



COMPARATIVE STUDY THE MINERAL CONTENT OF EEL FISH
(*Anguilla marmorata* (Q.) GAIMARD AND *Anguilla bicolor*) FROM POSOLAKE
CENTRAL SULAWESI

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ABSTRACT

Key Words

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Gaimard, *Anguilla bicolor*,
minerals, Lake Poso.



Eel fish contains vitamin, protein, and minerals that human need. This study aims to determine the level of minerals from different types of Eel fish *Anguilla marmorata* and *Anguilla bicolor* in Poso Lake, Central Sulawesi. For sample, we analyzed two weights from each species, they are 0.5 kg and 3 kg. The mineral composition was determined by microwave digestion method and *Inductively Coupled Plasma Mass Spectrometry* (ICP-MS). The results showed that the mineral content from those two species was different. *A. marmorata* contain Ca, Mg, P, K, and Na, but not Zn and I. While *A. bicolor* contain Mg, P, K, Zn, and I, but not Ca and Na. T-test Statistical result showed there are differences in the levels of minerals magnesium and phosphorus in *A. marmorata* and *A. bicolor* (weight 3 kg) with a significance value of <0.025 , potassium levels have not differences. Whereas *A. marmorata* and *A. bicolor* (weight 0.5 kg) are differences in levels of potassium, magnesium and phosphorus with significance value is <0.025 .

INTRODUCTION

Poso Lake located in Poso Region, Central Sulawesi Province of Indonesia. The lake drains into Poso River at Tentena, which flows into the Molucca Sea at the Poso. There are several endemic fish species such as *Adrianichthys kruyti* and *Adrianichthys roseni* (a type of Rono fish), *Xenopoecilus poptae* (Buntinge), *Webegobius amadi* (Bungu), *Xenopoecilus oophorus* (Rono), *Oryzias nigrimas*, *O. Orthognathus* (rice fish) and also included *Anguilla celebensis* (Eel Fish)¹. Eel fish commonly called Sogili fish by the Tentena people who live around Poso

Lake. There are 5 types of eel fish found in Poso Lake, they are *Anguilla marmorata*, *Anguilla celebensis*, *Anguilla interioris*, *Anguilla bicolor* and *Anguilla borneoensis*². But *Anguilla marmorata* and *Anguilla bicolor* are two types of eel fish that always consumed by Poso people.

Eel Fish is rich in protein, vitamins, fatty acids and minerals, this fish is extremely popular in many countries, especially Japan, China, Germany, and France. In addition this fish is also rich with vitamins

A, B1, B2, B6, C, D, protein albumin, DHA (*Docosahexaenoic acid*) and EPA (*Eicosapentaenoic acid*) or commonly known as omega-3³. Minerals is one of the components that are needed by living beings besides a carbohydrates, fats, protein, and vitamins, this element is also known as inorganic substances or ash content⁴.

Based on the type, minerals are divided into two groups, named macro minerals and micro minerals. Macro minerals needed or present in relatively large numbers, including Ca, P, K, Na, Cl, S, and Mg. Micro minerals are measily required and can found in tissues with lowets concentrations, including Fe, Mo, Cu, Zn, Mn, Co, I, and Se⁴.

Another freshwater fish, Carp 2.5-3 years old contain Ca, P, K, Mg, and Na respectively 91.33 mg/kg; 610 mg/kg; 88,74mg/kg ; 7.65 mg/kg and 59.85 mg/kg. Micro minerals are Fe, Cu, Zn, and I respectively 46.18µg/g; 12.83µg/g; 14.25µg/g and 0.0811 µg/g⁵. Other research on Eel Fish *A. marmorata* in yellow eel phase (35-40 gram) from Palu River and Poso Lake contain potassium 1.519 mg/kg and 1.360 mg/kg; magnesium 203mg/kg and 179 mg/kg; zinc 11.2 mg/kg (Palu river), strontium 1.32 mg/kg (Poso Lake) and mercury 0.129 mg/kg (Palu river)⁶. From these studies showed that the different types of fish have distinction mineral content.

METHODS

Sample Preparation

The fish have been caught removed the scales, gills and entrails, then cleaned with flow water until no more blood and mucus, cutted into small pieces and crushed using a blender until homogeneous. The samples were then stored in a clean container and sealed, put in the refrigerator until it is analyzed⁷.

