



## Formula “KE-KAME-TU” High Calcium, Phosphore and Magnesium as Basic Ingredients for Under Five Years Supplementary Feeding



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### Keywords

*high in calcium;  
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ke-kame-tu formula;*

### Abstract

The "ke-kame-tu" formula is a formula with high calcium, phosphorus and magnesium content using a mixture of ingredients such as moringa flour, cowpea flour and tuna flour. The specific objectives of the research are 1) Creating the "ke-kame-tu" formula high in calcium, phosphorus, and magnesium, 2) Analyzing the nutritional content (calcium, phosphorus, and magnesium) of the "ke-kame-tu" formula, 3) Analyzing the substance content nutrition (calcium, phosphorus and magnesium) of supplementary feeding (PMT) products, and 4) Testing the acceptability of supplementary feeding (PMT) products by panelists. The making of the "ke-kame-tu" formula used a randomized block design with 6 treatments and 3 replications so that the research units were 18 units. The supplementary feeding products are made by adding 100 grams of ke-kame-tu formula each. Analysis of calcium, phosphorus and magnesium using spectrophotometric methods. To determine the best supplementary feeding nugget product, a analysis of variance (Anova) was carried out on the results of the organoleptic test. The nutritional content of the ke-kame-tu formula, namely calcium, ranges from 129.563 mg% (F4) to 521,450 mg% (F6), phosphorus ranged from 493 mg% (F1) to 650 mg% (F6), and magnesium in the range of 709.98 mg% (F6) to 942.19 mg% (F1). Based on the anova analysis, the overall organoleptic test results obtained the following results, treatments P1 and P2 were not significantly different, but significantly different from treatments P3, P4, P5 and P6. The treatments between P3, P4 and P5 were not significantly different but significantly different from the P6 treatment. This ke-kame-tu formula (F2) is very possible to be used as a basic ingredient or a substitute for the manufacture of supplementary feeding nuggets at the integrated service post (posyandu). This will help meet the nutritional needs of toddlers, especially calcium, phosphorus and magnesium.

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## 1 Introduction

The stunting problem in Indonesia is 24.4% and in Bali Province it is 10.9%. In accordance with the mandate of Presidential Regulation No. 72 In 2021 the target to be achieved in 2024 is that nationally stunting decreases to 14% and in Bali Province to 6.15% (Ministry of Health RI, 2021). The government has made great efforts to tackle the stunting problem, including specific and sensitive nutrition interventions. One of the specific nutritional interventions is supplementary feeding (in Indonesia it is called PMT) to overcome chronic lack of energy in pregnant women and zinc supplementation (Izwardy, 2019).

One of the realizations of the program is the provision of PMT for children under five years in routine integrated service post (in Indonesia it is called posyandu) activities. The PMT distribution goes through the center to the community Health centers (in Indonesia it is called puskesmas) and continues to the posyandu. The cost required for the procurement of PMT is quite large, but there has been no specific study on the effectiveness of the supplementary feeding. Supplementary feeding for under five years is packaged in aluminum foil with a net weight of 40 grams, containing 4 biscuits (@ 10 g per piece) in a round shape. Nutrient content per 100 grams is total energy 464.5 kcal, protein 8.45 g, total fat 16.74 g, sodium 283.18 mg, vitamin A 286.43 mcg, vitamin D 6.35 mcg, vitamin E 5.47 mcg, vitamin B1 0.33 mg, vitamin B2 0.35 mg, vitamin B3 3.52 mg, vitamin B6 0.25 mg, vitamin B12 0.59 mcg, folate 85.47 mcg, iron 6.58 mg, iodine 91.26 mcg, zinc 3.5 mg, calcium 231.18 mg, Selenium 11.02 mg, phosphorus 183 mg, Fluorine 0.18 mg (Khofiah, 2022).

