

Study on Sanitary Napkin Use Satisfaction and Alternative Product Consumption Intention Among Urban Women: A Case Study of Tianjin

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Abstract: This study investigated satisfaction with the use of sanitary napkins and the willingness to consume alternative products among women aged 18 to 50 in Tianjin based on 612 valid questionnaires. K-means clustering, path analysis, and Bayesian models were adopted to explore key factors influencing consumer preferences. The results show that consumers give priority to absorbency, comfort, leak-proof performance and product safety. Although menstrual substitutes have environmental and economic benefits, their acceptance remains low due to perceived hygiene risks and insufficient public science promotion. Path analysis identified previous experiences and usage pain points as the key drivers of the experimental intent. Bayesian model indicates that upgrading safety standards can effectively reduce consumer resistance. Targeted suggestions were put forward for product innovation, market promotion and policy guidance to support sustainable adoption.

Keywords: Sanitary napkins; Consumer satisfaction; Consumption behavior; Alternative products; Purchase intention; Urban women

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1. Introduction

1.1. Research background

With the improvement of women's health awareness, the quality issues of sanitary napkins have gradually drawn social attention. Especially recently, a well-known brand of sanitary napkins was exposed to be substandard during quality inspection, which has sparked widespread discussion. Relevant public opinion discussions show that quality and safety, substandard cotton, fluorescent agents, false long labels, breathability and leak-proofing have become high-frequency concerns. It is urgent to upgrade traditional sanitary napkins and promote the popularization of new menstrual products. The choice of menstrual products for women is essentially a psychological decision-making process driven by a sense of body autonomy, a

sense of authority and personal value recognition, rather than a simple choice of product functions ^[1].

1.2. Research significance

This study investigates sanitary napkin satisfaction, usage pain points and willingness to adopt alternative menstrual products among urban women in Tianjin. The findings provide evidence for product improvement, market promotion and public health policy.

1.3. Research objectives

This study takes urban women aged 18 to 50 in Tianjin as the survey subjects, systematically exploring their satisfaction with the use of existing sanitary napkins, core experience pain points and functional demand preferences. At the same time, it deeply analyzes their awareness of alternatives to sanitary napkins such as menstrual cups and tampons, usage obstacles, influencing factors and consumption intentions.

2. Literature review

Women's physiological health is an important part of the Healthy China strategy. Sanitary napkins, as essential daily physiological products for women, have received widespread attention regarding their safety and health impacts. Existing studies have shown that product attributes such as absorbency, size compliance, and material safety of sanitary napkins directly affect consumers' usage experience and brand loyalty ^[2-3]. Moreover, incidents of substandard quality are prone to trigger trust crises and promote the continuous improvement of industry standards.

In terms of alternative products, new menstrual products such as menstrual cups and tampons have gradually entered the market due to their environmental and economic advantages. However, constrained by factors such as cultural concepts, usage habits, operational complexity, prices, and health concerns, their overall acceptance in China remains relatively low. Meanwhile, for the sake of protecting their own health, women believe that tampons may cause bacterial infections ^[4]. International authoritative reviews have confirmed that menstrual cups perform well in terms of safety, leak-proof performance and acceptance, and have a scientific basis for large-scale promotion ^[5].

Most of the existing research focuses on the overall overview of the alternative product market. There are relatively few detailed studies on the cognitive differences, acceptance willingness and influence mechanisms among different groups of people. International research has confirmed that sociodemographic characteristics, including income, education and health awareness, significantly influence women's acceptance of sustainable menstrual products ^[6]. However, practical strategies for promoting alternative menstrual products remain insufficiently explored.

Therefore, this study examines consumer preferences and adoption intention using cluster analysis, path analysis, association rules and Bayesian prediction.

3. Investigation planning and implementation

3.1. Investigation content and plan

3.1.1. Survey content

(1) Consumers' usage of sanitary napkins, purchasing decisions, pain points in experience and satisfaction;

- (2) Awareness of sanitary napkin alternatives, willingness to try, usage obstacles, sources of trust and market potential.

3.1.2. Investigation methods

The research was carried out by combining big data analysis, questionnaire surveys and in-depth interviews.

