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Sustainable Menstrual Hygiene Practices and Their Environmental and Health Implications: A Systematic Review in the Indonesian Context

Aida Nurul Azjuba, Nadhira Silmi Alifa*
Universitas Indonesia
Email: alifasn@gmail.com*

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Menstrual hygiene management, sustainable menstrual products, reproductive health, environmental health, health behavior

ABSTRACT

Menstrual hygiene management (MHM) intersects with critical domains of public health, environmental sustainability, and gender equity, particularly in low- and middle-income countries (LMICs) such as Indonesia. Despite increasing global discourse, MHM and sustainable menstrual products remain underrepresented in national health and development agendas. Hence, their adoption and impact within the Indonesian context require further investigation. A systematic literature review was conducted following the PRISMA methodology to explore patterns, challenges, and public health implications associated with the use of sustainable menstrual products in LMICs. A total of seventeen studies were selected based on their methodological robustness, topical relevance, and specific focus on the use of reusable menstrual hygiene products. Multiple benefits were consistently reported, offering advantages such as improved user health outcomes, enhanced long-term cost efficiency, and reduced environmental hazards. However, utilization remained low across reviewed settings due to major barriers to implementation, including deficiencies in water, sanitation, and hygiene (WASH) infrastructure, persistent sociocultural taboos, limited market availability, and prevalent misconceptions regarding intravaginal product safety. An ongoing theme across studies was the observed disconnect between product awareness and actual use—a gap frequently attributed to fragmented health education initiatives. The findings underscore the potential of sustainable menstrual hygiene interventions to enhance both public health and ecological outcomes in Indonesia. Successful implementation is made possible through concurrent investments in foundational infrastructure, culturally responsive education, and multisectoral coordination, while systemic barriers must be addressed through integrated policy and community engagement strategies.

INTRODUCTION

Menstrual hygiene management (MHM) is acknowledged as a critical yet frequently overlooked dimension of gender equity and public health, particularly in the context of low- and middle-income countries. Despite the fact that an estimated 300 million individuals menstruate each day, access to safe menstrual materials and adequate sanitation facilities remains unavailable to approximately 500 million people (World Bank, 2022). These challenges are defined by inadequate infrastructure and socio-cultural constraints, both of which continue to be observed in countries such as Indonesia (Poedjiastutie et al., 2021).

Similar challenges have been documented across other Southeast Asian nations, including the Philippines and Vietnam, where insufficient WASH infrastructure and persistent menstrual stigma

create barriers to dignified menstrual care (Sumpter & Torondel, 2013). In sub-Saharan Africa, particularly in Kenya, Uganda, and Ethiopia, adolescent girls face comparable obstacles related to product access, privacy, and cultural taboos that limit their educational participation and health outcomes (Mason et al., 2013; Phillips-Howard et al., 2016). These global parallels underscore that MHM is not an isolated regional issue but a widespread public health concern requiring coordinated international attention.

In Indonesia, the barriers associated with MHM are particularly acute. Adequate preparation for menstruation is often not provided to adolescents—especially girls and individuals assigned female at birth—either by parents or through school education. This issue stems from a combination of insufficient infrastructure and an enduring cultural reluctance to discuss menstruation openly. UNICEF Indonesia (2019) reported that one in four girls experiences menarche without having received any prior information or guidance, resulting in confusion and psychological distress. Additionally, national data indicate that nearly 20% of girls are uninformed about the biological purpose of menstruation, reflecting a significant knowledge gap associated with early marriage and poor reproductive health outcomes (National Population et al., 2018).

Recent studies from neighboring countries reinforce this pattern. Research in rural Bangladesh found that 63% of adolescent girls lacked adequate menstrual knowledge before menarche, leading to increased school absenteeism and psychological stress (Alam et al., 2017). In Nepal, a qualitative study revealed that menstrual taboos, including restrictions on temple entry and food preparation, significantly impact girls' self-esteem and social participation (Thapa & Aro, 2021). Within Indonesia, regional variations are pronounced—urban areas such as Jakarta show higher awareness levels compared to rural provinces like Nusa Tenggara Timur, where infrastructure deficits and traditional beliefs compound MHM challenges (Sivakami et al., 2019). Furthermore, evidence from India shows that integrating menstrual education into school curricula significantly improves hygiene practices and reduces stigma, suggesting a replicable model for Indonesia (Muralidharan et al., 2015).

Further compounding the issue is the limited availability of water, sanitation, and hygiene (WASH) infrastructure in educational environments. Gender-segregated toilet facilities are absent in more than half of Indonesia's primary schools—an issue that might not be problematic if sanitation were adequate, patriarchal norms diminished, and menstrual stigma non-existent. Additionally, clean water is not reliably provided in approximately 15% of schools (Hastuti et al., 2019). These environmental limitations are exacerbated by institutional neglect. As reported by Situmorang et al. (2024), 42% of students avoid changing menstrual products at school due to inadequate facilities. This finding highlights systemic inattention and its implications for public health and gender equity.

