

ORIGINAL ARTICLE

Acceptability of Fish and Fish Powder as Complementary Food Among Children Age 6-24 Months in Indonesia

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ABSTRACT

Introduction: This study explored strategies to enhance animal protein intake in children by introducing fish as a complementary food. **Objective:** The aim was to compare the acceptance of fried fish versus fish powder among children aged 6-24 months in Indonesia. **Methods:** The research used a one-shot case study within a pre-experimental Design, conducted in Sidoarjo Regency, Indonesia with 16 participants following the inclusion criteria (children aged 6-24 months who tolerate fish). Two interventions were carried out: the children first consumed 40g of fried fish (tuna and tempeh), followed a day later by 20g of fish powder. The paired sample t-test was used to analyze the differences in acceptance, with significance set at $p < 0.05$. **Results:** The findings showed that children preferred fish powder, with significantly less left over (5.06g) compared to fried fish (25.12g). The statistical analysis confirmed that there was a significant difference ($p < 0.05$). **Conclusion:** Fish powder is more effective than fried fish in increasing children's acceptance, making it a promising approach to enhance protein intake in young children.

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INTRODUCTION

Background

Protein intake has an essential role in supporting children's growth and development, especially animal source protein (1). One strategy to increase animal source protein consumption in children is introducing fish as a complementary food for children aged 6-24 months (2, 3). Fish contains omega-3 and has a more complete set of essential amino acids (4). Animal protein should also be included as a complementary food in infancy (5). However, fish consumption among children remains low, and children's acceptance of fish-based foods is also still low due to socioeconomic status (6, 7), the fishy smell and the risk of swallowing bones (8). Additionally, the variety of fish-based foods offered to children is often limited.

Data from Basic Health Research in Indonesia (RISKESDAS) shows that the prevalence of malnutrition and undernutrition among children was 17.7% (9). One of the causes of malnutrition in children is the insufficient consumption of animal protein, particularly fish (7). The Ministry of Marine Affairs and Fisheries in Indonesia reported in 2022 that the national fish

consumption rate reached 55.37 kg per capita (10) and that the fish consumption rate in East Java was lower than the national average, at 43.30 kg per capita. Children who eat an inadequate amount of animal protein, particularly fish, during their growth phase will suffer from protein deficiency and this can disrupt their growth and development such as undernutrition, malnutrition, and stunting (11).

The strategy used to provide varied fish-based dishes depends on the child's acceptance (12). Innovations for making fish products into interesting snacks are needed to increase the appetite of children and improve their nutritional status. Previous studies have highlighted the importance of modifying fish products to enhance their safety and acceptability for young children. Previous studies have emphasized that smoother food textures facilitate better consumption in early childhood, as children at this stage are still developing the oral motor skills necessary for chewing and swallowing solid foods (13). Similarly, our pilot study demonstrated that converting fish into a powdered form, specifically a product known as Koya Nate, can significantly improve appetite and reduce rejection in stunted toddlers. These studies suggest that fish modification, particularly into fine textured or powdered forms, not only addresses sensory barriers such as odor and taste but also minimizes the risk of choking on fish bones, ensuring safer consumption. Koya Nate is a combination of tuna and tempeh, with the bones carefully removed from the

tuna to enhance safety. Tempeh is added to soften the texture further and reduce the strong fish aroma, making the product more palatable and acceptable to children aged 6–24 months (14). However, there have been no studies comparing the acceptability and appetite of children towards animal protein, particularly fried fish versus this edible powdered fish. The aim of this study was to analyze the differences in the acceptance of fried fish and edible fish powder for children aged 6-24 months in Indonesia.

MATERIAL AND METHODS

Research design

The aim of this study was to analyze the differences in the acceptance of fried fish and edible fish powder for children aged 6-24 months in Indonesia. The research design was a one-shot case study with a pre-experimental design. The data was collected in May 2023 in Balong Biru Hamlet, Sadang Village, Taman District, in Sidoarjo Regency, Indonesia. The independent variable was an intervention program providing fried fish and edible fish powder, while the dependent variable was the children's acceptance of fried fish and fish powder.

Population, sample size and technique sampling

The total sample in this study was 16 respondents. The previous references recommend a minimum sample size of 10–30 respondents (15). The sample was selected using simple random sampling. The inclusion criteria was children aged 6-24 months and children who were tolerant of fish-based foods.

Intervention Program

In this study, two interventions were conducted. The first intervention involved children aged 6-24 months consuming fried fish and one day later, these children consumed powdered fish (tuna and tempeh) as a complementary food. In total, 40 grams of fried fish was given once during lunch. One day later, 20 grams of powdered fish was provided once at lunch.

