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Original Article

Unveiling the cycle: menarche age and menstrual challenges among adolescent school girls*

Revelando o ciclo: idade da menarca e desafios menstruais entre adolescentes em idade escolar

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ABSTRACT

Objective: to determine the average age of menarche and menstrual problems and to compare the discrepancies among the adolescent girls in urban and rural areas. **Methods:** cross-sectional study conducted in urban and rural schools. The population included schoolgirls aged between 9 and 15 years. Overall sample size was 520. Samples were selected by Systematic Random Sampling. Data was obtained through a validated, self-administered questionnaire organized into three distinct sections. The tool was provided with bilingual format (English and Tamil) to facilitate better understanding among respondents. **Results:** the mean age at menarche among rural sample was 12.28 ± 0.87 years, compared with 11.79 ± 1.16 years among their urban counterparts. Moderate menstrual problems were more common among rural girls (24.2%) than urban girls (10.8%), while severe problems were uncommon in both groups. **Conclusion:** this study shows that urban girls attain menarche earlier than rural girls, reflecting a shift toward earlier maturation in urban settings. Dysmenorrhea, back pain, abdominal pain, and body pain were the most commonly reported menstrual problems. **Contribution to practice:** educating adolescent girls about menstrual hygiene and monitoring the age of menarche and their health are the vital part on strengthening the menstrual practice and sustainable development.

Descriptors: Menarche; Menstruation Disturbances; Adolescent; Dysmenorrhea.

RESUMO

Objetivo: determinar a idade média da menarca e dos problemas menstruais e comparar as discrepâncias entre as adolescents das áreas urbanas e rurais. **Métodos:** estudo transversal realizado em escolas urbanas e rurais. A população incluiu meninas em idade escolar entre 9 e 15 anos. O tamanho total da amostra foi de 520, e selecionadas por amostragem aleatória sistemática. Os dados foram obtidos por meio de um questionário validado e autoaplicável, organizado em três seções distintas. A ferramenta foi fornecida em formato bilingue (Inglês e Tâmil) para facilitar a compreensão entre as entrevistadas. **Resultados:** a idade média da menarca entre a amostra rural foi de 12,28 ± 0,87 anos, em comparação com 11,79 ± 1,16 anos das urbanas. Problemas menstruais moderados foram mais comuns entre as meninas rurais (24,2%) do que entre as urbanas (10,8%), enquanto problemas graves foram incomuns em ambos os grupos. **Conclusão:** evidenciou-se menarca mais precoce entre meninas urbanas em comparação às rurais, sendo dismenorreia e dores lombares, abdominais e corporais os problemas mais frequentemente relatados. **Contribuição para a prática:** educar adolescentes sobre higiene menstrual e monitorar a idade da menarca e sua saúde são componentes essenciais para o fortalecimento das práticas menstruais e para o desenvolvimento sustentável.

Descritores: Menarca; Distúrbios Menstruais; Adolescente; Dismenorreia.

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Introduction

Menarche represents a critical developmental landmark in a girl's development, signaling her transition from childhood to womanhood. It marks the onset of puberty, the biological phase when the body undergoes hormonal and physical changes that prepare it for reproductive function. The occurrence of menarche—the first menstrual period—indicates that a girl has reached the stage of reproductive maturity and can potentially conceive. Menstrual health is an essential, though frequently neglected, aspect of adolescent well-being in India.

Cultural stigma and restrictive beliefs surrounding menstruation in India continue to influence menstrual behavior and delay healthcare-seeking practices, thereby worsening reproductive health outcomes[1-3].

Despite progress in awareness and reproductive health programs, menstrual problems such as dysmenorrhea, menorrhagia, irregular cycles, and premenstrual syndrome remain highly prevalent among school girls[4-5]. A recent study performed at an advanced health care facility in India report that the most common menstrual problems among adolescent girls are dysmenorrhea, irregular menstruation, and amenorrhea[6]. A university-based study conducted in Uganda revealed that 97.8% of participants experienced at least one type of menstrual disorder. The most common issues were premenstrual syndrome manifestations, followed by dysmenorrhea, irregular cycles, frequent periods, and infrequent menstruation. Both dysmenorrhea and premenstrual symptoms were found to significantly lower the participants' quality of life scores[7]. Studies from various part of the world also reported dysmenorrhea and premenstrual bleeding are the common menstrual problems found among adolescent girls[8-9].

