Supporting baby's physical growth through improving the quality of food for pregnant

Apoyar el crecimiento físico del bebé mediante la mejora de la calidad de la alimentación de las embarazadas

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Abstract

Objective: The quality of food consumed by pregnant women greatly affects the growth and development of the fetus in the womb until giving birth and breastfeeding the baby. A healthy and balanced diet, especially one rich in protein, is very much needed by pregnant women to help form the body tissues of the fetus and baby such as the heart, liver, brain, bones, muscles, skin, and others. This study aims to increase breast milk production and physical growth of infants through local foods rich in protein, namely Cerbung fish and Moringa leaves, as additional food in the form of noodles.
Methodology: This research is experimental research, through pre and post-tests. Subjects of this research are 18 mothers pregnant for treatment groups and 20 mothers pregnant for control groups—the range aged 21 - 30 years. Data collection was done by giving food addition results that were best for the mother in the third trimester of pregnancy and continued after the mother gave birth and breastfed. Before providing additional food, the researcher developed a food addition product made from fish flour and flour leaf Moringa in the form of instant noodles, organoleptic test, and analysis of nutritional content. The research data were then analyzed using SPSS software through independent sample tests.
Results: The research showed that combination of Moringa leaves and Cerbung fish in instant noodles could potentially enhance breast milk production and support the physical growth of babies.
Discussion: Moringa leaves have been shown to significantly increase milk production and improve various growth parameters in babies. While specific data on Cerbung fish is not provided, its general nutritional benefits could complement the effects of Moringa leaves.
Conclusions: Further research specifically on the combination of these two ingredients would be beneficial to confirm these effects.

Keywords

Baby's physical growth; cerbung fish; moringa leaf; nutritional supplements; pregnant woman.

Resumen

Objetivo: Este estudio busca aumentar la producción de leche materna y el crecimiento físico de los bebés mediante el consumo de alimentos locales ricos en proteínas, como el pez Cerbung y las hojas de Moringa, como alimento adicional en forma de fideos.
Metodología: Esta investigación es experimental, con pruebas previas y posteriores. Los participantes fueron 18 madres embarazadas de los grupos de tratamiento y 20 madres embarazadas de los grupos de control, con edades comprendidas entre los 21 y los 30 años. La recopilación de datos se realizó mediante la presentación de los resultados de la adición de alimentos que resultaron más beneficiosos para la madre en el tercer trimestre del embarazo y que continuaron después del parto y la lactancia.
Resultados: Se ha demostrado que las hojas de Moringa aumentan significativamente la producción de leche y mejoran diversos parámetros de crecimiento en los bebés. Si bien no se proporcionan datos específicos sobre el pez Cerbung, sus beneficios nutricionales generales podrían complementar los efectos de las hojas de Moringa.
Conclusiones: Sería beneficioso realizar más investigaciones específicas sobre la combinación de estos dos ingredientes para confirmar estos efectos.

Palabras clave

Crecimiento físico del bebé; pez cerbung; hoja de moringa; suplementos nutricionales; mujer embarazada.

Introduction

Pregnant women are a group that is highly vulnerable to nutritional problems. This happens because, during pregnancy, mothers require additional nutritional intake for the body's metabolic processes and to support the baby's growth (Gulo et al., 2021). Pregnant women are often unaware that there is an increase in nutritional intake needs during pregnancy (Erniawati & Sulastri, 2022); therefore, providing good nutritional intake needs for pregnant women is very important to maintain their nutritional status in normal status. One of the nutritional problems that often occurs in mothers is Chronic Energy Deficiency (CED) (Dewi et al., 2021). Indonesia is ranked fourth in the world with the largest prevalence of CED in pregnant women, namely 35.5% (Lestari et al., 2023). According to the Indonesian Health Survey (SKI), there are 16.9% of pregnant women who experience CED conditions. This prevalence has decreased significantly when compared to the previous survey. However, this figure is not based on the Ministry of Health's 2024 Strategic Plan, which targets a reduction in the prevalence of KEK in pregnant women to 10 percent in 2024 (Rahayu & Purnomo, 2024).

