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# *Keumamah* Processing Strategy as an Alternative Family Protein Source Stunting Prevention Effort

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**Abstract**

Stunting is one of the essential nutritional problems experienced by toddlers globally, especially in developing countries, including Indonesia. The impact of Stunting is not only in terms of health but also affects the level of intelligence of children. This study aims to find *a keumamah* product formulation that can be useful for supplementary feeding to prevent Stunting. The research design of this study is the Intact-Group Comparison model with two variables; (1) the experimental group and (2) the control group. To find the result, this research involves two types of test; pre-test and post-test. The pre-test is conducted before the experiment, while the post-test is performed after investigating both sample groups. The content of macronutrients, such as protein, fat, and carbohydrates, is higher in *keumamah* (Wooden fish), made from fresh fish with an oven drying process. The Keumamah made from fresh fish with the drying method using an oven is also more hygienic than those made from less fresh fish with the traditional drying process (Sun-drying). *Keumamah* dried in an oven is better than *Keumamah* dried with the conventional drying process (Sun-drying).

**Keywords:** Aceh; *Keumamah*; Sun-drying; Stunting

## Introduction

Stunting is one of the essential nutritional problems experienced by toddlers globally, especially in developing countries, including Indonesia. Stunting is a chronic condition that impairs growth due to long-term malnutrition. According to the WHO Child Growth Standard, Stunting is based on an index of body length for age (PB/U) or height for age (TB/U) with the limit of the z-score of less than -2 SD. Children who suffer from Stunting will be more susceptible to disease, and when growing as adults, they are at risk for degenerative diseases (Muliadi et al., 2021)

The impact of Stunting is not only interms of health but also affects the level of intelligence of children. Children are the nation's assets in the future. You can imagine how the condition of Indonesia's human resources will be in the future if many Indonesian children are currently suffering from Stunting (Ramadhaniah et al., 2021)

In 2018, Indonesia was the country with the second-highest stunting cases in Southeast Asia after Laos (Ministry of Health RI, 2018). In this case, Aceh province was one of the provinces with the highest prevalence of stunting in Indonesia, and it exceeded the national figure of 37.1%. This condition made Aceh have a "red report card" in the problem of Stunting. On the other hand, the trend of the prevalence of Stunting in the West Aceh district from 2015 to 2018 has increased. It is illustrated that the local Government's efforts to reduce the prevalence of Stunting have not been successful. For this reason, specific interventions are needed. The Stunting problem can be overcome (Elida, 2019).

According to the World Health Organization (WHO), in 2018, there were 151 million or 22.2% of children under five suffering from Stunting globally. More than a half are from Asia (55%), while more than a third (39%) live in Africa (WHO, 2018; Indonesian Ministry of Health, 2018). Based on the 2018 Basic Health Research (Riskesdas) results, the prevalence of stunting in Indonesia is 30.8%, while the standard tolerance rate for stunting prevalence set by WHO is 20%. In this case, Stunting is considered a severe public health problem if the majority is 30-39 percent. Therefore, since the range of stunting prevalence in Indonesia is more than 30 percent, thus Indonesia is considered a country that experiences severe public health problems.

There are two frameworks of Stunting Interventions planned by the Government. They are Specific Nutrition Interventions and Sensitive Nutrition Interventions. Specific Nutrition Interventions are interventions aimed at children in the First 1,000 Days of Life (HPK) and contribute to a 30% reduction in Stunting. This framework is generally carried out in the health sector, starting from the mother's pregnancy and giving birth to a toddler. Meanwhile, the sensitive intervention framework is carried out through various development activities outside the health sector and contributes to 70% of Stunting Interventions. The target of sensitive nutrition interventions is the general public (Muliadi et al., 2021)

Sensitive Nutrition Interventions can be carried out through several generally macro activities. One is increasing food security and community nutrition by making fish the primary protein consumption. Fish (TP2K) is a high-quality protein source. Fish protein has a complete composition and amount of essential amino acids. The fish protein absorption is higher than beef, chicken, etc. This is because fish meat has shorter protein fibers than beef or chicken. Fish also contains omega-3 (fatty acids), which has a unique advantage over other animal foods. It is because the composition of essential fatty acids is polyunsaturated. These essential fatty acids are required for all tissues' average growth and function, including optimal brain cell development. Fish is also rich in vitamins and minerals. For this reason, fish consumption in the community needs to be increased to meet the family's nutritional needs and prevent Stunting (Prameswari, 2018).

