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Organoleptic Characteristics and Nutritional Content of Instant Baby Porridge Made from the West Sulawesi Local Cultivar of Foxtail Millet (*Setaria italica* L.)

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Abstract: Instant baby porridge is a popular complementary food due to its convenience. Typically made from rice flour, alternatives like Foxtail Millet (Setaria italica) offer higher levels of protein, calcium, and phosphorus. This study analyzes the organoleptic characteristics and nutritional content of instant baby porridge made from Foxtail Millet, aiming to offer a nutritious alternative to rice-based products for breastfed infants. Two formulations were tested: F1 (60% Foxtail Millet, 20% chicken, 20% corn) and F2 (60% Foxtail Millet, 20% anchovy, 20% mung bean). Organoleptic tests showed F1 to be the most preferred formulation. Nutritional analysis of F1 revealed 8.50% moisture, 3.37% ash, 14.63% protein, 2.84% fat, 71.51% carbohydrate, 62.2% digestible carbohydrates, and 9.31% crude fiber. The study found Foxtail Millet-based porridge to be a promising alternative to rice, providing better nutritional value. Furthermore, the utilization of local Foxtail Millet contributes to food diversification and strengthens local food security in Indonesia by harnessing an underutilized, nutrient-rich resource. This research highlights the potential of Foxtail Millet to support both infant nutrition and local food resilience.

Keywords: Complementary Feeding; Foxtail Millet; Instant Baby Porridge; *Setaria italica; West Sulawesi*

Introduction

The global under-five mortality rate remains a serious issue, with 51% of deaths attributed to pneumonia, diarrhea, measles, and malaria, more than half of which are related to malnutrition (WHO, 2020). In Indonesia, according to the 2018 Basic Health Research (Riskesdas), 3.8% of children aged 0-23 months suffer from severe malnutrition, while 11.4% are undernourished (Budijanto, 2023). As infants grow, their nutritional needs increase, making breast milk alone insufficient, thus necessitating the introduction of Complementary Foods for Breastfed Infants at six months (Saleh et al., 2021).

Instant complementary foods, such as baby porridge, are popular among parents due to their convenience. However, most of these products are primarily made from rice or wheat flour, contributing to Indonesia's high rice consumption - around 140 kg per person per year—leading to imports from countries like Thailand and Cambodia (Singh & Rajput, 2023). Overreliance on rice and the increasing demand in the market also raise concerns about food security. This situation highlights the need for alternative food sources, particularly those that are more nutritious and sustainable, especially for the critical growth stages of young children who require complementary foods.

Foxtail Millet (*Setaria italica* L.), known locally in West Sulawesi as *jewawut* or *tarreang*, presents an excellent alternative to rice as the base ingredient for baby porridge. This millet is particularly valued for its higher protein, calcium, and phosphorus content compared to rice (Liu et al., 2018). Despite its abundance in regions like Polewali Mandar and Majene, West Sulawesi, the local cultivar of foxtail millet remains underutilized. Communities lack awareness and skills in

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processing this nutritious grain into food products, resulting in its minimal contribution to local diets, even though it holds great potential for supporting child nutrition (Lydia Pramitha., 2023).

Instant baby porridge, typically made from rice flour, is a widely used complementary food in Indonesia. However, the reliance on rice as the primary source of infant food may reduce food diversity and potentially lead to micronutrient deficiencies. As an alternative, Foxtail Millet (*Setaria italica* L.) has been recognized as a nutritious local food source, especially in the Sulawesi and Maluku regions. In West Sulawesi, Foxtail Millet, locally known as *Tarreang*, has long been cultivated and used in traditional dishes such as porridge, dodol, and *buras* in cultural ceremonies like Sayyang Pattu'duq, demonstrating its importance in local culture (Budijanto., 2023).

Foxtail Millet contains significant nutrients, including protein, fiber, and minerals such as calcium, which are essential for infant growth and development. Calcium plays a crucial role in bone and teeth formation and maintenance, as well as supporting nerve and muscle function. Additionally, Foxtail Millet contains iron, magnesium, and vitamin B1, which support energy metabolism and the nervous system (Bandyopadhyay et al., 2017).

