

Fortification of *Moringa Oleifera* Leaves on Traditional Cakes as Supplementary Food for Under Five Aged Children in *Posyandu*

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ABSTRACT

Under five children are an age group of vulnerable where they are still vulnerable to a wide range of health and nutritional disorders because they are still in growth and development period. The decrease in prevalence of wasting in Indonesia is still not in accordance with national medium term development plan (RPJMN) target. One of the efforts that can be done to improve the nutritional status of under five children are through the provision of supplementary feeding to the program Posyandu. In general, this research aims to develop supplementary food based on local foods that have been fortified with moringa leaves. The spesific purpose in this study was: 1) To formulation of traditional cakes that were fortified with moringa oleifera leaves; 2) To analyze the preferences level of traditional cakes that are fortified with moringa oleifera leaves; 3) To analyze nutrient content of traditional cake fortified with moringa oleifera leaves. The research method is experiment with complete random design. The results showed that the supplementary food from traditional cakes that are fortified with moringa oleifera leaf powder and fresh moringa oleifera leaves have a higher nutrient content in comparison with cakes that are not fortified. Analysis of the hedonic levels and the respondent's receiving of additional food in the Moringa oleifera leaves indicates that the most preferred cake is that given the addition of the leaves powder to 5%.

Keywords: *Moringa oleifera leaves, traditional cake, under five children*

I. INTRODUCTION

Toddlers are vulnerables group, they are still very vulnerable to various kinds of health and nutrition disorders because toddlers still in growth process. According to Cusick et al (2017), malnutrition that occurs in toddler stage can reduce the number of brain cells in their own brain. At this stage, the golden age period is also happening, where all the skills or peculiarity that are owned at this time can't be repeated for the second time, this period is also a time to determine for the next life, so the intervention in this stage is, a golden opportunity to determine the quality of the next life. (Uce,2017). One intervention that can be done to maximize the growth and development of toddlers is through nutrition interventions.

Supplementary feeding (SP) for toddlers is one of the government programs that aims to complete the nutritional needs in order to achieve the ideal weight according to age (The Ministry of Health of Indonesia, 2016). Supplementary feeding (SP) in various countries has been proven to be able to improve the nutritional status of children under five, both children under five who experience nutritional problems and children under five with normal conditions. The results of Iskandar's research (2017) show that supplementary feeding which is modified in the form of 150 grams porridge and given for 30 days to

toddlers can reduce the number of toddlers with poor nutritional status and malnutrition. Supplementary food that are given to children with moderate acute malnutrition for 12 weeks, shows a positive impact on improving nutritional status at the end of the intervention and 12 months after the intervention process (Trehan et al, 2015). Types of supplementary feeding for toddlers consist of two types, these are, supplementary feeding for recovery, and supplementary feeding for education in Posyandu. Supplementary feeding for recovery is aims for malnourished children under five in the form of additional primary foods, which made from local food ingredients. supplementary feeding for education in Posyandu is made to help fullfilling the nutritional needs of children under five years of age which is carried out by Posyandu. Usually, the form of food of this supplementary food is snacks (Dumen Sumenep, 2015) The supplementary feeding for education can also be used as an educational media for mothers of toddlers about a variety of dishes for children, to improve the nutritional status of toddlers, can be done to give an educational practice of feeding for the mothers of toddlers. The results of the study of Gandhi et al (2014) show that there is a relation between malnutrition of toddlers and feeding practices.

Observations from several Posyandu activities, in general the cadre of Posyandu providing the supplementary food

in the form of biscuits and milk boxes. This is not fit with government rules that supplementary food should be made from local food which is abundant in the local area. Moringa Oleifera leaves according to WHO is a miracle leaf, because, the nutritional and non-nutritional content such as antioxidant components in Moringa leaves are very good for health. According to Dhakar et al (2011), the amino acid content in moringa leaves is a better source of non-animal protein when compared to soybeans. According to Ravani et al (2017), almost all parts of the Moringa tree, very rich in protein, vitamins and minerals such as potassium, calcium, phosphorus, iron, folic acid and beta carotene.

