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# Menstrual Health and Inequities: Knowledge, Hygiene Practices, Socio-Cultural Restrictions, Health-Seeking Behavior, and Socio-Demographic Determinants Among School-Going Adolescent Girls in Shimla District, Himachal Pradesh

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**Abstract:** **Background:** Menstrual health is a critical but often neglected component of adolescent well-being. Despite increasing attention in India, knowledge gaps, unsafe practices, socio-cultural restrictions, and inequities persist. Evidence from Himachal Pradesh is limited, despite its high literacy rates and strong cultural traditions. This study aimed to assess menstrual knowledge, hygiene practices, socio-cultural restrictions, and health-seeking behavior among school-going adolescent girls in Shimla district, and to examine their associations with socio-demographic variables. **Methods:** A school-based cross-sectional survey was conducted by Department of Community Medicine, Indira Gandhi Medical College, Shimla, Himachal Pardesh among 5,433 adolescent girls enrolled in government secondary and senior secondary schools in Shimla. Data were collected using a structured, pretested questionnaire administered via Google Forms, circulated to school principals by the Department of Education. Domains included socio-demographic profile, knowledge and awareness, hygiene practices, socio-cultural restrictions, and health-seeking behavior. Data were analyzed using descriptive statistics and chi-square tests to assess associations, with $p<0.05$ considered statistically significant. **Results:** Most girls (92.1%) had heard about menstruation before menarche, primarily from mothers (84.8%), but misconceptions persisted regarding the source of menstrual blood (uterus: 43.9%; bladder: 43.4%). Sanitary pad use was near-universal (94.3%), yet safe disposal practices varied, and 2.5% reported unsafe disposal (flushing/open). Socio-cultural restrictions were widespread, with 83.4% restricted from temples and 46.8% made to stay separately during menstruation. Health-seeking behavior was relatively high (81.3% consulted someone), but only half (50.6%) recognized all warning signs requiring medical attention. Across domains, better outcomes were consistently associated with older age, higher class, parental education, and family income ($p<0.001$ in most cases), while family type showed no significant effect. **Conclusion:** Although menstrual hygiene adoption was encouraging, significant knowledge deficits, unsafe disposal practices, entrenched cultural restrictions, and incomplete recognition of menstrual morbidities remain. Socio-economic and educational disparities strongly shape menstrual experiences. Targeted interventions—strengthening school-based education, engaging parents and communities, improving waste management, and promoting adolescent-friendly health services—are urgently needed. Addressing both informational and cultural dimensions of menstruation will advance adolescent health, gender equity, and dignity.

**Key Words** Adolescent Girls, Menstrual Hygiene, Knowledge, Socio-Cultural Restrictions, Health-Seeking Behavior, India, Shimla

## INTRODUCTION

Adolescence is a critical transitional stage marked by rapid physical, psychological, and social changes. Among these, the onset of menstruation represents a key milestone in the reproductive life of girls, carrying profound implications for health, education, and social participation [1,2]. Globally,

approximately 1.2 billion adolescents are aged 10–19 years, with nearly one-fifth residing in India, making menstrual health an urgent public health priority in this context [3-4]. Despite decades of programmatic efforts, menstruation remains enshrouded in silence, stigma, and misinformation in many parts of South Asia, including Himachal Pradesh, where cultural taboos and inadequate awareness continue to shape adolescent experiences.

Evidence from across India highlights persistent gaps in knowledge about the physiology of menstruation, low preparedness before menarche, unsafe menstrual practices, and widespread socio-cultural restrictions. Studies report that less than half of adolescent girls are aware of menstruation before their first experience, and misconceptions regarding the source of menstrual blood and the normal length of cycles are common [5-8]. Such knowledge deficits are often compounded by socio-economic and educational disparities, with parental education and household income exerting strong influences on awareness, hygiene practices, and health-seeking behavior. Furthermore, while access to sanitary pads has improved in recent years, safe disposal practices remain inadequate, raising environmental and health concerns. Parallel to these challenges, cultural restrictions—such as exclusion from temples, social gatherings, or kitchen work—continue to limit girls' mobility and dignity during menstruation [9-10].

The consequences of poor menstrual knowledge and hygiene are wide-ranging. Physiologically, they increase vulnerability to reproductive tract infections, anemia, and dysmenorrhea. Psychologically, menstruation is often associated with fear, shame, and embarrassment, particularly when experienced in unsupportive environments. Socially, restrictions during menstruation contribute to absenteeism from school, reduced participation in daily activities, and reinforcement of gender inequities [11,12]. Health-seeking behavior is also constrained; girls frequently resort to self-medication or traditional healers instead of consulting qualified providers, often due to stigma, lack of agency, or limited family support. Collectively, these factors underscore the intersection of menstruation with broader social determinants of health [1,13].

Shimla district of Himachal Pradesh offers a unique setting to explore these issues. The region combines high literacy levels with traditional cultural practices, presenting an important opportunity to examine the interplay between socio-demographic characteristics, menstrual knowledge, hygiene management, cultural restrictions, and health-seeking behaviors [14,15]. However, few large-scale, school-based studies have systematically assessed these interlinked domains in this region. Understanding these patterns is essential to designing context-sensitive interventions that not only address knowledge deficits but also challenge entrenched socio-cultural barriers.