In recent years, the need to diversify food sources has prompted research into how foxtail millet can replace rice in various food products, especially in complementary foods like instant baby porridge. This effort aligns with the goal of addressing both food security issues and the nutritional needs of growing infants. The West Sulawesi foxtail millet cultivar offers promising nutritional benefits, making it an ideal candidate for innovative use in Complementary Foods for Breastfed Infants. The SNI No. 01-7111.1-2005 standard for instant baby porridge requires that products contain 363 kcal of energy, 70.84 g carbohydrates, 16.57 g protein, 1.48 g fat, 16.48 mg iron, 8.17 mg zinc, and 197.70 mg calcium. Foxtail millet's nutritional profile, including 72-84.2% carbohydrates, 9.9-12.07% protein, 2.38-4.90% fat, and significant crude fiber, makes it a superior alternative to rice-based porridge (Husain et al., 2020). Its higher nutrient density offers a more balanced and nutritious option for children in their golden growth years.

In recent years, the search for alternative, nutritious food sources to replace rice has become increasingly important for addressing food security and malnutrition in Indonesia. *Setaria italica* L. (Foxtail Millet), a hardy and nutrient-dense grain, holds significant potential to contribute to local food security by diversifying the food supply, especially in areas where rice dependency is high. Foxtail Millet is a resilient crop that thrives in various environmental conditions, requiring fewer resources than traditional staples like rice. This makes it an ideal candidate for sustainable agricultural practices that can be adopted in regions with limited access to water and arable land. Additionally, Foxtail Millet is packed with essential nutrients, including protein, fiber, and key minerals like calcium and iron, which are critical for the healthy development of infants.

By replacing rice with Foxtail Millet in complementary foods, Indonesia can reduce its reliance on imported rice while improving the nutritional content of baby food. Foxtail Millet can provide a more balanced and sustainable alternative, not only enhancing the variety of food available to infants but also offering a solution to the challenges of food security in the country. This study aims to analyze the organoleptic characteristics and nutritional content of instant baby porridge made from Foxtail Millet (*Setaria italica* L.), particularly focusing on the underutilized local cultivar from West Sulawesi. By highlighting its potential as an innovative alternative to rice in complementary foods, this study hopes to promote food diversification and better nutritional solutions for infants in Indonesia.

Research Methodology

Materials and Tools

The materials used in this study for making instant baby porridge include Foxtail Millet *(Setaria italica* L.) and mung beans sourced from Lambanan Village, Balanipa District, Polewali Mandar Regency. Other ingredients such as chicken, dried anchovy, corn, carrots, celery leaves, scallions, red onions, and garlic were obtained from the local traditional market. The nutritional analysis materials included reagents like 3% hydrochloric acid, 30% NaOH, 1% pp indicator, 20% KI, 25% H2SO4, and other relevant chemical compounds necessary for the analysis, such as Luff-Schoorl's reagent and Soxhlet extraction apparatus for fat analysis (Liu et al., 2018). The tools for making the porridge included a stove, blender, oven, digital scale, pots, bowls, trays, knives, stirring spoons, 80 mesh sieves, and gloves. For nutritional analysis, tools such as analytical balances, desiccators, furnaces, porcelain crucibles, burettes, Erlenmeyer flasks, pipettes, Soxhlet extractors, and hot plates were used to ensure precise measurements of nutrients such as fat, protein, carbohydrates, and fiber ([BSN] Badan Standarisasi Nasional, 2015).

Research Method

This study employed a laboratory experiment design with two treatments and no repetitions. The treatments involved mixing foxtail millet flour with both animal-based nutrients (chicken and anchovy flours) and plant-based nutrients (corn and mung bean flours) to produce ready-to-cook instant baby porridge. The treatments were formulated as follows:

F1 : 60 g foxtail millet flour + 20 g chicken flour + 20 g corn flour.
F2 : 60 g foxtail millet flour + 20 g anchovy flour + 20 g mung bean flour.