3.1.3. Pre-investigation

Preliminary interviews and questionnaire pre-surveys were carried out. A total of 160 questionnaires were collected from the pre-survey, among which 143 were valid, with an invalid questionnaire rate of 10%. Based on this, the formal questionnaire was revised and formed.

3.1.4. Sampling design

Based on a 95% confidence level and a 4% sampling error, the required minimum sample size was 378. A total of 612 valid questionnaires were finally collected.

3.2. Data analysis method

- (1) Univariate descriptive analysis
- (2) Contingency analysis
- (3) Analysis of variance
- (4) Mann-Whitney U test
- (5) Multiple response analysis
- (6) K-Means clustering
- (7) Path analysis
- (8) Association rule algorithm
- (9) Bayesian decision model

3.3. Data quality inspection

3.3.1. Reliability test

The Cronbach's α coefficient was used to evaluate the consistency within each survey item in the questionnaire. The calculation formula for Cronbach's α coefficient is:

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum S_i^2}{S_T^2} \right) \quad (1)$$

Here, k represents the number of items, $\sum S_i^2$ is the sum of the variances of each item, and S_T^2 represents the variance of the total score of the scale.

Table 1. Cronbach's α coefficient table of the questionnaire

Variable Name	Cronbach's Alpha	Number of Items	Reliability Evaluation
Core reasons for choosing sanitary napkin brands	0.896	6	Excellent
Influence degree of factors on sanitary napkin selection	0.873	4	Excellent
Factors related to willingness to use alternatives	0.866	6	Excellent
Overall	0.655	16	Good

Table 1 shows that the overall Cronbach's α coefficient is 0.655, and the coefficients of each dimension are all greater than 0.65, indicating good reliability and reliable data.

3.3.2. Validity test

The factor analysis method was mainly adopted. **Table 2** shows that the KMO values were all greater than 0.85, and the Bartlett sphericity test was significant ($P < 0.001$), which was suitable for factor analysis.

Table 2. KMO and Bartlett test coefficients table

		Overall	Core reasons for sanitary napkin brand selection	Factors' influence on sanitary napkin selection	Napkin satisfaction
Bartlett's sphericity test	KMO	0.976	0.908	0.850	0.895
	Approximate chi-square	3306.357	947.660	593.021	730.727
	df	120	15	6	15
	Sig.	0.000	0.000	0.000	0.000

3.3.3. Randomness test

The runs test results indicate $P > 0.05$ for all variables. The null hypothesis of randomness is therefore accepted, confirming good sample randomness.

4. Analysis of the urban women's sanitary napkin market

4.1. Descriptive statistical analysis

4.1.1. Basic information of the respondents

- (1) Age: 30.72% are aged 18–25, 27.78% are aged 26–35, 34.97% are aged 36–45, and 6.54% are over 46.
- (2) Occupation: 44.77% are sedentary workers in the workplace, 18.3% are students, 19.93% are mobile workers, and 16.99% are freelancers.
- (3) Income: 80.39% of monthly disposable income is below 5,000 yuan, with a relatively high price sensitivity.
- (4) Healthy behaviors: Mainly include menstrual cycle recording, hot compress therapy, and dietary adjustment. The frequency of exercise is mostly 1 to 3 times a week.

4.1.2. Sanitary napkin usage and purchase behavior

When making a purchase decision, consumers give priority to ingredient safety certification, promotional discounts, and recommendations from friends and relatives. The main procurement channels include supermarkets, chain convenience stores and comprehensive e-commerce platforms. The main pain points include viscosity, side leakage, allergic reactions, rough materials, inaccurate size labels and safety hazards.

4.1.3. Consumer satisfaction

Safety is the primary concern for consumers. Incidents related to quality have significantly reduced brand trust. There is a strong demand for features such as independent sterilization, private packaging, breathability, leak-proof design and compliant dimensions. When negative experiences occur, most consumers will quietly

switch brands, and the second most common reaction is to complain to friends and relatives.

4.1.4. Market for alternative menstrual products

- (1) Usage Experience: 217 consumers have only heard of but never used alternatives, 200 have tried them occasionally, 184 use them regularly, and 14 do not know such products.
- (2) Types of Alternatives: Menstrual cups, tampons, period underwear, and cloth pads.
- (3) Key Barriers to Adoption: Complex operation (32.29%), hygiene and safety concerns (33.33%), low cultural acceptance (31.11%), poor cost-effectiveness (34.38%), and lack of usage guidance (31.25%).

