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Organoleptic Test for the Addition of Red Sweet Potato, Temulawak, Banana Flower, and Goat Milk in Multi-nutrient Biscuit

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ABSTRACT

The enrichment of multi-nutrient biscuits, especially by using local ingredients that are proven to have good nutritional values may address the root causes of stunting, such as low socio-economy status and poor knowledge among the people. Moreover, it is a practical solution to reduce the prevalence of stunting. This research employed a quasi-experimental methodology to observe the acceptance of the addition of red sweet potato, temulawak, banana flower, and goat milk in multi-nutrient biscuit. The research population was all children aged between 6 and 7 months old in Langkat. Data analysis carried out was univariate and organoleptic analysis. There were more female toddlers (66.7%) than male. The majority (86.7%) of the research subjects were healthy during data collection and with no history of any diseases in the past one year (73.3%). They had normal birthweight (86.7%) and complete immunization status (53.3%) and were exclusively breastfed (70%) and not stunted (73.3%). There were two types of biscuit, A1 and A2, with different ratio of goat milk prepared in this study. Biscuit A1 with a reduced proportion of goat milk (15 gr) received the highest acceptability test score for color, aroma, texture, and taste.

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INTRODUCTION

In Asia, Indonesia is the country with the fifth highest prevalence of stunting. According to the Baseline Health Research (Riskerdas) 2013, the prevalence of stunting in Indonesia was 37.2%, with 19.2% of short children and 18% of very short children. Based on the evaluation of stunting handling effectiveness in Indonesia by Riskerdas in 2007, 2010, and 2013, there were only four provinces that managed to significantly reduce stunting prevalence in Indonesia, such as East Kalimantan, Bangka Belitung, Banten, and South Sumatra. Meanwhile, some other provinces experienced constant prevalence values, one of which was North Sumatra.

From the 2017 nutrition status monitoring in North Sumatra, the prevalence of stunted, short, and very short toddlers was 28.4%, 16%, and 12.4% respectively. There were 22 districts in North Sumatra with a higher prevalence than the national average. One of the districts were Langkat, that was at the 13th place with stunting prevalence of 26.2%.

Stunting is a chronic nutritional problem in toddlers that causes them to be shorter than other children their age. It is critical to reduce stunting as early as possible to avoid long-term consequences that affects the growth and development of children. The brain development in stunting cases puts children at a higher risk of developing chronic diseases as adults. Moreover, stunting and other forms of nutritional problems were estimated to have contributed to 2 – 3% loss of gross domestic product (GDP) each year. The effort to break the chain of stunting starts by improving the nutritional intake from the first 1,000 days of life, which is when pregnant mothers carry their children for 9 months until they are two years old.

The addition of nutrient-rich ingredients in the diet, especially those that are commonly found, may be an effective solution to reduce the prevalence of stunting. Multi-nutrient biscuits enriched with beneficial ingredients may become the practical solutions to reduce stunting. Sweet potatoes are high in beta-carotene as antioxidant and calories. Temulawak contains curcumin that stimulates appetite. It also contains high mineral content that promotes bone growth and iron, which helps to prevent anemia in babies. Banana flower contains antioxidant compounds, such as vitamin A and C, and has high fibers that aid digestive functions of the intestinal peristalsis. Goat milk is high in calories, protein, and fat, as well as mineral contents to promote growth and development in babies. Langkat district actually has a large and easy-to-obtain natural resources. However, due to the relatively low level of knowledge and socio-economic status in the community, stunting and anemia, as well as other nutritional problems remain high in children under the age of five in Langkat. Thus, the consumption of local food is a feasible approach to prevent stunting in children in Langkat.

RESEARCH METHODS

This research employed a quasi-experimental research approach, which involved the making of biscuits and conducting organoleptic test to determine which biscuits with the best acceptability. The number of samples for this research was calculated by using Slovin formula, with a minimum of 55 toddlers to involve in this study. However, due to the COVID-19 pandemic, this research only managed to gather 30 research samples. The data collected was primary data from interviews and questionnaires from the mothers who provided exclusive breastfeeding and meeting the inclusion criteria. Next, the data was analyzed by using univariate analysis and followed by organoleptic test. Descriptive analysis described the distribution of each variable. Organoleptic test allowed the determination of biscuits with the best acceptability.