Moringa leaf fortification in food dishes has proven to be beneficial for children's health. The results of Zakaria et al's study (2012) show that the fortification of Moringa leaf powder added to daily food can increase the body weight of malnourished children. Research with case control design, proves that 76.9% of malnourished children gaining weight while in the control group of children who gain weight only 60%. Moringa leaf fortification carried out in malnourished children in Togolese Africa can provide benefits in improving children's anemia status, this is indicated by an increase in red blood cells, hemoglobin and hematocrit (Bénissan et al, 2012). Moringa leaf fortification in making supplementary food extension provided at every Posyandu activity is expected to contribute in improving the nutritional status and health of children under five.

In general, this research aims to develop supplementary food based on local foods that have been fortified with moringa leaves. The spesific purpose in this study was: 1) To formulate the traditional cakes (Sosis solo) that were fortified with moringa oleifera leaves; 2) To analyze the preferences level of traditional cakes (Sosis solo) that are fortified with moringa oleifera leaves.

II. METHOD

1. Design, Place, and Time

This research is an experimental study with a completely randomized design (CRD) one factor, which is the proportion of Moringa leaf flour in the formula of sosis solo S25, S50, S75. The research was done in May - July 2019. The research site was in the Patiseri Laboratory, Home Economic Departement, Universitas Pendidikan Indonesia, West Java, Indonesia.

2. Materials and Tools

The Ingredients that used in making of sosis solo skin fortified with Moringa leaves are glutinous rice flour, moringa flour, milk, thick coconut milk, water, egg yolks, corn flour, milk powder, salt and pepper. The ingredients for making the filling of the sosis solo fortified with Moringa leaves are tempeh, carrot, catfish, celery, cheese, leek, onion, garlic, egg, corn flour, salt, sugar, milk, moringa leaf, pepper and cooking oil. The equipment that used in making of sosis solo with Moringa leaves is divided into 3 parts, these are, preparation tools,

processing tools and presentation tools. Preparation tools include scale, bowl, knife, chopping board, measuring cup, greater, strainer, balloon whisk, spoon, fork, whisking bowl, peeler, napkin, brush, and hand glove. Processing tools include frying pan, wooden spatula, sheet pan, gas stove, strainer, and sauce pan, the tools for serving of sosis solo is dinner plate.

3. The Research Step

This research was started by composing the formula of sosis solo fortified with Moringa leaves which is used for making sosis solo as supplementary food for children at Posyandu in the form of snacks. The next stage is the process of making sosis solos, then an organoleptic test. The next step is analyzing the nutritional content of prepered formula.

4. The Organoleptic Character of Sosis solo

The Organoleptic test of selected formula using hedonic test. The hedonic test is testing the extent of preference for the product, this preference test is carried out using a trial product with several formulations named 25, S50, S75. This hedonic test was carried out on 35 panelists. The panelists were the students of culinary education program at Universitas Pendidikan Indonesia. This Organoleptic test uses a line scale of 1 - 5. The hedonic test parameters for sosis solos include appearance, color, aroma, taste, texture, and overall assessment. The scale used for these parameters is (1) very like, (2) Like, (3) neutral, (4) dislike, (5) very dislike.

5. Data Processing and Analysis

The data was processed using Microsoft Excel 2010 and IBM SPSS statistics version 21. The measurement data obtained by variance (ANOVA) and Duncan at 95% interval to see whether there is influence of treatment or not.

III. RESULTS AND DISCUSSION

1. Formulation and the Process of Making Sosis solo as a Toddler Supplement Food

Traditional cake which was developed for Moringa leaf fortification in this study was sosis solo. Sosis solo is a typical food from the city of solo which is made from ground beef or chicken which wrapped with a skin, made from omelette. In this study, researchers modified the skin of sosis solo using rice flour and moringa leaf powder. Modifications are also done by replacing the ingredients in the sausage solo using tempeh, catfish, moringa leaves, and carrots.

