

Menstrual Product Use, Environmental Awareness, and Willingness to Adopt Menstrual Cups Among Young Women in Bangalore

Fathima Kinza Tirupattur¹, Deepa Lingadahalli Nanjundaswamy², Netra Gouda³

¹Student, Department of Community Medicine, East Point College of Medical Sciences & Research Center, Bangalore, India. ²Professor and HOD, Department of Community Medicine, Sri Madhusudan Sai Institute of Medical Sciences and Research, Muddenahalli, Karnataka, India. ³Associate Professor, Department of Community Medicine, PES University Institute of Medical Sciences and Research, Bengaluru, India

Abstract

Background: Despite availability of sustainable menstrual products, disposable sanitary pads remain dominant in India. Limited research examines young women's knowledge about health and environmental impacts of different menstrual products. Patterns of menstrual hygiene established during adolescence and young adulthood exert lasting effects on women's reproductive health. The objective is to assess menstrual product usage patterns, knowledge about health and environmental effects of disposable products, and awareness about menstrual cups among degree college-going women in Bangalore, India. **Material and Methods:** A cross-sectional study was conducted among 443 degree college women in Bangalore using structured questionnaires after obtaining institutional ethical approval. Data collected included current menstrual product usage, knowledge about health and environmental effects of disposable products, and existing awareness about menstrual cups. Awareness levels were categorized as good (>75%), satisfactory (50-75%), poor (25-50%), or very poor (<25%). **Results:** Sanitary pads were used by 97.7% of participants, with only 0.9% using menstrual cups. While 42% found disposable products expensive, they continued using them. Overall, 42% had good awareness about ill effects of disposable products, but 46.7% were unaware that pads are non-biodegradable, and 75% were unaware about tampons. Regarding menstrual cups, 49.4% had good awareness, only 37.5% of participants expressed willingness to try menstrual cups despite awareness. **Conclusion:** Significant gaps exist between product knowledge and usage patterns. Despite awareness of disposable products' drawbacks, they remain dominant. The menstrual cup remains largely unknown through formal healthcare channels. Targeted educational interventions and healthcare provider engagement are urgently needed to promote sustainable menstrual health management.

Keywords: Menstrual hygiene management, menstrual cup, sanitary pads, environmental health, women's health, college students.

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INTRODUCTION

Menstruation remains shrouded in taboos including impurity, untouchability, embarrassment, and shame in developing countries like India.^[1] This cultural context keeps menstruation-associated issues underdiscussed, leaving women inadequately informed about menstrual hygiene and available product options.^[1] Patterns of menstrual hygiene established during adolescence and young adulthood exert lasting effects on women's reproductive, environmental, and psychosocial health, underscoring the relevance of a life-course approach to mid-life health and well-being.

Disposable sanitary pads and tampons dominate the Indian menstrual product market despite being expensive, containing harmful pesticides and carcinogenic chemicals, causing genital infections, and creating significant environmental waste.^[1-6] These products contain non-biodegradable plastics that clog drainage systems and accumulate in landfill sites.^[2,3,5]

The menstrual cup—a reusable product made of health-grade, non-toxic, eco-friendly silicone—offers a sustainable alternative.^[1,2,4,7] It collects more menstrual fluid than disposable products can absorb and minimizes leakage, foul odour, skin allergies, urogenital infections, and Toxic Shock

Syndrome.^[1,3-4,8-9] Despite being developed decades ago, menstrual cup awareness and usage remain astonishingly low.^[6] Contributing factors to low menstrual cup adoption include ignorance about the hazardous effects of disposable products, inadequate advertisement and advocacy of menstrual cups, inaccessibility, fear of discomfort, and lack of education and support.^[6] Studies suggest that with proper education, more women are likely to opt for menstrual cups.^[6]

Few studies have comprehensively evaluated awareness about menstrual cups alongside detailed assessment of knowledge about commonly used menstrual products. This study addresses this gap by examining the current landscape of menstrual product usage and knowledge among degree college-going women in

Address for correspondence: Dr. Netra G, Associate Professor, Department of Community Medicine, PES University Institute of Medical Sciences and Research, Bengaluru, India. E-mail: drnetragouda23@gmail.com

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Bangalore, India.

