
Effect of Variations in Concentration and Length of Soaking Leaf Extract *Moringa (Moringa Oleifera)* to Bioavailability Content Nutrition and Response Antioxidant Flour Bucket (*Artocarpus Communist*) As Material Raw Making Biscuit MP-ASI

Husain Panggi¹, Sunarto Kadir², Vivien Novarina A. Kasim³

^{1,2,3}Department of Public Health, Postgraduate, Gorontalo State University, Gorontalo City

ABSTRACT: The Effect of Varying Concentrations and Soaking Time of *Moringa Oleifera* Leaf Extract on the Bioavailability of Nutritional Content and Antioxidant Response of Breadfruit Flour (*Artocarpus Communis*) as Raw Material for Making MP-ASI Biscuits. The first 2 years are characterized by very rapid physical and social development and growth which is influenced by food and nutritional intake. The aim is to analyze the effect of variations in concentration and soaking time of *Moringa* leaf extract on the bioavailability of nutritional content in making MP-ASI biscuits. The research used a multi-factor Completely Randomized Design (CRD). Factor x variation of *Moringa* leaf extract concentration 0%; 10%; 20% and 30% and the y factor is the soaking time for 6 hours; 12 hours and 18 hours, each treatment was repeated 3 times. Data Analysis Using Analysis of Variance (ANOVA). significant differences in treatment in DMRT analysis. The research results show that the treatment with a concentration of *Moringa* leaf extract of 30% with a soaking time of 18 hours because the average shows an increase in the antioxidant response and good nutritional content, the antioxidant response is 77.51 ppm (strong), vitamin A 356.08 µg/100, iron (Fe) 9.03 mgFe/ 100. For protein, carbohydrates, fat, water and ash, the best results were obtained from a combination treatment of 30% *Moringa* leaf extract with a soaking time of 6 hours, namely, 10.13% protein, 41.43% carbohydrates, 8.71% fat, 4.95% water and 1.64% ash. There is an influence of variations in concentration and soaking time on the response of antioxidants, protein, carbohydrates, fat, in MP-ASI biscuits as shown by the p value $0.000 < \alpha 0.05$.

KEYWORDS: Concentration, Soaking Time, Extract, *Moringa* Leaves, Breadfruit, MP-ASI

INTRODUCTION

Practice giving MP-ASI Which No appropriate become reason main emergence malnutrition in children. Incidence malnutrition increased significantly from ages 6 to 18 months in several countries. Improper provision of MP-ASI Also can give rise to risk happen stunting. By Because That, need there is training in processing MP ASI by utilizing local food sources, namely fish patin becomes various kinds of preparations for the MP menu breast milk. Based on the results of research conducted by (Al-Rahmad et al, 2013), 70.8% of children under five who are growing optimally receive MP-ASI and there are connection Which significant between incident stunting with giving MP-ASI. Furthermore, according to Hermina and Prihatini (2015), growth in babies and nutritional problems in children are often caused by parental inaccuracies in nutrition giving breast milk and MP-ASI, as well as mothers who are less aware of their babies aged 6 months already need MP-ASI in quantity and quality the good one.

MP-ASI on the market is usually in the form of biscuits and porridge easy to prepare in a short time (Abbas and Suhaeti, 2016). Level Biscuit consumption in Indonesia in 2021 will reach 1.83 kg/capita/year. Number the show growth positive as big as 165% compared to in 2014 which only reached 0.69 kg/capita/year (Food Security Agency, 2021). Biscuits are consumed by all ages, both babies and young people adults with different types of biscuits. Biscuits are classified into four type, between other biscuits hard, crackers, cookies, And wafer (Body Standardization National, 2011). Content carbohydrate Which Enough tall make biscuits normal consumed For breakfast or as food Intermezzo.

Making MP-ASI biscuits without using wheat flour can reduce wheat consumption in Indonesia. It is known that wheat flour contains gluten which cannot be digested properly by autistic children and people with diabetes mellitus. Gluten is a water-insoluble protein complex that functions as a structural member of the product framework found in wheat and other types of seeds. In autistic children, gluten and casein are not allowed to be consumed too much because there will be an increase in intestinal permeability, allowing undigested peptides from casein and gluten to escape from the intestinal wall into the bloodstream

Effect of Variations in Concentration and Length of Soaking Leaf Extract Moringa (*Moringa Oleifera*) to Bioavailability Content Nutrition and Response Antioxidant Flour Bucket (*Artocarpus Communist*) As Material Raw Making Biscuit MP-ASI

(Nugraheni, 2008).

It is necessary to diversify food products as a solution and alternative option for making MP-ASI made from wheat flour, one of which is by using breadfruit (*Artocarpus communis*). Breadfruit has an important role in food source needs because of its high number of calories and nutritional content. Therefore, breadfruit is a non-timber forest plant included in the International Treaty on Genetic Resources for Food and Agriculture data which will contribute to global efforts to ensure food security (Almatsier 2004).

Breadfruit is one of the fruits with a high carbohydrate content and has many advantages, including high calcium and phosphorus content when compared to other nutrients. High phosphorus content can be an alternative fruit to improve people's nutrition because phosphorus has an important role in the formation of essential cell components, plays a role in the release of energy, carbohydrates and fats and maintains body fluid balance (Widowati 2010).

Breadfruit has good nutritional content, but has deficiencies in vitamin A content and low antioxidant activity, so it is necessary to fortify vitamin A and antioxidants that come from plants that have quite high levels of vitamin A and antioxidants, such as Moringa leaves.

