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Research Article

Characteristic Organoleptic Properties of Instant Baby Porridge High in Protein and Betacarotene

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Abstract

Background and Objective: Breast milk is able to meet the needs of a baby only until the baby reach 6 months of age. After that, the milk production decreases in the mother, while the baby's needs increase with the baby's age and weight. This study aimed to determine a formula for instant baby porridge as a complementary food to breast milk, in which snakehead fish meal and pumpkin flour are substituted due to their organoleptic characteristic properties. **Materials and Methods:** Ingredients used in this instant baby porridge are gelatinized corn flour, powdered milk, snakehead fish meal, pumpkin flour, refined sugar and palm oil. The processing of instant baby porridge with snakehead fish meal and pumpkin flour was done by using the dry mixing method. The average results of organoleptic testing were based on the color, texture and taste of the porridge and data were analyzed using a t-test. **Results:** The results showed that the best formula for its color was formula A, 6.3 (slightly yellow); for its scent, formula A, 5.0 (rather strong smell of fish and pumpkin); for its texture, formula A, 5.0 (rather smooth) and for its flavor, formulas C and D 4.8 (sweetish). **Conclusion:** It can be concluded that the best formula of instant baby porridge as a complementary food to breast milk, based on its organoleptic characteristic properties, is formula A, comprising 15% snakehead fish meal and 10% pumpkin flour.

Key words: Complementary food, instant baby porridge, organoleptic properties

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Nutrient intake directly affects the nutritional status of a person, meaning that if the amount of intake of nutrients from foods consumed increases, then the nutritional status will increase as well. Age in physiologically normal human beings also affects the increase in food consumption, so the amount of nutrient intake also increases¹. Consumption of food in sufficient quantities and of nutritional value is indispensable for growing babies and toddlers. After the baby reaches 6 months of age, the nutritional content of breast milk is no longer sufficient and the baby's energy needs increase by 24-30% compared with the needs of a baby at 3-5 months of age^{2,3}. The development of digestive tract motility allow babies to obtained food in other ways. Therefore, the baby needs food instead of breast milk and this food is called the complementary food of breast milk⁴.

Important nutrients required in infancy, including protein and vitamin A. Protein plays a role in the growth and maintenance of cells and vitamin A plays a role in immune system function and protection of the epithelial cells lining the skin, the eye surface, the inside of the mouth and the gastrointestinal and respiratory tracts^{5,3}. Nutrients that have to be included in each 100 g of instant baby porridge include 400 kcal of energy, 8-22 g of protein and 250-350 µg of vitamin A⁶.

Fish and other aquatic organisms contain 18-20% of the proteins required. Advantages of using aquatic organisms are that the protein is easily digested and contains the complete compliment of required amino acids⁷. One local food source of protein that can be used as a primary ingredient in the manufacture of food complementary to breast milk is snakehead fish. Utilization of sneakhead fish is limited mostly to its direct consumption, so efforts need to be made to diversify the fishery process. Fishmeal processing is a form of diversification of possessed products and fish meal containing processed product intermediates can be added to other processed products such as instant porridge. Snakehead fish is an animal protein source that is considered to be a complete and high quality protein due to its broad set of essential amino acids, high digestibility and consequent high absorption by the body⁸. Snakehead fish extract has a good potential to increase serum albumin in post-operative patients. It also has antioxidants, which react with free radicals⁹. Functional food additives in biscuits fortified with snakehead fish, Zn and iron have been shown to increase hemoglobin, ferritin, zeng, albumin and immunoglobulin G levels in children¹⁰. About 100 g of snakehead fish meal contains 13.61% water, 5.96% cinder, 76.9% protein, 0.55% fat, 3.53% carbohydrate,

3.09 mg of Zn and 4.43 mg of iron¹¹. The protein content of snakehead fish (25.5%) is higher than sardines (21.1%), milkfish (20.0%), snapper fish (20.0%), catfish (17.71%) and gold fish (16.0%)¹². About 100 g of fish meal contains 60-75 g of protein, while the protein content in 100 g of skim milk is only 30 g^{13,14}.