KEK conditions in pregnant women are closely related to the provision of exclusive breastfeeding to babies (Salwa & Prikhatina, 2021), this happens because the mother's nutritional status during pregnancy and breastfeeding directly impacts breast milk production. Based on previous studies, nutritional deficiencies in breastfeeding mothers can result in decreased quality of breast milk, and lack of intake of certain nutrients in the mother will deplete body reserves, which, if not addressed, can affect the composition of breast milk (Carretero-Krug et al., 2024). Breast milk (ASI) is the best food in quantity and quality for babies from birth to six months of age because all important nutrients, including carbohydrates, essential fats, proteins, minerals, and immunological factors, are contained in breast milk (WHO, 2017). Babies who receive exclusive breastfeeding will be smarter and have good immunity against various diseases (Astriana & Afriani, 2022). Exclusive breastfeeding is one of the global strategies to improve baby's physical growth, development, and survival (Malfait et al., 2020; Yolanda et al., 2022). However, only about 27 percent of newborns are given breast milk in the first hour of birth (SKI, 2023), even though early breastfeeding initiation plays an important role in establishing long-term breastfeeding.

As a developing country, Indonesia has several development goals to improve the welfare of society, commonly known as the Sustainable Development Goals (SDGs). One of the goals of the SGDs is to ensure a healthy life and improve the welfare of people of all ages. More specifically, this goal targets to end all preventable deaths in children under the age of five, with all countries striving to reduce the Neonatal Mortality Rate to at least 12 per 1,000 live births (Ministry of National Development Planning/Bappenas, 2020). Exclusive breastfeeding is one of the specific interventions in an effort to make the government's 1000 HPK program a success, namely prioritizing improving the nutrition of the Indonesian people (Rosna et al., 2023). This implies that health problems, especially in pregnant women, are a crucial aspect of sustainable development goals, so they must be made a priority in the development efforts of every country in the world.

Indonesia is a developing country with low exclusive breastfeeding coverage. According to (WHO, 2023), the coverage of exclusive breastfeeding in Indonesia in 2022 was only 67.96 percent. This percentage decreased from the previous year (2021) to 69.7 percent. According to (BPS, 2024), the percentage of exclusive breastfeeding in baby's physical under six months in North Sumatra Province was 61.98 percent. This percentage has increased from previous years, namely 57.83 percent in 2021 and 57.17 in 2022, but North Sumatra Province is still included in the low coverage of exclusive breastfeeding in Indonesia. Langkat Regency is one of 33 regencies/cities in North Sumatra Province with low exclusive breastfeeding coverage of 33.85 percent; this is also in line with the low IMD percentage of 44.62 percent (Dinkes Provsu, 2020). Several factors influence the failure of exclusive breastfeeding, including lack of husband's support, low education and knowledge, age factors, and parity factors (Frila et al., 2023). At the individual level (mother), factors that cause the failure of exclusive breastfeeding are factors of breast milk that has not come out or insufficient breast milk production before the first 6 months of life (Nisar et al., 2021).

Efforts to increase breast milk production and the rate of breast milk secretion can be made by using galactagogue. Indonesia is one of the countries rich in various types of plants that are efficacious as medicinal plants, and some of them are efficacious, such as Lactogogue (Bai & Sekunda, 2023). In line

with that, the Indonesian Government has taken the initiative to make various efforts to prevent health problems in pregnant women, one of which is by creating a local-based Supplementary Food Provision (PMT) program for pregnant women (Rohmah, 2020). This program aims to improve the nutritional status of pregnant women who are at high risk of malnutrition (Rosyida et al., 2021).

Indonesia is the third country in the world in terms of biodiversity. Based on data from the Food Security Agency in 2020, there are at least 77 types of carbohydrate sources, 30 types of fish, six types of meat, four types of eggs, 26 types of nuts, 389 types of fruits, 228 types of vegetables, and 110 types of spices and herbs available in Indonesia (Ministry of Health of the Republic of Indonesia, 2023). However, the diversity of food ingredients in Indonesia has yet to be optimally utilized. According to (Ambar et al., 2022), this is based on various factors, one of which is the need for more public knowledge about the benefits of local food in terms of health and nutritional content. Moringa leaves and Cerbung fish are potential local food ingredients with high nutritional content, but their utilization could have been better.

