Decision support system analysis for selecting a baby cream product with Preference Selection Index (PSI) Baby Sensitive Skin Under 3 Year

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Abstract. The aim of this study was to examine the technology for decision support in the selection of baby cream products for sensitive skin in children under three years of age. Babies' skin sensitivity should be addressed in order to maintain the baby's skin health, but parents should be more careful with product selection in the number of products to treat sensitive skin in babies on the market. Data sources obtained through random observations, interviews and questionnaires (parents who have babies). The solution provided is the Preference Selection Index (PSI) method, which is part of the support system for decision making. Five criteria are used as parameters when selecting sensitive skin product for children, namely: price (K1), type of skin (K2), feeling of brand (K3), interests (K4) and packaging (K5). While the alternatives used based on the interview results are cussons (alt1), johnson's (alt2), zwitsal (alt3), pigeon (alt4), and sleek (alt5). The results of the Preference Selection Index could be used by analysis of the first recommendation of product alt1 (cussons), a value of 0.978584. The second recommendation of product alt3 (zwitsal) is a value of 0.976655. Research results are hoped to provide a wider awareness for babies when selecting sensitive skin products for three years old.

Keywords: DSS, Preference Selection Index (PSI), Sensitive Skin, Toddlers, Baby Cream Products.

1. Introduction

Sensitive skin (atopic skin) is a condition in which certain symptoms of irritating and allergic substances are presented on the skin [1]. The problem of babies is wide and complex, particularly skin problems. In the first months of life, every baby has highly sensitive skin. This relatively small skin condition improves infection, irritation and allergies [2] for the baby. Children under three years old (toddlers) have very delicate skin and still have parents who are infant children with sensitive skin because they are unable to speak so that babies can weep only as a means of communication [1]. Different symptoms can be caused by sensitive skin such as dry skin, itchy skin in the sweat, white spots, frequent skin infection, and eczema onset [3]. If you do not use products containing allergies like parabens, phthalates, detergents, etc. and pay attention to the appropriate pH of the child skin [4], you can cure sensitive skin of children with baby care products sooner rather than later. Baby Cream is a product made to reduce the parents' concerns about the care of their babies who have sensitive skin

when the product is specifically designed to avoid different skin difficulties [5]. The number of variants in the circulation of baby cream products makes it difficult for parents to determine which product is suited to the skin of the child. In such a case, it is necessary for baby care products to be selected under three years old by the correct decision support system (toddlers) [6]–[12].

Decision support systems are computer-based adaptive, flexible and interactive systems that are used to solve unstructured problems, thus increasing decision-making value [13]. One of the methods used is the index of preferences (PSI) [14]. This method has been selected because it could be used when the relative importance of attributes is determined by a conflict [15]. Many studies use the PSI method to solve problems when determining the relative importance of attributes as shown in the table below:

Table 1. Some research using the PSI method

Author	Title	Resume
V. B. Sawant, S. S. Mohite, and R. Patil [16]	a decision-making framework using the Automated Guided Vehicle Selection Index Preference Method	This article describes a logical procedure for selecting automated guided vehicles for a particular application in the manufacturing environment. The process is based on the entropy weighing preference index (PSI) and TOPSIS. An automatic guided vehicle selection index for the application is proposed to evaluate and classify automated guided vehicle. The efficiency and feasibility of methods are demonstrated with an illustration.
S. H. Sahir et al [17]	The method of selection of preferences to determine where to market laptops	The results of the discussion showed that the PSI is a decision-maker method that does not specify by decision-maker the weight of each criterion. This simplifies decision-makers' decision-making as much as possible.

Based on the advantages possessed by the PSI method, the results of the research are expected to be able to make recommendations in the form of ranking the baby cream product selection for sensitive skin for babies under three years.

