

Formulation of Sweet Potato, Tofu, and Dried Anchovy as Supplementary Feeding for Stunting Toddlers Aged 1 – 3 Years Old

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Abstract: *The proportion of malnutrition, undernutrition, and stunted in children under five is still a challenge for the government and the people of Indonesia. Deficit in energy consumption, macro and micro nutrients is said to be one of the causes of disrupted growth and development. A balanced intake of carbohydrates, proteins and fats is needed in the formation of body tissues, brain development and body resistance. Minerals Calcium (Ca), Phosphorus (P), and Potassium (K) are needed for growth, health and bone density. Sweet potatoes, tofu and dried anchovies are food ingredients that are rich in K, P and Ca minerals and can be developed into a supplementary feeding for toddlers that are rich with energy and nutrient sources. The purpose of this study was to determine the effect of the formulation of sweet potato, tofu, and dried anchovies on the quality of energy, nutrients, protein quality and organoleptic quality as supplementary feeding for toddlers. This type of research is a laboratory experimental study using 3 levels of treatments with different proportions of sweet potato, tofu and dried anchovies. The results of statistical analysis showed that there was no significant effect on the organoleptic quality of color, aroma and texture ($p = 0.13$; $p = 0.74$; $p = 0.29$), and there was a significant effect on the organoleptic quality of taste ($p = 0.04$). The best treatment level was P3 with an energy value of 144.2 Kcal, protein 5.1 grams, fat 7.8 grams, carbohydrates 13.9 grams, fiber 1.3 grams, calcium 58.6 milligrams, phosphorus 68.6 milligrams, potassium 135.2 milligrams.*

Keywords: *Supplementary Feeding, Toddlers, Stunting, Energy Density, Nutritional Content and Quality, Organoleptic Quality, Sweet Potatoes, Tofu, Dried Anchovies*

INTRODUCTION

Every child is the next generation of the nation. As the next generation, every child that is born to be expected to get and have a good quality of life in hope to be able to support the growth of the country. They be called that they have a "good quality" of life only can be seen from the nutritional status of the individual. Individuals who have good nutritional status are not susceptible to disease, both infectious nor degenerative diseases (Kemenkes RI, 2017). Good nutritional status will support the individual growth, development, energy production, immunity, and brain structure and its function.

Based on the results of the 2018 Basic Health Research or Riskesdas, Indonesia currently shows that the proportion of nutritional problems such as stunting and malnutrition status in children under five reaches an average of 30.8% and 17.7% respectively which still does not meet the target of

the National Mid-Term Development Plan for the 2015–2019 period, which are 28% and 17% respectively (Kemenkes RI, 2018).

Stunting when viewed from the level of consumption of nutrients can occur due to deficits not only in macronutrients but also in micronutrients such as Calcium, Phosphorus, Potassium, and Zinc which are known to have a role in growth, health and bone density. Research by Sari, et al (2016) showed that the intake of protein, calcium and phosphorus in stunted children aged 24-59 months was significantly lower than children who were not stunted. Likewise, the intake of Fe and Zinc in Dewi and Nindya's research (2017) which showed the same results. The consumption level factor mentioned above is also stated by the Ministry of Health (2017), namely that nutrition problems are basically a reflection of the consumption of nutrients that has not been sufficient for the body's

needs. A person will have a good nutritional status, if the nutritional intake is in accordance with the needs of his body.

Sweet potato is one of the local food ingredients and a source of carbohydrates that has a fairly high potassium micronutrient that is 210 milligrams/100 grams (Nutri software, 2008). In addition, there is also tofu which can be found easily at the traditional market and is a source of protein which has micronutrients that are quite balanced between Calcium, Phosphorus and Potassium, respectively 124 milligrams, 64 milligrams and 151 milligrams/100 grams. Another protein sources that can also be used is dried anchovies which contain very high calcium and phosphorus micronutrients, respectively 1200 milligrams and 1500 milligrams/100 grams.