Moringa (moringa oleifera) is a plant nicknamed "The Miracle Plant " because all parts of the moringa plant have good health benefits. Moringa leaves have many health benefits, including increasing breast milk production, overcoming anemia, regulating blood pressure and blood glucose levels, and others (Kashyap et al., 2022). Previous studies have shown that Moringa leaf extract can increase lactation hormone levels so that it can increase the quantity and quality of breast milk (Septadina et al., 2018); Moringa leaf extract and Katuk leaves are given to pregnant women in the third trimester and do not cause complications in the labor process and can increase breast milk production (Setiawandari & Istiqomah, 2017). The use of Moringa leaves as a local food ingredient in Indonesia still needs to be improved. This happens because of several things, such as public knowledge about the benefits of Moringa leaves for health, which is still low, the low level of enthusiasm for the use of Moringa leaves, and only a few Indonesians consume them (Darna et al., 2019).

People use Moringa leaves only to complement cooking, ornamental plants, and even animal feed (Marhaeni, 2021). The survey introduction shows that mothers' knowledge about Moringa leaves is 75 percent, and they know about Moringa leaves and their benefits. Meanwhile, 20 percent of mothers know about Moringa leaves but do not know their benefits, and five percent do not know about Moringa leaves and their benefits. Moringa leaves have never been used as vegetables consumed daily because, according to these mothers, the aroma of the leaves is unpleasant (langu).

Meanwhile, the Cerbung fish (bryconamericus sp) is a type of fish typical of the Langkat area, North Sumatra. The level of consumption of Cerbung fish in the community is still relatively low. Most people choose to sell Cerbung fish that have been cleaned of scales and bones and dried to be sold to agents. The community carries out this practice because the selling price of clean and dry Cerbung fish is much higher than unprocessed Cerbung fish. Besides, the distinctive aroma of this fish is too fishy, so it is less popular with residents. These two types of local food can be used as basic ingredients for additional food for pregnant women. Pregnant women and breastfeeding mothers are the targets for providing additional food because this group is prone to nutritional problems and requires more nutrients (Ningrum et al., 2020). Recommendations for Mother's Adequate Nutrition Intake (AKG) pregnant as big as 2250 Kcal/day and added 180-300 Kcal/day during pregnancy (Indonesian Minister of Health Regulation, 2019). This addition is needed to meet the needs of pregnant women, as well as fetal development and preparation of the mother for breastfeeding the baby (Ministry of Health of the Republic of Indonesia, 2019). Based on a study previously by (Friday et al., 2020), grant food addition to mothers pregnant in the third trimester can increase protein intake and food addition. This can be in the form of a dish complete with a big portion or food light as snacks.

Providing additional food from local sources must meet several requirements, namely acceptable, according to local beliefs and norms, practical or easy to make, meet nutritional intake needs, economical, easy to obtain, safe (free from dyes, preservatives, and other additives), and have nutritional content (Directorate General of Public Health, 2018). One form of additional food that can be given to pregnant women is instant noodles made from local food ingredients. Instant noodles are a favorite food of all levels of society, from children to the elderly, including pregnant women, because of the delicious, practical, and filling nature of noodles. According to (World Instant Noodles Association, 2023), instant noodle consumption in the world reached more than 121 billion portions. China, Indonesia, India, Japan, and Vietnam are the countries that are consumers of instant noodles. One reason why instant noodle

consumption is cheap, practical, and powerful is to save the product sold. Instant noodles made from wheat flour contain large amounts of carbohydrates, but only a little protein, vitamin, and mineral content (Yani et al., 2022). The high carbohydrate content makes noodles used as a source of carbohydrates to replace rice. In order for instant noodles to contain complete nutrients, vegetables, and protein can be added to them.

Additions of vegetables and protein in noodles can use local food like leaf Moringa and Cerbung fish. Previous research about using leaf Moringa in making noodles shows that adding leaf Moringa influences noodle protein content (Khasanah & Astuti, 2019). In addition, flour leaf Moringa produces different protein content, iron, zinc, calcium, and beta-carotene in dry noodles (Kamble et al., 2018). Based on this, a study about innovative food from Cerbung fish per 100 grams of Cerbung fish nuggets contains 11.3 percent protein, 3.14 percent carbohydrates, and 1.28 percent fat (Sagita, 2020). For that, there needs to be an innovative utilization of leaf Moringa and Cerbung fish as food to increase mothers' breast milk production. This study aims for increasing breast milk production and baby's physical growth through local foods, namely Cerbung fish and Moringa leaves, as additional food in the form of noodles. The study analyzed the effect of giving noodles made from Cerbung fish and Moringa leaves on maternal nutritional adequacy and how giving noodles made from Cerbung fish and Moringa leaves affects breast milk production.

