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Decision Support System for Facial Wash Recommendations for Oily Skin Using the Weighted Product Method

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ABSTRACT: As the cosmetics industry expands, particularly facial wash products, consumers often struggle to select suitable facial care items. Washing the face is a fundamental step in skincare for adult women. The wide variety of products available creates challenges, especially for women aged 18–25 with oily skin when determining products that meet their needs. Limited understanding of product ingredients and characteristics frequently results in mismatches with skin conditions, which may worsen skin problems if an inappropriate product is chosen. Based on these issues, this study aims to develop a Decision Support System (DSS) to recommend facial washes for oily skin using the Weighted Product (WP) method. This method ranks alternatives by multiplying each criterion's weight according to its importance. Data were collected through literature review, interviews with cosmetic store staff, and questionnaires distributed to female Information Technology students aged 18–25, resulting in five eligible alternatives. The findings indicate that alternative A3 (Senka Perfect Whip Acne Care) achieved the highest preference value of 0.2239 and is recommended as the best option. The system is expected to assist users in making structured decisions and serve as a reference for future multi-criteria recommendation system development.

KEYWORDS: Decision Support System, Facial Wash, Oily Skin, Weighted Product, Recommendation System.

I. INTRODUCTION

Cosmetics are one of the increasingly important necessities in modern life. This condition requires better literacy for the public to choose cosmetics that are safe and suitable for their needs. The face is the most important part of the body that requires extra attention. Facial care is a priority in maintaining optimal skin health[1]. Basic care for facial skin can be done by using facial cleansers or facial washes that contain ingredients that are safe for the skin. Based on research that has been conducted, most adult women have oily skin problems. Lack of knowledge about skin types is a particular difficulty for adult women who use facial wash products. Differences in skin types and problems often make it difficult to choose a facial wash, causing many adult women to experience damage to their facial skin [2]. Given these problems, a decision support system (DSS) is needed to help women determine the best facial wash choice objectively and systematically.

A decision support system (DSS) is a system that can provide problem-solving capabilities and the ability to communicate problems under semi-structured and unstructured conditions [3]. DSS is applied in various fields, including finance, business, government, health, and more. DSS provides many benefits for organizations and individuals in dealing with the complexity of decision making. First, DSS allows decision makers to quickly access more detailed information. Assisted by powerful data analysis support, DSS is able to identify patterns, trends, and relationships that are not visible manually [4].

In DSS, data processing is based on mathematical methods for optimal decision-making [5]. One of the appropriate methods used in DSS is Weighted Product (WP), which works by multiplying the values of each criterion, which have been previously weighted. The WP method can help in making decisions about choosing a facial wash. Calculations using the WP method only produce the largest value, which will be selected as the best alternative. The calculation will be in accordance with the method if the selected alternative meets the specified criteria. The WP method is more efficient because the time required for calculation is shorter [6]. This process is similar to normalization, where each attribute is assessed based on its level of importance. Thus, this method allows the system to provide more objective and relevant recommendation results according to user preferences. The application of the Weighted Product (WP) method in this study is focused on designing a system that can help consumers in selecting facial wash product recommendations. For oily skin. Based on research on the Application of the Profile Matching Method for Skincare Selection Recommendations for Oily Skin Types, Designing a Decision Support System for Skincare Product Recommendations for Oily, Acne-Prone, Normal, and Dry Skin Using the Weighted Product Method [7], Application of the Profile Matching Method for Skincare Selection Recommendations for Oily Skin Types [8], Decision Support System for Determining the Best E-Commerce Using the Weighted Product Method [9], Decision Support System for Determining Fitness Exercise Programs Using the Weighted Product Method [10], Implementation of the Fuzzy-AHP Method in a Decision Support System for Selecting Facial Wash Products [11], Decision Support System for Determining Teacher Reward Recipients Using the Weighted Product (WP) Method [12], Development of a Web-Based Skin Care Product Recommendation System Using the AHP Method [2], it is evident that the application of the WP method is capable of providing recommendations and

becoming an effective solution in determining the right skincare product according to skin type. The selection of the WP method is considered appropriate because it is capable of handling various criteria simultaneously and providing a more proportional assessment based on the weight of each criterion's importance.

Based on the issues described above, this study aims to design a decision support system that can provide facial wash product recommendations according to the user's skin type. The final result of this system is a recommendation of products that are relevant to the user's needs, compiled based on their preferences and previously determined skin conditions. Thus, it is hoped that this system will be able to provide facial wash product recommendations, thereby increasing the effectiveness of skin care.