Conventional disposable products, predominantly composed of non-biodegradable plastics (Fourcassier et al., 2022), generate enduring ecological harm. Improper disposal—whether through open dumping, burning, or flushing—leaches microplastics and endocrine-disrupting chemicals (phthalates, parabens, and VOCs) into ecosystems and human tissues (Blair et al., 2022; Sood et al., 2022). Pednekar et al. (2022) and Sinkko (2022) further quantify these impacts, tracing soil and water contamination to menstrual waste streams. Yet regulatory inertia persists; Indonesia, like many nations, lacks chemical safety standards for menstrual products (Jalali, 2023).

Despite the proven advantages of reusable options—menstrual cups, for instance, exhibit 99% lower lifetime carbon emissions than disposables (Harrison & Tyson, 2023)—adoption remains low. Deep-seated taboos, intravaginal product hesitancy, and supply chain constraints hinder progress (Agustian et al., 2024; van Eijk et al., 2019). These challenges mirror global patterns: in Ghana, sociocultural norms override environmental concerns (Gbogbo et al., 2025), while in Indonesia's urban poor communities, affordability is prioritized over sustainability (Sato et al., 2021).

In recent years, integrated approaches to menstrual hygiene have begun to show promising potential, particularly in low- and middle-income countries. In Indonesia, community-based initiatives have gained traction through the local production of reusable cloth pads. These efforts offer dual benefits: reducing environmental waste and creating economic opportunities for women (Agustian et al., 2024). This finding is supported by Rajah et al. (2025), whose study emphasized that educational outreach combined with robust and consistent policy support is crucial for sustaining such community-based programs.

However, ensuring equal access to sustainable menstrual products alone is not sufficient. Davis et al. (2018) argue that meaningful and lasting change also requires confronting the stigma and misinformation that continue to shape public perceptions of menstruation. Addressing this issue demands a broader conceptual shift: menstrual hygiene should not be viewed solely as a sanitary concern but as an issue intrinsically connected to environmental sustainability and fundamental human rights. Sommer, Torondel, et al. (2021) stress the importance of this transformation, and their subsequent work reiterates that progress in MHM depends on implementing inclusive and equitable efforts to mitigate menstrual issues within policy frameworks and institutional agendas (Sommer, Caruso, et al., 2021).

By integrating MHM into national development strategies, increasing investment in water, sanitation, and hygiene (WASH) infrastructure, and improving menstrual literacy, Indonesia has a unique opportunity to enhance reproductive health outcomes, reduce environmental burdens amid the climate crisis, and advance public health domestically and beyond

A critical gap remains in the existing literature: while numerous studies have documented barriers to sustainable menstrual product adoption globally, few have systematically examined the intersection of environmental sustainability, health outcomes, and socio-cultural factors within the Indonesian policy landscape. This study addresses this gap by synthesizing evidence on sustainable menstrual products in Indonesia and comparable LMICs, with a particular focus on identifying actionable policy entry points. Unlike previous reviews that approach MHM primarily as a discrete health or environmental issue, this research adopts an integrated framework that considers how WASH infrastructure deficits, cultural norms, economic constraints, and regulatory gaps collectively shape MHM practices. Furthermore, this study uniquely highlights the potential role of Indonesia's existing community health structures—such as Posyandu and PKK—in facilitating sustainable product adoption, an aspect underexplored in prior research. By mapping these intersections, this review provides novel insights for policymakers seeking to mainstream menstrual health within national development strategies, particularly in the context of Indonesia's commitments to the Sustainable Development Goals.

RESEARCH METHOD

This study employed a systematic literature review to synthesize recent evidence on the environmental, health, and economic dimensions of menstrual hygiene products, with a focus on Indonesia and comparable low- and middle-income countries. A structured search across Scopus (n = 20), PubMed (n = 57), and Google Scholar (n = 95) yielded 171 records. Using the Boolean search: “menstrual hygiene” AND (“menstrual pad” OR “menstrual cup” OR “tampons”) AND “sustainability” AND “Indonesia,” the review targeted studies addressing menstrual products in relation to sustainability, public health, and socio-economic outcomes.

Screening was conducted in three stages: 128 records were excluded by title, 20 by abstract (due to duplication, incompatibility, or lack of relevance), and 6 after full-text review. Seventeen studies met all inclusion criteria and were retained, as shown in Figure 1 (PRISMA flowchart).

To assess methodological quality and minimize bias, the Joanna Briggs Institute (JBI) Critical Appraisal Tools were applied according to each study's design. The included studies encompassed cross-sectional, cohort, quasi-experimental, participatory, LCA, SEM-TPB, DCE, and various qualitative methods. Each article was independently appraised by two reviewers, with discrepancies resolved through consensus. Only studies with sufficient methodological rigor were included in the final synthesis.

