



Original Article

Use of Menstrual Sanitary Products in Women of Reproductive Age: Korea Nurses' Health Study



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ABSTRACT

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Objectives: The use of menstrual hygiene products and its effect on women's health remains under studied. Patterns of menstrual hygiene product use and the rationale behind choices among Korean women aged 18–45 years were examined.

Methods: This cross-sectional study was a part of the Korea Nurses' Health Study. A total of 20,613 nurses participated, and 8,658 nurses participated in Module 7 which included a menstrual hygiene products-related survey. The data were collected through the mobile survey using a self-reported questionnaire. Participants' use of menstrual hygiene products and related characteristics were analyzed using frequency (percentage) or mean (SD).

Results: The most common types of menstrual hygiene products across all age groups were disposable menstrual pads (89.0%), followed by cloth menstrual pads (4.5%), tampons (4.2%), and only 1.6% used a menstrual cup. Disposable menstrual pads were the most common across all age groups, but in those aged under 30 years this was followed by tampon use (6%). The most important criteria when choosing a menstrual hygiene product was comfort for disposable menstrual pads (31.3%) and tampons (41.5%), natural ingredients or organic products for cloth menstrual pads (51.4%), and custom fit for the menstrual cup (50.7%). However, for all menstrual hygiene products (except cloth menstrual pads), there was a higher proportion of anxiety than perception of safety, and low awareness of toxic shock syndrome.

Conclusion: It is important for women to use menstrual hygiene products with confidence. More research is needed to better understand potential health effects of menstrual hygiene products.

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Introduction

Women's health has a significant impact not only on the women themselves but also on children's health, and the community. Menstruation is a part of women's health. Attitudes toward it and its management, can vary by individual experience or perceptions of health, as well as by social and cultural factors [1]. In South Korea, despite advancements in

women's social status, educational level, and their increased participation in economic activities, until relatively recently, menstruation-related issues were treated as taboo subjects not to be discussed publicly and therefore related research was insufficient [1]. However, with the rise in awareness of the risks of disposable menstrual pads, interest in menstrual hygiene and menstrual products, has increased.

Menstrual hygiene products for menstrual discharge

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include disposable menstrual pads, reusable cloth menstrual pads, tampons, and the menstrual cup. Globally, disposable menstrual pads are indispensable for women of childbearing potential, and it is estimated that a woman uses approximately 11,400 pads throughout her lifetime [2,3]. Ensuring the quality and safety of menstrual hygiene products is extremely important because they are in repeated direct contact each month, for a long duration of a woman's life (an average of 40 years). The Ministry of Food and Drug Safety has classified menstrual hygiene products as quasi-drug products in accordance with the Pharmaceutical Affairs Act, but consumers have pointed out that they lack objective information regarding quality and safety.

Globally, organized effort is being made to reduce the negative effects of menstrual hygiene products on a woman's body. Women's Voices for the Earth, an American organization, published "Potential Health Effects of Toxic Chemicals in menstrual hygiene products" in 2013 [4]. In South Korea, Ecofem, an organization for eco-friendly feminism, initiated a fully-fledged movement to ensure the safety of menstrual hygiene products and a report was published in 2017 [2]. However, the use of such products and the resulting health effects caused by menstrual hygiene products remains understudied, and public anxiety has not yet been relieved.

The main purpose of this study was to identify the patterns of use of menstrual hygiene products and the rationale behind product choice. This basic data associated with the use of menstrual hygiene products amongst Korean women aged 18-45 years may aid the evaluation of long-term health effects.

Materials and Methods

This cross-sectional study was part of the Korea Nurses' Health Study, a prospective cohort study conducted to identify the factors affecting health conditions, and causes of diseases in working women of childbearing potential (based on the protocols of U.S. Nurses' Health Study 3). The study participants consisted of Korean female nurses aged from 20 to 45 years. A detailed description of the sampling and data collection procedures has been reported [5].

