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Macro and Micro Mineral Composition of *Haruan* Fish (*Channa striata*) in Banjar District, South Kalimantan

Rahmat Yunus*, Dahlena Ariyani, and Muhammad Aisy

Departement of Chemistry, Faculty of Mathematics and Natural Science,
Lambung Mangkurat University, Banjarbaru, Indonesia

*Email: rahmat.yunus@ulm.ac.id

ABSTRACT

Minerals have an essential role in the human body. Information about the mineral content of haruan fish in Banjar Regency is very limited. This research aimed to determine the mineral compound of haruan fish originally from ponds in Banjar Regency. Pond-sourced fish samples were processed until they became powders. The ash compound of haruan fish powder was calculated using the gravimetric method. The mineral compound was analyzed using an XRF spectrometer. Wild haruan fish contained 98.85% macro minerals, with the mineral composition of 14.4% P (10.2 mg/kg), 19.9% Ca (19,9 mg/kg), 60.6% K (42.5 mg/kg), and 0.85% S (0.6 mg/kg). Farmed haruan fish contained 94,76% macro minerals, consisting of 15.6% P (12.9 mg/kg), 17.2% Ca (14.3 mg/kg), 61.1% K (50.8 mg/kg), and 0.86% S (0.7 mg/kg). Wild haruan contained 3.51% micro minerals, consisting of 4.44% Fe (3.7 mg/kg), 0.10% Cu (0.08 mg/kg), and 0.22% Zn (0.18 mg/kg). Farmed haruan contained 4.76% micro minerals, consisting of 4.44% Fe (3.7 mg/kg), 0.10% Cu (0.08 mg/kg), and 0.22% Zn (0.18 mg/kg). Wild haruan fish contained 0.56% trace element, 0.46% Rb (0.32 mg/kg), and 0.1% Re (0.07 mg/kg). Farmed haruan fish contained 0.42% trace element, 0.34% Rb (0.28 mg/kg), and 0.08% Re (0.06 mg/kg).

Keywords: haruan fish, macro mineral; micro mineral

ABSTRAK

Mineral mempunyai peranan yang sangat vital bagi tubuh manusia. Informasi tentang kandungan mineral yang terdapat pada ikan haruan di Kabupaten Banjar sangat terbatas. Tujuan penelitian ini adalah untuk mengetahui kandungan mineral ikan haruan yang berasal dari Kabupaten Banjar. Sampel ikan yang diperoleh dari tambak dan sungai dipreparasi sampai menjadi serbuk. Serbuk haruan diabukan dan dihitung persentase kadar abu dengan menggunakan metode analisis gravimetri. Kandungan mineral dianalisis menggunakan spektrometer XRF. Daging ikan haruan alam mengandung mineral makro sebesar 98,85 % dengan komposisi mineral P 14,4 % (10,2 mg/kg), Ca 19,9 % (19,9 mg/kg) K 60,6 % (42,5 mg/kg) dan S 0,85 % (0,6 mg/kg). Daging ikan haruan budidaya mengandung mineral makro sebesar 94,76 % dengan komposisi mineral P 15,6 % (12,9 mg/kg) Ca 17,2 % (14,3 mg/kg) K 61,1 % (50,8 mg/kg) dan S 0,86 % (0,7 mg/kg). Daging ikan haruan alam mengandung mineral mikro sebesar 3,51 % dengan komposisi mineral Fe 3,20 % (2,24 mg/kg) Cu 0,089 % (0,06 mg/kg) dan Zn 0,22 % (0,15 mg/kg). Daging ikan haruan budidaya mengandung mineral mikro sebesar 4,76 % dengan komposisi mineral Fe 4,44 % (3,7 mg/kg) Cu 0,10 % (0,08 mg/kg) dan Zn 0,22 % (0,18 mg/kg). Daging ikan haruan alam mengandung unsur runut sebesar 0,56 % yaitu Rb 0,46 % (0,32 mg/kg) dan Re 0,1

% (0,07 mg/kg). Daging ikan haruan budidaya mengandung unsur runut sebesar 0,42 % yaitu Rb 0,34 % (0,28 mg/kg) dan Re 0,08 % (0,06 mg/kg).