Inclusion Criteria

Studies were included if they were original, peer-reviewed research articles published between 2021 and 2025 and available in full-text open-access format. Eligible studies examined at least one menstrual hygiene product—such as disposable pads, menstrual cups, or reusable cloth pads—and addressed environmental sustainability, health outcomes, or economic affordability. Research focused on Indonesia or countries with similar socio-economic contexts was prioritized.

Exclusion Criteria

Articles were excluded if they were not original empirical studies (e.g., reviews, editorials, policy briefs), did not analyze menstrual products in relation to sustainability, health, or cost, were duplicates, used incompatible methodologies, were published before 2021, or were not available as open-access full texts.

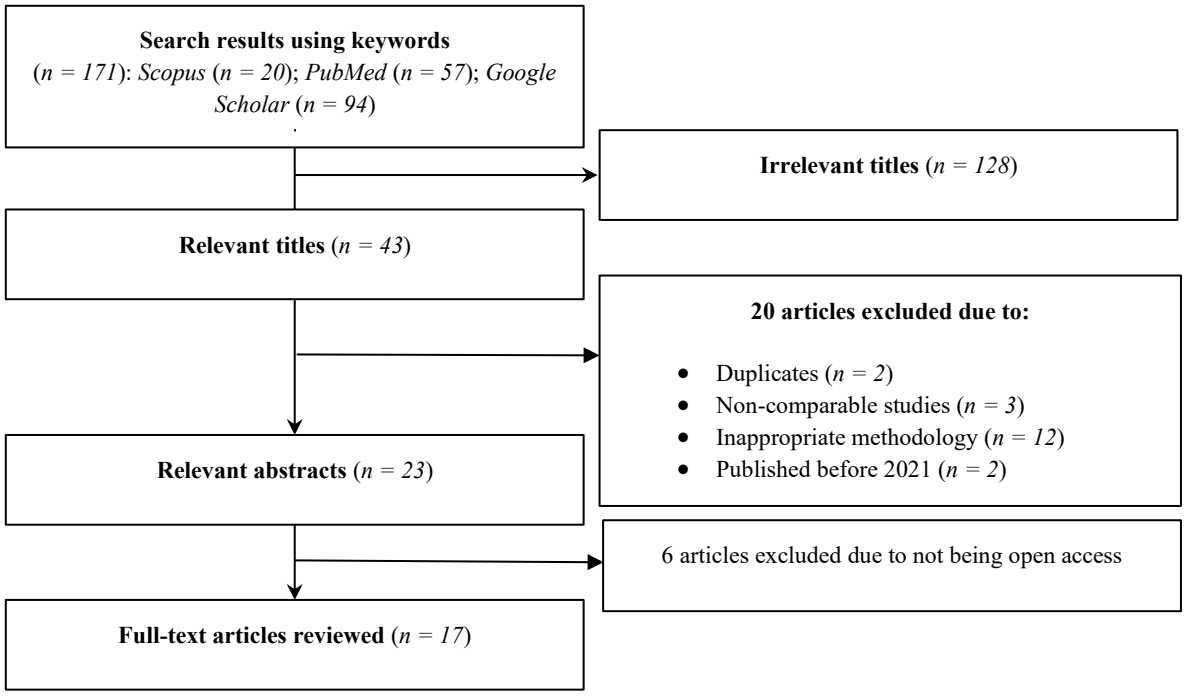

Figure 1. PRISMA Diagram of the Literature Search Flow

RESULT AND DISCUSSION

Table 1 presents a summary of the 17 studies reviewed, highlighting variations in geographic focus, research methods, product types, and key findings. It serves as a reference point for understanding current trends, knowledge gaps, and emerging themes in menstrual hygiene research, especially related to health, sustainability, and socio-cultural factors.