The Moringa plant (*Moringa oleifera*) or what is usually called Mother's Best Friends is one of the many plants that is common in Indonesia. Known as moringa (Java), maronggih (Madura), shedding (Flores), barunggai (Sumatra). It has benefits ranging from leaves, flowers, stems, leaves and roots. The part usually used is the leaves (Salim, 2019). Moringa leaves (*Moringa oleifera*) contain large amounts of nutrient A, nutrient C, nutrient B, calcium, potassium, iron and protein, which are easily processed by the human body (Dewi, 2018). The phytochemical content found in Moringa oleifera includes niazirin, niazirinin, flavonoids, anthocyanins, proanthocyanidin, kaempferol-3-O-(6"-malonylglucoside), 4-hydroxymelin, β -sitosterone, β -sitosterone acid, β -sitosterone acid, and β -sitosterol (Kesharwani et al, 2014).

In this research, the bioavailability of antioxidant compounds and vitamin A in breadfruit flour as raw material for making MP-ASI biscuits will be analyzed using varying concentrations of Moringa leaf extract and different soaking times.

METHODS

The research location was carried out at the Food Processing Laboratory, and nutritional content analysis was carried out at the Food Nutrition Analysis Laboratory, UNG. The research period was carried out for 3 months starting from November 2023–January 2024.

This research is a laboratory experimental research design The Post Test-Only Control Group . Using MP-ASI based biscuits breadfruit flour as a research subject. The experiment was carried out by design multi factor complete randomization consisting of % Variation in Leaf Extract Concentration Moringa (X) and Soaking Time (Y) with each factor being replicated three times times as a validation test of the resulting data.

RESULTS AND DISCUSSION

1. Effect of Varying Concentration and Soaking Time of Moringa Leaf Extract To Response Antioxidant Activity

Results analysis bioavailability activity antioxidant on biscuits MP-ASI with variations in concentration and soaking time for Moringa leaf extract as follows

Table 1. Results Analysis Activity Antioxidant

Activity Antioxidant (ppm)			
% Extract	Concentration	LeafLong Immersion	
Moringa		6 O'clock	12 hours
			18 Hours
0 %		176.81 ^a ± 2.57	183.07 ^{ab} ± 4.11
10 %		145.26 ^{bc} ± 3.61	140.51 ^c ± 2.10
20 %		127.74 ^d ± 2.15	109.82 ^e ± 1.97
30 %		98.54 ^{eph} ± 1.23	80.87 ^f ± 0.54
			71.55 ^g ± 1.23

Source : Primary data 2023

Information : Notation letter Which The same pointed out no different real at $\alpha=0.05$

Effect of Variations in Concentration and Length of Soaking Leaf Extract Moringa (*Moringa Oleifera*) to Bioavailability Content Nutrition and Response Antioxidant Flour Bucket (*Artocarpus Communist*) As Material Raw Making Biscuit MP-ASI

Table 2 Modeling Analysis Of Variance (ANOVA) Antioxidant activity

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	48290.736 ^a	11	4390.067	620,357	,000
Intercept	616115.105	1	616115.105	87062.795	,000
Extract_Concentration	46245.390	3	15415.130	2178.301	,000
Soaking_Time	834,074	2	417,037	58,931	,000
Extract_Concentration *	1211.272	6	201,879	28,527	,000
Soaking_Time					
Error	169,840	24	7,077		
Total	664575.681	36			
Corrected Total	48460.576	35			

Source : Primary data 2023

The research results show the influence of variations in concentration and duration immersion extract leaf Moringa to enhancement response antioxidant on MP-ASI biscuits. The higher concentration variations are 10%, 20% and 30% with Soaking time: 6 hours, 12 hours and 18 hours Moringa leaf extract is added, the more good antioxidant response on MP-ASI biscuits. Antioxidant response The highest was obtained in the 30% treatment combination extract leaf Moringa with long immersion 18 O'clock that is 71.55 ppm (strong), while the lowest antioxidant response was obtained in the control treatment combination 0% extract with long soaking Moringa leaf extract with long soaking time 18 hour, namely 187.45 ppm (weak).

2. Effect of Varying Concentration and Soaking Time of Moringa Leaf Extract To Protein Content

Results analysis bioavailability rate proteins on biscuits MP-ASI with Variations in concentration and soaking time for Moringa leaf extract can be seen in On treatment biscuits MP-ASI AS FOLLOWS :

Table 3. Analysis Results Protein Content

% Proteins	Long Immersion		
	6 O'clock	12 hours	18 Hours
0 %	2.03 ^a ± 0.06	1.94 ^{ab} ± 0.09	1.92 ^{ab} ± 0.09
10 %	7.00 ^b ± 0.08	6.44 ^{BC} ± 0.33	6.17 ^{BC} ± 0.17
20 %	8.07 ^c ± 0.32	7.19 ^{cds} ± 0.26	6.40 ^d ± 0.22
30 %	10.13 ^{de} ± 0.25	9.48 ^e ± 0.22	8.20 ^f ± 0.28

Source : Primary data 2023

Information : Letter notation Which same shows no different real at $\alpha=0.05$

Table 4. Modeling Analysis Of Variance (ANOVA) Rate Proteins

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	268,009 ^a	11	24,364	485.214	,000
Intercept	1404.625	1	1404.625	27972.848	,000
Extract_Concentration	256,885	3	85,628	1705.274	,000
Soaking_Time	7,036	2	3,518	70,060	,000
Extract_Concentration *	4,088	6	,681	13,569	,000
Soaking_Time					
Error	1,205	24	,050		
Total	1673,840	36			
Corrected Total	269,215	35			

Source : Primary data 2023

Effect of Variations in Concentration and Length of Soaking Leaf Extract Moringa (*Moringa Oleifera*) to Bioavailability Content Nutrition and Response Antioxidant Flour Bucket (*Artocarpus Communist*) As Material Raw Making Biscuit MP-ASI

Table 4. shows a significant influence on treatment Variations in concentration and soaking time of Moringa leaf extract to increase rate proteins biscuits MP-ASI. Results analysis rate proteins biscuits MP-ASI show happen enhancement rate proteins on biscuit MP-ASI along with the concentration of the extract added was 10% 20% and 30%, while experiencing significant decrease during the soaking process for 6 hours, 12 hours and 18 hours, highest protein content obtained in a combination treatment of 30% leaf extract Moringa with long immersion 6 O'clock that is 10.13% whereas experience decline on long soaking for 18 hours 8.20%.