Moringa leaf fortification on sosis solo is done by adding Moringa leaf powder to the sosis solo skin with three formulations, namely S25 which is an addition of 2.5% Moringa leaf powder to the skin mixture, S50 which is a 5.0% addition of Moringa leaf powder to the skin mixture , and S75, namely the addition of 7.50% of Moringa leaf powder to the skin mixture. As well as S10 as a control, that is the dough without added Moringa leaf powder.

Table 1. Percentage formulation of *sosis solo* dough

No	Ingridients	Formula			
		Control	Treatment		
		S 0 %	S 2,5 %	S 5,0%	S 7,5 %
1	Glutenious Rice				
	Flour	16,78	13,47	13,11	12,74
2	Moringa Flour	0,00	3,03	5,57	8,28
3	Milk	6,71	6,73	6,56	6,37
4	Coconut Milk	6,71	6,73	6,56	6,37
5	Water	50,34	50,51	49,18	47,77
6	Egg Yolk	12,08	12,12	11,80	11,46
7	Corn Flour	3,36	3,37	3,28	3,18
8	Milk Flour	3,36	3,37	3,28	3,18
9	Salt	0,34	0,34	0,33	0,00
10	Pepper	0,34	0,34	0,33	0,32
Total Weight		100	100	100	100

S 25' dough has a composition of glutinous rice flour 13,47%, moringa flour 3,03%, milk 6,73%, thick coconut milk 6,73%, water 50,51%, egg yolk 12,12%, corn flour 3,37% milk powder 3,37%, salt 0,34% and pepper 0,34%. S 50' Skin has a composition of glutinous rice flour 13,11%, moringa flour 5,57 %, milk 6,56%, thick coconut

milk 6,56%, water 49,18 %, egg yolk 11,80%, corn flour 3,28% milk powder 3,28%, salt 0,33% and pepper 0,33%. S 75' Skin has a composition of glutinous rice flour 12,74%, moringa flour 8,28%, milk 6,37%, thick coconut milk 6,37%, water 47,77 %, egg yolk 11,46%, corn flour 3,18% milk powder 3,18%, and pepper 0,32%.

