



The Effect of Menstrual Cups on Sustainable Hygiene Management: Revolutionizing Menstrual Health

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Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 22 Nov 2023	<i>This review article explores the use of menstruation cups to manage period hygiene and promoting environmental sustainability. The primary goal of this paper is to review different types of commonly used menstrual products such as tampons, sanitary pads, reusable cloth pads, menstrual cups, and period underwear, including their affordability, environmental impact, and health effects. Menstrual cups are found out to be a better alternative for managing menstruation because it is reusable, affordable, and does not cause harm to environment and human health. The paper also looks at how menstruation cups empower women and help to eradicate period taboos. Menstrual cups not only offer a sustainable menstrual hygiene solution but also support larger social and cultural changes by giving people the knowledge and ability to make conversant decisions. In this review article, few case studies are discussed which highlights the transforming potential of menstruation cups. The article serves as motivating examples for governments, non-government organizations and businesses to encourage the usage of menstrual cups in female and thereby help in developing a more inclusive and sustainable future. This study also aims towards eliminating period poverty and help in achieving the sustainable development goals (SDGs) i.e., SDG 3 (Well-being and Good Health), SDG 6 (Clean Water and Hygiene), SDG 11 (Sustainable Cities and Communities) and SDG 15 (Life on Land).</i>
CC License CC-BY-NC-SA 4.0	Keywords: Tampons, sanitary pads, reusable cloth pads, menstrual cups, period underwear and sustainable development goals.

1. Introduction

Around 1.8 billion women menstruate across the globe every month (Rohatgi and Dash 2023). Millions of women are incapable to maintain their menstrual cycle in a healthy way. The beginning of menstruation refers to a new phase and liabilities. Many females face humiliation, harassment, and social elimination during menstruation. It restricts their mobility and personal choices (<https://www.unicef.org/wash/menstrual-hygiene>). Menstruation, or a period, is a unique female procedure. Adolescence is a paphysical, psychological, and reproductive stage between puberty and legal adulthood. A woman's reproductive system changes from menarche to menopause in a significant stage (Ghai, 2009). Lack of scientific knowledge about menstruation causes psychological and religious barriers. Many impoverished young women are unaware of menstrual physiology. Menstruation is a natural procedure, but it is tied to many community perceptions and practices, some of which can harm a person's health (Yasmin et al., 2013).

Menstruating women must maintain proper hygiene. Menstruation's pathology, physiology, and psychology are associated to women's health and well-being, making it an important factor in morbidity and mortality (Bachloo et al., 2016). During this period, a woman is at her highest risk for reproductive system infections (RTIs), sexually transmitted diseases (STDs), and urinary tract infections (UTIs). Hygiene during menstruation refers to meeting women's medical needs and demands during their monthly periods. Increased knowledge about menstruation from childhood could lead to safer practices and reduce millions of women's suffering (Yasmin et al., 2013).

Women have developed their very own unique coping mechanisms to get through that time of the month in a healthy and happy manner. There is a significant amount of variation in these approaches all over the world because of a variety of factors including individual choices, the accessibility of resources,

educational status, economic status, cultural traditions and beliefs, and awareness regarding menstruation (Kaur et al., 2018). It is possible to develop toxic shock syndrome (TSS), reproductive tract infections (RTIs) and other vaginal diseases if proper menstrual hygiene practices are not followed (Narayan et al., 2001; Khanna et al., 2005; Rajaretnam and Hallad, 2010). This is a significant reason for concern as it can have an adverse impact on women's health and is potentially dangerous. At the age of puberty, many girls are not mentally prepared for menstruation because of the lack of information (Mudey et al., 2010).

This review paper delves with the various menstrual products commonly used by the females globally. Out of which menstrual cups (MCs) emerges as the safest product for female's health and environment highlighting the merits of MCs. Several case studies have been included to support the authenticity of the review paper. The article also deals with the correlation of MCs with the Sustainability Development Goals (SDGs).

2. Materials And Methods

In the present research article, secondary data are collated from various research articles. For this review numerous key research publishers (Elsevier/Science Direct, Springer Link, Scopus and Wiley) and google scholar search engines have been searched. This process is explained in Fig 1. The key words like sanitary napkin, tampons, period liners, menstrual cup, and sustainability development goals are applied for the selection of appropriate articles (Fig 2). An intensive literature review has been carried out to frame the article.