Keywords: ikan haruan; makro mineral; mikro mineral

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1. INTRODUCTION

inerals are chemical elements other than hydrogen, oxygen, carbon, and nitrogen needed by the body. Minerals have an essential role in the human body. Calcium (Ca) and phosphorus (P) play important roles in bone and tooth formation. Zinc (Zn) and iodine (I) are enzyme cofactors that function in biological processes. Lack of calcium can cause osteoporosis. Zinc deficiency results in stunted growth, while a lack of iodine consumption can lead to goiter and mental retardation (Olson et al., 1988).

There are two categories of minerals: macro and micro. Macrominerals are essential minerals for the formation of various organ components. According to Winarno (1992), the macromineral content required by the human body is greater than 100 mg per day or greater than 0.01% of body weight. Some examples of macro minerals are calcium, phosphorus, sodium, and potassium. Microminerals are other types of minerals which total content in the body is less than 0.01% of body weight and is only needed in amounts less than 100 mg/day. Some examples of microminerals are chromium, iron, and iodine.

Meeting the needs of minerals in humans can be obtained by consuming food, both derived from plants or animals. The best source of minerals is animal products because the biological availability of minerals in plant product is lower. It is caused by the presence of mineral-binding substances, such as fiber, that inhibit mineral absorption (Santoso, 2009).

Fish, including fish captured in rivers and farmed fish, can be consumed as a source of animal nutrition. Banjar Regency residents frequently consume various fish, including haruan fish (Channa striata). This fish is popular since it is a commodity in Banjar Regency's freshwater fishing industry.

The mineral content of fish has been studied before. Chasannah et al. (2015) stated that the mineral nutrient content in haruan fish was in the form of Ca, K, and Fe, each of which was 12.15, 283.00, and 0.17 mg/100g sample. Santoso (2009) stated that the macro mineral content of gourami aged 7 months - 1 year for Ca, K, and Mg were 162.37, 128.85, and 9.63 mg/kg, respectively; Microminerals for Fe, Cu, Zn, and I were 78.26, 18.72, 22.45, and 0.08 µg/g, respectively. The macro mineral content of gourami aged 2.5 - 3 years for Ca, P, K, Mg, and Na were around 91.33, 610, 88.74, 7.65, and 59.85 mg/kg, respectively. Microminerals for Fe, Cu, Zn, and I were 46.18, 12.83, 14.25, and 0.08 µg/g, respectively. Nurhayati (2014) stated that the highest levels of microminerals were found in milkfish weighing ± 150 g, namely Zn 6.95 ± 0.16, Cu 0.55 ± 0.0, and Fe 12.14 ± 0.06 mg/ kg bk. The highest I content was found in milkfish weighing ± 102 g, which was 76.33 ± 0.01 µg/100 g body weight.

Animal sustenance can be obtained by consuming either wild-caught or farmed fish. According to the Statistics Indonesia (BPS) for Banjar Regency, aquaculture production in 2017, 2018, and 2019 increased by 58,041.77, 58,105.50, and 60,870.36 tonnes, respectively. There is currently a lack of data and information on the mineral content of haruan fish in Banjar Regency. Therefore, more research is needed. This study is to provide valuable information

about the mineral content of haruan fish, which is widely consumed in Banjar Regency.

2. MATERIALS AND METHODS

2.1. Materials

The tools used were a food grinder, 30 mL porcelain cup, tongs, desiccator, stainless steel sample spoon, analytical balance (OHAUS Galaxy 400), oven (Thermologic), sieve no. 20 (mesh size 0331 inches, wire diameter 0.510 mm), ashing furnace, sample containers (plastic and glass), X-Ray Fluorescence (Jeol Element Analyzer type JSX-3211). The materials used wer0065 distilled water and Haruan fish samples.