RESULTS AND DISCUSSION

Characteristics of Respondents

The characteristics of respondents describe the characteristics of each observed variable, such as mother's age, education, income, occupation, etc.

Table 1. Mother characteristic distribution:

Characteristic of Respondents	n	(%)
Mother's age		
<25 years old	6	20
25-30 years old	10	33.3
>30 years old	14	46.7
Total	30	100
Mother's education		
Low (uneducated/elementary/ secondary school education)	12	40
High (high school/university education)	18	60
Total	30	100
Income		
High (≥Rp 15,000/person/day)	23	76.7
Low (< Rp 15,000/person/day)	7	23.3
Total	30	100
Occupation		
Stay-at-home mom	28	93.3
Entrepreneur	2	6.7
Total	30	100

Characteristic of Respondents	n	(%)
Hb level during pregnancy		
<11 gr/dl	22	73.3
≥11 gr/dl	4	13.3
Mid-upper arm circumference (MUAC)		
<23.5 cm	25	83.3
≥23.5 cm	5	16.7
TT vaccination		
<2 times	15	50
≥2 times	15	50
Pregnancy examination		
<4 times	12	40
≥4 times	18	60
Fe tablet consumption		
<90 Fe tablets	18	60
≥90 Fe tablets	12	40

Table 1 showed that almost half (46.7%) of the mothers in this research aged >30 years old. The research done by Pratiwi (2016) in Wua-Wua public health center (Puskesmas) showed that most mothers of toddlers aged between 25 and 29 years old (34.1%).

Based on the mother's last education, most of the mothers in this research completed higher education level (60%). A univariate analysis by Fajrina (2016) reported similar findings, where 45 out of 82 mothers of toddlers (54.9%) completed university studies. Based on the statistical analysis carried out, they concluded that there was a correlation between mother's education and stunting incidence. Children whose mothers had lower

education may be at 3.777 times higher risk of suffering from stunting.

Looking at the income per day, the majority of the respondents (76.7%) had high income (≥Rp 15,000/day/person). The research by Ilahi (2017) reported that over half (54.8%) of the respondents in their study were coming from families with monthly income below the minimum wage of Bangkalan district (<Rp 1,414,000).

The vast majority of the respondents in this study did not work or also known as stay-at-home mom (83.3%). Ilahi (2017) also reported a similar finding that the majority (79%) of the mothers of toddlers in their study did not work and they were stay-at-home mom. A mother's occupation may impact on her children's diet. The children whose mothers work outside home may receive less attention, particularly regarding the eating habits. Housewives, who devote more time at home to nurturing their children, tend to have better parenting styles for the growth and development of their toddlers than mothers who have to work outside home.

The status of pregnant mothers, such as the Hb level indicated anemia in pregnant mothers. Hb level <11 gr/dl indicated anemia condition and it is linked to the increased risk of premature birth and death of the mother and baby due to infections. Furthermore, iron deficiency anemia in the mothers may affect the growth and development of the fetuses during pregnancy and the babies after birth. In this study showed that the majority of the mothers (73.3%) had Hb level <11 gr/dl during pregnancy. The study done by Anggraini (2018) showed that the majority of the mothers in their study were not anemic (70.6%), while 29.4% of them experienced mild anemia.

Based on the mid-upper arm circumference (MUAC) of the mothers in this research during pregnancy, the majority (83.3%) had MUAC of <23.5 cm. Pregnant mothers with MUAC <23.5 cm are at risk of chronic energy deficiency (CED). CED is a disorder in which a mother experienced a long-term lack of nourishment (chronic) and causes health concern in the mother. Pregnant women with CED are at risk to deliver babies with low birthweight who are at high risk of mortality, or growth and development disorders. CED has also indirectly become the cause of death in pregnant women. A research done by Zaif et al (2017) reported that the majority of the pregnant women in their study (82.5%) did not experience CED. The statistical analysis showed no significant relationships between the MUAC of pregnant mothers and the growth of their toddlers based on Z-score body height/age (p=0.218) and body weight/body height (p=0.089). Another study by Alfarisi et al (2019) reported the majority of the pregnant women (64.1%) in their research did not suffer from CED (MUAC ≥23.5 cm).