This experimental setup was designed to analyze the nutritional content and organoleptic properties of the porridge, including its taste, texture, and aroma, to determine the most acceptable formula for use as Complementary Foods for Breastfed Infants (Firdamayanti, E., & Srihidayati, 2021). The study measured the energy, protein, fat, carbohydrate, and mineral contents in accordance with national food safety and nutritional standards ([BSN] Badan Standarisasi Nasional, 2015).

Research Procedure

1. *Flour Preparation*

a. *Preparation of Foxtail Millet Flour*

The Foxtail Millet (*Setaria italica* L.) was cleaned using a sieve to remove impurities. It was then dried in an oven at 50°C for 2 hours. After drying, it was ground with a blender and sieved using an 80-mesh sieve to obtain fine flour (Tensiska, 2016).

b. *Corn Flour Preparation*

The corn was cleaned and dried at 50°C for 1-2 hours. The milling process separated the bran, germ, and endosperm. The resulting mixture was dried to achieve a moisture content of 15-18%, then sieved with a 50-mesh sieve. Further drying and sieving resulted in fine, medium, and coarse granules (Sachdev et al., 2021).

c. *Mung Bean Flour Preparation*

Mung beans were cleaned using a sieve, dried in an oven at 50°C for 2 hours, then ground with a blender and sieved using an 80-mesh sieve to produce flour (Liu et al., 2018).

d. *Chicken Meat Flour Preparation*

Chicken meat was filleted, washed, and steamed for 30 minutes. Afterward, it was blended and dried in an oven at 55°C for 5-6 hours. The dried meat was then sieved using a 50-mesh sieve and classified into fine, medium, and coarse granules (Lydia Pramitha et al., 2023).

e. *Anchovy Flour Preparation*

Anchovies were cleaned by removing their heads, soaked in lime water for 1 hour to reduce odor, and washed again. The fish were steamed for 20 minutes, then blended and dried in an oven at 60°C for 5-6 hours. The dried fish was ground and sieved using an 80-mesh sieve to obtain anchovy flour (Ana, & Afifah, 2015).

f. *Instant Baby Porridge Preparation*

The preparation of instant baby porridge from Foxtail Millet involved mixing all the ingredients based on predetermined ratios. The process followed the dry mixing method, where all the ingredients were mixed thoroughly in their dry form, ensuring even distribution of nutrients. An analytical scale was used to measure each component accurately (Budijanto, 2023). This procedure is based on established methods for food processing that aim to preserve the nutritional content while ensuring high-quality sensory characteristics, such as flavor, texture, and appearance, in line with complementary food standards for infants (BPS, 2021).
Observation Parameters.

The ready-to-cook instant baby porridge produced was tested for its nutritional content, including moisture (SNI 01-2891-1992, section 6.1), ash (SNI 01-2891-1992, section 5), protein (SNI 01-2891-1992, section 7.1), fat (SNI 01-2891-1992, section 8.1), carbohydrates (SNI 01-2891-1992, section 7.1), digestible carbohydrates, and crude fiber (SNI 01-2891-1992, section 11). Organoleptic tests were also conducted (hedonic scale) to assess color, aroma, texture, and taste (Firdamayanti & Srihidayati, 2021).

Organoleptic Testing

The organoleptic test evaluated the sensory qualities of the porridge, including color, aroma, texture, and taste, based on variations in the proportions of foxtail millet flour, chicken flour, anchovy flour, corn flour, and mung bean flour. This test was conducted using 10 untrained panelists, applying a modified 4-point Likert scale as follows:
1 = strongly dislike;
2 = dislike;
3 = like;
4 = strongly like.

This approach aimed to determine panelists' preferences for different formulations of Foxtail Millet (*Setaria italica L.*)-based baby porridge, in line with studies such as those by Fauzi et al. (2019) also employed hedonic testing to assess food acceptability. The data gathered provided insights into the sensory acceptability of the porridge and the potential for developing a highly nutritious, locally sourced complementary food product for infants.

