

# Exploration of Various Issues Associated with Sustainable use of Sanitary Napkins

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## Abstract

*Sanitary napkins are layered designs, as they need to satisfy different end-use properties simultaneously. The most common issues with current napkins include leakage, odor, and the need for frequent change. To address these problems, a comprehensive survey was conducted among 500 women residing in two selected villages within the study area. The survey covered women's expectations of sanitary napkins, their perceptions of these products, performance characteristics, and the challenges encountered with existing sanitary napkins. In the initial segments of the overview, the expectations from sanitary napkins, perception of sanitary napkins, performance characteristics and the problems in current sanitary napkins were addressed. The findings indicated that women prioritize absorption properties such as leak-proofing and dryness, as well as an odorless and soft surface. The most desirable functional characteristic was antibacterial activity. There were notable differences in the expectations, selection factors, and issues reported by women across different age groups. The collected data was used to design a cost-effective sanitary napkin made up of more than 80% biodegradable materials, promoting sustainability in the production of sanitary napkins.*

## Keywords

*Sanitary napkin, cost-effective, antibacterial activity, sustainability*

## 1. Introduction

Since women make up about half of the world's population and all women menstruate during their fertile seasons, sanitary

napkins made of well-designed textile materials have a huge market [1]. Until more convenient, accessible, clean, and comfortable alternatives are created, the market for sanitary napkins will continue to expand.

Because sanitary napkins must concurrently meet many requirements for absorption, leakage control, comfort, etc., they are made as layered structures. These layers include textile and film (Figure 1). The topmost layer, often known as the top sheet, is in direct touch with the body. Polyethylene film or spun-bond non-woven fabric made of polypropylene can be used as the top sheet material. Under the top sheet is an acquisition-distribution layer (ADL), which transmits the menstrual fluid to the absorbent layer below by distributing it along the sanitary napkin. Air-laid wood pulp nonwovens or multicomponent structures comprised of wood pulp and synthetic fibers can be used to create ADL. Superabsorbent polymer and wood pulp are the typical ingredients in absorbent layers. The bottom layer, namely back sheet is usually an impermeable film [2].

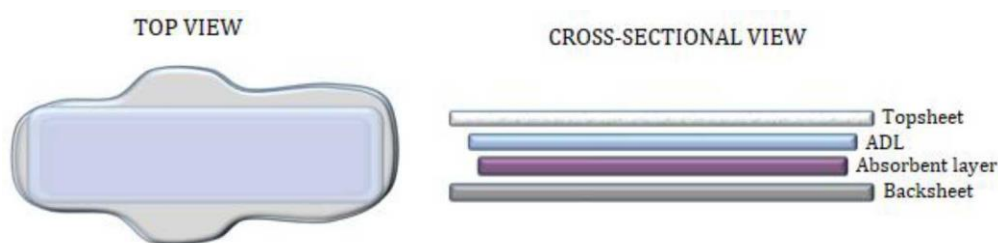


Figure 1. Main layers of a sanitary napkin

The literature is replete with studies on sanitary napkins. They particularly focused on how well the sanitary napkin could absorb and manage moisture. For usage in extremely thin sanitary napkins, Das et al. created absorbent layers with various ratios of superabsorbent viscose fibers [2]. Wastes from flax carding could be used as absorbent layers to reduce the cost of materials, [3]. Corn husk fibers' suitability as an absorbent layer in sanitary napkins has been studied [4]. There have also been reports of herbal-finished, eco-friendly sanitary products [5]. The results of these studies did not align with the actual needs of women, as indicated by neither questionnaires nor wear trials. Additionally, certain surveys and field studies have raised doubts regarding the usage, perception, and accessibility of sanitary napkins in areas with limited access to these products, such as African countries and India. [6-8].

The objective of this study was to identify the needs of women with regards to sanitary napkins, identify the key issues with existing products, and gather information to aid in the development of a high-performance sanitary napkin tailored to the specific requirements of women in the study area. Additionally, the study aimed to gather insights on the purchasing habits and preferences of women, providing valuable data to commercial producers.

