UTILIZING LOCALLY PROCESSED REBON SHRIMP (MYSIS RELICTA) AS FUNCTIONAL FOOD TO ALLEVIATE ANEMIA IN PREGNANT WOMEN

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ABSTRACT

Chronic energy deficiency (CED) during pregnancy contributes to anemia, leading to maternal and fetal complications. This study aims to explore the potential of locally processed Rebon shrimp (Mysis Relicta) as functional food to mitigate anemia in pregnant women. We developed Levon Shrimp Senbei, a premixed flour combining wheat flour and kidney beans, as an intervention strategy. A randomized controlled laboratory experiment included three treatments: chocolate, almond, and original. Pregnant women from Pematang Monastery, Deli Serdang Regency, were part of a quasi-experimental study with pre- and post-intervention assessments. While Levon Shrimp Crackers with Chocolate and Almonds emerged as preferred recipes, further investigation is needed to assess their impact on anemia. Detailed statistical analyses underpin the results, with implications for enhancing maternal nutrition and fetal well-being.y

***Keywords** : anemia of pregnant women, shrimp crackers, nutrition intake*

INTRODUCTION

Anemia among pregnant women poses significant risks, including bleeding during pregnancy and childbirth, low birth weight, and stunted child growth. Maternal mortality, primarily driven by iron-deficiency anemia, remains a concerning issue. In Deli Serdang, a coastal region, maternal mortality rates are alarmingly high, with 13 deaths per 100,000 live births. Despite efforts by the Health Office to mitigate this issue through emergency training and supplementary food distribution, effective solutions remain elusive (WHO, 2020). The region's collaboration with the Center for Science and Technology Excellence of the Medan Ministry of Health Polytechnic has prompted research initiatives to address local health challenges. Deli Serdang's strategic importance as a research locus is underscored by its role in downstream research dissemination. To address the maternal mortality resulting from chronic energy deficiency, harnessing the potential of local food resources becomes essential. Rebon shrimp (Mysis relicta), abundant and cost-effective, is protein-rich and

boasts a higher iron content. Its consistent availability along the North Sumatra coast fuels the rationale for transforming a previous shrimp-based cracker recipe, employing ronggeng shrimp, into one that utilizes rebon shrimp to ensure sustainable product production. Notably, nutritional supplementation in the form of biscuits, fortified with vitamins and minerals, is a conventional approach to tackling chronic energy deficiency in pregnant women (Casey *et al.*, 2020) .

This research seeks to develop rebon shrimp and other ingredients into functional food, specifically crackers, to combat anemia in pregnant women within Pematang Biara village, Deli Serdang Regency. The study aims to identify the optimal prawn cracker formula as functional food and evaluate the efficacy of rebon prawn crackers in improving maternal nutritional status (anemia) through pre and post-intervention assessments.

METHOD

The research consists of 3 stages of research, namely: 1) Phase-1: test the crackers formulation through trials in the integrated laboratory of the Medan Polytechnic of the Ministry of Health. The research was carried out for 3 months from January to March 2022 using a completely randomized design with 3 treatments each: A = shrimp crackers with the addition of chocolate; B = prawn crackers with the addition of almond flour and C = original prawn crackers (without addition), 2) Stage-2: Nutritional analysis (proximate) of the most preferred shrimp crackers by consumers at the Integrated Research and Testing Laboratory at Gajah Mada University, Yogyakarta, 3) Stage-3: Research in the field to the community: namely pregnant women.

The research consists of the three 1) Phase-1: test the crackers formulation through trials in the integrated laboratory of the Medan Polytechnic of the Ministry of Health. The research was carried out for 3 months, including from January to March 2022 with stages selection of ingredients and drying of rebon shrimp into rebon shrimp flour; making Rebon shrimp crackers formula with additions chocolate, almod and original nuts (without additives) and each recipe is tested through organoleptic tests by a team of experts. (consisting of 10 lecturers who have been trained in the test organoleptic). completely randomized design with 3 treatments each: A = shrimp crackers with the addition of chocolate; B = prawn crackers with the addition of almond flour and C = original prawn crackers (without addition), 2) Stage-2: The nutritional analysis (proximate) of shrimp crackers most preferred