Fish consumption in Indonesia is considered low and uneven between regions, and thus the Government continues to carry out various programs to increase fish consumption. Efforts to increase fish consumption are also related to food and nutrition policies set by the Government. According to (Dadhich & Faridi, 2013), the number of malnutrition in children under five is still alarming. It reaches 19.6%, while the number of stunted children reaches 37.2%. Therefore, increasing the consumption of fish as a source of nutrient-rich animal protein is expected to improve the nutritional quality of the Indonesian people.

Research by Rachim and Pratiwi in 2017 concluded a significant relationship between the consumption of fish species and the incidence of Stunting, with a p-value = 0.015. From several types of fish mentioned by respondents, it can be concluded that the kind of fish that is most popular in the community where this research is carried out is tuna. Previous research stated that marine fish have a higher range of Ca, Zn, and Fe content than freshwater fish (Achionye-Nzeh, C, 2011). Therefore, increasing the consumption of fish as a source of nutrient-rich animal protein is expected to improve the nutritional quality of the Indonesian people.

Fish is a marine commodity that is easily obtained along the waters of Aceh,which is directly adjacent to the Indian Ocean. Fish is easy to experience a process of quality deterioration and decay during post-catch. According to Jumhuri et al., (2012), fish is a food that is easily damaged by spoilage microorganisms; therefore, it needs special handling to maintain its quality. In the tropics, fish spoilage occurs more quickly due to high temperature and humidity. Consequently, the use of preservation techniques is required. Efforts are needed to maintain quality using proper handling to overcome this problem.

One of the fish preservation products carried out by the people of Aceh is wooden fish (Keumamah), which is processed from Tuna (Thunnus sp), tuna (Euthynus Pelamis), or skipjack tuna conducted Sulaiman in 2014, which concluded that there was a significant increase in protein content after fish was processed into keumamah compared to ordinary fresh fish. This shows that *Keumamah* is an alternative protein source that is good for families to consume to meet family protein needs and prevent Stunting in children. The preliminary survey results show that The quality of Keumamah produced in the coastal area of West Aceh is not guaranteed. Most of the fish used for making the *Keumamah* is not made of fresh tuna. Furthermore, the drying process is carried out outdoors, so it is very susceptible to contamination by pathogenic microorganisms that can harm health. Therefore, this study aims to see whether *Keumamah* dried using an oven is more hygienic and healthier than Keumamah dried traditionally (outdoor). This study is significant in finding a suitable method of processing *keumamah* to be cleaner and healthier. This study is expected to determine how to produce the typical

Acehnese *Keumamah,* healthy and guaranteed nutritional quality. Thus, it can be an alternative source of protein for family needs.

## Methods

The type of research used in this study is the pre-experimental study (non-design). According to Sugiyono (2011: 73), pre-experimental research is not yet a natural experiment where external variables still have an effect. The research design of this study is the Intact-Group Comparison model with two variables; (1) the experimental group and (2) the control group. To find the result, this research involves two types of tests; pre-test and post-test. The pre-test is conducted before the experiment, while the post-test is performed after investigating both sample groups.

Using this type of intact-group comparison design proves the hypothesis that the selection of raw materials and the use of different drying methods can produce different product qualities. In other words, processing by selecting the freshness level of fish (raw materials) and oven drying can have more hygienic and healthier *keumamah* products than processing them with the traditional drying system by using the poor quality of the raw tuna. The study's conclusion will be strengthened by bacteriological tests and the nutritional content tests on *keumamah* productsbefore and after treatment.

The materials used in this study were tuna (30 cm in length and 1 kg in weight), water, and salt. Thetools used in this study were a knife, storage containers, pans, water drainers, and ovens. They start with choosing fish measuring 30 cm or more or less 1 kg in weight from fresh fish. The tuna is washed and weeded until it is clean. The head of the tuna is removed. Only the body is used to make the wooden fish. Clean fish is addedwith 1.5 liters of water with a composition of 2% salt from the weight of the fish. The fish is boiled for half an hour and then dried with two different drying processes. One is dried in the sun for 24 hours, and the other is dried using an oven at $80^0$ C for 24 hours following the planning at the beginning of the preparation stage for the *keumamah* sample. Fresh tuna and less fresh tuna. The fish selected are fish of the same size and weight.Next, the fish are cleaned and boiled for 1 hour. Fresh fish and less fresh fish are separated in the different cooking pans to avoid contamination in the boiling stage. The next step is to dry fresh tuna using the oven, while the less fresh tuna is dried traditionally utilizing the sun's heat.

