International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Acceptance Test of *Blondo*, Snakehead Fish Flour and Brown Rice Flour based Biscuit Formulation

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Abstract

Potential nutrients contained in *blondo* (coconut protein produced by coconut oil production process), snakehead fish flour, and brown rice flour can be utilized to create biscuit. The biscuit is expected to help improving nutritional status among children under five years old, particularly in South Sulawesi Province. The aim of this study was to create nutritious *blondo*, snakehead fish flour and brown rice flour based formulated biscuit which can be accepted by children aged 3-5 years. The stages of the study were biscuit formulation, acceptance test to the mothers of children under five years in Pare-Pare City, and nutrient analysis. The result of the study showed that the formulated biscuit was preferred based on organoleptic test with 6 g blondo substitution (50% of margarine), 12 g snakehead fish flour, 40 g brown rice flour and 10 g wheat flour. Proximate analysis conducted to the formulated biscuit (biscuit added by blondo, snakehead fish flour and brown rice flour) obtained energy, protein, fat, carbohydrate, fiber, ash and water content which was 438 kcal, 16.3 g, 11.5 g, 67.3 g, 3.5 g, 1.5 g and 3.4 g, respectively. The result from acceptance test showed that the blondo, snakehead fish flour and brown rice flour based formulated biscuit was accepted by the panelists with category of "like extremely".

Keywords: biscuit; blondo; snakehead fish flour; brown rice flour.

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1. Introduction

Basic Health Research found that prevalence of underweight was 13.9% in 2013, decreased by 4% from 17.9% in 2010. In 2007, the prevalence was 18.4%. For stunting, the prevalence remained the same, which was 36.8% (2007), 35.6% (2010), and 37.2% (2013). East Nusa Tenggara and West Papua were found as the provinces with the highest prevalence of malnutrition, while South Sulawesi was ranked 10th [1].

Most of malnourished children in Indonesia had resident in rural (15.3%), occupation of farmer/sailorman/labor (15.8%), and education of elementary school or below (32.3%) [1]. Farmer as food producer often experience food scarcity. On the other hand, there are many less used agricultural products, such as *blondo* as the byproduct of coconut oil production which is abundant and always discarded. *Blondo* has potential to be functional food which contains energy, protein, mineral and antioxidant. Using *blondo* as functional food is the strategic way to enrich national food and to raise income/welfare of the farmer.

According to the data in 2011, South Sulawesi Province produced virgin coconut oil in total 1,440 liter per year produced by 5 coconut oil manufacturing companies. Based on that data, *blondo* can be produced in the amount of 720 kg, which tend to cause problem to the community near the location if it is not used. Discarded *blondo* will cause odor as the product of decomposition by the microbes [2]. *Blondo* has nutritional value which can be used in food production. This high potential can improve nutrient content of food, especially food for malnourished children.

Using *blondo* in biscuit production is expected to reduce the use of margarine. If assumed that the price of margarine is 20 rupiah per gram (4000 rupiah per 200 gram), one standard recipe which use 12 gram margarine will need 240 rupiah. Therefore, in 100 gram biscuit which use *blondo* to replace 50% of margarine, the cost can be saved into 120 rupiah. Using this assumption, if all produced *blondo* (720 kg) can be used for biscuit production, the cost will be reduced by 14,400,000 rupiah. Using *blondo* will also reduce environmental pollution.

Other potential food which can be used to improve nutrition quality is snakehead fish. Snakehead fish, which is formerly not preferred due to the head similar to snake, is recently consumed since it has good protein quality so that it can be used for nutrition theraphy. Data from Marine Affairs and Fisheries Office of South Sulawesi Province [3] showed that the production of snakehead fish per year was 4,190 kg in 2011 and 6,520 kg in 2012.

Beside *blondo* and snakehead fish, other potential product which limitedly used is brown rice. Several studies showed that antioxidant content in brown rice can be used to prevent coronary heart disease, cancer, diabetes, and hypertension as well as to treat xerophtalmia and beriberi [4]. As additive for food and beverage, brown rice has potential to improve antioxidant in medicinal beverage of rice and herbs [5]. In addition, brown rice isolate can produce lovastatine which is potential to reduce blood cholesterol [6]. Brown and black rice also can clear atherosclerosis plaque and improve antioxidant status in rabbit [7]. The production of brown rice was 0.03 million ton in 2011 and 0.05 million ton in 2012 [8].