2.2. Sampling

Sampling was performed at haruan fish cultivation sites and rivers in the Banjar Regency area. Sampling was carried out in two places. Wild haruan fish was taken from the Riam Kanan Reservoir, Aranio District, Banjar Regency, South Kalimantan Province. The farmed haruan fish was harvested from ponds in Tungkaran Village, Banjar Regency, South Kalimantan. The largest fish was chosen so that the same size was obtained. The fish was placed in a refrigerated box and transported to the FMIPA ULM Banjarbaru Basic Laboratory for analysis.

2.3. Determination of Water Content in Fish Meat

The ash content was determined by inserting an empty cup into the furnace. The temperature was then raised gradually until it reached 550°C and allowed to stand for 12 hours. The temperature was then lowered to around 40°C, and the empty cup was removed and cooled in a desiccator for 30 minutes and then weighed. A total of 5 grams of sample was put into an empty cup heated in an oven at 100°C for 24 hours. The crucible was transferred into the furnace, and the temperature was gradually increased until it reached 550°C ± 5C for 8 hours. The temperature was reduced to 40°C, and then the cup was removed using tongs and placed in a desiccator for 30 minutes. After cooling, the cup and its contents were weighed again.

2.4. Analysis using X-Ray Fluorescence (XRF)

A total of 5 grams of the sample that has been reduced to ash was placed in the sample container for XRF analysis. XRF analysis included reading the X-ray spectrum of the sample, identifying the peaks, and classifying each element as a major constituent based on the peak intensity. Parameter analysis consisted of qualitative analysis and quantitative analysis. The qualitative analysis included reading the spectrum of fluorescence light based on the size of the energy spectrum of the fluorescence light in kilo electron volt (keV) energy units. This value is unique to each type of material. Quantitative analysis was based on the intensity of the emitted energy. The information obtained from these two analyzes was the amount, composition, and type of material (Barone et al., 2003).

3. RESULTS AND DISCUSSION

3.1. Determination of Water Content in Fish Meat

Water content analysis was carried out to determine the amount of water contained in the haruan fish. Water content was obtained based on the weight lost after the sample was dried in the oven at 100°C. The results are presented in Table 1.

Based on Table 1, the meat of wild haruan fish contains a moisture content of 80.13%, while the meat of haruan fish produced by cultivation is 79.8%. It indicates that the water content contained is similar.

Table 1. Water Content of Haruan Fish Meat

Sample	Water Content (%)	Average (%)

Wild	81.3	80.1
	78.4	
	80.7	
Farmed	79.8	79.9
	80	
	80	

Based on Table 1, the meat of wild haruan fish contains a moisture content of 80.13%, while the meat of haruan fish produced by cultivation is 79.8%. It indicates that the water content contained is similar. The results obtained are similar to Kelvin et al.'s research (2014), which is equal to 80.4%, and Ahmed et al. (2012), which is equal to 82.6%. Chasannah et al.'s (2015) study showed lower wild haruan meat by 78.8% and farmed haruan meat by 77%. The type of food and fish habitat may influence these disparities (Suwandi et al., 2014).

3.2. Determination of Ash Content in Fish Meat

The determination of ash content aimed to determine the total minerals contained in fish and sediment samples. The results are presented in Table 2.

Table 2. Ash content of Haruan Fish Meat

Sample	Ash Content (%)	Average (%)
Wild	6.9	7
	6.8	
	7.2	
Farmed	8.02	8.3
	8.4	
	8.5	

Table 2 shows that the meat of wild haruan fish has an ash content of 7%, while the meat of farmed haruan fish is 8.3%. This result differs from Kelvin et al. (2014), which has a lower value of 1.5%, and Ahmed et al. (2012), which is equal to 0.4%. Ash content has a relationship with the mineral content of a material. The habitat of the haruan fish influences the difference in ash content. The ash content of the haruan fish depends on the habitat of the fish, which is related to the mineral content in the haruan fish's body (Sulthoniyah et al., 2013). High ash content implies that fish meat is rich in minerals.