The drying process using the sun's heat is carried out for three days with 24 hours of drying time (8 hours per day). While the drying process using the oven is carried out for the same 24 hours with an oven heat of $80^0$ C. Furthermore, the finished *keumamah* is stored in a closed container with the air circulation holes to maintain the humidity of *keumamah* products. Then the products are brought to the Faculty of Veterinary Medicine laboratory and the agricultural laboratory of Banda Aceh to be examined for microbiological tests and tests for the macronutrient content (protein, carbohydrates, fat, water, fiber, and ash content).

In microbiological testing (TPC colonies), the samples consisted of 4 types. They are fresh raw fish, less fresh raw fish, *keumamah* with the traditional drying process, and *keumamah* with the oven drying process. All of those samples are tested to see alltypes of microbiology present in fish when theyare still raw and have become *keumamah*. This test was repeated two times to obtain good data reliability.

## Result

**Tabel 1.** Proximate result of water content in fresh raw fish, less fresh raw fish, Keumamah with the oven drying process, and Keumamah with the traditional drying process.

| Sample Code | Wet Sample Weight (g) | Empty Cup (g) | Cups & dry samples (g) | Dry sample (g) | Water Content (%) |
|---|---|---|---|---|---|
| a | b | c | d | e = d - c | f = 100 - (e/b*100) |
| Keumamah with oven drying process | 5,0017 | 43,2320 | 46,3045 | 3,0725 | 38,57 |
| Keumamah with traditional drying process | 5,0256 | 43,2803 | 46,5445 | 3,2642 | 35,05 |
| Fresh raw fish | 5,0291 | 43,9666 | 45,6644 | 1,6978 | 66,24 |
| Less fresh raw fish | 5,0108 | 41,6811 | 43,3036 | 1,6225 | 67,62 |

Source: *Primary data, 2021*

**Table 2.** Proximate result of ash content in fresh raw fish, less fresh raw fish, Keumamah with the oven drying process, and Keumamah with the traditional drying process.

| Sample Code | Wet Sample Weight (g) | Empty Cup (g) | Cups & dry samples (g) | Dry sample (g) | Water Content (%) |
|---|---|---|---|---|---|
| a | b | c | d | e = d - c | f = 100 - (e/b*100) |
| Keumamah with oven drying process | 50,017 | 432,320 | 463,045 | 30,725 | 38,57 |
| Keumamah with traditional drying process | 50,256 | 432,803 | 465,445 | 32,642 | 35,05 |
| Fresh raw fish | 50,291 | 439,666 | 456,644 | 16,978 | 66,24 |
| Less fresh raw fish | 50,108 | 416,811 | 433,036 | 16,225 | 67,62 |

Source: *Primary data, 2021*

**Table 3.** Proximate result of fat content in fresh raw fish, less fresh raw fish, Keumamah with the oven drying process, and Keumamah with the traditional drying process.

| Sample Code | Wet sample weight (g) | Empty tube (g) | Tubes and fat (g) | Fat (g) | Fat content (%) |
|---|---|---|---|---|---|
| a | b | c | d | e = d - c | |
| Keumamah with oven drying process | 50,165 | 986,551 | 990,413 | 0,3862 | 7,70 |
| Keumamah with traditional drying process | 50,119 | 664,657 | 668,250 | 0,3593 | 7,17 |
| Fresh raw fish | 50,235 | 661,153 | 664,543 | 0,3390 | 6,75 |
| Less fresh raw fish | 50,261 | 951,028 | 954,075 | 0,3047 | 6,06 |

Source: *Primary data, 2021*

**Table 4.** Proximate result of protein content in fresh raw fish, less fresh raw fish, Keumamah with the oven drying process, and Keumamah with the traditional drying process.

| Sample Code | Sample weight (mg) | Vol HCl | Protein content |
|---|---|---|---|
| a | b | c | d |
| Keumamah with oven drying process | 554 | 2,60 | 41,09 |
| Keumamah with traditional drying process | 521 | 2,3 | 38,65 |
| Fresh raw fish | 533 | 1,25 | 20,53 |
| Less fresh raw fish | 565 | 1,2 | 18,59 |

Source: *Primary data, 2021*

**Table 5.** Proximate result of fiber content in fresh raw fish, less fresh raw fish, Keumamah with the oven drying process, and Keumamah with the traditional drying process.

| Sample Code | Wet sample weight (g) | Ash weight | Crude fiber (%) |
|---|---|---|---|
| a | b | c | d |
| Keumamah with oven drying process | 0,5170 | 0,0036 | 0,72 |
| Keumamah with traditional drying process | 0,505 | 0,0028 | 0,57 |
| Fresh raw fish | 0,519 | 0,0050 | 0,77 |
| Less fresh raw fish | 0,528 | 0,0061 | 0,53 |