Objectives:

1. To determine the pattern of menstrual products used for menstrual management among degree college- going women
2. To assess awareness of different menstrual products and their effects on health and environment
3. To evaluate existing knowledge about menstrual cups and willingness to use them

MATERIALS AND METHODS

Study Design and Setting: This cross-sectional study was conducted among degree college-going women within a 5 km radius of a medical college in east Bangalore, Karnataka, India, from March 2021 to April 2022.

Study Population:

Inclusion Criteria:

- Women who had attained menarche and experienced at least six menstrual cycles
- Currently enrolled in degree college
- Willing to provide informed consent

Exclusion Criteria:

- Women who did not provide consent

Sample Size Calculation: Using the formula

$$\frac{4pq}{d^2}$$

with $p = 36\%$ (based on previous study [10],

$q = 64\%$, and

$d = 13\%$ of p ,

the calculated sample size was 410. Adding 5% for potential non-response, final sample size was 430.

Sampling Technique: All degree colleges within the specified radius were listed and numbered. Using a random number table, colleges were selected sequentially until the sample size was achieved.

Prior written approval was obtained from the Institutional Ethics Committee. The permission to collect data was sought from the concerned authority of the college. The research objectives was briefed. Each participant completed a consent form and received participant information sheets in English and Kannada. Data were collected using pre-designed, pre-tested, self-administered questionnaires covering demographic information, current menstrual practices, knowledge about disposable products, and knowledge about menstrual cups.

Data were analysed using SPSS software(v). Descriptive statistics included frequencies and percentages. Chi-square tests examined associations between variables, with P -value <0.05 considered statistically significant.

Awareness Scoring System: Knowledge about disposable products and menstrual cups was scored based on correct responses. Awareness levels were classified as:

- Good: $>75\%$ correct responses
- Satisfactory: 50-75% correct responses
- Poor: 25-50% correct responses
- Very poor: $<25\%$ correct responses

RESULTS

As shown in [Table 1], 55.8% of participants belonged to the 18-20 years age group, and 43.1% belonged to the 21-23 years age group. The majority (90.3%) were pursuing health-related courses (medicine or science), whereas 9.7% were pursuing other courses.

Table 1: Distribution of Participants According to Their Age and Degree Pursued

	Category	Frequency (n=443)	Percentage
Age	18-20	247	55.8
	21-23	191	43.1
	24-26	5	1.1
Degree pursued	MBBS	239	54
	Bachelor of Science	161	36.3
	Bachelor of Arts/Commerce	31	7
	Engineering/Architecture	12	2.7

Table 2: Correlation of Degree Pursued by the Participant with Willingness to Use the Menstrual Cup

Degree pursued	Willing to try the menstrual cup	Frequency	Percentage
MBBS/BSc. (n=400)	Yes	150	37.5
	No	247	61.8
	Already a user	3	0.8
BA/BCom/Engineering/Architecture (n=43)	Yes	21	48.8
	No	21	48.8
	Already a user	1	2.3
Total		443	

Among those pursuing health-related courses, 37.5% were willing to try menstrual cups, compared to 48.8% of those pursuing other courses ($p = 0.015$), indicating a statistically significant relationship. [Table 2]

Current Menstrual Product Usage

The overwhelming majority (97.7%) used sanitary pads, followed by cloth (1.1%), menstrual cups (0.9%), and tampons (0.2%). [Figure 1]

Table 3: Participants experience of using the sanitary pad (n=443)

	Category	Frequency (n=443)	Percentage
Frequency of changing pad per day	Once	16	3.6
	Twice	114	25.7
	Thrice	214	48.3
	>3 times	99	22.3

Satisfaction using the pad in public place	Satisfactory	349	78.8
	Unsatisfactory	94	21.2
Comfort wearing the pad under close- fitting/light colored outfits	Comfortable	221	49.9
	Uncomfortable	222	50.1
Comfort & efficiency of sanitary pad at night	Efficient	260	58.7
	Inefficient	183	41.3
Comfort & efficiency of sanitary pad during exercise/sports	Efficient	190	42.9
	Inefficient	253	57.1
Ill effect experienced by pad user*	Leakage	292	65.9
	Foul odor	173	39.1
	Interference with mobility/activities/sleep	204	46
	Frequent changing/Difficulty in changing	280	63.2
Method of disposal of used menstrual products	Wrapped and disposed into bins	425	95.9
	Flushed down the toilet	9	2.0
	Wash and reuse	9	2.0

