

CHAPTER 2 - LITERATURE REVIEW

2.1 Overripe Tempe

Overripe tempe is tempe that has fermented further for 2 to 5 days longer than normal tempe until the natural mold of tempe cannot survive, and bacterial fermentation takes over. Overripe tempe has characteristics such as a pungent odor caused by hydrolyzed fat. Overripe tempe also has a brownish gray color with a softer texture compared to normal tempe (Hassanein *et al.*, 2015). Overripe tempe has a protein content that has been broken down into free amino acids with a composition of glutamate and aspartate, which produces an umami taste, so it has the potential to be used as a flavor enhancer (Gunawan-Puteri *et al.*, 2019).



Figure 1. Overripe Tempe

Investigative study of physicochemical and sensory characteristics of Overripe tempe flour, which was produced at various drying temperatures. The temperature identified as the most effective temperature for maintaining the desired properties was 60°C. Overripe tempe flour dried at 60°C showed the best physical, chemical, and sensory attributes compared to other temperatures tested. The flour has a brown color, characteristic aroma, and fine, dry texture, all of which were highly favorable in

sensory evaluation. These findings demonstrate that drying Overripe tempe at 60°C optimizes its quality for further use in food products (Andriani *et al.*, 2014).

With the umami flavor profile of overripe tempe, it can be used as a food flavor enhancer. PT. Bijak Pangan Indonesia is a pioneer of the first overripe tempe-based powdered broth product in Indonesia called Rhisoya.



Figure 2. Rhisoya (Instant Vegetable Broth)

Rhisoya is a vegetable stock made from overripe tempe without any preservatives, food colorant, and *monosodium glutamate* (MSG). PT. Bijak Pangan Indonesia offers product innovation from overripe tempe that can be used as a plant-based alternative stock that is nutritious to produce healthier dishes.

2.2 Children's Nutritional Dietary Guidelines

Children aged 1-5 years needed a diet with 3 main meals and 2 snacks, portions half the size of an adult's. The diet should be varied (staple foods, protein, vegetables, and fruits), creatively prepared, and accompanied by water, and snacks should not be given close to main meals. Child development includes systematic, progressive, and continuous physical and psychological changes, such as weight gain and improved thinking ability (Juairia *et al.*, 2022).

Proper nutrition plays an important role in the growth and development of young children, especially in their physical, neurological, and intellectual development.

Adequate nutrition during the critical early years, particularly between ages 0 and 2, is critical for optimal brain development and cognitive function. A balanced diet that includes the right macronutrients, such as carbohydrates, proteins, and fats, along with essential micronutrients such as vitamins and minerals, is essential to support healthy growth and overall development. This proves the importance of ensuring young children receive proper nutrition to improve their physical and cognitive well-being (Juairia *et al.*, 2022).

Indonesian children's dietary intake was often below recommended levels. Nutritional adequacy was highest among children aged 6-11 months and lowest in those aged 9-12 years. Older children, particularly those in rural areas, with low maternal education, and from lower socioeconomic backgrounds, were at greater risk of inadequate nutrient intake (Yekti Widodo *et al.*, 2013).

Table 1. Recommended energy and protein intake per day (Kementrian Kesehatan RI, 2019)

Age Size	Energy (kcal)	Protein (grams)
1 - 3 years old	1350	20
4 - 6 years old	1400	25
7 - 9 years old	1650	40

A nutritionally adequate single meal designed for children should have at least one-third of the recommended protein intake per day. The daily protein requirement for 1 meal should be approximately 6.7 grams for children aged 1-3 years old, 8.3 grams for those aged 4-6 years old, and 13.3 grams of protein for children aged 7-9 years old to ensure that each age group receives sufficient protein to support growth, cognitive function, and overall development.

Table 2. Recommended salt intake per day (Kementrian Kesehatan RI, 2019)

Age Size	Salt (mg)
1 - 3 years old	800
4 - 6 years old	900
7 - 9 years old	1000

Salt plays a critical role in maintaining fluid balance, nerve function, and muscle activity. However, excessive salt intake during childhood is not good and has been associated with an increased risk of hypertension. High blood pressure in childhood is recognized as a significant predictor of hypertension and cardiovascular disease in adulthood (He & MacGregor, 2009). In response to these concerns, the Indonesian Ministry of Health issued dietary guidelines, limiting salt intake to each age group, aiming to reduce the risk of long-term health issues.

2.3 Stunting Prevention

The Tangerang government also took part in preventing and reducing stunting cases through the implementation of the Gebrak Tegas program. Gebrak Tegas was an initiative that aimed to provide comprehensive education and awareness to the Indonesian community regarding issues of extreme poverty and stunting. The Gebrak Tegas program not only focused on increasing public understanding but also enhancing access to essential services in health, education, and the economy, especially for underprivileged communities. The Gebrak Tegas program contributed to improving overall well-being and quality of life for its people.

A study conducted in North Jakarta, Indonesia, focused on the development of a nutritious and child-friendly food product, the “Fish Katsu Food Box,” as a solution to address stunting in children. The initiative aims to empower families to utilize nutritious local ingredients to create appealing and affordable meals. The Fish Katsu Food Box contains fish katsu, vegetable rolls, potato wedges, and fruit, all designed to align with the “Fill My Plate” concept to ensure a balanced and visually appealing

meal. The product was developed to meet children's nutritional needs while maintaining affordability and taste. Future improvements to the food box include packaging features that detail nutritional content, halal certification, and branding through logos, enhancing its usability and marketability (Ismail & Tri Annisa, 2024).