Source: *Primary data, 2021*

**Table 6.** Proximate result of Carbohydrate content in fresh raw fish, less fresh raw fish, Keumamah with the oven drying process, and Keumamah with the traditional drying process

| Sampel | Water content (%) | Ash content (% ) | Fat content (% ) | Protein content (%) | Crude fiber (%) | Carbohydrate |
|---|---|---|---|---|---|---|
| Keumamah with oven drying process | 38,57 | 3,80 | 7,70 | 41,09 | 0,72 | 8,13 |
| Keumamah with traditional drying process | 35,05 | 4,17 | 7,17 | 38,65 | 0,57 | 14,39 |
| Fresh raw fish | 66,24 | 1,29 | 6,75 | 20,53 | 0,77 | 4,42 |
| Less fresh raw fish | 67,62 | 1,40 | 6,06 | 18,59 | 0,53 | 5,80 |

Source: *Primary data, 2021*

**Table 7.** The total bacterial count (TPC) test results in fresh raw fish, less fresh raw fish, Keumamah with the oven drying process, and Keumamah with the traditional drying process.

| No. | Sample code | Dilution | | | | | | Result of TPC (CFU/g) |
|---|---|---|---|---|---|---|---|---|
| | | 1-Oct | 2-Oct | 3-Oct | 4-Oct | 5-Oct | 6-Oct | |
| 1 | IKS (1) | TBUD | 63 | 55 | 9 | 4 | 0 | $6.0 \times 10^3$ |
| | | TBUD | 57 | 49 | 7 | 2 | 0 | |
| 2 | IKS (2) | TBUD | 97 | 15 | 6 | 1 | 0 | $8.2 \times 10^3$ |
| | | TBUD | 68 | 10 | 3 | 1 | 0 | |
| 3 | IKS + O (1) | 50 | 44 | 35 | 20 | 12 | 8 | $4.4 \times 10^3$ |
| | | 47 | 45 | 30 | 17 | 9 | 6 | |
| 4 | IKS + O (2) | 56 | 38 | 28 | 5 | 3 | 0 | $3.6 \times 10^3$ |
| | | 48 | 34 | 30 | 4 | 2 | 0 | |
| 5 | IK-S (1) | TBUD | TBUD | 212 | 41 | 6 | 4 | $1,2 \times 10^2$ |
| | | TBUD | TBUD | 210 | 43 | 4 | 3 | |
| 6 | IK-S (2) | TBUD | TBUD | 220 | 65 | 10 | 0 | $2,1 \times 10^5$ |
| | | TBUD | TBUD | 200 | 70 | 5 | 4 | |
| 7 | IK-SM (1) | TBUD | TBUD | TBUD | TBUD | 195 | 157 | $1,9 \times 10^7$ |
| | | TBUD | TBUD | TBUD | TBUD | 197 | 160 | |
| 8 | IK-SM (2) | TBUD | TBUD | TBUD | TBUD | 210 | 175 | $2.0 \times 10^7$ |
| | | TBUD | TBUD | TBUD | TBUD | 197 | 174 | |

Source: *Primary data, 2021*

## Discussion

### Water Content

The results of the analysis of water content in fresh raw fish and less fresh raw fish with different treatments, namely keumamah with the oven drying process and keumamah traditional drying process, can be seen in Table 1. According to Sulaiman (2014), the smaller the water content in *keumamah*, the higher quality of *keumamah* because the microorganisms in the material cannot grow, so it can prevent spoilage. Table 1 shows that the water content of fresh *raw* fish is 66.24% and keumamah with oven drying process has 38.57%. The less fresh *raw* fish showed a water content of 67.62%, and keumamah with the traditional drying process had 35.05%. The highest water content was in less fresh *raw* fish, while the lowest water content was shown in keumamah with the conventional drying process. The water content of the *keumamah* fish will decrease when it has been treated both in the oven and exposed to the sun. However, the water content is still not qualified, suggesting that wood fish's water content is a maximum of 18.00%, which meets the standards set by the Indonesian National Standard (SNI 01-2591-1992).

**Ash content**

Analysis of ash content was carried out to determine the content of some organics that cannot burn and form ash and to see the level of ash content purity and cleanliness of the materials produced by wooden fish (Sulaiman, 2014). Ash content is a parameter to measure the nutritional value of a food product (Hadi et al.,2021). Table 2 shows that the ash content of fresh raw fish is 1.29% and *keumamah* with oven drying has an ash content of 3.80%. Less fresh raw fish showed an ash content of 1.40%, and less fresh raw fish with a traditional drying process had an ash content of 4.17%. The lowest ash content in this study was shown in fresh raw fish, which was 1.29%. According to SNI 01-2691-1992, the specified ash content is 1%. The higher the drying rate, the higher the ash content.