4.2. Consumer profiling based on K-Means clustering

This study uses the K-Means clustering algorithm to divide the respondents into four consumer groups. These consumer groups have different preferences, product concerns, and acceptance levels of menstrual substitutes, revealing the heterogeneous consumption patterns of female consumers.

4.2.1. A quality-oriented group

Quality-oriented consumers value safety, comfort and brand credibility and show the highest willingness to adopt alternative menstrual products.

4.2.2. Cost-performance-sensitive group

Cost-performance-sensitive consumers prefer affordable traditional sanitary napkins and show limited interest in alternatives.

4.2.3. Leak-prevention-oriented group

Leak-prevention-oriented consumers focus on basic functionality and have moderate potential to adopt alternatives if safety is ensured.

4.2.4. Minimalist practical group

Minimalist practical consumers focus on basic functions and show the strongest resistance to alternative menstrual products.

5. Path analysis: Determinants of alternative product adoption intention

5.1. Variable setting

This study takes the future willingness to try sanitary napkin substitutes (Y) as the dependent variable and selects six core influencing factors as independent variables to construct a path analysis model:

- (1) X₁: The degree of annoyance caused by the stiffness of existing sanitary napkins
- (2) X₂: The degree of concern about the side leakage of existing sanitary napkins
- (3) X₃: Health and environmental awareness
- (4) X₄: Personal monthly disposable income level
- (5) X₅: Understanding and experience of sanitary napkin alternatives
- (6) X₆: The degree of awareness of policy support related to menstrual products

5.2. Results and core findings

The results of the path analysis showed that all independent variables had a significant positive impact on the willingness to try substitutes ($P < 0.001$), ranked by the intensity of the impact as follows:

Substitute understanding experience (0.30) > stuffiness annoyance (0.28) > leakage concern (0.25) > health and environmental awareness (0.18) > policy support cognition (0.15) > Income level (0.12).

The correlation among variables is significant:

- (1) There is a moderate positive correlation between the annoyance of stuffiness and the worry of side leakage ($r = 0.42$)
- (2) Health and environmental protection awareness is positively correlated with income level ($r = 0.35$)
- (3) The experience of substitutes is positively correlated with the perception of policy support ($r = 0.30$)

The structural model achieved satisfactory fitness levels, with CMIN/DF = 2.20, GFI = 0.95, AGFI = 0.93, CFI = 0.94, and RMSEA = 0.04. All of the above indicate that the model has a high degree of fit with the data, and the analysis results are stable and reliable.

5.3. Conclusion

Positive news: The pain points of existing products and the awareness of health and environmental protection have significantly driven the willingness to use substitutes.

Obstacles: Insufficient cognition, complex operation, and price threshold that inhibits acceptance;

Internal and external drivers: Social recommendations and personal preferences jointly influence the willingness to accept.

6. Association rules: Purchase behavior and demand preference segmentation

6.1. Rule setting

This study employs the Apriori algorithm to explore the intrinsic correlations among women's sanitary napkin purchasing behavior, product improvement demands, and policy expectations. A minimum support level of 10% and a minimum confidence level of 75% were set, and strong association rules with statistical significance and practical value were screened out.

6.2. Rules for selecting purchase channels

Association rule analysis showed that consumers with high cost-performance sensitivity preferred supermarkets and e-commerce platforms over convenience stores and community group-buying channels.

6.3. Trigger rules for purchase decisions

Promotional discounts and ingredient safety certifications significantly drive active stockpiling behavior in non-urgent situations. As shown in **Figure 1**, when the packaging appeal is strong, the influence of recommendations from relatives and friends on the purchase decision is significantly reduced, and consumers rely more on personal judgment.

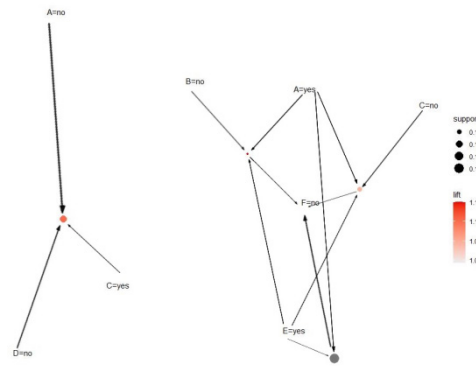


Figure 1. Purchase decision trigger factor association network diagram.