These disorders frequently interfere with girls' academic performance, attendance, and daily productivity, highlighting the ongoing need for improved education on menstrual well-being and peer and social support systems[10]. Multiple studies report that nutritional deficiencies, stress, hormonal imbalance, and lack of menstrual hygiene supplies contribute to the menstrual problems, particularly in low-income and rural settings[6,11].

The intersection of poor menstrual hygiene management, inadequate sanitation infrastructure, and limited school-based health education exacerbates both physical and psychosocial impacts on adolescent girls[12-13]. Central, northern, and northeastern states of India showed a high prevalence of period poverty, whereas the use of healthy menstrual practices was more common in the southern regions of the country[14]. Dysmenorrhea is the common problem experienced by the adolescent girls at menstruation[12-13,15].

Over the past two centuries, a marked global decline has been observed in the average age at menarche, a pattern similarly observed in studies from India. Over the past forty years, the average age at menarche has declined from around 16.5 years to 12.43 years. This gradual reduction in the onset age of menstruation has been associated with various physical and psychological health concerns among women[16-17]. Adolescent suicidal behavior, substance abuse, anxiety/depression, and other physical and psychological issues are linked to early menarche[18]. Additionally, it may result in early fusion of the epiphyseal growth plates, which impacts height later in life. Early menarche has been linked in studies to an increased risk of diabetes mellitus, obesity, insulin function impairment, and high blood cholesterol in adulthood, as well as high blood pressure, heart disease, cerebral infarction, and breast cancer in later life[19].

Studies also suggest that irregular menstruation before conception can increase the likelihood of gestational hypertension and related conditions and contribute to negative maternal or newborn outcomes. Furthermore, persistent menstrual problems can influence women's quality of life and, in some cases, may even affect their participation in the workforce[20-21].

To address these challenges, integrated interventions that combine menstrual hygiene promotion, nutritional counseling, and culturally sensitive education are essential. Strengthening menstrual health literacy within educational institutions and local com-

munities can play a significant role in reducing stigma and promoting gender equity in health outcomes[13]. Educating adolescent girls about menstrual hygiene and health is a vital part of their health education, helping them sustain good hygiene practices and remain active in daily activities[11]. This study aimed to determine the average age of menarche and menstrual problems and to compare the discrepancies among the adolescent girls in urban and rural areas.

Methods

Type of study and setting

This, school-based cross-sectional study was conducted among the selected urban and rural schools in the Tenkasi District of Tamil Nadu, India. The reporting of this study was guided by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist to promote completeness and methodological transparency.

Population and sampling

The study population comprised schoolgirls aged 9 to 15 years who attained menarche, excluding those with chronic medical conditions or those undergoing any form of medication. Six schools (three urban and three rural) were selected. These schools were randomly from the school official school list. Selection of participants was carried out through systematic random sampling. Total participants of the study was 520 which includes 260 urban and 260 rural. The overall sample size of participants was calculated based on a 50% prevalence of age at menarche above 12 years, with a 95% confidence interval and an additional 10% allowance for non-response.

Data collection and analysis

A pilot study was conducted prior to data collection to assess the feasibility of the research. The validity of the content for the instrument was established by consulting 11 experts in the field. Cronbach's alpha, calculated to test to establish the reliability of the questionnaire (0.807).

Data collection took place between January and May 2024 after obtaining approval and prior permission from the participating schools. At the initial stage of the study, teachers and the participants were informed about the objectives and significance of the research. The schools prepared a daily list of students for the researcher to approach, ensuring that their academic schedule was not disrupted.