## 2. Material and Method

The survey had five sections with a total of 60 questions and remarks. The names of the parts are given below. In addition, the full form can be found in the Appendix.

- Demographic data
- Requirements from sanitary napkins
- Desired Functionalities for sanitary napkins
- Sanitary napkin usage patterns
- Sanitary napkin preferences

The survey was carried out between January 1 and December 31, 2021, by visiting the two chosen villages (Kachhera-Varsabad and Baidpuraq3, Gautam Budhh Nagar, Uttar Pradesh). The survey was initially evaluated with small focus groups

to ensure clarity and comprehension, and input was gathered and integrated into the final form.

The survey form was then distributed to participants via low-cost, efficient methods such as email and WhatsApp. With a female population of 1561 and 2186 in the two villages, respectively, as reported by the 2011 Census, the study aimed to survey at least 384 participants, as recommended by the literature for populations greater than 10 million. However, data collection ceased once a total of 500 women had completed the survey. Each respondent answered all of the survey questions, and the survey form link is included for reference.

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For the second section of the survey titled "Requirements from sanitary napkins," a 5-point Likert scale was utilized, with ratings ranging from "not important" to "very important (1 to 5)." Multiple-choice and Yes/No questions were employed in the remaining sections, which included "Desired Functionalities for sanitary napkins", "Sanitary napkin usage patterns," and "Sanitary napkin preferences". Results were analyzed using mean comparisons and plots, and statistical analysis was conducted using the SPSS Package Program version 24.

### 3. Result and Discussion

Survey results were evaluated under five topics in accordance with the parts of the survey.

#### 3.1. Demographic data of participants

Demographic data such as age, accommodation, and occupation was gathered from the survey respondents. Figure 2 displays the age distribution of the participants, with the greatest number falling within the 31-35 age bracket, comprising 28% of the total sample. While a convenience sampling method was employed, the study successfully obtained data from all fertile age groups, with the exception of the 11-15 age groups, which was omitted in order to gather more accurate responses. Notably, participation was higher in Kachera Varsabad, with 300 respondents, as compared to Baidpura, which had 200 respondents.

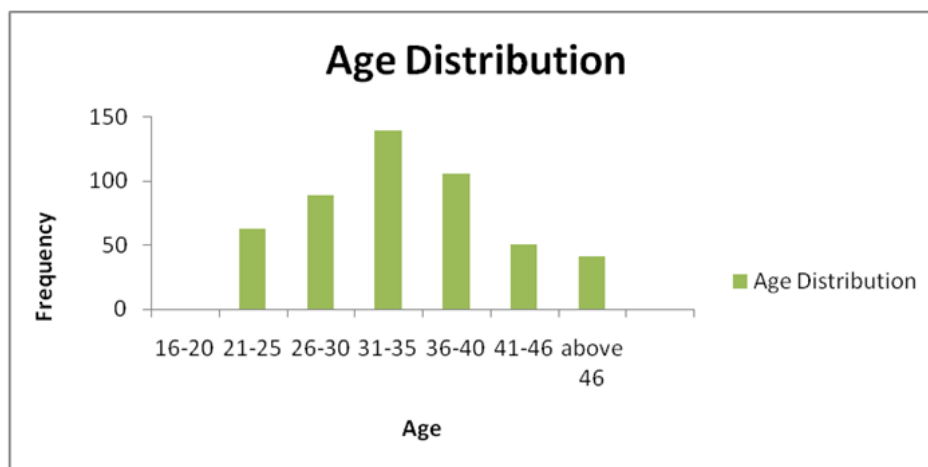


Figure 2. Age distribution of the respondents

The survey results revealed that the majority of the respondents were comprised of housewives and students. Overall, when the demographic information was evaluated, it became apparent that the survey participants effectively represented the population of women in the study area.

### 3.2. Requirements from sanitary napkins

Requirements of women from sanitary napkins were evaluated with the help of several performance requirements/characteristics such as absorption, sense of dryness, soft surface, leakage prevention, flexibility, having wings, long time useability, size, thickness, breathability and odor prevention, etc. Performance characteristics were formed according to preliminary studies with small groups. 5-point Likert-type scale was used (1="not important", 5= "very important"). The mean values for the statements of Requirements from sanitary napkins are given in Figure 3. Also, distribution of importance degrees for each criterion is given in Table 1.