Foodstuffs that are rich in vitamin A also need to be used in addition to breast milk. Utilization of pumpkin is not widespread and generally, this food source is only processed into snacks or used directly. Pumpkin contains high levels of vitamin A and beta-carotene (1.569 µg/100 g) and can be used as a complementary food source to breast milk. Additionally, protein derived from pumpkin flour has 99% digestibility, which is ideal for babies¹⁵.

The criteria for quality in food commodities are safety, health, flavor, texture, color, shelf-life, convenience, halal designation and price¹⁶. The ingredients and methods used in processing complementary breast milk foods influence both the nutrient and organoleptic qualities. Instant baby porridge is made from a mixture of rice flour, skim milk, refined sugar and vegetable oils^{16,17}. Based on the physical properties, foods complementary to breast milk should be non-kamba, so that the baby's stomach having a small capacity is not filled with less nutritious ingredients¹⁸⁻²⁰. The success of instant baby porridge is in the opening of the pores of the flour to ensure high rehydration in the shortest possible time^{21,22}. To improve the nutrient content, the raw materials of baby food can be substituted with another source of protein and vitamin A such as snakehead fish meal or pumpkin flour. The composition, as well as the right formula should produce complementary breast milk foods that are highly nutritious and acceptable to consumers. This study was aimed at obtaining the best formula for instant baby porridge as a complementary food to breast milk, in which snakehead fish meal and pumpkin flour are used as a substitute based on their characteristic organoleptic properties, this novel complementary food can support the growth and development of babies over 6 months in age.

MATERIALS AND METHODS

Materials: The materials used in processing of instant baby porridge are gelatinized corn flour, snakehead fish meal (*Ophiocephalus striatus*), pumpkin flour (*Cucurbita moschata* Duch), powdered milk, refined sugar and palm oil.

Research procedure: This study was conducted in two stages: A preliminary study and a main study. Preliminary study included the gelatinization of rice flour and pumpkin flour.

The main study incorporated the formulation of instant baby porridge as complementary breast milk food with snakehead fish meal and pumpkin flour as the substitutes, due to their characteristic organoleptic properties.

Research introduction: Fishmeal processing started from the cleaning step and removal of fish heads, tails, guts and fins. Next, the fish meat was cut along the dorsal side and the fish was washed with fresh water up to 3 times. Pasteurization of the fish was accomplished over 30 min at 85-90°C. The process of steaming the fish was followed by separating the meat from the bones and skin. The fish meat was dried in an oven at 50°C for 12 h. After drying, the fish meat was pulverized using a dry mill and sieved to obtain granules made of fishmeal ± 60 mesh²³.

Gelatinization of rice flour was achieved by cooking the rice flour and water in a 1:4 ratio to form a transparent white pulp. The porridge was then dried in an oven at 50°C for 12 h. After drying, the slurry was mashed and stirred to obtain a grain of gelatinization rice flour of fishmeal size ± 60 mesh.

Pumpkin flour was produced by slicing the pumpkin thinly and then drying it by using sunlight/oven at 40-50°C for 12 h. Next, the dry pieces of pumpkin were crushed and sieved to obtain a granular powder of ± 60 mesh.

Primary research: Ingredients used in the instant baby porridge processing were gelatinized cornflour, powder milk, pumpkin flour, snakehead fish meal, refined sugar and palm oil. There are four formulas of instant baby porridge: Formula O (without any substitution of snakehead fish meal or pumpkin flour; 35% gelatinized cornflour and 50% powdered milk as the control formula), formula A (15% snakehead fish meal and 10% pumpkin flour), formula B (15% snakehead fish meal and 15% pumpkin flour), formula C (20% snakehead fish meal and 10% pumpkin flour) and formula D (20% snakehead fish meal and 15% pumpkin flour). Complementary breast milk

foods with snakehead fish meal and pumpkin flour as substitutes were expected to provide sufficient amounts of protein and vitamin A.

The processing of instant baby porridge with snakehead fish meal and pumpkin flour was done by a dry mixing method. All processed ingredients (in a dry state) were mixed gradually. Water, in a ratio of 1:4 was added to the mixed ingredients. Next, the slurry was heated with a small flame until it reached 75°C. Cooked porridge was then chilled. Next, it was dried at 50°C for 12 h and mashed and sifted to obtain ± 60 mesh.