Table 1. Study Location, Method, and Product Focus

Author	Country	Method	Product Types
(Aridi & Yehya, 2023)	Global	Life Cycle Assessment (LCA), Environmental Cost Indicator (ECI), economic and social analysis	Reusable pads (banana fibers, cotton), disposable pads
(Babbar & Garikipati, 2023)	India	Ordinal logistic regression analysis, socio-demographic analysis from NFHS-5 survey data covering more than 241,000 women aged 15 to 24 years in India	Disposable pads, reusable pads, menstrual cups
(Shanmugasundaram & Luthra, 2024)	India	Feminist political ecology (FPE), semi-structured interviews, and qualitative analysis.	Sustainable Menstrual Products (SMPs), including menstrual cups, reusable pads, and other eco-friendly menstrual products.
(Tusita et al., 2024)	Indonesia	Descriptive-qualitative	Disposable pads, menstrual cups, tampons, menstrual underwear
(Shibeshi et al., 2021)	Ethiopia	Cross-sectional	–
(Sato et al., 2023)	Indonesia	Qualitative semi-structured interviews	Disposable sanitary pads, cloth pads
(Palgunadi et al., 2024)	Indonesia	Participatory action research, photovoice approach	Disposable sanitary pads
(Cassolatti Gracioli et al., 2023)	Brazil	Cohort (prospective longitudinal study)	Menstrual cup, sanitary pads
(Ikogho & Onoharigho, 2025)	Nigeria	Quantitative (survey, descriptive)	Disposable pads (sanitary napkins, regular pads), cotton wool, tampons
(Valentin & Hechanova, 2023)	Philippines	Structural Equation Modeling (SEM), Theory of Planned Behavior (TPB)	Menstrual cups
(Prima Citta et al., 2024)	Japam, Indonesia, France	Labeled Discrete Choice Experiment (DCE), preference analysis and consumer decision-making	Menstrual cups, sanitary napkins, tampons
(Downing et al., 2021)	Vanuatu	Mixed-method (Focus Group Discussion, qualitative interviews)	Disposable pads, reusable pads
(Patel et al., 2023)	India	Qualitative exploratory study, in-depth interviews	Menstrual cups
(Prasanna et al., 2024)	India	Quasi-experimental, pre-test/post-test statistical analysis	Menstrual cup
(Zahra et al., 2025)	Bangladesh	Survey, interview, Amsel test	Cloth pads, sanitary napkins
(Gondwe et al., 2025)	Zambia	Explorative qualitative (FGDs, in-depth interviews)	Menstrual cup

(Aini et al., 2024)	Indonesia	Quantitative (online survey)	Disposable pads, cloth pads, menstrual cup

Table 1 highlights a strong focus on studies from low- and middle-income countries, especially India and Indonesia, where menstrual hygiene is shaped by infrastructure, education, and cultural norms. It covers various menstrual products, including disposable pads, cloth pads, menstrual cups, tampons, and biodegradable options like banana fiber pads. This overview sets the stage for thematic analysis by showing the diversity of contexts and the growing interest in sustainable menstrual health solutions.

Table 2. Summary of Reviewed Studies and Key Findings

Author	Research Findings
(Aridi & Yehya, 2023)	A global LCA comparing pad types found banana fiber pads most cost-effective and eco-friendly (only $4.80 annually), while disposable pads had the highest environmental toll (600–800 years decomposition).
(Babbar & Garikipati, 2023)	Using NFHS-5 data from over 241,000 women (15–24), the study found education, caste, and urban residence shaped product usage. 78% used modern products, but menstrual cups had negligible use (0.3%).
(Shanmugasundaram & Luthra, 2024)	Based on 54 interviews, menstrual cups and reusable pads were seen as ideal, but high costs (INR 500–1,500), lack of clean water, and social taboos severely limited adoption.
(Tusita et al., 2024)	54% still viewed menstruation as taboo. Most preferred disposable pads; internal products like cups or tampons were avoided due to virginity myths. Despite eco-awareness, behavioral change lagged. Highlights "attitude–behavior gap" and stresses the role of peer-led health education.
(Shibeshi et al., 2021)	Cross-sectional study with schoolgirls found 65.9% of urban vs 43.4% of rural girls practiced safe MHM. Urban students had better WASH facilities and more parental support.
(Sato et al., 2023)	Qualitative interviews revealed girls avoided pad changes at school due to broken toilets and lack of privacy. Disposal often involved environmentally unsafe practices. Schools offered minimal menstrual education; mothers were primary information sources.
(Palgunadi et al., 2024)	20 girls aged 12–14 shared experiences through photos: broken toilets, lack of soap and bins led to anxiety and unhygienic disposal. Fear of mockery discouraged changing pads at school.
(Cassolatti Gracioli et al., 2023)	A Brazilian cohort study found 93.6% acceptance of menstrual cups. Users had lower rates of vaginal dysbiosis than pad users. Cups maintained healthy flora due to biocompatible silicone.
(Ikogho & Onoharigho, 2025)	Among female students, 97.6% used pads but 75.3% disposed waste unsafely (e.g., burning, open dumping). 86% experienced irritation; 77% reported rashes. Hygiene barriers included cost, access, and poor awareness.
(Valentin & Hechanova, 2023)	Structural Equation Modeling found that perceived control and environmental concern predicted cup use. Peer pressure had little effect. Results suggest personal values outweigh social norms in sustainable product adoption.
(Prima Citta et al., 2024)	Across Japan, Indonesia, and France, cost and long-term savings were strong predictors of cup preference. 80% of Indonesians preferred cups when informed of savings; only 60% in Japan due to stigma.