As per Figure 3, absorption properties and leakage prevention were the most prominent performance requirements. Table 1 show that the majority of respondents (85.6% and 89.8%, respectively) rated the properties of sense of dryness and soft surface with the highest score of 5. Only a very small proportion of respondents found these properties unimportant. The properties of odor prevention, absorption, and leakage prevention followed closely behind with mean values of 4.7 and were also rated as highly important by at least 80% of the respondents.

Other performance criteria, such as breathability, having wings, and permitting mobility, also had mean values above 4, and were considered very important by at least half of the respondents. However, being long, thick, and long-lasting were not considered as important as the other criteria.

Statistical analysis was performed to examine whether the importance of performance characteristics varied across different age groups. The results showed that respondents in the age group of 31-40 gave higher ratings to leakage prevention compared to those in the 21-30 age group, and this difference was statistically significant ( $p < 0.05$ ). Similarly, respondents in the 36-40 age group gave higher ratings to having wings than those in the 21-30 age group ( $p < 0.05$ ).

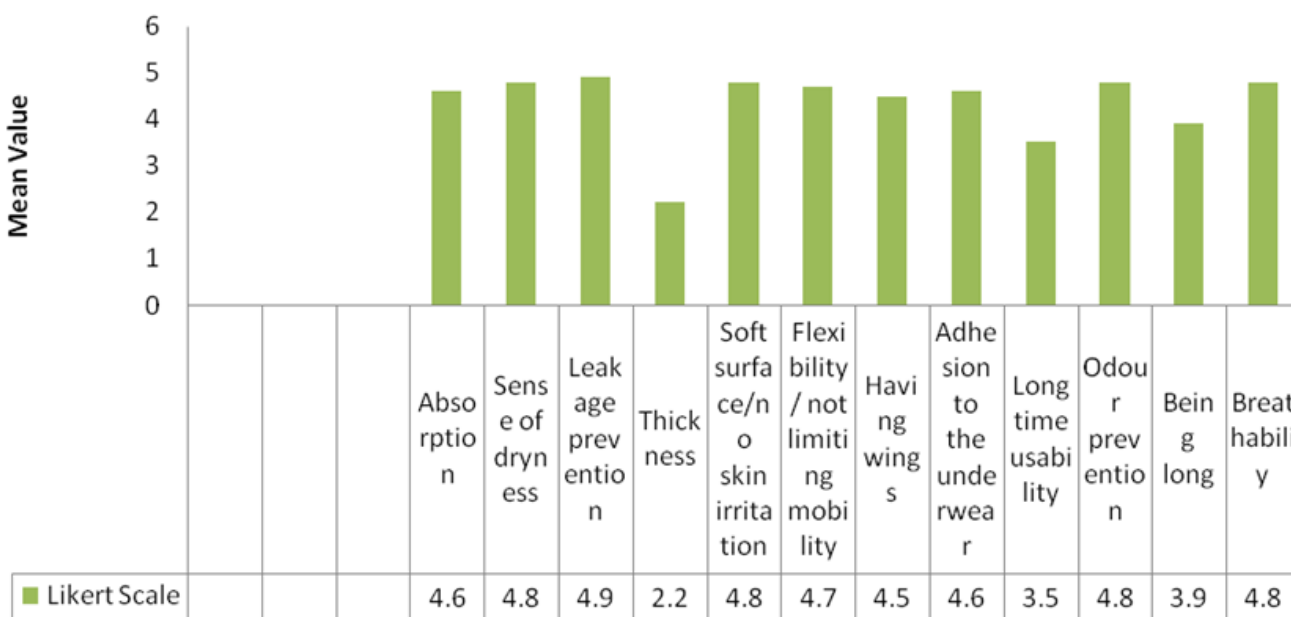


Figure 3. Mean values for performance characteristics of sanitary napkin

**Table 1.** Percentage distribution of importance performance characteristics

Performance criteria	Distribution of importance degrees (%)					Likert Scale Mean Value	Likert-Scale St. Dev.
	1 Not important	2	3	4	5 very important		
<b>Absorption</b>	0.25	0.81	4.1	9.3	85.4	4.6	0.58
<b>Sense of dryness</b>	0.7	1.0	4.8	12.2	81.4	4.8	0.65
<b>Leakage prevention</b>	0.4	0.8	3.6	5.4	88.8	4.9	0.55
<b>Thickness</b>	36.4	26.4	28.0	5.2	4.0	2.2	1.09
<b>Soft surface/no skin irritation</b>	0.6	0.8	5.4	13.4	79.8	4.8	0.68
<b>Flexibility/ not limiting mobility</b>	0.6	1.0	7.8	20.2	70.4	4.7	0.73
<b>Having wings</b>	0.7	3.4	13.0	22.0	60.8	4.5	0.88
<b>Adhesion to the underwear</b>	0.4	1.8	9.6	24.0	64.2	4.6	0.77
<b>Long time usability</b>	9.2	8.8	35.8	22.2	24.0	3.5	1.21
<b>Odor prevention</b>	0.6	0.4	5.4	12.0	81.6	4.8	0.63
<b>Being long</b>	3.8	6.4	32.4	25.0	32.4	3.9	1.09
<b>Breathability</b>	0.6	1.0	8.2	18.8	71.4	4.8	0.73

\* Total number of respondents for each statement: 500

