

Lemuru Fish Nugget with Carrot as an Alternative Supplementary Food to Prevent Stunting

Ni Made Novi Adi Purnami^{12*}, Hendrayati³, Aswita Amir³, Adriyani Adam³

*correspondence author : novi.adi81@gmail.com

1. Student Dietitian Department Health Polytechnic of Makassar, South Sulawesi, Indonesia

2. RSU Negara Bali, Jembrana Bali, Indonesia

3. Department Nutrition Health Polytechnic of Makassar, Makassar, South Sulawesi

ABSTRACT

Stunting can be prevented by ensuring diets rich in high-protein foods. Lemuru fish nuggets (Gemuru) are an alternative supplementary food based on local ingredients and formulated with high protein content. This study aimed to evaluate the acceptability and nutritional composition of Lemuru fish nuggets. A descriptive quantitative design was employed, and nutrient content was calculated using the Indonesian Food Composition Table (TKPI). Forty-nine respondents were selected through purposive sampling. Results showed that 44 respondents (89.8%) consumed the entire portion, while 5 (10.2%) left 25% uneaten. No respondents left more than 25% of the portion. Each 50-gram serving contains 68.1 kcal energy, 7.7 g protein, 1.6 g fat, and 5.6 g carbohydrates. These findings indicate high acceptability of Gemuru nuggets and suggest their potential as a locally sourced, protein-rich supplementary food to help prevent stunting.

Key Messages:

- Lemuru fish nuggets (Gemuru) are a high-protein, locally sourced supplementary food with strong acceptability, supporting efforts to prevent stunting.
- The study demonstrated that Gemuru nuggets are well-received and nutritionally beneficial, offering 7.7 g of protein and 68.1 kcal per 50-gram serving

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INTRODUCTION

Stunting remains a significant nutritional problem in Indonesia. It is defined as impaired linear growth that fails to meet standardized benchmarks, resulting in less competitive human resources (1). Indonesia ranks as the second-highest country for stunting prevalence in Southeast Asia after Timor-Leste, with rates reaching 31.8% in 2020 (2). The 2018 Basic Health Research (Riskesdas) reported an average national prevalence of 30.8% among children under five, with 37.2% recorded in 2013 (3)(4). In Bali Province, the prevalence in 2021 was 21.9%, down from 32.6% in 2013, yet still above the WHO's target of under 20%. In Jembrana Regency, stunting declined from 14.3% in 2021 to 8.7% in 2023 based on the Indonesian Health Survey (5).

The government implements a Supplementary Feeding Program (SFP) to increase dietary intake among children aged 6–59 months (6). Recovery SFP prioritizes underweight children through fortified biscuits, while Education SFP is distributed during Posyandu activities and utilizes locally sourced foods (7). However, based on field observations and health officer reports, not all children consume the SFP provided reasons include child refusal, parental forgetfulness, or consumption by other household members (8).

Nuggets are a popular food item among children. Typically made from ground meat shaped into squares and coated in seasoned flour (9), nuggets offer a familiar format for introducing nutritious foods. Lemuru fish, widely available and affordable in Jembrana, remains underutilized and is mostly fried. This study proposes developing Lemuru fish nuggets (Gemuru) as a SFP alternative at Posyandu centers.

To enhance nutritional value, carrots are added to the Gemuru recipe. Carrots are a preferred ingredient for early

complementary feeding due to their safety, vibrant color, and health benefits. Rich in beta-carotene (an antioxidant supporting eye health) and vitamin C, carrots can improve iron absorption from Lemuru fish nuggets (10). This study aims to evaluate the acceptability of Lemuru fish nuggets with added carrots as a supplementary feeding option for stunting prevention, as well as analyze their energy, protein, fat, and carbohydrate content per serving.

CASE DESCRIPTION

This study employed a descriptive quantitative design to assess the acceptability of Lemuru fish nuggets (Gemuru) as an alternative supplementary food for toddlers. Nutritional composition was calculated using the Indonesian Food Composition Table. The research was conducted at Posyandu Mekarsari, located in Berangbang Village, within the working area of Negara 1 Health Center, Jembrana Regency. Berangbang was selected due to its high stunting prevalence, and Posyandu Mekarsari was chosen as it recorded the highest rate in the village. Data collection occurred during the Posyandu event on July 14, 2025.

Gemuru production tools included a chopper, nugget molds, steamer, frying pan, plates, cutting board, and knife. Ingredients consisted of boneless Lemuru fish, eggs, carrots, wheat flour, tapioca flour, and iced water. Food waste data were collected using the Comstock leftover form, with direct observation by the researcher.

The study population comprised 63 registered toddlers at Posyandu Mekarsari (May 2025). Samples were selected using purposive sampling. Inclusion criteria: toddlers present during the Posyandu event, whose parents or guardians consented, and aged 12–59 months. Exclusion criteria: toddlers who were ill or had a history of seafood allergy, particularly to marine fish. A total of 49 participants met the criteria.

