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ALUPE UNIVERSITY MULTIDISCIPLINARY RESEARCH JOURNAL

journal website: aujournal.au.ac.ke

A Publication of Alupe University



ALUPE UNIVERSITY
Bastion of Knowledge

DOI: <https://doi.org/10.65466/y4kc5e27>

eISSN: 3106-0013

Environmental impact of plastic-based menstrual products in Kenya

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ARTICLE INFO

ABSTRACT

KEYWORDS

Menstrual Products,

Plastic Waste,

Sustainable Menstrual Alternatives,

Environmental Impact,

Microplastic Pollution

Globally, approximately 1.8 billion women of reproductive age menstruate monthly, generating significant waste from disposable menstrual products, which are primarily made of plastic and contain harmful chemicals. These products can release toxic substances, including endocrine disruptors and carcinogens, raising concerns about their environmental impact. The purpose of this study was to evaluate consumer awareness of the environmental risks associated with plastic-based menstrual products and to promote sustainable alternatives to reduce waste and pollution. The objective of this study was to assess the level of concern about impact of

commercial plastic-based menstrual product waste on the environment. The study adopted a quantitative approach and descriptive survey design to collect data on the level of concern about impact of plastic-based menstrual products on the environment. Quantitative data was gathered using questionnaires distributed to randomly selected secondary school girls in boarding schools at National, Extra- County and County level in Homa-Bay County, Kenya. Data was collected from 930 students which formed 30% of the students in three selected schools. Quality control was ensured using both validity and reliability of the data collection instruments. The findings suggest that there is a high level of awareness and concern among the majority of respondents regarding the environmental consequences of plastic menstrual product waste. The high level of concern may indicate a potential demand for more sustainable alternatives and could influence future product development and environmental policies related to menstrual products. This may encourage policymakers to address these concerns through regulations or initiatives aimed at promoting safer alternatives. The study recommends promotion of sustainable menstrual product alternatives such as menstrual cups,

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reusable pads, and period underwear which can significantly reduce plastic waste and environmental impact; manufacturers invest in research and development of safer, sustainable alternatives and stakeholders—including policymakers, manufacturers, and advocacy groups—collaborate to implement comprehensive awareness campaigns that educate consumers about the benefits and availability of sustainable option

Introduction

Menstruation is a natural and healthy biological process experienced by approximately 1.8 billion women of reproductive age globally each month (Anaba *et al.*, 2022). This represents about 26% of the world's population, with nearly 800 million individuals menstruating daily (House *et al.*, 2013). Across a lifetime, a woman menstruates between puberty and menopause for an estimated 459 cycles (Harlow & Paramsothy, 2011). During each cycle, most individuals use between three to six pads or tampons per day, amounting to roughly 20–23 pads per cycle. While these products are essential for menstrual hygiene, their widespread use has significant environmental implications due to their composition, disposal practices, and lack of biodegradability.

Globally, disposable menstrual products contribute substantially to waste streams. Over the course of a lifetime, a menstruator may generate up to 200 kilograms of non-biodegradable waste from disposable menstrual products such as pads and tampons (Aujla *et al.*, 2025). A year's worth of typical menstrual product use leaves a carbon footprint equivalent to 5.3 kg of CO₂ emissions (Thampan *et al.*, 2025). In India, for example, approximately 121 million women and girls use an average of eight disposable pads per month, generating 12.3 billion pads annually, much of which ends up in landfills, beaches, or oceans where it persists for decades (van Eijk *et al.*, 2019).

The environmental burden of menstrual products according to Thampan *et al.* (2025) is largely attributable to their composition. Nearly 90% of a menstrual pad and 6% of a tampon is plastic. Pads are primarily composed of polyethylene (PE) and

polypropylene (PP), while tampons contain cotton, rayon, or blends of both. These plastics do not decompose but instead fragment into microplastics smaller than 5 mm, which accumulate in soil and aquatic ecosystems (Citta *et al.*, 2024). PE and PP are among the most prevalent plastics found in oceans, contributing to widespread ecological contamination. Beyond plastic, menstrual product testing has revealed undisclosed toxic chemicals in tampons, raising concerns about both health and environmental risks (Aujla *et al.*, 2024).

Peberdy *et al.*, (2019) posits that in Kenya, menstrual waste management presents mounting challenges. Inadequate waste management infrastructure, coupled with limited public awareness, has led to improper disposal practices that threaten local water sources, soil quality, and broader environmental health. Homa Bay County, located along the shores of Lake Victoria, provides a unique context for studying menstrual product waste. The county has a population of over 1.1 million people and hosts a high concentration of girls' boarding schools near the lake, making it a strategic site for examining menstrual hygiene practices and their environmental impacts. The proximity to Lake Victoria a critical source of livelihood and domestic water heightens the risk of pollution from poorly managed menstrual waste (van Eijk *et al.*, 2019).