Instant baby porridge prepared with snakehead fish meal is a yellow refined powder. It is ready to eat after being combined with $\pm 60^\circ\text{C}$ hot water in a 1:1 ratio. The assessment of organoleptic characteristics was done by 15 trained panelists who were students of Fishery Product Technology, Faculty of Fishery Perikanan, University of Lambung Mangkurat.

Data analysis: Organoleptic testing measured the color, flavor, texture and taste of the porridge. Data were analyzed by t-test to assess differences between the formulas of complementary breast milk foods based on their organoleptic characteristics properties.

RESULTS AND DISCUSSION

Figure 1 shows the mean data values of the organoleptic breast milk complementary food instant baby porridge.

The highest average organoleptic value of instant baby porridge, specified by its color was formula A, 6.3 (rather yellow) and the lowest was C, 4.3 (pale yellow). Based on this result, the colors of A-O, C-O, D-O, B-A, C-A and D-A treatments were significantly different. This suggested the combinations of complementary breast milk foods have significant differences in color. However, B-O, C-B, D-B and D-C

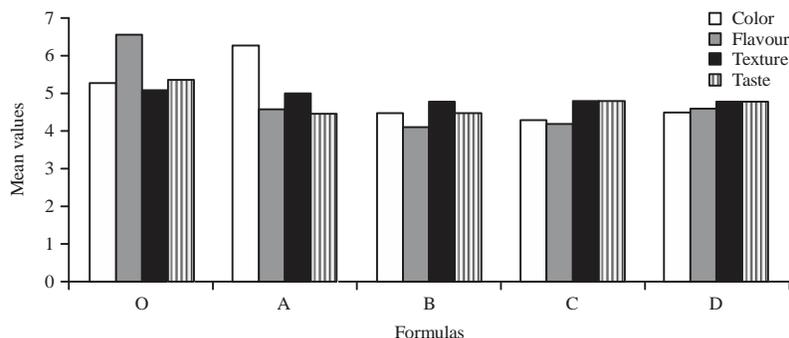


Fig. 1: Mean values of organoleptic instant baby porridge

Table 1: Test sign instant baby porridge

Specifications	Treatments	X ² count	X ² table (%)				
			5	1			
Color	A-O	9.90*	4.07	7.59			
	B-O	NS					
	C-O	264.0*					
	D-O	180.50*					
	B-A	760.50*					
	C-A	924.50*					
	C-B	NS					
	D-A	760.50*					
	D-B	NS					
	D-C	NS					
	Flavour	A-O			368.16*	4.07	7.59
		B-O			1404.50*		
C-O		702.25*					
D-O		924.50*					
B-A		12.25*					
C-A		24.50*					
C-B		72.00*					
D-A		0.75					
D-B		NS					
D-C		40.50*					
Texture		A-O	12.50*	4.07	7.59		
		B-O	NS				
	C-O	40.50*					
	D-O	40.50*					
	B-A	4.50*					
	C-A	NS					
	C-B	4.50*					
	D-A	NS					
	D-B	4.50*					
	D-C	NS					
	Taste	A-O	28.17*			4.07	7.59
		B-O	144.50*				
C-O		60.50*					
D-O		NS					
B-A		6.25*					
C-A		2.25					
C-B		NS					
D-A		0.17					
D-B		4.50*					
D-C		4.50*					

*Significant, NS: Non-significant

treatments did not show any significant differences (Table 1). The combination of breast milk formulas of instant baby porridge with the substitution of snakehead fish meal and pumpkin flour showed a similar color, light yellow, which is obtained from pumpkin flour, powdered milk and palm oil. The comparative formula is pale yellow since it is obtained from only powdered milk and palm oil. Pumpkin flour and palm oil contain beta-carotene, which has an orange color. The longer the beta-carotene bond is, the more orange the resulting color is. The color can be reduced by heating the ingredients²⁴. The drying temperature to make pumpkin flour was maintained at 50°C to ensure consistent levels of beta-carotene were preserved²⁵. A bright yellow color resulted

from pumpkin flour substitution and the addition of palm oil. Pumpkin flour and palm oil containing beta-carotene is orange²⁶.