*Multiple responses allowed

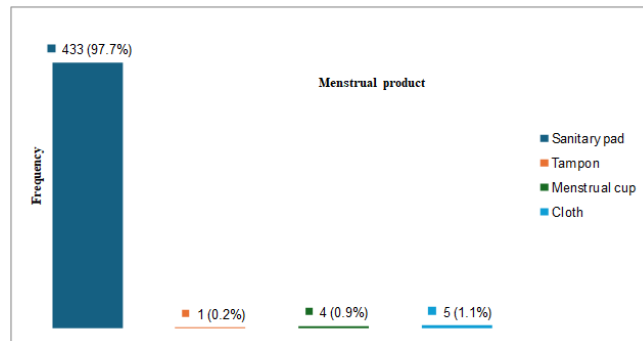


Figure 1: Pattern of usage menstrual product usage among the participants

Experience with Sanitary Pads

As shown in [Table 3, 48.3% of sanitary pad users changed their pads three times a day, while 22.3% changed them more than three times per day. While 78.8% of users were satisfied with pad efficiency in public places, 50.1% were uncomfortable wearing pads under close-fitting or light-colored clothes, 41.3% did not find pads efficient during sleep, and 57.1% were unsatisfied with their efficiency during exercise or sports. The majority (65.9%) experienced leakage, 39.1% reported foul odor, 46% reported interference with daily activities, and 63.2% found frequent changing inconvenient.

Cost Perceptions of Disposable Products:

Table 4: Opinion of Users Regarding the Affordability of Disposable Pads and Tampons

Affordability	Frequency	Percentage
Cheap	38	8.6
Expensive	186	42.0
Reasonable	219	49.4

Despite 42% finding these products expensive, 97.7% continued using them. [Table 4]

Knowledge About Disposable Sanitary Products

Table 5: Participants' knowledge of the ill effects of disposable pads and tampons on the users' health & the environment

		Frequency (n=443)	Percentage
Disposable pads are-	Biodegradable	103	23.3
	Non-biodegradable	236	53.3
	Don't know	104	23.5
Disposable tampons are-	Biodegradable	81	18.3
	Non-biodegradable	110	24.8
	Don't know	252	56.9
Ill effect on the user's health*	Allergy/Rash/Chafing/Vaginal irritation	426	96.2
	Bacterial or fungal infection/Fever/Urine infection	214	48.3
	Genital cancer	76	17.2
	Presence of plastics & toxins like carcinogens, pesticides	442	99.8
Ill effect on the environment*	Choking drainage systems	328	74
	Micro plastics in the oceans	221	49.9
	Increased solid waste/Breeding of microbes and flies/Reduced groundwater	357	80.6
	Release of toxic and carcinogenic fumes on burning	199	44

As shown in [Table 5], 46.7% and 75% of the participants were not aware about the non-biodegradable nature of disposable sanitary pads and tampons respectively. Only 17.2 knew that use of pads and tampons pose a risk of genital cancer. 80.6% of the participants knew that the disposable

sanitary napkins and tampons contributed to increased solid waste and breeding of flies/ microbes in landfill sites, and 74% knew they clog drainage systems due to their absorbent nature. Only 44% were aware about the toxic pollutant fumes released on burning these products.

