



Article

Enabling factors for sustainable menstrual hygiene management practices: a rapid review

Pednekar, Sulochana, Some, Shreya, Rivankar, Kajal and Thakore, Renuka

Available at <http://clock.uclan.ac.uk/43791/>

Pednekar, Sulochana, Some, Shreya, Rivankar, Kajal and Thakore, Renuka
ORCID: 0000-0002-2415-1001 (2022) *Enabling factors for sustainable menstrual hygiene management practices: a rapid review. Discover Sustainability, 3 (1). ISSN 2662-9984*

It is advisable to refer to the publisher's version if you intend to cite from the work.
<http://dx.doi.org/10.1007/s43621-022-00097-4>

For more information about UCLan's research in this area go to <http://www.uclan.ac.uk/researchgroups/> and search for <name of research Group>.

For information about Research generally at UCLan please go to <http://www.uclan.ac.uk/research/>

All outputs in CLoK are protected by Intellectual Property Rights law, including Copyright law. Copyright, IPR and Moral Rights for the works on this site are retained by the individual authors and/or other copyright owners. Terms and conditions for use of this material are defined in the [policies](#) page.



Article

Enabling factors for sustainable menstrual hygiene management practices: a rapid review

Pednekar, Sulochana, Some, Shreya, Rivankar, Kajal and Thakore, Renuka

Available at <http://clock.uclan.ac.uk/43791/>

Pednekar, Sulochana, Some, Shreya, Rivankar, Kajal and Thakore, Renuka
ORCID: 0000-0002-2415-1001 (2022) *Enabling factors for sustainable menstrual hygiene management practices: a rapid review. Discover Sustainability, 3 (1). ISSN 2662-9984*

It is advisable to refer to the publisher's version if you intend to cite from the work.
<http://dx.doi.org/10.1007/s43621-022-00097-4>

For more information about UCLan's research in this area go to <http://www.uclan.ac.uk/researchgroups/> and search for <name of research Group>.

For information about Research generally at UCLan please go to <http://www.uclan.ac.uk/research/>

All outputs in CLoK are protected by Intellectual Property Rights law, including Copyright law. Copyright, IPR and Moral Rights for the works on this site are retained by the individual authors and/or other copyright owners. Terms and conditions for use of this material are defined in the [policies](#) page.


Review

Enabling factors for sustainable menstrual hygiene management practices: a rapid review

Sulochana Pednekar¹  · Shreya Some^{2,3}  · Kajal Rivankar¹  · Renuka Thakore^{4,5} 

Received: 30 June 2022 / Accepted: 16 August 2022

Published online: 31 August 2022

© The Author(s) 2022  OPEN

Abstract

This paper highlights the crucial enabling factors in menstrual hygiene management. The use of products depends on various factors such as access to water, privacy, social, cultural and economic. Gender equality and women's empowerment are integral parts of the Sustainable Development Goals (SDGs). Half of the world's population are women, and women have specific needs to manage the menstrual cycle during their lifetime. To manage the bleeding during the menstrual cycle, girls and women use different products, depending on their accessibility and affordability. They are (a) disposable—one-time use products such as disposable pads, tampons, and (b) reusable products—reusable products such as cloth, washable and reusable cloth pads, menstrual cups, and period panties. The literature search revealed that there are limited studies related to the use of menstrual products and the impacts of these products on women's health and the environment. A rapid review of the literature identified factors responsible for choosing a particular type of menstrual product, the perceptions of women using the products, and their implications on health and the environment. The study concluded with the need to study the type of menstrual products preferred by women using appropriate variables, address the issues of disposal systems, provide adolescent girls with adequate infrastructure, provide access to affordable sanitary products and gender equity to manage their periods with dignity, and increasing awareness regarding sustainable/reusable menstrual products, suggesting further investigation in menstrual hygiene management.

1 Introduction

“Menstrual Hygiene Management should be universally recognised, promoted, and practised as a fundamental to good health, dignity and quality of life” [1].

Menstrual Hygiene Management (MHM) is the management of hygiene associated with the menstrual process [1]. WHO and UNICEF Joint Monitoring Programme (JMP) for drinking water, sanitation, and hygiene has used the following definition of MHM: ‘Women and adolescent girls are using a clean menstrual management material to absorb or collect menstrual blood, that can be changed in privacy as often as necessary for the duration of a menstrual period, using soap and water for washing the body as required, and having access to safe and convenient facilities to dispose of used

✉ Sulochana Pednekar, sulochana@unigoa.ac.in; ✉ Renuka Thakore, RThakore1@uclan.ac.uk; Shreya Some, ayerhs7891@gmail.com; Kajal Rivankar, kajal@unigoa.ac.in | ¹Women's Studies Programme, Manohar Parrikar School of Law, Governance and Public Policy, Goa University, Taleigao, Goa 403206, India. ²South and South-East Asia Multidisciplinary Applied Research Network on Transforming Societies of Global South, School of Environment, Research and Development, Asian Institute of Technology, Pathum Thani, Thailand. ³Global Centre for Environment and Energy, Ahmedabad University, Ahmedabad, India. ⁴University of Central Lancashire, Preston, Lancashire, UK. ⁵University College of Estate Management, Reading, Berkshire, UK.



menstrual management materials. They understand the basic facts linked to the menstrual cycle and how to manage it with dignity and without discomfort or fear' [2].

Half of the world's population are women, and women have specific needs to manage the menstrual cycle during their lifetime [3]. Women need to use products/ materials to absorb the menstrual blood and prevent the outflow during menstruation. Menstrual product is a material that a girl/woman uses to manage her menstrual blood, which should be safe, accessible, affordable and ensure dignity. To manage the monthly bleeding, girls and women use distinct types of products available in the market depending on the accessibility and affordability of the products [4, 5]. The safety and dignity of using these products are secondary as many women are still unable to even access the products in remote locations. On average, women use 6–8 sanitary napkins per cycle generating approximately 125 kg of menstrual waste during the menstruating period. Each used disposed menstrual pad takes 500 to 800 years to decompose, as 90% of the menstrual pads are made of plastic [6].

It is also essential that women and girls should be free from cultural restrictions, which have implications for women in effectively managing their menstruation. A study conducted in Australia found that women faced logistical challenges related to using menstrual products, including secrecy around purchasing sanitary items, high financial costs, and sufficient female-friendly infrastructure (e.g., working toilets, accessible disposal facilities, privacy) [7]. Women face difficulties accessing menstrual products to manage their periods and were most affected during the pandemic as they could not go out and buy or obtain menstrual pads, especially women who have been using disposable menstrual pads [4]. Menstrual hygiene is a global social and public health concern and must be addressed [8]. Studies suggest a need to create awareness and sensitise people about sustainable consumption's social and economic impact and environmental implications [8].

