Formulation and production costs optimization of complementary food for breast milk from red sorghum flour (sorghum bicolor l.), red bean flour (phaseolus vulgaris l.) and mungbean flour (phaseolus r

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Formulation and production costs optimization of complementary food for breast milk from red sorghum flour (sorghum bicolor l.), red bean flour (phaseolus vulgaris l.) and mungbean flour (phaseolus radiatus l.) using linear programming method

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Abstract. The purpose of this study is to obtain the optimal instant porridge for babies formulation using a linear programming method. The research has been conducted in two stages. Preliminary research aims to determine the characteristics of the raw materials to use. The main research has been conducted by determining the instant porridge for babies formulation using the linear programming method. The responses studied include chemical, physical, microbiological and organoleptic responses. The results show that instant porridge for babies formulation 3 (red sorghum flour 9%, red bean flour 3.6% and mung bean flour 5.4%) is the selected formula with a production cost of Rp. 1.319, - / 100 grams with the results of the analysis including the chemical response having a water content of 1.35%; ash content 3.62%; protein content 19.92%; fat content 1.44%; carbohydrate content 73.67%; and crude fiber content of 1.11%. Physical responses include rehydration time of 45.8 seconds; bulk density value 0.85 g / ml; water absorption 3.19 g / g; and 1.87 g / g oil absorption. The microbiological response which has a TPC value of $9x10^2$ CFU/ml and *Salmonella sp* was not identified. The formulation 3 fulfills the highest protein needs with 33.22%.

1. Introduction

Breastmilk is the only nutrient that babies need and has an important role for growth and development. However, after the baby reaches the age of 6 months, breastfeeding is not sufficient for the increasing of nutritional needs. Breast milk only fulfills infant nutrition as much as 60% of infants aged 6 to 12 months. The rest must be fulfilled with other foods that are sufficient in quantity and nutrition [1]. One form of complementary foods for breast feeding that has been known to the public is instant porridge.

Sorghum is a cereal crop that has the potential to be developed in Indonesia because it can be processed into various types of food. In general, sorghum protein is higher than corn and rice but still below wheat. However, the nutritional value of sorghum protein can be increased by mixing it with nuts which are the source of vegetable protein. Legume protein is generally high in lysine, leucine, and isoleucine, but limited in terms of methionine and cystine content. This causes nuts are often combined with cereals, because cereals are rich in methionine and cystine but poor in lysine [2].

Mung beans are considered as food rich in nutrients and high in digestibility. Mung beans are suitable for babies who have started consuming complementary foods because they are rich in fiber, contain vitamin B complex, provitamin A, iron, calcium and phosphorus [2]. Apart from mung beans, red beans (*Phaseolus vulgaris* L.) have a high protein content, between 21-27%. In addition, red beans also contain B vitamins, folasin, thiamine, calcium, phosphorus, and contain more omega-3 fatty acids, especially ALA which is important for brain growth and function [3]. Sorghum, mung beans, and red beans have the potential to be used in making instant complementary baby porridge and are expected to be able to meet nutritional needs and support the growth and development of babies aged 6 months and over.

The obstacle faced in producing complementary foods for babies is how to reduce production costs but still pay attention to the quality that is in accordance with the nutritional intake needs of infants according to SNI. However, to produce instant porridge for babies which has good nutritional content and quality as complementary foods is influenced by the formulation and costs in its production. To get the optimal formulation and production costs, we need an appropriate method, one of which is linear programming. According to [4], linear programming is a technique for solving the problem of allocating limited resources with muse linear equations and inequalities to get optimal solutions by considering existing constraints.

2. Material and methods

2.1. Materials

The raw materials used in the production of instant porridge for babies are red sorghum flour originated from Ganesha Farmhouse, Bandung City, Lingkar Organic brand of red bean flour, Lingkar Organic brand mung bean flour, powdered skim milk, sugar and water. The materials used in the analysis were concentrated H_2SO_4 solution, aquadest, phenopthalien indicator, 0.1 N NaOH, 0.1 N HCL, 25% HCL, Luff solution, 0.1 N $Na_2S_2O_3$, N-hexsan, buffered pepton water media. Plate count agar media, Salmonella shigella agar media, Selenite broth media.