Based on the above background, this study aims to analyze the effect of the proportion of sweet potato, tofu and dried anchovies formulations on energy density, nutrient content, protein quality and organoleptic quality (color, aroma, taste and texture) of supplementary feeding products for Toddlers.

METHODS

This research is a laboratory experimental study using three treatment levels with a ratio of the percentage of sweet potato: tofu: dried anchovies for P₁ (0: 99: 1), P₂ (33: 66: 1), P₃ (49.6: 49.6: 0.8).

The main ingredients used in the study were sweet potato, tofu, and dried anchovies. The processing tools used in the study included stoves, steamers, frying pans, basins, food scales, stainless plates, spoons, knives, measuring cups, and peelers.

Tools for the data analysis included scientific calculators, laptop or computer which has Microsoft offices, Nutri 2008, and SPSS 16.0 software in it.

RESULTS AND DISCUSSION

Energy Density

In this study, the reference of the daily needs for Toddlers that is being used is for the age between 1 – 3 years old, which based on Minister of Health Regulation No. 28 of 2019 regarding the RDA is 1350 Kcal.

Table 1. Energy Value of Supplementary Feeding Product Formulation

Treatment Level (%) (Sweet Potato : Tofu : Dried Anchovies)	Energy (Kcal)
P1 (0 : 99 : 1)	127.75
P2 (33 : 66 : 1)	138.75
P3 (49.6 : 49.6 : 0.8)	144.25

Taking 10% from the daily needs for the standard of the supplementary feeding which equal to one time snack, Table 1 showed that one portion of supplementary feeding product formulation recipe for each treatment level can meet the needs for daily supplementary feeding intake with the average value around 95 – 100% which mean it is in the “good” category.

Macronutrients

The daily needs of macronutrients for Toddlers aged 1 – 3 years old, based on Minister of Health Regulation No. 28 of 2019 regarding the RDA are 25 grams of protein, 45 grams of fat, 215 grams of carbohydrates and 20 grams of fiber.

Table 2. Macronutrients Value in Supplementary Feeding Product Formulation

Macronutrients	Treatment Level (%)		
	P1	P2	P3
Carbohydrates(g)	6.03	11.29	13.92
Protein (g)	6.93	5.73	5.13
Fat (g)	9.05	8.27	7.88
Fiber (g)	0.4	1	1.3

Taking 10% from the daily needs for the standard of the supplementary feeding which equal to one time snack, Table 2 showed that protein and fat on one portion of product formulation recipe for each treatment level can meet the need > 120%, and for carbohydrates < 90%.

The high result for fat value could be due to the absorption of oil that being used for the frying process. Chicken eggs as additional ingredient in the dough contributes as well to the fat and the protein value. The low result for carbohydrates value could be due to the different proportion of sweet potato in each level treatment as the main carbohydrate source in the product and is the only ingredient with high carbohydrates content compared to the other ingredients that were being used.

Micronutrients

The daily needs of micronutrients for Toddlers aged 1 – 3 years old, based on Minister of Health Regulation No. 28 of 2019 regarding the RDA are 650 milligrams Calcium, 460 milligrams Phosphorus and 2600 milligrams Potassium.

Table 3. Micronutrients Value in Supplementary Feeding Product Formulation

Micronutrients	Treatment Level (%)		
	P1	P2	P3
Calcium (mg)	86.8	68	58.6
Phosphorus (mg)	72.8	70	68.6
Potassium (mg)	117.5	129.3	135.2

Table 3 showed that one supplementary feeding product formulation recipe for each treatment level has a fairly high mineral content of calcium and phosphorus with the average value 90 - 100%, while in Potassium it only meet the need 45 - 52%. The low content of potassium can be due to the different proportion of sweet potatoes and tofu in each level treatment

Protein Quality Value

Protein quality value can be seen from it AAS (Amino Acid Score), NPU (Net Protein Utilization), BV (Biological Value), and Good Digestive Quality.