The questions that arise are how a girl or a woman decides what she needs to use to manage her menstrual blood, and who introduces her to the type of product that is being used? Are there any cultural factors that influence the use of the menstrual product? What are the implications on the health or environment of using specific menstrual products? Does a woman have a choice to choose what product best suits her needs during menstruation? When one shops for any food item for consumption, whether one checks the manufacturing and expiry date on the product packet? What does it contain, regarding ingredients used, how to use and the implications of using the product? What kind of information is provided to the consumers of the menstrual product? What can one know about the menstrual products that one uses regularly during their periods? Do these menstrual products give instructions on use and disposal?

Given that there are two types of menstrual products in the market: (a) disposable—which is one-time use products such as disposable pads, tampons, and (b) reusable products like reusable products such as cloth, washable and reusable cloth pads, menstrual cups and period panties [9]; this article tries to understand the choices of menstrual products that women make, the factors responsible for choosing a particular type of menstrual product, the perceptions of women using the products, and if there are any implications on the health and environment of using particular products.

The knowledge about menstruation and the need to manage menstruation healthily and effectively is very crucial for women as they spend the maximum period of their life managing menstruation which is 32–35 years assuming they attained menarche at the age of 13 years and reach menopause by the age of 45–50 years. The average age of menopause of an Indian woman is 46.2 years, and the age of menopause of their Western counterparts is 51 years [10]. If the number of days is considered spent menstruating, estimated an average of one period lasting for 5 days per month, accounts for 6–7 years of one's life spent only menstruating. Women tend to manage menstruation for a long duration of their life; however, not much attention is paid to making this process safe and hygienic and making the services/products accessible and affordable considering the impact of menstruation on their lives.

Bharadwaj and Patkar found that menstrual management is missing from the literature and that there is an urgent need to investigate the issue thoroughly and demonstrate viable, practical solutions on the ground related to MHM [11]. The broader problem of menstruation is related to the cultural practices and taboos surrounding menstruation that does not provide a healthy atmosphere for managing the menstrual cycle. There is a growing need to provide adolescent girls/women with adequate school infrastructure, access to affordable menstrual products, necessary knowledge, facilities and culturally safe practices and gender equity for them to manage their periods with dignity. Education is a key to bringing about sustainable social change [5, 12].

Gender equality and women's empowerment are an integral part of each of the 17 Sustainable Development Goals. There are gender-specific indicators in each of the goals which need to be achieved unless we ensure the completion of girls' education, we cannot expect women to take the decisions that matter to them. Similarly, when we look at sanitation facilities and water it is girls and women who are involved in the collection of water, and they are impacted the most if there is a lack of water and sanitation facilities. Women are the main carers and they often neglect their health when it

comes to their families. Menstruation is linked to various other goals of SDGs, and it is of utmost importance that there is adequate infrastructure and facilities provided to address the challenges faced by young girls and women. It is evident from the literature that there is an urgent need to manage menstruation effectively as it impacts girls' education due to the lack of facilities. Studies have elaborated on the link between sustainably managing menstrual health and hygiene (MHH) with the progress in SDGs. Sommer et al. have shown how improving MHH can help progress across the SDGs [13]. Education plays a very crucial role in the growth and development of a country. Empowering girls by providing them with adequate education will help them with opportunities to continue their education and participate in the labour market.

The literature review revealed that studies are focused on menstrual hygiene awareness, the menstruation process, and issues concerning the disposal of menstrual pads [13–15]. The studies also revealed that massive menstrual waste generation threatens the environment [16]. The critical point highlighted is that there is limited knowledge regarding sustainable menstrual products and an urgent need to study the type of menstrual products used by women and the disposal system.

The objective of this paper was twofold. One of the objectives was to analyse existing literature to understand and identify the gaps and propose a research study among women in higher educational institutes to understand further women's perceptions of using menstrual products. Another objective was to identify factors responsible for choosing a particular type of menstrual product, the perceptions of women using the products, and their implications on the health and environment (see Table 2). A rapid review of literature on menstruation and menstrual products identified many pertinent questions like:

- What type of menstrual products are used by girls and women, and what happens to the used products?
- Where are they disposed of?
- How long does it take to dispose of the used menstrual pad?
- What is known about the disposal of menstrual waste?

The literature search was carried out on menstrual products and their use among girls and women. The investigation focused on the specific studies that looked at the product types used by the girls and women and the role of education in choosing sustainable menstrual products.

2 Methodology

The objective of this paper was to understand what was already known or what were the unknown facts around menstruation and the use of sanitary products commonly used by many women need to be investigated [17]. This study carried out a rapid literature review. A rapid literature review is a modern literature review technique that follows partly the steps of a systematic review and is more rigorous and transparent than traditional literature reviews. It follows five steps: (1) building keywords and search strings based on research questions, (2) using the keywords to search in literature databases, (3) screening the articles, (4) coding the articles, and (5) analysing of the findings. All steps must be documented [18].

An online group brainstorming activity for the study resulted in three keywords: 'menstruation', 'sustainability' and 'hygiene' to best describe the research objectives. These keywords were used as small search strings like (menstruat* AND sustainab*) in Elsevier's Scopus database in February 2022 to search for relevant papers. Asterisks were used to capture variations of the word. A total of 76 articles were identified. For setting the inclusion criteria for screening, articles were divided into four sets and were randomly checked for consistency and agreement for inclusion. The titles of the paper were read and listed their inclusion criteria.

The inclusion criteria were as follows:

1. Title screening stage: any words related to menstruation, sanitation, reproductive health, menstrual products, and menstruation management.
2. Abstract screening stage: the paper's objective relates to sustainable MHM practices, the role of education in promoting MHM, menstrual products, sanitation, and reproductive health.
3. Detailed full-text reading stage: the findings of the paper relate to MHM including access to facilities during menstruation, menstrual waste management, the role of education in promoting MHM, and menstrual products.

The Kappa score [19] which is used to record agreement was 0.82 (average) denoting excellent agreement to include the studies. No further changes were made to the inclusion criteria. Out of 76 articles, title screening fetched 42 papers satisfying the inclusion criteria. The next stage of the abstract screening resulted in 36 papers. These papers were downloaded to read the full text in detail. Out of these 36 papers, 25 were finally included in our study. 3 papers were from the 1990s and thus were inaccessible due to the non-availability of the Doi/URL. 3 more papers were added from authors' knowledge and reviewers' suggestions. The relevant information and data from the final 25 papers were coded carefully and a detailed analysis was carried out based on four thematic areas:

- Studies focused on awareness about menstruation and menstrual health.
- Studies on the feasibility and acceptability of menstrual products.
- Studies exploring innovations around menstrual products.
- Studies focused on menstrual waste disposal and management issues.

