



Original Article

Beef nuggets are more effective than fish nuggets in promoting weight gain in stunted toddlers: a quasi-experimental study

Murti Ani ^{1✉}, Elisa Ulfiana ¹, Novita Ika Wardani ¹, Eni Sulastri ², Siti Yulaikah ²

¹ Department of midwifery, Poltekkes Kemenkes Semarang, Semarang, Central Java, Indonesia

² Department of midwifery, Poltekkes Kemenkes Surakarta, Surakarta, Central Java, Indonesia

ARTICLE INFORMATION

Received: November 21, 2024

Revised: June 08, 2025

Accepted: June 24, 2025

KEYWORDS

Body Weight; Growth Disorders; Stunting; Weight Gain

CORRESPONDENCE

Phone: +62 81225116081

E-mail: murtiani89@poltekkes-smg.ac.id

A B S T R A C T

Background: Stunting is a condition where children experience growth failure. Protein from animal sources, such as beef and fish, contains essential amino acids beneficial for stunted toddlers. However, a comparison of the effectiveness of beef nuggets and Fish nuggets on growth has never been conducted.

Objective: The aim of this study is to compare weight gain in stunted toddlers given beef nuggets and fish nuggets.

Methods: A quasi-experimental pretest-posttest design with a comparison group was used. One hundred two stunted toddlers were enrolled, 51 of whom were given beef nuggets and 51 Fish nuggets. Supplementation was given daily for 30 days. Body weight was measured before and after the intervention. Data were analyzed using a paired t-test for changes within groups and an independent t-test for comparisons between groups.

Results: Both groups showed significant weight gain after 30 days ($p = 0.001$). The average weight gain was 594.12 g in the beef nugget group and 441.18 g in the Fish nugget group. Intergroup analysis showed that beef nuggets were significantly more effective than fish nuggets in increasing weight gain ($p = 0.012$).

Conclusion: Beef nuggets were more effective than Fish nuggets in increasing weight gain in stunted toddlers.

INTRODUCTION

Stunting, which results from chronic malnutrition, is common among children in low and middle-income countries.² In Indonesia, stunting remains a national public health concern characterized by impaired linear growth as well as other indicators such as being underweight and wasted.³ Children with stunting not only have a height below the standard for their age but often also exhibit low body weight and poor nutritional status, which reflects a broader impact of long-term undernutrition.⁴

In 2022, the national stunting prevalence in Indonesia was 21.6%, with higher rates in Blora (25.8%) and Klaten (18.2%) Regencies. To address this, Indonesia aims to achieve zero stunting by 2030 as part of the Sustainable Development Goals (SDGs). Stunting is caused by various factors, particularly inadequate quantity and quality of food intake. Among key nutrients, sufficient protein is vital for both physiological function and tissue growth.^{5,6} Protein deficiency reduces insulin-like growth factor 1 (IGF-1)

levels, which are essential for growth and can be improved through adequate dietary protein intake.⁷

Research on protein supplementation in stunted toddlers remains limited despite several studies demonstrating positive outcomes. A study in Zambia reported improved linear growth in infants aged 6–7 months after receiving fish powder. In contrast, other studies found weight gain in stunted children given chicken floss and catfish nuggets.⁸⁻⁹ The protein needs of children encompass both maintenance and growth requirements, which decrease as they age. The effectiveness of dietary protein depends on its digestibility and amino acid content. Animal-based proteins are considered high-quality due to their complete amino acid profile and high bioavailability.¹⁰⁻¹¹

Emerging evidence suggests that balanced macronutrient intake not only prevents malnutrition but also supports better developmental and cognitive outcomes.¹²⁻¹³ Animal-source foods such as fish and beef are rich in essential amino acids.¹⁴ Fish, particularly Rastrelliger (mackerel), and beef are both nutrient-dense and culturally acceptable protein sources. In complementary feeding, which often

<https://doi.org/10.30595/medisains.v23i2.24523>

©(2025) by the Medisains Journal. Readers may use this article as long as the work is properly cited, the use is educational and not for profit, and the work is not altered. More information is available at [Attribution-NonCommercial 4.0 International](https://creativecommons.org/licenses/by-nc/4.0/).

lacks dietary diversity, incorporating such foods can significantly contribute to child growth.¹⁵⁻¹⁷

Nuggets made from fish or beef are palatable to children, making them a practical vehicle for nutritional intervention.¹⁸⁻²⁰ However, no study has yet compared the effectiveness of beef nuggets and fish nuggets in improving body weight among stunted toddlers. Therefore, this study aims to compare the body weight gain of stunted toddlers who are given beef nuggets with those who are given Fish nuggets.