Results and Discussion

Physicochemical Analysis

a. *Moisture Content*

Moisture content plays a crucial role in determining the quality and shelf life of food products. Higher moisture content increases the risk of microbial growth, leading to potential physical, chemical, or microbiological spoilage during storage (BPS, 2022). The moisture content of instant baby porridge made from Foxtail Millet (*Setaria italica* L.) was found to be 3,86 % in F1 and 3,74 % in F2. According to SNI 01-7111.4-2005, the moisture content of complementary foods (MP-ASI) should not exceed 4 gram per 100 gram, or 4% ([BSN] Badan Standarisasi Nasional, 2015). Both formulations met these requirements, indicating that both F1 and F2 have good shelf-life potential, minimizing risks of spoilage due to microbial growth. However, the higher moisture content in F2 compared to F1 suggests that the ingredients used may have impacted the final moisture levels. Ana & Afifah (2015) noted that differences in moisture content can arise due to variations in the raw materials used. In this case, F1 used whole corn kernels and fresh chicken meat to produce corn and chicken flour, which could explain its lower moisture content compared to F2.

Furthermore, foxtail millet has been recognized for its ability to retain low moisture content when processed, which is advantageous for extending shelf life (Zhang et al., 2018), the combination of low-fat chicken flour and corn flour in F1 might have contributed to better moisture control compared to the inclusion of anchovy and mung bean flour in F2, both of which tend to absorb more moisture (Demando, 2019) The findings align with the SNI standard, ensuring the formulations are safe and stable during storage.

In formulation F2, dried salted anchovy was used to produce anchovy flour, while mung beans were utilized to make mung bean powder. The difference in raw materials between F1 and F2 also led to variations in the heating treatment during the production of Foxtail Millet (*Setaria italica*)-based complementary foods. Formulation F1, which included fresh ingredients, required a longer processing time compared to F2. This was necessary to reduce the higher moisture content present in the fresh ingredients used in F1. Consequently, F1 retained higher moisture content compared to F2. As a result, F2 is expected to have a longer shelf life and less risk of spoilage due to its lower moisture content. Saleh et al., (2021) explained that moisture content also affects the calculation of carbohydrate content using the by difference method, as applied in this study. Therefore, the moisture content has a direct impact on the carbohydrate content in both formulations, with F2 likely showing a more stable carbohydrate profile due to its lower moisture level (Jin et al., 2023)

This outcome aligns with prior studies, such as Liu et al. (2018) and Jin et al. (2023), which demonstrated that raw material type and processing methods significantly influence moisture content and, subsequently, product stability and nutritional values. Thus, F2 has superior storage properties and is less prone to spoilage, making it a better candidate for long-term storage of instant baby porridge.

Table 1. Physicochemical Test Results of Foxtail Millet Instant Baby Porridge

Test Parameter	Test Result		Requirements for Complementary Foods Based on SNI 01-7111.4-2005	
	F1 (gram)	F2 (gram)	Min (gram)	Max (gram)
Moisture Content	3.86	3.74	-	4.0
Ash Content	3.37	3.12	-	3.5
Protein	14.63	20.31	8	22
Fat	9.34	6.83	6	15
Carbohydrate	68.8	65.68	-	-
Fiber	4.79	4.84	-	5
Digestible Carbohydrates	64.06	60.84	-	-

b. Ash Content

Ash content represents the total amount of inorganic components (minerals) contained in food (Husain et al., 2020). Food generally consists of 96% organic matter and water, with the remaining 4% being minerals. When food is subjected to high heat, organic matter burns away, leaving behind inorganic matter in the form of ash (Singh & Rajput, 2023). Ash content depends on the quality and chemical composition of the raw materials (Tensiska, 2016). According to Liu et al. (2018) higher ash content may indicate unwanted components like plant residues, soil, or other contaminants, making ash an important indicator of food hygiene. The ash content of Foxtail Millet-based instant baby porridge (as shown in Table 1) was found to be 3.37 gram in formulation F1 (foxtail millet with chicken and corn) and 3.12 gram in formulation F2 (foxtail millet with anchovy and mung bean). Both values meet the standards set by SNI 01-7111.4-2005, which requires ash content in instant complementary foods not to exceed 3.5 gram per 100 gram. Therefore, the results suggest that both F1 and F2 meet the quality standards in terms of hygiene and safety, with no significant contamination or toxicity.