The widespread reliance on disposable menstrual products has created a significant environmental challenge. Each product contains large amounts of plastic and other non-biodegradable materials that persist for centuries, contributing to mounting waste streams and microplastic pollution. With billions of pads and tampons discarded annually, improper

disposal practices exacerbate contamination of soil, waterways, and ecosystems. This problem is compounded by limited public awareness and inadequate waste management infrastructure, particularly in low- and middle-income countries. As a result, menstrual products not only meet essential hygiene needs but also generate long-term ecological risks that demand urgent attention (Aujla *et al.*, 2024).

Existing scholarship has largely examined the composition of menstrual products, their waste volumes, and disposal challenges. However, relatively few studies have investigated how consumers perceive the environmental impacts of these products or how such concern shapes the adoption of sustainable alternatives. Research shows that while awareness of the ecological burden of disposable menstrual products is growing, consumer knowledge remains limited, and uptake of reusable or biodegradable options is hindered by cultural, socioeconomic, and informational barriers (Peberdy *et al.*, 2019; Johnson *et al.*, 2025; Citta, *et al.*, 2024). Addressing this gap is crucial for designing effective interventions that promote sustainable menstrual practices.

Against this backdrop, the present study seeks to assess the level of concern about the impact of commercial plastic-based menstrual product waste on the environment, with a particular focus on Homa Bay County, Kenya. Homa Bay County was selected because of its proximity to Lake Victoria and its susceptibility to flooding. Run-off water contaminated with microplastic waste from used sanitary products often drains into the lake, posing risks to aquatic ecosystems and public health. By contextualizing the issue within a region where menstrual waste management challenges intersect with education, cultural norms, and environmental vulnerability, the study aims to generate insights that can inform sustainable

interventions and policy responses. The target population comprised of girls who are enrolled in boarding secondary schools at National, Extra-County, and County levels within Homa Bay County. Boarding schools were prioritized as they generate concentrated menstrual waste within institutional settings.

Methodology

The study was conducted in Homa Bay County, located in Kenya's Nyanza region. The county was purposively selected because of its proximity to Lake Victoria and its susceptibility to flooding. The target population comprised of girls who are enrolled in boarding secondary schools at National, Extra-County, and County levels within Homa Bay County as they form part of the population that uses menstrual products.

A quantitative approach using descriptive survey design was adopted to assess the level of concern about impact of commercial plastic-based menstrual product waste on the environment. Primary data was collected using structured questionnaires.

The Nyanza region comprises Kisumu, Homa Bay, Siaya, Migori, Kisii, and Nyamira counties. Among these, Homa Bay was purposively selected because it has a higher concentration of girls' boarding schools near Lake Victoria. Three schools were selected: one national school (A), one extra-county school (B), and one county school (C) based on their proximity to Lake Victoria.

By October 2024, student enrollment in Form 2, 3 and 4 for the mentioned schools was as follows:

A: Total enrollment was about 1,700 students.

B: The school had approximately 1,000 students.

C: The total enrollment was about 400 students

According to Mugenda and Mugenda (2013), if the accessible population is less than 10,000, a researcher can select 10 – 30 percent to be the

representative sample size. A sample size of 30% of the student population was randomly and proportionately drawn from these schools to ensure representativeness: 510 students in School A, 300 in School B, and 120 in School C, totaling 930 student Sample size.

Number of students	Form Two	Form Three	Form four	Total
A	155	185	170	510
B	107	98	95	300
C	39	41	40	120
Total	930			

Structured questionnaires were administered to randomly selected students in Forms 2–4 to assess awareness of environmental impacts of plastic-based menstrual products and explore sustainable alternatives. This was based on the fact that there was no enrollment of form 1 students in 2024.

To ensure quality of the data collection tool, validity was attained through construct validity. The questionnaire was reviewed by a panel of six public health experts to establish its Item-level Content Validity Indices (I-CVI). Each expert rated the relevance of every item on a 2-point scale (0 = not relevant, 1 = highly relevant)

The relevance ratings on the item scale

	EXP 1	EXP 2	EXP 3	EXP 4	EXP 5	EXP 6	EXPERTS IN AGREEMENT	I-CVI	UA
ITEM	1	1	1	1	1	1	6	1	1
Q1	1	0	1	1	1	1	5	0.83	0
Q2	1	1	1	1	1	1	6	1	1
Q4	1	1	1	0	1	1	5	0.83	0
Q5	1	1	1	1	1	1	6	1	1
Q6	1	1	1	1	1	1	6	1	1
Q7	1	1	1	1	1	1	6	1	1
Q8	1	1	1	1	1	1	6	1	1

Q9	1	1	1	1	1	1	6	1	1
Q10	1	1	1	1	1	1	6	1	1
PROPORTION RELEVANCE	1	0.9	1	0.9	1	1		0.97	0.8

The Average proportion of Items (I-CVI) judged as relevant across the six experts – 0.97

Based on the expert judgement, the Item-level Content Validity Indices (I-CVI) was 0.97 while the Universal Agreement (UA) was 0.8 implying that the items were considerably strongly valid (Yusof, 2019).