Method

Participants

The experimental research sample was mothers who were breastfeeding their babies in Langkat district, totaling 30 people, where 18 people were combined as a treatment group and 20 people were combined as a control group. All breastfeeding mothers have voluntarily agreed to participate in this study, while maintaining their privacy and good name. The researcher determined several criteria for mothers who were breastfeeding their babies to be participants in this study, including young mothers who were breastfeeding their babies with an age range of 21-30 years, mothers who breastfeed their babies with exclusive breast milk without additional formula milk, mothers who breastfeed their babies with a normal diet, namely 3 times a day with sufficient nutritional content, and mothers who breastfeed their babies without a history of pathology that interferes with breast milk production such as breast cancer.

Procedure

This research is experimental research, through pre and post-tests. Several research variables measured at the pre-test and post-test stages for the experimental and control groups include the intensity and frequency of breastfeeding a baby in a day, the duration of time in one breastfeeding session, and the volume of breast milk produced.

Data analysis

Data collection was carried out without providing nutritional supplements for processed noodles made from Cerbung fish flour and Moringa leaf flour at the pre-test stage for the experimental group and the control group. Furthermore, data was obtained without providing nutritional supplements for processed noodles made from Cerbung fish flour and Moringa leaf flour at the post-test stage for the control group and data by providing nutritional supplements for processed noodles made from Cerbung fish flour and Moringa leaf flour at the post-test stage for the experimental group from the third trimester of pregnancy until after the mother gave birth and breastfed. Before providing nutritional supplements, researchers developed additional food products made from Cerbung fish flour and Moringa leaf flour in the form of instant noodles, organoleptic tests, and nutritional content analysis. The research data were then analyzed using SPSS software through independent sample tests. By conducting a significance test, a variable is said to have a significant influence on another variable if it has a p-value of less than 0.05.

Results and Discussion

The effect of giving instant noodles made from moringa leaves and Cerbung fish on breast milk production

Mother's breast milk production is measured based on breastfeeding frequency during one day, duration of breastfeeding, and volume of breast milk.

Table 1. Mean Frequency Distribution Breastfeeding in Groups Treatment and Groups Control

Group	Mean ± SD	Mean difference	p-value
Treatment	12.22 ± 3.11	-0.278	0.777
Control	12.50 ± 2.89		

Table 1 above show that no difference in the frequency of breastfeeding between group treatment and group control (Sig . 0.777). Based on the observation results, it is known that 100 percent of the breastfeeding babies in the treatment group are in the good category, which is ≥ 15 times a day. Based on the monitoring results, it is known that 100 percent of the breastfeeding babies in the control group are in the good category, which is ≥ 15 times a day. The same frequency of breastfeeding between the experimental and control groups did occur naturally as experienced by all mothers who carry a fetus and breastfeed their babies. During pregnancy, the body prepares itself for breastfeeding by stimulating the growth and development of branched lactiferous ducts and lactocyte-lined alveoli that secrete milk by creating colostrum. These functions are caused by the action of estrogen, growth hormone, cortisol, and prolactin. In addition, in response to progesterone, clusters of mammary alveoli grow from the ducts and widen toward the chest wall. After delivery, breastfeeding triggers the release of oxytocin, which stimulates myoepithelial cells to squeeze milk from the alveoli. Breast milk then flows into the pores of the nipple to be consumed by the baby (Jouanne et al., 2021).

Table 2. Mean Duration Distribution Breastfeeding in Groups Treatment and Groups Control

Group	Mean ± SD	Mean difference	p-value
Treatment	30.28 ± 8.98	4,778	0.049
Control	25.50 ± 5.10		

Based on Table 2, it is known that the duration of breastfeeding between the group treatment and the group control is as big as *Sig*. 0.049. The duration of breastfeeding in the group treatment is an average of 30.28 minutes every time you breastfeed, while the average duration of breastfeeding in the group control is 25.50 minutes every time you breastfeed. These results are in line with the research results of Ciulei et al., (2023), which showed that additional nutritional supplements with balanced energy and protein (BEP) content can increase breast milk production, thereby extending the duration of breastfeeding, which ultimately reduces the chances of premature birth, both in terms of birth age and baby weight, and reduces infant mortality during the delivery process.