The highest average organoleptic value of instant baby porridge, specified in its flavor was formula O, 6.3 (strong milk flavor). The highest value of the combined formulas was formula A, 5.0 (rather strong flavor of fish and pumpkin), while the lowest one was formula B, 4.1 (less strong flavor of fish and pumpkin). These results suggested the A-O, B-O, C-O, D-O, B-A, C-A, C-B and D-C treatments have significant differences, which means that a variety of complementary breast milk formulas provide significant differences to the porridge flavor, while D-A and D-B treatments did not show significant differences (Table 1). Complementary breast milk formulas with snakehead fish meal and pumpkin flour allowed for minimization of the strong flavors of fish and pumpkin, so these were acceptable.

The highest average organoleptic value of instant baby porridge as specified by its texture was formula O, 5.1 (rather smooth). The highest value of combined formulas was formula A, 5.0 (rather smooth), while the lowest ones were formulas B, C and D, 4.8 (robust). These test results showed that A-O, B-A, C-O, C-B, D-O and D-B treatments had significant differences in texture. Meanwhile, B-O, C-A, D-A and D-C treatments did not have significant differences (Table 1). Porridge produced in a dry state has a rather smooth texture. After being mixed with water, it becomes smooth and rather sandy. The proper complementary breast milk food supplement for babies 6 months of age is semi-compact texture food. When mixed with water, it will be smooth without any clumps and will have the proper consistency to be eaten using a spoon. However, instant complementary breast milk food should also maintain proper particle sizes to encourage the baby to chew²⁷.

The texture of these products is derived from the ingredients used. Pumpkin flour sieving was accomplished with a 60 mesh strainer. The common refinement is 80 mesh. Some companies utilize a 100 mesh strainer as the standard to obtain highly refined flour. One criterion of good quality of flour is that 90% of the product can be sieved with an 80 mesh strainer. By comparison, the wheat flour refinement value of SNI 01-3751-2006 is that 95% of the product should be able to be sieved by an 80 mesh strainer²⁸. Pumpkin flour has good gelatinization properties because it can form a dough with consistency, firmness, viscosity and good elasticity²⁹. Snakehead fish is a high-protein food source. When it is powdered, the temperature causes the protein to clot and bind to smaller sizes of flour. Instead, starch in the form of glucose in pumpkin causes the conglomeration of flour, so the texture of instant porridge becomes slightly sandy.

The highest average organoleptic value of instant baby porridge, as specified in its taste was formula O, 5.4 (sweetish). The highest values of combined formulas were C and D, 4.8 (sweetish), while the lowest ones were formula A and B, 4.5 (neutral). The taste-test results of complementary breast milk food formulas showed that A-O, B-O, C-O, B-A, D-B and D-C treatments had significant differences, which means that different combinations produce different tastes. Meanwhile, D-O, C-A, C-B and D-A formulas did not show significant differences (Table 1). Taste is an important factor for customers' acceptance or rejection a food product. Though the other criteria are good, if the taste is not good, the product will not be accepted. There are four common tastes: Sweet, salty, sour and bitter. The other tastes are a combination of the common tastes³⁰. The taste of porridge is sweet and pleasing. Pumpkin flour and refined sugar give a sweet flavor, while snakehead fish meal and powdered milk give the taste of the instant porridge. The addition of sugar in complementary breast milk food sources may improve the taste of the porridge, but it should be limited since it will make the baby feel full and less likely to eat²⁰.

This study is part of a major study on complementary breast milk food sources including the snakehead fish as a diversified nutrition source. The implication of this study is that the obtained baby porridge formulas as an addition to breast milk in which substitutions of snakehead fish meal and pumpkin flour were used have the potential to meet nutritional needs, supporting the growth and development of babies more than 6 months of age. This study is based on only observations of the organoleptic properties of instant baby porridge. This study discovered the complementary formulas for instant baby food with high protein and beta-carotene, which are of important nutritional value to infants.

CONCLUSION

This study can be concluded that the best formula of instant baby porridge used as a complementary food to breast milk, based on its characteristic organoleptic properties, is formula A, comprising 15% snakehead fish meal and 10% pumpkin flour.

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