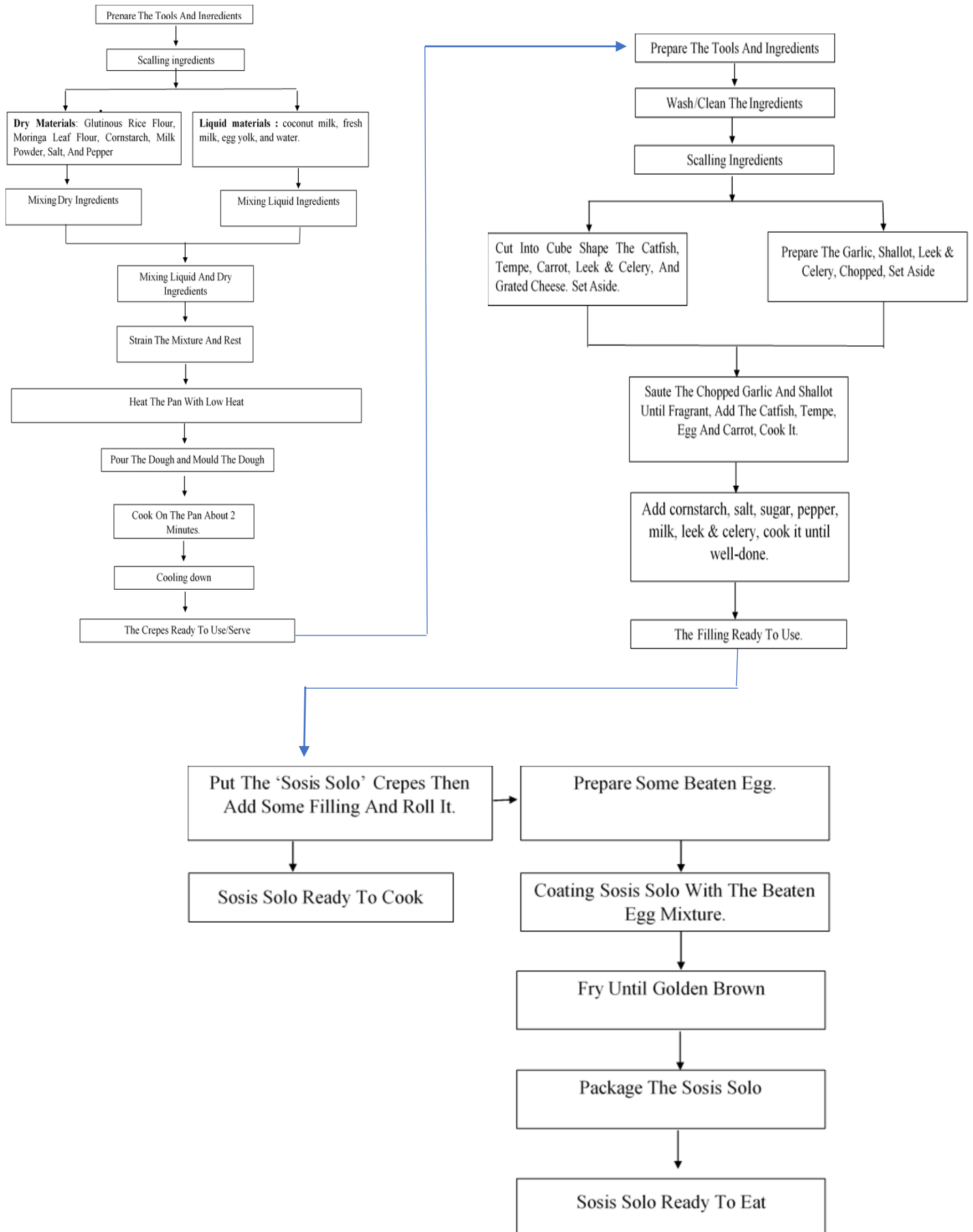
Table 2. Formulation of Sosis Solo Filling

No	Ingridients	Formula			
		Control	Treatment		
		S 0 %	S 25 %	S 50 %	S 75 %
1	Tempeh	27,40	26,74	26,11	25,51
2	Carrot	16,44	16,04	15,67	15,31
3	Cat Fish	13,70	13,37	13,05	12,76
4	Celery	0,82	0,80	0,78	0,77
5	Cheese	5,48	5,35	5,22	5,10
6	Leek	1,10	1,07	1,04	1,02
7	Garlic	2,74	2,67	2,61	2,55
8	Onion	2,74	2,67	2,61	2,55
9	Egg	10,96	10,70	10,44	10,20
10	Corn Flour	2,74	2,67	2,61	2,55
11	Salt	0,55	0,53	0,52	0,51
12	Sugar	1,10	1,07	1,04	1,02
13	Milk	13,70	13,37	13,05	12,76
14	Pepper	0,55	0,53	0,52	0,51
15	Fresh Moringa Leaves	0,00	2,41	4,70	6,89
Total Weight		100	100	100	100

Table 2 showa S 25 filling has the composition of tempeh 26.74%, carrot 16.04%, catfish 13.70%, celery 0.82%, cheese 5.35%, leeks 1.07%, onion 2.67%, garlic 2.67%, eggs 10.70%, corn flour 2.67%, salt 0.53%, sugar 1.07%, liquid milk 13.37%, pepper 0.53 %, Moringa leaves 2.41%. S 50 filling has the composition of tempeh 26.11%, carrot 15.67%, catfish 13.05%, celery 0.78%, cheese 5.22%, leeks 1.04%, onion 2.61%, garlic 2.61%, eggs 10.44%, corn flour 2.61%, salt 0.52%, sugar 1.04%, milk 13.05%, pepper 0.52 %, Moringa leaves 4.70%. S 75 filling has the composition of tempeh 26.74%, carrot