3. Effect of Varying Concentration and Soaking Time of Moringa Leaf Extract To Carbohydrate Levels

Results of bioavailability analysis of carbohydrate levels in MP-ASI biscuits with Variations in concentration and soaking time for Moringa leaf extract are as follows

Table 5. Analysis Results Rate Carbohydrate

% Carbohydrate			
% Extract Concentration Leaf Moringa	Long Immersion		
	6 O'clock	12 hours	18 Hours
0 %	35.43 ^a ± 0.13	33.64 ^{ab} ± 2.70	32.19 ^b ± 2.67
10 %	38.45 ^b ± 2.66	36.85 ^{bc} ± 2.67	36.73 ^c ± 2.53
20 %	40.05 ^c ± 0.19	38.38 ^{cde} ± 2.71	36.92 ^d ± 5.42
30 %	41.43 ^d ± 2.62	39.87 ^{de} ± 0.06	38.35 ^e ± 2.75

Source: Primary data 2023

Information: Notation letter Which same shows no different real at $\alpha=0.05$

Table 6. Modeling Analysis Of Variance (ANOVA) Level Carbohydrate

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	234,308 ^a	11	21,301	2,952	.013
Intercept	50248.453	1	50248.453	6964.957	.000
Extract_Concentration	184,087	3	61,362	8,505	.001
Soaking_Time	47,224	2	23,612	3,273	.055
Extract_Concentration * Soaking_Time	2,996	6	,499	,069	,998
Error	173,147	24	7,214		
Total	50655.908	36			
Corrected Total	407,455	35			

Source: Primary data 2023

Table 6 showing No exists influence Which significant on combination of treatments varying the concentration and soaking time of Moringa leaf extract. Results analysis rate carbohydrate pointed out exists exists enhancement rate carbohydrates along with increasing concentration of Moringa leaf extract up to 30%, but experienced a decrease in carbohydrate levels with each treatment long soaking 6 hours, 12 hours and 18 clock on MP-ASI biscuits.

Rate carbohydrate highest in get it on combination treatment 30% with soaking time for Moringa leaf extract for 6 hours, it is 41.43%. Meanwhile levels carbohydrate Lowest in get it on combination treatment 0% with long immersion 18 hours.

4. Effect of Varying Concentration and Soaking Time of Moringa Leaf Extract To Rate Fat

bioavailability analysis of fat content in MP-ASI biscuits with variations concentration And long soaking extract leaf Moringa AS FOLLOWS:

Table 7. Analysis Results Rate Fat

% Fat			
% Extract Concentration Leaf Moringa	Long Immersion		
	6 O'clock	12 hours	18 Hours
0 %	6.06 ^a ± 0.03	5.80 ^{ab} ± 0.09	5.46 ^b ± 0.09

Effect of Variations in Concentration and Length of Soaking Leaf Extract Moringa (*Moringa Oleifera*) to Bioavailability Content Nutrition and Response Antioxidant Flour Bucket (*Artocarpus Communist*) As Material Raw Making Biscuit MP-ASI

10 %	8.23 ^b ± 0.02	8.13 ^b ± 0.02	8.05 ^{BC} ± 0.03
20 %	8.32 ^b ± 0.01	8.26 ^{BC} ± 0.02	8.17 ^c ± 0.01
30 %	8.71 ^c ± 0.02	8.45 ^{cds} ± 0.02	8.21 ^d ± 0.01

Source: Primary data 2023

Information: Notation letter Which same shows no different real at a=0.05

Table 8. Modeling Analysis Of Variance (ANOVA) Level Fat

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	43,873 ^a	11	3,988	2117,759	,000
Intercept	2109.412	1	2109.412	1120041.665	,000
Extract_Concentration	42,862	3	14,287	7586.188	,000
Soaking_Time	,771	2	,386	204,714	,000
Extract_Concentration * Soaking_Time	,240	6	,040	21,225	,000
Error	,045	24	,002		
Total	2153,330	36			
Corrected Total	43,918	35			

Source : Primary data 2023

Table 8 shows that there is a significant influence on the combination treatment variation concentration And long immersion extract leaf Moringa. Results Fat content analysis shows that there is a concomitant increase in fat content with increasing density concentration extract leaf Moringa until 30%. However, the fat content decreased with each long soaking treatment 6 hours, 12 hours and 18 hours on MP-ASI biscuits. The highest fat content is obtained in the combination treatment of 30% Moringa leaf extract with a soaking time of 6 hours that is 8.71%. whereas rate fat Lowest on biscuits MP-ASI obtained on combination treatment 0% concentration extract leaf Moringa with long immersion 18 hours with a value of 5.46%.