The next section presents the analysis and results.

3 Results

Out of the 28 papers included in this study, 23 papers (82%) were from South Asia (India, Bangladesh, Nepal) and Africa (Ethiopia, South Africa, Kenya, Malawi, Ghana, Honduras, Mali, Mozambique, Niger, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe). Only 4 (16%) studies are from other regions: Taiwan, Korea, Argentina and Australia. In terms of developed and developing countries: 24 (86%) studies are from developing countries while only 3 studies (12%) are from developed countries. 1 study did not mention any geographic location.

3.1 Studies focused on awareness about menstruation and menstrual health

The studies dealing with awareness around the menstrual process and health and hygiene aspects focus on understanding the MHM needs in rural schools [20]. Studies have considered many factors leading to MHM disparities among girls in rural and urban areas. E.g., a study conducted in Ethiopia [14] and Ghana [4] explored the disparities between rural and urban areas and investigated variables like age, religion, ethnicity, education of parents, occupation of parents, knowledge of menstrual hygiene, source of information about menstrual hygiene, school environment-related issues, knowledge about menstrual hygiene, good MHM practice, functional toilet compartment in school, discussing menstrual hygiene with parents. The Ethiopia study found that there is variability, and the performance in the urban areas was better. Two significant reasons are: accessibility of sanitary materials, which is available more in urban areas, and sexual and reproductive discussion with parents is high in urban areas. Also, the study highlighted that the girls in urban areas have access to media, which helps them gather more information on MHM practices than rural girls. The study in Ghana found that girls and women are not allowed to perform religious practices during menstruation which is also a common practice in India.

Afiaz and Biswas reported that the factors influencing modern methods of managing MHM depend on the status of women's education and their access to media [15]. Accordingly, women with better access to media and higher education status were more likely to have better MHM practices. Future intervention-based studies using the media platforms should focus on providing access and knowledge regarding MHM to improve MHM practices. Studies should have more target-oriented research and generate specific data to evaluate the respondents' level of awareness while understanding the direct impact of media and mobile phone use [15]. There is a lack of awareness on keeping track of the menstrual cycle; therefore, there is a need for in-depth education about the basic biology behind menstruation [16].

Roxburgh et al. reported on the medicinal aspect of menstrual blood. The study revealed that menstrual blood is viewed as a powerful substance used in traditional medicine. The study found that several women preserved their menstrual clothes to be used when required in case of illness or injury of a family member, even after the cloth was worn out and no longer used. A study reported that a woman even obtained permission from her husband before discarding her used menstrual clothes, which were considered valuable [16]. Women took great care to keep their menstrual clothes secure and hidden at home, so they were not vulnerable to *ufiti* (witchcraft) [21]. Burning and discarding the used pads in pit latrines were considered the safest options. Due to the secrecy around menstruation, many women preferred

disposing of pads and burning used cloth. Further research is recommended to improve the availability and manufacturing standards of high-quality reusable sanitary pads [17].

Women face logistical challenges in storing and transporting menstrual products as secrecy around purchasing sanitary items, overcrowded housing, living across multiple residences, high financial costs, lack of privacy for safe keeping of personal items, sufficient female-friendly infrastructure (e.g., working toilets, accessible disposal facilities, privacy) [7]. The MHH content and material should be dealt with sensitivity and should be made available to all genders. Additionally, vending machines that provide free MHH products may improve access for girls while in school. Still, more evidence is needed to inform knowledge of the effectiveness and implementation of the strategy before scaling up [7]. It is assumed that young girls learn about their menstruation from their mothers. Still, studies show a need for in-depth education about the basic biology behind menstruation [17].

A multi-African country study was conducted in Ethiopia, Uganda, South Sudan, Tanzania, and Zimbabwe to understand the existing MHM practices and ascertain the feasibility of introducing sustainable menstrual practices like cups and reusable pads [22]. In all five countries, it was found that menstrual exclusion practices are still in practice, and menstruation is considered *taboo*; thus, there is silence around the topic. Menstruating women are considered impure and unclean, which affects their access to MHH.

The study also indicated that

“The materials used during menstruation range from nothing to disposable pads, cloths/rags, commercial sanitary pads (disposable and reusable), toilet paper, magazines, cotton, pieces of mattress, natural materials (leaves, tree bark), digging a hole, goat skin, cow dung, ash, and sand are the main materials used in managing menstruation in the five countries” [22].

McMahon et al. studied the Kenyan School girls’ perceptions and practices related to menstruation. The study was conducted in six rural schools. Data from 48 primary school students and nine teachers were collected through focused group discussions, in-depth interviews, and field notes. The respondent girls expressed fear, distractions, and shame around the topic of menstruation. The study recommends encouraging sustainable menstrual practices after considering practical and culturally acceptable practices [23].

3.2 Studies on the feasibility and acceptability of the menstrual products

Studies focussing on the feasibility and acceptability of reusable and sustainable menstrual products highlighted key points such as a need to consider upscaling such products. For e.g., In India, a study [24] on Banana fiber pads, a market-ready product, has less leakage compared to disposable pads, are largely biodegradable and, CO₂e mission is less than 0.01 kg (compared to one disposable sanitary pad is 0.041 kg), abundantly available, have suitable mechanical properties and ease of production and manufacturing. Banana fiber pads need prior soaking before washing. The paper pointed out that during COVID restrictions, the re-usability features of menstrual products have catered to the needs of women and helped in reducing menstrual poverty.

Studies have shown that women attach importance to comfort, volume, and duration of blood absorption in the selection of menstrual products [25].

“Among women’s attitudes regarding eco-friendly menstrual products, menstrual cloth pads and menstrual cups are the main trends, followed by menstrual underpants, while menstrual pads and tampons account for the market majority of menstrual products. While tampons are superior to menstrual pads in all aspects, women prefer the latter, as the former are invasive, and people are afraid of pain and have a misunderstanding of a “damaged hymen” [25].

A study on the acceptability of the menstrual cup among students in higher education institutions reported problems and experiences on ease of insertion and removal on first use and advised future studies to compare the use of menstrual cup with other alternative products and study the changes over time [26]. The amount spent on purchasing menstrual products should be collected and measured in the menstrual health management programmes that offer various products.

Girls and women were happy with the introduction of menstrual product interventions (both disposable and reusable), especially in schools and considered reusable pads and menstrual cups a better option in terms of affordability and disposal [27]. Reusable pads and menstrual cups were a one-time investment, as the products can be reused multiple

times depending on the type of material and can be used for several years. Future studies need to explore the barriers that prevent women from using sustainable menstrual products [27].