Correlation Between Knowledge and Willingness:

Table 6: Correlation of knowledge about non-biodegradability of disposable sanitary pads and willingness to use the menstrual cup

Participant's knowledge of the sanitary pad	Participant is willing to use/already uses the cup	Frequency	Percentage
Non-biodegradable (n=236)	Yes	217	91.9
	No	19	8.1
Biodegradable/Don't know (n=207)	Yes	177	85.6
	No	30	14.4
Total		443	

Among participants who knew pads are non-biodegradable, 91.9% were willing to use menstrual cups, compared to 85.6% of those unaware ($p = 0.023$), showing a statistically significant relationship. [Table 6]

Overall Awareness About Disposable Products:

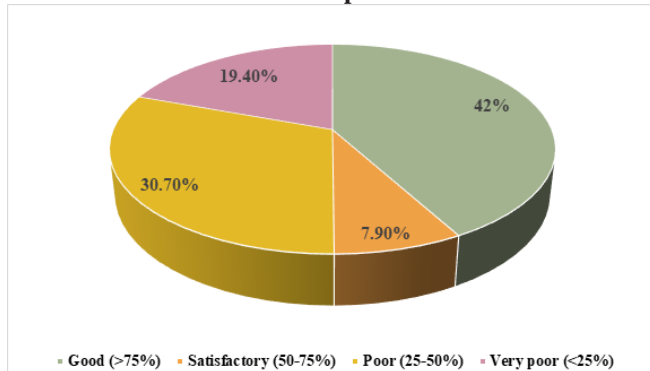


Figure 2: Overall level of awareness of participants about effects of disposable sanitary products on the users' health and the environment

42% of the participants had good awareness and 30.7% of the participants had poor awareness.

DISCUSSION

Dominance of Disposable Sanitary Pads: Our study found that 97.7% of degree college-going women use sanitary pads, with minimal usage of menstrual cups (0.9%) and tampons (0.2%). This pattern is consistent with Choi et al.'s findings in Korea, where 89.0% used pads, though Korea showed higher tampon (4.2%) and menstrual cup (1.6%) usage.^[10] The use of disposable pads despite awareness of their drawbacks, highlights the complex factors influencing menstrual product choice beyond knowledge alone.

Choice of menstrual product is influenced by personal preferences, resource availability, economic status, cultural traditions and beliefs, education status, knowledge about menstruation, and peer opinion.^[2,6]

Knowledge-Practice Gap in Menstrual Product Selection: A striking finding was that 42% of participants considered disposable products expensive, yet 97.7% continued using them. This economic contradiction suggests strong habitual and social factors maintaining disposable pad usage. Similar findings by Arugula et al. showed that 59.25% of users were unsatisfied with sanitary napkin prices yet continued using them.^[4]

The gap between knowledge and practice was further evident in biodegradability awareness: 46.7% were unaware that pads are non-biodegradable, and 75% were unaware

regarding tampons. Those aware of non-biodegradability showed significantly higher willingness to try menstrual cups (91.9% vs. 85.6%, $p = 0.023$), demonstrating that environmental knowledge does influence attitudes, even if it doesn't immediately change behaviour.

User Experience with Sanitary Pads: Our participants reported significant problems with sanitary pads which align with Arugula et al., who found that 47.55% experienced discomfort and rashes.^[4] Despite these widespread problems, the habitual use of pads persists, likely due to lack of knowledge about practical alternatives and social normalization of these discomforts as "normal" menstrual experiences.

Environmental Impact Awareness: While 80.6% knew disposable products contribute to solid waste and 74.0% knew they clog drainage systems, only 49.9% were aware of microplastics in oceans and 44.0% knew about toxic fumes from burning these products. This partial awareness is concerning given the environmental crisis posed by menstrual waste.

According to the National MHM consultation, India's annual estimated waste load is 12 billion pads, most non-compostable.^[11] As Kaur et al. note, deodorized sanitary products contain organochlorines that kill soil microflora and delay decomposition.^[2] Our finding that 2% of participants flush used products down toilets adds to the environmental burden through clogged drains and sewage backflow.

The disposal practice of 95.9% of users—wrapping products and placing them in domestic bins—contributes significantly to solid waste accumulation in landfills. This highlights the urgent need for environmental education alongside promotion of sustainable alternatives.

Limited Awareness of Health Risks

While 96.2% knew about allergies and infections, and 99.8% knew about toxic chemicals in disposable products, only 17.2% were aware of genital cancer risks. This knowledge gap is significant given documented correlations between organic solvents and endometriosis, premature birth, spontaneous abortion, congenital malformations, and infertility.^[6]

The low awareness of cancer risk despite high awareness of chemical content suggests that health education focuses on immediate, visible effects (rash, irritation) rather than long-term, serious health consequences. This represents a missed opportunity for health promotion.

