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Sustainability of freshwater snakehead fish empowerment as animal protein in increasing albumin and hemoglobin levels of breastfeeding mothers

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Abstract. Mothers with a shortage of red blood cells (anemia) can cause a loss of nutritional absorption through breast milk. A mother's lack of nourishment will affect her and her baby's health. The study aims to identify how administering snakehead fish nuggets affects Hb and albumin levels in breastfeeding moms in the Mandala Health Centre work area in Medan. Methods: From the 3rd to the 29th of February 2020, this study was carried out in the Mandala Public Health Centre. The study is quasi-experimental. This study included all breastfeeding women with children ≤ 5 years and then found 31 samples. The data is normality and then analyzed using the T-dependent test. The results showed that providing snakehead fish nuggets affected Hb and blood albumin levels with a value of (p-value =0.001). The use of snakehead fish as a freshwater fish will maintain the ecosystem process, if the snakehead fish is raised in traditional or modern ways. The treatment of snakehead fish nuggets improves albumin values. Meanwhile, based on percentages, the normal Hb level before treatment was 61%, growing to 84%, and the normal albumin level was 71%, climbing to 93%.

1. Introduction

Breastfeeding is a natural condition experienced by women after giving birth that involves the supply of breast milk to their babies [1]. Breastfeeding mothers' nutrition is closely linked to milk production, which is required for the growth and development of their babies. The mother's diet indirectly affects the quality of milk produced. Breastfeeding mothers do not need to overeat; a balanced nutritional intake is sufficient [2].

Protein Deficiency, Energy Deficiency, and Iron Deficiency Anemia are among Indonesia's two most common nutritional problems, especially among pregnant women and breastfeeding mothers [3]. People with a chronic lack of energy and a BMI below normal must undergo additional tests to confirm the diagnosis, including a blood biochemical examination [4]. One of the quantitative methods for evaluating nutritional status is biochemical assessment, which includes measuring hemoglobin and albumin levels. According to the findings of the Triatmaja study 57.4% of breastfeeding mothers had anemia [5], breastfeeding mothers with chronic lack of energy aged > 29 years have a prevalence of 38.7% due to infrequent protein consumption of 42.3%, allowing a breastfeeding mother to have low albumin levels [5].

Hemoglobin is a protein in the blood, its formation requires several nutrients, both primary and sporting. As for food ingredients containing hemoglobin forming substances, obtained from animal-sourced foodstuffs such as meat, fish, especially from the sea, which contain the mineral Fe and protein.

while green vegetables and nuts also contains high iron with low bioavailability values. However, green vegetable foodstuffs are high sources of vitamin C which can help the absorptions of Fe sources of vegetable origin. Hemoglobin is needed by breastfeeding mothers because it can help the process of supplying breast milk and maintaining the stability of breast milk production [2].

Albumin is formed in the liver and needed as a means of transporting some of the nutrients needed for the formation of breast milk. Albumin is usually found in food sources of animal protein, especially those from fish such as snakehead fish, eel, tilapia and others. The formation of albumin after consuming protein nutrients will be formed after 19-21 days [3].

Efforts can be made to improve the biochemical status of the blood that causes anemia and chronic lack of energy in breastfeeding mothers, by providing additional food in form of snacks. Snacks that are used as additional food can be processed into nuggets that can be made at home (homemade). Snakehead fish can be used as the main ingredient of nugget which has a very high content of nutrients including albumin, protein, iron (Fe), zinc (Zn), calcium and several vitamins [6,7]. The protein contained in snakehead fish nuggets is an easily digestible protein. The amino acid content in snakehead fish protein is in the form of arginine, lysine and histidine which is needed to grow [8,9]. According to the results of the examination at the Chemistry Laboratory, Brawijaya University in 2019, 100 grams of snakehead fish nuggets contain Energy: 234.96 kcal, Carbohydrates: 9.12 grams, Protein: 18.66 grams, Albumin: 2.28 grams, Fat 13.76 gr, Zinc: 6.70 mg, Fe: 2.59 mg, Vitamin C: 1.1 mg.