by consumers has been tested and has passed standard procedures determined by the Integrated Research and Testing Laboratory of Gajah Mada University, Yogyakarta. 3) Stage-3: Research in the field to the community: namely pregnant women. The number of pregnant women found in Pantai Labu District was 97 people, and 70 of them were anemic (anemia if the level of Haemoglobin < 12 mg / dl). With the calculation of the sample formula, 64 pregnant women were obtained to be studied, 32 treatment groups (in Pematang Monastery Village) and 32 controls (in Percut Village).

The population in this study were all pregnant women in the village of Pematang Biara, Deli Serdang Regency, totaling 97 people. Pregnant women in the selected villages were 64 pregnant women with a distribution of 32 people Pematang Biara village as intervention group and 32 people in Percut Village as a control group. The number of samples is determined by the formula (Sastroasmoro and Ismael, 2014).

$$n1 = n2 = 2\ \frac{(Z\alpha + Z\beta)Sd}{(X1 - X2)} = 32\ persons$$

Data analysis for the crackers formula was carried out by organoleptic assessment by 30 panelists consisting of pregnant women, then the data was analyzed using ANOVA. Intervention data in the field was carried out by collecting data through screening to select respondents who experienced anemia, observing to ensure that respondents followed the intervention provisions that had been agreed upon with the research subjects and measurements to determine Hb levels and nutritional status of pregnant women through measuring height and height. Data analysis was performed using univariate, bivariate and multivariate analysis.

The instrument used consisted of an organoleptic test form for the selection of the crackers formula. While in the field using food recall for food intake.

The recipe used for each treatment is a formula that has been selected through an organoleptic test by a team of experts as follows : Materials used: 125gr Wheat, 25gr Cocoa powder (1st treatment), 25gr Almond flour (treatment 2), 1/4 tsp Baking powder, 3 gr Yeast, 50ml of warm water, 1 tsp Powdered sugar, 15gr Rebon shrimp that has been mashed, 50gr Liquid Butter (Limenta and Chandra, 2017); (Prasetyo *et al.*, 2018) .

RESULTS AND DISCUSSION

The nutritional content contained in rebon shrimp is very complete, micronutrient deficiency is one of the precipitating factors for anemia. The content of rebon shrimp multi micronutrient with composition in 100 gr dried rebon shrimp contains 295 cal calories, 62.4 gr protein, 2.3 gr fat, 1.8 g carbohydrates, 1209 mg calcium, 1225 mg phosphorus, 6.3 mg iron, vit A 210 mg, 0.14 mg vitamin B1, 20.7 gr water (Syarif *et al.*, 2017). Iron supplementation sourced from animals is the main choice because it is more easily absorbed by the body by 20-30% when compared to foods derived from plants. This nutrient-rich food ingredient turned out to be less preferred, because of its distinctive smell and fishy aroma. Given that changes in pregnancy hormones can make pregnant women's sense of smell become more sensitive to odors, which can stimulate nausea and vomiting, then these foods are processed into foods that are liked, in demand and can be accepted by consumers as snacks with high nutritional value (Wagiyono, 2013); (Organization, 2016) .

The recipe used for each treatment is a formula that has been selected through an organoleptic test (aroma, taste, color, and texture test) by a team of experts (consisting of 10 lecturers who have been trained in organoleptic testing), namely: treatment A = shrimp crackers with chocolate, treatment B = original shrimp crackers, treatment C = rebon almond shrimp crackers, with the following results:

Picture 1. Rebon crackers

Furthermore, to find out preferences for the rebon shrimp crackers product, an organoleptic test was carried out by 30 panelists (pregnant women) who were not participants in the study and did not have a history of allergies to shrimp products. The results of the organoleptic test for aroma can be presented as follows:

To determine preferences for the rebon shrimp crackers product, an organoleptic test was carried out by 30 panelists (pregnant women) who were not participants in the study and did not have a history of allergies to shrimp products.