The first stage of research on the nutritional content of the "ke-kame-tu" formula is as follows: a) Zinc content ranges from 17.28% (F6) to 23.87% (F1), b) Protein content ranges from 16.49% (F6) to 26.97% (F2), c) Fat content ranges from 4.20% (F1) to 5.93% (F5). The ke-kame-tu formula contains complete essential amino acids and the limiting amino acid is methionine, so that it can guarantee the growth and development of the toddler's body (Wang et al., 2010; Jarvie et al., 2006). This formula has been tested as a mixture in the manufacture of PMT Nugget products and per 100 grams it contains 9.68% protein. PMT under five is very possible to be produced in the regions so that it will be very profitable and more efficient in terms of availability, funding and acceptability (Mataram et al., 2021).

This first stage research was continued by making the "ke-kame-tu" formula high in calcium, phosphorus and magnesium. Remember these three minerals are also very necessary in the growth process of under five years. Hopefully this formula can be used as an alternative intervention for stunting prevention (Almatsier, 2005; Daniel, 1999). The specific objectives of the research are 1) to create a formula "ke-kame-tu is high in calcium, phosphorus and magnesium, 2) analyze the formula "ke-kame-tu and supplementary feeding (PMT) products in the laboratory (calcium, phosphorus and magnesium), and the acceptability test of supplementary feeding (PMT) products by panellists (Galvez et al., 1990; Knaus et al., 1994; Sanchez & McManus, 1996).

## 2 Materials and Methods

### A. Research Design

The formulation of the kame-tu formula used a randomized block design with 6 treatments and 3 replications so that there were 18 research units, as follows: (Narka et al., 1985)

FORMULA KE-KAME-TU	FLOUR			
	Moringa Leaves (gram)	Cowpea (gram)	Tuna fish (gram)	
F1	15	70	15	
F2	15	60	25	
F3	15	50	35	
F4	15	40	45	
F5	15	30	55	
F6	15	20	65	

The manufacture of PMT products uses a randomized block design with 6 treatments and 3 replications so that the research unit is 16 units, as follows:

Ingredient	Formula Supplementary Feeding (PMT)					
	P1	P2	P3	P4	P5	P6
Ke-kame-tu (g)	F1-100	F2-100	F3-100	F4-100	F5-100	F6-100
Ground chicken (g)	600	600	600	600	600	600
Bread without skin (g)	60	60	60	60	60	60
UHT milk (ml)	200	200	200	200	200	200
White bread flour (g)	20	20	20	20	20	20
Wheat flour (g)	20	20	20	20	20	20
Tapioca flour (g)	20	20	20	20	20	20
Chicken eggs (item)	1	1	1	1	1	1
Carrot (g)	100	100	100	100	100	100
Pre-leaf (g)	50	50	50	50	50	50
Seasonings (garlic, salt, sugar, chicken broth, pepper)						

Note: F1-100 means that the formula for the F1 ke-kame-tu is 100 grams, and so on.

The ke-kame-tu formula high in calcium, phosphorus and magnesium is a formula consisting of Moringa leaf flour (*Moringa oleifera*) (Aminah et al. 2015; Putri, 2019; Wikipedia, 2020; Wikipedia, 2020; Anjarwati & Moringa Oleifera, 2020; Kelorina, 2022), cowpea flour (*Vigna unguiculata* L.) (Wikipedia, 2022; Yuwono, 2015) and tuna fish flour (*Thunnus*) (Amirudin, 2007; Determination Forward, 2020; Wikipedia, 2022; Riadi, 2020; Yoga, 2020; Wikipedia, 2022), which contain at least 20% calcium, 20% phosphorus and 20% magnesium (Persagi, 2009)

The organoleptic test of taste used 30 moderately trained panelists, with 5 scales. Nutrient analysis of the ke-kame-tu formula and PMT products was analysis of proximate nutrients (titration method) and calcium, phosphorus and magnesium (spectrophotometric method) carried out in the laboratory (Gandjar & Rohman, 2012; Sudarmadji, 2000). To determine the best ke-kame-tu formula, the proximate, calcium, phosphorus and magnesium content was analyzed and for the best PMT product, a diversity analysis (Anova) was carried out on the results of the organoleptic test (Gandjar & Rohman, 2012; Sudarmadji, 2000).