6.4. Rules for packaging improvement requirements

Consumers prioritize single-piece independent sterilization and privacy protection over environmental performance, with safety and privacy taking precedence. There is a conflict between eco-friendly materials and portable small packaging. The eco-friendly attribute will reduce the acceptance of portability. Association rule analysis indicates that when packaging convenience and privacy cannot be ensured, independent sterilization becomes consumers' primary requirement.

6.5. Expected rules for the new national standard

Consumers' top priorities are: mandatory labeling of absorption rates, restrictions on fluorescent brighteners, and standardization of promotional language. When the above three items are guaranteed, the necessity of allergen testing is significantly reduced and is no longer regarded as a mandatory requirement. **Figure 2** shows that when key indicators are missing, consumers will intensify their demands for basic safety indicators, forming a bottom-line safety compensation mechanism.

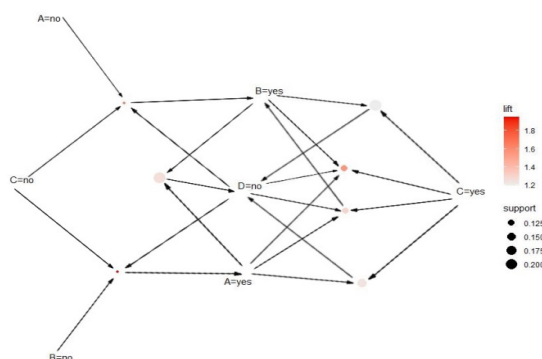


Figure 2. Sanitary Napkin Standard Expectation Correlation Network.

6.6. Policy advocacy and support rules

When legislation on public health facilities and safety is absent, compulsory health education courses should be regarded as the most urgent need. Policy support measures showed substitution effects. After

improvements in public health facilities, dependence on medical insurance subsidies declined.

7. Bayesian decision-making: Market forecast of alternatives

7.1. Formula

Prior probability:

$$P(A) = \sum_{i=1}^n P(B_i)P(A|B_i) \quad (2)$$

Posterior probability:

$$P(B_i|A) = \frac{P(B_i)P(A|B_i)}{\sum_{i=1}^n P(B_i)P(A|B_i)} \quad (3)$$

7.2. Prediction results

The stronger the demand for independent sterilization, the lower the willingness to resist substitutes, and the two are dynamically coupled. The expectation of the new national standard is positively correlated with the willingness to resist substitutes, and the difference rate gradually narrows over time. The support for school health education policies has increased, the distrust in alternative official education has declined, and cognitive barriers have rapidly lowered.

8. Conclusions and suggestions

8.1. Core conclusions

8.1.1. Satisfaction with sanitary napkin usage

Women aged 18 to 50 in Tianjin consider moisture absorption, comfort, leak-proof performance and safety as the core factors determining their satisfaction with use. Incidents related to quality have seriously eroded brand trust, while consumers' demands for product quality and privacy protection continue to rise.

8.1.2. The market prospects of sanitary napkin substitutes

At present, the acceptance of alternatives such as menstrual cups and tampons remains relatively low. However, the improvement of health and environmental awareness, dissatisfaction with the pain points of traditional products, and the increase in public education have driven a significant upward trend in the willingness to adopt. Young women and quality-conscious consumers are potential core markets.

8.2. Suggestions

8.2.1. Innovation of sanitary napkin products

Enterprises should improve product safety, absorbency, comfort and privacy protection through technological innovation and better packaging design. Governments should strengthen industry supervision and safety standards to enhance consumer confidence.

8.2.2. The market for sanitary napkin substitutes

Enterprises should improve the affordability, usability and promotion of alternative menstrual products.

Public education through hospitals, schools and social media should be strengthened to improve consumer awareness. Governments should provide policy support and appropriate subsidies to reduce menstrual poverty and promote women's health rights ^[7].

Disclosure statement

The author declares no conflict of interest.

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