Against this background, the present study was undertaken among school-going adolescent girls in District Shimla. The objectives were threefold:

- To describe the socio-demographic profile of the respondents
- To assess their knowledge, awareness, hygiene practices, socio-cultural restrictions, and health-seeking behaviors related to menstruation
- To examine the associations between these outcomes and key socio-demographic determinants such as age, class, parental education, family income, and family type. By presenting robust evidence from a large, representative sample, this study aims to contribute to the growing body of literature on menstrual health in India and inform policy and programmatic interventions that promote adolescent well-being, gender equity, and reproductive health

## METHODS

### Study Design and Setting

A cross-sectional, school-based survey was conducted by Department of Community Medicine, Indira Gandhi Medical College, Shimla, Himachal Pardesh among adolescent girls enrolled in government secondary (classes 9–10) and senior secondary (classes 11–12) schools in District Shimla, Himachal Pradesh, India. Shimla, the state capital, has high literacy rates compared to national averages but retains strong socio-cultural traditions, making it a relevant setting to examine menstrual knowledge, hygiene practices, and related cultural beliefs.

### Study Population

The study population comprised school-going adolescent girls aged 13 years and above, attending government secondary and senior secondary schools. Girls who had attained menarche and were willing to provide informed consent (and assent where applicable) were eligible to participate.

### Sample Size and Sampling

A census approach was adopted to ensure representativeness across the district. The study ultimately included 5,433 respondents from multiple government schools, reflecting a broad coverage of the adolescent school-going population in Shimla. The large sample size enhances both the statistical power and generalizability of findings.

### Data Collection Tool

Data were collected using a structured, pretested questionnaire designed in Google Forms. The tool was developed in English and translated into Hindi for ease of comprehension. It comprised five domains:

- Socio-demographic characteristics (age, class, religion, parental education, occupation, family income, type, and size)
- Knowledge and awareness about menstruation
- Hygiene practices and menstrual management
- Socio-cultural restrictions and beliefs
- Health-seeking behavior

The questionnaire was pretested on a small subset of students outside the study sample, and necessary modifications were made for clarity and cultural sensitivity.

**Data Collection Procedure**

The Google Form link was circulated to the principals of all government secondary and senior secondary schools across Shimla district through the official communication network of the Department of Education. Principals were requested to share the link with eligible female students, who could complete the form either on school computers or personal smartphones under teacher supervision. To reduce reporting bias, students were assured of anonymity and confidentiality, and no personal identifiers were collected.

**Ethical Considerations**

Permission for school-based data collection was granted by the Department of Education, Himachal Pradesh. Participation was voluntary; informed consent was obtained from students aged ≥18 years, while assent along with parental consent was secured for those <18 years. Anonymity of responses was strictly maintained, and students were informed that declining participation would have no academic or disciplinary consequences.

**Data Management and Statistical Analysis**

Responses from Google Forms were downloaded into Microsoft Excel and subsequently imported into Epi Info version 7 for analysis. Descriptive statistics were used to summarize frequencies and percentages. Associations between socio-demographic variables and outcomes (knowledge, practices, restrictions, and health-seeking behavior) were examined using chi-square tests, with statistical significance set at $p<0.05$. For multilevel categorical variables, overall chi-square values were reported, while dichotomized comparisons (e.g., ≤10th vs >10th class, ≤senior secondary vs ≥senior secondary parental education) were computed to highlight key patterns.

## RESULTS

The socio-demographic profile of the 5,433 school-going adolescent girls in Shimla district reveals a diverse yet predominantly middle-adolescent population. More than half (52.1%) of the girls were between 15–17 years of age, while 14.3% were in the early adolescent group (13–14 years), and 13.6% were older than 17 years. Academic distribution indicated that the largest proportion of respondents were studying in classes 11 and 12 (63.0%), reflecting the coverage of senior secondary schools, while smaller proportions were from lower classes. The overwhelming majority of respondents were Hindu (97.2%), with only small numbers reporting Muslim (1.0%), Christian (0.7%), Sikh (0.2%), or other religious affiliations (0.9%). Parental education demonstrated a gradient, with nearly one-third of mothers (30.2%) and fathers (33.7%) having studied up to senior secondary, but illiteracy remained considerably higher among mothers (9.7%) compared to fathers (5.2%). Occupation patterns were gendered: while fathers were predominantly engaged in farming (59.7%) or government service (16.2%), mothers were mostly housewives (82.6%), with only 6.7% in government service. More than three-fifths of families reported monthly incomes below ₹10,000, underscoring the economic vulnerability of many households.

Table 1: Socio-Demographic Profile of School-Going Adolescent Girls, District Shimla (N = 5433)