### 3 Results and Discussions

#### 3.1 Result

##### a. Created the formula "ke-kame-tu high in calcium, phosphorus and magnesium

The ke-kame-tu formula uses a mixture of moringa leaf flour, cowpea flour and tuna fish flour with a combination of weight (grams) as follows: F1 (15:70:15); F2 15:60:25; F3 (15:50:35); F4 (15:40:45); F5 (15:30:55) and F6 (15:20:65). (see table 1)

Table 1  
Combination of Flour Weight of Ke-Kame-Tu Formula

FORMULA KE-KAME-TU	FLOUR		
	Moringa Leaves (gram)	Cowpea (gram)	Tuna fish (gram)
F1	15	70	15
F2	15	60	25
F3	15	50	35
F4	15	40	45
F5	15	30	55
F6	15	20	65

The six ke-kame-tu formulas were then analyzed for their calcium, phosphorus and magnesium content. At the time of making supplementary feeding nuggets, 100 grams of this ke-kame-tu formula were added.

##### b. Nutrient Content of Ingredients

Moringa flour has the highest calcium content, namely 1136.136 mg%, while the magnesium content of Moringa flour (109.599 mg%) is almost the same as cowpea flour (105.312 mg%) but tuna fish meal is lower (61.725%). The highest phosphorus content was found in tuna fish meal (690 mg%), followed by Moringa leaf flour and cowpea flour. (see table 2)

Table 2  
Nutrient Content of Ingredients

Nutrients	Moringa leaves flour (gram)	Cowpea flour (gram)	Tuna fish flour (gram)
Calcium (mg%)	1136,136	75,138	11,180
Phosphor (mg%)	520	470	690
Magnesium (mg%)	109,599	105,312	61,725
Zinc*(mg%)	2,004	2,886	1,562
Protein (%)*	17,88	13,09	47,04
Fat (%)*	6,70	2,24	1,64
Ash (%)*	10,83	5,70	3,77
Water (%)*	7,12	7,83	15,21

\*References: Mataram & Kayanaya, 2021

### c. Nutrient Content of Formula

The nutritional content of the ke-kame-tu formula, namely calcium, ranges from 129.563 mg% (F4) to 521,450 mg% (F6). Phosphorus ranged from 493 mg% (F1) to 650 mg% (F6), and magnesium in the range of 709.98 mg% (F6) to 942.19 mg% (F1). (see table 3).

Table 3  
Nutrient Content of Formula

Nutrients	F1	F2	F3	F4	F5	F6
Calcium (mg%)	170,286	136,250	232,791	129,563	287,132	521,450
Phosphor (mg%)	493	500	523	563	573	650
Magnesium (mg%)	942,19	830,00	828,69	834,47	753,85	709.98
Zinc*(mg%)	2,387	2,088	1,846	1,783	1,785	1,728
Protein (%)*	23,42	22,74	20,58	21,87	20,01	21,08
Fat (%)*	1,68	1,94	2,08	2,30	2,25	2,02
Ash (%)*	4,56	4,79	4,38	4,39	4,27	3,51
Water (%)*	8,00	8,53	9,00	9,61	9,99	10,26

\*References: [Mataram & Kayanaya, 2021](#)

Note: The Ke-Kame-Tu formula is the ratio between moringa leaf flour:cowpea flour: tuna flour F1(15:70:15); F2(15:60:25); F3(15:50:35); F4(15:40:45); F5(15:30:55); F6(15:20:65)

### d. Making supplementary feeding (PMT) products based on the "ke-kame-tu" formula

The PMT nuggets product uses the following ingredients: minced chicken, skinless white bread, UHT milk, white bread flour, wheat flour, tapioca flour, chicken eggs, carrots, pre leaves, and seasonings. Each of these nuggets is then added to the ke-kame-tu formula as much as 100 grams. (see table 4)

