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ANALYSIS OF PMT MENU BUDGET OPTIMIZATION IN POSYANDU ACTIVITIES IN MIMBAAN VILLAGE USING THE SIMPLEX METHOD

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ABSTRACT

Mimbaan Village is one of the villages with the highest stunting rate in Panji District. One way to prevent *stunting* is by providing Supplementary Feeding (PMT) which is carried out during posyandu activities. However, the funds provided by the government are very limited, so cadres have difficulty in managing the PMT budget with a varied menu. This study aims to optimize the PMT menu budget using the simplex method so that all toddlers who participate in posyandu activities get a varied PMT by meeting appropriate nutritional needs. This type of research is a case study where the data collection process is through literature studies, interviews with posyandu cadres, and documentation. The menu chosen is corn porridge and roasted brains, because both have the same main ingredient (tilapia) and have nutritional content that is suitable for toddlers. Based on the results of the calculation of the simplex method, it is known that *the budget* for corn porridge is IDR 3,000 and grilled brains 2,500 with a capital of IDR 1,320,000. The results of this study show that the application of the simplex method can help cadres in managing PMT budgets efficiently, but cadres need to pay attention to the nutritional content needed.

Keywords: *Budget PMT, Optimization, Simplex Method.*

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PRELIMINARY

Stunting is a major health problem in toddlers in Indonesia that has an impact on stunted physical growth and cognitive development of children. This condition is related to chronic malnutrition in the long term, especially in the First 1,000 Days of Life (HPK) period (UNICEF, 2022). The low sensitivity of parents in paying attention to the diet of toddlers who are in the phase of being prone to diseases and infections also increases the risk of stunting. Lack of knowledge and the implementation of suboptimal diet, parenting, and sanitation are the main risk factors for stunting (Sumartini et al., 2023). This is in line with Mardihani and Husain (2021) who stated that the adequacy of nutritional intake of toddlers is greatly influenced by the pattern of feeding by parents, where an unbalanced

diet can interfere with children's growth. The World Health Organization (WHO, 2022) also emphasized that inadequate feeding practices are the main cause of stunting in developing countries. Toddlers with poor nutritional status have a higher risk of stunting due to low public knowledge about the provision of balanced nutrition (Syahda & Irena, 2021). The low diversity of food in the daily menu of toddlers causes the need for macro and micronutrients that play an important role in the growth and development process (Bappenas, 2022). Deficiency of essential nutrients can also reduce children's resistance to infections, worsening nutritional status and increasing the risk of stunting (Ministry of Health of the Republic of Indonesia, 2022).

Stunting problems are generally found in areas with limited access to health services and nutritional information (BPS, 2022), one of which is in Mimbaan Village, Panji District, Situbondo Regency. Based on stunting prevalence data in February and August 2023 through the Stunting Free Situbondo (SIBESTI) website, Mimbaan Village was recorded as the area with the highest stunting rate in Panji District. The results of interviews with posyandu cadres show that this condition is influenced by the low knowledge of parents about the importance of a nutritious diet and the lack of compliance with the correct feeding rules for toddlers.

Efforts to prevent stunting are carried out through increasing nutritional intake with the Supplementary Feeding Program (PMT) which is carried out at posyandu activities (Erliana et al., 2024). The PMT program has been proven to be effective in increasing energy and protein intake for toddlers if arranged according to nutritional needs and carried out in a sustainable manner (Sari et al., 2022). Posyandu as a community-based health service has a strategic role in improving the nutritional status of toddlers through the active involvement of cadres and mentoring health workers (Mufassaroh & Widodo, 2023). However, the implementation of the PMT program in Mimbaan Village still faces obstacles in the preparation of a varied PMT menu with optimal nutritional value due to budget limitations. A fund of Rp150,000 per posyandu must be sufficient to provide 2-3 PMT menus according to the number of toddlers, so that it has an impact on the low variety of menus and the decrease in the appetite of toddlers. Budget constraints are the main factor that affects the quality of PMT menus at the posyandu level (Pratiwi et al., 2022), in line with the findings of Werdani et al. (2024) who stated that limited funds are the main obstacle to providing PMT with optimal nutritional quality.