Destruction method used is a wet destruction using microwave digestion. The first stage begins with the weighin each samples 0.3 grams and then inserted

into a vessel. subsequently add 6 mL HNO₃. The vessel insert into the protection shield, then covered with a lid and tightened. Put vessel into the microwave digestion, and then connected with a temperature sensor, perform pre-digest for 10-15 minutes at room temperature. The second stage, set the temperature to 150-200°C. After the destruction process is complete, removed the vessel and cooled in room temperature, then the vessel is opened. Destruction resulting solution from the digestion vessel load into the flask and diluted with 6 mL HNO₃⁷.

Qualitative Analysis: Qualitative test using the method of screening element/total quant on an ICP-MS based on the identified elements mass as vulnerable mass number of 6 to 240, with a standard solution of external called smartune containing Be 1 g/L, Co 1 µg/L, In 1 µg/L, Ba 10 µg/L, Pb 1 µg/L, Th 1 µg/L, and U 1 µg/L⁷.

Quantitative Analysis: Quantitative assay using a calibration each of the elements tested, namely Ca, Mg, Na, P, K, Zn, and I at a concentration of 0.5; 1; 2; 3; 4 x RL. 6 ml of the decoded sample was inserted into the ICP-MS device for analysis.

Data analysis: Levels of minerals in the sample is calculated using the following formula:

$$\text{Level (mg/kg)} = F_p \times C$$

Nb:

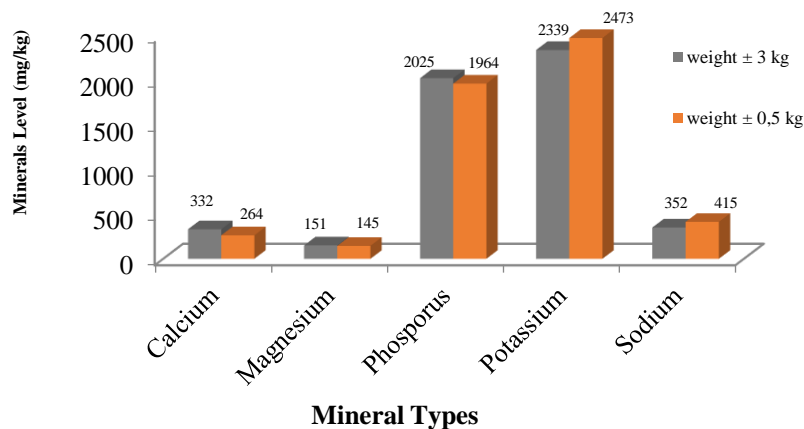
F_p = Dilution Factor

C = Concentration

Data were analyzed using parametric statistical tests, which test the hypothesis using unpaired t-test.

RESULT AND DISCUSSION

Minerals Level of Eel Fish (*Anguilla marmorata* (Q.) Gaimard)

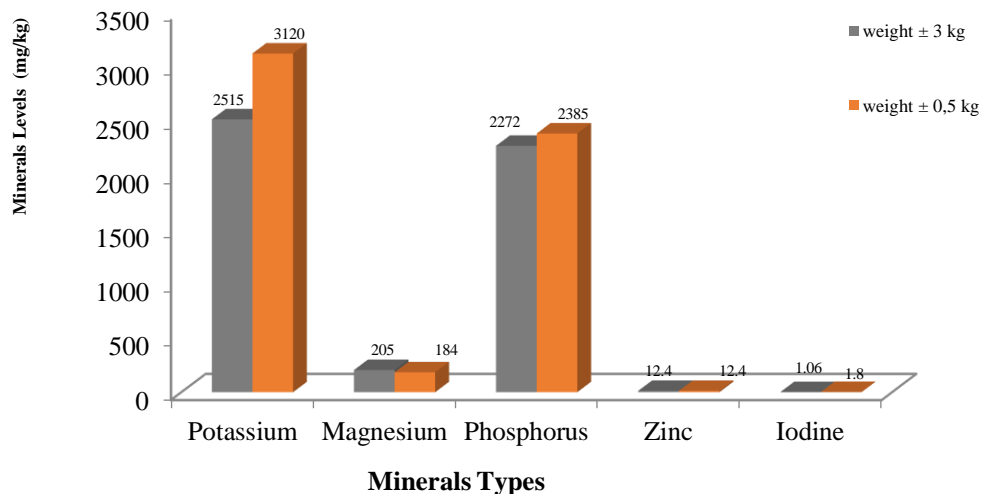


Graph 1. Minerals content of eel fish (*Anguilla marmorata*(Q.) Gaimard)