The high value of this ash content may have resulted from the addition of fortification to the fish diet. This fortification aims to meet and increase the nutritional needs of fish (Harmain et al., 2017).

3.3. Composition of Macro and Micro Minerals in Haruan Fish Meat

Table 3 shows that the mineral concentrations in natural and farmed haruan fish meat are different. It occurs because the body absorbs minerals as needed. The age of the fish has a significant impact on the accumulation of minerals in the body. The older the fish, the greater the mineral absorbed. According to Hafiludin (2016), the composition of vitamins, carbohydrates, fats, proteins, and minerals in each fish species varies according to age, metabolism, diet, environment, and reproductive mass. The meat of both wild and farmed haruan fish includes the same essential minerals, K, Ca, P, S, Fe, Zn, and Cu, but in different concentrations. Asfar (2014) found that haruan fish contains macro and micro minerals in the form of Na, K, Ca, Mg, Fe, Zn, Mn, Cu, and P, with the highest concentration being K of 2195 mg/kg and the smallest mineral being Cu of 1 .3 mg/kg.

Table 3. Mineral Composition of Haruan Fish Meat

No	Mineral	mg/kg	
		Wild	Farmed
1	(Ca)	13.9	14.3
2	(K)	42.5	50.8
3	(P)	10.2	12.9
4	(S)	0.6	0.7
5	(Fe)	2.24	3.7
6	(Zn)	0.15	0.18
7	(Cu)	0.06	0.08

3.4. Trace Element in Haruan Fish Meat

Trace elements are minerals with very small concentrations in soil, plants, and living organisms. Trace elements in nature are necessary to maintain the balance of other elements. The results of the trace element XRF spectrometer is presented in Table 4.

Table 4. Trace Elements in Haruan Fish Meat

Sample	Elements (mg/kg)	
	Rb	Re
Wild	0.32	0.07
Farmed	0.28	0.06

According to Tzu (2013), trace elements are found in waters with very small concentrations, namely 67.18-0.024 µg/L of water compared to other trace elements. Trace elements such as Rb and Re play an important role in various biological metabolic processes of organisms in an environment.

Wild haruan fish meat contained 0.32 mg/kg of Rb, while farmed haruan fish contained 0.28 mg/kg. Fahad et al. (2018) discovered that six fish samples collected from diverse locations in Bangladesh contained Rb. At 0.01%, tilapia (Oreochromis mossambicus) has the highest Rb concentration.

The Re element in the meat of wild haruan fish was 0.07 mg/kg, while in farmed haruan fish was 0.06 mg/kg. This value suggests that the Re concentration in haruan fish is safe. The Re element in fish is closely related to the environment in which the fish live. Chen et al. (2016) found that fish samples taken from the Canadian city of Ontario absorbed the radioactive element Re with the highest concentration of 0.06 mg/kg. This fish absorbs Re elements while seeking food in sediment deposits at the bottom of the sea. Therefore, radioactive elements in the sediments may accumulate in the fish's body.

4. CONCLUSIONS

The conclusions that can be drawn from this research are:

1. Minerals found in haruan fish meat in the Banjar Regency area include macro minerals such as K, Ca, P, and S, as well as micro minerals such as Fe, Zn, Cu, Rb, and Re.
2. Wild haruan fish meat contained macro minerals with a composition of 42.5 mg/kg K, 13.3 mg/kg Ca, 10.2 mg/kg P, and 0.6 mg/kg S; micro minerals with a composition of 2.24 mg/kg Fe, 0.15 mg/kg Zn, and 0.10 mg/kg Cu; and trace elements with a composition of 0.32 mg/kg Rb and 0.07 mg/kg Re.
3. Farmed haruan fish meat contained macro minerals with a composition of 50.8 mg/kg K, 14.3 mg/kg Ca, 12.9 mg/kg P, and 0.7 mg/kg S; micro minerals with a composition of 3.7 mg/kg Fe, 0.18 mg/kg Zn, and 0.08 mg/kg Cu; and trace elements with a composition of 0.28 mg/kg Rb and 0.06 mg/kg Re.

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