CHAPTER I
INTRODUCTION

1.1. Research Background

Toddlerhood was recognized as a crucial developmental stage, often referred to as the golden age of human growth and development. Issues related to growth and development during this period can impact both physical strength and cognitive abilities, with long-term consequences for an individual's future.[1] This phase demands considerable attention due to the numerous challenges that arise, including nutritional deficiencies, which can result in stunting.[2]

According to the World Health Organization (WHO), in 2020, Indonesia ranked second in Southeast Asia for stunting prevalence at 31.8%. Data from the Indonesian Nutrition Status Survey (SSGI) conducted in 2022 indicates that the national prevalence of stunting in toddlers decreased from 27.7% in 2019 to 21.6% in 2022. This reflects a reduction of 3.05% annually, though the national target aims for a 3.8% decrease per year to achieve a target rate of 14% by 2024.[3]

Stunting or short posture can also be categorized in toddlers whose posture is shorter than their age. A child's parameters are said to *be stunted* if the index value of the length or height measurement results by age is below minus 2 Standard Deviation (<-2SD) from the WHO median standard.[4] Stunting in early toddlerhood is associated with lower intelligence, motor -

[1] Putri Wulandini, Meiyil Efni, and Lora Marlita, "Overview of Knowledge of Mothers with Toddlers About Stunting at the Rejosari Health Center, Tenayan Raya District, Pekanbaru City 2019", *Collaborative Medical Journal (CMJ),* vol. 3, no. 1 (2020), pp. 8–14.

[2] Intan Tiara Indra Sanjaya and Myang Sari Ayu, "Risk Factors Affecting the Incidence of Stunting in the Amplas Health Center, Harjosari 1 Village, Amplas District, Medan City in 2020", *Ibnu Sina: Journal of Medicine and Health - Faculty of Medicine, Islamic University of North Sumatra*, vol. 21, no. 2 (2022), pp. 152–60.

[3] BKPK Public Relations, "Stunting Rate in 2022 Drops to 21.6 Percent", *Health Development Policy Agency | BKPK Ministry of Health* (25 Jan 2023).

[4] Atmarita. 2018. Optimal Nutritional Intake to Prevent Stunting. Bulletin of the Health Data and Information Window for the first semester of 2018 p: 14-25. Jakarta: Data and Information Center, Ministry of Health of the Republic of Indonesia.

function, and neuro-sensory integration. Stunting in toddlerhood will affect the quality of life throughout school years, adolescence, and even adulthood.[5] The primary cause of stunting is chronic malnutrition. This nutritional deficiency can begin in utero if the mother does not meet nutritional requirements during pregnancy. Therefore, it is essential for pregnant women to ensure adequate nutrition for optimal fetal growth and development.[6] Thus, efforts are needed to address the issue of stunting through the provision of supplementary feeding.

One of the solutions for handling stunting in toddlers is by providing supplementary food in the form of fishballs. One of the snacks that is quite popular with all groups of toddlers, teenagers, and parents. Fishballs are typically made from ground fish and tapioca flour, which are combined, shaped into small balls, and then boiled.[7] Efforts to mitigate stunting, particularly through the inclusion of animal protein sources, continue to focus on reducing the prevalence of stunted children. From the perspective of sustainable food security, local food alternatives, such as fish, offer a viable solution to address stunting and improve nutrition.[8]

Tongkol *(Euthynnus affinis)* is rich in omega-3 fatty acids and protein. The nutritional content of tongkol is 26.46% protein, 8.36% calcium, 30.17% beta-carotene. Meanwhile, catfish have a protein content of 24.63%, calcium of 1.27%, and beta-carotene as much as 11.67%.[9] The protein, calcium, and beta-carotene content of tongkol are higher than that of catfish. Additionally, tongkol contains several minerals, including calcium, phosphorus, iron, and

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[5] *Research "Forikes Voice")*, https://forikes-ejournal.com/index.php/SF/article/view/sf9407, accessed 4 Apr 2024.

[6] Yuli Trisnawati, Sugi Purwanti, and Misrina Retnowati, "A Descriptive Study of Pregnant Women's Knowledge and Attitudes About Nutrition in the First 1000 Days of Life at the Sokaraja Health Center, Banyumas Regency", *Journal of Midwifery* (2016), https://ejurnal.stikeseub.ac.id/index.php/jkeb/article/view/218, accessed 29 Sep 2024.

[7] Aulia Dewi Pratiwi, Laksmi Widajanti, and Sri Achadi Nugraheni, "Penerapan Sistem Jaminan Halal Dan Kandungan Gizi Bakso Sapi Produksi Usaha Mikro Di Pasar Rasamala Banyumanik Kota Semarang Tahun 2019", *Jurnal Kesehatan Masyarakat*, vol. 8, no. 1 (Fakultas Kesehatan Masyarakat Universitas Diponegoro, 2020), pp. 152–9.