Reliability was ensured by carrying out a pilot study and performing an internal consistency reliability test using SPSS. The internal consistency of the data collection instrument was analyzed using Cronbach's alpha where the Cronbach's alpha value for the constructs was .88. A Cronbach's alpha value of 0.85 and above is considered as excellent reliability (Taber, 2018).

The proposal was submitted to the School of Graduate Studies, Kaimosi Friends University for approval. The researcher went ahead to seek for a permit to carry out the study from National Commission of Science, Technology and Innovation (NACOSTI) before the actual data collection commenced. The researcher went to the Homabay county office in charge of education to seek for permission to collect data from schools within the county. The school heads authorized the researcher to go ahead with data collection in their specific schools before the researcher distributed the questionnaire with the aid of the class teachers. The questionnaires used for data collection were accompanied by an introductory letter which briefly introduced the purpose of the

study to the respondents. The researcher went ahead to seek consent of the respondents to take part in the study before they filled in the questionnaires. The data gathered was treated with utmost confidentiality and used for research purposes only.

The collected data was analyzed both descriptively and inferentially. The researcher used means to achieve descriptive data analysis while inferential data analysis was achieved using likelihood ratio test, Chi-square test and independent sample t-test (Asenahabi & Ikoha, 2021). Results were presented in tables to illustrate patterns of awareness, disposal practices, and perceptions of sustainable alternatives.

Results and Discussions

Age of respondents

Data analysis based on age of respondents revealed that 30% of the respondents were aged between 13 – 15 years, a majority of the respondents were aged between 16 – 18 years while 2 % of the respondents were 19 years and above.

Class level

The study revealed that 34 % (307) of the respondents were in Form 2, 33 % (294) were in Form 3 while 33 % (300) were in Form 4.

Education on menstrual hygiene

The study was out to establish if the respondents have received any education on menstrual hygiene. Based on the findings, 78 % of the respondents

have received education on menstrual hygiene while 20 % of the respondents have not received education on menstrual hygiene.

Impact of commercial plastic-based menstrual product waste on the environment

This section was included in the study to assess the level of concern about impact of commercial plastic-based menstrual product waste on the environment.

Menstrual products used by respondents

The respondents were required to select the type of menstrual products which they primarily use. Table 1- Menstrual products used by respondents summarizes the findings.

Table 1: Menstrual products used by respondents

Menstrual products	Frequency	Percent
Disposable pads	867	96.2
Tampons	26	2.9
Period underwear	6	.7
Menstrual cups	2	.2
Total	901	100.0

Based on the findings, majority of the respondents, 96 % use disposable pads while few, 3 % use tampons.

Menstrual products used per cycle

The study revealed that majority of the respondents (56 %) use between 10 and 14; 18 % use between 5 and 9, while 13 % use between 15 and 20.

Menstrual product disposal method

Data analysis based on method used for disposal of menstrual products revealed that majority of the respondents (80 %) dispose their menstrual waste products in trash bins, some of them, (10 %) dispose them through open burning, 4.2 % dispose through composting while 3.8 % dispose through flushing in toilets.

Menstrual product contribution to environmental pollution

Data analysis based on contribution of menstrual products on pollution of environment revealed that 63 % of the respondents knew that plastic-based menstrual products contribute to environmental pollution. 17 % of the respondents pointed out that plastic-based menstrual products do not contribute to environmental pollution while 17 % were unsure.

Impact of menstrual waste products on the environment

The study was out to establish the respondents' level of concern about the impact of menstrual waste products on the environmental. The five-point Likert scale (i.e., Not concerned at all, Not Concerned, Neutral, Concerned, Extremely Concerned) was collapsed into three categories: Concerned (i.e., Concerned and Extremely Concerned), Neutral (i.e., Neutral) and Not Concerned (i.e., Not concerned at all and Not Concerned). The likelihood χ^2 ratio test was employed to check the significant difference between the proportions of Not concerned, Neutral and Concerned as highlighted in Table 2

Table 2: Impact of menstrual waste products on the environment

Questionnaire Item	Not Concerned	Neutral	Concerned	χ^2
How concerned are you about environmental impact of menstrual waste products	111	230	542	284.197*
• $p < 0.000$ $N = 883$				

Findings showed that a significantly higher proportion of respondents (61 %) Concerned than those who are not concerned (13 %), but a sizeable number of respondents (26 %) were neutral in their view about the impact of commercial plastic-based menstrual product waste on the environment based on a likelihood χ^2 ratio test (284.197) with a $p < 0.000$ and $N = 883$.

