Decision Support System For Formula Milk Selection Based On Nutrition Value Using Tahani Model Database Fuzzy Method

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Abstract. The research is conducting aimed at making it easier for customers to choose formula milk products based on the nutrients most needed by infants. The method used to analyze the nutritional value data contained in formula milk products is Tahani model database fuzzy. Through several stages of the data calculation process for each variable that is determined, the final result of the processing is in the form of fire strenght or the highest value to the lowest value. The system recommends the right product based on the criteria required by the customer, ranging from the highest to the lowest, except for 0 (zero).

1. Introduction
Formula milk is an alternative way by a mother to divorce breast milk from a baby. Choosing the most appropriate formula milk for baby is very important because if wrong to choose, the baby is easy to fever, vomiting, diarrhea, and other diseases such as ulcers, swollen intestines, and stomach diseases. The mistake of choosing it is fatal to the baby and can even lead to death. The average illness suffered by infants without breast milk is the wrong consumption of formula milk. This happens because the nutritional support expected by the baby is not in accordance with the many nutrients contained in the formula milk consumed.

By utilizing information technology, researchers build a decision support system for the selection of formula milk products. The goal is to make it easier for customers to choose the right product based on the nutrients most needed by the baby. In addition, the system can also help nutrition experts ensure the right product to be recommended to customers when customers do consultations about infant nutrition.

The method used in the data analysis process is the tahani model database fuzzy method. Through several stages of the calculation process for each variable that is determined, the tahani model database fuzzy method provides fire strenght or final conclusion that recommends customers to choose the formula milk product that is most appropriate for their baby.

Data samples used for data analysis are obtained from the nutritional value information contained in formula milk products. For testing the system researchers took several samples of the types of formula milk products in supermarkets in the kisaran city. And to test the calculation of the method, the researcher took 4 variables contained in the nutritional value information on the product box, namely Vitamin A, Vitamin C, Vitamin D, and Vitamin E.
In choosing something that is considered complicated, the tahani model database fuzzy method has been widely used, one of the research that raised this method is “Application of Tahani model database fuzzy method in Providing Web-Based Home Purchase Recommendations”[1]. In this study the tahani model database fuzzy method is used to provide information on the five best values of the recommendations.

Basically the fuzzy database of the Tahani model still uses a standard relation, but to get information on the query, this model uses fuzzy set theory[2].

Fuzzy logic is a generalization of classical logic (crisp set) which only has two membership values, namely 0 and 1[3].

Alter defines decision support systems as interactive information systems that provide data modeling and manipulation information[4]. The information system according to Kusrini is the existence of a system within an organization that synergizes the needs of daily transaction data processing, supports operations, is managerial and has strategies in an organization, and presents information to outsiders[5].

2. Methodology
Stages carried out in research:

Researchers took data samples from one of the supermarkets in the city of Kisaran, namely "Supermarket Atlanta" in Sisinga Mangaraja, Kisaran, Asahan Regency. The object observed in this study is formula milk data and the data that becomes a benchmark is the nutritional value contained in the milk product observed.

The process of calculating or decomposing the data in this study uses the tahani model database fuzzy method. Through several stages of the calculation process for each variable specified, the tahani model database method provides a final conclusion that can be used as recommendations by customers in choosing the most appropriate formula for their baby.

Data collection techniques were carried out in 3 ways, namely: 1) Interviews and Questionnaire. Interviews were conducted to several customers of formula milk products and included filling out questionnaires that had been provided. 2) Observation. Conservation is carried out directly at atlanta supermarkets. Observations made in the form of nutritional value contained in each product and system for purchasing formula milk products. 3) Documents. All data relating to the object of research obtained from interviews, questionnaires (questionnaires), and observations will be documented to be used as reference material for the continuation of the study.

3. Result and Discussion
For samples of product researchers use several product examples, namely Morinaga, SGM, and Dencow. For samples the authors used 4 criteria, namely Vitamin A, Vitamin C, Vitamin D, and Vitamin E. Below are examples of information on nutritional value of formula milk products aged 0-6, months, 6-12 months, and 1-3 years, milk weight of 400 Mg.
Table 1. Example of Nutritional Value Data on Formula Milk Product