[8] Raden Roro Dewi Ngaisyah and Andre Kusuma Adiputra, "Pengembangan potensi lokal ikan menjadi nugget dan abon ikan untuk meningkatkan kesejahteraan masyarakat dan menurunkan angka kejadian stunting di Kanigoro, Saptosari, Gunungkidul", *Journal of Community Empowerment for Health*, vol. 1, no. 2 (2019), pp. 61–70.

[9] Rezaldi Hidayat, Maimun Maimun, and Sukarno Sukarno, "Analisis Mutu Pindang Ikan Tongkol (Euthynnus affinis) dengan Teknik Pengolahan Oven Steam", *Jurnal FishtecH*, vol. 9, no. 1 (2020), pp. 21–33.

sodium, as well as vitamin A (retinol) and B vitamins (thiamine, riboflavin, and niacin).[10] Stunting can be prevented not only by animal protein but also by vegetables such as Moringa leaves, which are more economical and highly nutritious. Moringa leaves can serve as an effective alternative in addressing dietary issues.[11]

Moringa leaves *(Moringa oleifera)* have been shown to enhance breast milk production and serve as a valuable nutritional source for toddlers during their growth phase in complementary feeding (MPASI).[12] Other research on the provision of Moringa oleifera extract can increase height by 0.342 cm with a prediction of 16.2%.[13] This made the benefits of Moringa leaf extract on toddler height growth identifiable. Meanwhile, research on the benefits of *Moringa oleifera* extract showed that the average height increase between the treatment and control groups was 1.849 cm. Therefore, it could be a reference for additional nutrition for stunted toddlers.[14] Moringa leaves contained 28.4 g of protein per 100 g.[15] Fresh Moringa leaves grown in Indonesia contained 8.53% protein, 1,077 mg of calcium, and 2,800 µg/100 g of vitamin A.[16] Protein formed and maintained body tissues, while calcium supported bone and teeth formation.[17] To address stunting issues, diversifying local food sources such as

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[10] Mafaza Nur Andjani and Mutiara Nugraheni, "Pengembangan Puff Pastry Isian Ikan Tongkol Dengan Subtitusi Ikan Tongkol (Matuna Puff Pastry) Untuk Mendukung Gerakan Gemar Makan Ikan (Gemarikan)", *Prosiding Pendidikan Teknik Boga Busana*, vol. 15, no. 1 (2020), http://journal.uny.ac.id/index.php/ptbb/article/view/36000, accessed 22 Jun 2024.

[11] *Nutraceutical or Pharmacological Potential of Moringa oleifera Lam - PubMed*, https://pubmed.ncbi.nlm.nih.gov/29534518/, accessed 27 Jun 2024.

[12] Rizal F. Aji Suryaningrat Wisnu M., "Potensi Ramuan Ekstrak Biji Klabet dan Daun Kelor sebagai Laktagogum dengan Nilai Gizi Tinggi", *Pusat Informasi Kesehatan Masyarakat*, https://lib.fkm.ui.ac.id, accessed 22 Jun 2024.

[13] Dyah Muliawati, Nining Sulistyawati, and Fitria Siswi Utami, "MANFAAT EKSTRAK MORINGA OLEIFERA TERHADAP PENINGKATAN TINGGI BADAN BALITA", *Prosiding Seminar Nasional: Pertemuan Ilmiah Tahunan Politeknik Kesehatan Karya Husada Yogyakarta*, vol. 1, no. 1 (2019), pp. 46–55.

[14] *Ibid.*

[15] Ramachandran Chelliah, Sudha Rani Ramakrishnan, and Usha Antony, "Nutritional quality of *Moringa oleifera* for its bioactivity and antibacterial properties", *International Food Research Journal*, vol. 24 (2017), pp. 825–33.

[16] Yuanita Indriasari, Wignyanto Wignyanto, and Sri Kumalaningsih, "Effect of Blanching on Saponins and Nutritional Content of Moringa Leaves Extract", *Journal of Food Research*, vol. 5 (2016), p. 55.

[17] Gusti Ayu Rai Saputri, Tutik Tutik, and Ayu Indah Permatasari, "Penetapan Kadar Protein Pada Daun Kelor Muda Dan Daun Kelor Tua (*Moringa Oleifera L.*) Dengan Menggunakan Metode *Kjeldahl*", *Jurnal Analis Farmasi*, vol. 4, no. 2 (2019), pp. 108–16.

tongkol fish meatballs with the addition of Moringa leaves was a nutritious option. This combination provided protein, calcium, and beta-carotene, which were essential for toddler growth and development, particularly in bone formation and immune system enhancement.[18] Beta-carotene intake from vegetables like Moringa leaves helped prevent vitamin A deficiency, which posed a risk for stunting.[19]

"Based on this background, research on the Innovation Supplementary Food of Tongkol Fishballs *(Euthynnus Affinis)* with Moringa Leaf *(Moringa Oleifera)* Substitution on Protein, Calcium, Beta-Carotene and Acceptability Levels Stunting Toddlers Aged 24-59 Months was necessary.