Effect of Varying Concentration and Soaking Time of Leaf Extract Moringa On Response Antioxidant Activity

Results Analysis Of Variance (ANOVA) pointed out There is influence variation Moringa leaf extract concentration increases the antioxidant response in biscuits MP-ASI ρ value as big as 0,000 ($< \alpha$ 0.05), increase response antioxidant This in influence by increasing variation concentration extract leaf Moringa Which added where the higher the concentration added the greater it is antioxidant response given to MP-ASI biscuits, extract concentration 30% Moringa leaves own bioavailability the good one on antioxidant response (strong). Several research results regarding the phytochemical content of Moringa leaves were obtained that, leaf Moringa own content alkaloids, flavonoids, saponin, triterpenoids/steroids, tannins and an IC50 value of 4.33 mg/mL (Cahyani and Sukadana, 2017). Mechanism antioxidant from compound flavonoids classified antioxidant primary And secondary. Same case with compound phenolic, flavonoids capable donating hydrogen atoms to inhibit the formation of free radicals, and prevent process oxidation with chelate ion metal. Second mechanism That This makes flavonoids have several effects, including inhibiting peroxidation lipids, push damage network by radical free Which trigger disease degenerative in in body (Simanjuntak, 2012)

Results Analysis Of Variance (ANOVA) pointed out exists influence long immersion extract leaf Moringa to enhancement response antioxidant on biscuits MP-ASI ρ value as big as 0,000 ($< \alpha$ 0.05), long immersion capable influence kanaan response antioxidant on biscuits MP-ASI, long Soaking for 18 hours has good bioavailability for antioxidant response (strong) biscuit MP-ASI. Research by Lisna, et al, (2018) Component Characteristics Antioxidant Porridge Corn Traditional Gorontalo with Immersion Extract Leaf Cherry (*Muntingia Calabura L.*) showing exists response availability compound antioxidant And substance nutrition on product porridge corn traditional use long immersion during 12 O'clock. Ascension response antioxidant This influenced by ability compound antioxidant type flavonoids Which decomposed into breadfruit flour during soaking. This is in accordance with Simanjuntak's statement, (2012) which explains that flavonoids are able to donate hydrogen atoms that bond with fish in polymer chain groups so that increases antioxidant activity to inhibit the formation of free radicals, And prevents the oxidation process by chelating metal ions.

Effect of Variations in Concentration and Length of Soaking Leaf Extract Moringa (*Moringa Oleifera*) to Bioavailability Content Nutrition and Response Antioxidant Flour Bucket (*Artocarpus Communist*) As Material Raw Making Biscuit MP-ASI

Effect of Varying Concentration and Soaking Time of Moringa Leaf Extract To Rate Proteins

The results of the Analysis of Variance (ANOVA) show that there is an influence significant in the treatment of variations in the concentration of Moringa leaf extract p value of 0.000 ($< \alpha$ 0.05), the results of analysis of the protein content of MP-ASI biscuits show that this occurs protein content increased along with the concentration of the added extract 10% 20% and 30% Moringa leaf extract. This is thought to be protein absorption in granule flour breadfruit so that rate proteins on biscuits increase. Alamsyah (2015) stated that one of the factors that influences the process absorption is type adsorbate (type, polarity adsorbate, type bond, adsorbate size, mixture viscosity). Research by Zakaria, et al. (2012) explains that leaf Moringa own content proteins Which Enough tall that is 28.25%.

The results of the Analysis of Variance (ANOVA) show that there is an influence significant in the long soaking treatment for Moringa leaf extract p value 0.000 ($< \alpha$ 0.05), the results of protein content analysis showed a decrease in protein levels in Each treatment soaked for 6 hours, 12 hours and 18 hours in MP-ASI biscuits. This is caused by the nature of the protein which dissolves in the soaking water and is wasted with the supernatant during the centrifugation process. Proteins have a molecular weight so large that when the protein is dissolved in water it will form a colloidal dispersion. Proteins can be hydrolyzed by acids, bases, or certain enzymes and produce mixture sour amino (Winarno, 2004). Part big protein when dissolved in water will form a colloidal dispersion and cannot diffuse when missed through membrane semipermeable. A number of proteins easily soluble in water, but some are difficult to dissolve. However, all proteins are not can dissolve in inorganic solvents such as ether, chloroform, or benzene (Yazid, 2006). Alamsyah (2015) stated that one of the influencing factors process absorption is type adsorbate (type, polarity adsorbate, type bond, size adsorbate, mixture viscosity).

Protein intake is said to be good if consumed in sufficient quantities and has good bioavailability . National Standardization Agency No 01-7111.2-2005 explained that the protein content in MP-ASI biscuits is not less than 1.5 grams per one hundred kcal or 6 grams per one hundred grams.

Effect of Varying Concentration and Soaking Time of Moringa Leaf Extract To Rate Carbohydrate

Results Analysis Of Variance (ANOVA) showing exists influence Which significant in the treatment of variations in the concentration of Moringa leaf extract p value of 0.001 ($< \alpha$ 0.05), the results of the analysis of the carbohydrate content of MP-ASI biscuits show that this occurs enhancement rate carbohydrate along with concentration extract Which added 10% 20% and 30% Moringa leaf extract. Increase in carbohydrate levels on biscuits MP-ASI This caused by exists adsorption from content carbohydrate on extract leaf Moringa to in flour breadfruit, increasing concentration extract cause his height pressure on granule flour breadfruit so that can increase Power adsorption. Study Tekle et al, (2015) explained that dried Moringa leaves contain carbohydrates quite high, namely 51.66%. High carbohydrate levels are also influenced by the height content carbohydrate on flour breadfruit. In study Call, 2018 explains that the carbohydrate content of breadfruit flour is carbohydrates 84.53%

The results of the Analysis of Variance (ANOVA) showed that there was no effect Which significant on treatment long immersion extract leaf Moringa p value 0.055 ($> \alpha$ 0.05), the results of the analysis of carbohydrate levels show a decrease in levels carbohydrates in each treatment, the soaking time was 6 hours, 12 hours and 18 hours biscuits MP-ASI. The more long process immersion the more decrease rate carbohydrates in MP-ASI biscuits. This happens because there is a negative correlation with water content during damping which causes the carbohydrate content to dissolve into the water which causes the longer the soaking process to increase amount carbohydrate Which decompose. carbohydrate Which arranged from two unit monosaccharides held together by a glycosidic linkage from carbon 1 of one unit to another OH unit. A common method of bonding is a α or β glycosidic linkage of the first unit to the 4-hydroxyl group of the unit second. Connection This called something bond 1,4'- α or 1,4'- β , depends on stereochemistry on the glycoside carbon soluble in water, slightly soluble in alcohol, And practically insoluble in ether (Sastroamidjojo & Hardjono, 2005).