Based on these problems, an efficient budget management strategy is needed so that the PMT menu remains varied and meets the nutritional needs of toddlers. One

alternative solution that can be applied is the simplex method, which is part of a linear program used to determine optimal decisions in the allocation of limited resources (Hani & Harahap, 2021). Previous research has shown that the simplex method is widely applied in the industrial and production fields to optimize profits and costs (Alam et al., 2021; Susanti, 2021; Susanto, 2021; Salsabila et al., 2023; Daryani et al., 2023; Ambarsari et al., 2024), but its application in the field of public health is still very limited. Therefore, this study aims to optimize the PMT menu budget in posyandu activities in Mimbaan Village so that all toddlers get PMT evenly with a variety of menus that suit nutritional needs and are cost-efficient.

METHODS

This type of research is a case study (field), with the process of collecting data through literature studies, interviews and documentation. Ardiansyah et al., (2023) also explained that in general, the data collection technique in qualitative research is an interview that involves respondents and researchers in order to obtain information related to the necessary data. The flow of this research process is presented in the form of a flowchart as shown in the following figure.

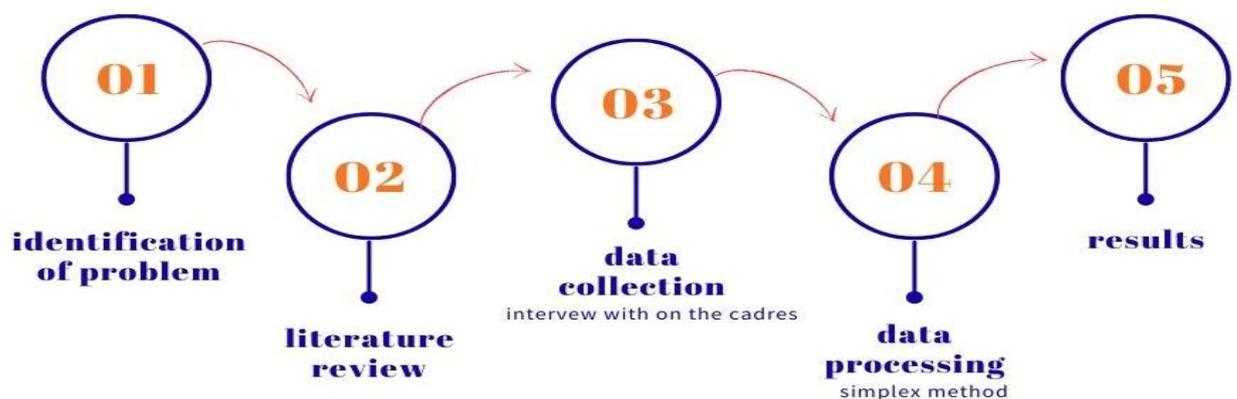


Figure 1. Research Process Flow

RESULT AND DISCUSSION

This research was conducted in Mimbaan Village, Panji District, Situbondo Regency, which is the area with the highest stunting rate based on *Stunting Free Situbondo (SIBESTI)* data in 2023. Based on the results of interviews with posyandu cadres, each

posyandu receives funds of IDR 150,000 every month for Supplementary Feeding (PMT) activities to around 20 toddlers. The basic ingredient data for the menu selected based on the E-Book of the Ministry of Health of the Republic of Indonesia is as follows.