Table 3. Distribution Mean Volume of Breast Milk

Group	Mean ± SD	Mean difference	p-value
Treatment	910.5 ± 105.41	62.25	0.024
Control	845.3 ± 61.84		

The volume of breast milk can be determined based on the baby's weight, namely by weighing the baby in ounces (1 kg = 10 ounces) and multiplying it by 28.4 mL (1 ounce = 28.4 mL). Based on the independent sample t-test, the S in value is known. Of 0.024 < 0.05, which shows a difference in the average volume of breast milk between the treatment group and the control group.

Breast milk production can be measured through the frequency of breastfeeding, the duration of breastfeeding on both breasts and the volume of breast milk consumed by the baby (Rodríguez & Martínez, 2022). This study showed that the volume of breast milk consumed by babies from mothers who consumed instant noodles made from Moringa leaf flour and Cerbung fish flour increased compared to the

volume of breast milk when the baby was just born. The average volume of breast milk in the month First after birth in the treatment group was 910.53 mL/day and the average volume of breast milk in the control group was 845.28 mL/day. The volume of breast milk in the month second after birth in the treatment group was 1166.25 mL/day, and the average volume of breast milk in the control group was 1095.20 mL/day. This shows a difference in the average volume of breast milk in the treatment group and the control group (Sig. 0.024), and a difference in the volume of breast milk between the second group is as much as 65.25 mL. In the second month after birth, there was a difference in the average volume of breast milk in the treatment group and the control group (Sig. 0.038), and a difference in the volume of breast milk between the second group was as much as 71.05 mL. This shows that food addition in the form of noodles instant made from fish flour and flour leaf Moringa influences the volume of breast milk.

Several studies have shown that breast milk volume varies widely. In industrialized countries, breast milk volume ranges from 750-800 mL/day in the first 4-5 months. The results of this study are more or less the same as the study by Amini (2003) in (Dinengsih et al., 2023), which revealed that the volume of breast milk at four months of breastfeeding ranges from 512-822.5 mL/day and is higher than the results of the study by Aritonang (2007) in (Dinengsih et al., 2023) namely the volume of breast milk after intervention was 438.4±137.4 mL/day at four months of breastfeeding.

The results of this study are in line with research (Zakaria et al., 2016) on breastfeeding mothers in Maros Regency who were given Moringa leaf extract and Moringa leaf flour that the volume of breast milk after intervention in both groups increased, the intervention group increased from 397.4 ± 117.5 mL to 660.5 ± 158.3 mL, an increase of 263.1 ± 40.8 mL (66.2%) and the control group increased from 448.8 ± 129.2 mL to 600.2 ± 119.8 mL, an increase of 151.4 ± 9.4 mL (33.7%).

Table 4. Distribution of Breast Milk Production in the Control Group

Breast milk production	n (20)	%
Fluent	7	35
Not smooth	13	75

Table 4 above explains that breast milk production in the control group based on frequency, duration of breastfeeding, and volume of breast milk is included in the smooth category, namely 35 percent, and breast milk production that is not smooth is 75 percent.

Table 5. Distribution of Breast Milk Production in Treatment Groups

Breast milk production	n (18)	%
Fluent	11	61.1
Not smooth	7	38.9

Table 5 explains that breast milk production in the treatment group is based on frequency, duration of breastfeeding, and volume of breast milk, which is included in the smooth category, namely 61.1 percent, and irregular breast milk production is 38.9 percent.

In a study (Dahliana & Maisura, 2021) on breastfeeding mothers in Bireuen, it was shown that there was a significant difference in changes in breast milk production as measured by the increase in baby's physical weight between the group given Moringa leaves and those not given Moringa leaves (p=0.000>0.05).

In a similar study by (Purnanto et al., 2020), it was found that the mean value at the *post-test stage* was greater than the *pre-test stage*, meaning that consumption of Moringa leaf tea affects increasing breast milk production in breastfeeding mothers. This increase in the quantity of breast milk is supported by the *p-value* obtained, which is 0.002 with a level of influence strength of 0.934, which means that the effect is very strong.

A number of research results above confirm that consuming healthy foods is one way to increase breast milk production in breastfeeding mothers to support optimal health for themselves and their babies. This is supported by the results of other studies showing that comprehensive nutritional supplementation containing various micronutrients plus balanced protein energy given to pregnant women with

malnutrition has been associated with better birth outcomes, including a decrease in low birth weight and smooth provision of exclusive breastfeeding to infants (Chapple et al., 2022).