Effect of Varying Concentration and Soaking Time of Moringa Leaf Extract To Rate Fat

Results Analysis Of Variance (ANOVA) showing exists influence Which significant in the treatment of variations in the concentration of Moringa leaf extract p value of 0,000 ($< \alpha$ 0.05), results analysis rate fat biscuits MP-ASI show happen enhancement rate fat along with concentration extract Which added 10% 20% and 30% Moringa leaf extract. Increase in fat content in MP-ASI biscuits It is thought to be influenced by an increase in the concentration of Moringa leaf extract This causes the fat content in Moringa leaf extract to be absorbed internally breadfruit flour granules resulting in an increase in the amount of flour. Alamsyah (2015) stated that one of the factors that influences the absorption process is type adsorbate (type, polarity adsorbate, type bond, size adsorbate, viscosity mixture). His height concentration extract leaf Moringa on treatment 30% cause pressure Which more tall to the surface granule flour so that more fat is absorbed and enters the flour. This matter in accordance with Amalia et al. (2019), Which state that the more concentrated The concentration of the solution, the higher the substance contained, and the longer it lasts immersion so will be more effective.

The results of the Analysis of Variance (ANOVA) show that there is an influence significant in the long soaking treatment

Effect of Variations in Concentration and Length of Soaking Leaf Extract Moringa (*Moringa Oleifera*) to Bioavailability Content Nutrition and Response Antioxidant Flour Bucket (*Artocarpus Communist*) As Material Raw Making Biscuit MP-ASI

for Moringa leaf extract p value 0.000 ($< \alpha$ 0.05), the results of the fat content analysis showed a decrease in fat content in Each treatment soaked for 6 hours, 12 hours and 18 hours in MP-ASI biscuits. Decreased fat content the presence of protein dissolved deep soaking water can tie sour fat, so that on process washing fat will follow wasted together proteins Which cause fat on biscuits MP-ASI decrease. Research results by Christina Litaay and Joko Santoso (2013) explains that many proteins will bind fat and fat molecules it will be wasted along with protein, resulting in fat content become more low.

Fat is one of the most important food substances for maintaining health body. There is a number of function fat in body, that is as the highest source of energy, protector of the body's internal organs, functions in formation wall cell, help in dissolve vitamin And works in formation of adipose tissue Body Standardization National No 01-7111.2-2005 explain content The fat in MP-ASI biscuits is the content fat No not enough from 1.5 grams per one hundred kcal or 6 grams per hundred grams and not more than 4.5 grams per one hundred kcal or 18 grams per hundred grams.

CONCLUSIONS

1. There is influence variation concentration And long immersion extract leaf Moringa to response antioxidants in MP-ASI biscuits are shown by mark p value 0,000 $< \alpha$ 0.05.
2. There is influence variation concentration And long immersion extract leaf Moringa The protein content in MP-ASI biscuits is shown by the p value 0.000 $< \alpha$ 0.05.
3. There is an influence of variations in the concentration of Moringa leaf extract on carbohydrate levels MP-ASI biscuits are shown with a p value of 0.000 $< \alpha$ 0.05. But no give influence Which significant on long immersion And interaction between concentration variations and long immersion leaf extract Moringa $\alpha > 0.05$.
4. There is influence variation concentration And long immersion extract leaf Moringa The fat content in MP-ASI biscuits is shown by value p value 0.000 $< \alpha$ 0.05.

REFERENCES

- 1) Anwar F, Latif S, Ashraf M, Gilani AH. Moringa oleifera. 2015. *A food plant with multiple medicinal uses. Phytother. Res.*;21:17- 25.
- 2) Alamsyah, Z. 2015. Kinetika Adsorpsi 2. <https://www.slideshare.net/chiepoe/kinetika-adsorpsi-2>
- 3) Amalia, M., Raharjo, D & Priyono, S. 2019. Pengaruh konsentrasi ekstrak kunyit dan lama perendaman terhadap daya simpan kerupuk basah. *Jurnal Teknologi Pangan* 3(2): 273–280.
- 4) Aminah, S., Ramdhan, T & Yanis, M. 2015. Kandungan nutrisi dan sifat fungsional tanaman kelor (*Moringa oleifera*). *Buletin Pertanian Perkotaan*, 5(2), 3544
- 5) Amin, N.A., 2013. Pengaruh suhu fosforilasi terhadap sifat fisikokimia pati tapioka termodifikasi.
- 6) Augustyn, G.H., Tuhumury, H.C.D & Dahoklory, M. 2017. Pengaruh penambahantepung daun kelor (*Moringa oleifera*) terhadap karakteristik organoleptik dan kimia biskuit Mocaf. *AGRITEKNO, Jurnal Teknologi Pertanian*, 6(2), 52-58.
- 7) Angraini, Y & Romadona, N. F. 2020. *Review of Stunting in Indonesia. In International Conference on Early Childhood Education and Parenting 2019 (ECEP 2019)* (pp. 281-284). Atlantis Press. <https://www.atlantispublishing.com/proceedings/ecep-19/125943159>
- 8) Ana Juliana1, Zainuri, Siska Cicilia. 2023. Fortifikasi Ekstrak Daun Kelor Untuk Meningkatkan Mutu Jelly Drink Daluman. *Pro Food (Jurnal Ilmu Dan TeknologiPangan)* Vol 9. Issn: 2443-1095
- 9) A. H. Al-Rahmad, A. Miko, and A. Hadi. 2013. Kajian Stunting Pada Anak Balita Ditinjau dari Pemberian ASI Eksklusif, MP-ASI, Status Imunisasi dan Karakteristik Keluarga Di Kota Banda Aceh. *J. Kesehatan. Ilm. Nasuwakes*, vol. 6, no. 2, pp. 169–184,.
- 10) Abbas A, Suhaeti RN. 2016. Pemanfaatan Teknologi Pascapanen untuk Pengembangan Agroindustri Perdesaan di Indonesia. *InForum penelitian Agro Ekonomi*, , 34,1, 21-34
- 11) Badan Ketahanan Pangan. 2021. *Direktori Pengembangan Konsumsi Pangan*. Jakarta: Kementrian Pertanian.
- 12) Badan Standarisasi Nasional. 2011. SNI 2973-2011: Syarat Mutu Biskuit. Jakarta: Badan Standarisasi Nasional.
- 13) Badan Pusat Statistik. 2022. *Impor biji Gandum dan Meslin Menurut Negara Asal Utama 2010-2020*. Badan Pusat Statistik
- 14) Basri H, Hadju V, Zulkifli A, Syam A, Indriasari R. 2021. *Effect of moringa oleifera supplementation during pregnancy on the prevention of stunted growth in children between the ages of 36 to 42 months. Journal of Public Health Research*, (10), 2207
- 15) Cahyani, Sisilia Leny, and I Made Sukadana. 2017. “Skrining Fitokimia Dan Aktivitas Penangkapan Radikal Bebas DPPH Ekstrak Etanol Daun Kelor (*Moringa Oleifera*) Di Ende.” *jurnal poltekkes kupang*: 410–16.
- 16) Dewi, D. P. 2018. Substitusi tepung daun kelor (*Moringa oleifera L.*) pada cookies terhadap sifat fisik, sifat organoleptik,