METHOD

Study Design

This research is quasi-experimental with a pretest-posttest control group design.²¹

Setting and Respondent

The research was conducted in Blora Regency and Klaten Regency, Central Java, in June - September 2024. The population in this study were toddlers who were stunted, a total sample was 102 respondents, consisting of 51 treatment groups and 51 control groups, with inclusion criteria: age 1-5 years, not having fish or beef food allergies, no under treatment, willing to follow the research to completion. Children with pulmonary tuberculosis, digestive disorders, and do not participate in the study until the end are exclusion criteria in this study. Sampling was done by simple random sampling.

Making Beef and fish Nuggets

Beef Nuggets

The ingredients include 1000 g of beef, white bread (8 slices), 200 ml milk, four eggs, 12 cloves of garlic, one onion, four spring onions, 12 tbsp melted margarine, 4 tbsp cornstarch, 1 tsp pepper, 1 tsp nutmeg, 2 tsp salt, 2 tsp powdered stock, 6 tsp sugar, and 8 tbsp water. The coating mixture consists of 240 g medium-protein wheat flour, 500 ml water, stock powder, pepper, and breadcrumbs.

To prepare, white bread is soaked in milk, while garlic and onion are sautéed until fragrant. Melted margarine, eggs, seasoning, and beef are blended until smooth, followed by the addition of soaked bread, sautéed spices, spring onions, and dissolved cornstarch. The mixture is poured into a parchment-lined mold, steamed for 25 minutes, then cooled and cut into star shapes. Nuggets are coated, breaded, frozen for 2 hours, and fried until golden brown. Frozen nuggets can be stored in airtight containers for up to 2 months.

Fish nuggets

The ingredients include 1000 gr of boneless Rastrelliger fish fillet, eight slices of white bread, 200 ml milk, four eggs, 12 cloves of garlic, one onion, four spring onions, eight tablespoons melted margarine, six tablespoons cornstarch,

one teaspoon each of ground pepper and nutmeg, two teaspoons salt, two spoons powdered stock, six teaspoons sugar, eight tablespoons water, four teaspoons oyster sauce, and four teaspoons fish sauce. The coating consists of 240 g of medium-protein wheat flour, 500 ml of water, stock powder, ground pepper, and breadcrumbs.

The bread is soaked in milk, and garlic and onion are sautéed. All ingredients, including fish, melted margarine, eggs, seasonings, sauces, soaked bread, sautéed spices, spring onions, and dissolved cornstarch, are blended until smooth. The mixture is poured into a parchment-lined mold, steamed for 25 minutes, cooled, and shaped. Nuggets are coated, breaded, frozen for 2 hours, and fried as needed. They can be stored in sealed containers for up to 2 months.

Hedonic Taste Acceptance Test

The hedonic test of taste was carried out on 30 consumer panelists, namely, stunting toddlers who were not the subject of the study. Panelists in this hedonic test have the same characteristics as research respondents. After the toddlers tasted the beef nuggets and fish nuggets, the panelist parents were asked to ask the child for an assessment, and the panelist parents filled out the sheets provided. The acceptance ranges for beef nuggets and fish nuggets were determined to really like, more likes, like, somewhat like, standard, and do not like. The hedonic test data is divided into two categories: acceptable and unacceptable.

Experimental Procedure

The intervention was conducted over 30 consecutive days. During this period, subjects in the treatment group received beef nuggets, while those in the control group received fish nuggets from Rastrelliger. Each participant consumed the nuggets once daily, with a total of six pieces per serving, weighing approximately 150 grams (± 25 g per piece).

Variable, Instrumen, and Measurement

The measured variable in this study was the body weight of stunted toddlers. The instruments used in this study used calibrated digital scales and observation sheets to record body weight. The weight of the stunted toddlers was measured twice (pre and post-intervention), specifically on the first day before the intervention and on the thirtieth day.

