

## A Research Study about the Expectations from Sanitary Napkins, Current Problems and Design of a Functional Sanitary Napkin

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### Keywords

Sanitary Napkin,  
Survey,  
Expectations,  
Problems,  
Functional Sanitary Napkin

**Abstract:** Sanitary napkins are technical textile products those are used by women during menstruation to collect menstrual fluids hygienically. Sanitary napkins are layered structures, as they have to fulfill different end-use properties at the same time. In this study, a detailed survey was conducted to 500 women living in different regions of Turkey. In the first parts of the survey, the expectations from sanitary napkins, perception of sanitary napkin performance characteristics and the problems in current sanitary napkins were questioned. In addition, some information to design a novel/functional sanitary napkin was collected. Also, to provide information to the companies in the sector, current preferences on sanitary napkins, usage habits and effects of product promotions were analyzed. Consequently, it was determined that women focused on odourless and soft surfaced sanitary napkins in addition to the absorption properties such as leak-proofing and dryness. The most frequent problems in current pads were leakage, odour and the need of frequent changes. In parallel, the most desired functional property of a new sanitary napkin was antibacterial activity. There were some statistically significant differences between the expectations, sanitary napkin selection factors and problems of the women depending on the age ranges.

## Kadın Pedlerinden Beklentiler, Mevcut Pedlerde Yaşanan Problemler ve Fonksiyonel Bir Kadın Pedi Tasarımı Üzerine Araştırma Çalışması

### Anahtar Kelimeler

Kadın Pedi,  
Anket,  
Beklentiler,  
Problemler,  
Fonksiyonel Kadın Pedi

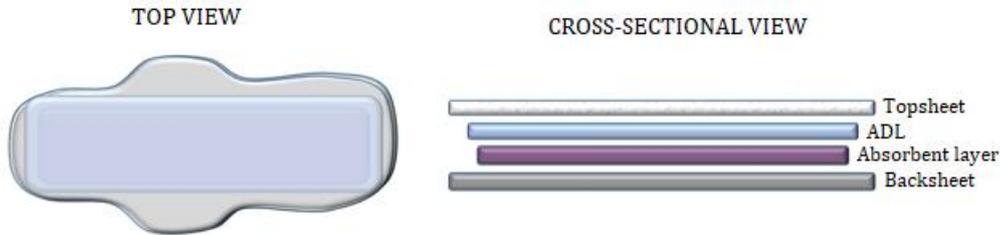
**Öz:** Kadın pedleri, kadınların menstrual sıvı ve atıklarını hijyenik bir şekilde toplamak için kullandıkları teknik tekstil ürünleri olarak tanımlanabilir. Kadın pedleri birbirinden farklı birçok özelliği aynı anda karşılamak zorunda olduğundan farklı katmanlar içeren özel bir yapıya sahiptir. Bu çalışmada Türkiye'nin farklı bölgelerinden toplam 500 kadına, kadın pedleri hakkında detaylı bir anket uygulanmıştır. Anketin ilk bölümlerinde; kadınların pedlerden beklentileri, pedin performans özelliği ile ilgili algıları ve mevcut pedlerde yaşadıkları problemler irdelenmiştir. Buna ek olarak, ilave bir fonksiyon içeren bir kadın pedinin tasarımında kullanılacak bilgiler edinilmiştir. Ayrıca, sektöre bilgi sağlamak üzere, kadınların mevcut durumdaki ped tercihleri, ped kullanım alışkanlıkları ve promosyonlar ile ilgili bilgiler sorgulanmış ve çalışma kapsamında değerlendirmeler yapılmıştır. Sonuç olarak kadınların kullanım performansı açısından bir pedden en büyük beklentilerinin; sıvıyı emme ile ilgili olan absorpsiyon, sızdırmazlık ve kuruluk hissinin yanı sıra kötü koku oluşumunu engelleme ve yumuşak üst yüzey olduğu tespit edilmiştir. Kadınların mevcut pedlerinde yaşadıkları en büyük problemlerin ise sık değiştirme ihtiyacı, sızdırma ve ıslaklık hissi olduğu belirlenmiştir. Kadınların pedlerinde en fazla istedikleri fonksiyonel özellik olarak ise antibakteriyellik ön plana çıkmıştır. Anket sonuçlarına göre, kadınların pedlerinden beklentileri, ped seçme kriterleri ve problemleri açısından yaşa bağlı istatistiksel olarak anlamlı farklar elde edilmiştir.

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## 1. Introduction

Sanitary napkins are a member of disposable hygiene products those belong to technical textiles as they contain functional textile materials. Sanitary napkins have a big market [1] because almost the half of the world population consists of women and every women have menstrual bleeding during their fertile periods [1,2]. The sanitary napkin market will maintain its size until new techniques, which are easier to use, accessible, hygienic and more comfortable, will be emerged.

Sanitary napkins are produced as layered structures as they have to fulfill different properties such as absorption, leakage prevention, comfort etc. at the same time. These layers contain textile and film structures (Figure 1). The uppermost layer which contacts with the body is the topsheet. The material of topsheet can be polyethylene film or polypropylene spunbond nonwoven fabric. An acquisition-distribution layer (ADL) is under the topsheet and it distributes the menstrual fluid along the sanitary napkin and transfers it to the absorbent layer below. ADL can be made of airlaid woodpulp nonwovens or multicomponent structures composed of woodpulp and man-made fibers. Absorbent layer is usually made of wood pulp and superabsorbent polymer. It can be produced by airlaid technology and with different configurations. The bottom layer namely backsheet is usually an impermeable film [1,3,4]. The ADL and absorbent layers are made up of nonwoven fabrics. It is advantageous to use nonwoven fabrics as they are easy and fast to produce, they absorb high amount of fluid and they provide comfort to the user [5].



**Figure 1.** Main layers of a sanitary napkin (original drawing)

There are several studies on sanitary napkins, in the literature. They mainly focused on the absorption and moisture management properties of sanitary napkins. For example, Das et. al. (2008) produced absorbent layers with different ratios of superabsorbent viscose fibers, to be used in ultra-thin sanitary napkins [6]. Karakurd Elma et. al. (2018) investigated the effects of absorbent layer thickness and superabsorbent polymer ratios to the liquid acquisition time and capacity [7]. Wijesingha and Perera (2017) examined the usability of corn husk fibers for absorbent layer of sanitary napkins [8]. Barman and Kathar (2017) developed an environmentally friendly sanitary napkin that is herbal finished [9]. Mishra et. al. (2016) investigated the usability of flax carding wastes as absorbent layers to decrease the material costs [10]. Yadav et. al. (2016) produced cellulose acetate nanofibers and searched their usability on sanitary napkins to avoid from health risks [11]. Pohlman (2016) analyzed the topsheets of commercial pantliners [5]. In all of these researches, researchers used their own perspective in designing and evaluating materials and experimental setups. None of these studies' results were supported by the real needs of women via questionnaires or wear trials. In addition, there are similar works in the literature on baby diapers and incontinence pads [12-15]. Also, there are some survey and field studies which question the sanitary napkin usage, perception, accessibility etc. in local places such as African countries and India where the accessibility of sanitary napkins are limited [16-23].