16.04%, catfish 13.70%, celery 0.82%, cheese 5.35%, leeks 1.07%, onion 2.67%, garlic 2.67%, eggs 10.70%, corn flour 2.67%, salt 0.53%, sugar 1.07%, liquid milk 13.37%, pepper 0.53 %, Moringa leaves 2.41%

2. Step of Making



The result of sosis solo can be seen in figure 1

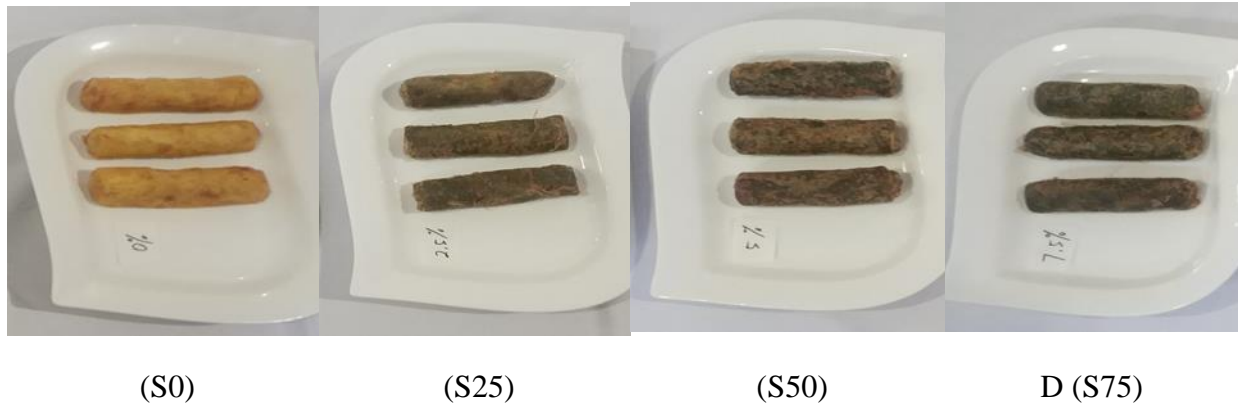


Figure 1. Sosis solo in various formulation

3. Organoleptic Characteristics of Sosis Solo as a Toddler Supplement

Data from the hedonic test on Sosis Solo products WITH S 25 S 50 and S 75 treatments are presented in a bar diagram, the presentation of a hedonic test of solo sausages in a bar diagram.

1) Appearance

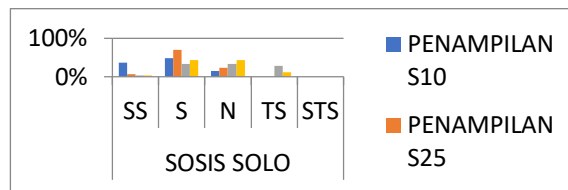


Figure 2. Organoleptic Appearance characteristics of Sosis Solo

Referring to the Fig 2, The hedonic test results on S25 products with the sensory appearance category show that, 6% of panelists said they really liked, 71% said they liked, and 23% stated they were neutral. The hedonic test results on S 50 products with the appearance sensory category showed that, as many as 3% of the panelists said they really liked, 34% said they liked, 34% said they were

neutral, and 29% said they didn't like it. The hedonic test results on the S 75 products with the color sensory category showed that, as many as 3% of panelists said they really liked, 43% said they liked, 43% said they were neutral, and 11% said they didn't like it.

2) Color

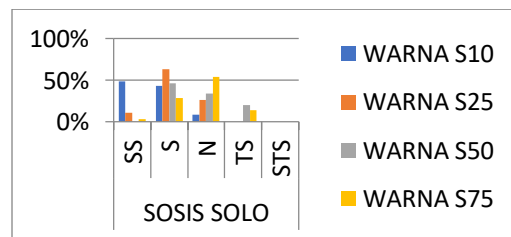


Figure 3. Organoleptic Colour characteristics of Sosis Solo

Referring to the fig 3. The hedonic test results on S25 products with the color sensory category showed that, 11% of panelists said they really liked, 63% said they liked, and 26% said they were neutral. The hedonic test results on the S 50 products with the color sensory category showed that, as many as 46% of panelists said they liked, 34% stated

neutral, and 29% said they did not like it. The hedonic test results on the S 75 products with the color sensory category showed that, as many as 3% of panelists said they really liked, 29% said they liked, 54% said they were neutral, and 14% said they didn't like it.