2.2. Research stages

2.2.1. Preliminary research

Preliminary research had been conducted to determine the characteristics of raw materials by analysing protein content, moisture content and fat content in red sorghum flour, red bean flour, mung bean flour, and powdered skim milk. The results of the analysis of raw materials are then used as a limiting factor for raw materials in the form of decision variables (changing variables) and decision changing variables (fixed variables) in linear programming modelling.

2.2.2. Main research

The formula used consists of fixed and changing raw materials. The raw materials as fixed variables used are skim milk powder, sugar, and water. Raw materials as variable changes used are red sorghum flour, red bean flour and green bean flour. The percentage of fixed and changing raw materials can be seen in Table 1.

Fixed raw materials and changing raw materials are then used as limiting factors for instant porridge for babies formulation in the linear programming solution model. Determination of the formulation in this study using the QSB + (Quantitative Systems or Business Plus) software program version 2.0. The design of a linear programming model from instant porridge for babies consists of several stages, as follows:

Table 1. Percentage of fixed raw material variable in instant porridge for babies

No.	Fixed Variable	Amount (%)
1.	Powdered skim milk	8
2.	Sugar	4
3.	Water	70
Total		82
Change Variable		18
Total fixed + change variable		100

1. Define the objective function
The objective function used is minimization, namely minimizing the costs incurred for making instant porridge for babies. The linear equation of the objective function is as follows:

$$\mathbf{Z = C_1X_1 + C_2X_2 + C_3X_3 + C_4X_4 + C_5X_5 + C_6X_6} \quad (1)$$

Note :
Zn: The objective function (cost minimization) of making instant porridge for babies.
Cn: Price per unit type of raw material / gram used in making instant porridge for babies.
Xn: The n-th type of raw material used in making instant porridge for babies.

2. Determine the variable
Model between the chemical components of the raw material and the type of raw material for which the optimal formulation will be sought, namely:

a. Decision variables (changing variables): red sorghum flour (X1), red bean flour (X2), and mung bean flour (X3).
b. Decision-changing variables (fixed variables): powdered skim milk (X4), sugar (X5), and water (X6).

3. Specifying the limiting function
The limiting function is taken based on the interaction between the type of raw material (X1 ... X6) and the limited chemical component of the raw material (a1 ... a3), namely aiXn which is a minimum. The limiting function is determined to achieve the desired nutritional content of the instant porridge for babies. The limiting function is divided into two types, namely:

a. A limiting function that limits the percentage of nutrient content contained in the final product (Table 2).

Table 2. Limiting the nutritional content of the final product of MP-ASI instant porridge

Nutrition Content	Requirements	Unit
Protein (b_1)	Maximum 8	g
Fat (b_2)	Maximum 15	g
Water (b_3)	Maximum 4	g

b. A limiting function that limits the percentage of raw material used.
Chemical Component Limiting Functions:

1. Protein Limiting Function (b_1) :
$$a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + a_{14}X_4 + a_{15}X_5 + a_{16}X_6 \geq b_1 \quad (2)$$
$$(X_1 + X_2 + X_3 + X_4 + X_5 + X_6)$$
2. Fat Limiting Function (b_2) :
$$a_{21}X_1 + a_{22}X_2 + a_{23}X_3 + a_{24}X_4 + a_{25}X_5 + a_{26}X_6 \leq b_2 \quad (3)$$
$$(X_1 + X_2 + X_3 + X_4 + X_5 + X_6)$$

3. Water Limiting Function (b_3) :

$$\frac{a_{31}X_1 + a_{32}X_2 + a_{33}X_3 + a_{34}X_4 + a_{35}X_5 + a_{36}X_6}{(X_1 + X_2 + X_3 + X_4 + X_5 + X_6)} \leq b_3 \quad (4)$$