The purpose of this study was to determine the expectations of women from sanitary napkins, to detect main problems in existing materials, and to collect information for the design of a functional sanitary napkin, for women who live in Turkey. Also, some information about the sanitary napkin preferences and buying habits were obtained in order to provide data for the commercial producers.

## 2. Material and Method

The survey study was constructed according to the 8-step process, which was proposed by Bas (2008) [24]. It consisted of 60 questions/statements under five parts. The names of the parts are given below. In addition, the full form can be found in the Appendix.

- A. Demographic information
- B. Expectations from sanitary napkins
- C. Functional properties to be added to sanitary napkins
- D. Sanitary napkin usage habits

## E. Sanitary napkin preferences

Survey was conducted to women by internet, utilizing Google Documents in the dates of 01-30 April 2019. The survey was firstly tested with small groups to see if the questions were fully understood and feedbacks were taken. After revisions, the survey was sent to participants by e-mail, social media and other digital platforms and convenience sampling method was used as it was the least expensive and time consuming method [25]. The Turkish population had 41433861 women in April 2019 according to Turkish Statistical Institute and approximately 21 million of them were in the range of 15-54 years old [26]. According to the literature [27, 28], at least 384 participants should be taken where the population is higher than 10 million. In this study, survey was ended when the total number of participants reached 500 women. Respondents answered all of the questions of the survey form.

In the second part of the survey which was captioned "Expectations from sanitary napkins", 5-point Likert-type scale was used (1="not important", 5= "very important"). In the other parts of the survey, namely "Functional properties to be added to sanitary napkins", "Sanitary napkin usage habits" and "Sanitary napkin preferences" parts, multiple choice questions and Yes/No type questions were used. Results were evaluated by comparing means and plots. Also, statistical analysis were performed by using SPSS Package Program version 24. For selected parameters, Kruskal-Wallis test was used to compare independent groups and Mann-Whitney U test was used to make pairwise comparisons [25].

Reliability tests for 5-point scaled 3 sub-parts of Part B (B1, B2 and B3) were performed according to Cronbach alpha analysis, utilizing SPSS Package Program version 24. Cronbach alpha was calculated as 0.882 for 31 statements in 3 sub-parts. Cronbach alpha coefficients were 0.834 and 0.901 for the statements in the parts of "Performance Requirements" and "Main problems in existing sanitary napkins", respectively. It showed that the statements in these parts showed very good internal consistency and reliability. For "Performance Requirements" part, the deletion of "thickness" and "long time usability" related statements could increase the Cronbach alpha value to 0.858 and 0.837, respectively. The increases were slight and current Cronbach alpha value was high so that these statements were not deleted. Similarly, for the "Main problems in existing sanitary napkins" part, deletion of any items would not increase the Cronbach alpha value importantly. For the statements of "Options for selecting sanitary napkin", the Cronbach alpha was calculated as 0.550 that had poorer internal consistency [29]. Nevertheless, the deletion of any item would not increase the Cronbach alpha value more than 0.001. In addition, no negative correlation was found between the statements of this survey part. Therefore, any of the statements were not excluded from the study.

## 3. Results

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

### 3.1 Demographics of participants

Age, accommodation and occupation information were collected as demographics of the respondents. The age distribution can be seen in Figure 2.a. The highest number of participants were from 31-35 age group with 28% ratio. In spite of using convenience sampling method, data was collected from all fertile age groups (11-15 age group was not taken into account to collect more correct answers).

Accommodation information of respondents is given in Figure 2.b, according to regions of Turkey. As seen from the figure, women from all regions of Turkey answered the survey. The participation from Marmara and Aegean Regions were higher due to the higher populations of these regions.

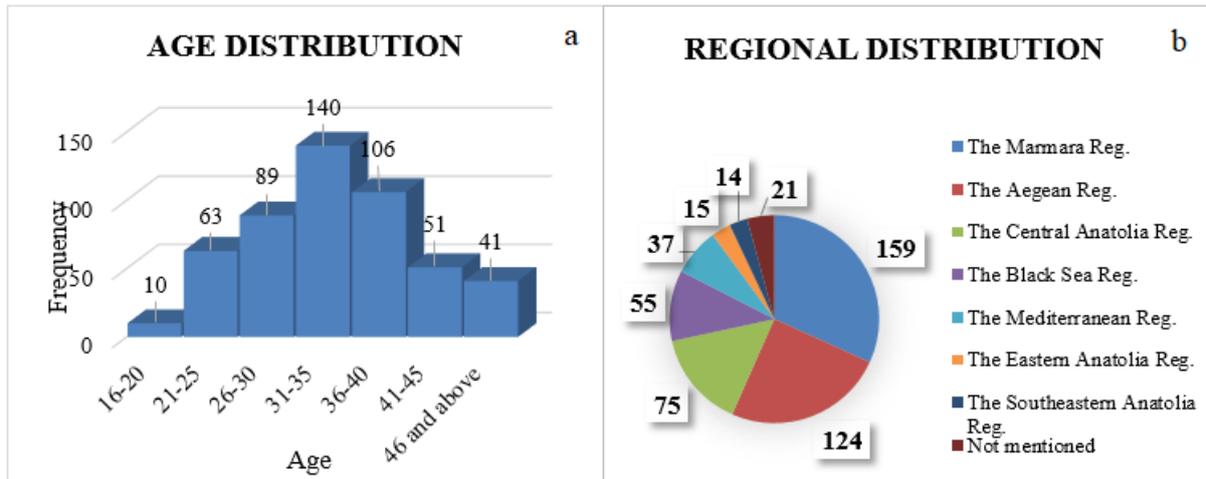


Figure 2. Age and regional distribution of the respondents

Respondents had a wide variety of jobs e.g. academician, researcher, cook, bank clerk, biologist, office worker, dentist, dietician, midwife, pharmacist, housewife, financier, physiotherapist, security guard, beautician/hairstylist, nurse, worker, operator, fireman, clerk, lab technician, market employee, architect, accountant, engineer, student, teacher, secretary, insurer, salesperson /sales consultant, designer, cleaner, theater artist, tourism professional.

When the demographic information of the individuals was considered in general, it was understood that the participants who filled the survey represented a wide range of Turkish women.

### 3.2 Expectations from sanitary napkins

Expectations of women from sanitary napkins were evaluated under 3 main questions. In the first question, the most important performance characteristics were determined. Performance characteristics were formed according to preliminary studies with small groups. The mean values for the statements of this subpart are given in Figure 3. Also, distribution of importance degrees for each criteria is given in Table 1.

According to Figure 3, absorption properties and leakage prevention were the most prominent performance requirements. Paralelly, in the literature, most of the studies focused on absorption properties [6, 7, 11]. According to distribution of importance degrees in Table 1, most of the respondents rated these properties with the highest score, 5 (85.6% and 89.8% respectively). The ratio of women, who found these properties unimportant, was less than 1%.