(Downing et al., 2021)	136 women shared concerns during emergencies: pad scarcity, lack of privacy, and safety fears. Preferred reusable products during disaster response. Advocated female-specific hygiene kits separate from food aid to reduce shame.
(Patel et al., 2023)	In-depth interviews with 26 users found menstrual cups were seen as safer, more comfortable, and cost-effective. Key challenges: finding the right size, fear of insertion, and lack of usage guidance.
(Prasanna et al., 2024)	Quasi-experimental study with 100 women aged 18–45 found that a 30-minute instructional video significantly increased knowledge and positive attitudes. Post-intervention attitude scores rose by 8.5 points.
(Zahra et al., 2025)	Among women with BV, 81% had poor menstrual hygiene practices. Cloth pads reused more than once per day were common. Stigma and cost limited sanitary options. 74% of married women also reported high-risk sexual behavior.
(Gondwe et al., 2025)	FGDs revealed widespread myths (e.g., cups cause cancer or virginity loss). With peer support, most users overcame fears and praised cups for durability and comfort.
(Aini et al., 2024)	Survey in Jakarta found 76% still use disposable pads, but environmental knowledge positively correlated with adoption of cloth pads and menstrual cups. 62% of pad users lacked awareness of alternatives.

Table 2 highlights key findings from studies in countries with socio-economic contexts similar to Indonesia such as India, the Philippines, Bangladesh, and Zambia. While menstrual cups and reusable pads offer clear health, environmental, and economic benefits, their adoption remains low due to cultural taboos, misinformation, limited access, and cost barriers.

Table 3. Retail Price and Availability of Menstrual Products

Product Type	Brand & Variant	Price (IDR)	Price (USD)	Quantity	Price per Unit (IDR)	Availability
Menstrual Cup	OrgXXXX (Size A/B)	Rp429,000	~$26.81	1 cup	Rp429,000	Online
	VivXXXX (Size S/L)	Rp55,000	~$3.44	1 cup	Rp55,000	Online
	RheXXXX (Size S/L)	Rp250,000	~$15.63	1 cup	Rp250,000	Online
Disposable Pads	ChaXXXX	Rp15,900	~$0.99	17 pcs	Rp935	Offline
	KotXXXX	Rp15,500	~$0.97	32 pcs	Rp484	Online & Offline
	SofXXXX	Rp6,400	~$0.40	20 pcs	Rp320	Online & Offline
Tampons	NatXXXX	Rp109,438	~$6.84	10 pcs	Rp10,944	Online
	NatXXXX	Rp176,698	~$11.04	16 pcs	Rp11,044	Online
	TamXXXX	Rp954,000	~$59.63	47 pcs	Rp20,298	Online
Cloth Pads	KinXXXX	Rp104,999	~$6.56	3 pcs	Rp34,999	Online
	YusXXXX	Rp190,000	~$11.88	8 pcs	Rp23,750	Online

Table 3 compares the prices and availability of menstrual products in Indonesia. Although menstrual cups have the highest upfront cost, menstrual cups are by far the most cost-effective option because it can be reused over multiple years and lower maintenance.

Health Impact and Effectiveness

The selection of menstrual hygiene products plays a pivotal role in influencing users' health, cleanliness, and physical comfort. A growing body of evidence indicates that disposable sanitary pads, despite their widespread use, are frequently associated with adverse dermatological outcomes, including skin irritation, rashes, and elevated infection risk—particularly when used without adequate hygiene facilities or with infrequent changing (Destariyani et al., 2023). In contrast, research conducted in Indonesia highlights that menstrual cup users tend to experience improved hygiene and a reduced incidence of skin problems. This benefit is primarily attributed to decreased moisture exposure and the hypoallergenic properties of medical-grade silicone (Rusdiana & Fauzi, 2022).

In West Java, menstrual cup users reported fewer issues with odor and leakage. Despite these benefits, however, social stigma and limited awareness still hinder broader adoption (Fitriani et al., 2022). Reusable cloth pads have also demonstrated clear health advantages when accompanied by proper hygiene practices. A community project in Naioni, Indonesia, found that participants who regularly washed and sun-dried their pads perceived them as safe, comfortable, and environmentally friendly (Nayoan et al., 2024). These habits were also linked to fewer instances of skin irritation compared to disposable products. Similarly, menstrual cups are gaining wider recognition globally as reliable and long-lasting alternatives. Research suggests that when users follow recommended cleaning protocols, infection risks remain low, reinforcing their suitability for extended use (Sharma & Rawat, 2023).

Despite these benefits, a significant knowledge gap persists. As documented by Bano et al. (2024), nearly nine out of ten college students surveyed were unfamiliar with key aspects of menstrual cup use—an information deficit that substantially hinders adoption, even in light of evident health advantages. At the same time, health concerns surrounding disposable menstrual products remain unresolved, particularly in contexts where sanitation infrastructure is inadequate or usage patterns are inconsistent.

Nonfoux et al. (2018) highlighted that high-absorbency tampons can facilitate the growth of Staphylococcus aureus, thereby increasing the risk of toxic shock syndrome. Conversely, alternative products such as menstrual cups may offer protective effects. Cassolatti Gracioli et al. (2023) demonstrated that menstrual cup users exhibited significantly lower incidences of vaginal dysbiosis, including bacterial vaginosis and candidiasis, compared to users of disposable pads. The study attributed this to the inert nature of silicone, which supports the stability of the vaginal microbiome. Likewise, van Eijk et al. (2019) documented that in refugee populations, reusable pads were associated with markedly lower self-reported irritation rates (23.8%) compared to disposable pads (72.8%).