DISCUSSION

The ingredients used to prepare Lemuru fish nuggets (Gemuru) were grouped into four categories:

- 1. Main ingredients: 400 g boneless Lemuru fish, 1 chicken egg
- 2. Additional mix-ins: 100 g grated carrot, 5 tbsp wheat flour, 2 tbsp tapioca flour, 100 ml iced water, 5 sliced kaffir lime leaves, 2 sliced celery stalks
- 3. Seasonings: 4 garlic cloves, 2 tbsp fried shallots, 3 tbsp oyster sauce, 1 tsp salt, ½ tsp pepper
- 4. Coatings: 2 tbsp wheat flour, 200 g breadcrumbs

Preparation consisted of two stages: dough preparation and frying. The fish and seasonings were blended in a chopper until smooth, then combined with mix-in ingredients and thoroughly stirred. The mixture was molded and steamed for 15–20 minutes until cooked, cooled, sliced into 50 g portions, coated with wet and dry layers, and deep-fried until golden brown. Each recipe yielded 12 portions.

Panelist Characteristics (n = 49), Gender: 32 male (65.3%), 17 female (34.7%), Age groups: 1–3 years: 25 (51.1%); 4–6 years: 24 (48.9%). Using the Comstock food leftover form, 44 toddlers (89.8%) fully consumed a portion of Gemuru, while 5 (10.2%) left 25% uneaten. No samples recorded leftover portions of 50% or more.

Nutritional Content per Portion (50 g), Energy: 68.1 kcal, Protein: 7.7 g, Fat: 1.6 g and Carbohydrates: 5.6 g. These values were calculated using the Indonesian Food Composition Table (11) The findings indicate strong acceptability and nutritional potential of Gemuru as a supplementary food for toddlers.

The majority of toddler participants demonstrated a strong level of consumption, with 89.8% fully finishing the provided Gemuru nugget portion. Only 10.2% left 25% of their portion uneaten . No instances were recorded of children leaving half or more of the portion, nor total refusal to consume. These results reflect a high acceptability level of Lemuru fish nuggets among the sample group.

Table 1. Nutritional Composition of Lemuru Fish Nuggets (Gemuru)

Ingredient	Weight (g)	Energy (kcal)	Protein (g)	Fat (g)	Carbohydrate (g)
Lemuru fish	400	448	80.0	12.0	0.0
Chicken egg	55	84.7	6.8	5.9	0.4
Carrot	100	36.0	1.0	0.6	7.9
Wheat flour	50	166.5	4.5	0.5	38.6
Tapioca flour	22.5	81.7	0.2	0.1	19.8
Total (12 servings)	605.0	816.9	92.5	19.1	66.7
Per serving (50 g)	—	68.1	7.7	1.6	5.6

The nutritional profile of Lemuru fish nuggets (Gemuru) reflects a thoughtful selection of locally sourced ingredients with complementary macronutrients. By combining high-protein fish with eggs, vegetables, and flour-based components, the formulation achieves a balanced energy contribution while emphasizing lean protein. The inclusion of carrot and other mix-ins not only enhances nutrient diversity but also appeals to young palates through familiar taste and texture. The calculated composition demonstrates that a single serving aligns with dietary targets for supplementary toddler meals, particularly in settings focused on stunting prevention. This nutrient synergy suggests that Gemuru can offer functional benefits beyond basic sustenance, contributing to growth and development in early childhood.

In the study conducted by Rafika Ananda and colleagues, the processing technique using boiling at 60°C emerged as the most effective method for producing high-quality lemuru fish flour. This treatment yielded the highest protein content (49.41%), the lowest moisture level (5.24%), and optimal fat composition (7%), making it nutritionally superior.

Additionally, physical characteristics such as whiteness degree and ash content were notably better in samples treated with either boiling or pressure-cooking at specific temperatures. Overall, the research highlights that temperature-controlled boiling is the most promising approach to enhance the physicochemical quality of lemuru fish flour, aligning with standards set by Indonesia's national food regulations (12). The study by Risma Aryana et al. demonstrated that consistent consumption of milkfish nuggets (Formula F2) significantly improved the nutritional status of undernourished children aged 1–5 years (13).

The review study by Mahrus et al. highlights the remarkable nutritional profile of lemuru fish (*Sardinella lemuru*), including high levels of omega-3 fatty acids, protein, calcium, iron, and vitamins A, E, and K. It concludes that lemuru, widely found in Indonesian waters, holds strong potential as an affordable and locally sourced health product and medicinal ingredient, rivalling the nutritional benefits of imported fish like salmon (14). The study by J. K. Negara et al. found that although panelists slightly preferred the stick-shaped cheddar cheese in terms of color, texture, and flavor, there were no significant differences in microbiological and sensory characteristics between stick and slice presentations (15).

CONCLUSION

Lemuru fish nuggets (Gemuru), formulated with carrot as an additional nutrient source, demonstrated high acceptability among toddlers, with 89.8% of participants consuming the entire portion. Nutritional analysis showed that a 50-gram serving provides 68.1 kcal of energy, 7.7 grams of protein, 1.6 grams of fat, and 5.6 grams of carbohydrates. These findings highlight Gemuru's potential as a locally sourced, protein-rich supplementary food that can support stunting prevention efforts in early childhood nutrition programs.

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Conflicts of Interest: The authors declare no conflict of interest.

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