Table 4  
Nugget PMT Formula

Ingredient	Formula Supplementary Feeding (PMT)					
	P1	P2	P3	P4	P5	P6
Ke-kame-tu (g)	F1-100	F2-100	F3-100	F4-100	F5-100	F6-100
Ground chicken (g)	600	600	600	600	600	600
Bread without skin (g)	60	60	60	60	60	60
UHT milk (ml)	200	200	200	200	200	200
White bread flour (g)	20	20	20	20	20	20
Wheat flour (g)	20	20	20	20	20	20
Tapioca flour (g)	20	20	20	20	20	20
Chicken eggs (item)	1	1	1	1	1	1
Carrot (g)	100	100	100	100	100	100
Pre-leaf (g)	50	50	50	50	50	50
Seasonings (garlic, salt, sugar, chicken broth, pepper)						

Note: F1-100 means the formula for the ke-kame-tu F1 is 100 grams, and so on, sufficient seasoning.

### e. Nutrient Contents of Supplementary Feeding (PMT) Nuggets

Nuggets made using a modified recipe by adding the ke-kame-tu formula. For nugget P1 added the formula ke-kame-tu (F1); P2 added F3; P3 added F3; P4 added F4; P5 is added F5 and P6 is added F6. The content of calcium nuggets ranged from 226,654 mg% (P5) s.d. 245.733% (P3), phosphorus ranged from 347.982% (P1) to. 402.084% (P6), and magnesium ranging from 31.242% (P6) to. 39.042% (P1). (see table 5)

Table 5  
Nutrient Content of Supplementary Feeding (PMT) Nugget

Nutrients	P1	P2	P3	P4	P5	P6
Calcium (mg%)	239.133	238.337	245.733	227.834	226.654	238.443
Phosphor (mg%)	347.982	357.033	371.255	389.267	368.785	402.084
Magnesium (mg%)	39.042	34.416	35.891	35.986	32.267	31.242
Zinc*(mg%)	51.21	18.32	15.38	18.14	15.47	14.85
Protein (%)*	9.17	9.98	9.73	9.29	8.62	9.79
Fat (%)*	3.49	3.68	3.46	2.64	3.32	3.34
Ash (%)*	2.15	1.63	2.04	1.79	2.34	1.91
Water (%)*	59.85	61.00	60.01	58.75	63.42	60.55

\*References: [Mataram & Kayanaya, 2021](#)

#### f. Supplementary Feeding (PMT) Nugget Organoleptic Test

The panelist test was used to assess the level of preference for nugget products including: a) aroma score of 3.9 (P1) to 4.1 (P6), b) color score 3.4 (P1) to 3.9 (P6), c) sense score 3.2 (P1) to 3.9 (P6), d) texture score 3.3 (P1) to 3.9 (P6) and e) overall score of 3.6 (P1) to 4.1 (P6). (see table 6)

Table 6  
Results of Organoleptic Tests and Analysis of ANOVA of Supplementary Feeding (PMT)

Treatment	Scent	Color	Flavor	Texture	Overall
P1	3,9 a	3,4 a	3,2 a	3,3 a	3,6 a
P2	3,9 a	3,4 a	3,4 ab	3,7 ab	3,6 a
P3	4,0 a	3,3 a	3,7 abc	3,9 b	3,9 ab
P4	3,9 a	3,7 ab	3,7 abc	3,8 b	3,8 ab
P5	4,1 a	3,8 b	3,6 abc	3,9 b	3,8 ab
P6	4,1 a	3,9 b	3,9 c	3,9 b	4,1 b

The letters behind the numbers are compared by column. The same letter indicates a non-significant difference or different letters indicate a significant difference.

