%) reporting moderate-to-severe pain; however, only 34 (10.1%) used analgesics. Lower physical activity was significantly associated with increased severity of dysmenorrhea (p=0.012). Commercial sanitary pads were used by 339 (90.4%) of participants, and 151 (40.3%) reported school absenteeism due to menstruation.

Conclusion: The mean menarcheal age in this population is consistent with regional trends. The high prevalence of dysmenorrhea and its significant impact on school attendance, coupled with low healthcare-seeking behavior, underscores the need for targeted adolescent health education and accessible pain management strategies.

Key Words: Adolescent health; Dysmenorrhea; Menarche; Menstrual health; Nepal

Access this article online

Website: www.jkmc.com.np

DOI: https://doi.org/10.3126/jkmc.v14i52.94892

HOW TO CITE
Shrestha A, Chandyo RK, Stæhr CS, Shrestha S. Menstrual pattern among schoolgirls in Bhaktapur District, Nepal: A cross-sectional study. J Kathmandu Med Coll. 2025;14(2):59-65.

Submitted: Jan 27, 2026
Accepted: Apr 27, 2026
Published: May 25, 2026

Address for correspondence
Dr. Ahana Shrestha
Lecturer, Department of Forensic Medicine,
Kathmandu Medical College Teaching Hospital, Sinamangal, Kathmandu, Nepal
E-mail: ahanashrestha@gmail.com

ISSN: 2019-1785 (Print), 2091-1793 (Online)

INTRODUCTION

Adolescence is a critical stage of biological and psychosocial development characterized by the appearance of secondary sexual characteristics and attainment of reproductive maturity.[1, 2] Menarche represents an important milestone in this transition, reflecting ovarian function and onset of fertility. Timing of menarche has important health implications: early menarche is associated with increased risks of breast cancer, cardiovascular disease, and metabolic disorders, whereas delayed menarche may be linked to menstrual irregularities and reduced bone mineral density.[3-5] Menstrual patterns are influenced by genetic, nutritional, environmental, and socioeconomic factors, and irregular

cycles in adolescents are common because of maturation of the hypothalamic–pituitary–ovarian axis.[6-8]

In Nepal, menstruation is strongly influenced by cultural beliefs and traditional practices affecting girls' hygiene, nutrition, mobility, and education. Many adolescents attain menarche with limited knowledge and experience restrictions that contribute to fear, anxiety, and poor menstrual hygiene practices.[9,10] Limited access to hygienic absorbents, sanitation facilities, and safe disposal systems remains a public health concern, contributing to reproductive tract infections, school absenteeism, and reduced academic participation.[11,12] Accurate data are essential for monitoring reproductive health trends and guiding interventions.[13] Therefore, this study aimed to assess menstrual patterns, hygiene practices, and associated factors among school-going adolescent girls in Bhaktapur district, Nepal.

METHODOLOGY

A school-based, analytical cross-sectional study was conducted in Bhaktapur District, Nepal, between November 2024 and February 2025. The district was selected for its mix of urban and semi-urban environments, providing a socioeconomically and ethnically diverse study population. Ethical approval was obtained from the Institutional Review Committee of Kathmandu Medical College (Ref: 16102024/10). Permission was secured from relevant school authorities. Written informed consent was obtained from parents/guardians, and verbal assent was acquired from each participant. Anonymity and confidentiality were strictly maintained.

The sample size was calculated using OpenEpi software (v3.01), assuming a 50% prevalence (for maximum variance), a 95% confidence level, 5% margin of error, and a 10% non-response rate, yielding a minimum sample of 375. A two-stage sampling technique was employed. First, schools were stratified into government and private categories, and proportionate number of schools were randomly selected from each stratum. Second, adolescent girls who had experienced menarche were selected from each school using simple random sampling. Included were adolescent girls aged 10-19 years, enrolled in selected schools, who had attained menarche and provided assent/consent. Excluded were those with known genetic or endocrine disorders affecting growth/puberty and those unable to recall their age at menarche.