Studies reported that patriarchal society and socio-cultural taboos reinforce menstruating women to restrict their choices of accepting Sustainable Menstrual Products (SMPs). Even though women were pro-environment, they were forced to continue with discomfort and constrained choices and resist change. The study provides powerful evidence for attitude-behaviour inconsistency in consumption decisions toward sustainable products [28].

Several studies have been conducted in African countries focusing on sustainable menstrual practices [22]. In western rural Kenya [29], a study was conducted to find out adolescent school girls' experience with the acceptability of menstrual cups and reusable pads. Initially, the uptake of the cup was slow, but once the girls switched to the cup, they preferred it compared to other menstrual products. Once they were comfortable with cups and pads, they were free from embarrassing leakages and odours. The girl's school absenteeism reduced as they switched to cups and pads.

3.3 Studies exploring innovations around menstrual products

'The pad project' is a global initiative to unite women to educate them about the menstrual cycle and hygiene. This project was initiated by a nurse from the USA (United States of America) who resides in India. Through this initiative, sustainable menstrual hygiene kits are provided to women when they come to attend menstrual education talks. Every kit contains six washable, reusable pads, underwear, two panty liners, a washcloth, two safety pins, a soap, and laundry detergent [30]. Jatan Sansthan, an NGO from Rajasthan, claims to have pioneered stitched cloth pads named 'Uger pads' in India [31].

A study in Argentina highlights how technologies and users co-construct each other in menstrual activism, working for the empowerment, de-stigmatisation, and sustainability [32]. The study recommends involving women's agencies in this cause. The study found that shifting to environmentally friendly menstrual products is a gradual process, and concern for the environment is the main reason for the shift. The respondents sought information about sustainable menstrual products from websites.

3.4 Studies focussing on menstrual waste disposal and management issues

A primary survey study conducted in Vanuatu found that during menstruation, it is the responsibility of the menstruators to collect their water, wash their reusable menstrual cloth, and use a separate latrine and bathing shelter [33].

A study on the disposal of menstrual waste found that the girls from rural schools do not use menstrual clothes during school hours as there is no room for changing and washing. And those who used menstrual clothes did not reuse them. They either buried or disposed of used clothes and pads. The study reported that girls missed school during menstruation, and others did not change sanitary pads during school hours due to a lack of supportive facilities. Menstrual waste was not managed efficiently due to inadequate toilet disposal facilities. Girls from urban and rural schools refrained from using school toilets, especially during menstruation, as they had to wait in a queue and lacked privacy and facilities to change or dispose of the used products. The most recommended facilities by girls in the study were: separate toilet and washroom, provision of toilet paper, sanitary pad and disposal bin in the toilet, and stored water and soap for handwashing. Students perceived puberty and menstruation as a matter of shame and should not be discussed with the opposite sex to avoid teasing. The school curriculum lacks sufficient information about puberty and menstruation; therefore, they fail to develop a clear understanding of MHM and the irresponsible attitude of teachers towards puberty and menstruation-related classes by advising students to read about these topics at home on their own [34].

In Asian countries, especially in India, there have been several menstrual activisms towards sustainable menstruation in recent times, and likewise, academic research studies have also been carried out [30, 31, 35, 36]. Imperfect Information in Menstrual Health and the Role of Informed Choice study by Tanya Mahajan, 2019, compare menstrual cups, reusable pads and disposable pads and understands how media influences our choices on menstrual products. Her study suggests that informed product choice can become a tool for enhancing women's agency further and can improve menstrual health [35]. Due to shyness girls dry their reusable pads in their rooms [4]. Nepal experienced an earthquake in 2015, post-earthquake, there was an intervention to help women and girls to switch to reusable pads. This initiative helped meet the women's immediate needs, and Nepalese women and girls welcomed reusable pads. The study recommends the promotion of reusable pads at the national level by the government is required [37].

Practices and challenges faced by the girls/women in developing countries [36] highlight the importance of menstrual education for improving the menstrual health of girls/women. The study also points out cultural beliefs and practices which influence menstrual practices. Along with parents, teachers, NGOs and social media should play an important role

in imparting menstrual education. The study also recommends that government should provide subsidies so that menstrual products become affordable, and schools should provide infrastructural facilities to meet their menstrual hygiene needs. The paper also suggests strategies to tackle menstrual waste management concerns such as incinerators, use of cloth pads and other biodegradable products, Latrines with chutes, etc. The study also suggests that men and women both should be given menstrual education.

4 Discussion

There is limited literature related to the use of menstrual products. Most studies focused on menstrual hygiene practices and awareness. Recently, there have been a lot of initiatives for producing low-cost sanitary napkins such as the Sakhi Project in India. The literature review identified several recommendations for future studies. Afiaz and Biswas suggests excluding women who do not menstruate prior to the study for more than 6 months as it will not provide adequate information on the use of menstrual products and experiences of managing menstruation [15]. Also, studies suggest a need for involving men in the awareness sessions on MHM to break the silence around menstruation.

The rapid review of the literature identified a few valuable sources of information such as (a) case studies identifying specific menstrual products and issues (see Table 1) [17, 23, 36, 38], and their awareness (see Table 2). The findings will be used in designing the survey and allow achieving the research aim and objective of the future study, (b) individuals and civil society organisations working at the grassroots level, creating awareness, and promoting alternative (sustainable) menstrual products to reduce environmental impact, and active on the social media discussing and deliberating the MHM issues.

4.1 Specific issues affecting MHM practice

The findings from Table 1 will be operationalised in a survey to investigate the current state-of-the-art of MHM practices in India and the UK. The survey will be conducted for girls and women aged 18 and above to understand their awareness and perceptions of sustainable menstrual products. The findings of the study will help in developing strategic interventions to enhance the participants' knowledge about sustainable menstrual products, and decision-making for informed choices on their usage and disposal, contributing to overall education in the menstrual hygiene management, growth and development of a country, gender equality and women's empowerment.

Lack of awareness can lead to ignorance and negligence of women's health, appropriate facilities and privacy, equity and dignity, even at the policy level [39]. The findings of this paper can influence policy. There is a significant need to provide focused guidance on reusable menstrual products and how often to change and dispose of them. Early menstrual education is vital to strengthen education and awareness, as it may improve good MHM practice. Studies have found that government and private enterprises should help increase and improve sanitation, education and sanitary facilities. Providing menstrual education to underage girls is crucial to reducing the infection rate. Moreover, studies also highlight that encouraging open discussions with families on menstrual hygiene can improve MHM.