### 3.2 Discussions

The ke-kame-tu formula uses a mixture of moringa leaf flour, red bean flour and tuna fish meal with a combination of weight (grams) as follows: F1 (15:70:15); F2 15:60:25; F3 (15:50:35); F4 (15:40:45); F5 (15:30:55) and F6 (15:20:65). The addition of moringa leaf flour with the same amount for all formulas while the addition of red bean flour and tuna fish meal were according to the treatment. Moringa leaf flour has the highest calcium content, namely 1136.136 mg%, while the magnesium content of moringa flour (109.599 mg%) is almost the same as cowpea flour (105.312 mg%) but tuna fish flour is lower (61.725%). The highest phosphorus content was found in tuna fish flour (690 mg%), followed by moringa leaf flour and cowpea flour. Moringa flour has the highest content of calcium and magnesium ([Herrera-Estrella & López-Arredondo, 2016](#)).

The nutritional content of the ke-kame-tu formula, namely calcium, ranges from 129.563 mg% (F4) to 521,450 mg% (F6). Phosphorus ranged from 493 mg% (F1) to 650 mg% (F6), and magnesium in the range of 709.98 mg% (F6) to 942.19 mg% (F1). This formula will be added to the manufacture of nugget products in the hope of increasing the nutritional content of nuggets, especially calcium, phosphorus and magnesium. In this study, the ke-kame-tu formula will be added to the manufacture of nuggets. However, in the future this formula can be used as a mixture of snacks or other side dishes such as meatballs, satay wraps or other pastries. Similar research has been carried out by creating a kahiguru formula using mung bean flour, gude bean flour and lemuru fish flour. The nutritional content of the kahiguru formula (20-60-20) is 30.38%

*Mataram, I. K. A., & Agustini, N. P. (2022). Formula "KE-KAME-TU" high calcium, phosphore and magnesium as basic ingredients for under five years supplementary feeding. International Journal of Health Sciences, 6(3), 1596–1606. <https://doi.org/10.53730/ijhs.v6n3.13539>*



protein, 3.8% fat and contains complete amino acids with the limiting amino acid, namely hystidine. This formula can also be applied as PMT at the posyandu in the form of dry snacks that are fried in a rectangular shape (Mataram et al., 2017).

The supplementary feeding (PMT) nuggets product uses the following ingredients: minced chicken, skinless white bread, UHT milk, white bread flour, wheat flour, tapioca flour, chicken eggs, carrots, pre leaves, and seasonings. Each of these nuggets is then added to the ke-kame-tu formula as much as 100 grams. To determine the preferred nugget according to the addition of the formula ke-kame-tu, a panelist test was used. The panelist test results are as follows: a) aroma score 3.9 (P1) to 4.1 (P6), b) color score 3.4 (P1) to 3.9 (P6), c) sense score 3.2 (P1) to 3.9 (P6), d) texture score 3.3 (P1) to 3.9 (P6) and e) overall score of 3.6 (P1) to 4.1 (P6).

Based on the ANOVA analysis, the following results were obtained: a) there was no significant difference in aroma between treatments, which means that treatments P1 to P6 had the same aroma, namely neutral-preferred, b) color, there was no significant difference between P1, P2, and P3 while against other treatments P5 and P6 were significantly different. There was no significant difference between P4, P5 and P6 treatments, c) the taste of P1 treatment was significantly different from P2, P3, P4, and P6 treatments. Treatment P2 was not significantly different from P3, P4 and P5, but significantly different from P6. Treatments P3, P4 and P5 were not significantly different, but significantly different from P6, d) the texture of treatment P1 was significantly different from other treatments, but between treatments P2, P3, P4, P5 and P6 there was no significant difference, e) Overall treatment P1 and P2 were not significantly different, but significantly different from the treatment P3, P4, P5 and P6. The treatments between P3, P4 and P5 were not significantly different but significantly different from the P6 treatment.

Based on the results of the organoleptic test, the nuggets ranged from neutral to d. like so that all nugget treatments can be applied as supplementary feeding (PMT) in integrated service post (posyandu) activities. If the P2 treatment is to be applied, these nuggets contain 238.337 mg% calcium, 357.033 mg% phosphorus and 34,416 mg% magnesium (Aghion et al., 2001; Vormann, 2003).

