

A Statistical Comparison of Menstrual Cup and Sanitary Pad Usage Among Women of Reproductive Age

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Abstract—Menstrual Hygiene Management (MHM) is an important public health issue with implications for women's health and environmental sustainability. This study presents a cross-sectional statistical comparison of menstrual cup and sanitary pad usage among women of reproductive age in Thiruvananthapuram district, Kerala. Primary data were collected from 327 respondents using a structured questionnaire addressing demographic characteristics, product preference, comfortability, health concerns, disposal practices, and environmental awareness. Due to non-normal data distribution, non-parametric methods including Spearman's rank correlation, Chi-square test, Kruskal–Wallis H test, and Mann–Whitney U test were employed.

Results showed that 19.6% of respondents used menstrual cups, while 80.4% relied on sanitary pads. Significant associations were observed between menstrual product preference and educational qualification, disposal methods and environmental concern, and comfortability across age groups. A moderate positive correlation was identified between satisfaction level and duration of menstrual cup usage. The findings suggest that menstrual cups offer a sustainable and satisfactory alternative to disposable sanitary pads and highlight the need for increased awareness and policy interventions to promote sustainable menstrual hygiene practices

Index Terms—Menstrual Hygiene Management, Menstrual Cup, Sanitary Pad, Sustainable Menstruation, Environmental Impact, Non-Parametric Statistics.

I. INTRODUCTION

Menstrual Hygiene Management (MHM) refers to the hygiene-related practices and health requirements of girls and women during menstruation, including access to appropriate information, materials, and facilities that enable menstrual management in a safe, dignified, and private manner [11]. Over their reproductive lifespan, women experience

menstruation for several decades, amounting to thousands of menstruating days, making effective menstrual hygiene management a critical public health concern [9].

Menstrual hygiene materials are used to absorb or collect menstrual blood and include disposable sanitary pads, tampons, menstrual cups, and reusable cloth-based products. Among these, disposable sanitary pads remain the most widely used menstrual product worldwide [12]. On average, a woman uses approximately 15–20 sanitary pads per menstrual cycle, and across her reproductive years—from menarche to menopause—this results in the consumption of thousands of pads, leading to a substantial accumulation of menstrual waste [11]. Consequently, the disposal of menstrual waste has emerged as a significant environmental challenge.

The concept of sustainable menstruation emphasizes the use of environmentally friendly and ethically produced menstrual products that minimize health risks and ecological damage. Sustainable alternatives include biodegradable sanitary pads, reusable cloth pads, and menstrual cups. Conventional disposable menstrual products are largely composed of plastic-based materials and are non-biodegradable, often requiring several hundred years to decompose, thereby contributing substantially to solid waste accumulation [11], [12].

II. AIM AND RESEARCH OBJECTIVES

A. AIM

To understand the preference of menstrual products among different age groups and to know about the factors affecting the preference.

B. OBJECTIVES

- **Comparative assessment:** To compare menstrual cup and sanitary pad users in terms of cost-related perception, comfortability, ease of use, duration of use, disposal practices, and environmental concern.
- **User experience and concerns:** To assess satisfaction levels and reported concerns (e.g., leakage, discomfort, allergy/irritation) associated with each menstrual product.
- **Barriers to menstrual cup adoption:** To identify key barriers to menstrual cup uptake, including lack of awareness, fear of insertion, cultural stigma, discomfort, and prior negative experiences.
- **Health-related outcomes:** To evaluate self-reported health implications linked to menstrual product use, such as irritation, suspected infections, and other reproductive health complaints.
- **Environmental impact perspective:** To examine environmentally relevant practices and perceptions, particularly disposal methods and environmental awareness, and their association with product choice.
- **Demographic determinants:** To analyze the association of demographic characteristics (age, education, occupation, marital status, and awareness of menstrual cups) with menstrual product preference.

III. LITERATURE REVIEW

MHM has emerged as a critical area of research within public health, gender studies, and environmental sustainability due to its implications for women's health, dignity, and ecological well-being [11]. Several studies have examined menstrual hygiene practices, access to menstrual products, and their associated health and social outcomes. Disposable sanitary pads have traditionally been the most commonly used menstrual product; however, growing concerns regarding waste generation, cost, and long-term health effects have led to increased interest in sustainable alternatives such as menstrual cups [12].

Previous research has highlighted the economic advantages of menstrual cups over disposable

sanitary products. Cost-effectiveness analyses conducted in low- and middle-income settings have demonstrated that menstrual cups offer substantial long-term financial benefits by reducing recurrent expenditure on disposable products [7]. These studies also suggest that the use of menstrual cups may contribute positively to school attendance and daily activity participation among adolescent girls and women [11].

Acceptability and user satisfaction have been widely explored in different cultural contexts. Several studies report that while initial adoption of menstrual cups is relatively low, users who adopt them often express high levels of satisfaction and willingness to recommend them to others [3], [7]. Factors such as comfort, reduced leakage, and convenience during prolonged use have been identified as key contributors to user satisfaction. Nevertheless, barriers including fear of insertion, lack of awareness, cultural stigma, and misconceptions regarding safety continue to limit widespread adoption [12].