3) Taste

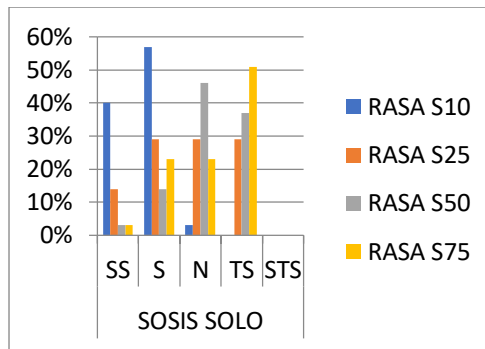


Figure 4. Organoleptic Taste characteristics of *Sosis Solo*

Referring to fig 4. The hedonic test results on S25 products with the taste sensory category showed that, 14% of panelists said they really liked, 29% said they liked, 29% said they were neutral, and as many as 29% said they did not like it. The hedonic test results on the S 50 products with the taste sensory category showed that, as many as 3% of the panelists stated that they liked it very much,

14% said they liked it, 46% said it was neutral, and 37% said they did not like it. The hedonic test results on the S 75 products with the color sensory category showed that, as many as 3% of panelists said they really liked, 23% said they liked, 23% said they were neutral, and 51% said they didn't like it.

4) Flavour

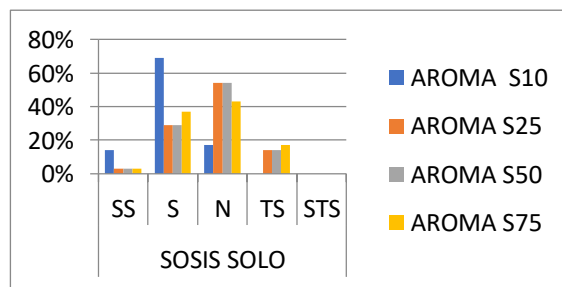


Figure 5. Organoleptic Flavour characteristics of *Sosis Solo*

Referring to the Fig.5 The hedonic test results on S25 products with the Flavour sensory category showed that, as many as 14% of panelists said they really liked, 69% said they liked, and 17% said they were neutral. The hedonic test results on the S 50 products with the aroma sensory category showed that, as many as 3% said they really

liked, 29% expressed like, 54% stated neutral, and 14% said they disliked. The hedonic test results on S 75 products with the aroma sensory category showed that, as many as 3% said they really liked, 37% said they liked, 43% said they were neutral, and 17% said they didn't like.

5) Texture

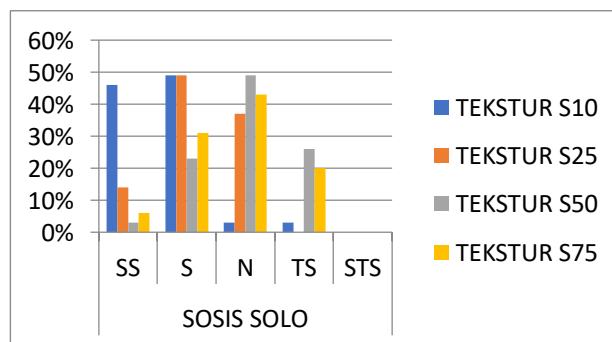


Figure 6. Organoleptic Texture characteristics of *Sosis Solo*

Referring to the Fig 6. the hedonic test results on S25 products with the texture sensory category showed that, 14% of panelists said they really liked, 49% said they liked, and 37% said they were neutral. The hedonic test results on the S 50 product with the texture sensory category showed that, as many as 3% said they really

liked, 23% stated they liked, 49% stated neutral, and 26% stated they did not like it. The hedonic test results on the S 75 product with the texture sensory category showed that, as many as 6% said they really liked, 31% said they liked, 43% said they were neutral, and 20% said they didn't like it.