The data were collected from self-reported questionnaires through the mobile survey system. A total of 20,613 women participated during the baseline period from July 2013 to November 2014. After the baseline questionnaires (Module 1), participants were asked to conduct subsequent modules (Modules 2-8) for follow-up purposes. Participants provided their socio-demographics, anthropometric information, medical and familial history, health behaviors, reproductive information, mood, occupational exposure, and subjective perception of health in Module 1. For the purpose of this

study, 8,658 single or married women participated in Module 7, which included a menstrual hygiene products-related survey, from December 2018 to September 2019. The Module 7 questionnaires are presented in the Appendix. In this study, the main use of menstrual hygiene products (disposable menstrual pads, cloth menstrual pads, tampons, and the menstrual cup) and related topics were analyzed. Participants were asked to report the reasons for use, change intervals, safety perception (of types of menstrual hygiene products), and pattern of use according to work. Toxic shock syndrome (TSS), refers to a rare but lethal, acute condition caused by bacteria inside the body (staphylococcus or streptococcus) releasing toxins causing symptoms including a high temperature or fever, nausea or vomiting, diarrhea, dizziness or fainting, and low blood pressure [6].

This study had approval from the Institutional Review Board of the Korea Centers for Disease Control and Prevention (IRB no.: 2013-03CON-03-P). All participants provided informed consent after receiving an explanation about the study, including the fact that they could withdraw their participation at any time without any consequences. Participants' use of menstrual hygiene products and related characteristics were analyzed using frequency (percentage) or mean (standard deviation). To statistically analyze differences amongst age groups, a general linear model and the chi-square test were used for continuous and categorical variables, respectively. The data were analyzed using SAS Version 9.4 (SAS, Cary, NC, USA) and *p* values less than 0.05 were considered indicators of statistical significance.

Results

The general characteristics of the 8,658 participants are presented in Table 1. According to age the mean age of participants was 35.1 years. Age of women was represented in 4 groups (< 30 years [*n* = 1,572], 30-39 years [*n* = 5,142], ≥ 40 years [*n* = 1,944]). In terms of the level of education, the largest proportion (64.3%) had a bachelor's degree. Regarding marital status, 63.2% were married. Of the entire number of participants, 50.3% had work experience as a nurse of more than 10 years, followed by those with experience of 5-10 years. At the time of the study, 5.2% of the participants were pregnant, and more than half of the women had been pregnant at least once in the past. Regarding the regularity of their menstrual cycle, 6.4% responded that they were not menstruating for reasons such as amenorrhea, taking birth control pills, having given birth up to 6 months previously, or breastfeeding. Among those who were menstruating, 32.4% said their cycle was very regular, varying by a maximum of 3 days (41.8% said it was regular, varying from 5 to 7 days). Overall, more than 70% of

Table 1. General characteristics of the participants (n = 8,658).