1.2. Research Problems

1. Is there a difference in protein levels in tongkol fishballs with moringa leaf substitution?
2. Is there a difference in calcium levels in tongkol fishballs with moringa leaf substitution?
3. Is there a difference in beta-carotene levels in tongkol fishballs with moringa leaf substitution?
4. Is there a difference in acceptability in tongkol fishballs with moringa leaf substitution?

1.3. Research Objectives

1. General Purpose

To analyzing the difference in moringa leaf substitution on protein, calcium, beta-carotene, and acceptability levels in tongkol fishballs as an innovation supplementary food for stunted toddlers aged 24-59 months.

2. Special Purpose

a. To analyzing the difference in protein levels in tongkol fishballs with moringa leaf substitution as an supplementary food innovation for stunted toddlers aged 24-59 months.

[18] Kurniawati I, Fitriyya M, Wijayanti W, 2018. Karakteristik Tepung Daun Kelor Dengan Metode Pengeringan Sinar Matahari. Dalam: Prosiding Seminar Nasional Unimus.

[19] Fika Nuzul Ramadhani, Endah Nurrohwinta Djuwarno, and Nur Ayun R. Yusuf, "Upaya Peningkatan Status Gizi Anak sebagai Pencegahan Stunting di Desa Mongiilo Utara Bone Bolango", *Jurnal Pengabdian Masyarakat Farmasi : Pharmacare Society*, vol. 1, no. 3 (2022), pp. 85–91.

b. To analyzing the difference in calcium levels in tongkol fishballs with moringa leaf substitution as an supplementary food innovation for stunted toddlers aged 24-59 months.

c. To analyzing the difference in beta-carotene levels in tongkol fishballs with moringa leaf substitution as an supplementary food innovation for stunted toddlers aged 24-59 months.

d. To analyzing the difference in acceptability in tongkol fishballs with moringa leaf substitution as an supplementary food innovation for stunted toddlers aged 24-59 months.

1.4. Research Benefits

1. Theoretical Benefits

Theoretically, this research is expected to provide scientific insights and expand knowledge regarding the use of tongkol fish and moringa leaves as alternative food supplements in efforts to address stunting and increase food variety.

2. Practical Benefits

a. For Researchers

This research will increase knowledge in the fields of food, nutrition, and health, particularly in the application of making tongkol fishballs using moringa leaves to enhance protein, calcium, beta-carotene, and acceptability levels for stunted toddlers aged 24-59 months, ultimately contributing to the development of beneficial food products.

b. For the Community

1) This research is expected to indirectly help the community in addressing the stunting problem.

2) It can inform the public about the potential use of tongkol fish as an supplementary business by utilizing tongkol meat as an ingredient for fishball production, thus fostering entrepreneurship and increasing food variety.

3) Increasing the value of tongkol fish and moringa leaves.

1.5. Authenticity Research

Research related to moringa fishballs with various variations of raw materials in their manufacture has been carried out by several researchers as shown in table 1 of this study.

Table 1. Authenticity Research

Research Title	Type of Research	Variable	Results	Research Differences
The effect of adding moringa leaf flour (Moringa oleifera Lamk) on the beta-carotene content and organoleptic properties of patin fish fishballs was studied.[20]	Experimental with a simple Randomized Complete Block Design (CRD) with 4 treatments and 5 replications.	Independent: catfish fishballs with moringa leaf flour Dependent: beta-carotene content, Organoleptic.	The addition of moringa flour to catfish fishballs has a significant effect ($p<0.05$) on beta-carotene content and organoleptic (appearance, texture, aroma, and taste).	Independent: tongkol fishballs with the addition of moringa leaves Dependent: protein content, calcium.
The effect of adding soybean pulp flour was analyzed on the protein content, fiber content, moisture content, and acceptability of Nile tilapia (Oreochromis niloticus) fishballs.[21]	Experimental using a posttest-only control group design.	Independent: Nile tilapia fishballs with the addition of soybean pulp flour. Dependent: Protein content, fiber content, moisture content, and acceptability	The research results showed that as the amount of soybean pulp flour increased (X0: 0 grams; X1: 5 grams; X2: 10 grams; X3: 15 grams), the protein, fiber, and moisture content of Nile tilapia fishballs also increased. The protein content changed to X0: 16.59%; X1: 16.88%; X2: 17.24%; X3: 17.42%. The fiber content increased to X0: 0.08%; X1: 0.14%; X2: 0.25%; X3: 0.35%, and the moisture content became X0: 63.63%; X1: 63.55%; X2: 63.75%; X3: 64.07%.	Independent: tongkol fishballs with the addition of moringa leaves Dependent: calcium content, beta-carotene.
The effect of fortifying catfish	A completely randomized design	Independent: fish fishballs	Shows that different concentrations of	Independent: tongkol