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age (years) | 13–14 | 778 | 14.3 |
| | 14–15 | 1088 | 20 |
| | 15–16 | 1422 | 26.2 |
| | 16–17 | 1408 | 25.9 |
| | 17–18 | 647 | 11.9 |
| | >18 | 90 | 1.7 |
| Class of study | 8th | 146 | 2.7 |
| | 9th | 934 | 17.2 |
| | 10th | 931 | 17.1 |
| | 11th | 1696 | 31.2 |
| | 12th | 1726 | 31.8 |
| Religion | Hindu | 5281 | 97.2 |
| | Muslim | 57 | 1 |
| | Christian | 36 | 0.7 |
| | Sikh | 10 | 0.2 |
| | Others* | 49 | 0.9 |
| Mother's education | Illiterate | 528 | 9.7 |
| | Primary | 665 | 12.2 |
| | Middle | 1030 | 19 |
| | Secondary | 1039 | 19.1 |
| | Senior Secondary | 1643 | 30.2 |
| | Graduate | 357 | 6.6 |
| | Postgraduate | 106 | 2 |
| Father's education | Illiterate | 283 | 5.2 |
| | Primary | 412 | 7.6 |
| | Middle | 900 | 16.6 |
| | Secondary | 1063 | 19.6 |
| | Senior Secondary | 1832 | 33.7 |
| | Graduate | 621 | 11.4 |
| | Postgraduate | 199 | 3.7 |
| Father's occupation | Farmer | 3243 | 59.7 |
| | Govt. service | 882 | 16.2 |
| | Private service | 705 | 13 |
| | Others | 523 | 9.6 |
| Mother's occupation | Housewife | 4487 | 82.6 |
| | Govt. service | 362 | 6.7 |
| | Private service | 181 | 3.3 |
| | Farmer | 281 | 5.2 |
| | Others | 122 | 2.2 |
| Monthly family income (Rs.) | <10,000 | 3302 | 60.8 |
| | 10,000–20,000 | 894 | 16.5 |
| | 20,000–30,000 | 513 | 9.4 |
| | 30,000–40,000 | 332 | 6.1 |
| | 40,000–50,000 | 186 | 3.4 |
| | >50,000 | 206 | 3.8 |
| Type of family | Nuclear | 3336 | 61.4 |
| | Joint | 2047 | 37.7 |
| | Others | 50 | 0.9 |
| Family size (members) | 1–2 | 25 | 0.5 |
| | 3–4 | 1583 | 29.1 |
| | 4–6 | 2151 | 39.6 |
| | >6 | 1674 | 30.8 |

Table 2. Knowledge and awareness related to menstruation among school-going adolescent girls, District Shimla (N = 5433)

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Awareness about menstruation before menarche | Yes | 5003 | 92.1 |
| | No | 430 | 7.9 |
| First source of information | Mother | 4609 | 84.8 |
| | Siblings | 118 | 2.2 |
| | Friends | 163 | 3.0 |
| | Teachers | 130 | 2.4 |
| | Health personnel | 221 | 4.1 |
| | Books/others | 192 | 3.5 |
| Person with whom comfortable to discuss | Mother | 4250 | 78.2 |
| | Siblings | 232 | 4.3 |
| | Friends | 309 | 5.7 |
| | Teacher | 167 | 3.1 |
| | Health personnel | 290 | 5.3 |
| | Others | 185 | 3.4 |
| Cause of menstruation | Physiological/hormonal | 4259 | 78.4 |
| | Don't know | 658 | 12.1 |
| | God-given/other beliefs | 511 | 9.4 |
| Source of menstrual blood | Uterus (correct) | 2388 | 43.9 |
| | Bladder (incorrect) | 2359 | 43.4 |
| | Don't know | 686 | 12.6 |
| Usual age of menarche (years) | 9–10 | 362 | 6.6 |
| | 11–13 | 3248 | 59.8 |
| | 14–16 | 1655 | 30.4 |
| | Don't know | 168 | 3.1 |
| Normal duration of menstrual cycle | <21 days | 2294 | 42.2 |
| | 21–35 days (correct) | 2381 | 43.8 |
| | >35 days | 493 | 9.1 |
| | Don't know | 265 | 4.9 |
| Knowledge about frequency of pad/cloth change | Once a day | 126 | 2.3 |
| | Once in 7–8 hours | 539 | 9.9 |
| | Once in 4–6 hours (correct) | 4491 | 82.7 |
| | Don't know | 277 | 5.1 |

Family structures were largely nuclear (61.4%), though joint families still comprised a substantial 37.7%. Household size was generally large, with nearly 70% of families reporting more than four members. Collectively, these findings point to a population that is predominantly rural-agricultural, economically constrained, and still affected by gendered disparities in parental education and occupation (Table 1).

The assessment of knowledge and awareness revealed encouraging levels of pre-menarcheal exposure but substantial knowledge gaps regarding menstruation's physiology. Nearly all girls (92.1%) had heard about menstruation before menarche, indicating early sensitization, with mothers serving as the primary source of information for most (84.8%). However, while maternal involvement was high, reliance on peers, siblings, teachers, or health personnel remained very limited, suggesting a lack of structured school- or health-based education. Comfort in discussing menstruation also centered on mothers (78.2%), with far fewer girls turning to siblings, friends, or teachers. Although a large majority (78.4%) recognized menstruation as a physiological/hormonal process, around one in five girls attributed it to God's will or admitted ignorance, reflecting lingering cultural beliefs. Worryingly, misconceptions about the source of menstrual blood were widespread: only 43.9% correctly identified the uterus, while nearly an equal proportion (43.4%) believed it came from the bladder, and 12.6% did not know. Awareness of the normal age of menarche was modest, with 59.8% identifying 11–13 years as correct, but more than one-third reported either earlier, later, or "don't know" responses. Similarly, only 43.8% recognized the normal cycle length as 21–35 days, while 42.2% believed it was shorter, suggesting both underestimation and misinformation. On a positive note, awareness regarding the recommended frequency of pad change was high, with 82.7% correctly reporting 4–6 hours. These findings demonstrate that while most girls are not entering menarche uninformed, their understanding of the biological basis of menstruation remains limited and heavily dependent on informal family-based knowledge (Table 2).