Although the majority of evidence favors the health benefits of sustainable products, some exceptions must be acknowledged. Tessandier et al. (2021) observed a slightly higher incidence of fungal infections among menstrual cup users compared to tampon users. However, their findings did not indicate significant disruptions to vaginal flora or systemic inflammation, suggesting that suboptimal hygiene behaviors rather than product materials were the underlying cause. This aligns with broader research emphasizing that menstrual health outcomes are significantly influenced by hygiene practices. For instance, Hamidah et al. (2023) reported that many Indonesian adolescents do not change their pads frequently enough to meet established hygiene standards. Such practices create

persistently moist conditions that foster microbial growth and increase susceptibility to infections. Reinforcing this concern, Torondel et al. (2018) found that women who changed their pads only once daily faced substantially higher risks of reproductive tract infections. Zahra et al. (2025) established inadequate menstrual hygiene as a significant risk factor for bacterial vaginosis (BV) prevalence in low-resource communities, with their longitudinal cohort study demonstrating a 2.3-fold increase in BV incidence among women lacking access to clean products or washing facilities.

Collectively, these findings underscore that while sustainable menstrual products—particularly menstrual cups and cloth pads—demonstrate superior health outcomes, their benefits are heavily dependent on proper use and hygiene practices. Therefore, public health interventions must not only promote access to sustainable products but also include comprehensive education on safe menstrual hygiene management.

Comfort and Accessibility

User comfort plays a pivotal role in menstrual product selection and continued use. In Indonesia, over 70% of menstruating individuals rely on disposable sanitary pads due to their familiarity, ease of use, and wide availability across both urban and rural settings (Alfiani et al., 2025). However, prolonged use is frequently associated with discomfort, including skin irritation and odor—especially in contexts with inadequate hygiene infrastructure (Fadilla et al., 2024; Rusdiana & Fauzi, 2022).

Sustainable alternatives such as menstrual cups and reusable cloth pads are often reported to offer greater long-term comfort, with users citing benefits such as reduced moisture, fewer leaks, and improved cleanliness (Fitriani et al., 2022; Patel et al., 2023). Aini et al. (2024) further noted that users of reusable products experienced fewer skin issues and better odor management. Yet, adoption remains limited, primarily due to accessibility barriers. While menstrual cups have gained visibility in some segments, their availability remains largely restricted to digital marketplaces and select urban retailers. Adoption of sustainable menstrual products is further constrained by concerns regarding product fit, methods of use, and the lack of clear instructional guidance (Agustian et al., 2024; Tusita et al., 2024). Although these products are more cost-effective over time, their upfront price—ranging from IDR 55,000 to 429,000—remains out of reach for many low-income consumers (Bano et al., 2024).

Historically, cloth was widely used for menstrual management, as evidenced by studies on past practices. Disposable menstrual pads, introduced in 1888, have since gained popularity, likely driven by consumerism (Zeng et al., 2021). However, this older practice has resurfaced, as local producers increasingly promote reusable cloth pads as environmentally friendly and affordable alternatives. Many users report that when properly cleaned and cared for, these pads are comfortable and easy to manage (Diiniyati & Kusmaryati, 2020; Habibie et al., 2019). Still, deeper socio-cultural challenges persist. Reusable menstrual products are often perceived as outdated or inconvenient by younger urban populations, limiting their broader acceptance and implementation (Prabawanti et al., 2023). Such perceptions—viewing reusable products as difficult, impractical, or old-fashioned—do not primarily stem from functional limitations but rather reflect entrenched cultural expectations and social norms that continue to shape how menstruation is understood and discussed. Normalizing sustainable alternatives, therefore, comes with challenges, one of which is overcoming these persistent misconceptions.

To deconstruct ongoing stigma and shift dominant narratives, many community-led initiatives have begun to drive meaningful change. Organizations such as Indonesia's Pemberdayaan Kesejahteraan Keluarga (Family Welfare Movement), which is predominantly women-led despite its formal name, have played a vital role in expanding access to sustainable menstrual products

(Prabawanti, 2 024). Beyond product distribution, these groups have successfully enhanced menstrual literacy and provided unwavering support for local livelihoods through income-generating activities. Their work contributes not only to practical implementation but also to the gradual transformation of public attitudes toward menstruation as a previously taboo subject.

The takeaway from this study is clear: menstruation can no longer be regarded as an isolated or purely individual issue. It must be recognized as a crucial component of inclusive and equitable public health development frameworks. Achieving lasting change requires advocates, institutions, and policymakers to uphold dignity and ensure that sustainable menstrual options are both accessible and acceptable to all—leaving stigma as a remnant of the past. The growing momentum of localized initiatives demonstrates that combining community-based action with structural reform can drive meaningful and enduring progress.