Raw material limiting function:

Overall raw material limiting function:

$$X_1 + X_2 + X_3 + X_4 + X_5 + X_6 = QT \quad (5)$$

1. Limiting function of red sorghum flour (X_1): $X_1 = Q_1 \times QT$ (6)
2. Limiting function of red bean flour (X_2): $X_2 = Q_2 \times QT$ (7)
3. Limiting function of mung bean flour (X_3): $X_3 = Q_3 \times QT$ (8)
4. Limiting function of powdered skim milk (X_4): $X_4 = Q_4 \times QT$ (9)
5. limiting function of sugar (X_5): $X_5 = Q_5 \times QT$ (10)
6. limiting function of water (X_6): $X_6 = Q_6 \times QT$ (11)

Notes :

Xnm : The n-th type of raw material in the instant porridge for babies formulation

Ainm : The value of the type of nutritional content of the i-th type of raw material used in the formulation of instant porridge for babies from the n-th ingredient.

Br : The maximum value of the percentage of nutritional content of the final MP-ASI instant porridge.

QT : Amount or quantity of the final product to be made (grams)

Qnm : The amount of the nth raw material (grams) added in the manufacture of the n-th formulation of instant porridge for babies.

2.3. Analysis

The feasible formulation of the results of linear programming analysed includes analysis of carbohydrate content by "different" method, protein content using the Dumas method (Dumaster D-480), fat content using the Weibull hydrolysis method, water content using the Gravimetric method, ash content using the Gravimetric method [5], and crude fibre content. Physical analysis includes rehydration time, bulk density test, oil absorption and water absorption. Organoleptic analysis was carried out on 30 panellists to determine the level of preference for instant complementary porridge products based on the hedonic test of taste, aroma, colour, and texture (mouthfeel). The microbiological analysis carried out was the total plate count analysis method and Salmonella identification test.

3. Result and discussion

3.1. Preliminary research

The results of the analysis of the raw material content used in making instant porridge for babies can be seen in Table 3. Based on the results of the analysis of protein content, red sorghum flour has a relatively high protein content but lower than that of red bean flour and green bean flour. Powdered skim milk contains higher protein than other raw materials. The fat content in red sorghum flour is lower than the standard quality of sorghum flour, which is at least 2.2% [6]. The results of the analysis of the moisture content of the mungbean flour used were in accordance with the quality requirements of the mungbean flour, namely max. 10% [7]. Likewise with the moisture content in red sorghum flour in accordance with the quality requirements of sorghum flour, namely a max of 15% [6].

Table 3. Chemical analysis results of instant porridge for babies raw materials

Materials	Protein (%)	Fats (%)	Water (%)
Red Sorghum Flour	12,58	1,46	10,30
Red Beans Flour	14,27	0,96	10,20
Mung Beans Flour	15,18	1,10	9,55
Skim Milk Powder	17,06	0,06	6,5

3.2. Main research

3.2.1. Solving linear programming mathematical models

The determination of the linear programming solution model is based on the results of the analysis of raw materials that have been carried out in preliminary research and the prices of all raw materials can be seen in Table 4.The instant porridge for babies formulation is composed of six raw materials, namely red sorghum flour (X1), red bean flour (X2), mung bean flour (X3), powdered skim milk (X4), granulated sugar (X5), and water (X6).

Table 4. Chemical analysis results and prices of raw materials

Materials (X_n)	Nutrients Content			Costs (C_n) (Rp/g)
	Protein (a_1)	Fats (a_2)	Water (a_3)	
Red Sorghum Flour (X_1)	12,58	1,46	10,30	45
Red Beans Flour (X_2)	14,27	0,96	10,20	27
Mung Beans Flour (X_3)	15,18	1,10	9,55	25
Skim Milk Powder (X_4)	17,06	0,06	6,5	35
Sugar (X_5)	-	-	5,4	13
Water (X_6)	-	-	-	5