Variables	Baseline age (y)								p
	Total (n = 8,658)		< 30 (n = 1,572)		30-39 (n = 5,142)		≥ 40 (n = 1,944)		
Age (y)	35.1	± 5.8	28.3	± 0.8	33.9	± 2.8	44.0	± 3.2	< 0.001
Educational level									
3-year college	1,696	(19.6)	359	(22.8)	1,038	(20.2)	299	(15.4)	< 0.001
4-year college	5,568	(64.3)	1,175	(74.7)	3,476	(67.6)	917	(47.2)	
≥ Graduate school	1,394	(16.1)	38	(2.4)	628	(12.2)	728	(37.4)	
Marital status									
Unmarried	3,039	(35.1)	1,112	(70.7)	1,646	(32.0)	281	(14.5)	< 0.001
Married/ Cohabiting	5,472	(63.2)	452	(28.8)	3,420	(66.5)	1,600	(82.3)	
Divorced/ Widowed/ Separated	147	(1.7)	8	(0.5)	76	(1.5)	63	(3.2)	
Work experience (y)									
≤ 1	48	(0.6)	14	(0.9)	27	(0.5)	7	(0.4)	< 0.001
1-3	184	(2.1)	85	(5.4)	92	(1.8)	7	(0.4)	
3-5	714	(8.2)	426	(27.1)	269	(5.2)	19	(1.0)	
5-10	3,358	(38.8)	1,041	(66.2)	2,244	(43.6)	73	(3.8)	
≥ 10	4,354	(50.3)	6	(0.4)	2,510	(48.8)	1,838	(94.5)	
History of pregnancy									
Currently pregnant	453	(5.2)	81	(5.2)	368	(7.2)	4	(0.2)	< 0.001
Previous pregnancies									
1	1,750	(20.2)	181	(11.5)	1,287	(25.0)	282	(14.5)	< 0.001
2	1,913	(22.1)	50	(3.2)	1,119	(21.8)	744	(38.3)	
≥ 3	953	(11.0)	9	(0.6)	441	(8.6)	503	(25.9)	
Current menstrual regularity									
Very regular (± 3 d)	2,806	(32.4)	418	(26.6)	1,715	(33.4)	673	(34.6)	< 0.001
Regular (± 5-7 d)	3,621	(41.8)	664	(42.2)	2,195	(42.7)	762	(39.2)	
Irregular	1,226	(14.2)	300	(19.1)	653	(12.7)	273	(14.0)	
Very irregular	447	(5.2)	112	(7.1)	257	(5.0)	78	(4.0)	
Amenorrhea, oral contraception, within 6 months of child birth, or breastfeeding	558	(6.4)	78	(5.0)	322	(6.3)	158	(8.1)	
Menstrual pain									
Severity*	5.4	± 1.8	5.7	± 1.8	5.5	± 1.8	5.0	± 1.8	< 0.001
Impact on daily activities†	4.6	± 2.1	4.8	± 2.1	4.7	± 2.1	4.1	± 2.0	< 0.001
Type of menstrual hygiene products									
Disposable menstrual pad	7,704	(89.0)	1,368	(87.0)	4,556	(88.6)	1,780	(91.6)	< 0.001
Cloth menstrual pad	387	(4.5)	66	(4.2)	254	(4.9)	67	(3.4)	
Tampon	364	(4.2)	94	(6.0)	212	(4.1)	58	(3.0)	
Menstrual cup	136	(1.6)	37	(2.4)	86	(1.7)	13	(0.7)	
Others (such as menstrual panty)	67	(0.8)	7	(0.4)	34	(0.7)	26	(1.3)	

Data are presented as mean ± SD or n (%).

* 10-point scale: 1 = no pain at all; 10 = extreme pain.

† 10-point scale: 1 = no trouble at all; 10 = very troublesome.

those who were menstruating, had regular periods, whilst about 20% reported irregular or very irregular periods. In addition, 65.7% of the participants complained of symptoms of menstrual pain which were at a normal level (5.4 for the severity of pain and 4.6 for the impact on daily activities) where 1 indicated no pain at all or no trouble at all, and 10 indicated extremely painful or very troublesome). Women in the oldest age group (≥ 40 years) had a significantly higher educational attainment, longer work experience, higher frequency of multiparous experience, more regular menstrual regularity, and a higher frequency of disposable menstrual pad use than other groups.

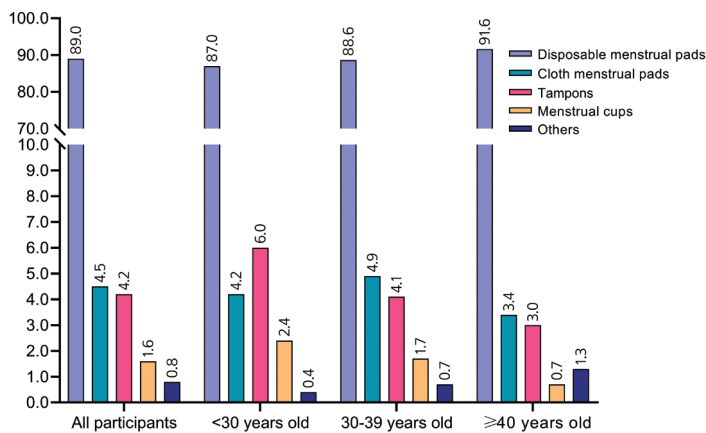


Figure 1. The distribution of use of types of menstrual hygiene products according to age ($n = 8,658$). Data are presented as a percentage.

