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To cite this article: Kiki Fatmawati *et al* 2019 *J. Phys.: Conf. Ser.* **1255** 012009

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Analysis of Promothoe II Method in the Selection of the Best Formula for Infants Under Three Years

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Abstract. Mother's own milk is the best source of nutrition for almost all babies. Beyond somatic growth, breast milk as a biological fluid has various other benefits, including modulation of postnatal bowel function, ontogeny immunity, and brain development. Although breastfeeding is highly recommended, breastfeeding may not always be possible, appropriate or just adequate. However, following baby's growth and development, breast milk alone is no longer enough to add nutrition to children. Because of that the baby must be given Mother's Milk Complementary Food. One milk product that has the best market is a formula, but it is not easy to choose what formula is suitable to meet the nutritional content of babies. Baby formula milk is a substitute produced by the industry for baby consumption. Infant formula tries to mimic the nutritional composition of ASI as close as possible, and is based on cow's milk or soy milk. A number of alternatives for cow milk-based formulas also exist. One of the SPK methods that can be used is PROMETHEE II. Based on the results of research using 9 criteria, namely: Energy, Fat, Sugar Protein, Carbohydrates, Sodium, Protein, Affordable Prices, More Variants of Flavor, Easy to Search and 5 Alternatives, namely: Dancow, SGM Eksplor, Vidoran Xmart, LactoGrow, Bebelac 3. The results of the assessment obtained the final result of the calculation of net flow is Vidoran Xmart (0.2075: Ranking 1), Bebelac 3 with net flow (0.0825: Ranking 2) and Dancow with net flow (0.0425: Ranking 3). It is hoped that this research can contribute to parents so that they will no doubt choose formula milk that is suitable for babies.

1. Introduction

Formula milk is a nutritious alternative to breast milk (ASI). Although the best intake for babies is Mother's Milk Ais, sometimes breastfeeding is not recommended if the mother or baby has certain medical problems. ASI is still the best milk for children. But it becomes a problem if you cannot consume breast milk adequately because you share conditions and conditions. Formula milk are an unavoidable alternative. These infant formula milk must have a standard composition of nutritional and safety content that must be met by all producers based on standards set by the world health and food agency (WHO and FAQ). Along with the times development many parents are often faced with the problem of choosing the right type of formula milk and good for babies. This problem is complicated by the increasing number of formula milk in the market. Information about understanding the selection of milk types is getting more and more, both from doctors, sales promotion in supermarkets, advertisements, printed and electronic media, brochures or from other mothers' experiences. This diverse information sometimes confuses parents, because it is often very different



and opposite. In general, the principle of selecting the right milk and good for children is milk that is suitable and acceptable for the child's body system. Many branches of computer science can solve complex problems. This is evidenced by several studies in the field of datamining [1]–[8][7], field of artificial neural networks [9]–[13], in the field of decision support systems[14]–[18] related to PROMETHEE II [19] [20]. This research is one of the authors' references in conducting research so that the author can enrich the theory used in reviewing the research conducted. From previous studies, the authors found no research with the same title as the title of the author's research. But the authors raised several studies as references in enriching the study material in the authors' research. Based on the above research, the researchers raised the title of the Future of PROMETHEE II Method on the Selection of the Best Formula Milk for Babies Under Three Years. It is expected that later research results will be obtained to facilitate the mother of the baby in determining the priority of the best formula milk for toddlers (under three years) so as to reduce errors in choosing baby milk.

2. Methodology

2.1. Decision Support System

Decision Support System is usually built to support the solution of a problem or for an opportunity, the application of decision support system is in decision making, the application of decision support system (CBSS) using CBIS (Computer Based Information System) that is flexible, interactive, and adaptable, developed to support solutions to specific unstructured management issues. A decision support system can be described as an interactive, computer-based system designed to help decision-makers to solve poorly structured problems. Using a combination of models, analytical techniques, and information retrieval, such systems help develop and evaluate appropriate alternatives[21][22].