| Product Name | Baby's Age | Vitamin A (UI) | Vitamin C (mg) | Vitamin D (UI) | Vitamin E (mg) |
|--------------|------------|----------------|----------------|----------------|---------------|
| Morinaga     | 0-6 Month  | 35             | 19             | 83             | 2.8           |
| SGM          | 0-6 Month  | 37             | 17             | 67             | 4.1           |
| Bebalac      | 0-6 Month  | 27             | 30             | 28             | 6.2           |
| Similac      | 0-6 Month  | 21             | 12             | 51             | 9             |
| Nutrilon     | 0-6 Month  | 75             | 60             | 94             | 7.8           |
| S26          | 0-6 Month  | 33             | 28             | 41             | 7             |
| Morinaga     | 6-12 Month | 75             | 15             | 87             | 4.6           |
| SGM          | 6-12 Month | 36             | 33             | 57             | 6             |
| Bebalac      | 6-12 Month | 23             | 40             | 51             | 7.2           |
| Similac      | 6-12 Month | 22             | 30             | 46             | 6.2           |
| Nutrilon     | 6-12 Month | 35             | 37             | 80             | 6.8           |
| S26          | 6-12 Month | 27             | 30             | 28             | 6.2           |

The first step is formed a fuzzy set with the membership function To assess the desired product, a number of categories are formed which need to be considered with the set owned by each criterion. These criteria are as follows:
1. Vitamin A (LOW, MEDIUM, and HIGH)
2. Vitamin C (LOW, MEDIUM, and HIGH)
3. Vitamin D (LOW, MEDIUM, and HIGH)
4. Vitamin E (LOW, MEDIUM, and HIGH)

From each of the criteria above that already has a membership assemblage, then the membership function is then made as follows:
1. Vitamin A (LOW, MEDIUM, and HIGH)

LOW and HIGH assemblage uses the shoulder-shaped membership function approach, while the MEDIUM assemblage uses a triangular membership function approach. The membership function of the Vitamin A criteria is shown in Figure 2, as follows:

![Function of Membership of Vitamin A Variable](image)

**Figure 2. Membership Function on Vitamin A Variable**

The membership function of the Vitamin A variable is formulated as follows:

$$\mu_{Vitamin A_{LOW}}[x_i] = \begin{cases} 
1 & x_i \leq 35 \\
\frac{50-x_i}{15} & 35 \leq x_i \leq 50 \\
0 & x_i \geq 50 
\end{cases}$$

$$\mu_{Vitamin A_{MEDIUM}}[x_i] = \begin{cases} 
0 & x_i \leq 35 \text{ or } x_i \geq 80 \\
\frac{x_i - 35}{15} & 35 \leq x_i \leq 50 \\
\frac{80 - x_i}{30} & 50 \leq x_i \leq 80 
\end{cases}$$
2. Vitamin C (LOW, MEDIUM, and HIGH)
LOW and HIGH assemblage uses the shoulder-shaped membership function approach, while the MEDIUM assemblage uses a triangular membership function approach. The membership function of the Vitamin C criteria is shown in Figure 3, as follows:

\[
\mu_{\text{VitaminC}}[x_1] = \begin{cases} 
1 & x_1 \geq 80 \\
\frac{x_1 - 50}{30} & 50 < x_1 < 80 \\
0 & x_1 \leq 50 
\end{cases}
\]

![Figure 3. Membership Function on Vitamin C Variable](image)

3. Vitamin D (LOW, MEDIUM, and HIGH)
LOW and HIGH assemblage uses the shoulder-shaped membership function approach, while the MEDIUM assemblage uses a triangular membership function approach. The membership function of the Vitamin D criteria is shown in Figure 4, as follows:

\[
\mu_{\text{VitaminD}}[x_1] = \begin{cases} 
1 & x_1 \leq 35 \\
\frac{50 - x_1}{15} & 35 \leq x_1 \leq 50 \\
0 & x_1 \geq 50 
\end{cases}
\]

![Figure 4. Membership Function on Vitamin D Variable](image)
4. Vitamin E (LOW, MEDIUM and HIGH)
LOW and HIGH assemblage uses the shoulder-shaped membership function approach, while the MEDIUM assemblage uses a triangular membership function approach. The membership function of the Vitamin E criteria is shown in Figure 5, as follows:

\[
\mu_{\text{VitaminE}}\text{LOW}[x_1] = \begin{cases} 
1 & \text{if } x_1 \leq 3 \\
\frac{5-x_1}{2} & \text{if } 3 \leq x_1 \leq 5 \\
0 & \text{if } x_1 \geq 9 
\end{cases}
\]

\[
\mu_{\text{VitaminE}}\text{MEDIUM}[x_1] = \begin{cases} 
0 & \text{if } x_1 \leq 3 \text{ atau } x_1 \geq 9 \\
\frac{x_1-3}{2} & \text{if } 3 \leq x_1 \leq 5 \\
\frac{9-x_1}{4} & \text{if } 5 \leq x_1 \leq 9 
\end{cases}
\]

\[
\mu_{\text{VitaminE}}\text{HIGH}[x_1] = \begin{cases} 
1 & \text{if } x_1 \geq 9 \\
\frac{x_1-5}{4} & \text{if } 5 \leq x_1 \leq 9 \\
0 & \text{if } x_1 \leq 5 
\end{cases}
\]