The aim of the study was to produce nutritious *blondo*, snakehead flour and brown rice flour based biscuit

formula to be accepted by children aged 3-5 years.

2. Materials and Methods

2.1. Design, Time and Place

The design of this study was experimental study conducted in March-November 2013. The biscuit formulation experiment was done in Laboratory of Cullinary in Makassar State University and Integrated Laboratory of Chemistry in Bogor Agricultural University. Acceptance test of the biscuit was conducted in Pare-Pare City, South Sulawesi.

2.2. Materials and Tools

The main materials in this study were *blondo* (coconut), snakehead fish flour (snakehead fish), and brown rice flour (brown rice), biscuit (wheat flour, snakehead fish flour, margarine, *blondo*, egg, sugar, vanilla, and baking powder). The additive was mixed selenium, concentrated sulphuric acid, boric acid, HCl, hexane, Whatman filter paper number 93, and aquadest.

The equipments were spoon, spatula, knife, basin, pan, frying pan, blender, mixer, biscuit printer, sieve, stove, steamer, scale and oven. The equipments for analysis were analytical scale, glasses (Erlenmeyer flask, Erlenmeyer flask with screw cap, volumetric glass, beaker glass, and volumetric flask), clamp, volume pipette, micro pipette, Soxhlet extractor, Kjeldahl flask, burette, evaporator, desiccators, oven, spectrophotometer, reaction tube, petri dish, autoclave, incubator, humidity chamber, vortex, Bunsen burner and HPLC.

2.3. Study Procedures

***Blondo* characterization and production**: Procedure of *blondo* production was started by paring the coconut skin, shell and husk, followed by grating the meat, adding coconut water, squeezing to separate coconut milk and pulp, separating pure coconut milk and water in the temperature of 70-80^{o}C, and separating oil and *blondo* in the temperature of 80-90^{o}C. The aim of the two separations was to obtain *blondo* with maximum protein content and to minimize oil and water. As the next step, yield parameter and proximate analysis (water, ash, fat, protein and carbohydrate/by difference) was conducted to the *blondo*.

Snakehead fish flour: Characterization and determination of protein content and amino acid composition of snakehead fish flour was conducted before fish flour production. The procedure was started by cleaning the fish and removing the head, tail, innards, scale and fin of the fish. The fish was cut on the back and cleaned using clean water for three times. Fish steaming (pasteurization) during 30 minutes in the temperature 85–90^{o}C was conducted. The aim of pasteurization was to inactivate enzyme, kill patogene spoilage microbes and prevent spores. Next, separating meat from bone and skin was conducted. The fish meat was dried using oven in the temperature of 50^{o}C for 4 hours. The dried fish was mashed using flour blender and sieved to obtain homogenous fish flour (sized 60–80 mesh). Yield parameter and proximate analysis (water, ash, fat, protein and carbohydrate) was conducted to the fish flour.

Brown rice flour: Procedure of brown rice flour production was started by removing gravel and unhulled rice from the brown rice. The brown rice was then cleaned for three times and soaked for 24 hours. The brown rice was strained, milled, dried for 3 hours under the sun light to reduce water content and sieved to obtain similar size (60-80 mesh).

Biscuit formulation: Biscuit formulation was based on energy and protein adequacy of children aged 3-5 years, which was 1,000 kcal energy and 25 g protein for 3 year old children, while for children aged 4-5 years was 1,550 kcal energy and 39 g protein. Biscuit production added by *blondo*, snakehead fish flour and brown rice flour was expected to fulfill energy and protein adequacy of children aged five years old. The formula was based on difference in concentration on *blondo*, snakehad fish and brown rice flour using three stages of formulation. The first stage was *blondo* substitution with seven concentrations, namely 0, 10%, 20%, 30%, 40%, 50% and 60% of total weight of margarine. Blondo substituted margarine in biscuit formulation. The second stage was preparing snakehead fish flour with five concentrations, namely 5%, 10%, 15%, 20% and 25% of total weight of wheat flour. Snakehead fish flour substituted wheat flour. The third stage was preparing brown rice flour with five concentrations, namely 20%, 40%, 60%, 80% and 100% of the weight difference between wheat flour and snakehead fish flour. Brown rice flour also substituted wheat flour use in biscuit formulation.

