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# Analysis of Omega-3, AA, EPA, Omega-6, DHA, Pb and Hg Fatty Acid Levels of Sardinella Lemuru

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**Abstract**

*Purpose*: Lemuru fish has been consumed as fresh fish and raw materials for making pindang fish (steam), canned fish and fish meal by several fishing industries. This is because the price of lemuru fish is relatively cheap but has a high protein content. The high content of omega-3 fatty acids and the incompatibility of the texture of lemuru fish become easily damaged and decayed due to microbiological activity. Therefore, it is necessary to carry out intensive handling both by direct processing in the form of lemuru presto fish and preservation in the form of lemuru fish meal.
*Methodology*: This study is experimental, which aims to analyze the levels of omega-3, AA, EPA, omega-6, and DHA fatty acids using the GC method. Pb and Hg levels using the ICP OES method. The samples of this study were lemuru presto fish and lemuru fish meal. Descriptive data processing using Microsoft Excel 2010 is presented in texttular and tabular form.
*Results*: Lemuru presto fish and lemuru fish meal are highest in omega-3 levels (870.2 and 1714.4 mg/100 g) and DHA levels (713.2 and 1274.0 mg/100 g). The fatty acid content of lemuru fish meal is higher than that of lemuru presto fish. Lemuru fish is safe to consume because its Pb and Hg levels are almost undetectable.

*Keywords* : Lemuru Fish, AA Levels, DHA Levels, EPA Levels, Hg Levels, Omega-3 Levels, Omega-6 Levels, Pb Levels

## Introduction Section

Lemuru fish (Sardinella lemuru Bleeker, 1853) usually inhabit areas where the process of water adjustment occurs, so that it can achieve high biomass. Therefore, lemuru fish depend on changes in the aquatic environment. The fishing season is high between September and December, in other months there are very few catches (Wujdi & Wudianto, 2015). Types of small pelagic fish that have economic value in Indonesia are mackerel (Rastrelliger sp.), kitefish (Decapterus spp.), selar fish (Selaroides sp), anchovies (Stolephorus spp), and lemuru fish (Hendiari, Sartimbul, Arthana, & Kartika, 2020:).

So far, lemuru fish is consumed as fresh fish and raw materials for making pindang fish, canned fish and fish meal by several fishing industries. This is because the price of lemuru fish is relatively cheap but has a fairly high protein content (Asare, Ijong, & Frets Jonas Rieuwpassa, 2018). Lemuru fish has a fat content between 3-24%, eicosapentaenoic acid (EPA) 19.37% and docosahexaenoic acid (DHA) content 4.60%, omega-3 fatty acid content as much as 6.56% (Ishak, 2011).

Fatty acids consist of essential fatty acids omega-3, EPA, DHA, omega-6, AA (Diana, 2012). The benefits of omega-3 fatty acids can help cure metabolic diseases such as type 2 diabetes, inflammation, cancer (Calder, 2015), cardiovascular, and improvement of growth, development of brain function, so that it can be utilized for food products (Amalia & Andriani, 2021). The content of omega-3 fatty acids is quite high and the texture of lemuru fish is easily damaged and decayed due to microbiological activity and autolysis during postmortem. For this reason, it is necessary to carry out intensive handling both by direct processing and preservation (Ananda, et al., 2022).

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Flour is an important type of basic food ingredient around the world to be used as various types of food products, it is a solid particle in the form of very fine grains. Fish meal is one of the results of drying and grinding of fish. There are various processing processes in fishmeal that are very diverse. The process of processing fish meal is dry and wet based on the fat content of the fish, there are three treatments, including presto, boiling, and steaming. The difference in the processing process greatly affects the quality of the quality of the fish meal produced. Lemuru fish meal contains 71.6% protein, 0.73% calcium and 38.5 mg zinc in 100 gr (Gultom & Martony, 2021). Lemuru fish is classified as an unwelcome fish because it is easily rotten and damaged (Sa'diyah, Hadi, & Ilminnafik, 2016), so that lemuru fish is a fish with a low grade, therefore it is necessary to conduct research by optimizing lemuru raw materials into flour products that have a longer shelf life (Ananda, et al., 2022). In addition to having a long shelf life, what is more important is the safety of fish for consumption, therefore it is necessary to check its heavy metal levels. Lemuru fish caught in the North Mindanao sea, 85% already contaminated with 3.74 microplastics ± 3.92 mm (Palermo, et al., 2020).