All of these studies show that the WP method excels in terms of efficiency, ease of implementation, and its ability to produce more proportional rankings. Therefore, WP was chosen as the most appropriate method for building a facial wash recommendation system in this study. It can be widely applied in various decision-making situations, including in selecting skin care products. This research is expected to make a real contribution to the development of decision support systems in the field of skin care, especially for adult women who have difficulty finding facial wash recommendations for oily skin.

Based on previous studies, most skincare product recommendation systems are still general in nature and do not specifically focus on the characteristics of oily skin with tailored criteria. In addition, several studies have not presented an analysis of the contribution of each criterion to the recommendation results. Therefore, this study focuses on the development of a Decision Support System using the Weighted Product method with criteria relevant to oily skin, so that it is expected to provide more accurate and targeted recommendations.

II. RESEARCH METHOD

Designing a Decision Support System for facial wash recommendations for oily skin begins with identifying the problem and continues with collecting the necessary data from female Information Technology students. Data collection techniques were carried out through observation and interviews. The collected data consisted of price (C1), active ingredient content (C2), other user reviews (C3), product packaging (C4), and product availability in the market (C5), as shown in Table 1, with weights for each criterion being (4; 3; 5; 2; 1). Next, data processing was carried out using the Weighted Product method. The next stage involved system design and implementation as well as system testing.

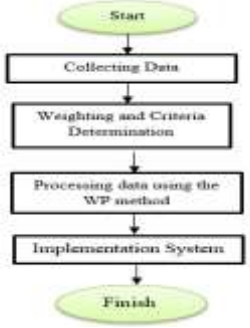

Figure 1 Research Stages

III. WEIGHTED PRODUCT METHOD (WP)

The Weighted Product (WP) method is used to determine the relative weight of each criterion involved in the decision-making process. In this method, each criterion is given a weight according to its level of importance, which can be adjusted based on organizational policies and applicable administrative provisions [13]. Weights on attributes of the benefit type have a positive influence in the multiplication process, while weights on attributes of the cost type have a negative influence. WP is one of the methods in Multi Attribute Decision Making (MADM) that aims to evaluate and select the best alternative from a number of available options. The WP method has been widely applied in various studies, one of which is a study titled "Designing a Decision Support System for Skincare Product Recommendations for Oily, Acne-Prone, Normal, and Dry Skin Using the Weighted Product Method." The results of this study show that the skincare product ranking process can help users determine the products that are suitable for their skin type. In the WP method, the calculation process is carried out by multiplying the value of each attribute by a predetermined weight to obtain a preference value for each alternative [10]. The weighting serves to reinforce the level of influence of a criterion on the overall assessment results. The next stage is the ranking process, which involves accumulating the values and weights of each criterion for each alternative to determine the order of priority for product recommendations.

The following are the steps for completing the WP method:

A. Identification of Alternative

Table 1 Alternative Data

No	*Alternative*	*Code*
1	Cetaphil Oily Skin Cleanser 125 ml	*A1*
2	COSRX Low Ph Good Morning Gel Cleanser 50 ml	*A2*
3	Senka Perfect Whip Acne Care 100g	*A3*
4	Skintific Pathenol Gentle Wash	*A4*
5	SCORA Salicylic Acid Gentle Low Ph Cleanser	*A5*

B. Indicate the criteria and weighting each criterion

Table 2 Criteria

No	Criteria	Code
1	Price	C1
2	Active Ingredient content	C2
3	Other user review	C3
4	Product packaging	C4
5	Product availability on the market	C5

Table 3 Criteria Weighting

Level	Score
Not Important at All	1
Not Important	2

Neutral	3
Important	4
Very Important	5

C. Relative calculation of initial weight.
The following is the calculation of initial weight using the relative initial weight formula

$$Wj = \frac{wj}{\Sigma Wj} = 1$$

Calculating the weight of importance:

a) $C1 = 4/15 = 0{,}2667$
b) $C2 = 3/15 = 0{,}2000$
c) $C3 = 5/15 = 0{,}3333$
d) $C4 = 2/15 = 0{,}1333$
e) $C5 = 1/15 = 0{,}0667$

The results of the normalized initial weight calculations are then used in the promotion process in the S vector calculation in the Weighted Product method. Thus, accuracy in determining the initial weight greatly affects the final ranking of alternatives produced by the system.