Data were collected via self-administered questionnaire using a pre-tested, structured questionnaire in a private setting within the schools. Socio-demographic details, menstrual history, dysmenorrhea prevalence and severity, problems during menstruation and hospital visits, menstrual hygiene practices, lifestyle factors including physical activity and Body Mass Index (BMI) were obtained. Data were coded, entered into Microsoft Excel, and analysed by using statistical package for social sciences, IBM SPSS Statistics for Windows version 26 (IBM Corp., Armonk, N.Y., USA). Descriptive statistics were reported as mean ± SD for continuous variables and frequencies/percentages for categorical variables. Inferential analyses included chi -square test (for menstrual cycle pattern and physical activity level) and ordinal logistic regression (for factors associated with dysmenorrhea severity). A p-value <0.05 was considered statistically significant to adjust for multiple comparisons.

RESULTS

All 375 recruited participants completed the questionnaire. The sample comprised more students from government schools 214 (57.1%) than private 161 (49.2%). Ethnically, the majority were Janajati 216 (57.6%) followed by Brahmin/Chhetri 131 (34.9%). According to BMI classifications, majority, 240 (64.0%) were normal weight and 7 (1.9%) were obese (Table 1).

The mean age at menarche was 12.08 ± 1.12 years, with 82.7% experiencing it between 11-13 years. Fewer participants experienced menarche at the extremes, with relatively low frequencies at <10 and ≥14 years (Figure 1). No significant correlation was observed between participants' current BMI and their age at menarche ($r = -0.07$, $p = 0.17$, figure 1).

The majority of participants, 248 (66.1%), reported regular menstrual cycles. The predominant cycle length was 21–35 days, reported by 280 (74.7%) participants, and the majority, 305 (81.3%), had a bleeding duration of 3–7 days. Commercial disposable sanitary pads were the most commonly used menstrual hygiene product, reported by 339 (90.4%) participants (Table 2).

Dysmenorrhea was reported by most of the participants, 335 (89.3%). Based on pain severity scores, 91 (27.2%) of participants had mild, 136 (40.5%) moderate, 72 (21.6%) had severe dysmenorrhea. Only 38 (10.1%) of those with pain used analgesic medication during menstruation, and merely 37 (9.9%) of the students had ever sought medical care for a menstrual problem. The most common reason for their visit to the doctor was due to excessive pain followed by irregular menstruation. School absenteeism due to menstruation was reported by 151 (40.3%) of participants (Table 3).

A Pearson Chi-square test was performed to examine the association between physical activity level and menstrual cycle pattern among the participants. Among the 375 participants, 248 (66.1%) had regular menstrual cycles, while 127 (33.9%) reported irregular cycles. The analysis showed no statistically significant association between physical activity level and menstrual cycle pattern, p=0.304 (Table 4). This indicates that menstrual cycle regularity did not differ significantly across varying levels of physical activity among the participants.

An ordinal logistic regression analysis was conducted to examine the effects of physical activity, body mass index (BMI), and menstrual cycle regularity on the severity of dysmenorrhea (Table 5). The overall model demonstrated borderline statistical significance, (p=0.064) with Nagelkerke R^2 value of 0.038, indicating that the model explained approximately 3.8% of the variance in dysmenorrhea severity. Among the predictors, physical activity level was significantly associated with dysmenorrhea (Odds Ratio = 0.62, p = 0.012). Menstrual cycle regularity showed a marginal association (Odds Ratio = 1.48, p = 0.089), while BMI grade was not a significant predictor (Odds Ratio = 1.09, p=0.608, Table 5.)