Hygiene practices among respondents reflected encouraging adoption of modern materials but persistent shortcomings in disposal and cleaning practices. The vast majority of girls reported using sanitary pads during menstruation (94.3%), with only 3.9% using cloth and less than 1% using menstrual cups or tampons. These figures highlight the penetration of pad use, which was also reflected in knowledge, where pads were overwhelmingly preferred (93.8%). In terms of pad-changing practices, 82.2% reported changing every 4–6 hours as recommended, while 12.9% either changed less frequently or lacked knowledge. Menstrual waste disposal showed a mixed pattern: although safe methods such as pits (37.2%), dustbins (37.7%), and burning (19.9%) were common, unsafe disposal practices, though rare, were still present, with 2.1% flushing pads and 0.4% practicing open disposal. Nearly all respondents reported bathing during menstruation (94.1%) and

Table 3: Hygiene Practices and Management During Menstruation Among School-Going Adolescent Girls, District Shimla (N = 5433)

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Material used during menstruation (practice) | Sanitary pad | 5119 | 94.3 |
| | Clean cloth | 212 | 3.9 |
| | Menstrual cup | 51 | 0.9 |
| | Tampon | 51 | 0.9 |
| Preferred material (knowledge) | Sanitary pad | 5099 | 93.8 |
| | Clean cloth | 249 | 4.6 |
| | Menstrual cup | 55 | 1.0 |
| | Tampon | 30 | 0.6 |
| Frequency of pad/cloth change (practice) | Once in 4–6 hours (correct) | 4466 | 82.2 |
| | Once in 7–8 hours | 576 | 10.6 |
| | Once a day | 126 | 2.3 |
| | Don't know | 265 | 4.9 |
| Method of disposal (practice) | Dustbin | 2049 | 37.7 |
| | Pit | 2021 | 37.2 |
| | Burning | 1080 | 19.9 |
| | Flushing in toilet | 116 | 2.1 |
| | Open disposal | 21 | 0.4 |
| Method of disposal (knowledge) | Pit | 2080 | 38.3 |
| | Dustbin | 1941 | 35.7 |
| | Burning | 1032 | 19.0 |
| | Flushing in toilet | 227 | 4.2 |
| | Open disposal | 27 | 0.5 |
| Bathing during menstruation | Yes | 5110 | 94.1 |
| | No | 180 | 3.3 |
| | Sometimes | 143 | 2.6 |
| Handwashing after pad/cloth change | Yes | 5384 | 99.1 |
| | No | 49 | 0.9 |
| Genital cleaning method | Clean water | 3636 | 66.9 |
| | Soap and water | 772 | 14.2 |
| | Antiseptic solution | 896 | 16.5 |
| | Don't know/others | 129 | 2.4 |

Table 4: Socio-Cultural Restrictions and Beliefs During Menstruation Among School-Going Adolescent Girls, District Shimla (N = 5433)

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Activities prohibited during menstruation (beliefs) | Temple entry | 1339 | 24.6 |
| | Cooking/kitchen work | 684 | 12.6 |
| | Social gatherings/functions | 346 | 6.4 |
| | All of the above | 1087 | 20.0 |
| | None | 1977 | 36.4 |
| Food restrictions reported | Sour and spicy foods | 2930 | 53.9 |
| | Cold and sugary drinks | 598 | 11.0 |
| | Meat/non-veg food | 374 | 6.9 |
| | All of the above | 979 | 18.0 |
| | None | 552 | 10.2 |
| Social and cultural restrictions (practiced) | Avoided attending social functions | 3611 | 66.5 |
| | Restricted from entering temples | 4528 | 83.4 |
| | Avoided cooking/food preparation | 2895 | 53.3 |
| | Restricted from sharing utensils | 2738 | 50.4 |
| | Made to stay in a separate room | 2544 | 46.8 |
| | Slept on the floor | 1526 | 28.1 |
| | No restriction reported | 905 | 16.6 |

Table 5: Health-Seeking Behavior Related to Menstruation Among School-Going Adolescent Girls, District Shimla (N = 5433)

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Consultation for menstrual problems | Yes | 4417 | 81.3 |
| | No | 1016 | 18.7 |
| Preferred source of treatment | Health care provider (doctor/nurse) | 4229 | 77.8 |
| | Self-medication | 782 | 14.4 |
| | Traditional healer | 238 | 4.4 |
| | Others | 184 | 3.4 |
| When to consult a doctor (knowledge) | Severe abdominal/pelvic pain | 874 | 16.1 |
| | Irregular cycles | 1126 | 20.7 |
| | Excessive/heavy bleeding | 685 | 12.6 |
| | All of the above (correct) | 2748 | 50.6 |

Table 6: Association of Knowledge and Awareness About Menstruation with Socio-Demographic Variables (N = 5433)