Sense of dryness, soft surface and odour prevention had mean value of 4.7 and followed absorption and leakage prevention properties in terms of performance requirements. According to Table 1, at least 80% of the respondents gave the highest scores to these criteria. Other performance criteria namely breathability, having wings and permitting mobility had higher mean values than 4. At least half of the respondents found these criteria very important as performance characteristics. Different from the others, respondents gave less importance to being long, thick and long time usable.

In the statistical analysis, it was examined if the importance of performance characteristics changed with the age groups. According to Kruskal-Wallis test, only leakage prevention (Sig.=0.030) and having wings (Sig.=0.012) had statistically significant differences depending on the age groups, in the confidence level of 95%. According to Mann-Whitney U test results; respondents at the ages of 31-40 gave higher ratings to leakage prevention when compared to respondents of 21-30 ages and the differences between these groups were statistically significant (Sig.<0.05). Similarly, respondents of 36-40 age group gave higher ratings to having wings when compared to respondents in the ages of 21-30 (Sig.<0.05).

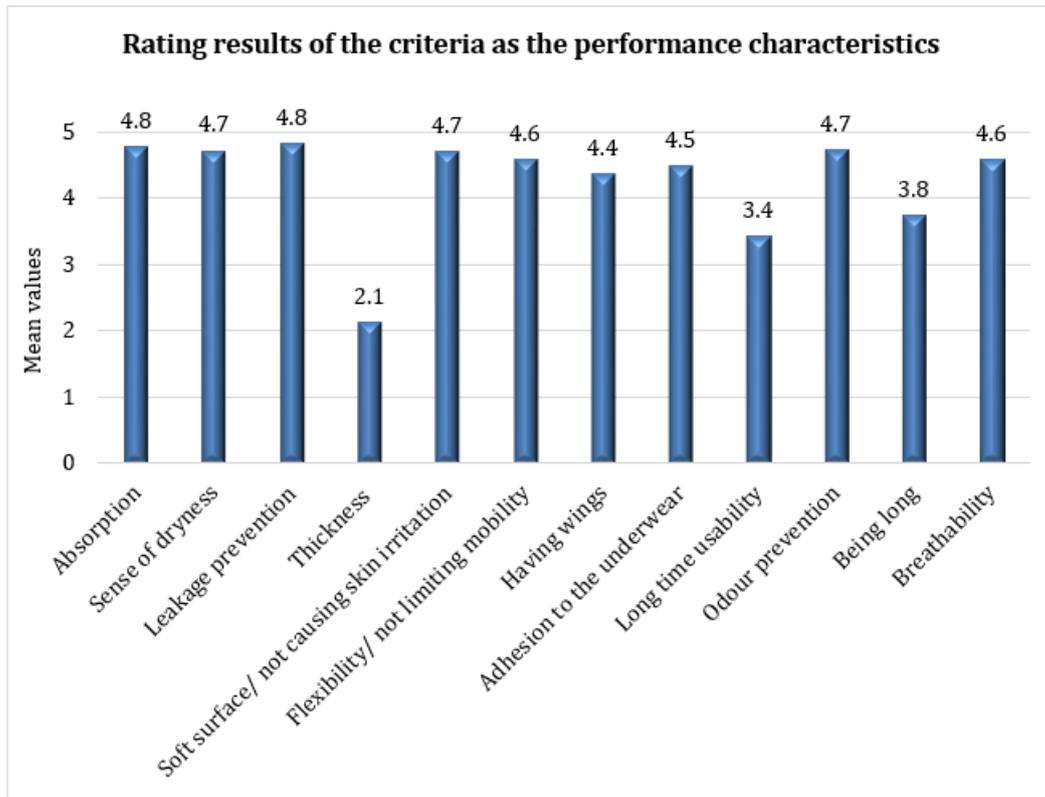


Figure 3. Mean values for performance characteristics of sanitary napkins

Table 1. Percentage distribution of importance degrees for 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		
Absorption	0.2	0.8	4.2	9.2	85.6	4.8	0.57
Sense of dryness	0.6	1.0	4.8	12.2	81.4	4.7	0.65
Leakage prevention	0.4	0.8	3.6	5.4	89.8	4.8	0.55
Thickness	36.4	26.4	28.0	5.2	4.0	2.1	1.09
Soft surface/no skin irritation	0.6	0.8	5.4	13.4	79.8	4.7	0.66
Flexibility/ not limiting mobility	0.6	1.0	7.8	20.2	70.4	4.6	0.73
Having wings	0.8	3.4	13.0	22.0	60.8	4.4	0.89
Adhesion to the underwear	0.4	1.8	9.6	24.0	64.2	4.5	0.77
Long time usability	9.2	8.8	35.8	22.2	24.0	3.4	1.21
Odour prevention	0.6	0.4	5.4	12.0	81.6	4.7	0.63
Being long	3.8	6.4	32.4	25.0	32.4	3.8	1.09
Breathability	0.6	1.0	8.2	18.8	71.4	4.6	0.73

\* Total number of respondents for each statement: 500

In the second question, the importance of the given options for selecting sanitary napkins, were investigated. The mean values for these options are given in Figure 4 and the percentage distributions for importance degrees are given in Table 2. According to Figure 4, respondents mostly decided to buy their sanitary napkins by focusing their performance properties. The least important factor in selecting sanitary napkins was having perfume. Respondents wanted the sanitary napkin to prevent odour (Figure 3) but they did not prefer a perfumed sanitary napkin that could suppress the odour (Figure 4). A similar result was obtained by Arugula et. al. (2017), in which the fragrance was rated as the least important selection parameter when compared to brand, price and comfort properties, by 500 students in Khammam/India [17]. 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).

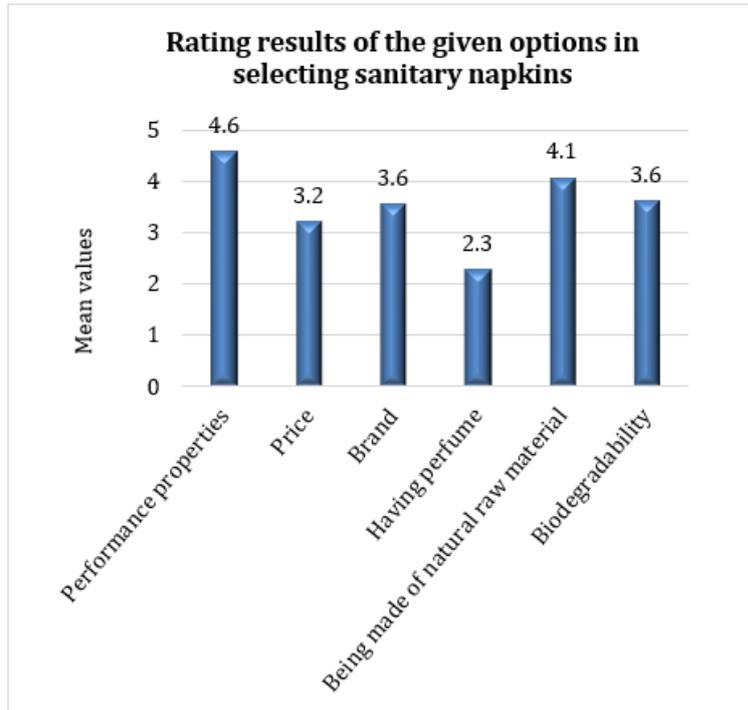


Figure 4. Mean values of sanitary napkin selection factors

Table 2. Percentage distribution of importance degrees for sanitary napkin selection factors