Testing using human or organoleptic senses (sensory tests or sensory tests), is a measurement of human acceptability of the product to be utilized. This test has an important role in the application of the quality of a product and can provide indications of rottenness, quality deterioration and other damage from the product being tested (Wagiyono, 2013).

Tabel 1. Results of the analysis of organoleptic tests on aroma, texture, taste and color of crackers

		Sum of Squares	df	Mean Square	f	Sig
Smell	Between Groups	133.422	2	66.711	308.7	0.000
	Within Groups	18.800	87	0.216		
	Total	152.222	89			
Texture	Between Groups	86.956	2	43.478	250.5	0.000
	Within Groups	15.100	87	0.174		
	Total	102.056	89			
Taste	Between Groups	55.089	2	27.544	84.9	0.000
	Within Groups	28.200	87	0.324		
	Total	83.289	89			
Colour	Between Groups	36.867	2	18.433	90.9	0.000
	Within Groups	17.633	87	0.203		
	Total	54.500	89			

Based on Table 1, it can be seen that the results of organoleptic tests by panelists consisting of 30 pregnant women showed that there was a significant difference ($p<0.05$) in the aroma, texture, taste and color of rebon shrimp crackers with the addition of chocolate, almond and original. These results were continued in Duncan's test to see the differences in each treatment, whose successive results can be seen as follows:

Table 2. Results of duncan's test analysis of aroma, taste, color and texture of rebon shrimp crackers

Treatment	Smell	Taste	Color	Texture
Added Almond (A)	3,87	3,77	3,87	3,83
No Addition (B)	1,93	3,03	3,03	2,47
Added Chocolate (C)	4,87	4,93	4,60	4,87

The data shown in Table 2 indicate that the aroma in the chocolate addition treatment was the most preferred treatment by the panelists. This can be explained by the fact that the addition of chocolate creates a chocolate aroma that can cover the aroma of Rebon shrimp. For color assessment, it can be concluded that the panelists preferred treatment C with the addition of chocolate. Various ingredients found in chocolate, sweetness in chocolate can improve mood, high antioxidants and resveratrol content that can increase endorphin and

serotonin levels (hormones that regulate feelings of pleasure or happiness) (Pangkalan Ide, 2013).

This also happens because the mixture of rebon prawn crackers with chocolate creates a more dominant chocolate flavor with the addition of a salty taste that comes from Rebon prawns. The taste caused by the addition of chocolate can increase the appetite of pregnant women for crackers.The color of the crackers that the panelists liked the most was the crackers with chocolate addition. This is because the crackers dipped in melted chocolate provide a better appeal because they can cover the surface of the crackers with chocolate making the more attractive to pregnant women.

The texture of the crackers that pregnant women like the most is also treated with the addition of chocolate. Based on the panelist's assessment, it can be concluded that the most preferred shrimp crackers are crackers with the addition of chocolate. In choosing the formula for shrimp crackers, one treatment was chosen, the addition of chocolate. This is because of the nature of chocolate which is generally liked by all age groups in various physiological situations. However, rebon prawns, which have a slightly fishy aroma, tend to be less liked, especially in pregnant women. However, because rebon shrimp is a food ingredient that is high in protein and iron and is easy to obtain at low prices. The nutritional potential of rebon shrimp is the main consideration in preparing good snacks for pregnant women which can be used as an alternative to overcome anemia and help meet the protein and iron requirements of pregnant women. The lack of interest of pregnant women in rebon shrimp, while rebon prawns have high nutritional potential, the addition of chocolate is an option to increase the acceptability of rebon prawn crackers.