To minimise the girls' absenteeism in schools/educational institutions during menstruation, institutions and the government must ensure the fulfilment of MHM guidelines by providing adequate infrastructural facilities. There are MHM guidelines specifying the need for infrastructural facilities regarding adequate and functioning toilet facilities with availability of water and soap, privacy for changing pads and proper disposal facilities. To overcome the challenges in managing menstrual waste; there is an urgent need to understand the volume of menstrual waste generated by the different types of menstrual products and disposal management systems.

4.2 Individuals and organisations active in MHM space

Women are often hesitant and feel ashamed to talk about menstruation due to socio-cultural factors. In recent times, there are lot many organisations working towards creating awareness and breaking the silence around menstruation. Every girl/woman has unique needs during menstruation like a private space to change, need a toilet with running water for cleaning, a safe disposal system, etc. School girls have specific needs to manage their menstruation at school to keep them in school.

Table 1 Specific menstrual products and issues affecting MHM practice

S. No and Items	Elements	Reason for inclusion in the questionnaire
Participant's Profile	Age, Course enrolled, Year, Subject, Location or locality of residence	Adoption of sustainable menstrual products and MHM may be linked with the age, profession/education of the consumer [4, 14, 15, 36] A need for more target-oriented research and generating more specific data to help evaluate the awareness level of the respondents [15]
Menstrual History	Age at Menarche Awareness about menstruation, Experiences and perceptions about menstruation Awareness and education on MHM Information about menstruation in School /college curriculum Perception/awareness of men /boys regarding menstruation Socio-cultural factors that influence menstrual practices	86% of the participants disclosed that their family members, relatives, and neighbours were reluctant to discuss puberty and menstruation Girls reported that the schoolboys teased them for staining their clothing All the students perceived puberty and menstruation as a matter of shame, and to avoid teasing, not discuss menstruation-related matters with the opposite sex [34] Menstrual education is transferred by the older females in the family when menarche is reached, but not beforehand [14, 35] Awareness helps in improving MHM [14] There is a need for in-depth education about the basic biology behind menstruation [17] Lack of sufficient pubertal and menstruation information in the school curriculum, thus lacking MHM knowledge Irresponsible attitude of teachers towards puberty and menstruation and they give the topic for self-study [31] Boys laughed at girls when teachers were taking puberty and menstruation classes [34] A need for creating culturally sensitive puberty education for girls and boys, emphasising that MHM content and material should be dealt with sensitivity, and should be made available to all the genders [7]
Menstrual Products and hygiene management	Access, availability, and affordability of the menstrual products, Privacy and safety Gender norms and socio-cultural factors Awareness about menstrual products Management of Menstruation Access to the type of products Affordability Importance of disposal Disposal of used products Awareness about the environmental impact of product disposal Factors responsible for a choice of menstrual product Duration of the Product use Facilities/infrastructure requirement Management of used products/ disposal Awareness about the type of product used Expenditure incurred on menstrual products per month	Logistical challenges related to the use of menstrual products include secrecy around purchasing sanitary items, high financial cost, sufficient female-friendly infrastructure [7] The difficulties in storing and transporting products because of overcrowded housing, living across multiple residences, and lack of privacy for safe keeping of personal items [7] The status of menstruating women restricts their consumption choice, as the deeply rooted socio-cultural taboos reinforce traditional gender norms creating conditions for resisting change (Meenakshi, 2020) The factors influencing use of modern methods of managing MHM depend on the status of education and access to media [5, 15] Majority of consumers attach importance to comfort, volume, and duration of blood absorption to selecting menstrual products [25] A need for future research on the use of menstrual cups in comparison with other products at different times of the menstrual cycle and study the changes over time [26] Importance of understanding the price/cost/expenditure per month on menstrual products [36] The amount of cost incurred in buying the menstrual products should be collected and measured in the menstrual health management programmes that offer different products [26] Importance of understanding the disposal or/and washing process to upscale reusable products [36] Attitude-behaviour inconsistency in consumption decisions towards sustainable products, e.g., though many women were pro-environment they were forced to continue with discomfort and constrained choice and did not change into SMP use [28] The girls from rural schools do not use menstrual clothes during school hours as there is no facility [34], or room for changing and washing [34] Participants chose reusable pads and menstrual cups for affordability and disposal [27] Reusable pads and menstrual cups are a one-time investment, can be reused multiple times for many years depending on the type of material and can be used for several years [24] Menstrual blood water draining from the bathroom should not be visible to neighbours/passers-by [16] The use of menstrual cups in comparison with other products at separate times of the menstrual cycle and study of the changes over time [26] Importance of understanding the price/expenditure per month on menstrual products [36]. Awareness and disposal facilities on MHM [16] and the medicinal aspect of the menstrual blood

Table 1 (continued)

S. No and Items	Elements	Reason for inclusion in the questionnaire
Menstrual Products/ facilities in educa- tional Institutions	Facilities to manage menstruation in universities Keeping track of cycle Availability of menstrual products in universities Price of products in educational institutions Access and Provisioning of products	62% of the girls missed school during menstruation and others did not change sanitary pads during school hours due to a lack of supportive facilities in the school [34] Girls are unaware of when their menstrual cycle will begin and do not know to track their menstrual cycle [17] Girls do not prefer to use school toilets during menstruation due to (1) requiring standing in the queue and (2) there are no changing or disposal facilities [34] The amount of expenditure incurred in buying menstrual products should be collected and measured in the MHH programmes offering various products [26] The provision of vending machines that provide free MHH products may improve access to menstrual products while in school, but more empirical evidence is needed to inform knowledge of the effectiveness and implementation of the strategy prior to scaling up [7] There were no regulations regarding the quality and standard of the menstrual products supplied by service providers that are promoted in the schools and communities [27] A need to examine regulations of menstrual products. Future interventions need to consider these issues while designing and implementing menstrual hygiene programs [27]
Personal hygiene	Access to water Restrictions or taboos Acceptance of restrictions Believe in restrictions/myths Awareness of the myths Challenges faced in the management of MHH	Understanding the disposal/washing process is important to upscale reusable products [20, 36] Socio-cultural beliefs do not allow menstruators to work in the gardens or cook as it is feared that they will kill crops and contaminate food or lifting heavy objects will lead to a heavier menstrual blood flow [33] Women are forced to accept taboos surrounding menstruating women in the patriarchal society [28] The deeply rooted socio-cultural taboos reinforce traditional gender norms creating conditions for resisting change and consumption choices [28] There is a need for in-depth education about the basic biology behind menstruation [17] Some women took the utmost care to hide the used cloth from their own husbands. For those who used disposable pads, they took care to dispose of the pads 'safely' so that nobody else could find them [16]
Others	Challenges during the pandemic Awareness of environmental problems caused by menstrual waste Willingness to shift to sustainable menstrual products	Studies say reusable products have helped reduce menstrual poverty during pandemics [36] Reusable products emit less CO ₂ and is less environmentally damaging [36] Though many women were pro-environment they were forced to continue with discomfort and constrained choice and did not use SMP, providing powerful evidence for attitude-behaviour inconsistency in consumption decisions towards sustainable products