Data were collected using a pre-tested, self-administered questionnaire consisting of three sections. The tool was provided in English and Tamil (bilingual format) to facilitate better understanding among respondents. The tool was developed based on a literature review and was divided into the following sections: Section A captured socio-demographic details such as current age, type of residence, religion, parents' educational and occupational status, family monthly income, and family structure, along with body mass index (BMI) and absenteeism during menstruation. Section B covered with Menarche age and characteristics of menstruation and Section C consisted of 20 items on menstrual problems and were scored using a 3-point scale: 1 = Never, 2 = Sometimes, 3 = Always.

The collected data was entered into an MS Excel spreadsheet, appropriately coded, and subsequently checked for potential mistakes. The statistics was performed using IBM SPSS Statistics for Windows, Version 22.0. Age of Menarche was calculated by using Mean value. The chi-square test ($p \geq 0.05$) was employed to determine Homogeneity of the variables between urban and rural sample. T test was used to compare the mean of urban and rural sample regards to age of menarche and menstrual problems. ANOVA was used to identify variations in means among multiple groups. Quintile regression was used to analyze how a response variable is related to one or multiple predictor variables.

Ethical aspects

This study was approved by the Departmental Research Committee at Shri JJT University (JJTU/R&D/DAL/078). Permission was taken from the principals of the selected school. Consent was obtained from the participants and the parents. The participants were well explained about the study purpose and confidentiality of the data.

Results

The key socio-demographic results indicated that the majority of participants in both urban (64.6%) and rural (87.3%) areas were Hindus. About one-third of the urban respondents were Muslims (33.8%), while only a small proportion (2.3%) of rural participants followed Islam. Approximately one in ten participants from rural schools (9.6%) were Christians.

In terms of mothers' educational status, nearly half of the mothers in both urban (48.5%) and rural (48.1%) areas had completed primary education. Around one-tenth of rural (10.4%) and urban (8.9%) mothers held a graduate degree or higher.

Regarding occupation, more than half of the urban mothers (56.9%) and over one-fourth of the rural mothers (28.5%) were homemakers. However, a greater proportion of rural mothers were involved in various occupations such as agriculture (10.4%), business (15.4%), private employment (11.5%), and wage labor (32.7%), indicating that rural mothers were more economically active compared to their urban counterparts. Less than one-fifth of both rural (17.3%) and urban (17.7%) families reported a monthly income between 5,000–10,000 rupees.

Family structure analysis showed that nuclear families were more prevalent among urban participants (65.4%) than rural ones (57.3%), whereas joint families were more common in rural areas (32.3%) compared to urban areas (23.1%).

In relation to nutritional status, over half of the rural girls (51.9%) and about two-fifths of urban girls (39.2%) were underweight. More than one-tenth of urban girls (13.07%) were overweight, while 36.5% of rural and 40.7% of urban participants had a healthy weight. Additionally, school absenteeism during menstruation was higher among rural girls (22.7%) than among urban girls (11.1%).

Table 1 revealed the menstrual characteristics among the adolescent school girl's. A greater proportion of urban girls discussed menstrual issues with their parents compared to rural girls. Regarding menstrual cycle regularity, three-fourths of the urban sample reported having regular cycles, whereas only of the rural sample did so. More than one-tenth of both rural and urban participants reported menstrual bleeding lasting longer than six days. More than half of rural girls and nearly half of urban girls experienced cycles shorter than 28 days, while 14 rural and 20 urban girls had cycles exceeding 35 days. Over half of the rural and urban respondents reported menstrual flow lasting between four and six days.

Table 1 – Distribution of menstrual characteristics among adolescent schoolgirls, presented as frequency and percentage (n=260). India, 2024