From a health perspective, systematic reviews and clinical studies have found no significant increase in the risk of infections or adverse reproductive health outcomes associated with menstrual cup usage when proper hygiene practices are followed [4], [12]. These findings position menstrual cups as a safe alternative to conventional menstrual products. In contrast, disposable sanitary pads have been associated with skin irritation and allergic reactions among some users, largely attributed to chemical components and prolonged moisture exposure [9].

Environmental impact has become an increasingly important dimension in menstrual hygiene research. Studies examining menstrual waste disposal practices report that disposable sanitary pads contribute significantly to non-biodegradable waste and environmental pollution [11]. In contrast, menstrual cups generate minimal waste due to their reusable nature, making them a more sustainable option [12]. Public awareness studies further indicate that environmental concern influences menstrual product choice, particularly among educated and urban populations [11].

Despite the growing body of literature on menstrual hygiene products, limited research has employed rigorous statistical methods to simultaneously

examine demographic, behavioral, health-related, and environmental factors influencing menstrual product preference. In particular, empirical evidence comparing menstrual cup and sanitary pad usage using non-parametric statistical techniques in the Indian context remains scarce. The present study addresses this gap by conducting a comprehensive statistical analysis of factors affecting menstrual product choice among women of reproductive age, thereby contributing to evidence-based policy formulation and sustainable menstrual hygiene promotion.

IV. METHODOLOGY

The study adopted a cross sectional descriptive research design to examine the usage patterns, preference, comfortability and benefits associated with sanitary pads and menstrual cups among women.

A. DATA SOURCE

The study is based on the primary data collected using a structured questionnaire mainly focusing on Thiruvananthapuram. A total of 327 respondents participated in the study. The participants comprised women from different age groups, marital status, and educational backgrounds

B. STATISTICAL ANALYSIS

The collected data were coded and analyzed using statistical software such as SPSS, MS EXCEL and R Studio [1], [2]. Both descriptive and inferential statistics [5], [6] were carried out according to the study objectives. The normality test was conducted by using Kolmogorov-Smirnov test. Spearman Correlation, Chi square, Kruskal Wallis H Test and Mann Whitney U Test [4], [10] were performed.

V. RESULTS

Out of 327 participants, 64(19.6%) respondents are using Menstrual cups and 263(80%) are using Sanitary pads. Most of the participants (64.2%) are in the age group of 19-27. Figure 1 concludes that a menstrual cup is better than a sanitary pad. Table 1 presents the problems faced by the menstrual cup and sanitary pad. Nearly 33.6% dispose of sanitary pads

by burning. Hence it is clear that sanitary pads make more environmental impacts.

FIGURE 1 THE MULTIPLE BAR DIAGRAM OF COMPARISON OF MENSTRUAL CUP AND SANITARY PAD

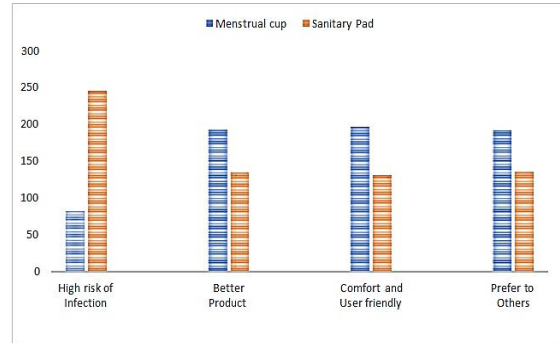


TABLE 1 THE PROBLEMS FACED BY MENSTRUAL CUP AND SANITARY PAD

Problems	Menstrual cup	Sanitary pad
Itching	11	16
Allergic	17	83
Discomfort while walking, sleeping, sitting etc.	3	14
Difficult to change frequently	3	165
No problem	10	5

Table 2 presents the Spearman’s correlation between Menstrual Cups and different selected study variables. Since, p-value = 0.002 < 0.05 in the correlation of satisfactory level and duration of product usage (Menstrual Cups), conclude that there is statistically significant correlation between satisfaction level and duration of product usage. And there is a moderate positive correlation relationship (r = 0.446) between satisfaction level and duration of product usage (Menstrual cup). The relation between age group and awareness about menstrual cup has a low positive correlation relationship, r = 0.319 (p value= 0.035 < 0.05). Also, there is a weak correlation relationship between age group and awareness about menstrual cup, r =0.142 (p value = 0.017<0.05).