In the next set of questions for survey, the importance of certain parameters for selecting sanitary napkins such as performance properties, price, brand, having perfume, made of natural raw material and biodegradability was studied. The results of this study are given in Figure 4 and Table 2. As per the results, it can be concluded that respondents mainly decided to buy sanitary napkins by concentrating on their performance properties. The least important parameter in selecting sanitary napkins was having perfume. Respondents wanted the sanitary napkin to prevent odor (Figure 3) but they did not prefer a perfumed sanitary napkin that could defeat the odor (Figure 4). According to Figure 4, respondents gave higher scores to being made of natural raw materials than price, brand and biodegradability. According to Kruskal-Wallis test results, performance properties, having perfume, being made of natural raw material and biodegradability ratings had statistically significant differences depending on the age groups at the 95% confidence level. According to Mann-Whitney U test, especially the age groups of 41-45 and 46-above gave higher ratings to being made of natural raw materials and biodegradability and 16-20 age group gave lower ranks to biodegradability when compared to other age groups and the differences were statistically significant (Sig.<0.05). Also, 21-25 age group had a higher mean value when compared to other age groups for the "being perfumed" property (Sig.<0.05). Rating results of the given options in selecting sanitary napkins.

**Figure 4.** Mean values of sanitary napkin selection parameters

**Table 2.** Percentage distribution of importance degrees for sanitary Napkin selection Factors

Distribution of importance degrees (%)							
Options	1 not important	2	3	4	5 very important	Likert- Scale mean val- ue.	Likert- Scale St. Dev.
<b>Performance properties</b>	1.0	0.7	9.7	14.4	74.2	4.7	0.78
<b>Price</b>	11.6	14.2	31.0	25.6	17.8	3.3	1.23
<b>Brand</b>	7.0	8.8	29.2	29.9	25.2	3.5	1.16
<b>Having perfume</b>	37.0	21.4	25.8	6.8	9.0	2.5	1.28
<b>Made of natural raw ma- terial</b>	4.6	3.0	23.7	17.8	51.2	4.4	1.12
<b>Biodegradability</b>	9.0	7.4	30.4	17.6	35.6	3.8	1.28

\* Total number of respondents for each statement: 500

In the last set of survey focused on main drawbacks, the problems identified by the respondents included discomfort during exercise and activities, skin irritation, and limited availability of biodegradable options (Figure 5; table 3). The most common problems were the need of frequent changes, sense of wetness and leakage. 34% of the respondents never experienced bacterial or fungal infections caused by sanitary napkins but the rest 66% at least rarely experienced this problem [8].