Minister of Health Regulation No. 28 of 2019 lists the adequacy according to age groups as follows: a) calcium includes: 270 mg for 6-11 months, 650 mg for 1-3 years and 1000 mg for 4-6 years; b) phosphorus includes: 275 mg 6-11 months of age, 460 mg of 1-3 years old and 500 mg of 4-6 years old; c) magnesium includes: age 6-11 months as much as 55 mg, age 1-3 years as much as 65 mg and age 4-6 years as much as 95 mg (Ministry of Health, 2019).

For example, if toddlers aged 1-3 years consume 50 grams of nuggets, they will be able to meet the adequacy of calcium as much as 18.4%, phosphorus as much as 38.8% and magnesium as much as 26.4%. Considering that these nutrients have benefits for helping the growth and development of under five years, it is very possible to apply them to the manufacture of supplementary feeding (PMT) which is carried out in integrated service post (posyandu) activities. Calcium is the main mineral in bones and teeth and immune function, phosphorus functions as bone and tooth calcification, absorption and transport of nutrients and magnesium functions as bone and tooth mineralization and protein synthesis (Wang et al., 2018; Xu et al., 2019).

## 4 Conclusion

The ke-kame-tu formula uses a mixture of moringa leaf flour, cowpea flour and tuna fish meal with a combination of weight (grams) as follows: F1 (15:70:15); F2 15:60:25; F3 (15:50:35); F4 (15:40:45); F5 (15:30:55) and F6 (15:20:65). The nutritional content of the ke-kame-tu formula, namely calcium, ranges from 129.563 mg% (F4) to 521,450 mg% (F6). Phosphorus ranged from 493 mg% (F1) s.d. 650 mg% (F6), and magnesium in the range of 709.98 mg% (F6) s.d. 942.19 mg% (F1). The panelist test results are as follows: a) aroma score 3.9 (P1) to 4.1 (P6), b) color score 3.4 (P1) to 3.9 (P6), c) sense score 3.2 (P1) to 3.9 (P6), d) texture score 3.3 (P1) to 3.9 (P6) and e) overall score of 3.6 (P1) to 4.1 (P6). ANOVA analysis shows results, the overall results of the P1 and P2 treatments were not significantly different, but significantly different from the P3, P4, P5 and P6 treatments. The treatments between P3, P4 and P5 were not significantly different but significantly different from the P6 treatment.

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*Recommendations*

Based on the nutritional content of the ke-kame-tu formula, it is very possible to use it as a basic ingredient or as a substitute for the manufacture of supplementary feeding (PMT) at the integrated service post (posyandu). This will help meet the nutritional needs of children under five years, especially calcium, phosphorus and magnesium.