TABLE 2 SPEARMAN'S RANK CORRELATION

	r	P Value
How long do you use a menstrual cup at a time & Comfortable	.446*	.002
Aware about menstrual cup & Age group	.319*	.035
How long do your sanitary pad at a time & Comfortability	.142*	.017

Table 3 presents the Chi square analysis and shows no statistically significant association between marital status and ease of use, p value = 0.872 >0.05. Significant associations were observed between disposal methods and environmental concern, p value = 0.026 < 0.05 and between menstrual product preference with age and educational qualification, p value = 0.001 < 0.05

TABLE 3 CHI SQUARE TEST

	Chi-square	P Value
Marital Status & Ease use of menstrual Cups	0.273292	0.872
Environmental impact of Sanitary Pads & Disposal Methods	18.90620	0.026
Preferred menstrual product & educational qualification	10.793	0.001

Table 4 presents Kruskal Wallis H Test results indicating significant difference in menstrual products preference across educational status, p=0.013 <0.05 and in comfortability levels across different age groups, p value = 0.017 <0.05.

TABLE 4 KRUSKAL WALLIS H TEST

	Kruskal-Wallis H	P Value
Preferences between menstrual cup and sanitary pad across different educational status.	10.760	.013
Comfortability level across different age groups	12.006	.017

Table 5 presents Mann Whitney U Test results showing a significant difference between perceived benefits and duration of menstrual cups usage, p

value = 0.001 < 0.05, while no significant difference between age groups and Comfortability level among sanitary pad users, p value = 0.541 > 0.05

TABLE 5 MANN WHITNEY U TEST

	Mann Whitney	P Value
Benefits and duration of the menstrual cup.	2.000	0.0000
Age group and comfortability of the sanitary pad	3266.000000	0.541314

VI. CONCLUSION

This study provides a comprehensive statistical comparison of menstrual cups and sanitary pads with respect to effectiveness, comfort, cost-related perceptions, environmental impact, and health considerations. The findings indicate that menstrual cups demonstrate comparable, and in some aspects superior, performance relative to sanitary pads, particularly in terms of user comfort, convenience, and duration of use. Higher satisfaction levels reported among menstrual cup users suggest increased acceptance with continued usage.

The analysis also underscores the substantial environmental advantages of menstrual cups, as they are associated with significantly lower waste generation compared to disposable sanitary pads, which are often disposed of using environmentally harmful methods. From a health perspective, both menstrual cups and sanitary pads were found to be generally safe when used appropriately; however, adherence to proper hygienic practices remains essential to minimize potential health risks.

Overall, the results support menstrual cups as a cost-effective, sustainable, and user-satisfactory alternative to disposable sanitary pads. The study highlights the importance of awareness programs, educational initiatives, and supportive policy measures to address misconceptions and barriers to adoption. Continued research with broader populations and longitudinal designs is recommended to further strengthen evidence on sustainable menstrual hygiene practices and inform public health

interventions aimed at improving women's reproductive health and environmental sustainability.

VII. LIMITATIONS

Despite the significance of the findings, the study has certain limitations that should be acknowledged. First, the survey was confined to a specific geographical area, which may limit the generalizability of the results to wider populations. Second, the sample size was restricted to 327 participants due to time and logistical constraints, which may have influenced the statistical power of the analysis. Additionally, the study relied on self-reported responses, which are subject to personal perceptions and may introduce response bias. Finally, the cross-sectional nature of the study restricts causal interpretation of the observed associations. Future research involving larger, multi-regional samples and longitudinal designs is recommended to enhance the robustness and generalizability of the findings.

VIII. SUGGESTIONS

Based on the findings of the present study, the following suggestions are proposed to improve menstrual hygiene management practices and promote the adoption of sustainable menstrual products:

1. **AWARENESS AND EDUCATION PROGRAMS:** Structured awareness campaigns should be conducted to improve knowledge about menstrual cups, focusing on correct usage, hygiene practices, and health safety, particularly among younger women and first-time users.
2. **TARGETED INTERVENTIONS FOR ADOPTION BARRIERS:** Educational initiatives should address common barriers to menstrual cup adoption, such as fear of insertion, cultural stigma, and misinformation, through demonstrations, counseling sessions, and peer-led programs.
3. **INCLUSION IN PUBLIC HEALTH POLICIES:** Menstrual cups may be incorporated into government-led menstrual hygiene schemes and community health programs as a sustainable and

cost-effective alternative to disposable sanitary pads.

4. **ENVIRONMENTAL SENSITIZATION:** Public education programs should emphasize the environmental impact of sanitary pad disposal and promote environmentally responsible menstrual hygiene choices.
5. **PRODUCT ACCESSIBILITY AND AFFORDABILITY:** Subsidization and free distribution of menstrual cups, especially in rural and low-income settings, may enhance accessibility and long-term usage.
6. **FUTURE RESEARCH DIRECTIONS:** Further studies with larger, multi-regional samples and longitudinal designs are recommended to assess long-term health outcomes, behavioral changes, and sustainability impacts associated with menstrual cup usage.

IX. FUTURE SCOPE

Future studies may extend this research by including larger and more diverse populations to improve generalizability. Longitudinal designs can be used to examine changes in menstrual product preferences, satisfaction, and health outcomes over time. The application of advanced statistical models may help identify key predictors of menstrual cup adoption. Additionally, integrating environmental life-cycle assessments and qualitative approaches could provide deeper insights into sustainability impacts and behavioral factors influencing menstrual hygiene choices.

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