The ingredients of this intervention were tuna fish. We

made fish powder for the intervention group, and we fried fish for the control group. The ingredients used to make fish powder included well-fermented, non-spoiled tempeh and fresh tuna with firm, red flesh and bright red gills. For the coconut milk, 150 ml was required. The seasoning blend consisted of 20 grams of shallots, 40 grams of garlic, 0.15 grams of candlenut, 0.01 grams of coriander, 4 grams of ginger, 5 grams of galangal, 3.5 grams of lemongrass, 2 bay leaves, 4 lime leaves, 32 grams of brown sugar, and 0.07 grams of salt. The dish was cooked using 2 grams of coconut oil. This is similar to a previous study(16).

Data collection procedure

The procedure of this study was approved and given ethical clearance by the Research Ethics Committee of Stikes Hang Tuah Surabaya, Indonesia, number PE/69/VII/2023/KEP/SHT. Permission for the research was also obtained from the National Unity and Political Agency of Sidoarjo, Indonesia, and the Sidoarjo Health Department. Additionally, the researcher received authorization from local Posyandu (integrated health post) cadres in Balong Biru Hamlet, Sadang Village, Taman District in Sidoarjo Regency, Indonesia, which was necessary to collect data from the children's parents or guardians.

The researcher explained the purpose of the study and requested informed consent. Figure 1 shows the flowchart of the study. The intervention involved providing 40 grams of fried fish as an animal protein source once at lunch. The following day, the children were given 20 grams of powdered fish and tempeh, also at lunch. This intervention was conducted for one day for control and for one day for the experiment group, based on a previous study (17). A questionnaire to gather the characteristics of the respondents was completed by the parents, while an observation sheet was used to assess the children's acceptance of fried fish and edible powder fish, filled out by the researcher after measuring the amount of waste food.

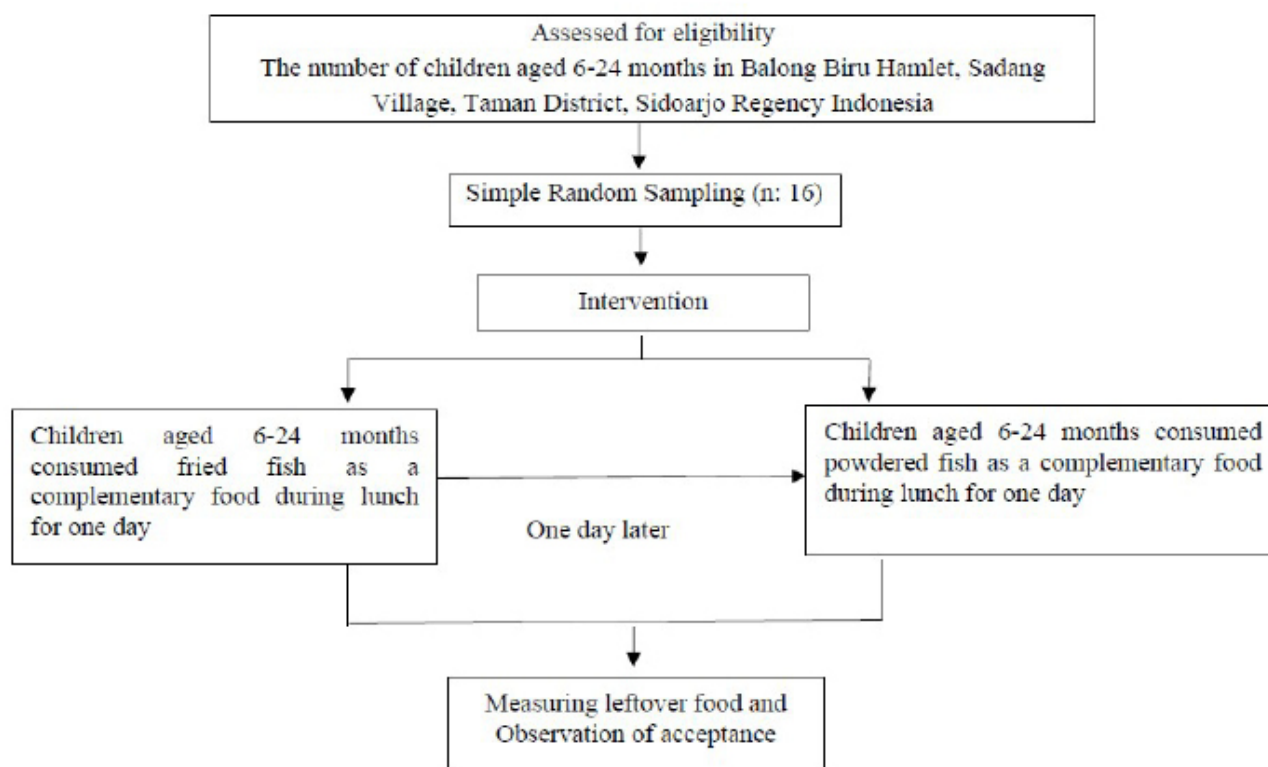


Figure 1: Flowchart of the study

Instruments

The instruments in this study included the characteristics of the respondents, including the child's age, gender, weight/height (W/H) ratio, birth order, mother's age, mother's education, and the child's characteristics when receiving food. The dependent variable was measured using a child acceptance form (Figure II), looking at both how much they ate and how they reacted. First, we weighed the leftover food after each meal to see how much was eaten. We used the Comstock Visual Scale,