The mathematical solution model in linear programming technique is as follows.
Cost minimization objective function:

$$Z = 45\ X_1 + 27\ X_2 + 25\ X_3 + 35\ X_4 + 13\ X_5 + 5\ X_6$$

a. Protein Limiting Function Maximum 8%
$12{,}58\ X_1 + 14{,}27\ X_2 + 15{,}18\ X_3 + 17{,}06\ X_4 + 0\ X_5 + 0\ X_6 \leq 8$
$(X_1 + X_2 + X_3 + X_4 + X_5 + X_6)$
b. Fat Limiting Function Maximum 15%:
$1{,}46\ X_1 + 0{,}96\ X_2 + 1{,}10\ X_3 + 0{,}06\ X_4 + 0\ X_5 + 0\ X_6 \leq 15$
$(X_1 + X_2 + X_3 + X_4 + X_5 + X_6)$
c. Water Limiting Function Maximum 4%:
$10{,}30\ X_1 + 10{,}20\ X_2 + 9{,}55\ X_3 + 6{,}5\ X_4 + 0\ X_5 + 0\ X_6 \leq 4$
$(X_1 + X_2 + X_3 + X_4 + X_5 + X_6)$
d. Overall raw material limiting function:
$X_1 + X_2 + X_3 + X_4 + X_5 + X_6 = 100$
e. Fixed raw material limiting function (decision variable)
$X_4 = 8$
$X_5 = 4$
$X_6 = 70$

The following are the results of the optimization of the formula with a linear program which can be seen in Table 5. Based on Table 5, it can be seen that formulation one produces the largest production price of Rp.1,388 / 100 grams and the lowest is formulation 3 of Rp.1.319/100 gram.

Table 5. Feasible formula for Instant porridge for babies with linear programming method

Materials	Formulation 1	Formulation 2	Formulation 3
Red Sorghum Flour	12,6	10,8	9
Red Beans Flour	1,8	5,4	3,6
Mung Beans Flour	3,6	1,8	5,4
Skim Milk Powder	8	8	8
Sugar	4	4	4
Water	70	70	70
Price (Rp./100 gram)	Rp. 1.388	Rp. 1.359	Rp. 1.319

Note: Each formulation is distinguished by the concentration of raw materials on the basis of each formulation

3.2.2. Chemical and physical analysis of instant porridge for babies

The results of chemical analysis of instant porridge for babies can be seen in Table 6. The water content of the three formulations of instant porridge for babies based on the linear programming method has a moisture content value that is lower than the requirements set by [8], which is not more than 4%. [3] explain that flour that has a higher protein content absorbs water more strongly than flour with a lower protein content.

Table 6. Chemical and physical analysis results of instant porridge for babies

Parameter (%)	Formulation		
	1	2	3
Water	1,71	1,94	1,35
Ash	3,45	3,55	3,62
Protein	17,88	18,71	19,92
Fats	0,65	0,20	1,44
Carbohydrate	76,33	75,60	73,67
Crude Fibre	1,30	1,24	1,11
Rehydration Time (detik)	48,9	52,8	45,8
Bulk Density (g/ml)	0,87	0,84	0,85
Water Absorption (g/g)	2,70	3,36	3,19
Oil Absorption (g/g)	1,86	1,85	1,87

The results of the ash content analysis showed that only formulation 1 with an ash content of 3.43% was in accordance with [8], which was less than 3.5%. The results of the protein content analysis showed that the three formulations produced were in accordance with [8], namely not less than 8% and not more than 22%. The addition of nuts/grains flour can help increase protein levels in complementary foods. The results of the fat content analysis showed that the three formulations produced by the linear programming method did not meet [8], namely less than 1.5%. The results of the research by [9] show that the carbohydrate content of commercial instant porridge is 75.48%. Formulation 1 and formulation 2 contain higher carbohydrates than commercial instant slurry. The results of the crude fiber content analysis showed that the three formulations had lower fiber content. According to [10], the crude fiber content in the diet of infants and toddlers is required not to be more than 5g / 100g of food. The high crude fiber content has the potential to interfere with the absorption of nutrients the baby needs.