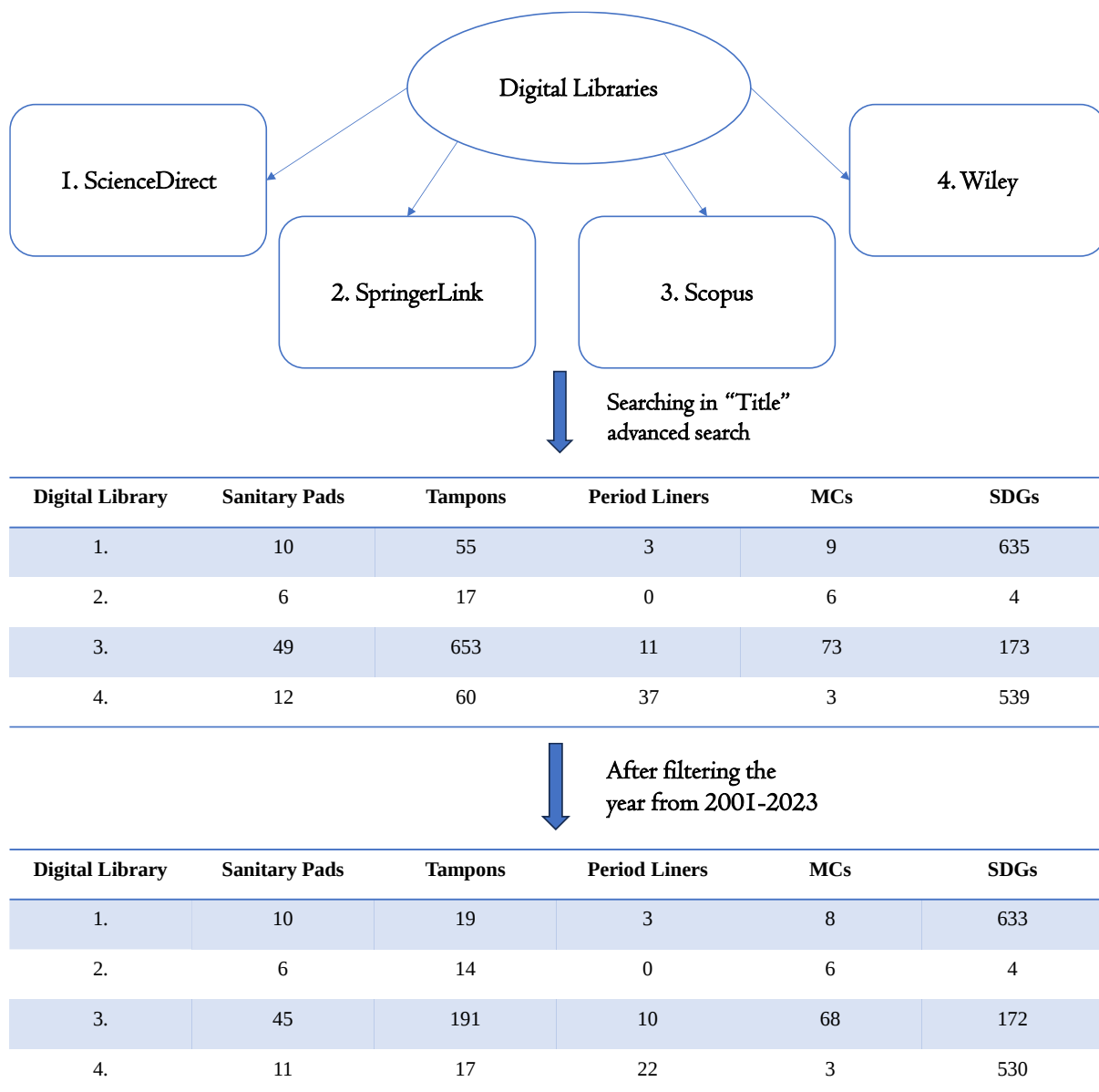


Fig. 1 Flow chart of the selection methodology

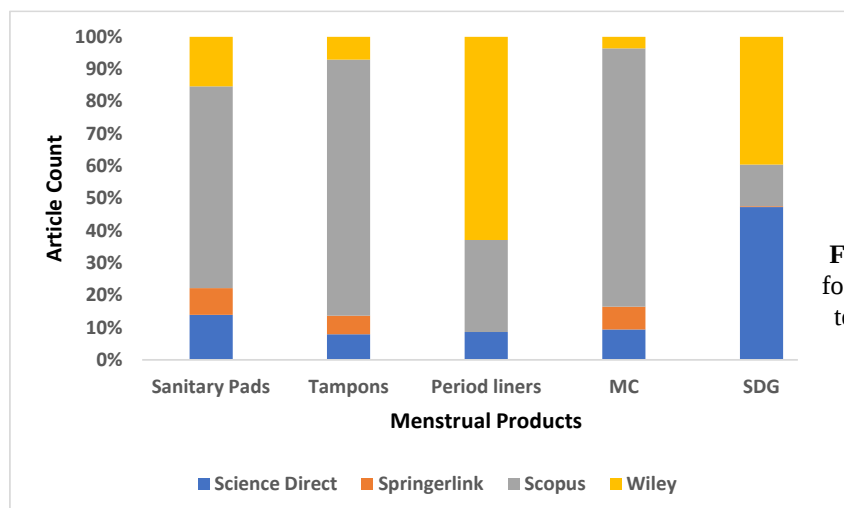


Fig. 2 Number of articles found in digital libraries in terms of keywords used.

The succeeding section describes different types of commonly used menstrual products globally by females.

3. Result and Discussion

Commonly used menstrual products

Adoption of sanitary protection products is primarily influenced by social factors, individual preferences, accessibility in residential areas, and financial circumstances. The commonly used menstrual products globally by the females during the menstruation cycle are depicted in **Fig 3**. The market contains both non-deodorized and deodorized sanitary products. These are constructed of rayon based synthetic fiber. Organochlorines are among the compounds included in the deodorized sanitary protection goods. These organochlorines contain bacterial-killing properties (Kamath et al., 2013). According to the research by Luthi et al. 2010, 57% women uses menstrual cup and tampons, 41% women uses cloths, and 1% women uses sanitary pads, ash, soil, and dried leaves in India (Luthi et al., 2010) (**Fig 4**). There are various kinds of period products available in the market. Each period product is briefly discussed below in succeeding sections.



Fig. 3 Commonly used menstrual product



Fig. 4 Usage of menstrual products in India

Tampons

Tampons are the most popular among other menstrual hygiene products. Tampon come in cylindrical form that is made up of cotton and rayon which are disposable products. Generally, tampons are white in color. To absorb body fluids, tampon injected inside the vagina with the help of finger or various applicators such as cardboard/plastic. The framework of an applicator is shown in figure 5. These applicators assist in comfortable insertion (Ren et al., 2018). Tampons are available in different varieties based on fragrance (scented and unscented) and size (Upson et al., 2022). Tampons are easy to use and allow females to participate in their normal activities, such as swimming or team sports. One of the biggest drawbacks of tampons is Toxic Shock Syndrome (TSS) which is a rare and a fatal disease that is caused by the infection of specific bacteria, namely *Streptococcus pyogenes* and *Staphylococcus aureus*. Super-absorbent tampons which stay in the vagina for a longer period of time helps bacteria to grow causing risk of TSS (<https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/toxic-shock-syndrome-tss>). However, these problems can be avoided if less absorbent tampons are used and are changed more frequently. The Food and Drug Administration (FDA) recommend changing of tampons every four to eight hours (<https://www.insider.com/guides/health/reproductive-health/how-long-can-you-keep-a-tampon-in>).

