

# HIVI (Hardtack Innovation Fish Scale) cookies made from fish scales to optimally increase nutrition

## Abstract

Indonesia is a maritime axis in the world due to its strategic location between oceans and vast waters, because of its strategic location Indonesia is also the largest fishery producer in Southeast Asia, especially in fishery products. Various kinds of fishery products produced include food, multivitamins to pharmaceuticals. The innovation that we made is making biscuits with the main ingredients that most people don't think of, namely fish scales. HIVI biscuits with the main ingredients of fish scales have a high collagen content of around 25% per 100 grams of samples which are usually only used as ingredients for the manufacture of cosmetics and other pharmaceutical ingredients that should be used as a source of protein in foods such as HIVI which uses collagen as a high source special protein lysine for rebuilding calcium in the human body. Macronutrients of HIVI biscuits, carbohydrates and fats are also fulfilled with additional ingredients such as corn flour, kidney beans, and honey. Its existence was analyzed by the proximate analysis method. Proximate analysis is a chemical test to determine the nutrient content of feed ingredients or feed which is divided into six nutritional fractions, namely water content, ash, crude protein, crude fat, crude fiber and extract without nitrogen (BETN). The hope is that with the presence of HIVI biscuits that can meet the nutrition of many people, especially being the first food diversification that is very efficient for humans who experience nutritional disorders, such as stunting, and osteoporosis.

**Keywords:** Fish Scales, Food Diversification, Malnutrition

Volume 9 Issue 3 - 2019

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**Received:** March 01, 2019 | **Published:** May 29, 2019

## Introduction

Fish scales are one of the waste products produced by fisheries production that are unused but have high nutritional value but unfortunately it has not received much attention, both by the government and society in general. The researchers have tested many of the benefits of fish scales in the laboratory, but the results have not been well socialized. This is because not many people want to innovate about empowerment in this case due to various things either due to lack of knowledge or fear of trying new things. Therefore, empowerment of waste in the community needs to be empowered and it is hoped that fish scale waste does not cause environmental pollution and can be useful in communities with proper processing. Based on data according to the Directorate General of PDSPKP 2016 (Strengthening Maritime and Fishery Product Competitiveness) it is known that the amount of fish consumption continues to increase each year so that the increase is directly proportional to the yield of post-processing fish waste such as fish scales. Nutrition is an important thing in the development of a country, nutrition is also an indicator of the assessment of life expectancy of a country. According to data from the WHO<sup>1</sup> set a tolerance limit of stunting (short stature) a maximum of 20% or one fifth of the total number of children under five. Meanwhile, in Indonesia there were 7.8 million out of 23 million children under five who were stunting or around 35.6%. A total of 18.5% were very short categories and 17.1% were short categories. This also resulted in WHO establishing Indonesia as a country with poor nutritional status.

Due to these facts we are concerned and plan to make an innovation biscuit called HIVI from the results of unused processing of fish scales which in addition to using unused processing of these biscuits have high calcium content that can fulfill the nutrition of the Indonesian

people. The status of Indonesia as an archipelagic country has been established since the Djuanda Declaration in 1957 and strengthened by the 2015 United Nations Convention on Law of the Sea (UNCLOS). Indonesia has around 17,500 islands, 81,000 km of coastline. About 62% of Indonesia's territory is sea and water, this is confirmed by data from the Ministry of Maritime Affairs and Fisheries, the land area is 1.91 million km<sup>2</sup> while the area of the waters reaches 6.32 million km<sup>2</sup>. So, Indonesia has the potential of extraordinary marine resources, especially in the fisheries sector. In addition, fish can be a solution because it is easy to have easily digestible proteins that support cell growth, vitamins A, D, B6, B12 which can maintain healthy eyes, bones, nerves and immunity, as well as minerals to prevent various diseases. And the content of omega 3 in fish ranges from 210 mg/100 gr which is greater than cows and chickens which are only 19 mg/100 gr and 22 mg/100 gr based on data according to Rinjani 2016 in the journal entitled "Water resources utilization and optimization to support advanced generations."