Data Analysis

Data were analyzed using a paired t-test to assess within-group differences (pre-post intervention) and an independent t-test to compare the weight gain between the beef and fish nugget groups.

Ethical Consideration

Ethical Consideration This study was approved by the Ethics Commission of the Poltekkes of the Ministry of Health Semarang with the number No. 0812/EA/KEPK/2024.

RESULTS

The weight of nuggets consumed daily by respondents can be seen in Figure 1. Based on Table 1, the characteristics of the respondents are homogeneous; most respondents in this study were male, with ages ranging from 2 to 3 years. All respondents were included in the stunting and underweight categories.



Figure 1. Beef and Fish Nuggets

Table 1. Characteristics of Respondents (n=102)

Characteristic	Beef Nuggets (n=51)	Fish Nuggets (n=51)
Gender		
Male	27 (52.94%)	29 (56.86%)
Female	24 (47.06%)	22 (43.14%)
Age, yr		
1-2	15 (29.41%)	11 (21.57%)
2-3	27 (52.94%)	30 (58.82%)
3-5	9 (17.65%)	10 (19.61%)
Height		
Severely Stunted	12 (23.53%)	7 (13.73%)
Stunted	39 (76.47%)	44 (86.27%)
Weight		
Severely Underweight	19 (37.25%)	17 (33.33%)
Underweight	32 (62.75%)	34 (66.67%)

The hedonic test showed that both products were well accepted, with 96.7% of children liking beef nuggets and 93.3% liking Fish nuggets, indicating that both interventions were culturally and sensorially appropriate.²² Table 2 shows that after 30 days of intervention, both groups experienced a statistically significant increase in body weight ($p = 0.001$). The mean weight gain in the beef nugget group was 594.12 ± 357.44 g, while the fish nugget group gained 441.18 ± 234.25 g. The increase in the beef nugget group was significantly greater than in the fish nugget group ($p = 0.012$), indicating beef consumption among stunted toddlers.

DISCUSSION

This study demonstrates that animal-based protein sourced from beef is more effective than that from fish in improving

the nutritional status of stunted children. This advantage can be attributed to the superior protein quality of beef, which features a more complete essential amino acid profile and higher bioavailability. High-quality animal protein supports tissue synthesis and stimulates the production of insulin-like growth factor 1 (IGF-1), a key hormone involved in linear growth and weight gain in children.²²⁻²⁴

Biologically, IGF-1 levels are influenced by adequate intake of protein and energy. Beef protein, which is readily digested and utilized, optimally stimulates IGF-1 synthesis, thereby enhancing the child's growth response. This aligns with the principle that protein quality not merely quantity is critical to supporting child growth, particularly in nutritionally vulnerable groups such as stunted toddlers. Additionally, beef is rich in heme, iron and zinc, which are essential for immune development and brain growth.^{25,26}

Previous studies have demonstrated that nutrition interventions incorporating animal-source foods are effective in enhancing a child's nutritional status in low-resource settings. While fish is also a valuable protein source and has been used in various interventions, beef offers higher nutrient density.¹² It has been associated with more substantial improvements in weight status. Moreover, from a sensory and behavioural perspective, beef-based products are generally more accepted by young children due to their familiar taste and texture.^{1,12}

The use of processed foods, such as beef nuggets, offers a practical and effective strategy for nutritional intervention, particularly due to their high acceptability and ease of preparation.²⁷ Food acceptance is a critical determinant of adherence in dietary programs targeting young children.²⁸ From an implementation standpoint, utilizing more effective protein sources can yield faster and more substantial improvements in nutritional outcomes, which is particularly important in community-based stunting reduction programs.²⁹

This study confirms the critical role of protein quality in the nutritional recovery of stunted children.³⁰ It emphasizes the importance of selecting protein sources that are nutritionally adequate, culturally acceptable, and locally feasible. Study limitations include the absence of strict control of confounding factors and the evaluation of only body weight, rather than height, due to time constraints.