Menstrual Cup Awareness: The Information Source Gap

A critical finding was that only 5.6% of participants learned about menstrual cups from healthcare providers, while 74% learned from internet, television, or social media. This healthcare provider gap is concerning, as it represents a missed opportunity for accurate, personalized information delivery.

Divakar et al. found similar patterns, wherein 50% of healthcare providers thought menstrual cups appropriate for young girls, but

only 35% proactively advocated for them, with most users relying on internet and peer groups.^[12,13] The predominance of informal information sources may contribute to misconceptions and incomplete knowledge.

Interestingly, willingness to try cups was not significantly different between those informed by healthcare providers (75.0%) versus other sources (89.5%, $p = 0.462$). However, the quality and accuracy of information, along with the ability to address individual concerns, likely differ substantially between these sources.

Knowledge About Menstrual Cups: Gaps and Misconceptions

Despite 88.7% having heard of menstrual cups, significant knowledge gaps existed these gaps suggest that awareness of menstrual cups' existence does not equate to comprehensive knowledge about their use and benefits. The finding that 49.4% had "good" overall awareness yet only 37.5% were willing to try cups indicates that even good awareness may be insufficient without addressing specific fears and practical concerns.

Educational and Cultural Factors

The finding that 48.8% of those pursuing non-health-related courses were willing to try menstrual cups compared to 37.5% of health-related students ($p = 0.015$) was unexpected. This may reflect greater openness to alternative practices in non-medical fields, or potentially more skepticism among medical students without formal curriculum coverage of menstrual health management options.

No significant relationship was found between family income and willingness to try menstrual cups, suggesting that affordability concerns may be less significant than cultural, informational, and practical barriers.

Most participants (93.7%) were sexually inactive, which may influence attitudes toward internal menstrual products. Cultural associations between virginity and menstrual cup use represent a significant barrier requiring culturally sensitive educational approaches.

Implications for Menstrual Health Management

As Kaur et al. acknowledge, schools should organize open discussions on puberty, sex education (including reproductive system knowledge), and menstruation to provide students with accurate information and clear their queries, ultimately raising well-informed women.^[2] Our findings support this recommendation and extend it to higher education settings.

The persistence of taboos and inadequate discussion of menstruation keeps women ignorant about menstrual hygiene and product options.^[1] Despite our participants being educated young adults with internet access, significant knowledge gaps persist, suggesting that formal, comprehensive menstrual health education is needed throughout the educational trajectory.

CONCLUSION

This study reveals a complex landscape of menstrual product usage among educated young women in India. Despite relatively high education levels and internet access, disposable sanitary pads dominate (97.7%), with minimal

menstrual cup usage (0.9%). Significant knowledge gaps exist regarding environmental impacts of disposable products and benefits of sustainable alternatives.

The most concerning finding is the disconnect between knowledge and practice: participants continue using products they know are expensive, environmentally harmful, and associated with health risks. Meanwhile, menstrual cups remain largely unknown through formal healthcare channels, with only 5.6% learning about them from healthcare providers.

Key Takeaways

1. Knowledge does not equal behavior change: 42% had good awareness about disposable products' harms yet 97.7% continued using them
2. Environmental education is inadequate: 46.7% unaware of pad non-biodegradability; 75% unaware about tampons
3. Healthcare providers are underutilized: Only 5.6% learned about menstrual cups from medical professionals
4. The willingness-action gap is substantial: Only 37.5% willing to try cups despite awareness

Recommendations: Healthcare providers, educators, and public health officials should offer clear, culturally sensitive menstrual health information, integrate menstrual education into routine practice and curricula, and promote awareness of sustainable options like menstrual cups. Researchers should identify barriers, cultural influences, and effective interventions to support informed product choice and behaviour change.

Bridging the knowledge-to-practice gap requires multi-level interventions addressing individual knowledge, social norms, healthcare system engagement, and product accessibility.

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Conflicts of interest

There are no conflicts of interest.

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