A good nutritional condition is the main condition of health and has an impact on the quality of human resources. Malnutrition according to the World Health Organization (WHO) is determined based on anthropometric indicators of body weight according to height or body length (BB/TB) with z-score of BB/TB <-3 SD and the presence or absence of edema.<sup>1,2</sup> Factors that cause malnutrition can be grouped into 2 namely direct causes and indirect causes. The direct causes of malnutrition include the lack of the quantity and quality of food consumed and suffering from infectious diseases, while the indirect causes of malnutrition are household food availability, poverty, inadequate parenting and low education, factors of food consumption are the direct causes of nutritional events bad for toddlers. This is due to the consumption of food that does not meet the number and composition of nutrients that meet the balanced

nutritional requirements, which are diverse, as needed, clean and safe so that it will directly affect the growth and development of toddlers. Factors of infectious diseases are related to the high incidence of infectious diseases, especially diarrhea, intestinal worms and acute respiratory disease (ARI). The factor of poverty is often referred to as the root of malnutrition, which is a factor that is closely related to the purchasing power of food in the household so that it has an impact on the fulfillment of nutrients.<sup>3</sup> To meet human calorie needs per day, EFP must have a calorie content of 2100 kcal/day with a percentage of protein calories of 10-15%, 35-45% fat, and 40-50% carbohydrates (Zoumas 2002). Water content in emergency food is also very much considered, one of which is a Snack bar which also has a very low water content of around 0.4%.<sup>4</sup> Water content plays an important role in knowing the amount of water contained in a sample that affects the shelf life. High water levels cause susceptibility to microbial activity. Drying is a way to extend the shelf life by drying the sample with a certain water content limit.<sup>5</sup> The higher the temperature, the lower the water content produced.

Fish scales are the barrier nature of the body of a fish forming the outermost layer of the skin to prevent the entry of foreign compounds into the body of the fish. Variations in fish scales are very broad, can be distinguished into the shape, size, and arrangement. General classification consists of cosmoid, ganoid, placoid, and elasmoid (cycloid and ctenoid) which are often found in the teleost class. Tissues in fish scales generally contain osteoblasts and osteoclasts with regulation of cell activity in the tissue is still little known.<sup>6</sup> Scales also have characteristics found in other structures such as bone, teeth, and tendon which are mineralized. The minerals that make up most of these structures are collagen which consists of hydroxyapatite and water.<sup>7</sup>

Fish scales have the main content, which is rigidly arranged collagen with low flexibility due to mineralization. Fish scales are wastes that have not been utilized optimally. Industrial scale fish scales (obtained from the fish fillet industry) can be used as a source of collagen, while on a household scale it is usually only discarded. Fish scales have a very high collagen content which is around 80-98% if not yet processed. This is very unfortunate if fish scales are not optimally treated. Fish scales in addition to having high collagen have inoulen hormone which functions as protein inulate in the body so that the absorption of protein in the body can be absorbed optimally besides that, fish scales containing collagen apply to fish that have scales on the basis of fish scales that have nutrients well.<sup>8</sup>

One of the main components of composing fish scales is collagen. Collagen is a fiber protein that provides strength and flexibility to tissues and bones and plays an important role for other tissues, including the skin and tendons. The collagen structure consists of a triple helix of three  $\alpha$  polypeptide chains and two types of amino acid derivatives.<sup>9,10</sup> The collagen triple helix structure is derived from three main amino acids, namely glycine, proline, and hydroxyproline (Lodish et al. 2000). Collagen is very popular in various studies because it contains many benefits such as medicine, cosmetics, and its residues (hydrolysate) can be used in the food industry as a food softener (Arvanitoyannis and Kassaveti, 2008). Collagen which scales fish can be used to heal burns and repair tissues (Gelse et al. 2003).