D. The next step is to calculate vector S by multiplying all criterion values for each alternative, which have been previously raised to the power of their respective weights. This raising process aims to adjust the level of influence of each criterion according to its level of importance.

$$Si = \prod_{j=1}^{n} X_{ij}^{wj}$$

$S_1 = C1^{W1} \times C2^{W2} \times C3^{W3} \times C4^{W4} \times C5^{W5}$
$= 5^{(-0,27)} \times 5^{0,2} \times 5^{0,33} \times 5^{0,13} * \times 5^{0,67}$
$= 2{,}119268953$

$S_2 = C1^{W1} \times C2^{W2} \times C3^{W3} \times C4^{W4} \times C5^{W5}$
$= 5^{(-0,27)} \times 5^{0,2} \times 5^{0,33} \times 3^{0,13} \times 2^{0,67}$
$= 1{,}862416604$

$S_3 = C1^{W1} \times C2^{W2} \times C3^{W3} \times C4^{W4} \times C5^{W5}$
$= 1^{(-0,27)} \times 5^{0,2} \times 3^{0,33} \times 2^{0,13} \times 1^{0,67}$
$= 2{,}182587944$

$S_4 = C1^{W1} \times C2^{W2} \times C3^{W3} \times C4^{W4} \times C5^{W5}$
$= 3^{(-0,27)} \times 5^{0,2} \times 3^{0,33} \times 5^{0,13} \times 5^{0,67}$
$= 1{,}913446184$

$S_5 = C1^{W1} \times C2^{W2} \times C3^{W3} \times C4^{W4} \times C5^{W5}$
$= 1^{(-0,27)} \times 1^{0,2} \times 3^{0,33} \times 3^{0,13} \times 1^{0,67}$
$= 1{,}669769737$

$\mathbf{\Sigma S} = S_1 + S_2 + S_3 + S_4 + S_5$
$= 2{,}119268953 + 1{,}862416604 + 2{,}182587944 + 1{,}913446184 + 1{,}669769737$
$= 9{,}747489061$

Based on the calculation of vector S, which has been done by multiplying all criterion values for each alternative that have been previously raised to the power of their respective weights, with the aim of adjusting the level of influence of each criterion in accordance with its level of importance. This value cannot be used directly to determine the final ranking, as it still needs to be converted into vector V form so that it can be compared proportionally between alternatives.

E. After calculating vector S, proceed to calculate vector V by dividing the value of vector S for each alternative by the total value of vector S for all alternatives. This process aims to produce more standardized values within the same range, so that the comparison results are more objective. With this normalization, each alternative can be assessed based on its contribution to the overall alternatives being tested.

$$V_i = \frac{Si}{\prod_{j=1}^{n} X_j^{*wj}}$$

$V_1 = \frac{2{,}119268953}{9{,}747489061} = 0{,}217416873$
$V_2 = \frac{1{,}862416604}{9{,}747489061} = 0{,}191066293$
$V_3 = \frac{2{,}182587944}{9{,}747489061} = 0{,}223912838$
$V_4 = \frac{1{,}913446184}{9{,}747489061} = 0{,}196301445$
$V_5 = \frac{1{,}669769737}{9{,}747489061} = 0{,}171302550$

The value of vector V indicates the recommendation level of an alternative. The greater the value of vector V, the higher the feasibility or priority of that alternative to be selected. Therefore, the final stage in the Weighted Product method is to rank the alternatives based on the value of vector V from largest to smallest to determine the best alternative according to the criteria that have been set.

F. After the calculations were performed, the following results were obtained from the facial wash recommendation calculations for oily skin. The weight of each criterion was normalized by dividing the initial weight by the total weight, so that the total weight was equal to one.

Table Ranking Results

Alternatif	V
A1	0,217416873
A2	0,191066293
A3	0,223912838
A4	0,196301445
A5	0,171302550

Alternative A3 received the highest rating because it scored highest on the criteria of active ingredient content and product availability, which in this study had the greatest weight compared to other criteria. This finding is in line with various studies in the field of Decision Support Systems which state that in the Weighted Product (WP) method, criteria with higher weights will have a more dominant influence on the final ranking results. This indicates that respondents tend to prioritize the benefits and effectiveness of a product over price when determining their recommendation for facial wash for oily skin. Thus, the Weighted Product method has proven to emphasize benefit-oriented criteria, resulting in recommendations that are more relevant to user needs.

CONCLUSIONS

This study contributes significantly to the design and implementation of a Decision Support System (DSS) for recommending facial wash products for oily skin by applying the Weighted Product (WP) method as a multi-criteria decision-making approach. The system is capable of processing several criteria in a structured manner and producing quantitative rankings of alternatives. Based on the calculation results, alternative A3, namely Senka Perfect

Whip Acne Care, obtained the highest preference score and is therefore recommended as the best product in the context of this study. These findings indicate that the WP method is effective in processing benefit and cost criteria proportionally according to their weight of importance. However, this study has several methodological limitations. The number of product alternatives analyzed is still limited, so it does not fully represent all facial wash products available on the market.

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