2. Methodology

Sources of data obtained from the results of interviews, observations and random questionnaires to respondents on the selection of baby cream products for sensitive skin babies under three years. The research was conducted in Medan Sunggal sub-district, Medan City, North Sumatra in several franchise retail chains with 250 respondents. The following is a flowchat of the Application of the Preference Selection Index Algorithm in the selection of baby cream products for sensitive skin babies under three years.

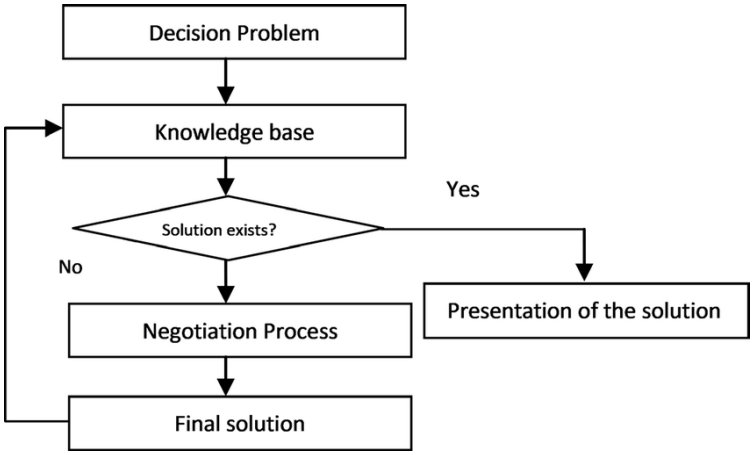

Figure 1. Flowchart of a knowledge base decision support system

The variables used in the study will be determined after obtaining the required data. In the previous stage, the data for each decision matrix shall be added on each of its aspects, so that at this stage, calculations are obtained to determine the ranking value of the decision. The data is processed in advance to determine final value.

2.1. Preference Selection Index (PSI)

In Hall's opinion, a system is a series of two or more interconnected components or subsystems, which unite to achieve the same objective. Maniya and Bhatt have developed the PSI method for solving the issue of MCDM. PSI does not require the assignment between criteria of significant relative values [14].

2.2. Baby Products

Toddler sensitive skin products are treatments given to babies by parents who really need to stay awake and prevent allergies on the skin. Parents need to be careful with the many types of ingredients of a baby product in order not to adversely affect the baby. The skin conditions of Toddler are different from birth, baby product use should be adapted to the skin condition of the young child [1].

3. Results and Discussion

The PSI method is a method of resolving the Decision Making for Multi Criteria (MCDM). The relative importance between attributes is not necessary in the proposed method. Actually, in this method, there is no need to calculate attribute weights. This approach is useful when the relative importance of attributes is determined by a conflict. The results can be obtained with a minimum and simple calculation in the Preference Selection Index (PSI) procedure, based on statistical concepts without the need for the weight of an attribute. The following table contains four alternatives and five criteria: At this stage.

Table 2. Product selection criteria

Kriteria	Tipe
Price (K1)	Cost
Skin Type (K2)	Benefit
Brand Feeling (K3)	Benefit
Interests (K4)	Benefit
Product Packaging (K5)	Benefit

Table 2 explains that the criteria for price (K1) with the type of cost are selected because of the criteria for incurring costs and not providing benefits, while the criteria for skin type (K2), brand feeling (K3), interest (K4), product packaging (K5) with the type of benefit are selected. Because the criteria do not require costs and do not provide benefits.

Table 3. Alternative

Alternative	Type
alt1	Cussons Baby
alt2	Johnson’s Baby
alt3	Zwitsal
alt4	Pigeon
alt5	Sleek

A weighted assessment using fuzzy numbers using the reasoning concept presented in the following table:

Table 4. Rating Weight

Weight	Information
0,9	Strongly agree
0,75	Agree

Weight	Information
0,6	Doubtful
0,5	Disagree
0,2	Strongly Disagree

Table 5. Alternative Comparison of Ranking Tables and Criteria

Alternative	Criteria				
	K1	K2	K3	K4	K5
alt1	0,729	0,690	0,763	0,731	0,731
alt2	0,754	0,719	0,740	0,744	0,706
alt3	0,754	0,708	0,734	0,738	0,75
alt4	0,694	0,622	0,688	0,717	0,733
alt5	0,708	0,683	0,719	0,733	0,75