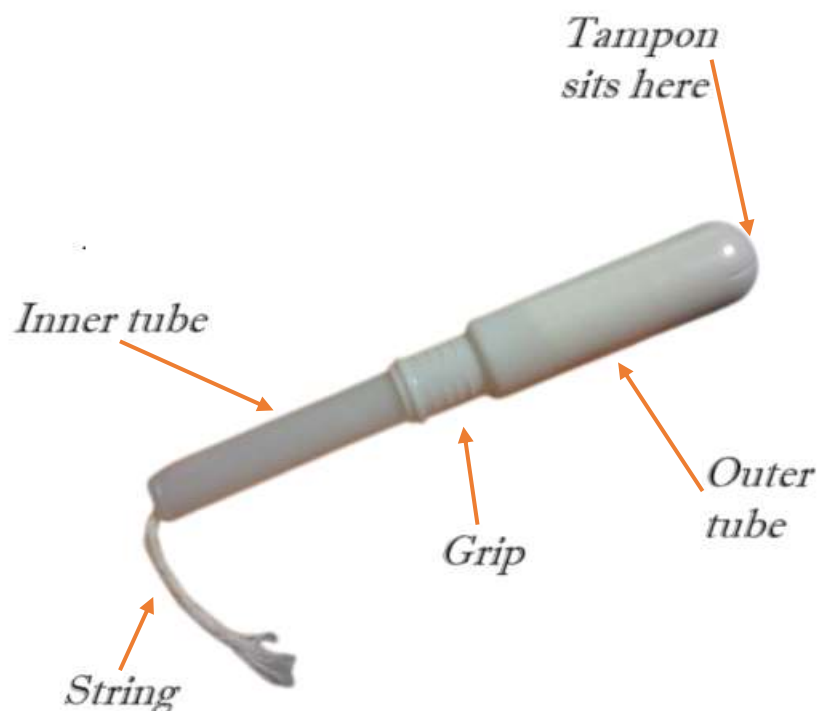


Fig. 5 A typical tampon applicator

Another commonly used menstrual product is sanitary pad which is briefly described in the next section.

Sanitary Pads

The most common form of menstrual product is the sanitary pad (Fig. 6), which is also referred to as a sanitary napkin, menstrual pad, panty liner, or simply pads. This is made of cotton or rayon and contains natural or synthetic fibers (Kavinkumar et al., 2023). Sanitary pads are also available in different sizes depending on the blood flow. The major difference between tampons and sanitary pads is that tampons are inserted into the vagina while sanitary pads are stuck on the undies. As mentioned in the above section, unlike tampons, sanitary pads do not cause TSS which makes it an excellent substitute for tampons. Some females consider sanitary pads in addition to tampons when the blood flow is heavier than average because the sanitary pads are more comfortable to wear. Sanitary pads do not cause irritation on the skin or make it dry unlike tampons (Ganguly et al., 2022). The only significant drawback of using sanitary pads is its recurrent cost. The box of sanitary pads costs \$6 to \$10. Unlike tampons, the sanitary pads need to be changed every few hours which causes a lot of waste (Dasra et al., 2014).



Fig. 6 Commonly used Sanitary pad

Reusable cloth pads

Reusable cloth pad is the third choice that is cost effective and environment friendly. It is easy to use reusable cloth pads instead of disposable sanitary pads. The most notable distinction is that they can be reused after being washed (Sinha and Paul 2018). Reusable cloth pads help in saving money over the course of their use is the primary advantage of this option. Unlike the disposable sanitary pads that needs to be changed in every few hours, reusable cloth pads generate a significant reduction in waste (Scott et al., 2013). The reusable cloth pads occupy less space than sanitary pads. These pads become more flexible, breathable, and less noticeable through the clothes (Fig 7). The reusable cloth pads costs between \$20 and \$30 and several pairs of these pads are required to get through the cycle. (<https://fsastore.com/learn-6-types-of-period-products-know-your-options.html>).

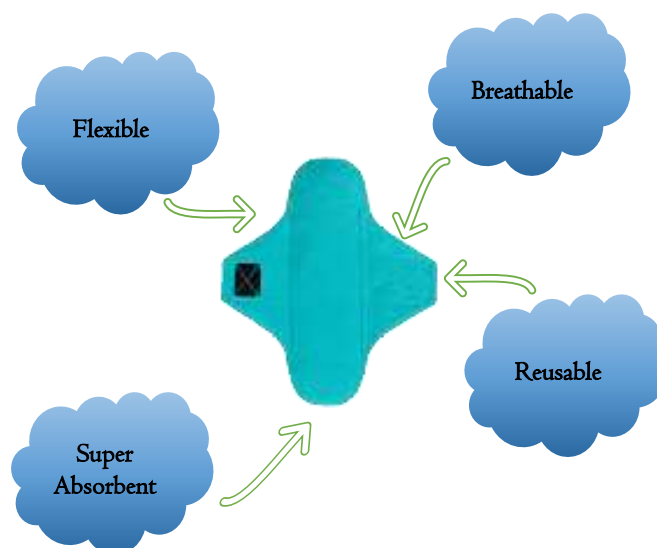


Fig. 7 Advantages of Reusable cloth pads

Period Underwear

Period underwear, also called period pants or menstrual underwear is another reusable menstrual product. This underwear is not like normal underwear because they have more than one layer because of which it can absorb more liquid than regular tampons or sanitary pads. Some females use them as extra security, especially at night (Sreenivas, 2023). The advantage of using period underwear is that it saves more money over time and make less trash by not using tampons or pads. Pros of using period underwear against sanitary pads is shown in Fig 8. Another advantage is that period underwear can hold as much blood as two tampons, but it needs to be changed after use (VanLeeuwen and Torondel, 2018). These underwear's could be inconvenient and messy while travelling. The price is the biggest disadvantage with period underwear. It costs between \$25 and \$40 per pair, and to get through period every month, more than one pair is required. The next section discussed in detail MCs, which are found to be the most appropriate option for women.