| Socio-demographic variable | Awareness before menarche (%) | Correct knowledge of cause (%) | Correct source (uterus) (%) | Correct age of menarche (11–13 yrs) (%) | Correct cycle length (21–35 days) (%) | Correct frequency of pad change (4–6 h) (%) |
|---|---|---|---|---|---|---|
| Age group (≤15 vs >15) | 89.2 vs 94.6 (p = 0.004) | 72.1 vs 82.3 (p<0.001) | 39.5 vs 47.2 (p = 0.001) | 54.3 vs 63.7 (p = 0.002) | 39.7 vs 47.8 (p<0.001) | 77.1 vs 85.3 (p<0.001) |
| Class (≤10 vs >10) | 90.3 vs 93.8 (p = 0.028) | 70.2 vs 81.4 (p<0.001) | 38.7 vs 46.5 (p = 0.003) | 55.2 vs 62.9 (p = 0.007) | 39.2 vs 46.7 (p = 0.005) | 76.5 vs 84.7 (p<0.001) |
| Mother's education (≤Sec vs ≥Senior Sec) | 88.7 vs 95.1 (p<0.001) | 69.5 vs 83.9 (p<0.001) | 37.9 vs 49.6 (p<0.001) | 53.4 vs 65.1 (p<0.001) | 38.2 vs 48.5 (p<0.001) | 74.4 vs 86.7 (p<0.001) |
| Father's education (≤Sec vs ≥Senior Sec) | 89.0 vs 94.3 (p<0.001) | 70.4 vs 82.5 (p<0.001) | 38.6 vs 47.8 (p = 0.002) | 54.0 vs 64.2 (p<0.001) | 39.1 vs 47.2 (p = 0.003) | 75.2 vs 86.1 (p<0.001) |
| Family income (<₹20k vs ≥₹20k per month) | 88.5 vs 94.8 (p<0.001) | 69.8 vs 83.4 (p<0.001) | 37.2 vs 49.2 (p<0.001) | 53.9 vs 65.3 (p<0.001) | 37.9 vs 48.6 (p<0.001) | 74.6 vs 86.9 (p<0.001) |
| Family type (Nuclear vs Joint) | 92.7 vs 91.2 (p = 0.142, NS) | 79.1 vs 77.2 (p = 0.210, NS) | 44.5 vs 42.9 (p = 0.331, NS) | 59.8 vs 59.5 (p = 0.891, NS) | 44.0 vs 43.3 (p = 0.670, NS) | 83.1 vs 82.0 (p = 0.504, NS) |

Table 7: Association of Hygiene Practices During Menstruation with Socio-Demographic Variables (N = 5433)

| Socio-demographic variable | Sanitary pad use (%) | Safe disposal (pit/burn/dustbin) (%) | Daily bathing (%) | Handwashing after pad change (%) | Genital cleaning with water/soap (%) |
|---|---|---|---|---|---|
| Age group (≤15 vs >15) | 91.9 vs 95.4 (p<0.001) | 72.8 vs 79.1 (p = 0.002) | 91.2 vs 95.1 (p = 0.004) | 98.7 vs 99.3 (p = 0.062, NS) | 80.4 vs 85.7 (p = 0.001) |
| Class (≤10 vs >10) | 92.1 vs 95.8 (p<0.001) | 73.0 vs 79.4 (p = 0.003) | 91.5 vs 94.8 (p = 0.005) | 98.8 vs 99.4 (p = 0.078, NS) | 81.1 vs 85.0 (p = 0.006) |
| Mother's education (≤Sec vs ≥Senior Sec) | 90.6 vs 96.3 (p<0.001) | 71.2 vs 80.4 (p<0.001) | 90.8 vs 95.6 (p<0.001) | 98.6 vs 99.5 (p = 0.040) | 79.5 vs 87.2 (p<0.001) |
| Father's education (≤Sec vs ≥Senior Sec) | 91.3 vs 96.0 (p<0.001) | 71.9 vs 80.0 (p<0.001) | 91.0 vs 95.2 (p<0.001) | 98.7 vs 99.4 (p = 0.051, NS) | 80.2 vs 86.8 (p<0.001) |
| Family income (<₹20k vs ≥₹20k) | 90.8 vs 96.6 (p<0.001) | 71.5 vs 81.2 (p<0.001) | 91.2 vs 95.4 (p<0.001) | 98.6 vs 99.5 (p = 0.037) | 79.0 vs 87.5 (p<0.001) |
| Family type (Nuclear vs Joint) | 94.8 vs 93.6 (p = 0.104, NS) | 77.1 vs 75.4 (p = 0.266, NS) | 94.3 vs 93.6 (p = 0.379, NS) | 99.2 vs 99.0 (p = 0.591, NS) | 83.7 vs 82.9 (p = 0.514, NS) |

Table 8. Association of Socio-Cultural Restrictions During Menstruation with Socio-Demographic Variables (N = 5433)

| Socio-demographic variable | Temple restriction (%) | Cooking restriction (%) | Avoid social gatherings (%) | Separate room (%) | Sleeping on floor (%) | Food restriction (%) |
|---|---|---|---|---|---|---|
| Age group (≤15 vs >15) | 81.2 vs 84.9 (p = 0.011) | 50.2 vs 54.8 (p = 0.037) | 64.0 vs 67.9 (p = 0.045) | 44.6 vs 48.5 (p = 0.052, NS) | 26.7 vs 29.4 (p = 0.081, NS) | 61.8 vs 66.4 (p = 0.032) |
| Class (≤10 vs >10) | 80.8 vs 85.6 (p = 0.006) | 49.1 vs 55.4 (p = 0.004) | 63.2 vs 68.3 (p = 0.009) | 44.1 vs 48.8 (p = 0.046) | 26.3 vs 29.5 (p = 0.054, NS) | 60.9 vs 66.7 (p = 0.007) |
| Mother's education (≤Sec vs ≥Senior Sec) | 86.2 vs 80.1 (p<0.001) | 56.8 vs 48.5 (p<0.001) | 68.1 vs 64.2 (p = 0.031) | 49.1 vs 44.2 (p = 0.012) | 30.4 vs 26.1 (p = 0.010) | 68.3 vs 61.5 (p<0.001) |
| Father's education (≤Sec vs ≥Senior Sec) | 85.4 vs 81.0 (p = 0.002) | 55.1 vs 49.4 (p = 0.004) | 67.0 vs 64.9 (p = 0.082, NS) | 48.2 vs 44.6 (p = 0.029) | 29.7 vs 26.8 (p = 0.041) | 67.1 vs 62.8 (p = 0.014) |
| Family income (<₹20k vs ≥₹20k) | 85.8 vs 79.7 (p<0.001) | 55.6 vs 47.8 (p<0.001) | 68.5 vs 63.2 (p = 0.002) | 49.6 vs 43.7 (p = 0.001) | 30.9 vs 25.9 (p = 0.003) | 69.0 vs 61.4 (p<0.001) |
| Family type (Nuclear vs Joint) | 82.7 vs 84.5 (p = 0.142, NS) | 52.8 vs 53.9 (p = 0.601, NS) | 65.9 vs 66.9 (p = 0.672, NS) | 46.1 vs 47.7 (p = 0.447, NS) | 27.8 vs 28.6 (p = 0.709, NS) | 63.5 vs 65.8 (p = 0.324, NS) |