Snakehead fish is a freshwater fish that is predatory and usually lives in swamps close to the sea. Utilization of snakehead fish as a source of easily digestible animal protein nutrients, by cultivating it will still maintain the stability of the survival of snakehead fish so that the balance of the ecosystem of living things in the low areas close to the seafront (swamp), well maintained. [10] Areas with lowland and swampy topography are common in North Sumatra, such as Belawan, Rampah and Tanjung Balai areas.

Kasim [11], found that taking 400 mg/day of snakehead fish albumin protein capsules can enhance albumin levels and nutritional status, which can strengthen the body's immune system [11]. Snakehead fish nuggets include the mineral element Fe, which has been enhanced by the addition of red beans, in addition to protein. Fe is required for the synthesis of blood hemoglobin [2]. Breastfeeding women in the Bantan and Bandar Selamat districts, where the Mandala Health Centre Medan works, were given snakehead fish nuggets. The purpose of the study was to determine the effect of snakehead fish nuggets provision as a source of animal protein on Hb and albumin levels in breastfeeding mothers by cultivating snakehead fish to maintain the sustainability of snakehead fish to be available as a commodity for overcoming nutritional problems.

2. Methods

This study was a quasi-experiment using a one-group pre-test and post-test design. The study lasted from February 3 through February 29, 2020. The population studied was breastfeeding mother with children under two years old in the work area of *Puskesmas (Health Center)* in Medan, Bantan, and Bandar Selamat villages. There are up to 31 moms in the total sample. Before collecting data from any sample, the Informed Consent (IC) form must be completed.

The data collected included data from sample characteristics, Hb, blood albumin, food recall 2×24 hours before and after treatment. All data obtained is manually processed using with a computer.

Examination of Hb and albumin levels was taken with a 2.5 mL syringe in the artery of the left arm because it was not used for doing activities. Then it was checked at the Prodia Medan Laboratory, for Hb levels using the *Cyanmethemoglobin* method with *Spectrophotometry*, while albumin levels were checked using the *Brom Cresol Green (BCG)* method with *Spectrophotometry*.

Snakehead fish nuggets were given directly for 24 consecutive days, which is eaten 2 pieces once a day with a weight of 100 gr. Researchers supervise and choose cadres for the ingestion of snakehead fish nuggets. The data were analyzed using univariate and bivariate methods, and the normality test was performed using the Kolmogorov-Smirnov algorithm. As all of the data in this investigation was normally distributed, the dependent t-test was used. This research has gone through a code of ethics

issued by the Health Polytechnic.

3. Results and discussion

Table 1 conducts the demographic distribution of the sample in this study, including age, last education, and occupation. Breastfeeding provides breast milk (ASI) to a child beginning at birth and continuing until the child is two years old. Mothers with a healthy nutritional status will build up nutrient food reserves in their bodies, which will be used to balance needs during nursing. According to the study's findings, the age group of 20-29 was the greatest (54.8%). The age group of 20-35 years old is a improvement reproductive age and that women are at their height of fertility at this age, with a 95% likelihood of getting pregnant, giving birth, and breastfeeding.

The study found level of education obtained some samples with high school education of 21 people (67.7%). Education level affect mother's knowledge in fulfilling nutrition intake. Mothers with higher education are easier to receive nutritional information that will be used as provisions to prevent anemia in mothers and stunting in children.

Table 1. Characteristic of individual.

Indicator	Variable	Frequency	Percentage
		N	%
Age	20-29 years old	17	54.8
	30-39 years old	13	41.9
	40-49 years old	1	3.2
	Total	31	100
Education	Primary School	1	3.2
	Junior High School	7	22.6
	Senior High School	21	67.7
	College	2	6.5
	Total	31	100
Mother Parity	Primipara	14	45.2
	Multipara	15	48.4
	Grade multipara	2	6.5
	Total	31	100

Table 2. Distribution of average value of nutrient intake in breastfeeding mothers.