Fig. 8 Comparison between sanitary pads and period underwear

Menstrual Cups (MCs)

In year 1932, first menstrual cup was patented and in 1987 The Keeper in United States become first commercial brand manufacturing menstrual cups (https://womana.dk/wp-content/uploads/2012/12/Menstrual-Cups_-WoMena_-Uganda-Pilot-Study-Report-Dec-2012-new-version.pdf). In recent years, a growing number of people have adopted more contemporary options like MCs rather than the more conventional options of tampons and pads during their periods. There are several types of MCs which are discussed in Table 1. Before use, the cup must be sterilized (Kakani and Bhatt 2017). Prior inserting the MC, hands must be washed with soap and warm water. MCs usage involves the folding of the cup and its insertion inside the vagina. Fig. 9 shows the different folding methods of MCs. After selecting folding method of MCs, the labia present at the vaginal opening must be separated with the fingers and gently push the cup inside the vagina. Release the hold once the cup is inside the vagina.

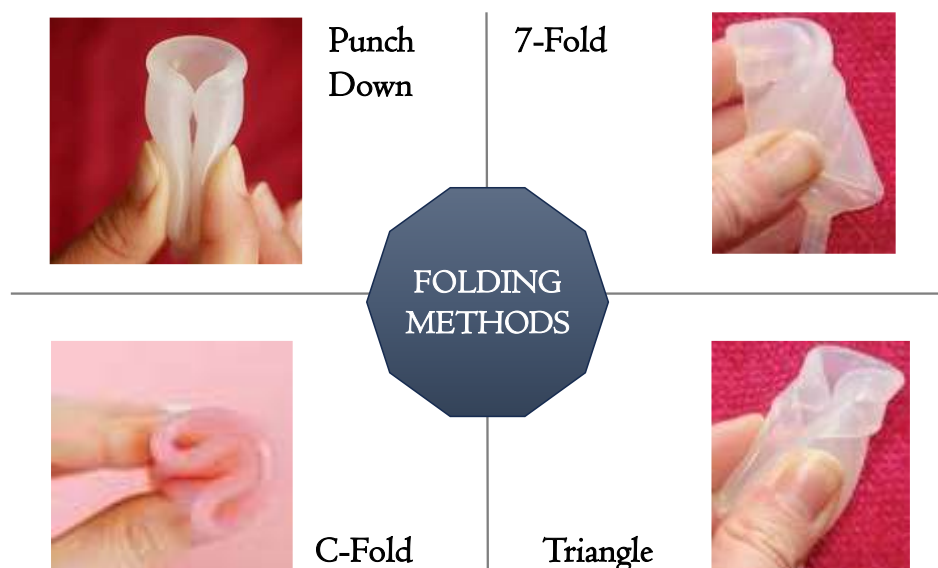


Fig. 9 Folding methods of a menstrual cup

Once the technique has been mastered, there will be no problem with leakages. It takes user some practice for cup to get the right position inside the vagina. But once it acquires the correct position, they are typically more comfortable. The cups can remain inside for up to 12 hours. After the use they need to be removed, emptied, rinse, and if needed can be re-inserted (<https://voxapod.com/blogs/journal/how-does-a-menstrual-cup-work-and-how-to-use-it-step-by-step-guide-2021>). At the end of the menstrual cycle the cup needs to be put through a sterilization process in boiling water, so that it can be used in next cycle. These cups are one of the options that are the most budget- and eco-friendly because they can be used for up to ten years making them one of the best choices. Several other advantages of using MC are highlighted in succeeding section. It is essential to be aware that, similar to the risk posed by tampons, there is a minuscule possibility of TSS when utilizing MCs (Kamath et al., 2013).