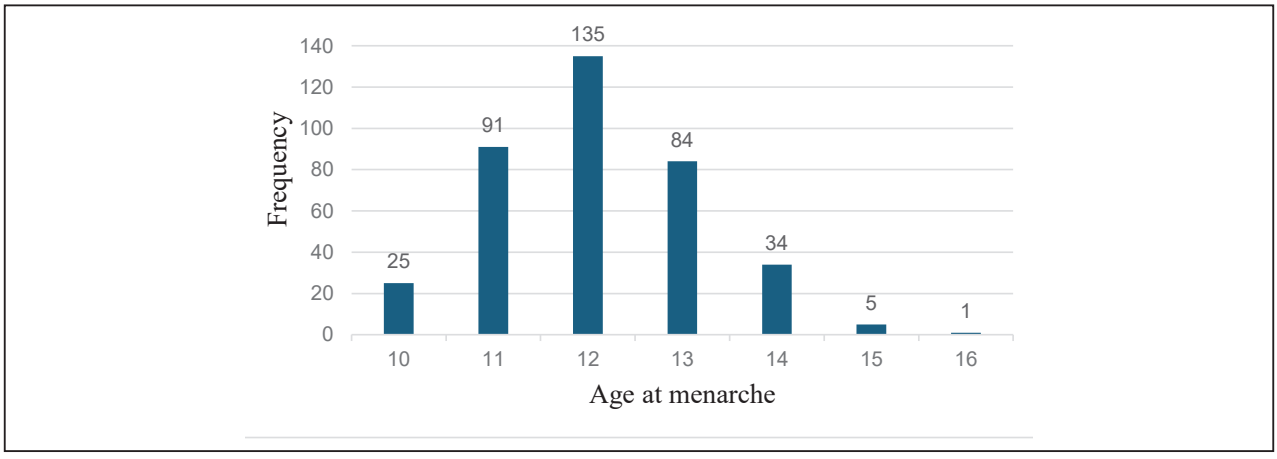

Figure 1: **Bar Diagram showing number of students with the age of menarche**

Table 1: **Socio-demographic characteristics of the respondents**

Type of school	n (%)
Government	214 (57.1)
Private	161 (49.2)
Ethnicity	
Brahmin/Chhetri	131 (34.9)
Janajati	216 (57.6)
Dalit	14 (3.7)
Madhesi	12 (3.2)
Muslim	2 (0.5)
BMI	
Underweight (<18.5)	105 (28)
Normal weight (18.5-24.9)	240 (64)
Overweight (25-29.9)	23 (6.1)
Obese (>30)	7 (1.9)

Table 2: **Menstrual pattern and hygiene practices**

Menstrual Pattern	n (%)
Regularity	
Regular	248 (66.1)
Irregular	127 (33.9)
Cycle length	
< 21 days	48 (12.8)
21–35 days	280 (74.7)
> 35 days	47 (12.5)
Duration of menstruation	
< 3 days	32 (8.6)
3-7 days	305 (81.3)
>7 days	38 (10.1)
Sanitary products used	
Single use menstrual pad	339 (90.4)
Reusable menstrual pad	22 (5.9)
Absorbent underwear/period panties	2 (0.5)
Single use menstrual pad and Reusable menstrual pad	11 (2.9)
Reusable menstrual pad and Menstrual cup	1 (0.3)

Table 3: Hospital visit and school absenteeism due to menstruation problem

Hospital Visits	n (%)
Yes	37 (9.9)
No	338 (90.1)
Reason for visiting doctor	
Irregular menstruation	14 (3.7)
Excessive pain	16 (4.3)
Itching/discharge	5 (1.3)
Irregular menses and excessive pain	2 (0.5)
Missed school/class	
Yes	151 (40.3)
No	206 (60.0)
Don't remember	18 (4.8)

Table 4: Association between Physical Activity Level and Menstrual Cycle

Menstrual Cycle	Sedentary	Moderately Active	Active	p-value
Regular	77	142	29	
Irregular	30	79	18	0.3*
Total	107	221	47	

p-value significant at <0.05, *= Chi-square test

Table 5: Factors associated with severity of dysmenorrhea

Predictor	Odds Ratio (OR)	95% CI	p - value
Physical activity level	0.44	0.23-0.83	0.012†
Menstrual cycle regularity	1.48	0.45-1	0.089†
BMI grade	1.09	0.24 - 6.72	0.608 †

p-value significant at <0.05, †=logistic regression

DISCUSSION

This study documents a mean menarcheal age of 12.08 years among adolescent girls in Bhaktapur, aligning closely with contemporary data from Western and South Asian population and reflects the persistent ongoing global secular trend towards earlier pubertal onset.[14-16] Over the past decades, Western countries have demonstrated a marked decline in menarcheal age, largely attributed to improvements in childhood nutrition, health, and living conditions.[17-19] Recent large-scale studies from Europe and North America suggest that this decline may be stabilizing around 12–13 years, while simultaneously revealing an increasing proportion of girls experiencing very early menarche (≤10 years).[19-21] This emerging pattern appears to be driven by a complex interplay of rising childhood obesity, exposure to endocrine-disrupting chemicals, psychosocial stressors, and socioeconomic disparities, indicating that menarcheal timing in high-income countries is becoming increasingly heterogeneous rather than uniformly earlier.[18-19]