Acceptance test of formulated biscuit: To obtain accepted biscuit, acceptance test of the formulated biscuit was conducted. In order to obtain accurate result, acceptance test was conducted in 20% of the calculated samples [9]. Acceptance test was conducted in two stages. The first stage was conducted to 10 semi trained panelists, while the second stage was conducted to 55 panelists from community (mother of children under five years old). In the second stage, biscuit sample with code F0 and F15 was presented to the panelists to be assessed in term of color, flavor, texture, taste and overall acceptability using 7-point hedonic scales (0-1 = dislike extremely, 1.1-2 = dislike moderately, 2.1-3 = dislike slightly, 3.1-4 = neither like nor dislike, 4.1-5 = like slightly, 5.1-6 = like, 6.1-7 = like extremely) [10].

Nutrient analysis: Nutrient analysis conducted was protein content using semi micro Kjehdal method [10], fat content using Soxlet method [10], water content using direct heating method, ash content with dry ashing method, carbohydrate content using by difference [11].

Experimental design: Formulation of *blondo*, snakehead fish flour and brown rice flour based biscuit was conducted using completely randomized design. Acceptance test to the biscuit used 7-point hedonic organoleptic test.

3. Results

3.1. Characteristic of Materials

(1) *Blondo:* The result of study showed that 100 g *blondo* contained 16.9 g protein, 23.9 g fat, 31.8 g carbohydrate, 9.1 g fiber, 1.4 g ash and 341 kcal energy. There was difference in nutrient content between coconut products which was presented in Table 1.

The result of study showed that energy, carbohydrate and protein content of *blondo* was higher than pure coconut milk and coconut meat, while fat and water content was lower. Based on this result, *blondo* is potential to substitute material for biscuit to improve the nutrient content. Fifteen pieces (7.5 kg) of *blondo* yielded 500 g or 6.7% (wet weight).

Table 1: Differences in Nutrient Content among Coconut Products per 100 g

Nutrient	*Blondo*	Pure Coconut Milk [13]	Old Coconut Meat
Energy (kcal)	341	222	359
Carbohydrate (g)	31.8	28.8	14
Fat (g)	23.9	11.6	34.7
Protein (g)	16.9	0.4	3.4
Water (g)	16.9	58.6	47

(2) Snakehead fish flour: Amino acid analysis was conducted to know amino acid composition and to determine protein quality of snakehead fish. Amino acid composition of snakehead fish was presented in Table 2.

Table 2: Amino acid composition of fresh snakehead fish and flour

Type of amino acid	Concentration (% wet weight)	
	Fresh fish	Flour
Aspartic acid	1.9	5.28
Glutamic acid	2.94	8.71
Serine	0.78	2.33
Histidine	0.4	1.26
Glycine	1.06	3.56
Threonine	0.79	2.70
Arginine	1.34	3.77
Alanine	1.32	3.68
Tyrosine	0.67	1.93
Methionine	0.62	1.68
Valine	0.85	2.78
Phenylalanine	0.84	2.50
Isoleucine	0.85	2.73
Leucine	1.13	4.38
Lysine	1.67	4.83

Table 2 showed that snakehead fish in this study contained 15 amino acids with 3 essential amino acids in the highest concentrations, namely lysine (1.67%), arginine (1.34%) and leucine (1.13%). The content was higher in the form of flour, which was 4.83% for lysine, 3.77% for arginine and 4.38% for leucine.

(3) Brown rice flour: The result of this study showed that 100 g brown rice flour contained 7.4 g protein, 2.6 g fat, 5.2 g carbohydrate and 358 kcal energy. One kilogram of brown rice (wet weight) yielded 950 g brown rice flour (95%).

3.2. Biscuit Formulation

The materials for biscuit formulation were low protein wheat flour, powdered sugar, egg yolk, margarine, baking powder, and vanilla. Biscuit formulation was based on the substitution of margarine. Biscuit formulation consisted of there stages.