CONCLUSION AND RECOMMENDATION

Beef nuggets were significantly more effective than fish nuggets in increasing the body weight of stunted toddlers. These findings suggest that beef-based dietary interventions are a practical strategy to address undernutrition in early childhood. Future studies should examine long-term effects on linear growth, cognitive outcomes, and integration with parental education to optimize child development

Table 2. Body Weight Changes Before and After 30-Day Nugget Intervention in Stunted Toddlers (n = 102)

Group	Pre-intervention (g)	Post-intervention (g)	Mean Difference (g) ± SD	p-value
	Mean ± SD	Mean ± SD		
Beef Nuggets (n = 51)	10.339.22 ± 1.786.51	10.964.71 ± 1.778.52	594.12 ± 357.44	0.001
Fish Nuggets (n = 51)	10.303.92 ± 1.591.47	10.745.10 ± 1.610.38	441.18 ± 234.25	0.001
Between-group difference			152.94	0.012

Exp: p-value calculated using paired t-test for within-group changes and independent t-test for between-group comparison

REFERENCES

- Ricardo U, Anura K, Kwaku T, *et al.* Role of Protein and Amino Acids in Infant and Young Child Nutrition : Protein and Amino Acid Needs and Relationship with Child Growth. Published online 2015:192-194. doi:10.3177/jnsv.61.S192
- Sapartini G, Wong GWK, Indrati AR, Kartasasmita CB, Setiabudiawan B. Stunting as a Risk Factor for Asthma: The Role of Vitamin D, Leptin, IL-4, and CD23+. *Medicina (Lithuania)*. 2022;58(9). doi:10.3390/medicina58091236
- Hermawan D, Kurniasari D, Sandayanti V, Sari N, Listyaningsih E. Relationships of deworming drug consumption and animal protein intake with stunting. *Parasite Epidemiol Control*. 2023;23. doi:10.1016/j.parepi.2023.e00326
- Kemenkes RI. Buku Saku Hasil Survei Status Gizi Indonesia (SSGI) 2022. Badan Kebijakan Pembangunan Kesehatan Kementerian Kesehatan RI. 2022.
- Prendergast AJ, Humphrey JH. The stunting syndrome in developing countries. *Paediatr Int Child Health*. 2014;34(4):250-265. doi:10.1179/2046905514Y.0000000158
- Christian P, Lee SE, Angel MD, *et al.* Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low- and middle-income countries. 2013;(August):1340-1355. doi:10.1093/ije/dyt109
- Arsenault JE, Brown KH. Effects of protein or amino-acid supplementation on the physical growth of young children in low-income countries. 2017;75(9):699-717. doi:10.1093/nutrit/nux027
- Prentice A, Schoenmakers I, Laskey MA, De Bono S, Ginty F, Goldberg GR. *Symposium on "Nutrition and Health in Children and Adolescents" Session 1: Nutrition in Growth and Development: Nutrition and Bone Growth and Development Europe PMC Funders Group.*; 2007. doi:10.1079/PNS2006519
- Yayha ZA, Millward DJ. Dietary protein and the regulation of long-bone and muscle growth in the rat. *Clinical Science*. 1994 Aug 1;87(2):213-24. doi:10.1042/cs0870213
- Chipili G, Van GA, Lombard CJ, Van NE. The Efficacy of Fish as an Early Complementary Food on the Linear Growth of Infants Aged 6–7 Months: A Randomised Controlled Trial. *Nutrients*. 2022;14(11). doi:10.3390/nu14112191
- Wijayanti K, Harwijayanti BP, Ani M. Chicken floss and catfish nuggets supplementary to increasing weight gain in stunted children. *MEDISAINS*. 2023;21(1):3. doi:10.30595/medisains.v21i1.17150
- Joint WHO/FAO/UNU Expert Consultation. Protein and amino acid requirements in human nutrition. World Health Organ Tech Rep Ser. 2007;(935):1-265, back cover. PMID: 18330140.
- Consultation FAOE. *Consultation FE. Dietary Protein Quality Evaluation in Human Nutrition. FAO Food Nutr. Pap. 2011 Mar 31;92(1-66):26369006.*
- Suri DJ, Tano DK, Ghosh SA. Optimization of the nutrient content and protein quality of cereal – legume blends for use as complementary foods in Ghana. 2014;35(3):372-381. doi:10.1177/156482651403500309
- Eliana E, Yuniantini E, Kamsiah K, Yuniarto AE. Pengaruh Pemberian Pangan Setengah Jadi Berbasis Ikan (Sosis Analog) Dengan Kecukupan Protein Balita Dalam Upaya Penurunan Stunting Di Kabupaten Seluma. *Gizi Indonesia*. 2022;45(2):173-182. doi:10.36457/gizindo.v45i2.665
- Darawati M, Yuniarto AE, Doloksaribu TH, Chandradewi AASP. Formulasi food bar berbasis pangan lokal tinggi asam amino esensial untuk anak balita stunting. *Action: Aceh Nutrition Journal*. 2021;6(2):163. doi:10.30867/action.v6i2.480
- Salman Y, Syainah E, Rezkiyah R. Analisis Kandungan Protein, Zat Besi dan Daya Terima Bakso Ikan Gabus dan Daging Sapi. *Jurnal Kedokteran dan Kesehatan*. 2018;14(1):63. doi:10.24853/jkk.14.1.63-73
- World Health Organization. Indicators for Assessing Infant and Young Child Feeding Practices Part 3: Country Profiles. *World Health Organization*; 2010.
- Shivakumar N, Kashyap S, Kishore S, *et al.* Protein-quality evaluation of complementary foods in Indian children. *American Journal of Clinical Nutrition*. 2019;109(5):1319-1327. doi:10.1093/ajcn/nqy265
- Septiana T, Rahmiati BF, Jauhari MT. Pengaruh nugget ikan kakap terhadap perubahan tinggi badan balita stunting usia 24-59 bulan di wilayah Puskesmas Alas. *Nutrition: Jurnal Pangan, Gizi, Kesehatan*. 2022 Jun 17;3(1):10-7. doi:10.30812/nutrition.v3i1.1994
- Abraham I, Supriyati Y. Desain Kuasi Eksperimen Dalam Pendidikan: Literatur Review. *Jurnal Ilmiah Mandala Education (JIME)*. 8(3):2442-9511. doi:10.36312/jime.v8i3.3800/http
- Allowances RD. Nutrient Requirements and Recommended Dietary Allowances for Indians. *ICMR-National Institute of Nutrition: Hyderabad, India*. 2009.
- Wiley AS. Cow milk consumption, insulin-like growth factor-I, and human biology: A life history approach. *American Journal of Human Biology*. 2012;24(2):130-