Options	Distribution of importance degrees (%)					Likert-Scale Mean Value	Likert-Scale St. Dev.
	1 not important	2	3	4	5 very important		
Performance properties	1.0	0.8	9.6	14.6	74.0	4.6	0.78
Price	11.4	14.2	31.0	25.6	17.8	3.2	1.23
Brand	7.0	8.8	29.2	29.8	25.2	3.6	1.16
Having perfume	37.0	21.4	25.8	6.8	9.0	2.3	1.28
Made of natural raw material	4.4	3.0	23.6	17.8	51.2	4.1	1.12
Biodegradability	9.0	7.4	30.4	17.6	35.6	3.6	1.28

\* Total number of respondents for each statement: 500

In the last question of this part of survey, women rated the main problems of their existing sanitary napkins. The mean values to these problems are given in Figure 5 and the percentage distribution for importance degrees are given in Table 3. According to results in Figure 5, any of the problems did not get higher mean values than 3.5. The most common problems were the need of frequent changes, sense of wetness and leakage, that all of them were related to moisture management and absorption performance. According to Table 3, respondents also faced other problems, too, but in smaller quantities. For example, 32% of the respondents never experienced bacterial or fungal infections caused by sanitary napkins but the rest 68% at least rarely experienced this problem.

When the results were analyzed statistically, sense of wetness, allergy, stiffness and sense of fullness/foreign body were found to have statistically significant changes according to the age groups of respondents (Kruskal- Wallis test, sig.<0.05). It can be concluded that, especially sense of wetness was a more frequent problem for the 16-20 age group among the all age groups (Mann-Whitney U test, sig.<0.05, mean value for 16-20 age group: 4.4).

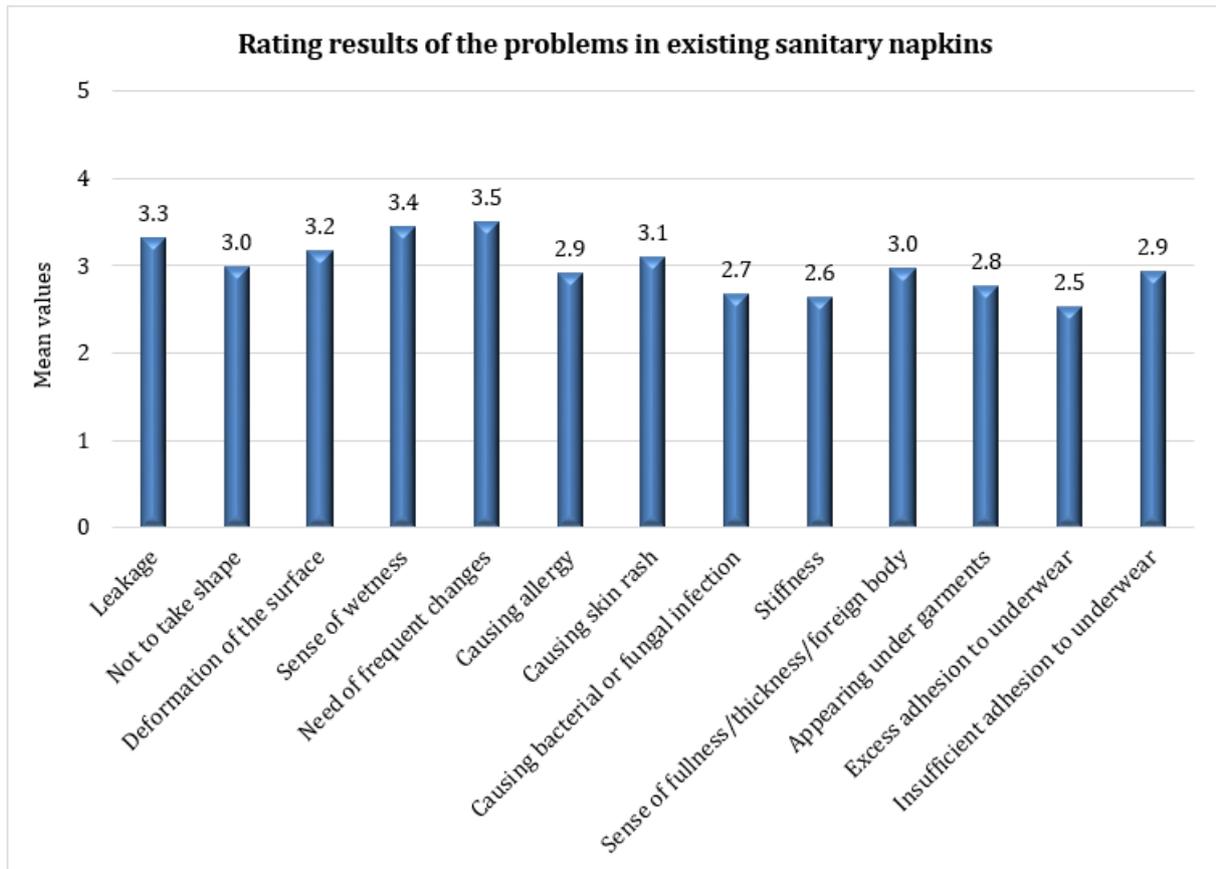


Figure 5. Mean values for problems of existing sanitary napkins

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

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

\* Total number of respondents for each statement: 500

### 3.3 Functional properties to be added to sanitary napkins

In this part of the survey, it was investigated what new and functional properties could be added to sanitary napkins. In Figure 6, the functional property preferences of respondents are given in terms of frequencies. Respondents were able to choose more than one option. According to the results, most of the respondents wanted to have antibacterial property (316 women). 104 of the total respondents would like to use a sanitary napkin with painkilling property. The use of topical painkillers in the topsheet of sanitary napkins may help the vulva related pains of users and this can result with a niche industry within sanitary napkin production. The respondents do not prefer the novel properties such as reusability, self-warming property, moisturizing property and drug delivery.

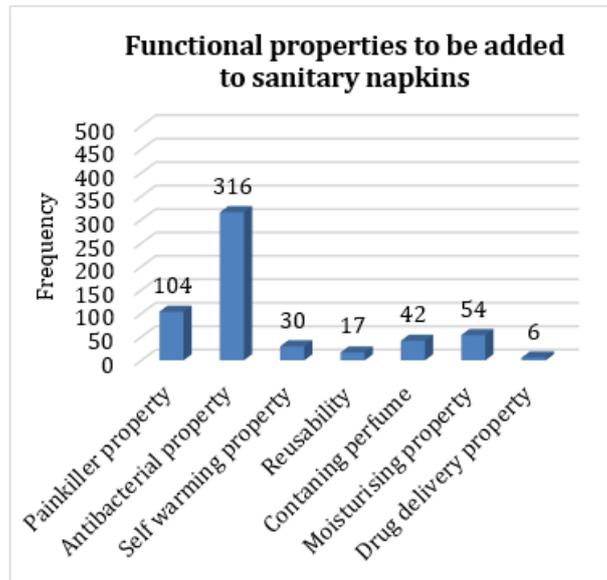


Figure 6. Functional properties to be added to sanitary napkins

Also, the approach of women to a panty shaped sanitary napkin was evaluated. According to Figure 7.a, 66% of the respondents would not like to use a panty shaped sanitary napkin. Most of the respondents stated that it could cause difficulties in changing the sanitary napkin (Figure 7.b).