2.2. PROMETHEE II

Preference function based outranking method is a special type of MCDM tool that can provide a ranking ordering of the decision options. The PROMETHEE (preference ranking organization method for enrichment evaluation) method was developed by Brans and Vincke in 1985. The PROMETHEE I method can provide the partial ordering of the decision alternatives, whereas, PROMETHEE II method can derive the full ranking of the alternatives. In this paper, the PROMETHEE II method is employed to obtain the full ranking of the alternative locations for a given industrial application[20].

2.3. Data

Primary data was collected with research instruments namely, questionnaires were used to obtain factors related to the selection of formula milk for infants under three years of age. Data obtained from formula milk packaging boxes for infants under three years old. The population of this study is 75 mothers who have babies under three years old. The number of samples in this study was 75 people. Using the total sampling method takes the entire population to be sampled.

3. Result and Discussion

The first step is the criteria and weight to do the calculation process so that the best alternative will be obtained, and later the highest alternative will be chosen to recommend the best formula milk for toddlers.

3.1. Criteria and Weight

The PROMETHEE II method in the process requires criteria to be calculated for the process of ranking the best formula milk selection for toddlers. The criteria for consideration are as follows:

Table 1. Criteria

Criteria	Information
C1	Energy
C2	Fat

C3	Sugar Protein
C4	Carbohydrate
C5	Sodium
C6	Vitamin Protein
C7	Affordable prices
C8	More Variant Flavors
C9	Easy to search

Table 2. Alternative

Product name	C1	C2	C3	C4	C5	C6	C7	C8	C9
Dancow	160	6	5	21	105	26	30	30	33.3
SGM Eksplor	150	5	5	22	95	25	30	26.7	36.7
Vidoran Xmart	170	6	6	23	95	28	40	40	20
Lactogrow 3	160	5	5	22	35	25	40	30	30
Bebelac 3	180	6	6	26	70	29	40	35	30

From each of these criteria, the weight will be determined. The weight consists of four Fuzzy numbers, namely Very Good (SB), Good (B), Sufficient (C), Less (K):

Information: SB = Very Good, B = good, C = Enough and K = less

From Fuzzy numbers can be converted to Crips. For more information, weights are formed in the following table 3:

Table 3. Weight

Fuzzy Numbers	Value
Very Good (SB)	40
Good (B)	30
Enough (C)	20
Less (K)	10

Step 1:

Weight (W) = Energy (160), Fat (6), Sugar Protein (5), Carbohydrate (21), Sodium (105), Protein (26), Alternative (N) = 5

Initial Matrix:

$$C = \begin{pmatrix} 30 & 40 & 30 & 10 & 40 & 40 & 30 & 30 & 30 \\ 20 & 30 & 30 & 20 & 40 & 30 & 30 & 20 & 30 \\ 40 & 40 & 40 & 30 & 40 & 40 & 40 & 40 & 20 \\ 30 & 30 & 30 & 20 & 10 & 30 & 40 & 30 & 30 \\ 40 & 40 & 40 & 40 & 20 & 40 & 40 & 30 & 30 \end{pmatrix}$$

First step: Normalize the decision matrix using the following equation:

$$C_{11} = (30-10)/(40-10) = 20/30 = 0,67$$

Step 2: Calculate the preference function

$$A_{12} : 0,67 \leq 0,33 \Rightarrow 0,67 - 0,33 = 0,34$$

$$1 \leq 0,67 \Rightarrow 1 - 0,67 = 0,33$$

$$0,67 \leq 0,67 = 0$$

$$0 \leq 0,33 = 0$$

$$1 \leq 1 = 0$$

$$1 \leq 0,67 = 1 - 0,67 = 0,33$$

The same step is taken up to the 5th criterion.