Effect of Variations in Concentration and Length of Soaking Leaf Extract Moringa (*Moringa Oleifera*) to Bioavailability Content Nutrition and Response Antioxidant Flour Bucket (*Artocarpus Communist*) As Material Raw Making Biscuit MP-ASI

- kadar proksimat, dan kadar Fe. Ilmu Gizi Indonesia, 104.
- 17) de Souza, C.T., SA.R. Soares, A.F.S. Queiroz, AM.P. dos Santos and S L.C. Ferreira. 2016. *Determination and evaluation of the mineral composition of breadfruit (Artocarpus altilis) using multivariate analysis technique. Microchemical Journal* 128: 84-88.
 - 18) Departemen Kesehatan RI. 2006. Pedoman Umum Pemberian Makanan Pendamping Air Susu Ibu (MPASI) Lokal Tahun 2006. Jakarta: Depkes RI.
 - 19) Etchevery P, Hawthorne KM, Liang LK, Abrams SA, Griffin IJ. *Effect of beef and soy proteins on the absorption of non-heme iron and inorganic zinc in children. J Am Coll Nutr* 2006;25(1):34-40
 - 20) Fuglie LJ. The miracle tree: *Moringa oleifera: natural nutrition for the tropics. Available from: <https://agris.fao.org/agris-search/search.do?recordID=XF2015018648>*
 - 21) Enaam S Shokery, Mohamed G El-Ziney, Asmaa H Yossef and Reda I Mashaly. 2017. *Effect of Green Tea and Moringa Leave Extracts Fortification on the Physicochemical, Rheological, Sensory and Antioxidant Properties of Set-Type Yoghurt. Department of Dairy Science and Technology, Faculty of Agriculture, El-Shatby, Alexandria University, Alexandria, Egypt. J Adv Dairy Res, an open access journal ISSN:2329-888X*
 - 22) Eva, I., Defitri, Rahmayeni, Susi, Yeni & Nazar. 2019. Substitusi tepung jagung fermentasi dan tepung tempe terhadap mutu organoleptik biskuit sebagai mpasi anak baduta. *Jurnal Riset Kesehatan Poltekkes Depkes Bandung, 11(1)*, 365. <https://doi.org/10.34011/Juriskesbdg.V11i1.799>
 - 23) Fitriani R. Hubungan Antara Pengetahuan Gizi Seimbang, Citra Tubuh, Tingkat Kecukupan Energi dan Zat Gizi Makro dengan Status Gizi pada Siswa SMA Negeri 86 Jakarta. *J Heal Sci Gorontalo J Heal Sci Community [Internet].* 2020 Mar 26;4(1):29–38. Available from: <https://ejournal.ung.ac.id/index.php/gojhes/article/view/5041>
 - 24) Gustiya SD, Hadisaputro S, Sumarni S. 2021. *Does moringa oleifera leaf nanoparticles increase albumin levels in stunting toddlers. Journal of Physics: Conference Series, 1943, 1-6. <https://iopscience.iop.org/article/10.1088/1742-6596/1943/1/012073/meta>*
 - 25) Glover-Amengor M, Aryeetey R, Afari E, Nyarko A. 2017. *Micronutrient composition and acceptability of Moringa oleifera leaf- fortified dishes by children in Ada- East district, Ghana. Food Science & Nutrition, 5, 317-323. <https://doi.org/10.1002/fsn3.395>*
 - 26) Haura Jilan Muthiah. 2022. Pengaruh Konsentrasi Ekstrak Daun Kelor (*Moringa Oleifera*) Dan Variasi Suhu Pengeringan Terhadap Karakteristik Fisikokimia Susu Daun Kelor Bubuk. Tugas Akhir. Program Studi Teknologi Pangan. Fakultas Teknik. Universitas Pasundan. Bandung
 - 27) Hermina and S. Prihatini. 2015. “Pengembangan Media Poster dan Strategi Edukasi Gizi untuk Pengguna Posyandu dan Calon Pengantin,” *Bul. Penelit. Kesehat.*, vol. 43, no. 3, pp. 195–206.
 - 28) Irmayanti, W. O., Hermanto & Asyik, N. 2017. (Ipomea batatas L) dan kacang hijau (*Phaseolus radiatus* L). *J.Sains dan Teknologi Pangan, 2(2)*, 12.
 - 29) Indriyani F, Nurhidajah, & Suyanto A. 2013. Karakteristik fisik, kimia dan sifat organoleptik tepung beras merah berdasarkan variasi lama pengeringan. *Jurnal Pangan dan Gizi, 4(8)*: 27- 34
 - 30) Indeks, H., Tubuh, M., Resiko, D., Back, L., Pada, P & Di, P. 2022. *Jurnal Keperawatan Muhammadiyah. 7(1)*, 3–6.
 - 31) Irwan. *Metode Penelitian Kesehatan*. Zahir Publishing; 2021.
 - 32) Katarina Lisak Jakopovic. 2022. *Fortification of Cow Milk with Moringa oleifera Extract: Influence on Physicochemical Characteristics, Antioxidant Capacity and Mineral Content of Yoghurt. MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.*
 - 33) Kania, I., & Wardani, F. 2022. Sosialisasi Pembuatan Makanan Pendamping Asi / Mp- Asi (Cupcake Sabu / Sayur Dan Buah) Bagi Ibu Yang Memiliki Balita Guna Mencegah Stunting Di Desa Bantar Jaya Kecamatan Pebayuran Kabupaten Bekasi Tahun 2022. 6 (September), 1370–1374.
 - 34) K. Simanjuntak, “Peran Antioksidan Flavonoid dalam Meningkatkan Kesehatan,” *Bina Widya*, vol. 23, no. 3, hal. 135–140, 2012
 - 35) Kementerian Pertanian. 2015. *Statistik Konsumsi Pangan 2015. Pusat Data dan Sistem Informasi Pertanian. Sekretariat Jenderal: Kementerian Pertanian.*
 - 36) Lisna Ahmad, Suryani Une, Yoyanda Bait. 2018. Karakteristik Komponen Gizi, Antioksidan, dan Respon Organoleptik Bubur Jagung Tradisional Gorontalo dengan Ekstrak Daun Kersen (*Muntingia calabura* L.). *AgriTech, 38 (4)* 463-468. ISSN 0216-0455
 - 37) Liu, Y., D. Ragone and S.J. Murch. 2015. *Breadfruit (Artocarpus altilis): a source of high- quality protein for food security and novel food products. Amino Acids* 47: 847– 856.
 - 38) Luvita F. Pengaruh Substitusi Tepung Jamur Tiram Putih (*Pleurotus ostreatus*) dan Ikan Bandeng (*Chanos chanos*)