The most common types of menstrual hygiene products used were disposable menstrual pads (89.0%), followed by cloth menstrual pads (4.5%), and tampons (4.2%). Only 1.6% of the participants used a menstrual cup, which was approved for use in South Korea in December 2017. The distribution of use of types of menstrual hygiene products according to age is represented in Figure 1. Disposable menstrual pads were the most commonly used across all age groups, followed by tampons in those aged under 30 (6%). In those aged 30-39, together with disposable menstrual pads, cloth menstrual pads were used (4.9%). In addition, the frequency of using other menstrual hygiene products such as the menstrual panty was the highest in those over 40 (1.3%), presumably owing to a relatively lighter menstrual flow compared with other age groups.

The reasons for using a particular type of menstrual hygiene product are shown in Table 2. In the case of regular menstrual pads, convenience in changing them (84.8%), and easy disposal (50.8%) were the most common reasons, whilst cloth menstrual pads were used for health reasons (71.6%) and eco-friendliness (53.7%). Tampons were preferred because they did not hinder physical activity (78.8%) and offered comfort (47.0%), whilst the menstrual cup was preferred because of comfort (72.1%) and eco-friendliness (36.8%). Appendix A presents the most important criteria when choosing menstrual hygiene products including comfort "disposable menstrual pad (31.3%), tampon (41.5%)", natural ingredients or organic products "cloth menstrual pad (51.4%)", and custom fit "menstrual cup (50.7%)".

The change interval of menstrual hygiene product, varied greatly by type (Table 3). On days with heavy flow, users of disposable menstrual pads (64.6%), cloth menstrual pads

Table 2. Reasons for use of menstrual hygiene products ($n = 8,591$).

Variables	Types of menstrual hygiene products, n (%)							
	Disposable menstrual pad ($n = 7,704$)		Cloth menstrual pad ($n = 387$)		Tampon ($n = 364$)		Menstrual cup ($n = 136$)	
Convenient to change	6,533	(84.8)	7	(1.8)	43	(11.8)	22	(16.2)
Hygienic	1,192	(15.5)	75	(19.4)	88	(24.2)	43	(31.6)
Good absorption	886	(11.5)	30	(7.8)	30	(8.2)	8	(5.9)
Comfort	599	(7.8)	130	(33.6)	171	(47.0)	98	(72.1)
Eco-friendliness	54	(0.7)	208	(53.7)	2	(0.5)	50	(36.8)
Easy to dispose	3,917	(50.8)	3	(0.8)	29	(8.0)	26	(19.1)
For health reasons	-	-	277	(71.6)	67	(18.4)	48	(35.3)
Comfortable when active	-	-	-	-	287	(78.8)	2	(1.5)
No specific reason	1,296	(16.8)	9	(2.3)	4	(1.1)	-	-

Data are presented as n (%).

Table 3. Change interval by type of menstrual hygiene product ($n = 8,591$).