Heavy metals are elements that have a density of more than 5 gr / cm3, one of the environmental pollutants, and some of these metal elements are the most dangerous metals, including Arsenic (As), Lead (Pb), Mercury (Hg) and Cadmium (Cd). The properties of these metals have a great affinity with sulfur (sulfur). These metals attack sulfide bonds on important cell molecules such as proteins (enzymes), so the enzymes do not work. Heavy metal ions can be bound to important molecules of the cell membrane causing disruption of the transport process through the cell membrane (Endrinaldi, 2010). intake causes fever, hemolysis, erythema, edema, and eye irritation. Lead causes depression, loss of appetite, intermittent abdominal pain, nausea, diarrhea, constipation, muscle aches, and problems with sleep. Zinc causes nausea, vomiting, loss of appetite, stomach cramps, diarrhea, and headaches (Merusomayajula, Tirukkovalluri, Kommula, & Chakkirala, 2021). The presence of Lead in waters can contaminate aquatic ecosystems, in aquatic biota and sediments. Aquatic biota containing Lead in certain concentrations can be harmful and toxic if they enter the human body manusia (Simbolon, 2018). Therefore, for the safety of food consumed such as lemuru fish, it is necessary to analyze the Pb levels.

Several colorimetric and spectrometric methods for the determination of Lead, Palladium, and Zinc have developed and validated Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) methods. No methods for discontinuation of Palladium, Lead, and Zinc by ICP-OES are reported in the drug substance voriconazole (Merusomayajula, Tirukkovalluri, Kommula, & Chakkirala, 2021). Gas Chromatography (GC) or Gas Chromatography or gas-liquid partition chromatography (GLPC) or vase-vapor chromatography (VPC) is a widely used analytical technique used to separate and analyze gaseous and volatile compounds. This technique is used for the separation of amino acids. GC has many applications because this technique is fast and has a high sensitivity (Gurleen Kaur, 2018). The ICP-OES method has become a routine analysis technique for the determination of metals; But information relating to validation methods is extremely rare, and research on this area is still required. Several studies present the use of ICP-OES for the determination of metals in tea or food samples (Senila, Andreja, Pintar, Senila, & Levei, 2014).

## Method

This study is experimental, which aims to analyze the levels of omega-3, AA, EPA, omega-6, and DHA fatty acids using the GC method. Pb and Hg levels using the ICP OES method, analyzed at PT Saraswanti Indo Genetech SIG Laboratory Jl. Rasamala No. 20, Taman Yasmin, Bogor, West Java 16113. The variables studied were chemical tests in the form of analysis of the content of omega-3, AA, EPA, omega-6, DHA, Pb and Hg. Ingredients used in the research of lemuru presto fish and lemuru fish meal. Used tools gas cylinders, stoves, pressure cookers, baking sheets, ovens, blenders, flour sieves, tablespoons, basins, dishes, scales. Materials and tools used for chemical tests of extraction equipment along with timbel (sleeve) and Soxhlet Extractor. Descriptive data processing using Microsoft Excel 2010 is presented in texttular and tabular form.

## Result and Discussion

From the results of the analysis shown in Table 1. Both lemuru presto and lemuru fish meal have the highest levels of omega-3 compared to AA, EPA, omega-6 and DHA levels. The fatty acid content of lemuru fish meal is higher than that of lemuru presto fish. Pb and Hg levels in lemuru fish caught from the Pekalongan sea in Central Java are almost undetectable so lemuru fish are still safe for consumption. Mercury concentration in lemuru fish caught in the East Java sea (Prigi and Muncar) was 0.938 ± 0.45 mg/kg and 0.58 ± 0.65 mg/kg (Sartimbul, Amandani, & D Yona, 2021).

**Table 1.** Levels of Omega-3, AA, EPA, Omega-6, DHA, Pb and Hg

| Sampel Name (mg/100 g) | Omega-3 | AA | EPA | omega -6 | DHA | Pb | Hg |
|---|---|---|---|---|---|---|---|
| | | mg/kg | | | | | |
| Lemuru fish Presto | 870.2 | | 80.2 | 143,9 | 136.6 | 713.2 | 0.009 | 0.004 |
| Lemuru fish flour | | 1714.4 | | 162.4 | 374. | | | |

## Conclusion

Lemuru presto fish and lemuru fish meal are highest in omega-3 levels (870.2 and 1714.4 mg/100 g) and DHA levels (713.2 and 1274.0 mg/100 g). The fatty acid content of lemuru fish meal is higher than that of lemuru presto fish. Lemuru fish is safe to consume because its Pb and Hg levels are almost undetectable.

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