The first stage (*blondo* biscuit) was 7 formulations, namely F0 (0% *blondo*, 100% margarine), F1 (10% *blondo*, 90% margarine), F2 (20% *blondo*, 80% margarine), F3 (30% *blondo*, 70% margarine), F4 (40% *blondo*, 60% margarine), F5 (50% *blondo*, 50% margarine), F6 (60% *blondo*, 40% margarine).

Table 3: Mean Value of Organoleptic Test Stage I

Characteristics	Formulated Biscuit Stage I						
	F0	F1	F2	F3	F4	F5	F6
Appearance	3.40	3.47	3.4	3.29	3.71	4.06	3.31
Taste	3.74	3.79	3.31	3.06	3.44	4.08	3.31
Color	3.49	3.36	3.4	3.04	3.92	4.08	3.42
Texture	3.69	3.38	3.54	3.27	3.35	4.56	3.33
Flavor	3.56	3.31	3.33	3.29	3.67	4.06	3.21

Notes: F0 = 12 g (100%) margarine, F1 = 10.2 g (90%) margarine and 1.2 g (10%) *blondo*, F2 = 9.8 g (80%) margarine and 2.4 g (20%) *blondo*, F3 = 8.4 g (70%) margarine and 3.6 g (30%) *blondo*, F4 = 7.2 (60%) margarine and 4.8 g (40%) *blondo*, F5 = 6 g (50%) both margarine and *blondo*, and F6 = 4.8 g (40%) margarine and 7.2 g (60%) *blondo*.

Table 3 showed that mean value of organoleptic test for biscuit F5 was the highest among other formula. Therefore, biscuit formula F5 with 6 g (50%) both margarine and *blondo* was used in the second stage of biscuit formulation.

The second stage (*blondo* and snakehead fish flour biscuit) was combining formula F5 with snakehead fish flour formulation. There was 5 biscuit formulations, namely F7 (5% snakehead fish flour and 95% wheat flour), F8 (10% snakehead fish flour and 90% wheat flour), F9 (15% snakehead fish flour and 85% wheat flour), F10 (20% snakehead fish flour and 80% wheat flour), and F11 (25% snakehead fish flour and 75% wheat flour).

Table 4 showed that mean score of organoleptic test of biscuit formula F10 was the highest among other formula. Based on this result, biscuit formula F10 with 12 g (20%) snakehead fish flour and 50 g (80%) wheat flour was used in the next biscuit formulation.

The third stage (*blondo*, snakehead fish flour and brown rice flour biscuit) was combining biscuit formula F10 with brown rice flour. There was 5 biscuit formula, namely F12 (20% brown rice flour and 80% wheat flour), F13 (40% brown rice flour and 60% wheat flour), F14 (60% brown rice flour and 40% wheat flour), F15 (80% brown rice flour and 20% wheat flour), F16 (100% brown rice flour).

Table 4: Mean Value of Organoleptic Test Stage II

Characteristics	Formuated Biscuit Stage II				
	F7	F8	F9	F10	F11
Appearance	3.5	3.8	3.6	3.9	3.3
Taste	3.9	3.9	3.7	4.3	3.2
Color	3.4	3.8	3.7	4.2	4
Texture	3.7	3.9	4.1	4.2	3.1
Flavor	3.3	4	4.3	4.1	3.1

Notes: F7 = 3 g (5%) snakehead fish flour and 59 g (95%) wheat flour, F8 = 6 g (10%) snakehead fish flour and 56 g (90%) wheat flour, F9 = 9 g (15%) snakehead fish flour and 53 g (85%) wheat flour, F10 = 12 g (20%) snakehead fish flour and 50 g (80%) wheat flour, and F11 = 16 g (25%) snakehead fish flour and 46 g (75%) wheat flour.