Table 4. Protein Quality Value in Supplementary Feeding Product Formulation

Treatment Level	AAS	Protein Quality (%)		
		Digestive Quality (C)	NPU	BV
P1	74	87.3	64.6	74
P2	77	88	67.8	77
P3	79	88.5	69.9	79

Table 4 showed that one supplementary feeding product formulation recipe for each treatment level had produced good AAS, BV and Good Digestive Quality (> 70%). AAS is the proportion of essential amino acids utilized by the body compared to those absorbed (Hardinsyah and Martianto, 1992). While digestibility quality means the portion of protein or amino acids that can be absorbed by the body compared to what was consumed. BV showed how suitable the amino acids absorbed by the body to the body's needs (BPOM RI, 2019).

The NPU value was to describe how the protein that can be consumed can be maintained by the body and the result of it in this study showed that each treatment level need be improved by 1 – 5% to meet 70% of need. Based on Sunita (2003), foods that have an NPU and BV value of 70 or more are considered capable of providing growth if they are eaten in sufficient quantities and sufficient energy intake.

Organoleptic Quality

This supplementary feeding product formulation for Toddlers was shaped round like a small ball, the color of it is golden yellow, a little bit crispy on the outside and soft on the inside.

Table 5. Organoleptic Quality in Supplementary Feeding Product Formulation

	Organoleptic							
	Color		Aroma		Taste		Texture	
	\bar{X}	M	\bar{X}	M	\bar{X}	M	\bar{X}	M
P1	3.5	4 ^a	3.2	3 ^a	3.1	3 ^a	3.4	3 ^a
P2	3.1	3 ^a	3.1	3 ^a	2.5	2 ^b	2.9	3 ^a
P3	3.2	3 ^a	3.2	3 ^a	2.8	2 ^{ab}	2.9	3 ^a

* M = Modus,

** Different notation indicates a significant difference ($\alpha = 0.05$)

Table 5 showed that by the average value, the proportions of sweet potatoes, tofu, and dried anchovies affect the panelists' preference for color, aroma, taste and texture of supplementary feeding products. However, the results of Kruskal Wallis' statistical analysis showed that only the taste parameter had a significant effect ($p = 0.043$) on the panelists' preference level regarding the proportions of sweet potato, tofu, and dried anchovies.

To determine the level of preference of the panelists on taste, further tests were carried out using Mann Whitney analysis for each level of treatment. The results of Mann Whitney's statistical analysis (95%) showed that there was a significant difference between P1 and P2 ($p = 0.012$) which affected the panelists' preference for the taste. Because of the proportion of dried anchovies were the same in each treatment level, the differences of preference can be due to the difference proportion of sweet potatoes and tofu that being used in each treatment level. This is because in P1 there was no sweet potato in it,

while in P2 the proportion of tofu is reduced and replaced with sweet potato.

Meanwhile, between P1 and P3 showed that there was no significant difference ($p = 0.164$) to the level of preference of the panelists for taste. At P2 and P3 also showed that there was no significant difference ($p = 0.292$) on the level of preference of the panelists for taste. If in P1 and P2 the reduced proportion of sweet potato affects the panelists' preference for taste, then the results of the comparison between the two above with P3 indicate that the ratio of sweet potato and tofu can be well received by the panelists if the proportion is 50 : 50.

Through the calculation using the effectiveness index by considering all the variables that play a role in determining product

quality, the result indicated that the best treatment level is P3 with score 0.74.

CONCLUSIONS

The formulations of sweet potato, tofu, and dried anchovies already meet the energy needs of toddlers (10% RDA) aged 1-3 years. The value of protein quality (AAS, BV, and Digestive Quality) in the formulations of each treatment level was in the “good” category. And there is a significant effect ($p > 0.05$) on the level of preference for the taste of the supplementary feeding product formulation. The best treatment level was P3 with an energy value of 144.2 kcal, protein 5.1 grams, fat 7.8 grams, carbohydrates 13.9 grams, fiber 1.3 grams, calcium 58.6 milligrams, phosphorus 68.6 milligrams, and potassium 135.2 milligrams.

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