**Fat Content**

The results of the analysis of fat content in fresh raw fish and less fresh raw fish with different treatments can be seen in Table 3. Table 3 shows that the fat content of fresh raw fish is 6.75%, and *keumamah* with oven drying process has a fat content of 7.70%. The less fresh raw fish showed a fat content of 6.06%, and *keumamah* with the traditional drying process had a fat content of 7.17%. The highest fat content was demonstrated in *keumamah* with oven drying process at 7.70%, while *keumamah* with traditional drying process was 7.17%. According to pundoko et al. (2014), the fat content will increase when there is low water content.

**Protein content**

The results of the analysis of protein content in fresh raw fish, less fresh raw fish, *keumamah* with the traditional drying process, and *keumamah* with the oven drying process can be seen in Table 4. Table 4 shows that the protein content of fresh raw fish is 20.53, and *keumamah* with oven drying process has a protein content of 41.09. The less fresh raw fish showed a protein content of 18.59. Meanwhile, with the traditional drying process, ummah had a protein content of 38.65. Protein levels increased in the treated *keumamah*. *Keumamah* with oven drying process had the highest protein content of 41.09. According to Pundoko et al.,(2014), protein will be degraded at high temperatures, resulting in changes in the value of protein content. According to Hadiet et al. (2021), protein content is also influenced by water content. When the water content is low, the protein content will be high. This is called protein degradation. According to Jumburiet al (2014), bacteria can also influence high and low levels of protein.

**Fiber Content**

The results of the fiber content analysis in fresh raw fish, less fresh raw fish, *keumamah* with the traditional drying process, and *keumamah* with the oven drying process can be seen in Table 5. Table 5 shows that the fiber content of fresh raw fish is 0.77%, and *keumamah* with oven drying process has a fiber content of 0.72%. Less fresh raw fish showed a fiber content of 0.53%, and *keumamah* with the traditional drying process had a fiber content of 0.57%. The highest fiber content was demonstrated in fresh raw fish, 0.77%.

**Carbohydrates**

The results of carbohydrate analysis using the method pass different fresh raw fish and less fresh raw fish with other treatments can be seen in Table 6. Table 6. shows that the carbohydrates of *keumamah*, according to calculations using the method pass different, have the highest carbohydrate value in *keumamah* with the traditional drying process is 14.39, while the lowest carbohydrate value is in fresh raw fish at 4.42. According to Sirait (2019), one factor affecting the value of carbohydrates is the drying process, and the carbohydrate content will increase with the longer drying time.

**Total Bacteria Calculation**

Total Plate Count (TPC) is a general method used to measure or calculate the value and number of microbes in a sample (Hadi et al., 2021). The total bacterial count analysis results in fresh raw fish, less fresh raw fish, *keumamah* with the traditional drying process, and *keumamah* with the oven drying process can be seen in Table 7. Table 7 shows that *keumamah* with oven drying process has the number of bacteria tends to be less than *keumamah* with the traditional drying process. The difference in treatment between fresh raw fish and less fresh raw fish also dramatically affects the number of bacteria. When fresh raw fish is baked, the number of bacteria tends to decrease, while in less fresh raw fish exposed to sunlight, the number of bacteria tends to increase. According to SNI 7288:2009, the maximum limit for the number of bacteria in fish is 5.0 X 105 CFU/g. Based on the results of this study, fresh raw fish, less fresh raw fish, and *keumamah* with oven treatment showed that they did not exceed the SNI threshold, which ranged from 1.2 x 102up to 2.1 X 105, so the number of bacteria contained in normal limits. In contrast, keumamah with the traditional drying process shows that it has exceeded the maximum threshold of the number of bacteria set by SNI, an average of 1.95 x 107. *Keumamah*, made from fresh fish and treated with oven drying, has the least number of bacteria (3.6 X 103CFU/g).

## Conclusion

Based on the results of the analysis of nutritional content tests and microbiological tests in the laboratory, it can be concluded that the content of protein, fat, and fiber is higher in *keumamah,* which is made from fresh fish with the oven drying process. *Keumamah* processing with the oven drying process is more hygienic than those fish made from less new raw tuna processing with the traditional drying method (sun drying).

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## Author Contributions and Competing Interest

The author states that there is no conflict ofinterest in this study.

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