Table 1. Raw Materials and Availability

Ingredients/Constraints	Corn Fish	Brain – Roasted	Availability
	Porridge (X_1)	Brain (X_2)	
Tilapia	200 gram	250 gram	Rp 1.226.000
Cornstarch	15 gram	-	Rp 46.000
Tempe	5 gram	-	Rp 17.000
Squirrel bananas	25 gram	-	Rp 75.500
Daun kangkung	20 gram	-	Rp 60.000
Coconut oil	5 ml	-	Rp 15.000
Sago flour	-	5 gram	Rp 12.500
Egg whites	-	3,75 gram	Rp 11.000
Coconut milk	-	10 ml	Rp 25.200
Garlic	-	2 siung	Rp 5.300
Orange leaves	-	3 lembar	Rp 7.500
Banana leaves	-	100 lembar	Rp 253.000
Cup plastic	1	-	Rp 3.000
Total Cost of Raw Materials			Rp 1.757.000

Description:

1. The provision of raw materials is obtained from the cadre handbook from the Ministry of Health of the Republic of Indonesia except for the provision of tilapia.
2. The total availability of expenditure is obtained from one-time expenditure that has been made by cadres.

The data listed in table 1 above, as a reference in the calculation process of the simplex method. The steps in calculating the simplex method are:

3. Determining Decision Variables

The decision variables in this study are:

X_1 : Corn Fish Porridge

X_2 : brains – brains roasted

4. Purpose Function

The purpose function of this study is to maximize the *budget* of corn porridge and roasted brains, which will be given to all toddlers who participate in posyandu activities in Mimbaan Village, which is as many as 240 toddlers. So the mathematical model is:

$$Z = 240 X_1 + 240 X_2$$

3. Constraints

The function of the constraints in this study are:

$$\begin{array}{rclcl}
 200X_1 & + & 250X_2 & \leq & 1.226.000 \\
 15X_1 & + & 0 & \leq & 46.000 \\
 5X_1 & + & 0 & \leq & 17.000 \\
 25X_1 & + & 0 & \leq & 75.500 \\
 20X_1 & + & 0 & \leq & 60.000 \\
 5X_1 & + & 0 & \leq & 15.000 \\
 0 & + & 5X_2 & \leq & 12.500 \\
 0 & + & 3,75X_2 & \leq & 11.000 \\
 0 & + & 10X_2 & \leq & 25.200 \\
 0 & + & 2X_2 & \leq & 5.300 \\
 0 & + & 3X_2 & \leq & 7.500 \\
 0 & + & 100X_2 & \leq & 253.000 \\
 X_1 & + & 0 & \leq & 3.000
 \end{array}$$

1. Converting objective and constraint functions into canonical form (simplex ready)

➤ Purpose function

$$\begin{aligned}
 Z = & 240 \cdot X_1 + 240 \cdot X_2 + 0 \cdot S_1 + 0 \cdot S_2 + 0 \cdot S_3 + 0 \cdot S_4 + 0 \cdot S_5 \\
 & + 0 \cdot S_6 + 0 \cdot S_7 + 0 \cdot S_8 + 0 \cdot S_9 + 0 \cdot S_{10} + 0 \cdot S_{11} + 0 \cdot S_{12} + 0 \cdot S_{13}
 \end{aligned}$$

➤ Constraints

$$\begin{array}{rclcl}
 200X_1 & + & 250X_2 & + & 0 \cdot S_1 & = & 1.226.000 \\
 15X_1 & + & 0 & + & 0 \cdot S_2 & = & 46.000 \\
 5X_1 & + & 0 & + & 0 \cdot S_3 & = & 17.000 \\
 25X_1 & + & 0 & + & 0 \cdot S_4 & = & 75.500 \\
 20X_1 & + & 0 & + & 0 \cdot S_5 & = & 60.000 \\
 5X_1 & + & 0 & + & 0 \cdot S_6 & = & 15.000 \\
 0 & + & 5X_2 & + & 0 \cdot S_7 & = & 12.500 \\
 0 & + & 3,75X_2 & + & 0 \cdot S_8 & = & 11.000 \\
 0 & + & 10X_2 & + & 0 \cdot S_9 & = & 25.200 \\
 0 & + & 2X_2 & + & 0 \cdot S_{10} & = & 5.300 \\
 0 & + & 3X_2 & + & 0 \cdot S_{11} & = & 7.500 \\
 0 & + & 100X_2 & + & 0 \cdot S_{12} & = & 253.000 \\
 X_1 & + & 0 & + & 0 \cdot S_{13} & = & 3.000
 \end{array}$$