Source: Collated from the literature by authors

Table 2 Menstrual products and their awareness

Type of products	Strengths	Weaknesses	Facilities required	Environmental impact	Awareness Score*
Menstrual cloth	Reusable Affordable Easy availability	Washing and drying in the sun Unhygienic if used repetitively and unwashed	Water, soap, and privacy to change	Minimum as degrades	5
Disposable Menstrual Pad	Easy accessibility Easy to use	Contains dioxin/bleach can cause rashes made of plastic, so harmful to the environment not affordable to all	Privacy to change	500–800 years to dispose if burnt emits dioxins	4
Bio-degradable menstrual pad	Eco-friendly	Expensive Not accessible easily	Privacy Water and soap	minimum	3
Tampons	Accessible Provides advantages in terms of mobility to women especially sports women and swimmers	Toxic shock syndrome Disposal facilities	Privacy to change water and soap	0.5- 5 years	3
Washable reusable cloth pad	Eco-friendly 75 times usability per pad Easy to carry and change cost-effective	Not accessible easily Not advisable in the water scarcity and flood regions	Privacy Water and soap for washing Sun drying	Minimum as it degrades	3
Disposable cloth pads	Eco-friendly	Not accessible easily	Privacy water and soap for washing	Minimum as it degrades	3
Menstrual Cup	Leakproof No rashes Eco-friendly Affordable Trash free	May not suit every menstruator May take time to adjust Cultural restrictions for unmarried girls to use	Water soap and privacy to empty and re-insert	Depends on the material with which the cup is made	1

Source: Authors own creation and compilation

* Score 0–5, 0 = No awareness, 5 = High awareness, the awareness score was reached through the discussion between the authors/experts

Arunachalam Muruganatham is popularly known as the “*menstrual man*” designed and developed using the innovation eco-friendly, low-cost sanitary napkin which has reached many women in rural villages of India. He thought of inventing this product after noticing his wife following unhygienic practices during the menstrual cycle. In terms of use of the menstrual products, one needs to consider accessibility, affordability, safety, dignity for women and sustainability for the environment [40].

In 2018, after the release of ‘Padman’ a movie based on Arunachalam, there have been breakthroughs on the silence around menstruation since then and about menstrual pads in India. Also, there has been a lot of propaganda on providing menstrual products to girls and women in schools. The invention of producing the menstrual pad has reached many parts of the country empowering women to take the lead in producing the products and marketing. This has generated employment in rural villages of India [40].

Literature on the provision of menstrual products shows that there are organisations working on producing, and marketing sanitary napkins like Sakhi sanitary pads, and Saathi Sanitary pads [17]. The government of India came up with schemes to provide sanitary napkins to underprivileged girls and women at an affordable rate @Rs.1/- through Pradhan Mantri Bhartiya Janaushdhi Pariyojna -PMBJP Kendras across the country. Jan Aushdhi Suvidha Oxo-biodegradable sanitary napkins were launched in August 2019. Access to menstrual hygiene products has far-reaching consequences not only for health but it can reduce school absenteeism and can positively affect the working potential, efficiency, and involvement of women in the workforce.

There are many initiatives that have emerged in recent times developing sustainable menstrual products and working towards creating awareness about menstrual health among young adolescents in India. One such initiative is Eco Femme—A women’s initiative to save the planet. Eco Femme is based in Auroville, Tamil Nadu, India (<https://ecofemme.org/>). Eco Femme is a social enterprise organisation where women are earning their livelihood through the production of reusable, washable cloth pads. The organisation is involved in conducting workshops on menstrual health for adolescent girls and providing them with the option of choosing washable cloth pads through a program called Pad for Pad. Eco Femme is promoting healthy, dignified, affordable and environmentally sustainable menstrual products [41]. The authors in Goa have been involved in creating awareness about menstrual hygiene and various sustainable menstrual products. In the literature, there are studies which are centred around the projects implemented to promote menstrual products in India.

There are several types of menstrual products that are used for managing the menstrual blood which is available on the market. There are companies which promote their products through advertisements on television and other media. In India, traditionally, many women used a cloth to manage their periods which was then washed and reused very often over the months together. Due to the stigma and shame associated with menstrual blood often the cloth was not dried in an open space or in the sun, it was dried in dark /closed spaces. A study conducted in Malawi observed that young girls feared that menstrual blood was being used in witchcraft which led women to take precautions not to dispose of the used menstrual cloth in the open where it could be found by someone who can use it for witchcraft [16]. Women have gradually shifted to the use of commercial disposable sanitary pads which are used and thrown in the garbage bins and landed up in the fills. It is widely recognised in the literature that the used menstrual products/waste cause a lot of waste management issues as they are not biodegradable. The initiatives taken by individuals and organisations to produce biodegradable low-cost menstrual products, therefore, are significant in contributing to addressing these issues [36, 38, 42].

5 Conclusion

Rapid literature reviews are not as rigorous as systematic literature reviews and few steps of systematic reviews are omitted but it helps to provide timely information. Our rapid review provided interesting findings like the current practices in MHM and the awareness; use and factors affecting sustainable menstrual products (see Tables 1 and 2); the role of education in the MHM; gender equality and women’s empowerment in relation to the SDGs.

It is acknowledged that the study is limited to the articles found by the search query and those indexed in Scopus only. The inclusion of more literature databases and country-focused searches may have helped in getting more nuanced information which could be taken up for future research. This study is unique because it tries to explore specific enabling factors of MHM practices and outline the strengths, weaknesses, environmental impact and awareness levels of different menstrual products. It is striking to find that the awareness level for sustainable menstrual products ranges from low to medium. Therefore, increasing awareness through education is the need of the hour to aid in achieving SDGs 3

(Good health and wellbeing), 6 (Clean water and sanitation), 11 (Sustainable Cities and Communities), 12 (Sustainable consumption and production), and 13 (Climate action).