Nutrition	N	Before Intervention		After Intervention		*P-value*
		Mean	SD	Mean	SD	
Carbohydrate (gr)	31	217.677	31.4909	217.255	26.8763	0.922
Protein (gr)	31	53.845	11.69	74.826	6.51	0.00
Fe (mg)	31	6.123	1.71	9.313	1.53	0.00
Zn (mg)	31	5.245	.9899	5.310	.9596	0.758
B_{12} (µg)	31	0.98	0.24	1.311	0.23	0.00

Data on the average intake of nutrients in breastfeeding mothers with additional interventions are presented in table 2. The table contains the average intake of breastfeeding mothers before and after treatment. The average initial protein intake was 53.845 g, and final protein was 74.826 g, the initial Fe intake was 6.123 mg and the final Fe was 9.313 mg, the initial B12 intake was 0.98 and the final B12 was 1.

Table 3. Distribution of Hb and albumin parameters pre and post intervention.

Indicator	N	Mean	Min	Max	SD	*P value*
Hemoglobin Before	31	11.05	9.1	15.0	1.5263	0.001
Hemoglobin After	31	11.28	9.8	15.2	0.9410	0.001
Albumin Before	31	3.0387	2.18	3.60	.33861	0.001
Albumin After	31	4.3871	4.08	5.05	.23670	0.001

Table 4. Changes in Hb and albumin parameters pre and post intervention.

Intervention	n	Haemoglobin				Albumin				*P value*
		Normal		Low		Normal		Low		
		n	%	N	%	n	%	N	%	
Before	31	19	61%	12	39%	22	71%	9	29%	0.001
After	31	26	84%	5	16%	29	93%	2	7%	

The hemoglobin is shown in Table 3, the results revealed that the average Hb score before intervention by giving snakehead fish nuggets was 11.05, and after the intervention was 11.28, an increase of 0.22. The Paired T Test technique yielded p - values = 0.001, suggesting a difference before and after the intervention. And meanwhile, table 4 shows that the percentage of normal hemoglobin categories has increased from 61% to 84%. This demonstrates that consuming snakehead fish nuggets for 24 days can boost blood hemoglobin levels.

Haemoglobin formation can occur due to consumption of food sources of Fe which can be obtained from foods rich in sources of Fe, including meat, fish, poultry, nuts and green vegetables. When viewed from the source of Fe, it can be divided into two parts, namely Fe heme which is comes from animal origin and Fe Non-Heme which comes from vegetable food sources. The affinity value of each depends on the source of Fe, where non-heme Fe has lower biological value than heme Fe. However, its absorption can be assisted by the availability sources of vitamin C which can be obtained from foodstuffs such as fruits and vegetables. Excess Fe consumed daily will be stored in the form of ferritin and hemosiderin in the liver and bone marrow [12].

Snakehead fish nuggets' protein content functions as a building block for hemoglobin and the creation of erythrocytes. Iron is not found free in the human body but is bonded with protein molecules to create ferritin, an iron-protein complex [2]. The protein in snakehead fish can transport iron by transferrin, which can be carried by the liver, spleen, and bone marrow and converted into hemoglobin. Using snakehead fish will increase hemoglobin level [13].

According to the findings of Astuti's 2015 study, consuming 100 grams of snakehead fish nuggets and red seaweed will enhance hemoglobin levels [14]. According to the findings of Warouw's study, delivering snakehead fish extract to clients, which is rich in zinc, albumin, and animal antioxidants, produces considerable benefits by raising hemoglobin [15].

According to table 3, the mean albumin level of 31 samples of breastfeeding moms before providing snakehead fish nugget treatment was 3.03 g/dl, while the mean albumin level after the intervention was 4.38 g/dl. So, a mean increase in albumin levels of 1.34 g/dl for 24 days is the result. The Paired T-Test was used to analyses data on albumin levels, and the result was p-value = 0.0001, indicating an influencebefore and after the intervention.