Table 6. Decision Matrix X_{ij}

X_{ij}				
0,729	0,690	0,763	0,731	0,731
0,754	0,719	0,740	0,744	0,706
0,754	0,708	0,734	0,738	0,75
0,694	0,622	0,688	0,717	0,733
0,708	0,683	0,719	0,733	0,75

Based on the above equation, the next step is to create a normalization matrix.

X_{ij}^{min} = [0,729 0,754 0,754 0,694 0,708]

X_{ij}^{min} = 0,694

$R_{11}=\frac{X^{min}}{X_{11}}=\frac{0,694}{0,729}=0,953$

$R_{21}=\frac{X^{min}}{X_{21}}=\frac{0,694}{0,754}=0,921$

$R_{31}=\frac{X^{min}}{X_{31}}=\frac{0,694}{0,754}=0,921$

$R_{41}=\frac{X^{min}}{X_{41}}=\frac{0,694}{0,694}=1,000$

$R_{51}=\frac{X^{min}}{X_{51}}=\frac{0,694}{0,708}=0,980$

This step is carried out until j = 5 and produces a normalized matrix as below

Table 7. Alternatives to Comparison of Ranking Tables and Criteria

R_{ij}				
0,953	0,961	1,000	0,982	0,997
0,921	1,000	0,971	1,000	0,962
0,921	0,986	0,963	0,991	1,023
1,000	0,866	0,902	0,963	1,000
0,980	0,951	0,943	0,985	1,023

The next step is to determine the average value of the normalized matrix..

N_{j1} = 0,953 + 0,921 + 0,921 + 1,000 + 0,980 = 4,776

N_{j2} = 0,961 + 1,000 + 0,986 + 0,866 + 0,951 = 4,764

N_{j3} = 1,000 + 0,971 + 0,963 + 0,902 + 0,943 = 4,778

N_{j4} = 0,982 + 1,000 + 0,991 + 0,963 + 0,985 = 4,920

N_{j5} = 0,997 + 0,962 + 1,023 + 1,000 + 1,023 = 5,004

Value of N_j = [4,776;4,764;4,778;4,920;5,004]

$N = \frac{1}{5}\sum_{i=1}^{m} N_{j1} = \frac{1}{5}$. 4,776 = 0,955147487

$N = \frac{1}{5}\sum_{i=1}^{m} N_{j2} = \frac{1}{5}$. 4,764 = 0,952761414

$N = \frac{1}{5}\sum_{i=1}^{m} N_{j3} = \frac{1}{5}$. 4,778 = 0,95564663

$N = \frac{1}{5}\sum_{i=1}^{m} N_{j4} = \frac{1}{5}$. 4,920 = 0,984061834

$N = \frac{1}{5}\sum_{i=1}^{m} N_{j5} = \frac{1}{5}$. 5,004 = 1,000865801

The next step is to calculate the value of the preference variation.

$\emptyset_{j11}$ = [0,953 – 0,955147487]^2 = 0,000004

$\emptyset_{j21}$ = [0,921 – 0,955147487]^2 = 0,001141

$\emptyset_{j31}$ = [0,921 – 0,955147487]^2 = 0,001179

$\emptyset_{j41}$ = [1,000 – 0,955147487]^2 = 0,002012

$\emptyset_{j51}$ = [0,980 – 0,955147487]^2 = 0,000637

Table 8. Value of Preference Variation

Φij				
0,000004	0,000067	0,001967	0,000005	0,000017
0,001141	0,002231	0,000231	0,000254	0,001501
0,001179	0,001093	0,000056	0,000044	0,000478
0,002012	0,007531	0,002917	0,000457	0,000001
0,000637	0,000003	0,00017	0,000001	0,000478

The next step is to add the ranking results to the matrix $\emptyset_{ij}$.