The findings of this paper also highlights a lack of studies undertaken in developed countries, Only a few studies from been identified from developed countries, despite the issues related to menstrual products and MHM being the same. For example, the issues in the UK are not less serious. According to the global children's charity Plan International UK, "nearly two million girls (64%) aged 14–21 in the UK have missed a part-day or full day of school because of their period, with 13% of girls missing an entire school day at least once a month". The Alliance for Sustainability Leadership in Education reported that 68% said they felt less able to pay attention in class at school or college while menstruating. These girls risk falling 145 education days behind their male counterparts. More than 1 in 3 girls (40%) in the UK have used toilet rolls because they could not afford menstrual products. Against this backdrop, future research will aim to understand the type of sanitary products used by women during menstruation and their awareness/perception of sustainable menstrual products in India and the UK to study the issues in both the developing and the developed countries. A potential opportunity for studying these issues in the context of other countries will also be investigated for the overall contribution to global literacy on the issue.

Acknowledgements SP, KR, RT, and SS acknowledge the online free worldwide platform for early career researchers to connect and work for SDGs facilitated by RT, founder of the Global Sustainable Futures Progress through Partnerships Network, and in-kind supported by the University College of Estate Management, Reading, UK, without which this research could not have initiated. SP, KR, RT acknowledges the fund provided by the School of Justice Pump Priming School of Justice Research Pump Priming Scheme 2021/2, the University of Central Lancashire, Preston, UK, for this research. SP and KR acknowledge the support provided by the Women's Studies Programme, Manohar Parrikar School of Law, Governance and Public Policy, Goa University, in the conduct of this research. SS duly acknowledges the infrastructural support provided by the Global Centre for Environment and Energy, Ahmedabad University and South and South-east Asia Multidisciplinary Applied Research Network on Transforming Societies of Global South (SMARTS@SERD-AIT), School of Environment, Research and Development, Asian Institute of Technology, Thailand for carrying out this research.

Author contributions SP and SS started the preliminary framing of the research objectives. SS constructed the review methodology. SP, KR and RT worked on the remaining methodology. All authors carried out the rapid review and e-met weekly for consistency checking. SP, SS, and KR summarised the results and the tables. All authors discussed the results, structured the paper and contributed to the final manuscript. RT structured the discussion and the conclusion of the article. SP and RT proofread the analysis. RT did thorough editing and formatting before the final submission. All authors read and approved the final manuscript.

Declarations

Competing interests The authors declare no competing interests.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

1. WHO/UNICEF. Consultation on draft long list of goal, target and indicator options for future global monitoring of water, sanitation and hygiene. 2012.
2. UNICEF. Guidance on Menstrual Health and Hygiene. 2019; <https://www.unicef.org/media/91341/file/UNICEF-Guidance-menstrual-health-hygiene-2019.pdf>.
3. House S, Mahon T, Cavill S. Menstrual hygiene matters. *WaterAid*. 2012:347.
4. Asumah MN, Abubakari A, Aninanya GA, Salisu WJ. Perceived factors influencing menstrual hygiene management among adolescent girls: a qualitative study in the West Gonja Municipality of the Savannah Region, Ghana. *Pan Afr Med J*. 2022. <https://doi.org/10.11604/pamj.2022.41.146.33492>.
5. Ha MAT, Alam MZ. Menstrual hygiene management practice among adolescent girls: an urban-rural comparative study in Rajshahi division, Bangladesh. *Bangladesh Women's Health*. 2022;22(1):86. <https://doi.org/10.1186/s12905-022-01665-6>.
6. London Assembly Environment Committee. Single-use plastics: Unflushables. 2018; https://www.london.gov.uk/sites/default/files/plastics_unflushables_-_submitted_evidence.pdf.