138. doi:10.1002/ajhb.22201
24. Pimpin L, Kranz S, Liu E, *et al.* Effects of animal protein supplementation of mothers, preterm infants, and term infants on growth outcomes in childhood: A systematic review and meta-analysis of randomized trials. *American Journal of Clinical Nutrition.* 2019;110(2):410-429. doi:10.1093/ajcn/nqy348
25. Bonjour JP. The dietary protein, IGF-I, skeletal health axis. *Horm Mol Biol Clin Investig.* 2016;28(1):39-53. doi:10.1515/hmbci-2016-0003
26. Inzaghi E, Pampanini V, Deodati A, Cianfarani S. The Effects of Nutrition on Linear Growth. *Nutrients.* 2022;14(9). doi:10.3390/nu14091752
27. Hess SY, Lönnerdal B, Hotz C, Rivera JA, Brown KH. Recent Advances in Knowledge of Zinc Nutrition and Human Health. *Food and Nutrition Bulletin.* 2009 Mar;30(1_suppl1):S5-11. doi:10.1177/15648265090301S102
28. Brown KH, Pearson JM, Rivera J, Allen LH. Effect of supplemental zinc on the growth and serum zinc concentrations of prepubertal children: A meta-analysis of randomized controlled trials1-3. *American Journal of Clinical Nutrition.* 2002;75(6):1062-1071. doi:10.1093/ajcn/75.6.1062
29. Dewey KG, Adu-Afarwuah S. Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. *Matern Child Nutr.* 2008;4(SUPPL.1):24-85. doi:10.1111/j.1740-8709.2007.00124.x
30. Smuts CM, Dhansay MA, Faber M, van Stuijvenberg ME, Swanevelder S, Gross R, Benade AS. Efficacy of Multiple Micronutrient Supplementation for Improving Anemia, Micronutrient Status, and Growth in South African Infants1. *The Journal of Nutrition.* 2005 Mar 1;135(3):653S-9S. doi:10.1093/jn/135.3.653S