Step 3: Aggregate Preference Function

$A_{12} : (0,34 \times 4) / 40 = 0,034$
 $(0,33 \times 4) / 40 = 0,033$
 $(0 \times 4) / 40 = 0$
 $(0 \times 4) / 40 = 0$
 $(0 \times 4) / 40 = 0$
 $(0,33 \times 4) / 40 = 0,033$

Table 4. The results of the agreeat preference function

A1,A2	0.034	0.033	0	0	0	0	0.033	0.034	0
A1,A3	0	0	0	0	0	0	0	0	0.034
A1,A4	0	0.033	0	0	0.1	0.1	0.033	0	0
A1,A5	0	0	0	0	0.067	0.067	0	0	0
A2,A1	0	0	0	0.033	0	0	0	0	0
A2,A3	0	0	0	0	0	0	0	0	0.034
A2,A4	0	0	0	0	0.1	0.1	0	0	0
A2,A5	0	0	0	0	0.067	0.067	0	0	0
A3,A1	0.033	0	0.033	0.067	0	0	0	0.033	0
A3,A2	0.067	0.033	0.033	0.034	0	0	0.033	0.067	0
A3,A4	0.033	0.033	0.033	0.034	0.1	0.1	0.033	0.033	0
A3,A5	0	0	0	0	0.067	0.067	0	0.033	0
A4,A1	0	0	0	0.033	0	0	0	0	0
A4,A2	0.034	0	0	0	0	0	0	0.034	0
A4,A3	0	0	0	0	0	0	0	0	0.034
A4,A5	0	0	0	0	0	0	0	0	0
A5,A1	0.033	0	0.033	0.1	0	0	0	0	0
A5,A2	0.067	0.033	0.033	0.067	0	0	0.033	0.034	0
A5,A3	0	0	0	0.033	0	0	0	0	0.034
A5,A4	0.033	0.033	0.033	0.067	0.033	0.033	0.033	0	0

Table 5. The results of the calculation above

Alternative	A1	A2	A3	A4	A5	Total
A1	-	0.134	0.034	0.266	0.134	0.568
A2	0.033	-	0.034	0.2	0.134	0.401
A3	0.166	0.267	-	0.399	0.167	0.999
A4	0.033	0.068	0.034	-	0	0.135
A5	0.166	0.267	0.067	0.265	-	0.765
Total	0.398	0.736	0.169	1.130	0.435	-

Step 4: Determine outflows and outflow currents

For Leaving Flow:

$A1 : \frac{1}{5-1} * 0,367 = 0,09175$

For Entering flow :

$A1 : \frac{1}{5-1} * 0,53 = 0,1325$

Table 6. The results of outflows and outranking damage

Alternative	Leaving Flow	Entering Flow
A1	0.142	0.0995
A2	0.10025	0.184
A3	0.24975	0.04225
A4	0.03375	0.2825
A5	0.19125	0.10875

Step 5: Calculate net outranking or net flow for each alternative
Where the calculations are:

Table 7. The results of outranking are clean for each alternative

Alternative	Net Flow	Rangking
A1	0.0425	3
A2	-0.0838	5
A3	0.2075	1
A4	-0.2488	4
A5	0.0825	2

From the results of the alternative calculations above shows that a very good alternative to recommend the best formula milk for under-three-year-old babies with an interval value of ≥ 0.10 with 1, therefore the best formula milk for toddlers is A3: Vidoran Xmart (Net Flow 0.2075), A5: Bebelac 3 (Net Flow 0.0825) and A2: Dancow (Net Flow 0.0425).

4. Conclusion

Based on the results of the research and discussion on the Application of PROMETHEE II Algorithm in Recommending the Best Formula Milk for Under-Three-Year-Old Babies concluded as follows:

- Determination of the criteria of the study there are 9 criteria (Nutrition content), namely: Criteria 1 (Energy), Criteria 2 (Fat), Criteria 3 (Sugar Protein), Criteria 4 (Carbohydrate), Criteria 5 (Sodium), Criteria 6 (Protein), Criteria 7 (Affordable Prices), Criteria 8 (More Variants of Taste), Criteria 9 (Easy to Search)
- Alternative Determination (Formula Milk Brand) are 5, namely: Alternative 1 (Dancow), Alternative 2 (SGM Eksplor), Alternative 3 (Vidoran Xmart), Alternative 4 (LactoGrow), Alternative 5 (Bebelac 3).
- Get the final net flow calculation as follows: rank 1: Vidoran Xmart with net flow = 0.2075, ranking 2: Bebelac 3 with net flow = 0.0825, rank 3 Dancow with net flow = 0.0425, rank 4 LactoGrow with net flow = -0.2488, rank 5, SGM Explores with net flow = -0.0838.

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