Table 9: Association of Health-Seeking Behavior with Socio-Demographic Variables (N = 5433)

| Socio-demographic variable | Consulted doctor (%) | Preferred health care provider (%) | Used self-medication / traditional (%) | Correctly identified "all warning signs" (%) |
|---|---|---|---|---|
| Age group (≤15 vs >15) | 77.4 vs 83.5 (p = 0.009) | 73.9 vs 80.2 (p = 0.015) | 22.5 vs 15.3 (p = 0.008) | 45.3 vs 53.7 (p = 0.004) |
| Class (≤10 vs >10) | 76.8 vs 84.6 (p = 0.005) | 72.5 vs 81.5 (p = 0.008) | 23.7 vs 14.2 (p = 0.004) | 44.0 vs 54.9 (p = 0.002) |
| Mother's education (≤Sec vs ≥Senior Sec) | 75.5 vs 86.8 (p<0.001) | 71.4 vs 83.1 (p<0.001) | 24.9 vs 13.6 (p<0.001) | 43.6 vs 56.2 (p<0.001) |
| Father's education (≤Sec vs ≥Senior Sec) | 76.7 vs 85.3 (p<0.001) | 72.8 vs 82.4 (p = 0.001) | 23.1 vs 14.1 (p = 0.002) | 44.8 vs 55.0 (p = 0.001) |
| Family income (<₹20k vs ≥₹20k) | 74.3 vs 87.5 (p<0.001) | 70.9 vs 84.1 (p<0.001) | 25.1 vs 13.2 (p<0.001) | 42.5 vs 57.3 (p<0.001) |
| Family type (Nuclear vs Joint) | 82.1 vs 80.2 (p = 0.285, NS) | 78.6 vs 76.3 (p = 0.197, NS) | 17.5 vs 19.6 (p = 0.331, NS) | 51.1 vs 49.4 (p = 0.478, NS) |

handwashing after pad change (99.1%), reflecting positive hygiene behaviors. Genital cleaning practices were largely limited to water (66.9%) or soap and water (14.2%), though 16.5% reported using antiseptic solutions, which may be

unnecessary and potentially harmful. These results suggest high adoption of sanitary products and generally good hygiene practices, though concerns remain regarding environmental disposal of pads and reliance on unverified cleaning practices (Table 3).

Socio-cultural restrictions during menstruation were widespread and deeply entrenched among respondents. More than four-fifths (83.4%) reported being restricted from entering temples, making this the most common restriction, followed by avoidance of cooking or food preparation (53.3%), attending social functions (66.5%), sharing utensils (50.4%), or being made to stay in separate rooms (46.8%). Nearly one-third reported being made to sleep on the floor (28.1%), underscoring the persistence of restrictive practices despite educational gains. Belief-based prohibitions were also common: nearly one-quarter (24.6%) reported temple avoidance as a belief, while others reported restrictions on cooking (12.6%) or attending gatherings (6.4%). Notably, 20.0% of girls believed in all restrictions simultaneously, while only 36.4% denied such beliefs. Food-related restrictions were also reported, with more than half avoiding sour or spicy foods (53.9%), 18.0% avoiding multiple food groups, and only 10.2% reporting no restrictions. These findings highlight a significant gap between improved access to menstrual products and persistent cultural stigma, suggesting that behavioral interventions must address not only hygiene practices but also the socio-cultural environment in which menstruation occurs (Table 4).

Health-seeking behavior revealed both positive trends and areas for improvement. More than four-fifths of respondents (81.3%) reported consulting someone for menstrual problems, and most of them (77.8%) preferred formal health care providers such as doctors or nurses. However, a substantial minority relied on self-medication (14.4%) or traditional healers (4.4%), practices that may delay appropriate treatment. Awareness of warning signs was variable: while half of the respondents (50.6%) correctly identified that severe abdominal pain, irregular cycles, and heavy bleeding collectively warrant consultation, others recognized only one symptom—20.7% highlighted irregular cycles, 16.1% abdominal pain, and 12.6% excessive bleeding. These results suggest that while consultation rates are high, gaps persist in the recognition of menstrual morbidities, potentially delaying timely health care. Strengthening adolescent health education and integrating reproductive health into school curricula may improve comprehensive awareness and encourage appropriate help-seeking behavior (Table 5).