6) Overall Impression

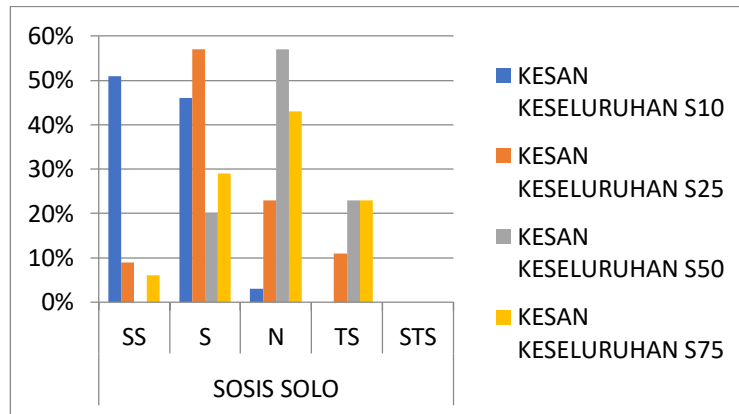


Figure 7. Organoleptic Over all Impression characteristics of Sosis Solo

Referring to fig.7 the hedonic test results on the S25 product with the overall sensory impression category showed that, as many as 9% of panelists said they really liked, 57% said they liked, 23% said they were neutral, and 11% said they didn't like. The hedonic test results on S 50 products with the overall impression sensory category showed that, as many as 20% said they liked, 57% said they were neutral, and 23% said they did not like it. The hedonic test results on S 75 products with the overall impression sensory category showed that, as many as 6% said they really liked, 29% said they liked, 43% said they were neutral, and 23% said they didn't like it. Hedonic Test Data that has been processed in table 4.7 is then of the ANOVA and Duncan's test on solo sausage products with treatments S 25, S 50, and S 75 can be seen in the table 3

analyzed using the ANOVA method and Duncan's follow-up test to find out whether treatment (t) has a significant effect on the level of panelists' preference.

4. Favorite Level of sosis solo as a Toddler Supplement

The data collected on the hedonic test were then analyzed using Microsoft Excel software for ANOVA test with 95% or 0.05 confidence intervals. then researcher performed a Duncan test to find out which Products had the highest level of preference. The results

Table 3 Panelist hedonic average value of the organoleptic test of Sausage Solo as supplementary food based on the type of product

Treatment	Colour	Teksture	Moringa Aroma	Egg Aroma	Saltiness	Savouriness	Shape	Moringa Filling	Egg Filling	Fish Filling	Teksture Filling	Average Score
S 25	63,51 a	4,79 a	5,06 a	5,23 a	4,96 a	5,35 a	9,20 a	5,98 a	7,06 a	5,98 a	8,22 a	11,4 a
S 50	93,91 b	5,31 a	5,76 a	5,50 b	5,31 a	6,34 b	9,22 a	7,30 a	7,67 a	6,49 a	9,50 a	14,8 a
S 75	102,02 b	5,65 b	9,28 b	5,77 b	6,63 b	7,70 c	11,90 a	9,61 b	10,21 b	7,39 a	9,76 a	16,9 a

Data in the table 3 are given group notation "a", "b", and "c", notation "a" given to the group with the lowest preference level, and notation "c" is the group with the highest preference level, Duncan test result can be in one group if the level of product preference is not significantly different from each other (being in one group), if there is double-correlated data, it means that the data is between 2 groups.

The results of the level of preference test for S 25, S 50 and S 75 products in the color category show 2 different notations, this shows that the three research products have different taste preferences, products with the notation "a", S 25 products are products with a low preference level, and products with the notation "b", S 50 and S 75, are products with the highest preference level.

The results of the level of preference test for S 25, S 50 and S 75 products in the texture category show 2 different notations, this shows that the three research products have different taste preferences, products with the notation "a", S 25 and S 50 is a product with a low preference level, and a product with the notation "b", S 75 product is the product with the highest preference level.

