Original Article

UTILIZATION OF MILKFISH BONE FLOUR (*Chanos chanos forskal)* AS COMPLEMENTARY HEALTH FOODS

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Abstract

Background: Milkfish (Chanos chanos, Forskal) is one of the strategic commodities to fulfill protein needs that are relatively inexpensive and favored by consumers in Indonesia. The use of milkfish bones (solid waste) is a natural source of Ca for food and supplements. This research is a strategy to maximize the utilization of milkfish resources while effectively reducing waste from the fishing industry. Objectives to find out the content of milkfish bone extract as a complementary health foods.

Methods: Experimental laboratory design with a post test only with control group design, this research was conducted at the Biopharmaca Laboratory of the Faculty of Pharmacy, Hasanuddin University. Sampling was done using convenience sampling method. The location of sampling and research in the milkfish aquaculture Barru Regency South Celebes, Pharmacy Laboratory of Alauddin State Islamic University of Makassar and Makassar Health Laboratory Center. Determination of the mineral and vitamin contents of milkfish uses three stages of analysis namely mineral analysis and vitamin analysis.

Result: The results of the analysis of milkfish bone extract it was found that the milkfish bone extract the highest content in calcium with a content as many as 4820,06 µg/g and the highest content in milkfish bone flour were found in calcium with a content as many as 76752,55 µg/g.

Conclusion: Milkfish bone extract and milkfish bone flour positively contain minerals and vitamins that can be used as complementary health foods.

Keywords: Milkfish (*Chanos chanos, forskal*); calcium; protein; vitamin; mineral.

Introduction

Most of Indonesia's territory is water. With these conditions, Indonesia has abundant aquatic products. There are various types of fish that live in Indonesian waters, one of which is milkfish. Milkfish (Chanos chanos) is a type of eurihalin fish. Therefore, milkfish can live in freshwater, brackish water, and sea water. Until now, little to no

attention has been given to the exploitation of marine by – products from the fishing industry. In general, there is a lack of scientific documentation regarding the content and function of various components of marine by-products. Norwegian fisheries produce more than 600,000 tons of by-products each year, which is more than 20% of all fish caught and grown in Norway. At present times, most of the by-products are used as raw materials for feed production; such as fishmeal, silage and furry animals food. Around 166,000 tons are still discharged into the sea [1].

Fish bones are also an important source of minerals: sodium, phosphorus, and calcium. Among them, calcium ions (Ca2+) are important for the development of human bones and teeth especially in infants. Utilization of fish bones can be a natural source of calcium for calcium as a food material and supplement. This will be a strategy to maximize the utilization of fish resources as well as to effectively reduce waste from the fishing industry. In developed countries, the use of fish bones has long been done by processing it into flour [2].

Indonesia is a tropical country with abundant natural resources, but as a developing country, nutritional problems still often occur mainly in pregnant women and children. One of the health problems is the lack of nutrition in pregnant women and children. This is a serious problem for Indonesian people. The need for calcium in pregnant women in developing countries has not been a major concern, even though calcium deficiency will endanger the health of the mother and fetus [3].

Pregnant women in developing countries generally have a low intake of calcium, so there are risk of experiencing various diseases. Research in Cameroon shows that as many as 94,6% of pregnant women have inadequate calcium intake, the median intake of pregnant women only meets 62,3% of the calcium recommended dietary allowances (RDA) of 1300 mg / day. Based on research in the Southern Thailand, it shows that as many as 55% of pregnant women have inadequate calcium intake with an average calcium intake of 493,2 mg / day which is equivalent to 61,65% of the calcium RDA of Thailand people. Another study conducted in Peru showed that the prevalence of pregnant women who had an inadequate calcium intake was 86%. There is not much information about calcium intake from food and the level of calcium adequacy in pregnant women and breastfeeding mothers in Indonesia, but according to the Regulation of the Head of National Agency of Drug and Food Control of Republic of Indonesia, the calcium RDA of pregnant women is 1300 mg / day, this calcium intake is 200 mg higher than other people in general, which only requires 1100 mg / day. But as a tropical and developing country, this is a serious problem for the people of Indonesia, referring to the high number of pregnant women who do not meet the RDA during pregnancy.