Table 1: Different types of MCs

S. No.	Type	Material
1.	Silicone MCs	Medical-grade silicone
2.	Rubber/Latex MCs	Rubber or latex (due to latex allergy and the accessibility of silicone cups, they are less used)
3.	TPE Thermoplastic Elastomer (TPE)MCs	Polymer mixture made of rubber and plastic
4.	Foldable/Collapsible MCs	TPE or Silicone

Advantages of MCs

MCs are a common option for those who menstruate since it provides several advantages over the other conventional disposable sanitary items, such tampons, and pads. They are quite environmentally friendly. Menstrual cups are reusable, decreasing the quantity of menstrual waste in dumpsters. With careful maintenance, they may typically survive for several years, which considerably reduces the amount of environmental damage brought by single-use products (Peter and K, 2021).

MCs are not only environmentally friendly, but also incredibly economical. Their reusability makes them a smart long-term investment, even though their initial cost may be more than that of disposable alternatives. Menstrual cups are far more cost-effective in the long run since they may be used again. They are also secure and convenient to use in terms of health. These cups are often made of medical-grade silicone, latex, or TPE and are regarded as safe for use internally (Ryan and Kurth, 2022). Cups do not absorb natural vaginal moisture as tampons do, which helps to maintain the pH balance of the vagina and lowers the risk of illnesses like Toxic Shock Syndrome (TSS). They also don't include any chemicals or scents, which reduces the possibility of allergic responses and skin irritations (Hill et al., 2010). Menstrual cups are soft, pleasant, and identified for their flexibility and longevity. They are available in a range of sizes to accommodate varying flow rates and cervix placements. They are sustainable and biodegradable. TPE cups are usually more comfortable than silicone cups which makes them a perfect alternative for some females (Mahajan, 2019). Also, they are reusable, making them a

good substitute for people who are allergic to silicone. These cups are made to collapse, making it simpler to insert and remove them. They are more discreet and portable due to their folding nature.

Menstrual cups provide unmatched comfort and convenience on a practical level. They can be used for longer durations i.e. upto 12 hrs., before discharging from the vagina. MCs collect more menstrual blood than pads and tampons (Tuli et al., 2018). When MCs is properly placed, they offer a leak-free experience that gives the wearer a sense of safety and ease when engaging in various activities like swimming and working out. Furthermore, cups come in a variation of sizes and degrees of flexibility, allowing users to select one that exactly matches their body and convenience preferences.

The absence of odour is a noteworthy advantage of MCs. In contrast to tampons and pads, in MCs menstrual blood get enclosed inside the cup. So, this blood expose less to air which leads to odour absence. Menstrual cups are also used to enhance self-awareness and empowerment. Understanding one's own anatomy is necessary for using a cup, giving individuals important information about their bodies and menstrual cycles (Pascoe, 2015). In addition, the lack of information leads to certain challenges and misconceptions which are briefly discussed in the coming section.

Challenges and Misconception

The difficulties many users feel during insertion and removal, especially in their early experiences, is a significant problem with menstrual cups. For beginners, the technique might be scary because it calls for perseverance, practice, and an awareness of one's own anatomy (Sommer et al., 2015). MCs adoption is sometimes hampered by a lack of knowledge about them and common misunderstandings about them. Misinformation about how to use MC might cause concern, which can discourage potential users from investigating this environmentally good choice. The correct and thorough education is essential in addressing the myths related to MCs. Myths related to MCs are they are unhygienic, they are painful or uncomfortable, can cause infections, can lost, or stuck inside the vagina, can't pee while wearing it, etc.([# : ~ : text = Using % 20 menstrual % 20 cups % 20 loses % 20 virginity, to %20do%20with%20menstrual%20cups](https://www.peesafe.com/blogs/news/menstrual-cup-myths-debunked-tossing-away-the-stigma)) and promoting acceptance and utilization (Mohamed et al., 2018). An important barrier is posed by social and cultural shame, particularly in conservative nations. Openly discussing menstruation hygiene is looked down upon, and menstrual cups are occasionally seen as taboo. The elimination of deeply rooted cultural attitudes and practices calls for focused education and awareness campaigns. It's crucial to eliminate these taboos so that people may make educated decisions regarding their menstrual health (Koskeniemi, 2023).