Table 5: Mean Value of Organoleptic Test Stage III

Characteristics	Formulated Biscuit Stage III				
	F12	F13	F14	F15	F16
Appearance	3.2	3.1	4	4.2	3.5
Taste	3.7	3.4	3.8	4.2	4
Color	3.6	2.8	3.9	4.3	3.9
Texture	3.4	3.4	3.8	4.4	4
Flavor	3.2	3.6	3.9	4.3	4.1

Notes: F12 = 10 g (20%) brown rice flour and 40 g (80%) wheat flour, F13 = 20 g (40%) brown rice flour and 30 g (60%) wheat flour, F14 = 30 g (60%) brown rice flour and 20 g (40%) wheat flour, F15 = 40 g (80%) brown rice flour and 10 g (20%) wheat flour, and F16 = 50 g (100%) brown rice flour.

Table 5 showed mean score of organoleptic test of biscuit formula F15 was the highest among other formula. Based on this result, biscuit formula F15 with 40 g (80%) brown rice flour and 10 g (20%) wheat flour was used for intervention to children aged 3-5 years. Biscuit formula in the third stage was presented in Table 6.

Type of biscuit formulated in this study was short dough which was characterized as inelastic dough [12]. Gluten production in the dough was minimized, resulting in moistened dough. The first stage in biscuit formulation was mixing process. Mixing process was divided into two stages, namely cream formation and dry material mixing. In cream formation process, margarine was mixed in medium speed, added by sugar, and mixed with yolk in high speed. Browning cream was added by baking powder and vanili before it was mixed with blondo in medium speed.

As the next stage, wheat flour was added to the cream and mixed until moistened. Overmixing may enable gluten matrix formation. Therefore, in order to produce high quality biscuit, the mixing was done minimumly. This two stage mixing process is recommended for biscuit formulation since it can reduce gluten formation [12].

Table 6: Formulation Preference

Composition	Biscuit	
	Standard (F0)	Formulated (F15)
Wheat flour (gram)	62	10
Brown rice flour (gram)	0	40
Snakehad fish flour (gram)	0	12
Margarine (gram)	12	6
Blondo (gram)	0	6
Egg yolk (gram)	14	14
Powdered sugar (gram)	12	12
Total	100	100

The next process was flattening and printing. The dough was grinded using rolling pin and become sheets with similar thickness, which was 0.4 cm and 12 g in weight. The dough in the form of sheets was then printed and baked using oven. In this study, the baking process was conducted in 30 minutes with temperataure of 150°C. Temperature and duration of baking process in oven depends on type of oven and product. Baking process causes texture change, create surface color and reduce water content. The size of biscuit is bigger during baking process. There are several factors affecting this fluffiness, namely particle size of flour and sugar, dough mixing, and lubricant use in the prepared pan. When baking process is done, biscuit should immediately chilled to reduce temperature and to harden the product due to condensed sugar and fat [12].

3.3. Nutrient Content of Biscuit

Nutrient analyses including water, ash, protein, fat and carbohydrate content was conducted to both standard (12 g or 100% margarine and 62 g or 100% wheat flour) and formulated biscuit (6 g *b*, 6 g margarine, 12 g snakehead fish flour, 40 g brown rice flour and 10 g wheat flour. The detail of nutrient content was presented in Table 7.

Table 7: Result of Analysis of Standar (F0) and Formulated Biscuit (F15)

Nutrient Content	Biscuit		Quality Standard for Biscuit (National Standard of Indonesia)
	Standard (F0)	Formulated (F15)	
Energy (Kkal)	460	438	min 400 kcal
Protein (g)	8.9	16.32	min 9 g
Fat (g)	14.3	11.5	10 - 15 g
Carbohydrate (g)	73.9	67.3	min 70 g
Fiber (g)	1	3.48	max 5 g
Ash (g)	1.3	1.48	
Water (g)	1.6	3.4	max 5 g

Standard biscuit had higher fat and carbohydrate. However, the formulated biscuit significantly increased water, ash, fiber and protein content. Water content was 47% higher due to high water content in *blondo*. Protein content of the biscuit was increased by 55% due to addition of snakehead fish flour. When compared to the quality standard of biscuit (National Standard of Indonesia Number 01-297392), almost all three biscuit met the requirement, except carbohydrate in formulated biscuit.

3.4. Acceptance Test of Biscuit

Acceptance test of the biscuit was conducted using hedonic organoleptic test by 55 semi trained panelists. Organoleptic test was conducted in term of color, flavor, taste and texture [13]. Mean value and proportion of panelists was presented in Table 8.