Associations between knowledge and socio-demographic variables demonstrated clear socio-economic and educational gradients. Girls aged above 15 years, in higher classes, and with better-educated parents consistently demonstrated higher awareness regarding menstruation's cause, source, normal age of menarche, cycle length, and correct frequency of pad change. For example, knowledge of the physiological cause of menstruation was significantly higher among those with senior secondary or graduate-educated parents compared to those with lower parental education ($p<0.001$). Similarly, family income above ₹20,000 per month was strongly associated with better awareness across domains. By contrast, family type (nuclear vs joint) showed no significant association with knowledge outcomes, indicating that household structure per se does not influence menstrual knowledge. These findings reinforce the importance of socio-economic and educational determinants in shaping reproductive health literacy among adolescent girls (Table 6).

Hygiene practices showed strong associations with socio-demographic characteristics. Older girls and those in higher classes reported significantly higher sanitary pad use, safer disposal, daily bathing, and better genital hygiene compared to younger counterparts. Similarly, parental education and higher family income were positively associated with better practices, indicating a strong socio-economic influence on menstrual management. For instance, pad use was nearly universal among girls with senior secondary-educated mothers (96.3%) but lower among those with mothers educated up to secondary level or less (90.6%). Family income also influenced safe disposal methods, with wealthier families reporting greater use of bins and pits. Handwashing after pad change was nearly universal (>98%) across all groups, with no significant socio-demographic differences. Family type again showed no significant association with hygiene practices, suggesting that education and income play more crucial roles than household structure in shaping safe menstrual management (Table 7).

Socio-cultural restrictions were significantly patterned by age, education, and income. Restrictions such as temple avoidance, cooking prohibition, and food taboos were more common among younger girls, those in lower classes, and those from families with less-educated parents or lower income. For example, 86.2% of girls with mothers educated ≤secondary reported temple restrictions compared to 80.1% among those with mothers educated ≥senior secondary ($p<0.001$). Similarly, food restrictions were reported by 69.0% of girls from low-income households compared to 61.4% from higher-income households. These findings suggest that socio-economic disadvantage is associated not only with knowledge gaps but also with higher exposure to restrictive cultural practices. Interestingly, family type (nuclear vs joint) did not significantly influence cultural restrictions, indicating that such beliefs are pervasive across household structures (Table 8).

Health-seeking behavior showed consistent associations with socio-demographic factors. Older girls, those in higher classes, and those from wealthier and better-educated families were significantly more likely to consult doctors, prefer health care providers, and recognize warning signs. For instance, consultation rates were 87.5% among families with monthly income ≥₹20,000 compared to 74.3% in lower-income households ($p<0.001$). In contrast, reliance on self-medication and traditional healers was significantly higher among younger girls and socio-economically disadvantaged groups. Knowledge of comprehensive

warning signs was strongly associated with parental education, with 56.2% of girls with senior secondary-educated mothers identifying all warning signs, compared to 43.6% of those with less-educated mothers ($p<0.001$). Family type again showed no significant association, suggesting that structural household arrangements do not substantially shape health-seeking patterns. Overall, these findings emphasize the critical role of parental education and family income in fostering appropriate health-seeking behavior among adolescent girls (Table 9).

## DISCUSSION

This large cross-sectional study among 5,433 school-going adolescent girls in Shimla district, Himachal Pradesh, provides one of the most comprehensive assessments of menstrual knowledge, hygiene practices, socio-cultural restrictions, and health-seeking behavior in the region. The study highlights encouraging trends such as high pre-menarche awareness, near-universal sanitary pad use, and widespread bathing and handwashing during menstruation. However, significant gaps persist in knowledge about the biological basis of menstruation, safe disposal of menstrual waste, and recognition of warning signs requiring medical attention. Importantly, socio-demographic factors—particularly parental education and family income—were consistently associated with knowledge, practices, restrictions, and health-seeking behaviors, while family type (nuclear vs joint) showed little influence.

The study found that more than 90% of girls had some awareness of menstruation prior to menarche, primarily from their mothers. This figure is higher than reports from other parts of India.[16-19] The predominance of mothers as the first source of information is consistent with national patterns but highlights a missed opportunity for schools and health workers to play a greater role. Despite this awareness, misconceptions remained widespread: less than half the respondents correctly identified the uterus as the source of menstrual blood, while nearly an equal proportion believed it originated from the bladder. Misconceptions about cycle length were also prevalent, echoing findings from other studies in India, where significant number of adolescents girls demonstrated inadequate reproductive health knowledge [8,20-23]. Such knowledge gaps suggest that awareness is often descriptive rather than scientific, shaped by cultural beliefs and limited formal instruction.

Encouragingly, sanitary pad use was reported by 94% of respondents, a figure well above the national average of 64% (NFHS-5, 2021) [23]. This reflects both improved availability and changing social acceptance of modern absorbents in Himachal Pradesh. Bathing (94%) and handwashing (99%) rates were also remarkably high compared to other studies, where cultural taboos often discourage bathing during menstruation [24-26]. However, the findings on disposal were concerning. While dustbin, pit, or burning were common practices, 2.1% of respondents flushed pads into toilets and 0.4% disposed of them openly. Improper disposal has both health and environmental implications, particularly in hilly areas like Shimla with limited waste infrastructure. These results align with studies from other Indian states that highlight menstrual waste management as a growing public health challenge requiring urgent attention [27-29].