Variables	Types of menstrual hygiene products n (%)							
	Disposable menstrual pad ($n = 7,704$)		Cloth menstrual pad ($n = 387$)		Tampon ($n = 364$)		Menstrual cup ($n = 136$)	
On days with heavy flow								
Every 1 h	648	(8.4)	30	(7.8)	27	(7.4)	-	-
Every 2-3 h	4,981	(64.6)	209	(54.0)	213	(58.5)	45	(33.1)
Every 4-5 h	1,900	(24.7)	138	(35.7)	114	(31.3)	42	(30.9)
> 6 h	175	(2.3)	10	(2.6)	10	(2.7)	49	(36.0)
On days with light flow								
Every 1 h	42	(0.5)	3	(0.8)	5	(1.4)	-	-
Every 2-3 h	1,303	(16.9)	48	(12.4)	41	(11.3)	1	(0.7)
Every 4-5 h	4,474	(58.1)	199	(51.4)	197	(54.1)	13	(9.6)
> 6 h	1,885	(24.5)	137	(35.4)	121	(33.2)	122	(89.7)

Data are presented as n (%).

(54.0%), or tampons (58.5%) changed the product on average, once every 2 to 3 hours. However, users of the menstrual cup (36.0%) changed once every 6 hours or more. On days with light flow, those who changed their products once every 4 to 5 hours formed the highest proportion among users of disposable menstrual pads (58.1%), cloth menstrual pads (51.4%), and tampons (54.1%), and most menstrual cup users (89.7%) changed the products only once every 6 hours or more.

Safety perception of menstrual hygiene products are shown in Figure 2. There were 61.5% of participants who knew that cloth menstrual pads were safe, whilst 46.2% considered tampons to be unsafe. For all menstrual hygiene products (except the cloth menstrual pad), there was a higher proportion of anxiety than perception of safety. After the disposable menstrual pad issue in 2017, 11.0% of women who used disposable menstrual pads, switched to cloth menstrual pads ($n = 702$), a menstrual cup ($n = 146$), or tampons ($n = 105$; data not shown). Although the demand for alternative menstrual hygiene products has recently increased owing to the controversy over toxic chemicals in disposable menstrual pads, there was low awareness of TSS (46.2%) which may occur when tampons or a menstrual cup is left for longer than the recommend period i.e., not changed for a long interval, despite the fact that the participants were nurses (data not shown).

The use of menstrual hygiene products used during work and the reasons why are shown in Appendix B. Of the participants, 5.5% used a different type of menstrual hygiene product when working, and the main reason was to be more comfortable when they needed to be physically active (51.7%). Nurses

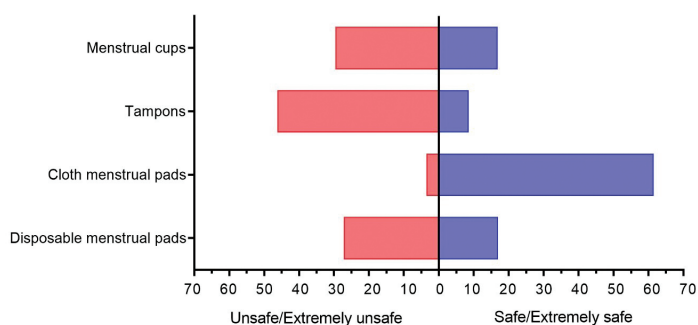


Figure 2. Safety perception of menstrual hygiene products ($n = 8,658$). Red bar represents unsafe or extremely unsafe and blue bar represents safe or extremely safe. Data are presented as a percentage.

with relatively longer intervals between changes owing to busy work schedules accounted for 91.3% of the participants compared with general office workers.

Discussion

This study investigated the use of menstrual hygiene products amongst nurses (18-45 years) in South Korea, and examined their overall attitudes towards, and perception of the products. We observed that as with previous studies, the most used menstrual hygiene products were disposable menstrual pads, because they are convenient to change, and easy to

discard [2,7-9]. However, the participants did not consider this product particularly safe. There were 16.8% of participant who reported that they used menstrual pads because there were no other good options available. Generally, the participants considered cotton pads the only safe menstrual hygiene product to use, and tampons were perceived as particularly harmful. This was a similar finding to a French study [10].