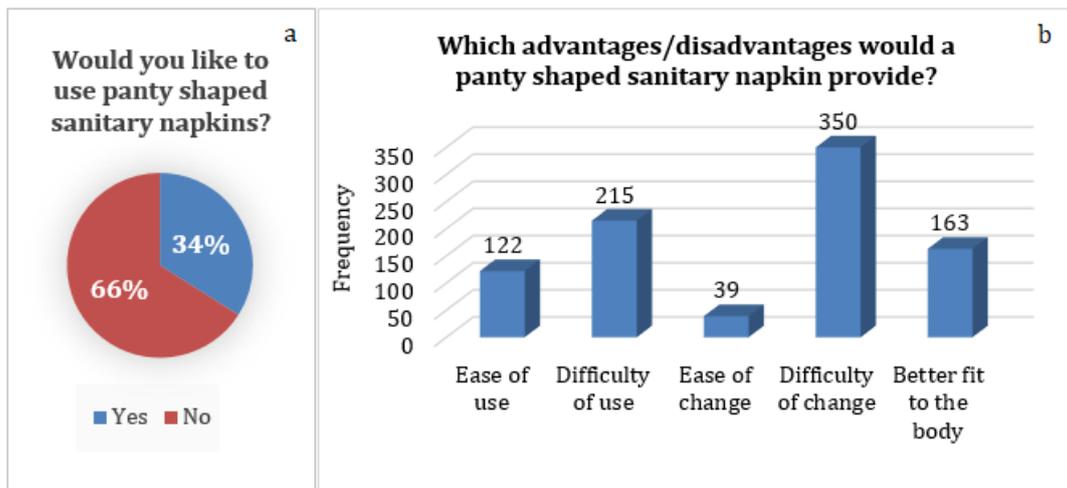


Figure 7. Approach of women to panty shaped sanitary napkin design

According to Figure 8.a, 85% of respondents thought that there were harmful chemicals in sanitary napkins. Therefore, 96% of them would like to use sanitary napkins with natural raw materials (Figure 8.b). They thought that sanitary napkins with natural raw material were less harmful to their skins (372 respondents, Figure 8.c). It can be concluded that respondents do not trust their sanitary napkins in terms of health.

Statistical analysis was performed to determine if there were any differences in the ratings of “being made of natural raw materials” and “biodegradability” statements (Table 2), depending on the thoughts of “harmful chemicals in sanitary napkins” (Figure 8.a). According to the Kruskal-Wallis test, there were not any significant differences between the mean values of “being made of natural raw materials” and “biodegradability”, depending on the thought of harmful chemicals. Also respondents who stated that they would like to use sanitary napkins made of natural raw materials because of being less harmful to their skin (Figure 8.c), gave higher ratings to the “being made of natural raw materials” in the Table 2 (Sig.< 0.05). In addition, respondents who stated that they would like to use sanitary napkins made of natural raw materials because of degrading in nature faster (Figure 8.c), gave higher ratings to the “biodegradability” in the Table 2 (Sig.< 0.05).

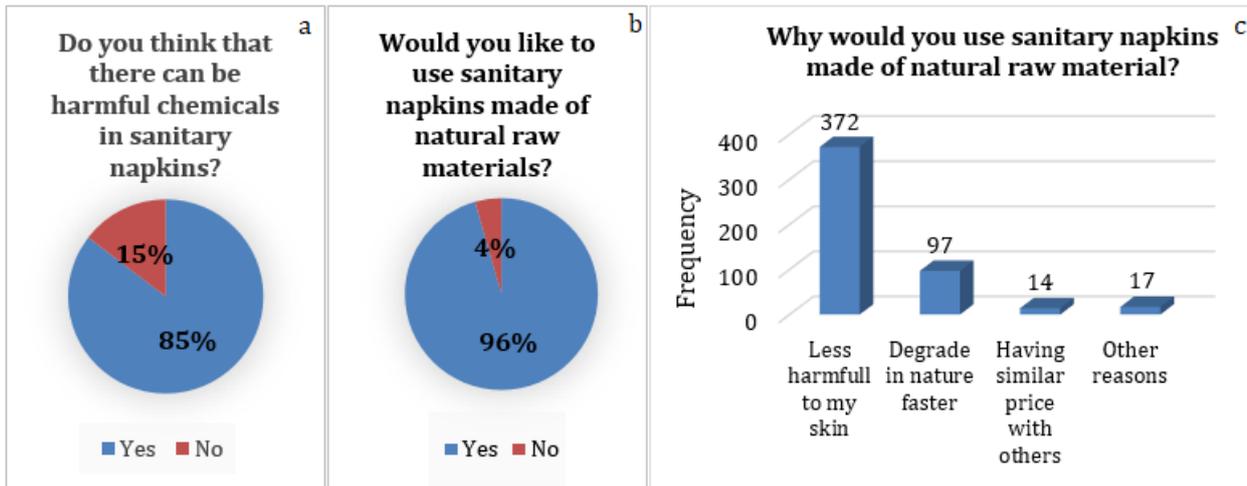


Figure 8. Perception of women about the content of sanitary napkins

Almost half of the respondents stated that the shape, size and grabbing of wings were sufficient and the sanitary napkin fitted well on the underwear (Figure 9).