2. Insert the canonical form into the simplex table. (Table 2 simplex table)

Table 2. Simplex Table

Cj		240	240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bi	Ri
Ci	Xi/Xj	X1	X2	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13						
0	S1	200	250	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.226.000	
0	S2	15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46.000	
0	S3	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17.000	
0	S4	25	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	75.500	
0	S5	20	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	60.000	
0	S6	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	15.000	
0	S7	0	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	12.500	
0	S8	0	15/4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	11.000	
0	S9	0	10	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	25.200	
0	S10	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5.300	
0	S11	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	7.500	
0	S12	0	100	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	253.000	
0	S13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3.000	
	Zj	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Zj - Cj	-240	-240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Description :

X_1 : Raw Material of Corn Fish Porridge

X_2 : Brain Raw Material – Roasted Brain

X_1 sampai s_{13} : variabel slack

Bi : availability or quantity of materials in one purchase

Ri : the division result of the Bi and the key column for

$$\text{Define the key line } (Ri = \frac{Bi}{\text{kolom kunci}})$$

because there is a value of $Zj - Cj$ that is negative or not optimal, the calculation must be continued using iteration.

6. Iteration 1

Table 3. Calculation Results of Iteration 1

Cj		240	240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bi	Ri
Ci	Xi/Xj	X1	X2	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13								
0	S1	0	250	1	0	0	0	0	-40	0	0	0	0	0	0	0	0	0	0	0	0	626.000		
0	S2	0	0	0	1	0	0	0	-3	0	0	0	0	0	0	0	0	0	0	0	0	1.000		
0	S3	0	0	0	0	1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	2.000		
0	S4	0	0	0	0	0	1	0	-5	0	0	0	0	0	0	0	0	0	0	0	0	5.00		
0	S5	0	0	0	0	0	0	1	-4	0	0	0	0	0	0	0	0	0	0	0	0	0		
240	X1	1	0	0	0	0	0	0	$\frac{1}{5}$	0	0	0	0	0	0	0	0	0	0	0	0	3.000		
0	S7	0	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	12.500		
0	S8	0	15/4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	11.000		
0	S9	0	10	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	25.200		

0	S10	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.300
0	S11	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	7.500
0	S12	0	100	0	0	0	0	0	0	0	0	0	0	0	0	1	0	253.000
0	S13	1	0	0	0	0	0	0	$-\frac{1}{5}$	0	0	0	0	0	0	0	1	0
	Zj	240	0	0	0	0	0	0	48	0	0	0	0	0	0	0	0	720.000
	Zj – Cj	0	-240	0	0	0	0	0	48	0	0	0	0	0	0	0	0	720.000

Because the results of $Z_j - C_j$ in iteration 1 are still not optimal, it must be iterated again.

7. Iteration 2

Table 4. Iteration 2 Calculation Results

	Cj	240	240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bi	Ri
Ci	Xi/Xj	X1	X2	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13			
0	S1	0	0	1	0	0	0	0	-	0	0	0	0	-	0	0	1.000		
									40					250/3					
0	S2	0	0	0	1	0	0	0	-3	0	0	0	0	0	0	0	1.000		
0	S3	0	0	0	0	1	0	0	-1	0	0	0	0	0	0	0	2.000		
0	S4	0	0	0	0	0	1	0	-5	0	0	0	0	0	0	0	500		
0	S5	0	0	0	0	0	0	1	-4	0	0	0	0	0	0	0	0		
240	X1	1	0	0	0	0	0	0	$\frac{1}{5}$	0	0	0	0	0	0	0	3.000		
0	S7	0	0	0	0	0	0	0	0	1	0	0	0	$-\frac{5}{3}$	0	0	0		
0	S8	0	0	0	0	0	0	0	0	0	1	0	0	$-\frac{5}{4}$	0	0	1.625		
0	S9	0	0	0	0	0	0	0	0	0	0	1	0	$-\frac{10}{3}$	0	0	200		
0	S10	0	0	0	0	0	0	0	0	0	0	0	1	$-\frac{2}{3}$	0	0	300		
250	X2	0	1	0	0	0	0	0	0	0	0	0	0	$-\frac{1}{3}$	0	0	2.500		
0	S12	0	0	0	0	0	0	0	0	0	0	0	0	$-\frac{100}{3}$	1	0	3.000		
0	S13	0	0	0	0	0	0	0	$-\frac{1}{5}$	0	0	0	0	0	0	1	0		
	Zj	240	240	0	0	0	0	0	48	0	0	0	0	80	0	0	1.320.000		
	Zj – Cj	0	0	0	0	0	0	0	48	0	0	0	0	80	0	0	1.320.000		