In additions to being delicious, chocolate also has various benefits for the body, ranging from improving mood to maintaining heart health. This causes chocolate to be liked by almost all people and age groups. In addition to its distinctive and delicious taste, chocolate also has health benefits (Vidyarini, Martianto and Syarief, 2021); (Limenta & Chandra, 2017). Some of the benefits of chocolate include that it contains antioxidants, is healthy for the heart, relaxes, improves brain memory and contains micronutrients, namely in 100 grams it contains 12 mg of iron, 230 mg of magnesium, 2 mg of manganese, 73 mg of calcium and various other minerals (Pangkalan Ide, 2013). The results of the organoleptic test showed that almond-flavored crackers were the preferred choice after chocolate-

flavored crackers. Based on the results of nutritional analysis at the Integrated Research and Testing Laboratory at Gajah Mada University, Yogyakarta, it was found that in 100 grams of rebon shrimp crackers with the addition of chocolate and almonds were as follows:

Table 3. Nutritional contet in brown reborn shrimp crackers and almonds (in 100grams) and perpiece (10grams)

Parameter	Amount/100g		Amount/piece		Unit
	Chocolate	Almond	Chocolate	Almond	
Calories	516.59	530.66	51.7	51.01	Kalori
Water Content	5.48	6.20	0.05	0.62	ml
Fat Total	9.25	3.67	0.93	0.37	gr
Protein	10.55	14.10	1.11	1.11	gr
Carbohydrate	71.70	73.99	7.17	7.40	gr
Phospor	0.19	0.17	0.002	0.012	mg
Ca (calsium)	309.12	287.22	30.91	28.72	mg
Fe (besi)	8.18	3.36	0.82	0.34	mg
Zn (seng)	3.43	3.36	0.34	0.34	mg

Before and after the intervention, hemoglobin (Hb) levels were measured with the respondents signing informed consent to participate in research activities. Based on the number of samples, 64 pregnant women were selected who met the inclusion criteria, namely with anemia, consisting of 32 pregnant women in the village of Pematang Monastery (intervention group) and 32 pregnant women in the village of Percut Sei Tuan (control group). The nutritional content contained in chocolate-flavored crackers has a higher content of fat, calcium, iron and zinc when compared to other flavored craekers, where this nutritional content is needed by pregnant women for fetal growth in the process of pregnancy.

Table 4. Distribution of respondents to the intervention and control groups before the intervention

Characteristic	Intervention		Control		p-value
	f	%	f	%	
Hb Levels					0.12
Anemia	32	100	32	100	
Tidak Anemia	0	0	0	0	
Energy Intake					1.00
< RDA	9	28.1	10	31.2	
≥ RDA	23	71.8	22	68.8	
Carbohydrate Intake					0.06
< RDA	31	71.8	22	93.75	
≥ RDA	1	28.2	10	6.25	
Protein Intake					0.29

< RDA	14	56.3	9	68,8	
≥ RDA	18	43.7	23	31.2	
Iron Intake					0.80
< RDA	28	78.1	9	81.3	
≥ RDA	44	21.9	23	18.7	
Zink Intake					0.01
< RDA	29	71.9	16	87.5	
≥ RDA	3	28.1	16	12.5	
Calsium Intake					0.73
< RDA	28	65.6	26	75.0	
≥ RDA	4	34.4	6	25.0	
Phospor Intake					0.73
< RDA	7	62.5	6	62.5	
≥ RDA	25	37.5	26	37.5	

Hb level data was measured using an easy touch tool and grouped into: Anemia if Hb level < 12 mg/dl and Not Anemia if Hb level ≥ 12 mg/dl (Auerbach and Adamson, 2016). Nutritional intake data were collected through a 24-hour food recall for two consecutive days and compared with the Recommended Adequacy of Nutrition (RDA) with the fulfillment category, namely: if intake ≥ 100% meets the RDA and if < 100% does not meet the RDA. The research data, can be summarized as follows:

Table 5. Distribution of respondents to the intervention and control grops before the intervention

Charakteristic	Intervention		Control		P-value
	f	%	f	%	
Hb Levels					0.03
Anemia	3	9.4	21	65.6	
Not Anemia	29	90.6	11	34.4	
Energy Intake					0.07
< RDA	27	28.2	16	31.2	
≥ RDA	5	71.8	16	68.8	
Carbohydrate Intake					0.04
< RDA	23	21.9	30	93.7	
≥ RDA	9	28.1	2	6.3	
Protein Intake					0.49
< RDA	2	6.2	9	28.1	
≥ RDA	30	93.8	23	71.9	
Fat Intake					0.08
< RDA	3	9.4	13	40.6	
≥ RDA	29	90.6	19	59.4	
Iron Intake					0.00
< RDA	0	0	23	71.9	
≥ RDA	32	100	9	28.1	
Zink Intake					0.08