Based on tetanus toxoid (TT) vaccination, half of the pregnant mothers in this research had <2 times TT vaccination, while the other half had ≥2 times TT vaccination. The immunization against tetanus toxoid (TT) for pregnant women and their unborn fetuses are known to provide the immunity against TT. In order to ensure a complete immunization, TT vaccine should be given before entering the eighth month of pregnancy. TT vaccination is given twice to pregnant mothers. The study conducted by Yunica (2016) showed that over half of the pregnant mothers in their research received a complete TT vaccine (55.7%).

Over half (60%) of the mothers in this research had ≥4 times pregnancy examination. Based on Fe supplementation, over half (60%) of the mothers consumed <90 Fe tablets during pregnancy. It is recommended for pregnant women to consume at least 90 pills of iron supplementation during their pregnancy. Statistical analyses showed a significant relationship between the adequacy of iron and stunting incidence. Nurdin (2019) reported that regular iron consumption in pregnant women was influenced by knowledge about the importance of Fe adequacy, support gained from the husbands, participation in counselling about the importance of Fe, availability of Fe, and beliefs and good attitude about Fe importance. Counselling was found to be the most influential factor in maternal adherence to Fe pill consumption.

Table 2. Frequency distribution of gender, disease history, birthweight, breastfeeding, and basic immunization status of toddlers

Characteristic	f	%
Gender		
Male	10	33.3
Female	20	66.7
Total	30	100
History of underlying disease	23	76.7
Current disease		
Yes	4	13.3
No	26	86.7
Total	30	100
History of diseases for the past one year		
Yes	8	26.7
No	22	73.3
Total	30	200
Birthweight		
Low (<2500 gram)	4	13.3
Normal (≥2500 gram)	26	86.7
Total	30	100
Breastfeeding status		
Non-exclusive breastfed	9	30
Exclusively breastfed	21	70
Total	30	100
Basic Immunization Status		
Incomplete	14	46.7
Complete	16	53.3
Total	30	100
Stunting		
Yes	8	26.7
No	22	73.3

In this research, there were more female toddlers (66.7%) than male toddlers. Similarly, Hasanah (2018) also reported more female respondents (53%) than male respondents in their study. Based on the history of underlying diseases, most toddlers were healthy (86.7%), while 13.3% were sick during the research activity. The sick toddlers were suffering from acute respiratory infection (6.7%), helminthiasis (3.3%), and fever (3.3%). The majority of toddlers participated in the study (73.3%) were not sick for the last one year, while 26.7% of them were sick. They were suffering from acute respiratory infection (6.7%), pulmonary TB (3.3%), and fever (16.7%). The research done by Nainggolan (2019) in the public health center (puskemas) at the working area of West Bandung reported that the majority of newborns (76.3%) had low birthweight. The statistical analysis showed a correlation between low birthweight and stunting incidence, with a PR value of 25.5 that indicated newborns with low birthweight had 25 higher risks of being stunted compared to newborns with normal birthweight. Birthweight is closely linked to long-term growth and development of children because newborns born with low birthweight have smaller anthropometric measurement for their development.

Based on the breastfeeding status, the majority of the respondents in this research (70%) were exclusively breastfed. Hasanah (2018) reported similar findings that the majority of the infants (74.3%) were exclusively breastfed. The statistical analysis showed a significant relationship between exclusive breastfeeding status history and stunting incidence in the toddlers in the public health center of Kotagede I working area. Fikadu et al (2014) reported a significant relationship between the length of breast milk provision and stunting incidence. The report stated that children given breast milk for <6 months old were at 3.6 times higher risk of developing stunting than children who were exclusively breastfed. Their research reported 39 stunted toddlers (38.6%) even though they were exclusively breastfed. This finding was explainable because besides exclusive breast milk, stunting was also caused by many other factors, such as receiving complementary foods too early or infectious diseases. The research done by Lestari et al (2014) reported higher stunting incidence found in children who did not receive exclusive breast milk and received complementary foods way too early.