In addition, the incidence of stunting (short) in children under five years old is a major nutritional problem facing Indonesia. Based on Nutritional Status Monitoring (NSM) data for the past three years, stunting has the highest prevalence compared to the other nutritional problems such as malnutrition,

thinness, and fattiness. The prevalence of short children under five years old has increased from 2016 which 27,5% to 29,6% in 2017. Maternal health and nutritional conditions before and during pregnancy and after delivery affect fetal growth and the risk of stunting. One of the factors that influence the occurrence of stunting is the lack of nutrient intake during pregnancy. Based on the RDA for the infants aged 0 – 6 months requires calcium intake of 200 mg / day, infants aged 7 – 11 months requires 250 mg / day, and children aged 1 – 3 years requires 650 mg / day [4,5].

The nutritional content found in the milkfish bones is very good for human bone health because the

main elements of milkfish are calcium, phosphorus, and carbonate. Calcium is the fifth highest element and cations are the highest elements in the human body, which is about 1,5 – 2% of body weight. Calcium is needed for the forming process and maintaining the skeletal tissues of the body as well as several important activities in the body such as assisting in the regulation of the ions transportation inside and outside of the cell membrane [6].

Material and methods

This type of research is an experimental laboratory. The research plan used in this study is a pre-post test only with control group design. This research was conducted at the Pharmacy Laboratory of Alauddin State Islamic University of Makassar and Makassar Health Laboratory Center. The study was conducted in January to July 2019. The population of this study was milkfish (Chanos chanos F.), while the sample used was milkfish (Chanos chanos F.) taken from the milkfish aquaculture in Barru Regency, South Celebes, Indonesia, which was then made into milkfish bone extract, milkfish bone flour and then the content of each sample was tested.

Results

This study uses milkfish bone material which is then processed into milkfish bone extract, milkfish bone flour, and milkfish biscuits. Afterwards, the test of content of the samples with Iron (Fe), Potassium (K), Calcium (Ca), Manganese (Mn), Magnesium (mg), Sodium (Na), Zinc (Zn), Copper (Cu), Vitamin A, Vitamin C as parameters is conducted. Data from the sample content test results can be seen in the following table.

Table 1. Milkfish bone extract content test results

No	Parameter	Unit	Test Results	Methods Specification
1	Iron (Fe)	µg/g	57.68	Atomization
2	Potassium (K)	µg/g	727.31	Atomization
3	Calcium (Ca)	µg/g	4820.06	Atomization
4	Manganese (Mn)	µg/g	2.55	Atomization
5	Magnesium (Mg)	µg/g	1581.33	Atomization
6	Sodium (Na)	µg/g	2571.72	Atomization
7	Zinc (Zn)	µg/g	1.73	Atomization
8	Copper (Cu)	µg/g	<0.01	Atomization
9	Vitamin A	µg/g	8.70	Spectrophotometry
10	Vitamin C	µg/g	1625.53	Spectrophotometry

Table 2. Milkfish bone flour content test results

No	Parameter	Unit	Test Results	Methods Specification
1	Iron (Fe)	µg/g	17.23	Atomization
2	Potassium (K)	µg/g	199.06	Atomization
3	Calcium (Ca)	µg/g	76752.55	Atomization
4	Manganese (Mn)	µg/g	43.04	Atomization
5	Magnesium (Mg)	µg/g	3438.94	Atomization
6	Sodium (Na)	µg/g	1359.52	Atomization

7	Zinc (Zn)	µg/g	41.97	Atomization
8	Copper (Cu)	µg/g	0.09	Atomization
9	Vitamin A	µg/g	0.84	Spectrophotometry
10	Vitamin C	µg/g	51.12	Spectrophotometry

Based on Table 1, it can be concluded that milkfish bone extract positively contains Iron (Fe), Potassium (K), Calcium (Ca), Manganese (Mn), Magnesium (mg), Sodium (Na), Zinc (Zn), Copper (Cu), Vitamin A, Vitamin C with the highest content in milkfish bone extract were found in calcium with a content as many as 4820,06 µg/g and the lowest content was found in Copper (Cu) with a content < 0,01 µg/g.

Based on table 2, it can be concluded that milkfish bone flour positively contains Iron (Fe), Potassium (K), Calcium (Ca), Manganese (Mn), Magnesium (mg), Sodium (Na), Zinc (Zn), Copper (Cu), Vitamin A, Vitamin C with the highest content in milkfish bone flour were found in calcium with a content as many as 76752,55 µg/g and the lowest content was found in Copper (Cu) with a content as many as 0,09 µg/g.

Discussion

The resulting fish bone flour is in the form of a fine powder with yellowish white to yellow in color depending on the autoclaving time and the frequency of boiling.

The results of the mineral and vitamin content analysis of milkfish bone extract as a basic ingredient for complementary foods for the growth of bones and teeth in children showed positive results. Based on the test results, it was found that the milkfish bone extract, milkfish bone flour, and milkfish bone biscuits contain Iron (Fe), Potassium (K), Calcium (Ca), Manganese (Mn), Magnesium (mg), Sodium (Na), Zinc (Zn), Copper (Cu), Vitamin A, and Vitamin C.