With women's increasing awareness of healthy menstrual hygiene products as a result of extensive media coverage of harmful substances detected in disposable menstrual pads (based on Ecofem's 2017 study [2]), several epidemiological studies have been conducted [11,12]. In December 2017, the Ministry of Food and Drug Safety conducted a risk assessment of 84 volatile organic compounds detected in a total of 666 items of menstrual pads and pantyliners on the market. The results showed that the amount of volatile organic compounds detected was not statistically hazardous to the human body [12]. However, women using these products report symptoms including menstrual cramps and menstrual flow changes, and the possibility of exposure to harmful substances detected in menstrual pads although not statistically hazardous, are still a worry to some women. This is justified because the level of formaldehyde, colorants, fluorescent materials, acids, and alkalis in menstrual hygiene products which are regulated under the current law in South Korea, do not consider the exposure route in women (direct contact with the vagina) using these menstrual hygiene products.

Some disposable menstrual products contain environmental chemicals and hazardous substances, and exposure in women may cause harm. The vaginal and vulvar mucosal tissues (which are directly exposed to menstrual hygiene products) are more hydrated and permeable than the rest of the skin[4], and due to the function of a menstrual hygiene product, it is used in a narrow, confined area making vulnerability to chemicals and irritants more likely [4,13]. In addition, the vaginal and vulvar tissues absorb chemicals rapidly without metabolizing them first, and exposure to toxic chemicals such as endocrine disruptors can affect women's health [11,14-17]. Moreover, direct absorption of chemicals has been reported to increase serum concentrations significantly compared with the same dose administered orally [14,18,19] because, the vaginal mucosal walls are filled with blood and lymphatic vessels, which allows the direct transfer of chemicals into the circulatory system [20].

It has been reported that some menstrual pads contain chemicals including dioxins which are linked to cancer, reproductive harm, endocrine disruption, and vulvar dermatitis [14,17,21]. A cross-sectional study of female workers in pharmaceutical companies, reported that increased exposure to organic solvents statistically significantly raised the levels of follicle stimulating hormone, luteinizing hormone, and thyroid

stimulating hormone [22]. The group exposed more to organic solvents reported heavier menstrual flow, increased menstrual cramps, a higher incidence of menstrual irregularity, and oligomenorrhea [22]. A preliminary survey of South Korean women showed that the use of disposable menstrual pads was associated with changes in the menstrual cycle (26.0%), menstrual cramps (24.0%), menstrual flow (20.0%), and vulvar irritation (10.0%). In this survey some women reported that switching to other menstrual hygiene products relieved the symptoms related to their vulva, and menstruation [11].

Controversy over the potential health risks of disposable menstrual pads brought attention to the adverse effects of these products. This, in turn led to the increased interest in South Korean women into alternative menstrual hygiene products such as tampons, cotton pads, and the menstrual cup. In particular, despite the VAT exemption on menstrual pads won in 2004 by women's rights groups, the prices of disposable menstrual pads are the highest amongst all Organization for Economic Cooperation and Development member countries, with consumer prices almost doubling in the past few years [23]. Expensive disposable menstrual pads place a great burden on women of relatively low socioeconomic status, which has resulted in a growing interest in reusable menstrual hygiene products such as cotton pads and the menstrual cup. Yet there has been little research into the health risks of menstrual hygiene products used, and existing studies are limited to the safety assessment.

Due to social, cultural, and age differences, the choice of menstrual hygiene products among women varies greatly. Tampons and the menstrual cup are rarely used in South Korea, but they are used by women under 30 [9]. Data on the use of menstrual products is insufficient, but a comprehensive review of surveys conducted in the 1990s and 2000s in the United States observed that 50-86% of women used tampons and 62-73% used disposable menstrual pads. American women use tampons more than their South Korean counterparts [4,14,24-27]. In December 2017, the Ministry of Food and Drug Safety in South Korea approved the use of menstrual cups, and agreed to promote awareness of the necessary precautions and its correct use, but even in nurses in this study who are medical professionals, more than 50% were uninformed of TSS. The Ministry of Food and Drug Safety need to do more. TSS, may occur from leaving an inserted vaginal menstrual hygiene product such as a tampon or menstrual cup in situ for longer than the manufacturer recommended period of time, it is a rare but life threatening condition, and the worry is that if medical professionals are unfamiliar with TSS, the general public may have a lower level of awareness [6,7]. The Ministry of Food and Drug Safety advises on how to determine the product size (using an index finger measure from the vaginal opening to the cervix) however, 66.2% of menstrual cup users in this