Based on the status of basic immunization, over half (53.3%) of the toddlers in this research had received a complete immunization based on their age. Kasim et al (2019) reported that almost all of the toddlers in their study (95.5%) had received complete immunization. Their study also reported that the majority of their respondents had good and sufficient nutritional intake (88.6%), while 6.8% of them were underweight. There were around 4.5% toddlers in their study who had incomplete immunization but with normal nutritional status. The statistical analysis showed no significant relationship between the immunization status and nutritional status in toddlers (nutritional status based on body weight/body height). Immunization in children does not only provide antibody to children but also prevent the risk of infections. In this research, the majority of the toddlers (73.3%) were not stunted and only 26.7% toddlers were stunted. According to the Decree of the Ministry of Health of the Republic of Indonesia No 1995/MENKES/SK/XII/2010 concerning about the anthropometric standards to addressing the nutritional status of children, the definition of short and very short is based on the nutritional status based on the body height or length index according to age (body length/age or body height/age). The analysis in this research concluded that the factors that affect stunting are the non-fulfillment of 14 normal variables that influenced stunting incidence, which were found in 8 toddlers in Langkat district.

Table 3. Distribution of knowledge, attitude, and behavior of the respondents' mothers

Characteristic	f	%
Knowledge		
High	17	56.7
Low	13	43.3
Total	20	100
Characteristic	f	%
Attitude		
Good	15	50
Poor	15	50
Total	30	100
Behavior		
Good	17	56.7
Poor	13	43.3
Total	30	100

Table 3 shows the characteristic of the mothers involved in this study in terms of their knowledge, attitude, and behavior about stunting and how to prevent it. Over half of the mothers were knowledgeable (56.7%). Knowledge is an important basis that determines one's actions. Knowledge based on good understanding allow positive attitude that results in desirable actions. The research by Olsa et al (2017) reported that almost half of their respondents (48.7%) had adequate knowledge about stunting. The statistical analysis showed a significant relationship between mother's knowledge and stunting incidence. This research showed the prevalence of stunting in Langkat district was 26.7% in 2017 remained high. This result was because the proportion of mother with poor knowledge about stunting remained high (43.3%). The study done by Munthofiah (2008) showed that the knowledge of mothers about health and parenting has an influence on the nutritional status of the children. Mothers with good knowledge is 17 times more likely to have children with good nutritional status compared to mothers with poor knowledge. Fajriani (2020) reported a significant relationship between balanced nutrition behavior, which includes knowledge, attitude, and behavior, and the nutritional status of

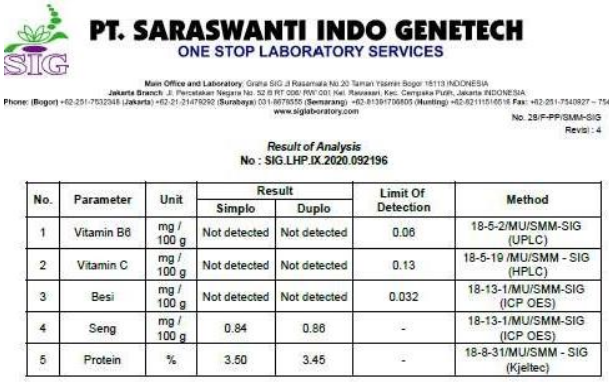
children between 2 and 5 years old. From the qualitative research showed that nutritional problems in toddlers is also affected by the socio-economic status of the family, parenting patterns, as well as the culture in the community.

Table 4. Characteristics of multi-nutrient biscuits with red sweet potato, temulawak, banana flower, and goat milk

Characteristic	Multi-nutrient biscuit	
	A1	A2
Color	Brownish-yellow	Brownish-yellow
Aroma	Neutral	Quite fishy
Flavor	Sweet like biscuits	Quite fishy and not sweet
Texture	Quite crispy	Quite soggy

Remarks :
A1 = Red sweet potato flour 40 gr, goat milk powder 15 gr, temulawak ½ tsp, and banana flower 1 tbsp
A2 = Red sweet potato flour 40 gr, goat milk powder 30 gr, temulawak ½ tsp, and banana flower 1 tbsp