Based on table 4 of the calculation results of iteration 2 above, it shows that the value of $Z_j - C_j$ is optimal so that it can be known that *the* budget for corn porridge is Rp 3,000 while *the budget* for roasted brains is Rp 2,500 with the function of the target purpose of Rp 1,320,000

1. Simplex Method Calculation With the help of *MATLAB* Software.

After obtaining the value X_1 and X_2 from the application of the simplex method manually, then a simplex calculation is carried out using *MATLAB* software to find

out the calculation above, the result will be the same or not. The following are the results of the simplex calculation using *matlab* software in Figure 2.

```

C:\Program Files\MATLAB\R2014b\bin
>> f=[-240 -240];
A=[200 250;15 0;5 0;25 0;20 0;5 0;0 5;0 3.75;0 10;0 2;0 3;0 100;1 0];
>> b=[1226000 46000 17000 75500 60000 15000 12500 11000 25200 5300 7500 253000 3000];
>> Aeq=[];
>> beq=[];
>> lb=[0 0 0 0 0 0 0 0 0 0 0 0 0];
>> ub=[];
>> [X,Z]=linprog(f,A,b,Aeq,beq,lb,ub)
Warning: Length of lower bounds is > length(x); ignoring extra bounds.
> In checkbounds at 27
    In linprog at 242
Optimization terminated.

X =

    3000
    2500

Z =

-1320000

>> format rat
>> Z=Z*-1

Z =

    1320000

>>

```

Figure 2. Result of The Simplex Calculation Using MATLAB

Based on Figure 4.2 of the results of the calculation of the simplex method using matlab, the value of X_1 and X_2 the same as the results of manual simplex calculations, namely the value X_1 obtained is IDR 3,000 and X_2 IDR 2,500 is obtained with the value of the destination function of IDR 1,320,000.

These findings show that the application of the simplex method is able to help posyandu cadres optimize PMT budgets efficiently without reducing the quality and variety of menus. These results are in line with the research of Susanti (2021) and Ambarsari et al. (2024) who stated that the simplex method is effective in determining the optimal solution to the problem of production cost allocation. Although the purchase of menus is more cost-efficient, the results of the interviews show that the processing of the menu itself ensures the suitability of the nutritional content for toddlers. Thus, the simplex method can be used as a decision-making tool in managing the PMT budget to be more efficient and measurable.

CONCLUSION

This study shows that the application of the simplex method can be used to optimize the budget of the Supplementary Feeding (PMT) menu in posyandu activities in Mimbaan Village. The calculation results show that the corn porridge menu with a cost of Rp3,000 and grilled otak-otak Rp2,500 provide an efficient budget solution with a total capital of Rp1,320,000. This finding proves that the simplex method is able to help posyandu cadres in making budget decisions mathematically and effectively.

As a follow-up, it is recommended that posyandu cadres can apply the simplex method in a sustainable manner in the management of the PMT budget, as well as obtain simple training on the application of optimization methods. The village government is also expected to provide financial support and technical assistance so that PMT menu planning is not only cost-efficient, but also meets the nutritional standards of toddlers.

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