which scores how much food was left on the plate, from 5 (not touched at all) to 0 (completely eaten) (18). While the children were eating, we watched how they reacted, including whether they vomited or rejected the food. These behaviors helped us understand whether they liked the food. By using all of this information, we could clearly see how well the children accepted both the fried fish and the fish powder.

Time for eating	Intervention	Weight of Complementary food (gram)	Leftover food (gram)	Food finished (gram)
Day, Date Time for lunch: 11:00	Fried Fish	40 grams		
Day, Date Time for lunch: 11:00	Fish powder	20 grams		

Figure 2: Child Acceptance Form

Data Analysis

All data was entered into SPSS for analysis. Descriptive statistics were used to examine the characteristics of the respondents and each variable. To determine the differences in the children's acceptability of consuming fried fish and fish powder for children aged 6-24 months, inferential statistics were employed using the paired sample T-test. The statistical significance level was determined using p value < 0.05 .

RESULTS

Characteristics of the Respondents

Table 1 shows the characteristics of the children and their mothers. The majority of children aged 6-24 months were 18-24 months old. Most of the respondents

were female children (68.8%). The most commonly consumed protein sources among children aged 6-24 months were eggs (37.5%) and chicken (37.5%). The majority of children, 9 children (56.2%) in total, could eat independently without assistance, while 7 children (43.8%) still needed assistance from their parents while eating. Fish consumption among children was relatively low: 8 children (50.0%) consumed fish only once a week, 6 children (37.5%) consumed fish twice a week, and only 2 children (12.5%) consumed fish three times a week. There were 4 children (25.0%) who ate fish until the point of zero waste, while 8 children (50.0%) ate only a small amount. Furthermore, 2 children (12.5%) rejected the fish, and 2 children (12.5%) vomited.

Table 1: Characteristic Respondent

Age (months)	Frequency (f)	Percentage (%)
6-11	3	18.8
12-17	5	31.2
18-24	8	50.0
Total	16	100.0
Gender		
Male	5	31.2
Female	11	68.8
Total	16	100.0
Protein Consumed by Children		
Egg	6	37.5
Chicken	6	37.5
Fish based dishes	4	25.0
Total	16	100.0
Children's eating behaviour		
Eating independently	9	56.2
Fed by parents	7	43.8
Total	16	100.0
Weekly fish consumption		
Once a week	8	50.0
Twice a week	6	37.5
Three times a week	2	12.5
Total	16	100.0
Children's response to fish		
Finished eating	4	25.0
Eaten a Little	8	50.0
Vomited	2	12.5
Reject	2	12.5
Total	16	100.0
Complementary Food Varian		
Fried fish	10	62.5
Seasoned fish	6	37.5
Total	16	100.0

Descriptive statistics of the children's acceptance when consuming fried fish and fish powder

Table II explains the children's acceptance when consuming fried fish. It showed that 10 children (62.6%) fitted the untouched until three quarters remained of the fish categories, and only 6 children (37.4%) fitted the half of the food remaining until zero waste categories. Regarding the acceptability of fish-based powder, there were 12 children (75.0%) who fitted the half food remained until zero waste categories, while only 4 children (25.0%) ate three quarters and one bite, while 0% did not touch it.

Table II: Acceptance of fried fish and fish powder as complementary food in children aged 6-24 months (n=16)

(%) Fried fish	Category	Frequency (f)	Percentage (%)
0%	zero waste	3	18.8
25%	one quarter remined	2	12.5
50%	half food remained	1	6.1
75%	three quarter remained	4	25.0
95%	one bite	3	18.8
100%	untouched	3	18.8
Total		16	100.0
(%) Powder fish	Category	Frequency (f)	Percentage (%)
0%	zero waste	8	50.0
25%	one quarter remined	4	25.0
50%	half food remained	0	0.0
75%	three quarter remained	3	18.8
95%	one bite	1	6.2
100%	untouched	0	0.0
Total		16	100.0

Comparison of the mean score of children's acceptance in consuming fried fish and fish powder

Table III shows that there was a significant difference in the acceptability of children aged 6-24 months in Sidoarjo, Indonesia. The data indicated that more children preferred consuming fish powder compared to fried fish. The mean for fried fish left over by the children was 25.12 grams, whereas the mean of the leftover powder fish was lower at 5.06 grams. Based on the paired sample T-test, the result showed a significant value $p < 0.05$. This indicates a statistically significant difference in the acceptability of fried fish and powder fish among children aged 6-24 months.