Presence of discarded menstrual waste products in the environment

The study findings based on analyzed data revealed that 79 % of the respondents pointed out that they had witnessed discarded menstrual waste products in the environment while 21 % were of the contrary opinion.

Environmental impact concern levels across different age groups

An independent sample t-test was conducted to compare respondents' level of concern about the environmental impact of menstrual waste products based on their age groups with the respondents aged 13 – 15 years having ($M = 3.78$, $SD = 1.26$) and those aged 16 – 18 years having ($M = 3.73$, $SD = 1.08$). The assumption of equal variance was tested using Levene's Test and the results indicated a significant difference in

variance between the groups $F = 13.304$, $p = 0.000$. The t-test results showed that, assuming the significant difference in variance, there was no significant difference in the respondents' level of concern based on age of respondents $t(867) = 0.592$, $p = 0.554$, *Effect size* = 0.044, 95% *CI* [-.10, .19]. Therefore, the study failed to reject the null hypothesis, indicating that there is insufficient evidence to conclude that the mean level of concerns about the environmental impact of menstrual waste products differ significantly based on age groups of respondents. These results suggest that age of the respondents has no impact on the level of concern about the environmental impact of menstrual waste products.

Plastic-based menstrual products contribution to environmental pollution

This study was out to establish if the respondents believe that plastic-based menstrual products contribute significantly to environmental pollution. The findings revealed that majority of the respondents, (86 %) believe that plastic-based menstrual products contribute significantly to environmental pollution while 13 % were of a contrary opinion.

Relationship between education level and menstrual products environmental pollution

A chi-square test of independence was conducted to examine the relationship between level of

education and believe that plastic-based menstrual products contribute significantly to environmental pollution

Table 3: Relationship between education level and menstrual products environmental pollution

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.029 ^a	6	.002
Likelihood Ratio	23.741	6	.001
N of Valid Cases	901		

a. 6 cells (50.0%) have expected count less than 5. The minimum expected count is .33.

The results indicated significant association, $\chi^2 = 21.029$ (6, N = 901) $p = 0.002$. This implies that there is a statistically significant association between level of education and believe that plastic-based menstrual products contribute significantly to environmental pollution.

Concern level about the environmental impact of menstrual waste products

An independent sample t-test was conducted to compare respondents' level of concern about the environmental impact of menstrual waste products based on the respondents who support the ban or reduction of disposable products in favor of biodegradable products ($M = 3.79$, $SD = 1.08$) and those who were against it ($M = 3.60$, $SD = 1.28$). The assumption of equal variance was tested using Levene's Test and the results indicated a significant difference in variance between the groups $F = 9.019$, $p = 0.003$. The t-test results

showed that, assuming the significant difference in variance, there was a significant difference in the respondents' level of concern about the environmental impact of menstrual waste products based on the respondents who support the ban or reduce disposable in favor of biodegradable products and those who do not support it $t(842) = 2.087$, $p = 0.037$, *Effect size* = 0.17, 95% *CI* [.10, .33]. Therefore, we reject the null hypothesis, indicating a statistically significant difference in the level of concern about the environmental impact of menstrual waste products based on the respondents in the two groups. These results suggest that the level of concern about the environmental impact of menstrual waste products impacts the respondents' support for ban or reduction of disposable menstrual waste products in favor of biodegradable menstrual waste products.

Conclusion

The objective of this study was to assess the level of concern about impact of commercial plastic-based menstrual product waste on the environment. The findings suggest that there is a high level of awareness and concern among the majority of respondents regarding the environmental consequences of plastic menstrual product waste. The high level of concern may indicate a potential demand for more sustainable alternatives and could influence future product development and environmental policies related to menstrual products.

Recommendation

Promoting sustainable menstrual product alternatives, such as menstrual cups, reusable pads,

and period underwear, can significantly reduce plastic waste and environmental impact. Educational campaigns highlighting their benefits and accessibility can encourage consumers to make eco-friendly choices, fostering a shift towards more sustainable menstrual practices.

Acknowledgement

The authors acknowledge financial support from Kaimosi Friends University, Directorate of Research, Innovation and Outreach.

Conflict of Interest

The authors declare no conflict of interest.

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