< RDA	15	46.9	26	81.2	
≥ RDA	17	53.1	6	18.7	
Calsium Intake					0.73
< RDA	16	50.0	23	71.9	
≥ RDA	16	50.0	9	28.1	
Phospor Intake					0.73
< RDA	7	21.9	6	18.7	
≥ RDA	25	78.1	26	81.3	

Furthermore, nutritional intake data before and after the intervention were compared to determine the effectiveness of the research intervention. From the results of the analysis of the data obtained, it was found that in the initial conditions there was no difference in Hb levels and nutritional intake of respondents in the control and intervention groups > 0.05 (Table 4). Furthermore, after the intervention, there was a significant difference in the intervention group <0.05 (Table 5). After the intervention, there was a change in the anemia status of the respondents, namely as many as 90.6%, there was a change in the anemia status of the mother from anemic to non-anemic. Meanwhile, in the control group, there was a change from anemia to not anemia by 65.6%.

This means that the effectiveness of shrimp crackers in overcoming anemia in pregnant women = 90.6 %/34.4 % = 2.63 times more effective when compared to the control group which did not receive intervention.

Processing rebon shrimp into various preferred food products in addition to increasing nutritional levels can also increase its selling value. The formulation of rebon shrimp craekers with chocolate flavor turned out to be in demand by research subjects. This snack product with a crunchy texture, attractive packaging and can be stored for a relatively long time makes rebon shrimp craekers the first choice of snacks for pregnant women, coupled with a little salty, which comes from rebon shrimp, can reduce the nausea vomiting of pregnant women in early pregnancy. It can also be a factor that supports mothers to consume rebon shrimp craekers regularly, making it effective in increasing their Hb levels.

This condition can occur due to the contribution of iron as much as 0.82 mg from the rebon prawn crackers consumed by respondents daily as much as 20 grams per day (1 piece of crackers) for 1 month. This can be seen by the increase in iron intake which increased significantly in the intervention group 100% after the intervention with a p = 0.00, whereas in the control group there was an increase in iron intake of 28.1%. Adequacy of nutrition for

energy, carbohydrates, protein, fat, iron and zinc in the intervention group, has met the recommended nutritional adequacy rate.

The results of previous studies have also found: giving Rebon shrimp at a dose of 1.67 gr / kg body weight accompanied by Fe tablets for 14 days has an effect on increasing hemoglobin levels in anemic pregnant women 1.67 gr / dl (Indriyani, 2022). There is an effect of consumption of koya powder made from rebon shrimp (Mysis relicta) on changes in hemoglobin levels of pregnant women (Vera Iriani Abdullah, 2020).

This can prove that in addition to giving iron tablets, pregnant women should also be given supplementation of foods containing iron (Auerbach and Adamson, 2016) .

Adequacy of iron intake will prevent anemia and deficiency of other nutritional intake will create a good nutritional status in the mother so that she will be able to meet the nutritional intake of the fetus she contains and will subsequently give birth to a healthy baby (Organization, 2016) ; (Torlesse et al., 2021).

CONCLUSION

The formula for the Rebon prawn crackers recipe with the addition of chocolate, as well as the Rebon prawn crackers with the addition of almonds, can effectively increase the Hb levels of pregnant women so that they can help overcome anemia by 90.6%. In addition shrimp crackers have the potential to help meet nutritional intake for energy, carbohydrates, protein, fat, iron and zinc.

Researchers feel that the results of this study are not perfect, especially in the assessment of potential allergic reactions to chocolate or almonds. It is recommended that future researchers pay attention to this for the safety of dietary interventions, especially in pregnant women. It is necessary to conduct further tests for the possibility of a wider target range and the possibility of different tastes and acceptability and cooperate with Micro, Small and Medium Enterprises (UMKM) and industry for the production of rebon shrimp crackers so as to meet the target needs in the next study.

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