Effect of Variations in Concentration and Length of Soaking Leaf Extract Moringa (*Moringa Oleifera*) to Bioavailability Content Nutrition and Response Antioxidant Flour Bucket (*Artocarpus Communist*) As Material Raw Making Biscuit MP-ASI

- terhadap Kandungan Zat Besi dan Protein serta Mutu Mie Basah Organoleptik. 2014.
- 39) Maulana A. 2016. Analisis Parameter Mutu dan Kadar Flavonoid pada Produk Teh Hitam celup [Tugas Akhir]. Program Studi Teknologi Pangan, Fakultas Teknik, Universitas Pasundan, Bandung
 - 40) Muliawati D, Sulistyawati N, Utami FS. 2019. Manfaat ekstrak Moringa oleifera terhadap peningkatan tinggi badan balita. Yogyakarta: Prosiding Seminar Nasional Poltekkes Karya Husada.
 - 41) Matsungo TM, Kruger HS, Smuts CM, Faber M. 2017. *Lipid-based nutrient supplements and linear growth in children under 2 years: a review*. Proceedings of the 406 Jurnal Kesehatan, Volume 13, Nomor 2, Tahun 2022.
 - 42) Nina Jusnita, Wan Syurya. 2019. Karakterisasi Nanoemulsi Ekstrak Daun Kelor (*Moringa oleifera* Lamk.). Jurnal Sains Farmasi & Klinis p-ISSN: 2407-7062
 - 43) Olga Kaltsa, et, al. 2021. *Fortification Of Chocolate Using Moringa Oleifera Extract Encapsulated In Microemulsions OCL 2021, 28, 38, Published by EDP Sciences, 2021 <https://doi.org/10.1051/ocl/2021026>*
 - 44) Panggi Husain. 2018. Karakteristik Tepung Sukun (*Artocarpus Communis*) Dengan Kombinasi Metode Perendaman Asam Sitrat Dan *Steam Blanching*. Skripsi.Repository UNG.
 - 45) Pinasthi S. T. 2017. Bab IV Pembahasan. Reposioy.uksw.edu/bitstream/12345678/9/1487/4/T1_512011033_BAB%20IV.pdf
 - 46) Rusmimping R, Hutagaol UR. Hubungan Persepsi, Sikap dan Kebiasaan Makan dengan Status Gizi Siswa di MTS Muhammad Amin Rajo Tiangso Jangkat Timur. J Heal Sci Gorontalo J Heal Sci Community [Internet]. 2021 Oct 30;5(2):330–40. Available from: <https://ejournal.ung.ac.id/index.php/gojhes/article/view/11276>
 - 47) Roberts-Nkrumah, L.B. and G. Legall. 2013. *Breadfruit (Artocarpus altilis, Moraceae) and chataigne (A. camansi) for food security and income generation: the case of Trinidad and Tobago. Economic Botany* 67(4): 324–334
 - 48) Syafutri, M., Syaiful, F., Lidiasari, E & Pusvita, D. 2020. Pengaruh Lama dan Suhu Pengeringan Terhadap Karakteristik Fisikokimia Tepung Beras Merah (*Oryza nivara*). AGROSAINSTEK: Jurnal Ilmu dan Teknologi Pertanian, 4(2), 2020.
 - 49) Satria Adi Nugraha. 2023. Pengaruh Perendaman Dalam Ekstrak Daun Kelor (*Moringa Oleifera*) Terhadap Karakteristik Fisik, Kimia, Dan Mikrobiologi Tahu. Skripsi. Program Studi Teknologi Hasil Pertanian Jurusan Teknologi Pertanian Fakultas Pertanian Universitas Sriwijaya.
 - 50) Silalahi, M. and W.A. Mustaqim. 2020. *Tumbuhan Berbiji Di Jakarta Jilid 1: 100 Jenis Jenis Pohon Terpilih*. UKI Press, Jakarta: 139-140arsial. *Jurnal Teknologi Hasil Pertanian, 14(2)*, 12.
 - 51) Sandra M. Gomes, Anabela Leitão, Arminda Alves and Lúcia Santos. 2023. *Incorporation of Moringa oleifera Leaf Extract in Yoghurts to Mitigate Children's Malnutrition in Developing Countries. Molecules* 2023, 28, 2526. Licensee MDPI, Basel, Switzerland
 - 52) Sari, D. K., Marliyati, S. A., Kustiyah, L., Khomsan, A & Gantohe, T. M. 2014. Uji Organoleptik Formulasi Biskuit Fungsional Berbasis Tepung Ikan Gabus (*Ophiocephalus striatus*). *Jurnal AgriTECH, 34(2)*