$\sum_{i=1}^{n} = \emptyset_{j11} + \emptyset_{j21} + \emptyset_{j31} + \emptyset_{j41} + \emptyset_{j51}$
= 0,000004+0,001141+0,001179+0,002012+0,000637
= 0,005

$\sum_{i=1}^{n} = \emptyset_{j12} + \emptyset_{j22} + \emptyset_{j32} + \emptyset_{j42} + \emptyset_{j52}$
= 0,000067+0,002231+0,001093+0,007531+0,000003
= 0,011

$\sum_{i=1}^{n} = \emptyset_{j13} + \emptyset_{j23} + \emptyset_{j33} + \emptyset_{j43} + \emptyset_{j53}$
= 0,001967+0,000231+0,000056+0,002917+0,00017
= 0,005

$\sum_{i=1}^{n} = \emptyset_{j14} + \emptyset_{j24} + \emptyset_{j34} + \emptyset_{j44} + \emptyset_{j54}$
= 0,000005+0,000254+0,000044+0,000457+0,000001
= 0,001

$\sum_{i=1}^{n} = \emptyset_{j15} + \emptyset_{j25} + \emptyset_{j35} + \emptyset_{j45} + \emptyset_{j55}$
= 0,000017+0,001501+0,000478+0,000001+0,000478
= 0,002

$\emptyset_j$ = [0,005; 0,011; 0,005; 0,001; 0,002]

The next step is to determine the deviation in the preference values.

Ω_{j1} = 1 − 0,005 = 0,995

Ω_{j1} = 1 − 0,011 = 0,989

Ω_{j1} = 1 − 0,005 = 0,995

Ω_{j1} = 1 − 0,001 = 0,999

Ω_{j1} = 1 − 0,002 = 0,998

Calculate the total value of the Ωj deviation.

$\Sigma\Omega_j$ = 0,995+0,989+0,995+0,999+0,998 = 4,976

After the total deviation value is known, the next step is to find the weight of each criterion.

$w_1 = \frac{0,995}{4,976} = 0,199984$

$w_2 = \frac{0,989}{4,976} = 0,198788$

$w_3 = \frac{0,995}{4,976} = 0,19991$

$w_4 = \frac{0,999}{4,976} = 0,200831$

$w_5 = \frac{0,998}{4,976} = 0,200486$

w = [0,199984; 0,198788; 0,19991; 0,200831; 0,200486]

The final step is to calculate the index selection preference value.

Θ_1 = 0,190617 + 0,19103 + 0,19991 + 0,197191 + 0,199836 = 0,978584

Θ_2 = 0,184261 + 0,198788 + 0,194084 + 0,200831 + 0,192892 = 0,970856

Θ_3 = 0,184148 + 0,19597 + 0,192537 + 0,198958 + 0,205043 = 0,976655

Θ_4 = 0,199984 + 0,172146 + 0,180247 + 0,193337 + 0,200486 = 0,946201

Θ_5 = 0,196063 + 0,189053 + 0,18844 + 0,197833 + 0,205043 = 0,976433

The final result of the calculation can be seen in the following table.

Table 9. Result

Alternative	Value	Rangk
alt1	0,978584	1
alt2	0,970856	4
alt3	0,976655	2
alt4	0,946201	5
alt5	0,976433	3

The results of the Preference Selection Index could be used by analysis of the first recommendation of product alt1 (cussons), a value of 0.978584. The second recommendation of product alt3 (zwitsal) is a value of 0.976655. Research results are hoped to provide a wider awareness for babies when selecting sensitive skin products for three years old.

4. Conclusion

The study of the best sensitive skin products in kids has concluded that decision-support system analysis using the Preference Selection Index (PSI) method can be used to recommend the purchase for children with defined criteria and weight of baby skin cream products for sensitive skin during the collection of data.

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