Table 4 shows the percentage of normal albumin has increased from 71% to 93%. This suggests that the snakehead fish nuggets intervention treatment to albumin levels in breastfeeding moms has increased and that eating snakehead fish nuggets can contribute to an increase in albumin levels [16].

Albumin is a parameter for severe protein insufficiency in body tissues. Therefore, it can be used as a long-term reference for a person's protein-deficient status. Albumin can also be used to predict surgical outcomes [17,18]. Snakehead fish nuggets with high albumin, was able to regulate Zn metabolism so it can repair damaged cells by the HIV virus. Another function of albumin is able to regulate Zn metal in its metabolic process and is also able to bind drugs so that the solubility process in the blood is not easy to occur [15,16].

Albumin is a protein needed by the body, especially for nursing mothers in the process of growth and development of the baby they breastfeed. Fulfilling the need for albumin in the body will accelerate the increase in breast milk production which will also help the growth of the baby's bone matrix. Albumin is a protein compound that is formed in the liver within 19-21 days. The process of zinc regulation that babies need in their growth and development process will run optimally because zinc can increase the baby's immunity through consumption of breast milk. In addition, albumin has a role in maintaining osmotic pressure in the blood so that amino acids in the blood not come out and the availability of breastfeeding mothers is maintained, which directly affects breast milk productions [17]. In addition, research by Restiana [19], said that giving high protein intake can increase albumin levels after being given for 5 consecutive weeks. Besides that, the results obtained by Wahyuni research [16] in the Graha Hita Room, dr. Iskak Tulungagung hospital, claimed that feeding snakehead fish extract for 7 days straight results in a rise in albumin levels in up to 85% of surgical patients with hypo albumin [16,19].

Increased levels of haemoglobin and blood albumin will help breastfeeding mothers provide a source of nutrients that are important for the growth and development of a baby and also maintained the stability of growth hormone such as IGF-1. Sources of food that are suitable and fulfilled can be obtained from food sources around the home environment, especially nursing mothers who live in lowland, swampy and watery areas. The food ingredients in question are fresh water fish such as speckled snake and snakehead fish. The availability of fresh water fish sources, including snakehead fish, can be used as an alternative for breastfeeding mothers to always consume a source of protein needed for the formation of Haemoglobin and blood albumin levels [11]. Snakehead fish processing to avoid boredom should be done in a variety of ways, including snakehead fish which can be made into meatballs, sausages, pempek and nuggets which are now a days snacks that are liked by people of all age groups [12]. Snakehead fish is easy to get because it can reproduce quickly, especially during the rainy season.

Snakehead fish contains necessary amino acids required for albumin production. Branched Chain Amino Acid (BCAA) is critical for preventing muscle growth and albumin production damage [20]. Giving snakehead fish nuggets with red beans to nursing moms at the Mandala Health Centre in Medan can boost their haemoglobin and albumin levels. The rise in haemoglobin and albumin was caused by the inclusion of red beans, which provide protein macronutrients with concentrated amino acids and micronutrients such as Fe, Zn, and vitamins B9 and B12, all of which aid in the process of generating Hb [9].

Snakehead fish besides being able to overcome health problems, especially nutrition. Snakehead fish cultivation can also maintain the ecosystem of watery lowland areas (swamps). For this reason, it is necessary to breed snakehead fish as a food that is easily available and always available at any time/season. Snakehead fish which is always available to be used as a food ingredient will cause stability in the price to remain affordable for people who want to use snakehead fish food as a functional food ingredient [10].

4. Conclusions and suggestions

Giving snakehead fish nuggets correlated on Hb levels $p = 0.001$ and blood albumin $p = 0.001$ in breastfeeding mothers. Meanwhile, based on the percentage, the normal Hb level before treatment was 61%, increasing to 84%, while normal albumin results were found before treatment by 71%, increasing to 93%.

Breastfeeding mothers who have babies are still at the stage of growth and development and include

the period of the First 1000 Days of Life (HPK), always try to meet the nutritional needs according to their physiological period by utilizing sources of nutrients that are easy to obtained and affordable prices

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