Moreover, Sachdev et al. (2021) highlighted that ash content affects carbohydrate calculation through the by difference method, as used in this study. Thus, the ash content directly impacts the carbohydrate values in these formulations. The relatively low ash content in both formulations indicates that the products are safe for consumption, with well-maintained hygienic conditions during preparation, confirming the integrity of their nutritional quality.

c. Protein

Protein is a vital nutrient for the body, providing essential amino acids necessary for metabolism and growth (Lydia Pramitha, J., Jeeva, G., Neethu, F., & Ravikesavan, 2023).. For infants aged 6-12 months, adequate protein intake is critical due to the rapid growth occurring during this period, making complementary foods an essential part of their diet (Ana, A. L., & Afifah, 2015). In the formulation of Foxtail Millet (*Setaria italica* L.)-based complementary foods, ensuring sufficient protein was a key consideration. Protein can be sourced from both plant and animal ingredients, and this study used chicken flour in F1 and anchovy flour in F2 to complement the protein content in foxtail millet, which is relatively low in protein.

The analysis in Table 1 shows that the protein content of F1 (foxtail millet with chicken and corn) was 14.63 gram, while F2 (foxtail millet with anchovy and mung bean) had 20.31 gram of protein. Both formulations meet the SNI 01-7111.4-2005 standard for instant complementary foods, which requires a protein content between 8-22 g per 100 g. The higher protein content in F2 can be attributed to the use of dried anchovy, which has a significantly higher protein concentration than fresh anchovy (Faroj, 2019). This difference illustrates the impact of using dried ingredients in improving the overall protein content in complementary foods, further highlighting the importance of raw material selection in product formulation. On the other hand, the protein content in F1, while adequate, reflects the lower protein contribution of chicken flour compared to anchovy flour.

d. Fat

Fat, or fatty acids, is a nutrient that provides a higher energy density than carbohydrates and proteins (Demando, 2019). Due to the limited stomach capacity in infants, complementary foods need to have adequate energy density, often achieved by adding fat. Fat is crucial not only for energy but also for aiding the absorption and transport of fat-soluble vitamins A, D, E, and K. Insufficient fat intake can disrupt vitamin absorption, which is essential for infant development (Restiara Tamrin, 2015). Based on the analysis in Table 1, the fat content in Foxtail Millet *(Setaria italica* L.)-based complementary foods was 9.34 gram in formulation F1 (with chicken and corn) and 6.83 gram in formulation F2 (with anchovy and mung bean). According to SNI 01-7111.4-2005, the fat content for instant baby porridge should range from 10-15 gram per 100 gram, meaning that both F1 and F2 meet the lower end of the standard, with F1 closer to the required range. The lower fat content in both formulations, particularly F2, can be attributed to the repeated heating processes involved in product preparation. This is consistent with Singh & Rajput, (2023), who noted that heating processes can reduce fat content due to the volatility of fat components, which may evaporate as aldehydes, ketones, alcohols, and hydrocarbons. Prolonged drying times during production can also decrease the fat content, as heat accelerates fat breakdown (Budijanto, 2023).