If want to know what are the names of products that have MEDIUM of Vitamin A, MEDIUM of Vitamin C, HIGH of vitamin D, and HIGH of Vitamin E for babies aged 0-6 months, then, Structured Query Language (SQL) formed is: SELECT produk FROM dtnilaigizi WHERE (Vitamin A = "MEDIUM") AND (Vitamin C = "MEDIUM") AND (Vitamin D = "HIGH") AND (Vitamin E = "HIGH"). Table 2 shows fire strength as a result of surgery from (Vitamin A MEDIUM) AND (Vitamin C MEDIUM) AND (Vitamin D HIGH) AND (Vitamin E HIGH) as:

\[
\mu_{\text{VitaminAMEDIUM}}\wedge\mu_{\text{VitaminCMEDIUM}}\wedge\mu_{\text{VitaminDHIGH}}\wedge\mu_{\text{VitaminEHIGH}} = \min(\mu_{\text{VitaminAMEDIUM}}[x_3],\mu_{\text{VitaminCMEDIUM}}[x_5],\mu_{\text{VitaminDHIGH}}[x_9],\mu_{\text{VitaminEHIGH}}[x_{12}])
\]

| Product Name | Vitamin A MEDIUM | Vitamin C MEDIUM | Vitamin D HIGH | Vitamin E HIGH | Fire Strength |
|--------------|------------------|------------------|----------------|----------------|---------------|
| Morinaga     | 0                | 0                | 1              | 0              | 0,000         |
Table 2 above presents information showing search results for Query. There is one product recommended, with the Nutrilon product name. While the other 5 products are not recommended.

The form of processing the nutritional value data above using the system is as follows:

1. **Product Form**
   The product form is used to manage product data. These data, namely the product code, product name, product weight, and age of the baby. On this form there are 5 buttons as navigation. The Add button to clean product data on objects that aim to add new data. Save button to save product data into the database. Edit button to correct incorrect product data that has been stored in the database. Delete button to delete product data in the database. Exit button to exit the product form.

2. **Nutrition Form**
   Nutrition form is used to manage nutrition data. These data, namely nutritional codes and nutritional names. In this form there are 5 buttons as navigation. The Add button to clean data on objects that aim to add new data. Save button to store nutritional data into the database. Edit button to correct incorrect nutritional data that has been stored in the database. Delete button to delete nutritional data in the database. Exit button to exit the nutrition form.

3. **Nutritional Value Form**
   The nutritional value form is used to manage nutritional value data. These data, namely product data, nutritional data, value unit data, nutritional value data contained in the product, membership set data, and calculation data through the Tahani model database fuzzy method. In this form there are 5 buttons as navigation. The Add button to clean the nutritional value data on objects that aim to add new data. Save button to store nutritional value data into the database. Edit button to correct incorrect nutritional...
value data that has been stored in the database. Delete button to delete nutritional value data in the database. Exit button to exit the nutritional value form.

![Figure 8. Nutritional Value Form](image)

4. Information on Product Recommendations

After going through several processes in the previous forms, the final results of the process can be seen in the product recommendation information. But before the results are obtained, the system directs the user to fill in the data in the product recommendation search form, which means that the information is presented based on nutritional names, nutritional level categories, and the type of age of the baby.

![Figure 9. Search Product Recommendation](image)

Based on the data entered in the product recommendation form, the results are as follows:

![Figure 10. Product recommendation](image)

From the presentation of the system, it can be concluded that, for the name of "Vitamin A" nutrition, the nutritional assemblage needed "MEDIUM", and the age of infants "0-6 Months", the highest value of some products is Nutrilon, the second is SGM. So, automatically these two products
are the best recommendations from the system, while other products are not recommended because they have a value of 0.

4. Conclusion
Based on the description in the previous chapters, the conclusions that can be drawn from this research are, 1) Decision support system for the selection of formula milk products makes it easy for customers to choose the right product based on the nutritional value needed by the baby. 2) Decision support system for the selection of formula milk products can be used by nutritionists in recommending the right products to customers when customers conduct child nutrition consultations with the nutritionist. 3) The best product recommended by the system is the result of calculating the nutritional value of the process using the tahani model database fuzzy method. Where the best products are presented in the form of ranking or fire strength. 4) The results of this study add to intellectual property and the development of teaching materials on the subjects of decision support systems, databases, and programming for lecturers who teach the subject.

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