The results of mineral examination on *Anguilla marmorata*(Q.)Gaimard with a weight of ± 3 kg in Graph 1, determined the level of Calcium (Ca), magnesium (Mg), Phosphorus (P), Potassium (K) and Sodium (Na) respectively obtained is 322 mg/kg; 151 mg/kg; 2.025 mg/kg; 2.339 mg/kg; and 352 mg/kg, while the mineral content for

Anguilla marmorata (Q.) Gaimard with a weight of ± 0.5 kg, Calcium (Ca), Magnesium (Mg), Phosphorus, Potassium and Sodium respectively obtained is 264 mg/kg; 145 mg/kg; 1.964 mg/kg, 2.473 mg/kg, and 415 mg/kg.

Minerals Level of Eel Fish (*Anguilla bicolor*)



Graph 2. Minerals content of eel fish (*Anguilla bicolor*)

Test results of Eel Fish (*Anguilla bicolor*) with weight of ± 3 kg and ± 0.5 kg in Graph 2 showed the mineral content obtained as follows; 2515 mg/kg and 3120 mg/kg of Potassium (K), 205 mg/kg and

184 mg/kg Magnesium (Mg), 2.272 mg/kg and 2.385 mg/kg Phosphorus (P), for both sample the levels of Zinc (Zn) is equivalent is 12.4 mg/kg and the Iodine (I) levels is 1.06 mg/kg and 1.8 mg/kg.

Table 1. Mineral level of eel fish *Anguilla marmorata*(Q.) Gaimard and *Anguilla bicolorin* weight 3 kg

Minerals	<i>A. marmorata</i> (mg/kg)	<i>A. bicolor</i> (mg/kg)	Paired T-test
Calcium (Ca)	322±6.245	-	-
Magnesium (Mg)	151±6.997	205±4.163	0.001*
Phosphorus (P)	2025±4.163	2272±34.078	0.009*
Potassium (K)	2339±34.078	2515±34.078	0.288*
Sodium (Na)	352±8.082	-	-
Zinc (Zn)	-	12.40±0.057	-
Iodine (I)	-	1.06±0.085	-

Nb :

* = There are differences in levels (significance value <0.025)

** = There are no differences in levels (significance value > 0.025)

Table 2. Mineral level of *Anguilla marmorata*(Q.) Gaimard and *Anguilla bicolorin* weight 0.5 kg

Minerals	<i>A. marmorata</i> (mg/kg)	<i>A. bicolor</i> (mg/kg)	Paired T-test
Calcium (Ca)	264±8.083	-	-
Magnesium (Mg)	145±4.392	184±0.577	0.003*
Phosphorus (P)	1964±11.060	2385±32.716	0003*
Potassium (K)	2473±18.735	3120±19.858	0001*
Sodium (Na)	415±27.683	-	-
Zinc (Zn)	-	12.4±0.100	-
Iodine (I)	-	1.8±0.049	-

Nb :

* = There are differences in levels (significance value <0.025)

** = There are no differences in levels (significance value > 0.025)

DISCUSSION

This study was conducted to analyze and determine the mineral content in different type of Eel Fish *A. marmorata* and *A. bicolorin* Poso Lake. The fish that used as sample has different weight in average 0.5 kg and 3 kg, in order to see the effect of the difference in weight of fish with high levels of minerals contents in the sample on fish in elver or adult phase.

In this study, the mineral content of the fish were analyzed using instruments *Inductively Coupled Plasma Mass Spectrometry* (ICP MS). MS ICP instrument selection based on some profit-making tool that is highly selective and can be used to measure multiple elements at once in the sample, the tool is able to

analyze 80 elements including metals analyzed the mineral until the ppb unit.

The stages carried out in the analysis began with the fish being cleaned and then destroyed using a microwave digestion device. Microwave digestion is used because the process required relatively short destruction that is about 20-40 minutes at a temperature of 200°C and has high quality result, so no elements are missing. Further the sample was inserted in ICP MS tube to be analyzed.