Menstrual characteristics	Rural group	Urban group
	f (%)	f (%)
Talking to parents about menstruation		
Yes	212 (81.5)	247 (95.0)
No	48(18.4)	13 (5.0)
Regular menstruation		
Yes	173 (66.5)	195 (75.0)
No	62 (23.8)	45 (17.3)
Don't know	25 (9.6)	20 (7.7)
Length of menstrual cycle (days)		
< 28	141 (54.2)	127 (48.8)
28-35	105 (40.3)	113 (43.4)
≥ 35	14 (5.3)	20 (7.6)
Bleeding at each menstruation (days)		
<3	78 (30.0)	52 (20.0)
4-6	152 (58.4)	172 (66.2)
>6	30 (11.5)	36 (13.9)
Material use as absorbent		
Sanitary pad	78 (30.0)	193 (74.2)
Sanitary pad and cloth	152 (58.4)	63 (24.2)
Cloth	30 (11.5)	4 (1.5)
Number of pads or cloth used per day		
<2	31 (11.9)	42 (16.2)
2-4	123 (47.3)	173 (66.5)
4-6	83 (31.9)	39 (15.0)
>6	23 (8.9)	6 (2.3)
Medication to change the period date		
Yes	10 (3.8)	5 (1.9)
No	212 (81.5)	239 (91.9)
Don't know	38 (14.6)	16 (6.15)

According to Figure 1, most rural schoolgirls—99 (38.1%)—experienced menarche at age 12, while the fewest, 4 (1.5%), began at age 10. Among urban girls, the largest proportion, 94 (36.2%), also reached menarche at age 12. About one-fifth (20.4%) did so at age 11, 12.3% at age 10, and the smallest group, 8 (3.1%), at age 9.

Table 2 identified the average age of menarche. With the among the rural adolescent girls the age of menarche was 12.28±0.87, while in urban adolescent girls it was 11.79±1.16 years. In terms of menarche age, Table 2 presented a significant difference between adolescent girls in urban and rural areas (t=5.45, P<0.001). Each menstrual problem was scored using a 3-point scale. Rural adolescent girls experienced more menstrual problems (28.8±6.17) than urban girls (27.66±4.75).

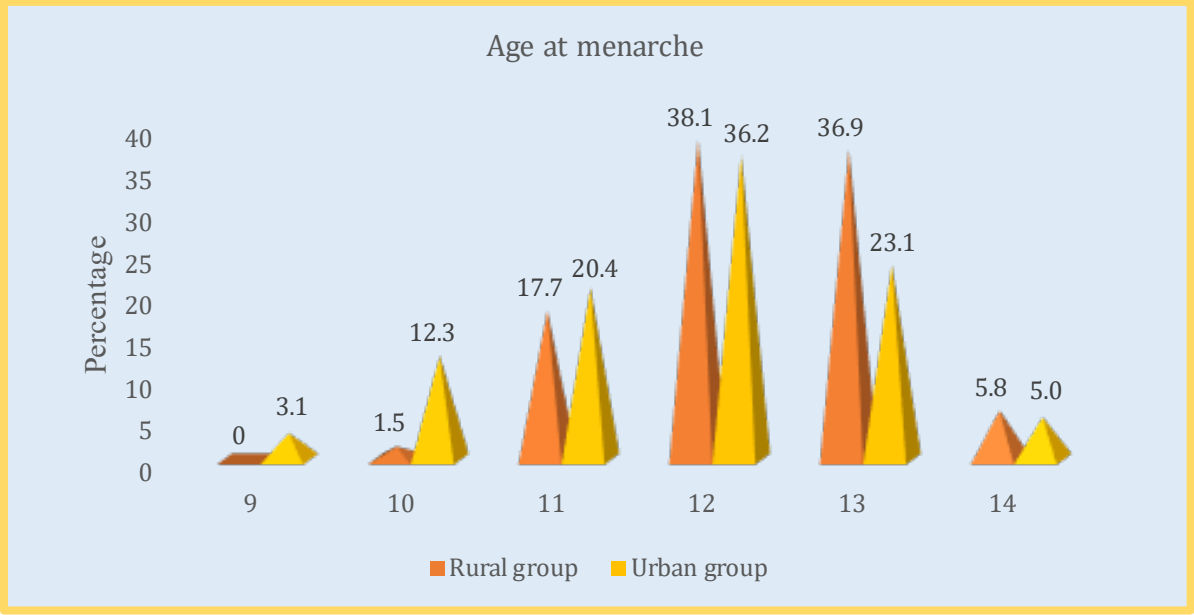

Figure 1 – Percentage distribution of adolescent girls based on age at menarche, represented in a multiple pyramid diagram (n=260). India, 2024