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## References

- Aghion, E., Bronfin, B., & Eliezer, D. (2001). The role of the magnesium industry in protecting the environment. *Journal of materials processing technology*, 117(3), 381-385. [https://doi.org/10.1016/S0924-0136\(01\)00779-8](https://doi.org/10.1016/S0924-0136(01)00779-8)
- Almatsier, S. (2005). *Basic Principles of Nutrition*. Gramedia Pustaka Utama, Jakarta.
- Aminah, S., Ramdhan, T., & Yanis, M. (2015). Nutritional content and functional properties of moringa plants (Moringa oleifera). *Bul Pertan Perkota*, 5, 35-44.
- Amirudin, M. (2007). Preparation and Analysis of Gelating Characteristics of Tuna Fish Bone (thunnus albacores), Bogor, Department of Agricultural Industrial Technology.
- Anjarwati, J. & Moringa Oleifera. (2020). Taxonomy, Benefits, and Planting Methods, available at <https://foresteract.com/kelor/>, Friday, 21 October 2022.
- Arikunto, S. (2002). *Research Procedures A Practical Approach*. Rineka Cipta, Yogyakarta.
- Daniel, W. W. (1999). *Biostatistics A Foundation For Analysis In the Health Sciences*. John Wiley & Sons, Inc., New York.
- Determination Forward. (2020). The Nutritional Value of Tuna. Available at Sign in|Recent Site Activity|Report Abuse|Print Page|Powered By Google Sites. Sunday, July 26, 2020
- Galvez, A., Gimenez-Gallego, G., Reuben, J. P., Roy-Contancin, L., Feigenbaum, P., Kaczorowski, G. J., & Garcia, M. L. (1990). Purification and characterization of a unique, potent, peptidyl probe for the high conductance calcium-activated potassium channel from venom of the scorpion *Buthus tamulus*. *Journal of Biological Chemistry*, 265(19), 11083-11090. [https://doi.org/10.1016/S0021-9258\(19\)38560-6](https://doi.org/10.1016/S0021-9258(19)38560-6)
- Gandjar, I. G. & Rohman, A. (2012). *Analysis of Drugs by Spectrophotometry and Chromatography*, Student Library (IKAPI Member), Jogjakarta
- Herrera-Estrella, L., & López-Arredondo, D. (2016). Phosphorus: the underrated element for feeding the world. *Trends in plant science*, 21(6), 461-463. <https://doi.org/10.1016/j.tplants.2016.04.010>
- Izwardy, D. (2019). Policies and Strategies for Tackling Stunting in Indonesia. Available at [https://www.persi.or.id/images/2019/data/FINAL\\_PAPARAN\\_PERSI\\_22\\_FEB\\_2019\\_Ir\\_Doddy.pdf](https://www.persi.or.id/images/2019/data/FINAL_PAPARAN_PERSI_22_FEB_2019_Ir_Doddy.pdf)
- Jarvie, H. P., Neal, C., & Withers, P. J. (2006). Sewage-effluent phosphorus: a greater risk to river eutrophication than agricultural phosphorus?. *Science of the total environment*, 360(1-3), 246-253. <https://doi.org/10.1016/j.scitotenv.2005.08.038>
- Kelorina (2022). Moringa Nutrition Content, available at <https://kelorina.com/nutrition-kelor/>, Friday, October 21, 2022.
- Khofiah, I., N. (2022). Provision of Supplementary Food (PMT) Toddlers, available at <https://ners.unair.ac.id/site/index.php/news-fkp-unair/30-lihat/2494-giving-food-additional-pmt-toddlers>, Friday, October 21, 2022.
- Knaus, H. G., Garcia-Calvo, M., Kaczorowski, G. J., & Garcia, M. L. (1994). Subunit composition of the high conductance calcium-activated potassium channel from smooth muscle, a representative of the mSlo and slowpoke family of potassium channels. *Journal of Biological Chemistry*, 269(6), 3921-3924. [https://doi.org/10.1016/S0021-9258\(17\)41720-0](https://doi.org/10.1016/S0021-9258(17)41720-0)
- Mataram, I. K. A., & Kayanaya, A. G. R. (2021). Formula "Ke-kame-tu" High Protein and Zinc as Basic Ingredients for Under Five Years Old Supplementary Feeding. *International Research Journal of Engineering, IT and Scientific Research*, 7(6), 225-232.
- Mataram, I., Laraeni, Y., & Agustini, N. P. (2017). Formula kahiguru high protein for making of food supplement as elimination stunting. *International Journal of Life Sciences Vol. 1 No. 3, December 2017, pages: 14~ 27*, 1(3), 14-27.
- Ministry of Health RI, (2021). Pocket Book of Indonesian Nutrition Status Study Results (SSGI) in 2021. Available at <https://www.litbang.kemkes.go.id/buku-saku-hasil-studi-status-gizi-indonesia-ssgi-tahun-2021/> Friday, October 21, 2022.
- Ministry of Health RI. (2021). PERPRES No. 72 of 2021 regarding the Acceleration of Stunting Reduction [JDIH BPK RI] available at <https://peraturan.bpk.go.id/Home/Details/174964/perpres-no-72-tahun-2021>, Friday, October 21, 2022.
- Ministry of Health. (2019). Minister of Health Regulation No. 28 of 2019 concerning the recommended nutritional adequacy rate for the Indonesian people.
- Narka, T., Raka, D. G., & Agung, D. G. (1985). *Experimental Design*, Udayana University, Denpasar.