**Table 3.** Percentage distribution of importance degrees for problems of existing sanitary napkins

Distribution of importance degrees (%)							
Problems	1 not important	2	3	4	5 very important	Likert Scale Mean Value	Likert- Scale St. Dev.
<b>Leakage</b>	8.4	15.8	35.0	18.2	22.6	3.3	1.22
<b>Not to take shape</b>	10.2	21.0	41.0	15.4	12.4	3.0	1.13
<b>Deformation of the surface</b>	14.0	16.0	30.6	17.6	21.8	3.2	1.32
<b>Sense of wetness</b>	5.0	11.8	40.0	21.2	22.0	3.4	1.11
<b>Need of frequent changes</b>	3.2	10.0	42.2	23.4	21.2	3.5	1.03
<b>Causing allergy</b>	25.4	15.4	24.6	11.6	23.0	2.9	1.48
<b>Causing skin rash</b>	21.0	15.2	23.0	14.6	26.2	3.1	1.48
<b>Cause bacterial /fungal infection</b>	31.6	17.6	22.6	9.2	19.0	2.7	1.48
<b>Stiffness</b>	23.0	20.0	38.0	8.8	10.2	2.6	1.22
<b>Fullness/thickness/foreign body</b>	16.0	19.2	33.6	15.0	16.2	3.0	1.28
<b>Appearing under garments</b>	22.0	21.8	29.6	11.2	15.4	2.8	1.33
<b>Excess adhesion to underwear</b>	28.0	22.0	28.2	12.6	9.2	2.5	1.27
<b>Insufficient adhesion to underwear</b>	19.0	19.8	28.0	15.4	17.8	2.9	1.35

\*Total number of respondents for each statement: 500

### 3.3. Desired Functionalities to be added to sanitary napkins

This part of the survey aimed to identify which new and functional properties could be added to sanitary napkins, and the results are presented in Figure 6 in terms of frequency of preference. Respondents were allowed to select more than one option. The majority of respondents (316 women) indicated a preference for sanitary napkins with antibacterial properties. Additionally, 104 respondents expressed interest in using sanitary napkins with painkilling properties. It may be possible to

create a niche industry within the sanitary napkin production market by incorporating topical painkillers into the top sheet of the napkins to alleviate vulva-related pains for users. However, respondents did not show a preference for novel properties such as reusability, self-warming properties, moisturizing properties, or drug delivery