Nutritional content in noodles processed from Cerbung fish flour and Moringa leaf flour

The results of the analysis of macronutrient and micronutrient content in noodles made from Cerbung fish flour and Moringa leaf flour are presented in the table below.

Table 6. Results of Analysis of Nutritional Content of Noodles in 100 grams

Parameter	Kandungan Gizi
Energi (Kal)	350,41
Karbohidrat (g)	57,362
Protein (g)	13,89
Fe (mg)	14,88
Kalsium (mg)	0,73

Based on the table above, it can be seen that noodles made from Cerbung fish flour and Moringa leaf flour contain macronutrients, namely energy and protein, which are relatively balanced and contain essential micronutrients such as calcium (Ca) and iron (Fe). During pregnancy until breastfeeding, the intake of energy-producing foods, namely those containing carbohydrates, is very much needed to supply the energy needs of the mother and her baby (Othman et al., 2020). Carbohydrates consumed by humans will go through a series of cellular metabolic reactions in the form of glycolysis, the citric acid cycle, as well as electron transport and oxidative phosphorylation which convert chemical potential energy into a temporary storage form in the form of ATP which can be used for mechanical muscle work, membrane transfer work, and various biochemical reactions (Nurkhozin & Mulyanti, 2017). However, carbohydrate consumption should be within reasonable and balanced limits because excess calories do not guarantee adequate intake or nutritional status that is essential for healthy pregnancy outcomes. Excessive consumption of foods containing carbohydrates and fats during the reproductive cycle is associated with short-term and long-term maternal health risks, including obesity, diabetes, dyslipidemia, and cardiovascular disease (Procter & Campbell, 2014).

Pregnancy is a unique physiological nutritional stage characterized by an increased need for foods containing protein, both animal and vegetable protein, especially those containing essential amino acids, which are needed for the development of new tissues, such as the fetus, and existing tissues, such as the uterus (Ciulei et al., 2023). Essential amino acids needed by humans, including for infant growth and development, include valine which is useful for stimulating muscle growth and regeneration; leucine which is useful in producing growth hormones; isoleucine involved in muscle metabolism; phenylalanine which is important for the formation of protein structures and a deficiency of the amino acid phenylalanine can cause the disease phenylketonuria; threonine The hydroxyl group, -OH, in threonine can be used to hydrogen bond either with water molecules when placed on the exterior or with other polar groups when in the interior. In addition, the -OH group in threonine can also bond with oligosaccharides to form glycoprotein compounds; tryptophan, the least hydrophobic amino acid and as a limiting amino acid between hydrophobic amino acids and hydrophilic amino acids; methionine, The amino acid methionine is useful for donating methyl groups, -CH3, in biosynthesis reactions involving transmethylation reactions; lysine, where the amino group as a side group can undergo an oxidation reaction to produce an aldo group with the help of the enzyme lysyl oxidase, then the reaction product is reacted with other lysine residues to form a cross-covalent bond bridge which is useful in maintaining the structure of fiber proteins such as collagen and elastin; and histidine, where the imidazole group on the histidine residue in a protein can function as a proton buffer which helps maintain normal blood pH at around 7.4 (Nurkhozin & Mulyanti, 2017).

Pregnant women should focus on diet quality and be encouraged to choose nutrient-rich foods high in important vitamins and minerals (de Seymour et al., 2019). Vitamins are organic nutrients that are needed in small amounts in human food and functions as a coenzyme precursor, namely a non-protein part in the form of an organic molecule that is important for the activity of an enzyme. Moringa leaves are proven to contain vitamins A, C, B2, and B6 (Sagita, 2020). Vitamin A aldehyde or retinal through the enzymatic isomerization reaction of 11-cis retinal to 11-trans retinal and continues to repeat in the