The calcium content in fish is not only in the meat but also in the bones. Fish bones are one of the wastes that have not been utilized properly even though they contain high calcium. One of the fish bones that can be utilized is milkfish bone (Chanos chanos). Every day, production of milkfish bone waste reached 15 kg, or about 5,4 tons per year. Even though, it contains high nutritional value that can prevent osteoporosis. Milkfish bones contain 4% calcium, 3% phosphorus, and 32% protein [7].

Increased calcium content in various products has been done including making crackers with the addition of yellowfin tuna bone flour with 0%, 10%, 20% and 30% showed that the crackers contain 1% - 7,42% of calcium. Other studies stated that the balance of shrimp flour with wheat flour with 0% : 100%; 2,5% : 97,5%; 5% : 95%; 7,5% : 92,5%; and 10% : 90% ratio showed that fortification of 5% shrimp shell flour produced the best chemical, physical, and organoleptic characteristics with 1,43% of calcium content; 62,47% of water content; with 7,40% elongation. The addition of fish bone flour to various products that have been mentioned as the most preferred source of calcium by panelists. Based on theses studies fish bone flour fortification affects the level of panelists' preference and high level of calcium content.

Fish bone protein is mostly composed of collagen proteins with the main constituent of amino acids are proline, glycine, and alanine. Under natural conditions, these fibril or scleroprotein proteins area difficult to digest by the pepsin enzymes and pancreatin or trypsin or chymotrypsin into amino acids. Therefore, it is necessary to hydrolyze and dissolve the protein by heating. The process is also very useful for separating and utilizing calcium phosphate. Collagen is insoluble in water but when heated will turn into water – soluble gelatin. However, chemical hydrolysis (NaOH and heating used in this study) will also cause damage to other proteins that may be rich in the amino acids of lysine and arginine[8].

The condition of the mother before pregnancy, both body posture (weight and height) and nutrition is one of the factors that influence the occurrence of stunting. Adolescent girls as future mothers should have good nutritional

status. In 2017, the percentage of young women with short and very short conditions increased from the previous year which was 7,9% very short and 27,6% short. In terms of nutrition intake, 32% of girls in Indonesia in 2017 are at risk of having chronic energy deficiency (CED). Around 15 provinces have percentages above the national average. If the nutrition of adolescent girls is not improved then in the future there will be more and more expectant mothers who have short body postures and / or chronic energy deficiency. This will have an impact on the increasing prevalence of stunting in Indonesia.

supplements. To be able to meet calcium adequacy, pregnant women gain high – calcium foods [9].

Calcium has various functions in the body, including the formation of bones and teeth, regulates biological reactions, helps with muscle contractions and regulates blood clotting. In the bone, calcium has two functions, namely as part of the bone structure and as the body's calcium stockpile. During the growth process, a calcification process takes place in preparation for the bones to support the weight when the child starts to start walking. Deposits of calcium are stored in the long end of the bone called the trabeculae. These deposits are useful for maintaining normal levels of calcium in the blood. If the normal level of calcium in the blood decreases, the calcium reserves in the bone will be taken. If this situation persists continuously, it can result in reduced calcium that reserves in the bone and ends. So that the fulfillment of adequate nutrition is needed to overcome this problem [10].

Conclusion

Based on the research conducted, it can be concluded that the utilization of milkfish bones is very efficient if it is processed properly. In addition, milkfish bone extract and milkfish bone flour positively contain minerals and vitamins that can be used as complementary foods for the growth of bones and teeth in children.

Ethical approval

This research was approved by the research ethics commission of the Faculty of Dentistry, Hasanuddin University, Indonesia with number 0213 / PL.09 / KEPK-RSGMP Unhas / 2019.

Competing interests

The Journal of Nutrition found that calcium can also reduce the risk of preeclampsia, a condition where pregnant women experience high blood pressure and protein in the urine and have to give birth early. Calcium deficiency can also affect cardiovascular development in the fetus and increase high blood pressure after the baby is born. Calcium is the most abundant mineral in the human body. About 99% of calcium is present in hard tissues, namely bones and teeth, while 1% of calcium is in blood and soft tissues. Without this 1% of calcium, the muscles will experience contraction problems, blood will be difficult to clot, nerve transmission will be interrupted, and so on. Mothers who do not consume enough calcium from food need additional calcium

Author has declared that no competing interests exist.

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