Rehydration time that is expected in instant slurry products is that which requires a short time so that the serving process is easier. Based on the results of the analysis in Table 6, it shows that the rehydration time of the three formulations is faster than the instant slurry of complementary food composite of red bean flour and canna starch which requires rehydration time of 62 seconds [11]. The density of bulk in instant slurry of red sorghum complementary ranged from 0.84 to 0.87 g / ml. Research by Yustiyani (2013) states that instant porridge for babies composite of red bean flour and canna starch has a density value of 0.61 g / ml, while in Tamrin and Pujilestari's research (2016) instant porridge for babies with

arrowroot flour and red bean flour has a density value. bulk ranges from 0.543-0.588 g / ml. Baby food products with high bulk density tend to be expected because they can occupy less space in the baby's digestive tract and more nutrients the baby can receive. Water absorption is closely related to the density of the cages and the volume of pulp that will enter the baby's digestive tract. The absorption power of instant porridge for babies ranged from 2.70 g / g-3.36 g / g. This value is lower than the commercial product, which is 6.18 g / g [11]. The absorption capacity of instant porridge for babies oil ranges from 1,846 g / g-1,858 g / g. The absorption of flour oil is needed to improve mouth feel and retain flavor [12] and is related to fat and protein levels [13].

3.2.3. Microbiological analysis of instant porridge for babies

The results of microbiological analysis can be seen in Table 7. The results of the total plate count test analysis, the TPC value in formulation 1 was $2.3x10^3$, formulation 2 was $1.4x10^3$, and formulation 3 was $9x10^2$. Based on [8], the number of microbes detected in the TPC test was not more than $1.0x10^4$ colonies / gram. The three formulations of instant porridge for babies with red sorghum flour are classified as safe for consumption by babies and have met the standards. The test results on instant porridge for babies showed that the three formulations were not contaminated by Salmonella sp.

Tabel 7. Result of microbiological analysis of instant porridge for babies

Parameter	F1	F2	F3
TPC (CFU/ml)	$2,3 \times 10^3$	$1,4 \times 10^3$	9×10^2
Salmonella sp.	negative	negative	negative

3.2.4. *Organoleptic Analysis of Instant porridge for babies*

The results of the hedonic test can be seen in Table 8 showing that based on the results of the observation of the organoleptic test on the attributes of color, taste and texture (mouthfeel) the most favored by the panelists is Formulation 2. Formulation 2 has a concentration of red sorghum flour (10.8%), peanut flour. red (5.4%), and green bean flour (1.8%). Meanwhile, in terms of aroma attributes, the most preferred is formulation 3.

Table 8. The Average results of the instant porridge for babies hedonic test

Sample code	Quality Attribute			
	Color	Aroma	Taste	Texture (*mouthfeel*)
F1	4,47 (a)	4,40 (a)	4,43 (a)	4,67 (a)
F2	4,87 (a)	4,50 (a)	4,63 (ab)	4,77 (a)
F3	4,23 (a)	4,63 (a)	4,10 (b)	4,47 (a)

3.2.5. Nutritional contribution of instant porridge for babies

Based on the results of the analysis of the nutritional contribution, one serving of the three formulations of instant porridge for babies each can provide sufficient energy for 15.68%; 15.84%; and 16.03% of the recommended reference for infants aged 7-11 months per day. Meanwhile, the contribution of protein in the three formulations of instant porridge for babies was 29.77%; 31.17% and 33.22%. According to [14], food that can meet 20-35% of ALG protein for certain age categories is categorized as a source of protein. Thus, the three formulations of instant porridge for babies can be claimed as food sources of protein.

3.2.6. Determination of selected instant porridge for babies formulation

Based on the results of linear program calculations, it shows that formula 3 is more feasible with the use of red sorghum flour (9%), red bean flour (3.6%), mung bean flour (5.4%), powdered skim milk (8%).), sugar (4%), and water (70%). This is because the price of instant porridge for babies formulation 3 is

the lowest, which is Rp. 1.319. The use of ingredients in formulation 3 can produce a feasible formulation based on a linear program at a low price.