vision cycle; vitamin C or ascorbic acid acts as a coenzyme in the enzymatic hydroxylation reaction of proline residues to produce 4-hydroxyproline residues which are used as collagen helix stabilizers through electrostatic repulsion between pyrrolidine rings in the same collagen helix chain and through hydrogen bonds between collagen helices; vitamin B2 or riboflavin is a precursor to two coenzymes characterized by -N=C-C=N- as a temporary carrier of 2 hydrogen atoms, namely flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD); and Vitamin B6 or pyridoxine as a precursor of two related coenzymes, namely pyridoxal phosphate and pyridoxamine phosphate. Pyridoxal phosphate functions as a prosthetic group in a number of enzymes that catalyze amino acid reactions, such as transamination reactions, namely the reversible transfer reaction of amino groups from an α-amino acid to the α-carbon atom in an α-keto acid. Pyridoxal phosphate plays a role in receiving amino groups from α-amino acids so that they change into pyridoxamine phosphate. Pyridoxamine phosphate then transfers the amino group to the α-keto acid (Nurkhozin & Mulyanti, 2017).

Noodles made from Cerbung fish flour and Moringa leaf flour have also been identified as containing important minerals such as calcium (Ca) and iron (Fe). Ca^{2+} ions contribute to the process of muscle contraction implying that thin actin filaments are not only F-actin polymers, but contain other proteins that can interact with calcium ions. The fact shows that in the F-actin helix there is a depression containing a dimer-shaped fiber protein that fills the F-actin depression called tropomyosin. Each tropomyosin apparently binds three small proteins called troponin I, C, and T. The presence of tropomyosin and troponin inhibits the binding of the myosin head by actin unless the Ca^{2+} concentration is around 10^{-5} M. Fe^{2+} ion as the central atom in the heme group in hemoglobin which has an octahedral geometry with six coordination numbers. Four coordination numbers are used to bond with the nitrogen atom of the tetrapyrrole ring. The fifth coordination number of the Fe^{2+} ion bonds covalently with the Histidine-93 residue called proximal Histidine and the oxygen molecule bonds covalently with the last coordination (Nurkhozin & Mulyanti, 2017). Iron deficiency can cause symptoms of anemia. Pregnant women who suffer from anemia have a 5.1 times greater risk of experiencing postpartum hemorrhage compared to pregnant women who do not suffer from anemia (Karemoi et al., 2020). However, the symptoms of anemia experienced by pregnant women have relatively little effect on the fetus they are carrying. This is based on the fact that the blood of a baby in the womb contains more oxygen than the blood of its mother. This is because hemoglobin in babies contains other tetramers than adults, namely α2γ2. The difference is in the γ1 and γ2 subunits where there is a serine residue that replaces the Histidine 143 residue in the β1 and β2 subunits. The replacement of the Histidine 143 residue by the resin residue in the γ subunit causes the loss of two positive charges so that the γ subunit in the baby's hemoglobin has a low affinity for BPG and conversely has a much higher affinity for oxygen. This mechanism is responsible for transporting oxygen from the mother to the fetus in the womb until the baby is ready to be born into the world, where the γ subunit is replaced by the β subunit in adult hemoglobin (Nurkhozin & Mulyanti, 2017).

Conclusions

Noodles made from Cerbung fish flour and Moringa leaf flour contain representative nutrition, namely macronutrients in the form of relatively balanced energy and protein and micronutrients in the form of vitamin A, vitamin C, vitamin B2, vitamin B6, calcium, and iron, so it is highly recommended for use as an additional nutritional supplement for pregnant and lactating mothers. This is because the nutritional supplement in the form of noodles has been proven to increase the volume and production of breast milk, where breast milk is very much needed for the growth and development of babies who have healthy bodies and intelligent brains so that they can be expected to become the next generation that brings progress and better civilization.

The evidence from this research suggests that Moringa leaves and Cerbung fish offer potential nutritional benefits for breast milk production, with studies demonstrating positive effects on milk yield, composition, and reproductive performance in lactating animals. Furthermore, the cultural significance of Moringa leaves in traditional practices related to lactation indicates its potential importance in addressing nutritional challenges in lactating women and their infants. However, it's important to note that the potential health risks associated with consuming instant noodles made from Moringa leaves and Cerbung fish during lactation have not been extensively studied, and further research is needed to

fully understand the implications. The combination of Moringa leaves and Cerbung fish in instant noodles could potentially enhance breast milk production and support the physical growth of babies. Moringa leaves have been shown to significantly increase milk production and improve various growth parameters in babies. While specific data on Cerbung fish is not provided, its general nutritional benefits could complement the effects of Moringa leaves. Further research specifically on the combination of these two ingredients would be beneficial to confirm these effects.

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