The results of the level of preference test on S 25, S 50 and S 75 products in the Moringa aroma category showed 2 different notations, this shows that the three research products have different taste preferences, products with the notation "a", S 25, and S 50 is a product with a low preference level, product with the notation "b", S 75 is a product with a high preference level.

The results of the level of preference test for S 25, S 50 and S 75 products in the egg aroma category showed 2 different notations, this shows that the three research products have different levels of preference for aroma of eggs, products with the notation "a", S 25 products is a product with a low preference level, and a product with the notation "b", S 50 and S 75 products are the products with the highest preference level.

The results of the test level on the products S 25, S 50 and S 75 in the category of saltiness showed 2 different notations, this shows that the three research products have a level of salt taste preferences that are not significantly different, products with the notation "a", S 25, and S 50 are the products with the lowest preferred level, products with the notation "b", S 75 product is the product with the highest preferred level.

The test results on the level of preference on S 0, S 25, S 50 and S 75 products in the savory taste category showed 3 different notations, this shows that the three research products have significantly different taste preferences, with products with the notation "a", S 25 products are products with the lowest liking level, products with the notation "b", S 50 products are products with moderate preference level, and products with notation "c", S 75 products are products with the highest preferred level.

The results of the level of preference test on the S 25, S 50 and S 75 products in the shape category do not show different notations, all products are in the "a" notation, this shows that the three research products have a degree of likeness that is not significantly different

The results of the level of preference for S 25, S 50 and S 75 products in the Moringa content category show 2 different notations, this shows that the three research products have a level of preference for Moringa content that is not significantly different, products with the notation "a", namely products, S 25, and S 50 are the products with the lowest preferred level, products with the notation "b", ie the S 75 product is the product with the highest preferred level.

The results of the S 25, S 50 and S 75 preference levels in the egg filling category show 2 different notations, this shows that the three research products have different levels of preference for egg contents, products with the notation "a", 25, and S 50 is the product with the lowest level of preference and the product with the notation "b", ie the

product S 75 is the product with the highest level of preference

The results of the level of preference test on the S 25, S 50 and S 75 products in the fish filling category did not show any different notation, all products were in the "a" notation, this showed that the three research products had a degree of likeness that was not significantly different

The results of the test of the level of preference on the S 25, S 50 and S 75 products in the texture content category do not show different notations, all products are in the "a" notation, this shows that the three research products have a degree of likeness that is not significantly different

The average test level of S 25, S 50 and S 75 shows 1 similar notation, this shows that the three research products have a preference level that is not significantly different, however, products that have

IV. CONCLUSION

The product formula for sosis solo with S 25 treatment was 13.47% glutinous rice flour, 3.03% moringa flour, 6.73% liquid milk, 6.73% thick coconut milk, 50.51% water, 12.12% egg yolk, 3.37% corn flour, 3.37% milk powder, 0.34% salt, and 0.34% pepper. The product formula for sosis solo with S 50 treatment was 13.11% glutinous rice flour, 5.57% moringa flour, 6.56% liquid milk, 6.56% thick coconut milk, 49.18% water, 11.80% egg yolk, 3.28% corn flour, 0.33% salt, and 0.33% pepper. The product formula for sosis solo with S 75 treatment was 12.74% glutinous rice flour, 8.24% Moringa flour, 6.37% liquid milk, 6.37% thick coconut milk, 47.77% water, 11.46% egg yolk, 3.18% corn flour, 3.18% milk powder, and 0.32% pepper.

The hedonic test results with ANOVA analysis and Duncan's follow-up test stated that the level of preference of the three research products showed significant differences in the sensory categories of color, texture, moringa aroma, egg aroma, salty taste, savory taste, moringa content, and egg content, products that have the highest level of preference in the sensory category is the S 75 product, while the level of preference of the three products in the shape category does not differ significantly. The product with the highest average level of preference is the S 75 product and the product that has the lowest level of preference is the S 25 product.

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