study determined the product size based on the opinions of their friends and families. In addition, microwave or alcohol disinfection of the menstrual cup was used 11.8% of users which may deform the cup or increase the likelihood of skin irritation, respectively.

Women menstruate for an average of 40 years and there is a basic human right that menstrual hygiene products are safe [13]. Most South Korean women continue to use disposable menstrual pads despite the controversy, even though they consider the pads unsafe to use. This is because they do not believe there are adequate replacements available. Women's health rights are now up for public discussion and as a result, full ingredient labeling is a requirement for menstrual pads as of October 2018. However, taboos in Korean society around menstruation and women's health need to be addressed, such as education on these matters in schools, and a guarantee of approved menstrual leave is required in the workplace [13].

The present study has several limitations. Firstly, the causal relationship between menstrual hygiene product use patterns and its complications cannot be determined in this cross-sectional study. Secondly, menstrual hygiene products use patterns were measured by self-reported questionnaires and were not objectively confirmed. Thirdly, the Korea Nurses' Health Study participants may not be representative of the entire population of reproductive aged women in Korean, because they were recruited from only 1 occupational cluster. Finally, despite a large sample size (8,658), there were only 387 of women who used cloth menstrual pads, 354 used tampons, and 136 used a menstrual cup in this study.

The health of reproductive age women (18-45 years) is directly related to their future and that of society. It is important for women to be able to use menstrual hygiene products with confidence. Education on use of product and complete manufacturer product disclosure (ingredient list and hazards) will address these issues and concerns.

Appendix

Supplementary data is available at <https://www.kcdcphrp.org>.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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Appendix A. Most important criteria in choosing a type of menstrual hygiene product ($n = 8,591$).

Variables	<i>n</i>	(%)
Disposable menstrual pad ($n = 7,704$)		
Comfort	2,414	(31.3)
Absorption	2,301	(29.9)
Natural ingredients or organic products	1,707	(22.2)
Price	618	(8.0)
Brand awareness	362	(4.7)
Others	302	(3.9)
Cloth menstrual pad ($n = 387$)		
Comfort	91	(23.5)
Absorption	45	(11.6)
Natural ingredients or organic products	199	(51.4)
Price	6	(1.6)
Brand awareness	28	(7.2)
Others	18	(4.7)
Tampon ($n = 364$)		
Comfort	151	(41.5)
Absorption	79	(21.7)
Natural ingredients or organic products	66	(18.1)
Price	24	(6.6)
Brand awareness	29	(8.0)
Others	15	(4.1)
Menstrual cup ($n = 136$)		
User reviews on social media	32	(23.5)
Size that fits the body	69	(50.7)
Manufacturing country and company	20	(14.7)
Price	5	(3.7)
Others	10	(7.4)

Appendix B. Reasons for selecting menstrual hygiene product during working hours ($n = 7,555$).

Variables	<i>n</i>	(%)
Use a different type of menstrual hygiene products when working	480	(5.5)
Disposable menstrual pad	263	(54.8)
Cloth menstrual pad	9	(1.9)
Tampon	190	(39.6)
Menstrual cup	18	(3.8)
Main reason for the switch		
More comfortable in active condition	248	(51.7)
Able to use it longer	104	(21.7)
To prevent skin troubles	37	(7.7)
To avoid any indications of menstrual periods	37	(7.7)
Others	54	(11.3)
Experienced a longer interval between menstrual hygiene products changes because of busy work schedule	6,895	(91.3)