To minimize nutrient degradation in instant baby porridge, Tensiska (2016) recommend using the dry mixing method, where ingredients are gradually combined and manually stirred to ensure homogeneity without excessive heating. Additionally, Saleh et al., (2021) suggest vacuum evaporation as an alternative drying method, which can preserve nutritional and antioxidant properties in food products. By using shorter drying times and controlled heat, nutrient loss, particularly fat content, can be minimized.

e. Carbohydrate

Carbohydrate intake should account for at least 52-54% of energy needs (Demando, 2019). In this study, carbohydrate content was calculated using the carbohydrate by difference method, which is influenced by other nutrients like ash, fiber, protein, and fat. The analysis in Table 1 shows that the carbohydrate content in Foxtail Millet (*Setaria italica* L.)-based complementary foods was 68.8 gram for F1 (chicken and corn) and 65.68 gram for F2 (anchovy and mung bean). Infants require carbohydrates to provide 50-60% of their total energy (Husain et al., 2020). Though SNI 01-7111.4-2005 does not specify carbohydrate requirements for instant complementary foods, the carbohydrate content in F1 and F2 is comparable to commercial baby porridge, which typically contains 66.8-70.8 gram per 100 gram. F1, with 60% foxtail millet, 20% chicken, and 20% corn, closely matches the carbohydrate content of commercial baby porridge (68.8 gram compared to 66.8-70.8 gram/100 gram). F2, with anchovy and mung beans, has a slightly lower carbohydrate content (65.68 gram), likely due to the different ingredients used, as most commercial porridge relies on rice or rice flour, which contains higher levels of digestible carbohydrates.

Foxtail Millet contains 60-80% carbohydrates per 100 gram, most of which are gluten-free, making it suitable for infants diagnosed with autism, as gluten-free foods are recommended for children with this condition (Budijanto, 2023). Additionally, foxtail millet's high fiber content (8-12%) impacts its overall carbohydrate content, with insoluble fiber reducing the total digestible carbohydrates (Restiara Tamrin, 2015). Therefore, F2's lower carbohydrate content, compared to commercial products, reflects the higher fiber content in foxtail millet, which is beneficial for digestive health.

f. Crude Fiber

Crude fiber is an essential component of carbohydrates, defined as the portion left after chemical digestion using sulfuric acid and sodium hydroxide (Sachdev et al., 2021). It plays a key role in assessing food quality by reflecting its nutritional value. However, excessive fiber consumption can cause early satiety in infants due to its high water absorption, potentially limiting nutrient intake (Sukmawati, Adriyani Adam, 2022). In this study, the crude fiber content in F1 (4.79 gram) and F2 (4.84 gram) was measured. Both values comply with the SNI standard, which mandates that crude fiber in instant complementary foods should not exceed 5%. These values are close to the upper limit, which indicates that while the products meet the required standards, they approach the threshold for acceptable fiber levels.

Foxtail Millet (*Setaria italica* L.) is known for its high dietary fiber content, including hemicellulose, cellulose, phenolic esters, and glycoproteins (Sachdev, N., Goomer, S., Singh, 2021). These fibers are beneficial as they aid digestion and provide bulk to the stool, assisting in bowel movements. Additionally, soluble fibers like beta-glucan and pectin are easier to digest and provide similar health benefits (Budijanto, 2023). However, excessive amounts of insoluble fiber may interfere with the absorption of essential nutrients such as fats, vitamins, and minerals, which are crucial for infant growth (Restiara Tamrin, 2015). Therefore, while fiber is beneficial, its content must be carefully balanced in complementary foods to avoid compromising nutrient absorption.

g. Digestible Carbohydrates

Digestible carbohydrates, also called "available carbohydrates," are calculated as the difference between total carbohydrates and dietary fiber ([BSN] Badan Standarisasi Nasional, 2015). These are the carbohydrates that the body can digest, absorb, and metabolize (Budijanto, 2023). According to BPOM Regulation No. 26 of 2021, total and digestible carbohydrates are listed separately in nutritional information.

The total carbohydrate content in Foxtail Millet-based complementary foods was 68.8 gram for F1 and 65.68 gram for F2. After accounting for fiber, the digestible carbohydrate content was 64.06 gram for F1 and 60.84 gram for F2. These values are slightly lower than commercial baby porridge, which typically contains 66.8-70.8 gram per 100 gram. The reduction in carbohydrate content in F1 and F2 is likely due to the use of high temperatures and extended drying times, which may have caused the breakdown of some carbohydrate molecules (Ana & Afifah, 2015). To improve carbohydrate retention, adjustments in the production process, such as optimizing drying temperature and time, could help.