Nutritional Content of Multi-nutrient Biscuits



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Result of Analysis
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No.	Parameter	Unit	Result		Limit Of Detection	Method
			Simplo	Duplo		
1	Vitamin B6	mg / 100 g	Not detected	Not detected	0.06	18-5-2/MU/SMM-SIG (UPLC)
2	Vitamin C	mg / 100 g	Not detected	Not detected	0.13	18-5-19 /MU/SMM - SIG (HPLC)
3	Besi	mg / 100 g	Not detected	Not detected	0.032	18-13-1/MU/SMM-SIG (ICP OES)
4	Seng	mg / 100 g	0.84	0.86	-	18-13-1/MU/SMM-SIG (ICP OES)
5	Protein	%	3.50	3.45	-	18-8-31/MU/SMM - SIG (Kjeltec)

Figure 1. Lab test result for the nutritional content of multi-nutrient biscuit

Based on the result of laboratory testing to assess the nutritional content in the multi-nutrient biscuit used in this study, there were 0.86mg/100mg zinc content and 3.45% protein content. Protein is an important nutrient for the growth in toddlers. The quantity and quality of protein intake has an effect on the insulin growth factor 1 (IGF-1) plasma and the bone matrix protection plays an important role in the formation of bone. Zinc plays role to promote good immune system, accelerate wound healing, aid sensing (smell and taste) ability, as well as play important roles in the cell growth, cell division, body metabolism, and child growth. The research done by Sundari (2016) showed a significant relationship between protein intake and Z-score body height/age index in the incidence of stunting. Similarly, Anidiyah (2015) reported similar findings in their research involving toddlers. They reported a relationship between the adequacy of protein and child growth. Besides that, the research showed that the majority (75%) of toddlers with lack of protein had stunted growth. Zinc plays a role in T-cell function, such as in the formation of antibodies by B cells. Zinc deficiency will affect growth hormones, such as low insulin like growth factor 1 (IGF-1), growth hormone (GH), receptors and GH binding RNA protein. Low concentration on these hormones may inhibit a linier growth until the cessation of weight growth. Infancy is a period of rapid growth (growth spurt) causing rapid tissue synthesis that results in low zinc serum and plasma. Zinc also plays a role in the formation and mineralization of bones. Therefore, in cases with zinc deficiency, the metabolism of GH is inhibited which results in the reduction of IGF-1 synthesis and secretion. With nutritional contents that are very beneficial for the growth of toddlers to prevent stunting, multi-nutrient biscuits become one of the best choice to be consumed by toddlers. Moreover, multi-nutrient biscuits are practical and instant choices for mothers to fulfil the nutritional needs of toddler to prevent stunting.

Organoleptic Test Analysis

Table 5. Multi-nutrient biscuit assessment for color

Assess-ment	Sco-re	A1			A2		
		Panelist	Score	%	Panelist	Score	%
Like	3	26	78	86.7	24	72	80
Like less	2	4	8	13.3	6	12	20
Dislike	1	0	0	0	0	0	0
Total		30	86	100	30	84	100

The organoleptic test for color criteria showed the highest score, such as 78 (86.7%), for biscuit A1. Meanwhile, A2 biscuit received 72 (80%) score. Based on the total score received by the two types of biscuits, the respondents showed better acceptance in biscuit A1 compared to biscuit A2.

From the result of the normality test, the organoleptic test for color of the multi-nutrient biscuit was not normally distributed with a significant value 0.000< α (0,05). Kruskal Wallis analysis test showed a significance value of 0.492 > α (0,05) which indicated no significant difference between A1 and A2 biscuit variance. The result of this study showed no significant difference in the color of both biscuits because they had the same color, such as brownish-yellow identic with the color of biscuits in general. Because of that similarity, the respondents could not choose which color they liked

and which color they did not.

Table 6. Multi-nutrient biscuit assessment for aroma

Assess-ment	Score	A1			A2		
		Panelist	Score	%	Panelist	Score	%
Like	3	20	60	66.7	18	54	60
Like less	2	9	18	30	6	12	20
Dislike	1	1	1	3.3	6	6	20
Total		30	79	100	30	72	100

The results of the organoleptic test for the aroma of the biscuits showed that A1 biscuit received 60 (66.7%) score, while A2 biscuit received 54 (60%) score. The total score concluded that the respondents prefer the aroma of A1 biscuit to A2 biscuit. A2 biscuit contained more goat milk than A1 biscuit. Goat milk produced a fishier smell. Therefore, A2 biscuit developed a fishier smell than A1 biscuit.