7. Krusz E, Hall N, Barrington DJ, Creamer S, Anders W, King M, Martin H, Hennegan J. Menstrual health and hygiene among Indigenous Australian girls and women: barriers and opportunities. *BMC Womens Health*. 2019;19(1):146. <https://doi.org/10.1186/s12905-019-0846-7>.
8. Francis A, Sarangi GK. Sustainable consumer behaviour of Indian millennials: some evidence. *Curr Res Environ Sustain*. 2022. <https://doi.org/10.1016/j.crsust.2021.100109>.
9. Blair LAG, Bajón-Fernández Y, Villa R. An exploratory study of the impact and potential of menstrual hygiene management waste in the UK. *Clean Eng Technol*. 2022. <https://doi.org/10.1016/j.clet.2022.100435>.
10. Ahuja M. Age of menopause and determinants of menopause age: A PAN India survey by IMS. *Journal of mid-life health*. 2016;7(3):126–31. <https://doi.org/10.4103/0976-7800.191012>.
11. Bharadwaj S, Patkar A. Menstrual hygiene and management in developing countries: taking stock. *Junction Soc*. 2004;3(6):1–20.
12. The Lancet Child & Adolescent Health. Normalising menstruation, empowering girls. *Lancet Child Adolesc Health*. 2018;2(6):379. [https://doi.org/10.1016/S2352-4642\(18\)30143-3](https://doi.org/10.1016/S2352-4642(18)30143-3).
13. Sommer M, Torondel B, Hennegan J, Phillips-Howard PA, Mahon T, Motivans A, Zulaika G, Gruer C, Haver J, Caruso BA. How addressing menstrual health and hygiene may enable progress across the Sustainable Development Goals. *Glob Health Action*. 2021. <https://doi.org/10.1080/16549716.2021.1920315>.
14. Shibeshi BY, Emiru AA, Asresie MB. Disparities in menstrual hygiene management between urban and rural schoolgirls in Northeast, Ethiopia. *PLoS ONE*. 2021. <https://doi.org/10.1371/journal.pone.0257853>.
15. Afiaz A, Biswas RK. Awareness on menstrual hygiene management in Bangladesh and the possibilities of media interventions: using a nationwide cross-sectional survey. *BMJ Open*. 2021;11(4):e042134. <https://doi.org/10.1136/bmjopen-2020-042134>.
16. Roxburgh H, Hampshire K, Kaliwo T, Tilley EA, Oliver DM, Quilliam RS. Power, danger, and secrecy—a socio-cultural examination of menstrual waste management in urban Malawi. *PLoS ONE*. 2020;15(6):e0235339. <https://doi.org/10.1371/journal.pone.0235339>.
17. Bhagwat A, Jijina PA. The psychosocial lens on an indigenous initiative to address menstrual health and hygiene in Indian villages. *Soc Work Public Health*. 2020;35(3):73–89. <https://doi.org/10.1080/19371918.2020.1738972>.
18. Khangura S, Konnyu K, Cushman R, Grimshaw J, Moher D. Evidence summaries: the evolution of a rapid review approach. *Syst Rev*. 2012;1(1):1–9. <https://doi.org/10.1186/2046-4053-1-10>.
19. Chin RF, Neville B, Scott RC. A systematic review of the epidemiology of status epilepticus. *Eur J Neurol*. 2004;11(12):800–10. <https://doi.org/10.1111/j.1468-1331.2004.00943.x>.
20. Cronk R, Guo A, Fleming L, Bartram J. Factors associated with water quality, sanitation, and hygiene in rural schools in 14 low-and middle-income countries. *Sci Total Environ*. 2021. <https://doi.org/10.1016/j.scitotenv.2020.144226>.
21. Adolfsson JS, Moss SM. “Even the NGOs Never Talk About Ufiti [Witchcraft]”: a decolonial and feminist cultural psychological analysis of individualized development clashing with communal ways of being. *Hum Arenas*. 2021. <https://doi.org/10.1007/s42087-021-00230-1>.
22. Tamiru S, Mamo K, Acidria P, Mushi R, Ali CS, Ndebele L. Towards a sustainable solution for school menstrual hygiene management: cases of Ethiopia, Uganda, South-Sudan, Tanzania, and Zimbabwe. *Waterlines*. 2015;92–102.
23. McMahon SA, Winch PJ, Caruso BA, Obure AF, Ogutu EA, Ochari IA, Rheingans RD. The girl with her period is the one to hang her head. Reflections on menstrual management among schoolgirls in rural Kenya. *BMC Int Health Hum Rights*. 2011;11(1):1–10.
24. Muthupalani K, Kolil VK, Bist A, Sreesuthan K, Sreedevi A. A novel banana fiber pad for menstrual hygiene in India S: a feasibility and acceptability study. *BMC Womens Health*. 2021;21(1):1–14. <https://doi.org/10.1186/s12905-021-01265-w>.
25. Tu J, Lo T, Lai Y. Womens cognition and attitude with Eco-friendly menstrual products by consumer lifestyle. *Int J Environ Res Public Health*. 2021;18(11):5534. <https://doi.org/10.3390/ijerph18115534>.
26. Beksinska M, Nkosi P, Zulu B, Smit J. Acceptability of the menstrual cup among students in further education institutions in KwaZulu-Natal, South Africa. *Eur J Contracept Reprod Health Care*. 2021;26(1):11–6. <https://doi.org/10.1080/13625187.2020.1815005>.
27. Kambala C, Chinangwa A, Chipeta E, Torondel B, Morse T. Acceptability of menstrual products interventions for menstrual hygiene management among women and girls in Malawi. *Reprod Health*. 2020;17(1):185. <https://doi.org/10.1186/s12978-020-01045-z>.
28. Meenakshi N. Taboo in consumption: Social structure, gender and sustainable menstrual products. *Int J Consumer Stud*. 2020;44(3):243–57. <https://doi.org/10.1111/ijcs.12562>.
29. Mason L, Laserson KF, Oruko K, Nyothach E, Alexander KT, Odhiambo FO, Eleveld A, Isiye E, Ngere I, Omoto J, Mohammed I, Vulule J, Phillips-Howard PA. Adolescent schoolgirls experiences of menstrual cups and pads in rural western Kenya: a qualitative study. *Waterlines*. 2015: 15–30. <http://www.jstor.org/stable/24688188>.
30. Raines M, Garner SL, Spies LA, Riley C, Prater LS. The pad project: a global initiative uniting women. *J Christ Nurs*. 2017;34(1):42–7. <https://doi.org/10.1097/CNJ.0000000000000334>.
31. Murthy L. Green is the new colour for menstruation. Uger fabric pads show the way through a sustainable perspective. In Chakrabarti A. *ICoRD’15 – Research into Design Across Boundaries Volume 2: Creativity, Sustainability, DfX, Enabling Technologies, Management and Applications Volume 2* Springer. 2015;213–225.
32. Gaybor J. Empowerment, destigmatization and sustainability: the co-construction of reusable menstrual technologies in the context of menstrual activism in Argentina. *Gender Technol Dev*. 2019;232:111–29. <https://doi.org/10.1080/09718524.2019.1643522>.
33. Wilbur J, Morrison C, Iakavai J, Shem J, Poilapa R, Bamberg L, Baker S, Tanguay J, Sheppard P, Banks LM, Mactaggart I. “The weather is not good”: exploring the menstrual health experiences of menstruators with and without disabilities in Vanuatu. *Lancet Region Health Western Pac*. 2022. <https://doi.org/10.1016/j.lanwpc.2021.100325>.
34. Jahan F, Nuruzzaman M, Sultana F, Mahfuz MT, Rahman M, Akhand F, Luby SP, Unicomb L, Winch PJ. Piloting an acceptable and feasible menstrual hygiene products disposal system in urban and rural schools in Bangladesh. *BMC Public Health*. 2020;20(1):1–14. <https://doi.org/10.1186/s12889-020-09413-x>.
35. Mahajan T. Imperfect information in menstrual health and the role of informed choice. *Indian J Gender Stud*. 2019;26(1–2):59–78. <https://doi.org/10.1177/0971521518811169>.
36. Kaur R, Kaur K, Kaur R. Menstrual hygiene, management, and waste disposal: practices and challenges faced by girls/women of developing countries. *J Environ Public Health*. 2018. <https://doi.org/10.1155/2018/1730964>.

37. Budhathoki SS, Bhattachan M, Pokharel PK, van Bhadra M, Teijlingen E. Reusable sanitary towels: promoting menstrual hygiene in post-earthquake Nepal. *J Fam Plan Reprod Health Care*. 2017;432:157–9. <https://doi.org/10.1136/jfprhc-2016-101481>.
38. Tudu PN. Saathi Sanitary Pads: eco-friendly pads which will make you go bananas! *Int J Nonprofit Volunt Sector Market*. 2020. <https://doi.org/10.1002/nvsm.1667>.
39. Weiss-Wolf J. *Periods gone public: Taking a stand for menstrual equity*. Simon and Schuster. 2017.
40. Jalan S. Meet the real PadMan — Arunachalam Muruganantham. 2018. <https://indianexpress.com/article/entertainment/bollywood/real-pad-man-arunachalam-muruganantham-akshay-kumar-5059709/>.
41. Singh S, Sumbria G. Devising success strategy for Eco Femme. Bangalore: Indian Institute of Management Bangalore. 2016: <https://repository.iimb.ac.in/handle/2074/20638>.
42. Achuthan K, Muthupalani S, Kolil VK, Bist A, Sreesuthan K, Sreedevi A. A novel banana fiber pad for menstrual hygiene in India: a feasibility and acceptability study. *BMC Womens Health*. 2021;21(1):1–14. <https://doi.org/10.1186/s12905-021-01265-w>.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.