Organoleptic Test

The organoleptic test data for Foxtail Millet (*Setaria italica* L.)-based complementary foods involved assessments of color, texture, aroma, and taste using two formulations, F1 and F2. The data were collected from 10 untrained panelists, including 5 mothers of infants aged 6-12 months and 5 biology students from Universitas Sulawesi Barat.

Table 2. Organoleptic Test Results of Foxtail Millet Baby Porridge

Parameter	Treatment	Avarage	Catagory	p-value
Color	F1	3.7	strongly like	0.594
	F2	3.5	strongly like	0.640
Aroma	F1	3.8	strongly like	0.509
	F2	3.5	strongly like	0.655
Texture	F1	3.7	strongly like	0.594
	F2	3.4	Like	0.640
Taste	F1	3,8	strongly like	0.594
	F2	3,4	Like	0.640

a. Preference for Color

Color is an essential aspect of sensory evaluation, assessed visually. F1 had a yellowish powder appearance, while F2 displayed a grayish-green hue. Based on the analysis, there was a notable preference for the color of F1 (p-value = 0.648 > 0.05). F1 (60% foxtail millet: 20% chicken: 20% corn) had the highest score, while F2 (60% foxtail millet: 20% anchovy: 20% mung bean) had the lowest score. The highest score, with 70% of panelists expressing a strong preference for F1's color, resulted from its bright yellow appearance, which was perceived as more attractive compared to F2's gray-brown color. This preference aligns with findings by Ma et al. (2022), indicating that the yellow color is due to the use of sweet corn. The pale brownish color of F2 may be attributed to the Maillard reaction during roasting, which occurs due to the high protein content of mung bean flour (20.15%). Extended roasting times and high temperatures enhance this reaction, which causes a brown color due to the interaction between reducing sugars and amino acids from proteins (Anwar & Aprita, 2023).

b. Aroma Preference

Aroma, the scent produced by the Foxtail Millet-based complementary foods, was assessed through olfactory perception. The aroma of F1 was savory, characterized by a roasted chicken scent, while F2 had a more earthy aroma with a distinctive, sharper smell of anchovy. The analysis using the Kruskal-Wallis test showed a significant difference between the two formulations (p-value = 0.170 > 0.05), with F1 receiving the highest score, primarily due to its appealing roasted chicken aroma. The preference for F1, with 80% of panelists expressing a strong liking, can be attributed to its distinctive roasted chicken aroma, enhanced by the layered roasting process during preparation. This aligns with Ana & Afifah (2015), who found that roasting chicken liver creates heterocyclic volatile compounds that react with sulfur components, resulting in a rich, savory aroma. In contrast, F2 had an earthy and sharp anchovy aroma, partly due to the addition of mung bean flour. Dewi et al. (2017) noted that mung beans have a characteristic earthy smell caused by the lipoxygenase enzyme, which necessitates the addition of anchovy flour to balance the aroma. While the anchovy flour effectively masked the earthy smell of the mung beans, the strong anchovy scent remained prominent, as also observed in Faroj (2019). The strong aroma of anchovy, though not fishy, can be overpowering for panelists unfamiliar with such a strong scent, as described by Anwar & Aprita, (2023) in their study of anchovy-scented bagea cookies.

c. Texture Preference

Texture plays a significant role in determining the acceptability of Foxtail Millet-based complementary foods. According to the analysis, F1 (60% foxtail millet, 20% chicken, 20% corn) had a smooth, soft texture, making it easier to dissolve and consume, which was preferred by 70% of panelists. The smooth texture is due to the high moisture content of fresh chicken and corn, contributing to its softness. In contrast, F2 (foxtail millet, anchovy, mung bean) had a slightly grainy texture, likely due to the anchovy flour and mung bean, which contain less moisture. The grainy texture resulted from the drying and processing of these ingredients, reducing their ability to blend smoothly (Firdamayanti & Srihidayati, 2021).