The lack of a significant link with current BMI and age at menarche in this study diverges from well-established literature in populations with higher obesity prevalence. This discrepancy may be explained by the participants' anthropometric profile, where the majority (64.0%) were of normal weight and 28.0% were underweight, creating a restricted range that may obscure a detectable adiposity signal. This suggests that in populations undergoing nutritional transition but where underweight remains a concern, the influence of adiposity on pubertal timing may be attenuated or overshadowed by other determinants such as genetics, prenatal nutrition, or childhood illness history. Ethnicity related biological and sociocultural differences may also influence pubertal timing, as evidenced by studies in the region showing variation in mean age at menarche across ethnic groups and associations between ethnicity and menstrual patterns.[15,22] However, no correlation was seen in the age at menarche with the different ethnicity groups included in this study.

Menstrual disorders, including dysmenorrhea, irregular cycles, and heavy menstrual bleeding, represent a common morbidity during adolescence, adversely affecting quality of life, academic performance, and psychosocial well-being.[23] Despite its physiological basis, menstruation is often shrouded in misconception and stigma, leading to inadequate knowledge, anxiety, and poor management of symptoms among young girls.[16,23,24] The exceptionally high prevalence of dysmenorrhea (89.3%) identified in this study, and its tangible consequence in significant school absenteeism (40.3%), underscores a substantial and often overlooked burden of disease affecting adolescent well-being and educational equity. The profound disconnects between the menstrual pain experience and minimal rates of analgesic use (10.1%) or formal healthcare consultation (9.9%) reveals a critical failure in symptom management pathways. This gap is not merely clinical but systemic, likely entrenched in the normalization of menstrual pain as an inevitable experience with limited health literacy, sociocultural stigmas that inhibit open discussion, and structural barriers to accessing youth-responsive health

services.

A recent systematic review from Nepal highlighted persistent barriers including inadequate menstrual education, limited water, sanitation and hygiene (WASH) facilities, restrictive cultural practices, and entrenched stigma, all of which contribute to poor menstrual management, school absenteeism, and adverse psychosocial outcomes.[25] Qualitative and mixed-methods studies from low- and middle-income countries similarly describe menstruation as occurring within a context of silence, shame, and normalization of pain, with limited autonomy for girls to seek care, leading to underutilization of both analgesics and health services.[26] In this context, the minimal utilization of analgesics and healthcare services highlights the unmet clinical and public health needs, emphasizing the role of school-based education, stigma reduction, and adolescent-focused health services. In addition, research from Pakistan and other low and middle-income settings has documented misconceptions that analgesic use may adversely affect future fertility, acting as a major barrier to evidence-based care.[27,28]

Our analysis further identifies modifiable lifestyle factors, notably physical inactivity, as a significant predictor of increased dysmenorrhea severity. This finding transforms a common morbidity into a potential point of intervention, reinforcing the role structured physical activity programs could play in integrated menstrual health promotion. Severe menstrual pain, including pain related to underlying conditions such as endometriosis, may contribute to reduced activity through chronic pain and fatigue, suggesting possible reverse causation.[29] Physical activity should therefore be promoted as part of integrated menstrual health strategies. However, standard evidence-based treatments, including NSAIDs and hormonal contraceptives, remain essential for moderate to severe symptoms and should be incorporated into comprehensive care pathways.[30]

Concurrently, the dominant use of commercial disposable pads (90.4%) reflects a successful shift toward improved menstrual hygiene materials in this setting. However, this trend necessitates complementary education on proper use and disposal, alongside sustained efforts to ensure affordable and equitable access to a range of safe products, including sustainable options, for all socioeconomic groups.

The cross-sectional design limits causal inference. Recalling bias may affect the accuracy of reported menarcheal age. Furthermore, the study sample was limited to school-going girls, potentially excluding more vulnerable out-of-school adolescents and limiting generalizability.

Conclusion

The mean age at menarche in this population is 12.08 ± 1.12 years. While menstrual patterns are largely physiological, dysmenorrhea is nearly universal, severely under-managed, and a leading cause of school absenteeism. Physical activity is a modifiable protective factor. These findings advocate for the urgent integration of comprehensive menstrual health education into school curricula, focused on pain management and help-seeking behaviors. Concurrently, promoting physical activity and ensuring accessible, adolescent-responsive healthcare services are essential public health priorities to safeguard the well-being and educational engagement of adolescent girls in Nepal.

Source (s) of Support: None
Conflict of Interest: None

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