Table 2 – Unpaired "t"-test between rural and urban adolescent girls regards to menarche age and menstrual problems (n=260). India, 2024

Variables	Maximum Score	Rural group			Urban group			t-value	p-value
		Mean	SD*	SE†	Mean	SD	SE		
Menarche age	–	12.28	0.87	0.05	11.79	1.16	0.07	5.45	0.001‡
Menstrual problems	60	28.8	6.17	0.38	27.66	4.75	0.29	2.34	0.019§

*Standard deviation; †Standard error; ‡Highly significant; §Significant

Table 3 observed the significant difference between rural and urban adolescent girls on the following menstrual problems on a 3 point scale: Changes in appetite, vomiting, painful urination, frequent urination, mood swing, body ache, pain during menstruation, and bleeding between periods.

Table 3 – Item wise analysis with mean, standard deviation between rural and urban group to assess the menstrual problems among the adolescent girls (n=260). India, 2024

Problems during menstruation	$\bar{X} \pm \sigma$*		t test (p-value)
	Rural	Urban	
Occurrence of pain during menstrual periods	1.69 ± 0.75	1.88 ± 0.60	3.16 (0.001†)
History of missed menstrual periods for more than three months	1.08 ± 0.35	1.15 ± 0.38	0.85 (0.395‡)
Presence of frequent light menstrual flow	1.11 ± 0.37	1.15 ± 0.46	0.945 (0.344‡)
Presence of a menstrual cycle longer than 35 days	1.09 ± 0.31	1.103 ± 0.31	0.285 (0.775‡)
Experience of long-lasting and heavy menstrual flow	1.23 ± 0.52	1.23 ± 0.53	0.16 (0.868‡)
Presence of frequent menstruation before 21-day intervals	1.2 ± 0.47	1.13 ± 0.36	1.99 (0.045§)
Experience of excessive, prolonged, and frequent menstrual bleeding	1.21 ± 0.51	1.13 ± 0.37	1.86 (0.062‡)
History of spotting or bleeding between periods	1.18 ± 0.44	1.09 ± 0.36	2.47 (0.013§)
Tiredness	1.79 ± 0.76	1.86 ± 0.68	1.02 (0.306‡)
Change in appetite	1.61 ± 0.74	1.44 ± 0.69	2.63 (0.008†)
Vomiting	1.22 ± 0.55	1.14 ± 0.39	2.00 (0.045§)
Painful urination	1.30 ± 0.58	1.15 ± 0.42	3.45 (<0.001†)
Frequent urination	1.47 ± 0.73	1.31 ± 0.62	2.73 (0.006†)
Mood swing	1.46 ± 0.72	1.16 ± 0.45	5.638 (<0.001†)
Back pain	1.87 ± 0.76	1.83 ± 0.76	0.578 (0.562‡)
Pelvic pain	1.78 ± 0.75	1.77 ± 0.76	0.232 (0.816‡)
Body ache	1.95 ± 0.78	1.78 ± 0.73	2.66 (0.008†)
Abdominal pain	1.98 ± 0.77	1.96 ± 0.75	0.347 (0.728‡)
Breast tenderness	1.28 ± 0.54	1.22 ± 0.54	1.457 (0.145‡)

*Mean plus or minus the standard deviation; †Highly Significant; ‡Not Significant; §Significant

This study identified the extent of menstrual problems among school-going girls from urban and rural areas. Based on the score distribution, scores ≤ 50% were categorized as minimal, scores from 51% to 75% as moderate, and scores above 76% as high. Approximately one-fourth of rural girls (24.2%) reported experiencing moderate menstrual problems, whereas only around ten percent of urban girls (10.8%) reported the same. A very small proportion of both urban and rural respondents indicated severe menstrual problems.