- Persagi. (2009). Indonesian Food Composition Table, Jakarta. Komputindo Media.
- Putri, N.H., (2019). 13 Interesting Benefits of Moringa Leaves for Body Health. Available at <https://www.sehatq.com/article/intip-vari-benefits-daun-kelor-for-kesehatan-berikut-ini>. Sunday 26 July 2020
- Riadi, M. (2020). Tuna (Classification, Type, Nutritional Content and Quality Grade), available at <https://www.kajiandunia.com/2020/02/ikan-tuna-classification-tipekandungan-gizi-and-grade-quality.html>, Friday, October 21, 2022.
- Sanchez, M., & McManus, O. B. (1996). Paxilline inhibition of the alpha-subunit of the high-conductance calcium-activated potassium channel. *Neuropharmacology*, 35(7), 963-968. [https://doi.org/10.1016/0028-3908\(96\)00137-2](https://doi.org/10.1016/0028-3908(96)00137-2)
- Sudarmadji. (2000). Guidelines for Laboratory Analysis, Jakarta.
- Vormann, J. (2003). Magnesium: nutrition and metabolism. *Molecular aspects of medicine*, 24(1-3), 27-37. [https://doi.org/10.1016/S0098-2997\(02\)00089-4](https://doi.org/10.1016/S0098-2997(02)00089-4)
- Wang, X. J., Xu, D. K., Wu, R. Z., Chen, X. B., Peng, Q. M., Jin, L., ... & Wang, H. Y. (2018). What is going on in magnesium alloys?. *Journal of Materials Science & Technology*, 34(2), 245-247. <https://doi.org/10.1016/j.jmst.2017.07.019>
- Wang, X., Shen, J., & Liao, H. (2010). Acquisition or utilization, which is more critical for enhancing phosphorus efficiency in modern crops?. *Plant science*, 179(4), 302-306. <https://doi.org/10.1016/j.plantsci.2010.06.007>
- Wikipedia, (2020). Kelor available at <https://id.wikipedia.org/wiki/Kelor>, Friday, October 21, 2022.
- Wikipedia, (2020). Moringa. Available at <https://id.wikipedia.org/wiki/Kelor>, Friday, July 24, 2020
- Wikipedia. (2022). Peanut Tunggak available at [https://id.wikipedia.org/wiki/Kacang\\_tunggak](https://id.wikipedia.org/wiki/Kacang_tunggak), Friday, October 21, 2022.
- Wikipedia. (2022). Thunnus available at Thunnus - Indonesian Wikipedia, the free encyclopedia, Friday, October 21, 2022.
- Wikipedia. (2022). Tuna available at <https://id.wikipedia.org/wiki/Tuna>, Friday, October 21, 2022.
- Xu, T., Yang, Y., Peng, X., Song, J., & Pan, F. (2019). Overview of advancement and development trend on magnesium alloy. *Journal of Magnesium and Alloys*, 7(3), 536-544. <https://doi.org/10.1016/j.jma.2019.08.001>
- Yoga, I. (2020). Tuna: Types, Classification, Morphological Characteristics, and Cultivation Methods, available at <https://dosenpertanian.com/ikan-tuna/>, Friday, October 21, 2022.
- Yuwono, S., S. (2015). Cowpea (*Vigna unguiculata* L.), available at <http://darsatop.lecture.ub.ac.id/2015/07/kacang-tunggak-vigna-unguiculata-l/>, Friday, 21 October 2022.

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