There was also a community service program that was implemented in Langge Village, Bone Bolango Regency, Gorontalo, which focused on training residents to make healthy food products from fish, especially nuggets, as part of efforts to prevent stunting. This program aims to increase community understanding of stunting, including its causes, characteristics, prevention, and strategies for overcoming it. Through this initiative, participants gained valuable knowledge about the importance of nutrition in overcoming stunting and acquired practical skills to make fish-based nuggets tailored to children's tastes. The program also provided valuable learning opportunities for participating students, equipping them with insights into stunting and effective community engagement strategies. The training was received enthusiastically, with community members expressing their happiness and active involvement in the program, highlighting its positive impact on local awareness and capacity-building efforts (Hasan *et al.*, 2023).

2.4 Tempe-Based Product

Tempe is a traditional Indonesian fermented food product made from soybeans that goes through a fermentation process by inoculating *Rhizopus spp* into ripe and dehulled soybeans. Tempe is a food that is inherent in Indonesian culture and is also widely consumed by people in Indonesia, and has begun to develop abroad because of its delicious taste and nutritional value. The fermentation process in the tempe production process is reported to increase the bioavailability of protein, fiber, vitamins, and isoflavones (Adinda Darwati Kadar *et al.*, 2020). By being a food that is high in nutrients and suitable for a plant-based diet, tempe is widely used in innovative products that offer nutritional value.

Research conducted by UD Berkah in collaboration with the University of North Sumatra led to the development of several products made from tempe, such as

mendoan tempe, tempe chips, green tea flavored tempe, red chili tempe, and chocolate tempe. Tempe products are prepared by slicing tempe thinly and frying it until it is golden brown. The results of the fried tempe will be mixed with various flavors to produce 250 mg and 500 mg per week and sold. Tempe product innovation has become popular in the community in Medan, North Sumatra, and helps provide solutions for people in utilizing tempe into innovative products (Ameilia ZuliYanti Siregar *et al.*, 2019).

The limited community skills in processing tempe into a product presented a challenge to its broader utilization. While tempe is commonly processed into chips, it also has the potential for application in a variety of innovative food products, including baked goods. Innovative processed products based on tempe include rainbow tempe dumplings, tempe cookies, Pamia's creative tempe, gelamai tempe mocaf flour, and fermented soybean dessert box (Simanjuntak *et al.*, 2022).

The large number of products made from tempe has the potential to improve economic development and increase people's interest in consuming tempe. However, the majority of the Tempe-based products available are products that did not focus on improving health and enhancing nutritional value.

2.5 Protein Source

Protein is an essential macronutrient required to support growth, tissue repair, and overall health (Wilde, 2014). Natural sources of protein are primarily sourced from animal-based and plant-based sources. Animal-derived protein, such as that found in meat, dairy, eggs, and fish, is classified as a complete protein because these sources have all nine essential amino acids and are rich in bioavailable nutrients such as vitamin B12, iron, and zinc (Ferrari *et al.*, 2022). However, epidemiological studies have linked high consumption of animal protein, particularly red and processed meats, to an increased risk of chronic diseases such as cardiovascular disease, cancer, and type 2 diabetes (Ferrari *et al.*, 2022).

In contrast, plant-based protein sources, such as grains, beans, and legumes, are associated with a lower risk of chronic diseases and offer an environmentally

sustainable alternative (Thakur *et al.*, 2023). However, protein obtained from natural sources, whether animal-based or plant-based, still has a fairly high cost compared to commercial protein alternatives.

Commercialized protein sources, such as whey, soy, casein, and pea protein, have gained popularity as concentrated protein sources designed to meet nutritional demands. One of the commercialized protein sources is Isolated Soy Protein (ISP). ISP is a highly refined soy product that has 90% protein by weight. ISP has been shown to have positive effects on cardiovascular health and lipid profiles, and its nutritional value and nitrogen balances are comparable to animal-based protein (Wayler *et al.*, 1983). Moreover, ISP is considered a safe option for children to support growth, bone health, and metabolic function, and is comparable to children fed cow's milk (Vandenplas *et al.*, 2014).

2.6 Flavor Enhancer

Four flavors are known as sweet, salty, sour, and bitter, and other flavors are considered to be a mixture of the four flavors. Still, there is one flavor that is different from the four flavors. That flavor gives the feeling of umami, often described as brothy, meaty, or savory, that's naturally present in food sources such as fish, meat, and most noticeably from broth prepared from dried bonito and seaweed. This flavor is referred to as umami (Ikeda, 2002).

A widely used flavor enhancer that produces the umami taste is monosodium glutamate (MSG). MSG is a glutamic acid that was first extracted from seaweed broth (Ikeda, 2002). Today, it is commercially produced by combining glutamate and sodium. MSG is known to have an intense umami flavor and can enhance the taste of food. While MSG remains a staple in the global food industry, yeast extract has emerged as a natural alternative flavor enhancer. Yeast extract is obtained from autolyzed yeast cells, where the internal contents of *Saccharomyces cerevisiae* (brewer's and baker's yeast) are released and broken down into amino acids, peptides, and nucleotides (Maluly *et al.*, 2017).

Compared to MSG, yeast extract offers several functional advantages. It contains a wider range of amino acids and nucleotide content to add layers for more complex flavors. Furthermore, yeast extract contains lower sodium levels than MSG, where MSG has 1/3 sodium by weight (Maluly *et al.*, 2017). In addition, Yeast extract is the source of vitamins, proteins, and minerals, positioning it as a functional ingredient with growing relevance in the food industry. Yeast extract also has a future that attracts increasing attention due to low production cost and versatile applications (Tao *et al.*, 2023).