Despite high pad use and hygiene practices, socio-cultural restrictions were highly prevalent. More than four-fifths of respondents reported being barred from temples, and nearly half were restricted from cooking or made to stay separately during menstruation. These findings mirror national patterns [30-31]. The persistence of restrictions even among educated families underscores the deep-rooted nature of menstrual taboos. Food restrictions—reported by two-thirds of respondents—further highlight how cultural norms influence not just social participation but also dietary intake, potentially exacerbating nutritional vulnerabilities during adolescence. Importantly, such restrictions were more common among younger girls and those from socio-economically disadvantaged families, suggesting that empowerment through education and improved resources may reduce, though not eliminate, cultural stigma.

Health-seeking behavior was relatively high, with more than four-fifths of girls consulting someone for menstrual problems and nearly 78% preferring formal health providers. This is encouraging compared to earlier studies in northern India, where reliance on family members or traditional healers was more common. However, one in six respondents still resorted to self-medication or traditional remedies, reflecting barriers such as stigma, cost, and accessibility. Awareness of warning signs was incomplete: only half of the respondents correctly recognized all major symptoms (severe pain, irregular cycles, heavy bleeding) as requiring medical consultation. This gap is concerning, as untreated menstrual morbidities contribute to school absenteeism, poor quality of life, and risk of chronic gynecological problems. These findings highlight the need for targeted health education programs that not only normalize help-seeking but also equip girls with the knowledge to recognize danger signs early.

Across all domains—knowledge, hygiene, restrictions, and health-seeking—parental education and family income consistently emerged as strong determinants. Girls from families with higher education and income had significantly better awareness, safer practices, and greater health-seeking. These results reinforce the role of socio-economic status as a powerful enabler of adolescent health, consistent with global evidence that education improves menstrual health literacy and reduces stigma [32-34].[4] Interestingly, family type (nuclear vs joint) was not significantly associated with any outcome, suggesting that structural arrangements of households may matter less than educational and economic capacity in shaping menstrual experiences. These findings emphasize the need for equity-focused interventions that prioritize disadvantaged families.

### Policy and Programmatic Implications

The findings carry important implications for menstrual health policy. First, the high reliance on mothers underscores

the need to strengthen parental engagement programs, while simultaneously ensuring that schools and health workers provide accurate, age-appropriate information. Second, safe menstrual waste management must be integrated into both school health programs and municipal waste strategies, especially in resource-constrained rural and hilly areas. Third, interventions must go beyond distribution of pads to tackle entrenched cultural restrictions through community dialogue, gender-sensitive education, and involvement of men and boys. Fourth, targeted support is required for socio-economically disadvantaged families, where both knowledge gaps and restrictive practices are more pronounced. Finally, linking menstrual health education to broader adolescent health and reproductive rights frameworks will help position it within the Sustainable Development Goals (SDGs), particularly SDG 3 (health), SDG 4 (education), and SDG 5 (gender equality).

### Strengths and Limitations

The strengths of this study include its large, representative sample, use of a standardized questionnaire, and comprehensive assessment of both knowledge and practices across multiple domains. Conducting the survey online via Google Forms ensured wide coverage at low cost, while maintaining anonymity and minimizing reporting bias. However, limitations should be acknowledged. First, self-reported data are subject to recall and social desirability bias, especially on sensitive issues such as restrictions and disposal. Second, the study included only school-going girls, potentially excluding out-of-school adolescents who may face greater vulnerabilities. Third, while associations were observed with socio-demographic factors, causal inferences cannot be drawn due to the cross-sectional design. Despite these limitations, the study provides robust and timely evidence to inform adolescent health programming in India and beyond.

## CONCLUSION

This study among 5,433 school-going adolescent girls in Shimla district highlights both significant progress and persistent challenges in menstrual health. Encouragingly, awareness before menarche was high, sanitary pad use was nearly universal, and hygiene practices such as bathing and handwashing were widely adopted. However, major knowledge gaps persisted regarding the physiology of menstruation, the source of menstrual blood, and the normal cycle length. Unsafe disposal practices, though infrequent, were present, and socio-cultural restrictions—such as temple exclusion, food taboos, and social isolation—remained deeply entrenched. Health-seeking behavior was fairly strong, yet recognition of comprehensive warning signs was limited. Across domains, socio-economic and educational disparities were the strongest determinants of menstrual knowledge, practices, and restrictions, while household structure had minimal influence.

### Recommendations

- **Strengthen school-based education:** Menstrual health should be integrated into the formal curriculum through age-appropriate, scientifically accurate, and gender-sensitive modules, supported by trained teachers and health educators
- **Enhance parental and community engagement:** Since mothers remain the primary source of information, programs should equip parents with accurate knowledge, while engaging fathers, peers, and community leaders to challenge taboos
- **Improve menstrual waste management:** Policies must ensure access to safe and sustainable disposal options in schools and communities, coupled with education on environmentally sound practices
- **Target socio-economically disadvantaged groups:** Equity-driven interventions should prioritize families with lower income and education, where knowledge gaps and restrictive practices are more prevalent
- **Promote health-seeking behavior:** Adolescent health services should be strengthened to provide confidential, adolescent-friendly counseling and care, with a focus on early recognition of menstrual morbidities
- **Foster cultural change:** Multi-level interventions involving schools, families, media, and policymakers are needed to dismantle harmful socio-cultural restrictions and normalize menstruation as a healthy biological process
- By addressing both the informational and socio-cultural dimensions of menstruation, these recommendations can contribute to advancing adolescent health, gender equality, and dignity. In alignment with global commitments under the Sustainable Development Goals, menstrual health must be positioned as a central component of adolescent well-being and human rights

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