The results of mineral levels found in *A. marmorata* and *A. bicolor* on Poso Lake showed that the composition and mineral content in these fish were different which can be seen in table 1 and 2. Minerals found in *A. marmorata*

included calcium (Ca), magnesium (Mg), phosphorus (P), potassium (K) and sodium (Na), while the minerals contained in *Anguilla bicolor* is Potassium (K), Magnesium (Mg), Phosphorus (P), Zinc (Zn) and Iodine (I). Both of fish in weight 0.5 kg and 3 kg had the highest potassium levels, followed by phosphorus. Potassium plays a role in setting the liquid content of cells and is present in muscle. Phosphorus is a mineral that is most abundant in meat and bone⁵.

The mineral content in weight 0.5 kg and 3 kg has no difference. Both of type of Eel fish has the same constituent. *A. marmorata* has no Zinc (Zn) and Iodine (I). While *A. bicolor* has no Calcium (Ca) and Sodium (Na). The lowest mineral content found in *A. marmorata* is magnesium, whereas in *A. bicolor* is iodine. Iodine is a rare element. The levels in freshwater only 5 ug/L, whereas at sea is 50 ug/L (ten times higher than freshwater). This causes freshwater fish has a low iodine content in the meat⁵.

Comparison T-test value of each mineral content of *Anguilla marmorata* (Q.) Gaimard and *Anguilla bicolor* with weights ± 3 kg can be seen from the significant value <0.025 (2.5% significance level), it can be concluded that there are differences in levels magnesium and phosphorus minerals. For the mineral content of potassium is not a significant differences between both of fish with weight ± 3 kg, due to the significant value of $> 0,025$. while at fish with weight of ± 0.5 kg, there are differences in the levels of the mineral magnesium, phosphorus and potassium as the significance value <0.025 (2.5% significance level).

For *A. marmorata* in yellow eel phase (35-40 gram) only contain P and Mg⁶, meanwhile *A. marmorata* in elver eel phase (0.5-3 kg) contain Ca, Mg, P, K, and Na. Differences in levels of minerals in an organism can be attributed to variation in the type of food consumed by the biota and environmental conditions. The mineral

content in an aquatic biota is also influenced by the ability to absorb the mineral content found in aquatic environments as a habitat for the living beings⁹. Moreover, it can also be caused by differences in the growth phase or influenced by intrinsic and extrinsic factors. Intrinsic factors such as fish species, fish age, fish sex, and fish genetic factors. Extrinsic factors include areas of life or life cycles of fish, seasons, and food sources available in the waters⁹.

Minerals are needed to maintain normal cell function and form bone and blood composition suitable for the human body. To fulfilled the needs of these substances in our body can be obtained from various sources of food such as fruit, vegetables and animal products, such as fish¹⁰. Minerals are usually absorbed in the salt form dissolved in the liquid, and then used in the form of electrolyte.

CONCLUSION: Based on the results of this study concluded that:

1. Mineral composition of eel fish (*Anguilla marmorata*(Q.) Gaimard) weighing ± 3 kg, ie Ca 322 mg/kg, Mg 151 mg/kg, P 2025 mg/kg, K 2339 mg/kg, and Na 352 mg/kg, and the sample with weight of ± 0.5 kg ie Ca 264 mg/ g, Mg 145 mg/kg, P 1964 mg/kg, K 2473 mg/kg, and Na 415 mg kg . Whereas the mineral composition in *Anguilla bicolor* with a weight of ± 3 kg, ie K 2515 mg/kg, Mg 205 mg/kg, P 2272 mg/kg, Zn 12.4 mg/kg, and I 1.06 mg/kg, and samples with a weight of ± 0.5 kg, ie K 3120 mg/kg, Mg 184 mg/kg, P 2385 mg/kg, Zn 12.4 mg/kg, and I 1.8 mg/kg.
2. The different types of minerals in *Anguilla marmorata*(Q.)Gaimard and *Anguilla bicolor* in PosoLake. Minerals contained in *Anguilla marmorata*(Q.) Gaimard include calcium, magnesium, phosphorus, potassium and sodium, while the minerals contained in *Anguilla bicolor* are potassium, magnesium, phosphorus, zinc and iodine.

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