d. Flavor Preference

Flavor is the most important factor in determining the overall acceptability of the product. The Foxtail Millet-based baby porridge in F1 had a savory roasted chicken flavor, highly appreciated by the panelists due to the rich, umami taste, which is enhanced during roasting. This formulation had a smoother, milder flavor, making it more appealing for infant consumption (Dewi et al., 2017). Meanwhile, F2 had a slightly bitter taste, with a distinct anchovy flavor, which, although traditional in some cultures, was less preferred due to the combination of mung beans and anchovy flour. The presence of mung bean, which tends to have an earthy, slightly bitter flavor, combined with the strong anchovy aroma, contributed to a flavor profile that was less favored (Nur Miyana, 2021).

In terms of nutritional benefits, Foxtail Millet-based instant baby porridge was found to have significant potential as a nutritious alternative to rice-based baby food. Both formulations (F1 and F2) met the required nutritional standards for complementary foods, with high levels of protein, fiber, and essential minerals. These findings highlight the viability of *Setaria italica* L. (Foxtail Millet) in supporting the nutritional needs of infants, especially in regions with limited access to rice or where rice consumption is unsustainable.

However, beyond its immediate nutritional advantages, the long-term sustainability of Foxtail Millet as a local food source must be considered. Jewawut's resilience to different climatic conditions and its low resource requirements (compared to rice) make it an excellent candidate for sustainable agriculture. Foxtail Millet can be cultivated with less water and fewer agricultural inputs, making it a viable crop in areas with water scarcity or poor soil quality. By integrating Jewawut into local food systems, it can contribute to a more diverse, resilient, and sustainable food supply in Indonesia, reducing dependence on imported rice and enhancing local food security. Furthermore, the utilization of Jewawut can drive local agricultural development, creating economic opportunities and improving the overall food landscape for communities. This research not only advocates for Foxtail Millet as a nutritious alternative but also emphasizes its potential role in advancing food sustainability and diversification, supporting both the nutritional needs of infants and the broader goals of food security in Indonesia.

Conclusion

The preferred formulation for instant foxtail millet baby porridge was F1, which included 60 gram of foxtail millet, 20 gram of chicken, and 20 gram of corn. This formulation was highly favored in sensory evaluations, with 70% of panelists liking its yellowish-brown color, 80% enjoying its roasted chicken aroma, 70% appreciating its smooth texture, and 80% finding the taste very appealing. Proximate analysis showed the following nutritional composition: moisture 3.86%, ash 3.37%, protein 14.63%, fat 9.34%, carbohydrates 68.8%, fiber 4.79%, and digestible carbohydrates 64.06%, meeting the SNI 01-7111.4-2005 standard. This combination of sensory and nutritional properties indicates that F1 is a suitable choice for complementary infant feeding. This study demonstrates that Foxtail

Millet (*Setaria italica* L.) based instant baby porridge is a promising alternative to rice-based baby food, offering favorable organoleptic qualities and meeting nutritional standards. The use of Jewawut supports food diversification and enhances local food security in Indonesia.

Further research is needed to evaluate the long-term effects of consuming this product on infant nutrition, including clinical trials to assess growth and micronutrient status. Additionally, exploring alternative formulations that incorporate natural flavor enhancers or other fortifying ingredients could improve the product's market competitiveness. These recommendations provide a foundation for future studies to develop sustainable, nutritious, and market-competitive alternatives to rice-based baby food.

Author Contributions

Mufti Hatur Rahmah, Dian Aulia, Hermin Pondo Pasoso', Winarty : conceptualization, analysis, methodology, discussion, conclusion, visualization, investigation; Mufti Hatur Rahmah and Dian Aulia : writing original draft and Mufti Hatur Rahmah : proofreading, editing and review.

Conflicts of Interest

There are no conflicts of interest to declare.

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