Table III: Comparison of mean score of Children's acceptance in consuming fried fish and fish powder (n: 16)

Paired Sample T-Test 0,000 Sig (2-tailed) <0,05				
	Mean	Std. Deviation	Minimum	Maximum
Fried fish	25.12gram	15.731	0	40
Powder fish	5.06gram	7.085	0	19

DISCUSSION

The research revealed that the children wasted more food when eating fried fish compared to powdered fish. Moreover, the children's acceptance of fried fish is lower, with many expressing a preference for the powdered fish. The protein in fish plays a crucial role in promoting growth, enhancing intelligence, and supporting overall health in children (19). A deficiency in animal protein, particularly from fish, can lead to Protein-Energy Malnutrition (PEM), resulting in growth delays, undernutrition, malnutrition, and stunting (20). The main reasons for disliking fish include its strong odor and concerns about choking on bones (21). To address this, strategies have been developed to introduce alternative ways for children to consume fish, such as through snacks and powdered fish products.

Children are able to perceive the taste of the foods they eat, starting from breast feeding (22). As a result, their acceptance of food is influenced by internal factors such as appetite, eating habits, and boredom, as well as external factors like the food's taste, color, aroma, texture, and presentation (23, 24). Standard fish preparation methods often leave a fishy smell. However, the study showed that children were more likely to enjoy fish dishes when these issues were addressed. To improve children's acceptance of fish, it is essential to not only diversify fish-based menus but also to use preparation techniques that eliminate the unpleasant odor. There is a study supporting the idea that enhancing children's acceptance of fish can be achieved by diversifying fish-based dishes and improving upon the preparation methods used to minimize unpleasant odors (17, 25).

Children's acceptance of fish is often shaped by their family's eating habits (26); if their parents frequently eat fish, the children are more likely to follow suit, unless they have a fish allergy. The children's willingness to consume processed fish dishes can be improved,

especially if the mothers show an interest in incorporating fish into the family meals (27). However, many children still reject fish due to their mothers' limited knowledge on how to prepare it in a way that appeals to young palates (27, 28). This study used powdered fish as an innovation to enhance the acceptance of fish among children. Powdered fish is a processed variation made by combining tuna and tempeh. The bones are removed from the tuna, and tempeh is added to reduce the strong fishy aroma and create a softer, more palatable texture (17). This method not only enhances the taste but also serves as a practical solution for mothers looking to incorporate more fish into their children's diet. Based on a pilot study, this powdered fish offers a significantly higher nutritional value compared to traditional fried fish. Per 100 grams, fish powder contains 43.5 grams of protein, 30.3 grams of fat, and provides 517 kilocalories. It is also rich in important micronutrients, including 600 mg of calcium and 6.8 mg of iron (17), both of which are essential for healthy growth and development.

This study supports global research showing that it is important to give children nutritious foods early in life. In many low- and middle-income countries, adding animal-source foods like fish has been shown to help children grow better and improves their brain development (1, 29). Using local fish-based foods has been proven to be both effective and accepted by communities in the fight against child malnutrition (29). The findings also suggest that government groups, like the Ministry of Health and the Ministry of Marine Affairs and Fisheries, as well as NGOs, could include fish powder in national feeding programs. Public education and the local production of fish powder could make it more affordable and suitable for local communities. Adding fish powder to nutrition policies could help to improve protein intake and reduce malnutrition among children. These findings highlight the importance of creating fish-based products, like fish powder, that are safe, culturally suitable, and easy for children to eat.

CONCLUSION

The research revealed that children waste more food when eating fried fish compared to powdered fish. Moreover, the children's acceptance of fried fish is lower, with many expressing a preference for powdered fish. This study demonstrates that incorporating a variety of fish preparations can be highly effective at increasing children's acceptance of fish. This approach is particularly important as a strategy to meet children's nutritional needs and can help prevent nutrition-related issues, such as deficiencies and growth problems. This strategy not only enhances dietary variety but also addresses the challenge of ensuring that children receive sufficient animal protein. Several limitations in this study were considered. This study did not investigate the frequency of breastfeeding or whether the children were breastfed, and the limited number of respondents may

affect the generalizability of the findings. Further study is needed to measure the frequency of breastfeeding, while a larger sample would allow for greater statistical power and more robust conclusions. Long-term studies are needed to evaluate whether the consistent consumption of fish powder improves child growth, development, and health outcomes over time. Additionally, future research could investigate the stability of fish powder products under different storage conditions, as well as its cost-effectiveness and its feasibility for large-scale implementation in public health nutrition programs.

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