The analysis demonstrated significant relationships between menstrual problems and various demographic characteristics among adolescents from rural areas. Factors such as age ($F = 7.181$, $p < 0.001$), father's educational background ($F = 8.727$, $p < 0.001$), mother's occupation ($t = 4.434$, $p = 0.001$), father's occupation ($F = 6.229$, $p < 0.001$), household income ($F = 15.285$, $p < 0.001$), family structure ($F = 2.686$, $p = 0.032$), and body mass index ($F = 3.290$) were all associated with menstrual problems.

Among urban adolescent girls, differences in menstrual-related concerns were also significant in relation to fathers' employment status ($F = 3.516$, $p = 0.008$), family composition ($F = 5.529$, $p < 0.001$), and BMI ($F = 2.666$, $p = 0.048$).

The findings further revealed notable variations in the average age at menarche among rural participants, depending on current age ($p < 0.001$), maternal occupation ($p = 0.043$), family income ($p = 0.048$), and BMI classification ($p = 0.0371$). Similarly, in urban groups, the age of menarche differed significantly across categories of current age ($p < 0.001$), family income ($p = 0.0389$), and BMI ($p = 0.049$).

Based in the family income, rural participants with family incomes above ₹10,000 and below ₹5,000 reported more menstrual problems compared to other rural income groups. In contrast, among urban participants, those with lower incomes experienced more menstrual issues. The results of this study indicated that rural participants who did not discuss menstrual concerns with their parents showed higher levels of menstrual problems. Conversely, the urban group displayed an opposite trend.

According to figure 2, rural girls who were either obese or underweight experienced more menstrual issues compared to those with normal weight. Among urban participants, those who were overweight or obese reported a higher prevalence of menstrual problems.

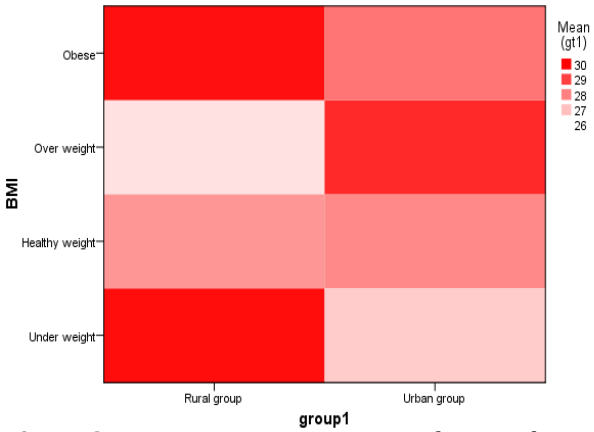

Figure 2 – Heat map representation of BMI and menstrual problems in adolescent girls. India, 2024

Discussion

A notable variation in age at menarche indicates that the average age of first menstruation tends to be lower in urban areas compared to rural ones. Consistent with these findings, a study conducted in Bangladesh also revealed that a greater proportion of urban girls experienced earlier menarche than their rural counterparts[22]. Another study from South India was also revealed early onset of menarche among the urban girls[4].

This current study reported less than one fifth of the adolescent girls who have reached menarche less than 10 years of age. In a study from Bangladesh reported one fourth of the participant's reached menarche prior to 10 years of age[22]. These findings were similar to another study conducted at Kerala, India [4]. Variations between rural and urban adolescents may be attributed to lifestyle differences; however, a general downward trend in the onset of menstruation was noted in both settings. Similar patterns have been reported globally—for instance, a Portuguese study documented an average menarche age of 12.4 years[23]. The current findings of mean menarche is aligned the other Indian studies and also noted gradual decline and menarche age[13,24-25].

Significant associations were also found between the average age of the first menstruation and the mother's occupation, family income, and BMI classifications in the rural setting. Similarly, on the urban setting also noticed the significant difference between the average age of menarche and the current age, family income, and BMI categories. These findings were supported by a Bangladesh study that anthropometric and sociodemographic factors of parents influence the age of menarche among schoolgirls[22]. A study conducted in Gangtok also reported a negative correlation between BMI and age at menarche[26]. Similarly, research from Karnataka identified several determinants of menarche timing, including late sleeping habits, animal based diet, excess body weight, and extensive media usage, and physical inactivity[27]. Interestingly, girls from larger families tended to experience menarche at a younger age, as families with more children often included older siblings, which may influence the physiological and social environment of younger members.