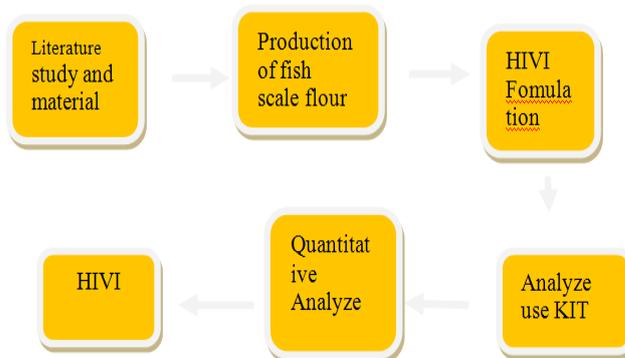
Collagen has a precursor namely tropagenagen, a triple helix of three polypeptide chains that copy braids to form a mine-like structure with large stretch strength. There are 1000 amino acid residues in each polypeptide chain. Collagen has a helix structure in the form

of a connective tissue matrix component. This helix can rotate to the left with a distance between two links of 0.96 nm and 3.3 amino acid chains per cycle. Helix collagen does not have a hydrogen bridge and is more steep compared to alpha helix. The stability of the structure is generated by combining three helixes together into one triple helix that rotates to the right.<sup>11</sup>

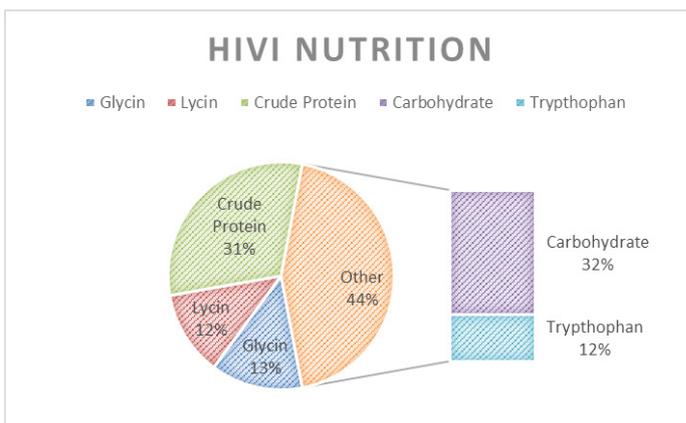
## Methods and materials

The writing of this paper was done with literature studies and research in the laboratory. Literature studies are conducted to look for ingredients for making HIVI which can then be a comparison for the results of analysis of HIVI products. The research conducted in 2 laboratories, namely for making snack bars, was conducted at the Dietetic Laboratory of the Department of Nutrition, University of Indonesia Public Health Faculty on 8 December 2018. Furthermore, HIVI analysis was conducted at the Pharmacy School Laboratory, Bandung Institute of Technology on 9 December 2018 using KIT type 203 to detect the content contained in the biscuit, then for the quantitative test use the Type 342 HPLC to find out what percentage of the content is in the biscuit.

Figure



## Results



## Discussion

Food diversification is a program that is intended so that people are not fixated on only one basic food type and are encouraged to also consume other foodstuffs as a substitute for the staple food they have been consuming. In Indonesia, food diversification is intended so that the Indonesian people do not consider rice as the only staple food