[20] Oktavia Cahyaningati and Titik Dwi Sulistiyati, "Pengaruh Penambahan Tepung Daun Kelor (*Moringa Oleifera Lamk)* Terhadap Kadar Î²-Karoten Dan Organoleptik Bakso Ikan Patin (Pangasius pangasius)", *JFMR (Journal of Fisheries and Marine Research)*, vol. 4, no. 3 (2020), pp. 345–51.

[21] Syafrilia Fillaili, Farida Wahyu Ningtyias, and Sulistiyani Sulistiyani, "Pengaruh Penambahan Tepung Ampas Tahu Terhadap Kadar Protein, Kadar Serat, Kadar Air Dan Daya Terima Bakso Ikan Nila (Oreochromis Niloticus)", *Buletin Penelitian Sistem Kesehatan*, vol. 23, no. 4 (2020), pp. 215–27.

Research Title	Type of Research	Variable	Results	Research Differences
bone flour (Clarias sp.) on the calcium content and acceptability of fish fishballs.[22]	(CRD) was applied, consisting of four treatments and five replications with different concentrations of catfish bone flour, namely 0%, 5%, 7.5%, and 10%.	fortified with catfish bone flour Dependent: calcium content and acceptability.	catfish bone meal fortification affect calcium levels in catfish bone meal fortified products in the manufacture of crackers with 0% concentration (0.21%), crackers with 5% concentration (0.85%), wet noodles with 10% concentration (3.98%) and biscuits with 20% concentration (7.59%). The results of the analysis of the acceptance value of catfish fishballs have an effect on the fortification of catfish bone meal on the aspects of taste and aroma of fishballs at concentrations of 5% and 10%.	fishballs with the addition of moringa leaves Dependent: protein content, beta-carotene.
The analysis of protein content, iron, and acceptability of snakehead fish fishballs and beef.[23]	It was an experimental study with a completely randomized design (CRD). The study consisted of 3 treatments and 3 replications with proportions of snakehead fish and beef at 60%:40%, 50%:50%, and 40%:60%.	Independent: cork fish and beef fishballs Dependent: protein content, iron, and acceptability.	The average test values of protein and iron content were highest in the proportion of cork fish and beef (60%: 40%), namely 55.65% and 48.50 ppm with statistical test results, respectively, p = 0.000 and p = 0.001 with α = 0.05, which means that there are differences in the protein and iron content of fishballs with different proportions of cork fish and beef.	Independent: tongkol fishballs with the addition of moringa leaves Dependent: calcium content, beta-carotene.
The protein content of broiler chicken fishballs with the addition	It was an experimental study with a Completely Randomized Design (CRD) consisting of 4 treatments, which	Independent: broiler chicken fishballs with the addition of oyster mushrooms	The addition of oyster mushrooms to broiler chicken fishballs had a significant effect (P>0.05) on the protein content of the fishballs.	Independent: tongkol fishballs with the addition of moringa leaves

[22] Aida Nuraini, "Pengaruh Fortifikasi Tepung Tulang Ikan Lele (Clarias Sp.) Terhadap Kadar Kalsium Dan Daya Terima Bakso Ikan", skripsi (Universitas Airlangga, 2020), http://lib.unair.ac.id, accessed 27 Jun 2024.

[23] Yuliana Salman, Ermina Syainah, and Rezkiah Rezkiah, "Analisis Kandungan Protein, Zat Besi dan Daya Terima Bakso Ikan Gabus dan Daging Sapi", *Jurnal Kedokteran dan Kesehatan*, vol. 14, no. 1 (2018), pp. 63–73.

Research Title	Type of Research	Variable	Results	Research Differences
of oyster mushrooms.[24]	were the addition of oyster mushrooms in fishball production: 0% (P0), 10% (P1), 20% (P2), and 30% (P3) of the weight of broiler chicken meat, with 3 replications.	Dependent: protein content.	The highest protein content (5.37%) in broiler chicken fishballs with the addition of oyster mushrooms was found with the addition of 10% oyster mushrooms by weight of the broiler chicken meat.	Dependent: calcium content, beta-carotene, and acceptability.

[24] Ria Harmayani and Susi Susanti, "Kadar Protein Bakso Daging Ayam Broiler Dengan Penambahan Jamur Tiram", *Agriptek (Jurnal Agribisnis dan Peternakan)*, vol. 1, no. 1 (2021), https://ejournal.unwmataram.ac.id/index.php/agriptek/article/view/608, accessed 23 Feb 2024.