Portugal study indicated that girls who attain menstruation before the age of twelve are more likely to experience menstrual bleeding extending beyond six days. However, in the present study, participants with earlier menarche age reported longer bleeding duration. Furthermore, the Portuguese study found that more than half of the girls had regular menstrual cycles, and most of them reported menstrual bleeding for six days or less[23].

The following menstruation problems reported commonly among the among adolescent girls residing in urban and rural settings: abdominal pain, back pain, pelvic pain, body aches, tiredness, and changes in appetite, health and daily functioning. Similarly study conducted among junior high school girls in Shanghai found that 67.2% of respondents reported dysmenorrhea[28]. In an Ethiopian study, school girls reported 55% missed school due to menstruation-related factors, the predominant factors includes sociocultural

factors, menstrual pain and Water, Sanitation, and Hygiene facilities[29]. Dysmenorrhea is common notable menstrual symptoms associated among Saudi women and that negatively impact quality of life. Grasping its factors and related symptoms is crucial for enhancing management approaches and lessening its effect[30].

Recent studies continue to show that menstrual problems were highly prevalent among adolescent school-girls especially dysmenorrhea and carry significant implications for their education[4,30]. However the current study reported predominantly minimal menstrual problems, with significant difference among adolescent girls residing in urban and rural settings. Current age, age at menarche, Family composition, BMI, father and mother's education and number of days with bleeding were the common factors found significant association with the occurrence of menstrual problems. Similarly a study from Shanghai also reported that young age, irregular menstrual cycles, academic stress and socioeconomic background associated with the menstrual disorders[28]. Another study from Uttar Pradesh India highlighted the association between body mass index and sedentary life style[5]. The findings of this study align with National Family health Survey (NFHS-5) data, which show that the use of menstrual products is higher among urban girls compared to their rural counterparts. Rural participants also reported a greater prevalence of menstrual problems[14]. These outcomes point to the need for tailored rural interventions aimed at improving menstrual health among adolescent girls in schools.

Menstrual problems are not isolated to physical symptoms—they also ripple into mental health, daily participation and academic engagement in the education. Improving menstrual health in India therefore requires comprehensive interventions that focus on awareness creation, menstrual hygiene education, and accessible healthcare services. Educational programs in schools, combined with efforts to dispel myths and normalize menstruation, can contribute significantly to better reproductive health outcomes among adolescent girls.

Study limitations

The main limitation of this study is its cross-sectional nature, which restricts drawing causal conclusions between the variables examined. Therefore, future prospective studies are recommended to further explore and validate these associations. Additionally, since the research was conducted within a specific geographical region, the findings should be interpreted with caution when attempting to generalize them to broader populations. Furthermore, as the study relied on self-reported data obtained through questionnaires, the results may be influenced by the participants' recall bias or subjective responses.

Contribution to practice

This observation underscores the need to examine the contributing factors and consider the potential implications of earlier menarche onset. Understanding adolescents' awareness of menstrual hygiene and the difficulties they face is essential before designing effective health care interventions. The findings of this study will provide insights into the age at which menarche occurs, the factors influencing it, the challenges linked to early onset, and adolescents' knowledge of menstrual hygiene practices. The results will be valuable for informed health care planning and for supporting development in rural communities.

Conclusion

The findings indicate that urban girls experience menarche at a slightly earlier age than rural girls, suggesting possible differences influenced by environmental, nutritional, or socioeconomic factors. Dysmenorrhea, back pain, abdominal pain, and body pain were the most commonly reported menstrual problems.

Authors' contribution

Conception and design or analysis and interpretation of data; drafting of the manuscript or critical revision

of its intellectual content; final approval of the version to be published; responsibility for all aspects of the text to ensure the accuracy and integrity of any part of the manuscript: **Rafi FKM, Varghese A**.

Data availability

The data supporting the findings of this study cannot be made publicly available because the article from the PhD program. Data may be provided upon reasonable request and with institutional approval.

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