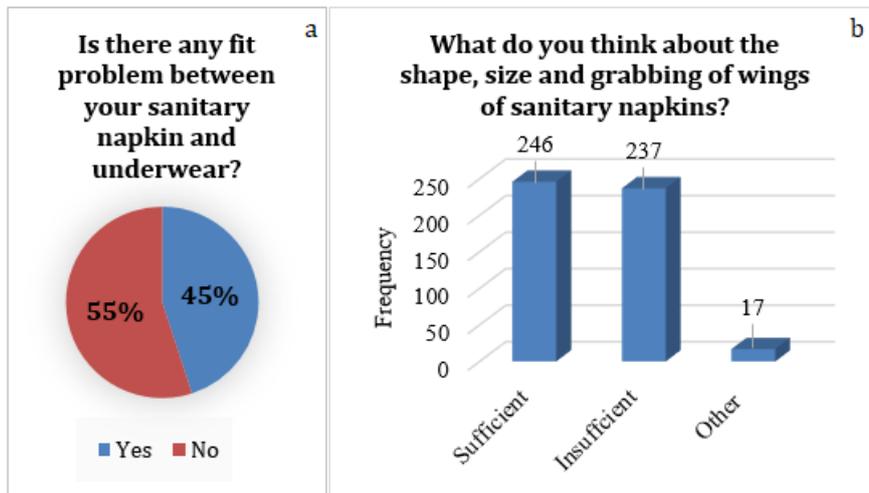


Figure 9. Wings and fit properties of existing sanitary napkins

### 3.4 Sanitary napkin usage habits

In this part of the study, the usage and disposal habits of the participants were determined. Firstly, sanitary napkin changing periods were questioned for the first 3 days of menstruation (the heaviest bleeding days) and the rest days. The results for these questions are given in Figure 10.a. According to the figure, respondents change their sanitary napkins in 2, 3 and 4 h periods, in the first 3 days of menstruation. After 3 days, changing period increases to 5-12 h, mostly. According to Figure 10.b, wet sensation, leakage and odour are the most prominent reasons for changing the sanitary napkin. Statistical analysis was performed to determine if the sanitary napkin changing periods (Figure 10.a) were related to the problems in the existing sanitary napkins (Figure 5). According to Kruskal-Wallis test results, only insufficient adhesion had significant differences depending on the sanitary napkin changing periods for both first 3 days and after 3 days (sig.<0.05). Also surface deformation of sanitary napkins was different for changing periods of 3 hours and 4 hours after the first 3 days of menstruation (Sig.< 0.05). Therefore, any statistically significant difference was not determined between the mean values of other problems depending on the sanitary napkin changing periods (Sig.>0.05).

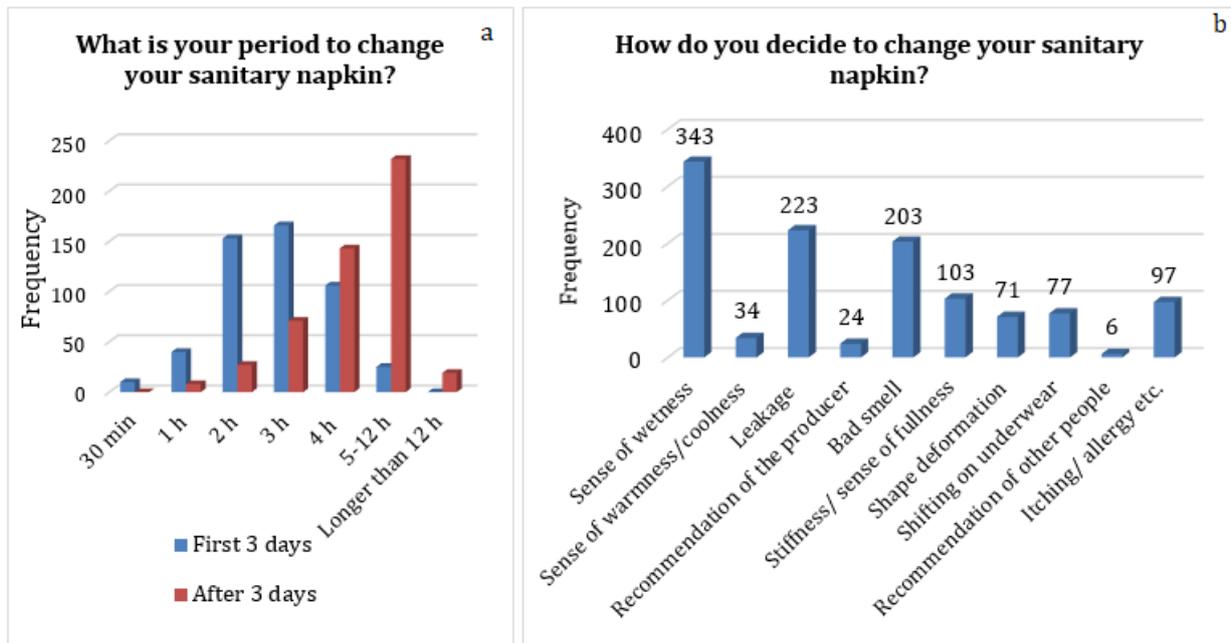


Figure 10. Periods of changing sanitary napkins

Respondents' disposal habits are summarized in Figure 11. Figure 11.a shows that 94% of respondents threw their sanitary napkins to the trash and 6% of them threw it to the specially designed containers. Figure 11.b shows that, most of the respondents wrapped their sanitary napkins to the next napkin's cover before throwing it to the trash. It can be concluded that, to protect the environment, it is not enough to produce natural and biodegradable sanitary napkins, but also the covers of the sanitary napkins should be biodegradable. The disposal of the sanitary wastes, including sanitary napkins and other materials (cotton, tampon etc), was explored by Nyoni et al. (2011) too, for Zimbabwean women. Different from the trend in Turkey, only 28% of 200 Zimbabwean women threw their sanitary wastes in the trash. Other methods for disposal were burning, throwing it in the toilet, washing etc. [16].

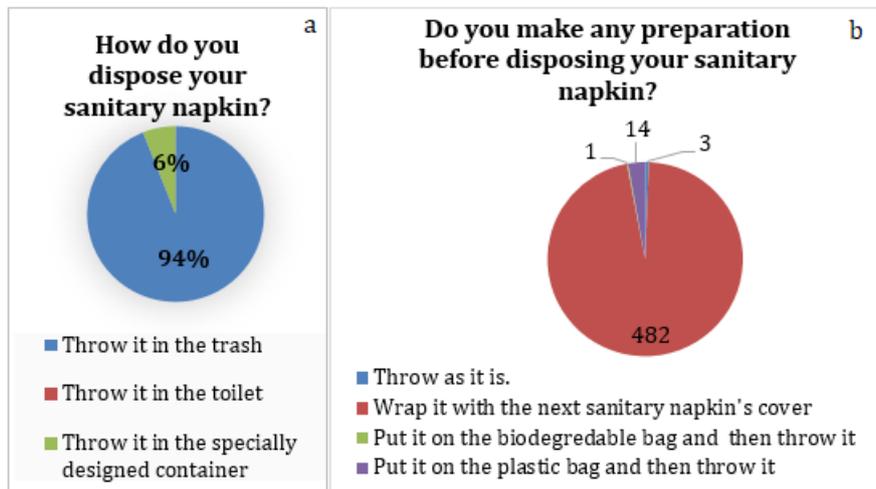


Figure 11. Disposal habits

### 3.5 Consuming preferences

In the last part of the survey, sanitary napkin consuming preferences of women were detected. This information is gathered together to provide information to the producers. According to Figure 12.a, women mostly bought their sanitary napkins from markets. In contrary with the expectations of the author, pharmacy and the internet were the least preferred sellers. According to Figure 12.b, women saw the sanitary napkin promotions mostly on the television and according to Figure 12.c only 6% of respondents were influenced by promotions. Most of the women preferred their sanitary napkins according to their experiences. Also, Figure 13.a shows that bad performance was the most effective criterion in changing the existing sanitary napkin.