Socio-Cultural and Behavioral Influences

The decision to use sustainable menstrual products such as menstrual cups or cloth pads is often not solely driven by cost or convenience. While these factors play a role, deep-rooted social expectations and cultural norms frequently exert a stronger influence—sometimes unconsciously. In Indonesia, as well as in countries such as India, the Philippines, Bangladesh, and Zambia, education levels and media exposure significantly shape individuals' awareness of and comfort with non-conventional menstrual product options. Babbar & Garikipati (2023) found that urban women with better access to reproductive health education and exposure to a broader range of products were more likely to consider alternatives such as menstrual cups or cloth pads. However, awareness does not always translate into use. Gondwe et al. (2025) showed that even when communities are aware of these products, their adoption remains low in the absence of clear, relevant, and contextualized guidance—especially when health messages are not adapted to local realities. In such situations, information shared by trusted community members or familiar figures tends to be more effective than official campaigns.

Geographical and cultural variations further add to the complexity. Although urban areas typically offer better health infrastructure and education systems, this does not necessarily result in improved menstrual management practices. For example, in Bandung, Sato et al. (2023) found that many young women disposed of menstrual waste based on perceived social norms rather than the available sanitation facilities. Meanwhile, in areas such as Papua—where water and sanitation infrastructure remain limited—women often burn or bury their menstrual waste, a practice driven more by necessity than choice (Assa et al., 2024). Cultural influences are also evident across regions. In the cosmopolitan urban centers of Bali, young women are increasingly comfortable using tampons or menstrual cups, influenced by daily interactions with tourists and expatriates. However, in Jombang, East Java—where conservative Islamic values are more deeply rooted—access to these products remains very limited. Retnowuni (2018) reported that students in Islamic pondok schools often do not receive formal education on menstruation and instead rely on informal knowledge, which can be incomplete or unsafe. Even in semi-urban areas such as Tangerang, basic sanitation facilities in schools remain inadequate, indicating that infrastructure challenges are not limited to rural environments (Wihdaturrahmah & Chuemchit, 2023).

These inequalities are closely tied to broader social and religious structures. In many parts of eastern Indonesia, menstruation remains a topic shrouded in stigma and silence. According to Davis et al. (2018), a combination of poor infrastructure and cultural discomfort continues to restrict access to safe and dignified menstrual care. Resistance to products such as tampons and menstrual cups often arises not from practical considerations but from cultural concerns about virginity, which are closely linked to family honor and religious values (Raihana & Ghufron, 2023; Tusita et al., 2024). Although

no explicit prohibition exists within religious teachings, local interpretations often impose restrictions. In Salafi-influenced communities, menstruation is frequently framed within the discourse of ritual purity, limiting which products are considered acceptable (Leiliyanti et al., 2022). White et al. (2023) argue that this conservative interpretation reinforces patriarchal norms that influence both individual decisions and institutional policies. Similarly, Bouchouk & Ayaz (2024) note that when religious teachings intertwine with traditional customs, they can create invisible yet powerful moral barriers to adopting modern menstrual solutions—even in highly educated communities.

Nevertheless, change is possible. Religious values are not static, and recent developments show that reinterpretation is both feasible and impactful. One notable example is the Kongres Ulama Perempuan Indonesia (KUPI, Indonesian Congress of Women's Scholars), a group of Muslim women scholars advocating for gender-just interpretations of Islamic texts. Kloos & Ismah (2023) describe how KUPI's theological efforts have reframed menstruation as a matter of dignity and human rights, contributing to a shift in public discourse within and beyond religious communities. These developments demonstrate that even deeply entrenched norms can evolve—especially when transformation is led by trusted community voices and grounded in local cultural values.

Environmental Impact and Menstrual Waste Management

In Indonesia, the widespread use of disposable sanitary pads has caused serious environmental problems. The country's current waste management system is already struggling to cope with the growing volume of healthcare waste, particularly that which cannot be naturally decomposed (Hasanul Bulqiyah, 2023). Since most disposable sanitary pads are composed primarily of plastic, they persist in the environment long after disposal. Improper waste management exacerbates the problem: incineration releases toxic gases; disposal in drainage systems clogs sewage networks; and open dumping contributes not only to visual pollution but also to soil degradation and water contamination (Alfiani et al., 2025; Kattimani et al., 2024). These unsustainable practices reflect an environmental crisis that begins with individual consumer behavior and ultimately manifests as a systemic ecological burden.