The normality test for aroma of the multi-nutrient biscuit was not normally distributed with a significant value of 0.000< α (0.05). The analysis by Kruskal Wallis test resulted in a significance value of 0.350 > α (0.05) indicated no significant relationship between the aroma of A1 and A2 biscuit.

Table 7. Multi-nutrient biscuit assessment for texture

Assess-ment	Score	A1			A2		
		Panelist	Score	%	Panelist	Score	%
Like	33	22	66	73.3	17	51	56.7
Like less	2	8	16	26.7	11	22	36.7
Dislike	1	0	0	0	2	2	6.7
Total		30	82	100	30	75	100

The results of the organoleptic test for the texture of the biscuits showed that A1 biscuit received 66 (73.3%) score, while A2 biscuit received 51 (56.7%) score. The total score concluded that the respondents prefer the texture of A1 biscuit to A2 biscuit.

The normality test for texture of the multi-nutrient biscuit was not normally distributed with a significant value of 0.000< α (0.05). The analysis by Kruskal Wallis test resulted in a significance value of 0.141 > α (0.05) indicated no significant relationship between the texture of A1 and A2 biscuit.

Table 8. Multi-nutrient biscuit assessment for flavor

Assess-ment	Score	A1			A2		
		Panelist	Score	%	Panelist	Score	%
Like	3	25	75	83.3	12	36	40
Like less	2	5	10	16.7	10	20	33.3
Dislike	1	0	0	0	8	8	26.7
Total		30	85	100	30	64	100

The results of the organoleptic test for the flavor of the biscuits showed that A1 biscuit received 75 (83.3%) score, while A2 biscuit received 36 (40%) score. The total score concluded that the respondents prefer the texture of A1 biscuit to A2 biscuit.

The normality test for flavor of the multi-nutrient biscuit was not normally distributed with a significant value of 0.000< α (0.05). The analysis by Kruskal Wallis test resulted in a significance value of 0.000 < α (0.05) indicated a significant relationship between the flavor of A1 and A2 biscuit. The difference between A1 and A2 biscuit was in the composition of goat milk, in which A2 biscuit contained more goat milk than A2 biscuit. The rest of the compositions were in the same ratio.

Niswah (2012) produced Dangke, a type of Indonesian cheese, made of goat milk and soy milk reported that the organoleptic properties of Dangke made of 20% soy milk and 80% goat milk had a less white color, with less smell and unpleasant taste. On the other hand, Sulistyowati et al (2016) assessed the preference of yogurt made of goat milk with the addition of 5%, 10% or 15% durian and reported that goat milk yogurt with the addition of 15% was the most favorable. Durian has a strong and pungent taste that could neutralize the unpleasant taste from the goat milk. Therefore, goat milk yogurt with the highest composition of durian became the most favorable.

CONCLUSION

The following conclusions are drawn from the results of this research:

1. The distribution of the respondents' mothers showed that most mothers were >30 years old (46.7%), stay-at-home mom (93.3%), and highly educated (60%). They had high income (76.7%), <11 gr/dl Hb level during pregnancy (73.3%), <23.5 cm MUAC (83.3%), <2 times TT vaccination (50%) and ≥22 times TT vaccination (50%), ≥4 times pregnancy examination (60%), and <90 Fe tablets consumption (60%). Over half of the mothers had good knowledge (56.7%) and behavior (56.7%), and half of them had good attitude.
2. Based on the distribution of toddlers as respondents, there were more female

toddlers (66.7%) than male. The majority (86.7%) of the research subjects were healthy during data collection and with no history of any diseases in the past one year (73.3%). They had normal birthweight (86.7%) and complete immunization status (53.3%), were exclusively breasted (70%) and not stunted (73.3%).

3. Goat milk biscuit A1 with a reduced proportion to 15 gr received the highest acceptability test score for color, aroma, texture, and taste, such as 86.7%, 66.7%, 73.3%, and 83.3% respectively. There were different results for the taste preference assessment, unlike the preference for color, aroma, and texture.

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