Health-related issues are one of the common misconceptions. Some people worry that menstruation cups might create health issues or become lost within the body. Menstrual cups, on the other hand, rest securely inside the vaginal canal and provide no risk when used properly. An experience that is safe and sanitary is made possible by proper usage, which includes proper insertion and routine cleaning (Ng et al., 2020). The notion that menstruation cups are messy is a further misunderstanding. Some individuals are concerned that utilizing cups may be messier than using disposable items. However, most users find using menstruation cups to be less dirty than using pads and tampons with some practice and good technique. The method is more sanitary than people may anticipate because in this method blood will store within the cup and exposing less to the air, which in turn minimize the odour problem (Kaur et al., 2018).

Many researchers studied about MCs which is highlighted in the section named Case Studies.

Case Studies

Valentin and Hechanova (2023) examined the anticipated usage of menstruation cups in the Philippines. The study's conclusions highlight the critical importance of perceived quality, self-identity, attitudes, and perceived behavioral control in determining subjects to use menstrual cups and deliver insightful information for encouraging their use (Valentin and Hechanova, 2023). Varghese et al. 2023 examined the anticipated usage of menstruation cups at Alappuzha Municipality, Kerela. The study's conclusions highlight the critical importance of perceived quality, self-identity, the effects of teaching and raising women's knowledge about MCs as a healthy, secure, user-friendly, and reasonably priced menstrual hygiene device. Only 20.7% of the women who acknowledged MCs without attending an awareness assembly began using them; in contrast, 40.6% of the women who attended the awareness session began using the MCs, which is about twice as many (Varghese et al., 2023). Patel et al. (2022) examined the challenges and difficulties met by MCs users in India. The ages of the participants varied from 25-37 years, with an average of 29.6 (0.91) years. They used MC on average for 2.4 (0.34) years. In comparison to sanitary pads, MCs were revealed to be more secure, affordable, environmentally

friendly, and practical (Patel et al., 2022). Sreeja et al. (2023) conducted a study in Andhra Pradesh to determine how menstruation cups are perceived by young people and adult women who attend a tertiary care facility in a rural setting. 87.8% of the research participants used sanitary pads when they were menstruating. 11.59% also used cloth. Menstrual cup use was reported by 0.61%. The majority of participant 73.7% stated that they had never heard of menstruation cups, while 26.3% said they were familiar with them. Only 4.65% out of 43 individuals had an excellent understanding of menstruation cups (Sreeja et al., 2023).

The next section provides a brief conclusion that MCs are more sustainable for human health and environment compared with other menstrual products and how MCs are related with sustainability.

Menstrual cups and Sustainability Development Goals

Humans have constantly been faced with a significant issue in the form of sustainable development. With the aim to address environmental, economic, and social problems at the same time, nations all over the world are actively looking into ways to promote United Nations Sustainable Development Goals (Li et al., 2023; Fernandes et al., 2022). The United Nations adopted 17 Sustainable Development Goals (SDGs) in 2015, which place a strong emphasis on cross-sectoral and international collaboration for sustainable development also promote the significance of stakeholders (Masuda et al., 2022). Among the 17 SDGs, one of the UN's goals i.e., SDG3, is to ensure healthy lives and encourage wellbeing for people of all ages by 2030 (Wakunuma et al., 2020). Therefore, the study encourages the use of MCs to enhance the health and wellness of women. MCs are safe, hygienic, and reduce the risk of infections and improve users' overall health. MCs shows decreased rates of uro-genital infection, such as bacterial vaginosis as compared to tampons or sanitary pad use which fulfill the aim of SDG 6 that promotes the use of safe sanitation (Taweesan et al., 2023). The other goals like SDG 11 (Mahadevja et al., 2023) which aspires to create inclusive, secure, resilient, and sustainable cities and SDG 15 aims life on land and respectively. So, both the SDG 11 and SDG 15 can be achieved with the use of MCs. These cups reduce land pollution by decreasing the demand for throwaway menstruation products, which usually end up in landfills and can take hundreds of years to degrade. In turn, MCs help in maintaining the biodiversity, natural ecosystems, and soil quality necessary to support life on land. These cups have lower environmental effect, making cities and communities sustainable.

4. Conclusion

The revolutionary potential of menstruation cups as a long-term answer to menstrual hygiene and environmental preservation is highlighted in this review study. Menstrual cups provide a useful and powerful alternative to against throw away items because to its affordability, less environmental impact, and favorable health consequences. Menstrual cups may be adapted and used effectively in a variety of circumstances, as shown in the case studies. These case studies highlight the critical importance of education and community involvement in encouraging the use of menstruation cups. Menstrual cups are bringing a revolution in menstrual health but also in helping in sustainable hygiene management.

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