 - 53) SNI 01-7111.2-2005. 2005. Makanan Pendamping Air Susu Ibu (MP-ASI)-Bagian 2: Biskuit. Badan Standarisasi Nasional. *Badan Standarisasi Nasional*.
 - 54) Saepudin, L., Setiawan, Y., Sari, P.D. 2017, Pengaruh perbandingan Substitusi Tepung Sukun dan Tepung Terigu dalam Pembuatan Roti Manis, *Jurnal Agrosience, VI. 7 No. 1, pp. 227-243*
 - 55) Sefanadia Putri, Reni Indriyani, Y. N. 2021. *The Training of Making Local MPASI With Cassava For Batita in Cadre of Integrated Services Post (Posyandu) in Hajimena Health Center Lampung Selatan. 2, 29–36*.
 - 56) Sukandar, D., Muawanah, A., Amelia, E.R. & Basalamah, W. 2014. Karakteristik Cookies Berbahan Dasar Tepung Sukun (*Artocarpus communis*) bagi Anak Penderita Autis. *Jurnal Valensi, Vol. 4 No. 1: 13–15*. Diakses dari <http://journal.uinjkt.ac.id/valensi/article/viewFile/1047/930>
 - 57) Susanty, Sri Anastasia Yudistirani, M. Bahrul Islam. 2019. Metode Ekstraksi Untuk Perolehan Kandungan Flavonoid Tertinggi Dari Ekstrak Daun Kelor (*Moringa Oleifera Lam*). Volume 8 No.2 Issn : 2252 – 7311
 - 58) Sikarwar, M.S., B.J. Hui, K. Subramaniam, B.D. Valeisamy, L.K. Yean and K. Balaji. 2014. *A review on Artocarpus altilis (Parkinson) Fosberg (breadfruit). Journal of Applied Pharmaceutical Science* 4(08): 091-097.
 - 59) Shiriki, D., Igyor, M.A & Gernah, D.I. 2015. *Nutritional evaluation of complementary food formulations from maize, soybean and peanut fortified with Moringa oleifera leaf powder. Food and Nutrition Sciences, 6, 494-500*
 - 60) Tekle, A., Belay, A., Kelem, K., Yohannes, M. W., Wodajo, B & Tesfaye, Y. 2015. *Nutritional profile of Moringa stenopetala species samples collected from different places in Ethiopia. European Journal of Nutrition & Food Safety*.
 - 61) Tahir, M & Hikmah, N. 2016. Analisis kandungan vitamin c dan β- karoten dalam daun kelor (*moringa oleifera lam.*) dengan metode spektrofotometri uv–vis. *Jurnal Fitofarmaka Indonesia, 3(1)*, 6.
 - 62) Tengo, N. A., “Isolasi dan Karakterisasi Senyawa Alkaloid dari Daun Alpukat (*Persea americana mill*) Jurusan Pendidikan Kimia Fakultas MIPA Universitas Negeri Gorontalo,” 2008.

Effect of Variations in Concentration and Length of Soaking Leaf Extract Moringa (*Moringa Oleifera*) to Bioavailability Content Nutrition and Response Antioxidant Flour Bucket (*Artocarpus Communist*) As Material Raw Making Biscuit MP-ASI

- 63) USDA National Nutrient Database. 2015. *Drumstick Leaves, Raw*. U.S. Departement of Agriculture
- 64) Williams, E.W., E.M. Gardner, R. Harris, A. Chaveerach, J.T. Pereira and N.J.C. Zerega. 2017. *Out of Borneo: biogeography, phylogeny and divergence date estimates of Artocarpus (Moraceae)*. *Annals of Botany* 119: 611–627.
- 65) Widowati, S. 2010. Pangan Sukun (*Artocarpus communis*) Sebagai Pangan Sumber Karbohidrat dalam Mendukung Diversifikasi Konsumsi Pangan. www.majalahpangan.com
- 66) Winarno F. *Kimia Pangan Dan Gizi*. Bogor: PT Embrio Biotekindo; 2008
- 67) Zakaria. 2013. Pemanfaatan Tepung Kelor (*Moringa Leifera*) Dalam Formulasi Pembuatan Makanan Tambahan Untuk Balita Gizi Kurang Media Gizi Pangan', *Media Gizi Pangan*, XV(1)
- 68) Zulfa, N. I., & Rustanti, N. 2013. Nilai cerna protein in vitro dan organoleptik MP-Asi biskuit bayi *Journal of Nutrition College*, 2(4), 439–446.