Evidence from life cycle assessment (LCA) studies has consistently demonstrated that reusable menstrual products produce significantly lower environmental impacts. For instance, Hait & Powers (2019) found that menstrual cups result in less than 1.5% of the annual environmental footprint of single-use products. Alzate & Sanchez (2020) estimated that a user of disposable pads generates over 800 grams of waste per year—amounting to more than 8 kilograms over a decade—compared to under 100 grams for menstrual cup users. Reusable pads, particularly those made from natural or biodegradable fibers, have also shown reduced environmental loads (Dobur et al., 2022). The degradation timeline is striking: conventional pads can take up to 500 years to decompose (Chavan et al., 2024). Aridi & Yehya (2023) reported that each pad emits between 4.8 and 5.1 kg of CO_2-equivalent emissions, a figure that rises to 8.4 kg when production and transport are included. In contrast, menstrual cups reduce emissions by over 99% across multiple environmental categories (Fourcassier et al., 2022). As a response, innovative products such as banana fiber pads—composed of 77% agricultural waste—have shown promise both environmentally and economically, with multiple studies affirming their long-term ecological viability (Prima Citta et al., 2024; Sinkko, 2022).

Nevertheless, adoption of reusable products remains inconsistent. Despite their environmental advantages, many users report barriers related to discomfort, stigma, limited product availability, and relatively high upfront costs—issues particularly evident in Indonesia and elsewhere in Asia (Tusita et al., 2024). Although awareness of environmental benefits is gradually increasing, uptake remains uneven, shaped by complex interrelated factors.

Among these, misinformation and stigma continue to play a substantial role. Babbar & Garikipati (2023) and Valentin & Hechanova (2023) emphasize that the absence of clear, culturally sensitive, and user-centered guidance limits the transition toward sustainable menstrual products. Information alone is insufficient; behavioral change relies on locally tailored educational initiatives that not only explain technical aspects of use but also confront the cultural narratives that discourage adoption.

The management of menstrual waste also intersects with broader public health and environmental vulnerability. Regions such as Bali, Papua, and Tangerang remain particularly concerning due to inadequate water, sanitation, and hygiene (WASH) services. Strengthening WASH infrastructure would enable individuals to access menstrual products safely and maintain proper hygiene. Combined with persistent menstrual taboos, these structural gaps often compel individuals to burn, bury, or openly discard used products—not by choice, but out of necessity (Assa et al., 2024; Palgunadi et al., 2024; Wihdaturrahmah & Chuemchit, 2023). Environmental sustainability is also pivotal for mitigating practices that pose health and ecological risks, including methane emissions, groundwater contamination, and chemical exposure among waste workers (Elledge et al., 2018; Kitole et al., 2024; Mor & Ravindra, 2023; Nanda & Berruti, 2021).

This challenge can be addressed through strengthened policy support and community engagement. Culturally sensitive campaigns that encourage social change—alongside measures such as tax exemptions for reusable products and their inclusion in school programs—could accelerate adoption (Downing et al., 2021; Rajah et al., 2025). Peer education and hands-on demonstrations can also reduce stigma and build trust in transitioning toward more sustainable options (Prasanna et al., 2024), with similar models having been successfully implemented in Pakistan (Talpur et al., 2024).

CONCLUSION

As the discussion on menstrual hygiene management (MHM) expands, concerns are emerging about how environmental, health, and cultural factors influence product use, particularly in Indonesia. While single-use pads remain the most widely used menstrual product, it is increasingly difficult to overlook their long-term ecological consequences, especially the accumulation of plastic waste. Additionally, a growing body of research highlights potential health issues—such as skin irritation and disruption of the vaginal microbiome—raising important questions about the long-term safety and suitability of such materials. These challenges underscore the urgency of transitioning toward more sustainable product alternatives. Although several studies have demonstrated the environmental and health benefits of reusable menstrual cups and cloth pads, their adoption remains limited. Importantly, these challenges extend beyond issues of price or availability.

Strategic and culturally sensitive communication efforts are essential to addressing social and religious barriers. Employing clear, contextualized, and evidence-based approaches can promote greater understanding and acceptance. Furthermore, inadequate WASH (Water, Sanitation, and Hygiene) facilities and persistent economic limitations in both rural and low-income urban areas continue to reinforce dependence on single-use products. Nevertheless, meaningful progress is visible. Community-based initiatives—such as women-led pad-making cooperatives and peer-driven education campaigns—are reshaping public attitudes and improving access to reusable products. These grassroots initiatives illustrate the power of localized action in advancing menstrual health equity.

To sustain and scale these gains, future investment should prioritize three key areas: subsidizing cost-effective sustainable products, expanding sanitation infrastructure, and integrating menstrual health into public education and primary healthcare programs. Collaboration with religious leaders

and local community figures is also recommended to address deeply rooted taboos and foster inclusive dialogue. Ultimately, menstrual health must be recognized as a fundamental component of equitable social development. In light of intensifying environmental pressures, repositioning menstrual hygiene as both a public health concern and a sustainability imperative is now more critical than ever. Promoting menstrual equity will not only strengthen individual well-being and dignity but also contribute to a more just and environmentally responsible future.

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