The results obtained in the organoleptic test differed from those with the linear program. The results of the preference test on the three instant porridge for babies formulations showed that formulation 2 was preferred by panelists in terms of color, aroma and taste attributes. Thus, formulation 2 was considered preferred by panelists because the test results showed formulation 2 was superior in three of the four attributes tested. It can be concluded that there are two selected formulations of sorghum instant porridge for babies.

4. Conclusion

Based on the results of the research that has been done, it can be concluded that the use of the linear programming method can determine a feasible instant porridge for babies formulation with low production costs. The formulation with the lowest cost is formulation 3 with a composition of 9% red sorghum flour, 3.6% red bean flour, 5.4% mung bean flour, 8% powdered skim milk, 4% granulated sugar, and 70% water with production costs. Rp. 1,319. It is necessary to add a source of fat from other raw materials that can meet the fat content of instant solid complementary pulp to comply with quality standards.

References

[1] Mufida L, Widyaningsih T D and Maligan J M 2015 Prinsip dasar makanan pendamping air susu ibu (MP-ASI) untuk bayi 6-24 bulan: kajian pustaka *Jurnal Pangan dan Agroindustri* **3** 4 1646-1651
[2] Listyoningrum H and Harijono 2015 Optimasi susu bubuk dalam makanan pendamping ASI (MP-ASI). *Jurnal Pangan dan Agroindustri* **3** 4 1302-1312
[3] Tamrin R and Pujilestari S 2016 Karakteristik bubur bayi instan berbahan dasar tepung garut dan tepung kacang merah. *KONVERSI* **2** 2 2252-7311
[4] Mahar J M, Mufida L and Widyaningsih T D 2018 Optimasi energi bubur instan ubi jalar (*Ipomoea Batatas L*) terfermentasi dengan metode *linear programming*. *Jurnal Teknologi Pangan* **4** 7-16
[5] AOAC 1995 Official Method of Analysis of association of official analytical chemist 14th edition Airington AOAC Inc.
[6] Codex Standart 1989 Codex standart for sorghum flour codex standard 173-1989.
[7] Badan Standarisasi Nasional 1995 SNI 01-3728-1995 Tepung kacang hijau Jakarta
[8] Badan Standarisasi Nasional 2005 SNI 01-7111.1-2005 Makanan pendamping air susu ibu (MP-ASI)-Bagian 2:Bubuk Instan Jakarta
[9] Anandito R.B, Siswanti K and Kusumo D T 2016 Kajian karakteristik sensoris dan kimia bubur instan berbasis tepung millet putih (*Panicum miliceum* L) dan tepung kacang merah (*Phaseolus vulgaris* L) *Jurnal Teknologi Hasil Pertanian*, **IX** 1: 17-23
[10] Noer E R, Ninik R and Leiyla E 2014 Karakteristik makanan pendamping ASI balita yang disubstitusi dengan tepung ikan lele dan labu kuning *Jurnal Gizi Indonesia* **2** 2 83-89
[11] Yustiyani 2013 Formulasi bubur instan sumber protein menggunakan komposit tepung kacang merah *(Phaseolus vulgaris L.)* dan pati ganyong *(Canna edulis* Kerr.) sebagai makanan pendamping ASI (MP-ASI) Institut Pertanian Bogor
[12] Ravi R and Bhattacharya S 2004. Flow behaviour of chickpea (*Cicer arietinum* L.) flour dispersions: effect of additives *Journal of Food Engineering* **65** 619–624
[13] Ibrahim E M and Ghanimah M A 2018 Effect of Trypsin on the functional properties of salted and ultrafiltrated whey protein concentrates *J. Sus. Agric. Sci.* **44** 3 115-121
[14] BPOM. 2011 Peraturan Kepala Badan Pengawas Obat dan Makanan tentang Pengawasan Klaim dalam Label dan Iklan Pangan Olahan

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