that cannot be replaced by other foodstuffs. Indonesia has a variety of agricultural products which can actually be used as staple foods such as breadfruit, sweet potatoes, taro, etc. which can be the main supporting factors for food diversification. Food diversification is one way to achieve rice self-sufficiency by reducing rice consumption so that total consumption does not exceed production (Amba 2017). The definition of food diversification is contained in Government Regulation No. 68 of 2002 concerning Food Security. According to Susanto (2015), fish scales have a large amount of collagen which is around 60% if it has been processed into a product, besides having a very good function for skin health, collagen serves to activate protein substrates namely triptopan, glycine and lysine. These three protein substrates have a function to regenerate damaged cells while activating the choliesistokinin hormone which functions to influence the satiety in the stomach. The ingredients used to make Biscuits are nuts, honey and fish scales. The peanuts used are peanuts. The supply of peanuts as a source of carbohydrate and peanuts contains the choliesistokinin hormone which functions to influence the satiety in the stomach. According to Miranda,<sup>12</sup> activation of the cholecystokinin hormone occurs in the duodenum, and the small intestine is usually known in the duodenum and the small intestine where it absorbs protein and vitamins. When protein and vitamins enter the small intestine, and the small intestine absorbs all the proteins and vitamins in the food, the small intestine activates hormonal in the form of coliesistokinin to respond to the stomach to stop eating because coliesistokinin can be called a signal to body to stop because the body has fulfilled protein and vitamins or we usually call it full. The activation of the cystokinin hormone in the body must be initiated with the presence of sufficient collagen compounds to activate the work of the choliesistokinin hormone. After that, give honey to glue the snack bar well to function as an anti microbiological activity on food. Honey has anti-microbial properties, namely honey has a cytokinin hormone which functions to slow or stop microbial growth in food. In addition, glucose contained in honey can damage cells that exist in microbes because it is difficult to breed. The addition of fish scales at the snack bar serves to activate the choliesistokinin hormone because the fish scales contain high collagen (Ahmad 2012). Collaboration of these materials makes biscuits from fish scales make them potential as food diversification to overcome malnutrition. Nutrition is an important thing in the development of a country. Nutrition is also an indicator of the assessment of life expectancy of a country. According to the Data and Information Center of the Ministry of Health of the Republic of Indonesia, it can be seen from Bone Mineral Density that both men and women have decreased levels of calcium in their old age so that they need additional nutrients in calcium and minerals to cope with osteoporosis. From the facts above, we innovated to make useful biscuits according to calcium requirements by the community. HIVI is an innovative product in the form of biscuits made from fish scales. Making HIVI is not much different from making biscuits in general, only the main composition used is fish scales, fish scales used for making biscuits in the form of extracts from fish scales flour processed by making extracts from fish bones using an extraction method, flouroin, where flouroin is an extraction method that separates the main components from the main ingredients (Livia 2017). Making tilapia scales flour. Tilapia scales are washed and weighed and then soaked in a solution of lime juice (*Citrus aurantifolia* s.) And ovened at 150 degrees Celsius for 60 minutes to get dried fish scales, weigh fish scales into flour. This fish scales are formulated with roasted peanuts and honey. At the same time it is mixed into the biscuit mixture. The design with the method of mixing many sources aims to produce nutrients that are suitable for human needs. mixed into

the existing dough the components are separated, then the dough is made for the biscuit, then separate it to be put into the biscuit dough, to make the biscuit dough put eggs, flour, sugar, salt, vanilla, honey and beans. After that add fish scales flour until smooth. After that, it is made to print like a biscuit normally, then bake it over the oven for ripening from the biscuit, after it's finished the biscuits are ready for consumption. HIVI has been analyzed through the research method stage, which is using the advanced flouroin method, which is weighed 100 grams of sample, then dissolved into a glass tube and dissolved in water after analysis so that the results of the analysis are carbohydrate containing about 32%, crude protein containing 31%, lysine 12%, glycine 13% and triptopan 12% fat content is very low at around 11% B/B.

According to WHO (2014), the fulfillment of carbohydrates in the Indonesian community is 24% and asar protein is 20% according to the data which means that it can fulfill the people's nutrition. The results of the HIVI analysis contain carbohydrates and proteins that are in accordance with the standards of carbohydrates and proteins for human needs. Furthermore, lysine 12%, glycin 13% and tryptopan 12% are important additions to the macronutrient support of HIVI. However, the fat content is very low at around 11% B/B. However; HIVI can still be used as a biscuit made from fish scales to fulfill the special nutrition of the community for the fulfillment of nutrients to combat malnutrition, such as stunting and osteoporosis. Biscuits are made from several places at the same time made and analyzed in 2 laboratories, namely making biscuits at the Dietetic Laboratory of the Department of Nutrition, University of Indonesia Public Health Faculty on December 8, 2018. Furthermore, the analysis was conducted at the Pharmacy School Laboratory, Bandung Institute of Technology on December 9, 2018 used type 203 KIT to detect the contents in the snack bar, then for the quantitative test using the Type 342 HPLC to find out what percentage of the content contained in the biscuit.<sup>13-18</sup>

## Conclusion

Fish scales are present as one of the enhancers in the processing of biscuit foods, a mixture of fish scales is believed to help improve nutrition in the community, especially to overcome malnutrition, which often has problems in foods with unbalanced nutritional content. The existence of processed foods like this is one of the solutions to diversification of food with balanced nutrition. This is one reason why this product is worthy of being an emergency food because it contains high protein so it can delay hunger. In addition to protein, important macronutrients from these biscuits such as carbohydrates and fats are contained in them. However, research must be done so that this product can develop well.

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