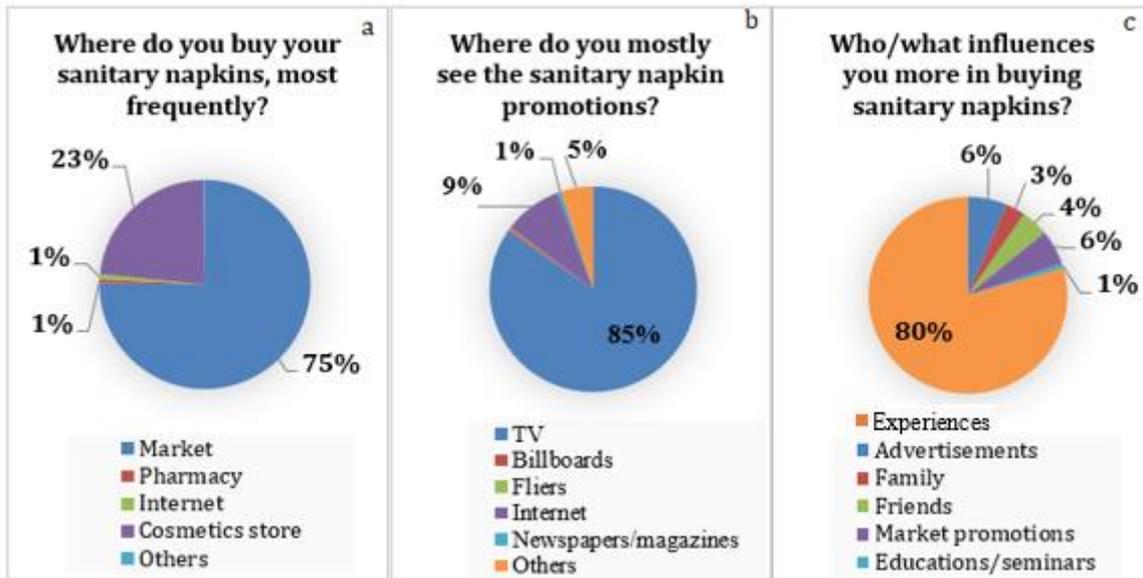


Figure 12. Sanitary napkin buying preferences and the affecting factors

According to Figure 13.b and c, sanitary napkins were accessible in Turkey and most of the respondents thought that (67%) they were affordable. When this result was compared with the survey studies in the literature, it was seen that Turkish participants found the affordability of sanitary napkins quite high. In the study of Adika et. al. (2011), 66.4% of 140 participants who were adolescent school girls in Nigeria, stated that the sanitary napkins were expensive or too expensive [22]. Similarly, it was determined that 57% of the 500 students in Khammam/India was not satisfied with the price of sanitary napkins [17].

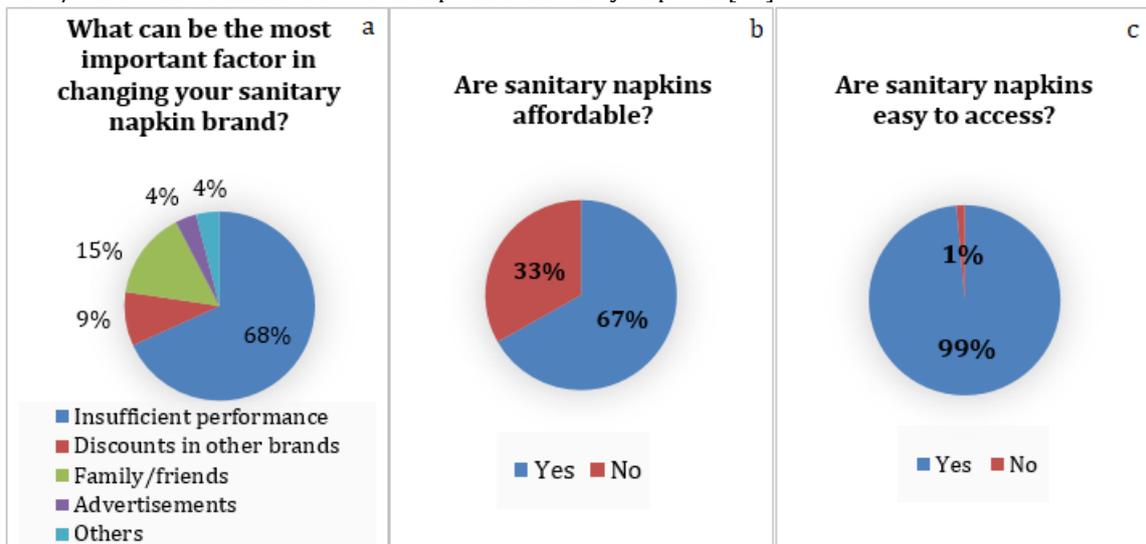


Figure 13. Sanitary napkin preferences

Figure 14 shows the methods used by women during menstruation. All of the respondents used sanitary napkins but some of them also used other methods such as tampons, reusable cloths and baby diapers.

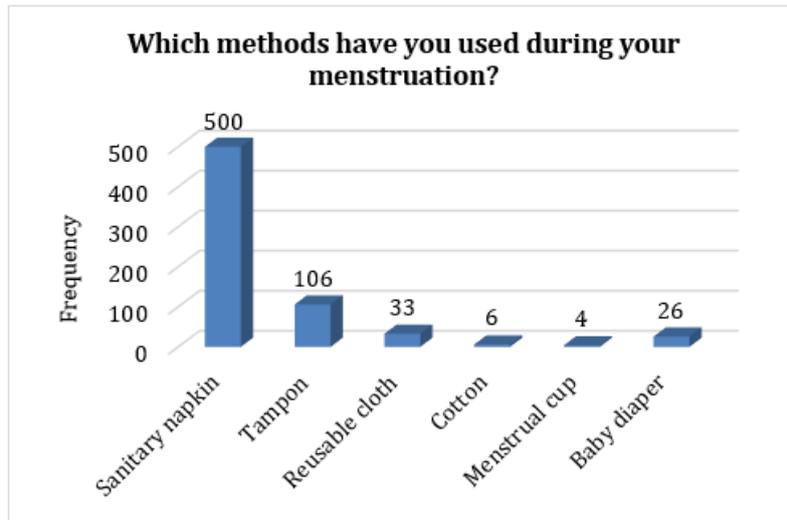


Figure 14. Methods used during menstruation

#### 4. Discussion and Conclusion

In this study, expectations from sanitary napkins, perception of sanitary napkin performance characteristics, functional property needs and usage habits of 500 women around Turkey were evaluated, in details.

The most important performance requirements from sanitary napkins were determined as absorptivity, leakage prevention, dry sense, soft surface and odour prevention. The most common problems of respondents were found to be wetness, leakage and need of frequent changes. Despite the fact that the use of superabsorbent polymers enhanced the absorption and leakage prevention of sanitary napkins, the sense of dryness and leakage prevention are not fully met in existing sanitary napkins. Therefore, in further studies, the gelation property of the absorbent layer should be enhanced and also some studies should be performed on the moisture management properties of upper layers, namely topsheet and acquisition-distribution layer. It is known that, moisture and wet sensation in genital area can cause skin irritation and dermatitis [30]. According to survey results, women prefer a sanitary napkin with higher performance and it means that they can spent more money for a better choice. Also, there were statistically significant differences between the ratings of some statements depending on the age groups of respondents, such as leakage prevention and having wings ratings as performance criteria.