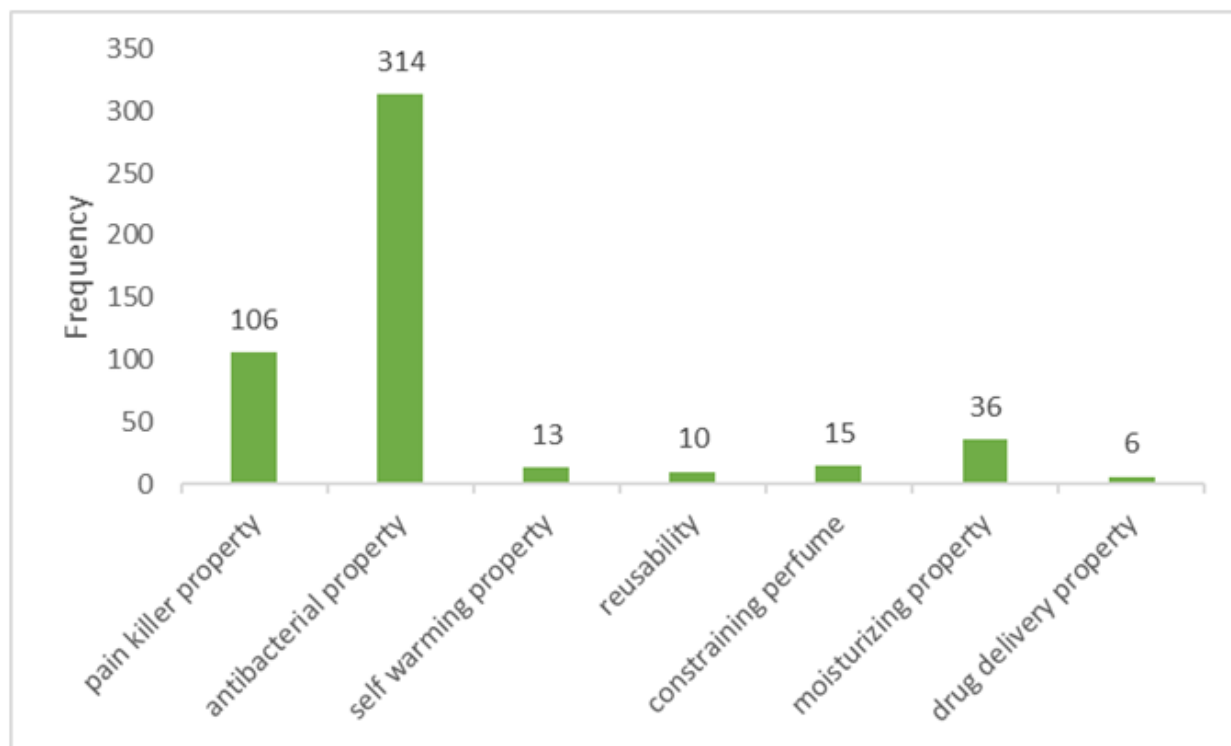


Figure 5. Functional properties to be added to sanitary napkins

### 3.4. Sanitary napkin usage habits

The study also found that the majority of respondents (77.8%) prefer using pads as their primary menstrual product, while 22.2% prefer tampons. The main reasons for preferring pads were comfort (39.4%), ease of use (32.4%), and fear of toxic shock syndrome (TSS) (12.4%). On the other hand, the main reasons for preferring tampons were convenience (31.2%), ease of use (29.2%), and less leakage (19.2%). In terms of disposal methods, respondents who threw their used sanitary napkins in the trash reported concerns about the potential spread of diseases (31.6%), and odor (24.6%). Those who used the specially designed containers mentioned the feeling of being more hygienic (46.2%). Overall, the study highlights the importance of developing biodegradable covers for sanitary napkins and promoting proper disposal methods to minimize the environmental impact of menstrual products.

### 3.5. Consuming Inclinations

In this part of the survey, sanitary napkin consuming inclinations of women were observed. Most of the women preferred their sanitary napkins according to their experiences, only 6% of respondents were influenced by promotions. Also, the survey exhibited that fact that bad performance was the most effective criterion in changing the existing sanitary napkin. Furthermore, sanitary napkins were accessible in the study area and 63% of the respondents thought that they were affordable.

## 4. Conclusion

In this study, expectations from sanitary napkins, perception of sanitary napkin performance characteristics, functional property needs and consuming inclinations of 500 women in study area were evaluated.

The absorptivity and leakage prevention of sanitary napkins were found to be the most crucial performance requirements. Wetness, leaking, and the necessity for frequent changes were discovered to be the respondents' most common issues. In order to improve the absorbent layer's ability to gel, as well as to manage moisture, future research should focus on the top sheet and acquisition-distribution layer's moisture management capabilities. Survey results also stated that the most important functional property to be added to sanitary napkins was antibacterial property. This property could help odor prevention. Respondents did not prefer perfume on sanitary napkins to hide the odor, but they wanted an antibacterial system to solve this problem radically.

Overall, the survey provided valuable insights into the preferences and habits of women regarding sanitary napkins. The results suggest that women consider absorption, leakage prevention, dryness, soft surface, and odor prevention as the most important performance characteristics of sanitary napkins. Additionally, respondents showed interest in having antibacterial and painkilling properties in their sanitary napkins. The survey also highlighted the need for biodegradable covers for sanitary napkins to reduce waste load on the environment.

The study's findings can be useful for sanitary napkin manufacturers in developing products that meet the preferences and needs of women. The information gathered from the survey can also be used to guide marketing and advertising efforts to promote consumer- and environment-friendly products. Further research could be conducted to investigate the presence of harmful chemicals in sanitary napkins and to evaluate the effectiveness of natural and biodegradable materials in improving the safety and environmental impact of sanitary napkins.

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