Survey results also stated that the most important functional property to be added to sanitary napkins was antibacterial property. This property could help odour prevention. Respondents did not prefer perfume on sanitary napkins to hide the odour but they wanted an antibacterial system to solve this problem radically. Herein, care should be taken to avoid from deterioration of skin flora. Therefore, the absorbent layer can be targeted to give antibacterial property to inhibit bacterial growth in menstrual residue instead of upper layers, which are in contact with the skin. Considering the usage time of a sanitary napkin, the price-benefit ratio should be adjusted carefully.

Another issue that the survey pointed out is the insufficient trust of respondents to their sanitary napkins. They think that there can be harmful chemicals in sanitary napkins and it can give damage to their skin. Therefore, they want to use sanitary napkins with natural raw materials. It is thought that, this result is related to increasing number of promotions on TV about the organic sanitary napkins. In the literature, there are some studies, which showed that sanitary napkins contain harmful dioxins [31, 32] but these studies are limited. More studies should be done to detect if the amount of these materials are in harmful levels. In this context, in order to make a right decision, the resistance to bacterial growth, comfort levels, the pesticide and chemical requirements, environmental damage and the extinction time in nature of both natural raw material and synthetic raw material for sanitary napkins should be compared.

According to survey results, the sanitary napkin changing frequencies are related to the period of menstruation. Sanitary napkin changing frequency can be evaluated from different perspectives. The first perspective is related to waste load. According to the results, sanitary napkins are mostly thrown in the trash after wrapping with insoluble cover material or plastic bags. Therefore, frequent changes increase the waste load even the sanitary napkin itself is made of biodegradable material. For this reason, biodegradable sanitary napkin producers are recommended to produce the cover sheath with biodegradable materials by taking into account the women's usage habits. On the other hand, longer use of the sanitary napkins (eg. longer than 12 hours) was hypothesized

to cause leakage, deformation, rash and allergy of the skin etc., by the author. However, according to the statistical analysis results, significant differences were not found for most of the existing problems depending on the sanitary napkin changing period.

As known, insufficient adhesion of sanitary napkin on the underwear can cause shifting, where the excessive adhesion can result with delamination of sanitary napkin layers during removal. Women with both problems also participated in the survey. Therefore, the adhesive amount on the backsheet layer should be optimized to overcome these problems.

In the last part of the survey, women's sanitary napkin purchase preferences were collected to serve the market in directing advertising/promotion works. It is expected that this information will contribute to the effective promotion of more user-friendly and environmentally friendly products.

Although this study cover women of different ages from all regions of Turkey, women who are not ashamed of sharing their private information and who had access to the internet, participated this survey. This constitutes a realistic limitation of the study. The study can be broadened by using different samples, in the further studies.

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**Appendix. Survey Form**

**A. Demographic information**

**A.1 Age**.....

**A.2 Accommodation**.....

**A.3 Occupation**.....

**B. Expectations from sanitary napkins**

**B.1 Performance requirements**

Please rate the importance of the below given criteria as the performance characteristics.						
Performance criteria		1-not important	2	3	4	5- very important
1	Absorption					
2	Sense of dryness					
3	Leakage prevention					
4	Thickness					
5	Soft surface/ not causing skin irritation					
6	Flexibility/ not limiting mobility					
7	Having wings					
8	Adhesion to the underwear					
9	Long time usability					
10	Odour prevention					
11	Being long					
12	Breathability					

**B.2 Options for selecting sanitary napkin**

Please rate the importance of the below given options in selecting sanitary napkin.						
Options		1-not important	2	3	4	5- very important
1	Performance properties					
2	Price					
3	Brand					
4	Having perfume					
5	Being made of natural raw material					
6	Biodegradability					

**B.3 Main problems in existing sanitary napkins**

Please rate the most important problems in existing sanitary napkins.						
Problems		1-not important	2	3	4	5- very important
1	Leakage					
2	Not to take shape					
3	Deformation of the surface					
4	Sense of wetness					
5	Need of frequent changes					
6	Causing allergy					
7	Causing skin rash					
8	Causing bacterial or fungal infection					
9	Stiffness					
10	Sense of fullness/thickness/foreign body					
11	Appearing under garments					
12	Excess adhesion to underwear					
13	Insufficient adhesion to underwear					

**C. Functional properties to be added to sanitary napkins**

**C.1 Which functional property would you prefer to be added to sanitary napkins?**

- Painkiller property
- Antibacterial property
- Self-warming property
- Reusability
- Containing perfume
- Moisturizing property
- Drug delivery property

**C.2 Would you like to use panty shaped sanitary napkins?**

Yes/No

**C.3 Which advantages/disadvantages would a panty shaped sanitary napkin provide you?**

- Ease of use
- Difficulty of use
- Ease of change
- Difficulty of change
- Better fit to the body

**C.4 Do you think that there can be harmful chemicals in sanitary napkins?**

Yes/No

**C.5 Would you like to use sanitary napkins made of natural raw materials?**

Yes/No

**C.6 Why would you use sanitary napkins made of natural raw material?**

- Less harmful to my skin
- Degrade in nature faster
- Having similar price with others
- Other reasons

**C.7 What do you think about the shape, size and grabbing of wings of sanitary napkins?**

- Sufficient
- Insufficient
- Other

**C.8 Is there any fit problem between your sanitary napkin and underwear?**

Yes/No

**D. Sanitary napkin usage habits**

**D.1**

What is your period to change your sanitary napkin?	First 3 days	After 3 days
30 min		
1 h		
2 h		
3 h		
4 h		
5-12 h		
Longer than 12 h		

**D.2 How do you decide to change your sanitary napkin?**

- Sense of wetness
- Sense of warmness/coolness
- Leakage
- The recommendation of the producer
- Bad smell
- Stiffness/ sense of fullness
- Shape deformation

- Shift of the sanitary napkin on underwear
- The recommendation of other people
- Itching/ allergy etc.

**D.3 How do you dispose your sanitary napkin?**

- Throw it in the trash
- Throw it in the toilet
- Throw it in the specially designed container

**D.4 Do you make any preparation before disposing your sanitary napkin?**

- Throw as it is.
- Wrap it with the next sanitary napkin's cover
- Put it on the biodegradable bag and then throw it
- Put it on the plastic bag and then throw it

**E. Sanitary napkin preferences**

**E.1 Where do you buy your sanitary napkins, most frequently?**

- Market
- Pharmacy
- Internet
- Cosmetics store
- Others

**E.2 Where do you mostly see the sanitary napkin promotions?**

- TV
- Billboards
- Fliers
- Internet
- Newspapers/magazines
- Others

**E.3 Who/what influences you more in buying sanitary napkins?**

- Advertisements
- Family
- Friends
- Market promotions
- Educations/seminars
- Experiences

**E.4 What can be the most important factor in changing your sanitary napkin brand?**

- Insufficient performance
- Discounts in other brands
- Recommendations of family/friends
- Advertisements
- Others

**E.5 Are sanitary napkins affordable?**

Yes/No

**E.6 Are sanitary napkins easy to access?**

Yes/No

**E.7 Which methods have you used during your menstruation?**

- Sanitary napkin
- Tampon
- Reusable cloth
- Cotton
- Menstrual cup
- Baby diaper