Table 8: Acceptance of Biscuit

Characteristics	Group				*PValue*
	Standard Biscuit (F0)		Formulated Biscuit (F15)		
	Mean	Category	Mean	Category	
Color	5.5 ± 1.2	Like	6.1 ± 0.7	Like extremely	0.001
Flavor	5.1 ± 1.4	Like	6.2 ± 0.7	Like extremely	0.000
Taste	5.7 ± 1.3	Like	6.4 ± 0.7	Like extremely	0.001
Texture	4.8 ± 1.4	Like slightly	5.8 ± 0.9	Like	0.000
Overall	5.2 ± 1	Like	6.1 ± 0.7	Like extremely	0.000

Notes: Scale 0-1 = dislike extremely, 1.1-2 = dislike moderately, 2.1-3 = dislike slightly, 3.1-4 = neither like nor dislike, 4.1-5 = like slightly, 5.1-6 = like, 6.1-7 = like extremely [10]

Table 8 showed that mean value of acceptance to the color was 5.5 (like) for standard biscuit (F0) and 6.1 (like extremely) for formulated biscuit (F15). Mean value of acceptance to the flavor was 5.1 (like) for standard biscuit (F0) and 6.2 (like extremely) for formulated biscuit (F15), while mean value for taste was 5.7 (like) for

standard biscuit (F0) and 6.4 (like extremely) for formulated biscuit (F15). For texture, the mean value was 4.8 (like slightly) for standard biscuit (F0) and 5.8 (like) for formulated biscuit. Overall, the mean score was 5.2 (like) for standard biscuit (F0) and 6.1 (like extremely) for formulated biscuit (F15). Independent T-test showed that the difference was very significant ($p<0.01$).

4. Discussion

Characteristic of produced *blondo* was paste with beige color, fresh coconut oil flavor, soft texture and slighly sweet taste. Biological value of the protein is defined as capability of the protein to be utilized by the body as nitrogen source for protein synthesis in the body. There are two factors affecting biological value of the protein, namely: (1) bioavailability and (2) essential amino acid content. Bioavailable (hydrolized) protein by digestion enzymes and containing complete and balanced essential amino acid content is required for protein with high biological value [14].

Characteristic of snakehead fish flour was refined flour with beige color, fish flour flavor, soft texture and dried snakehead fish taste. The result of the study showed that snakehead fish contained 19.3% (wet weight) or 9.9% (dry weight) protein and 45.3% (wet weight) or 82.8% (dry weight) albumin compared to total protein. After processed into flour, the protein content became 76.9% (dry weight). Fish and other aquatic animal have high protein content, which is 18-20% [15]. Characteristic of protein in aquatic animal is digestible and has complete amino acid content. Study by Santosa and Nurilmala found that snakehead fish has 25.5% (wet weight) protein and 24% (wet weight) albumin. Result of analysis showed that protein and albumin content in snakehead fish flour was affected by habitat of the fish and processing method of the flour [16], [17]. Meat protein is unstable and easily changed as the change in environment [18]. Protein content of fish, both in wet weight and dry weight, may change due to the species and processing method [19].

Arginine, lysine, and leucine are essential amino acid produced in aquatic animal which is known as high protein food [20]. Amino acid which is essential for children is arginine and histidine [21]. Arginine is very important for children to increase excretion of growth hormone [22]. Lysine is functioned as material for blood antibody, strengthen circulation system, maintain normal cell growth, together with proline and vitamin C form collagen and reduce excessive blood triglycerides [23]. The highest non essential amino acid in snakehead fish is glutamic acid (2.94%) and aspartic acid (1.9%). Glutamic and aspartic acid are important in giving flavor and taste of the food [24]. Ten kilograms snakehead fish yielded 800 g or 8% snakehead fish flour (wet weight).

Beside physical characteristics of the biscuit, energy and protein adequacy of children less than five years old determined the planning of biscuit formulation. The energy and protein adequacy of children aged 1-3 years (12 kg body weight) is 1000 kcal and 25 g per day, respectively. In bigger age (4-6 years), the adequacy is 1550 kcal energy and 39 g protein per day [25]. Biscuit is expected to be potential protein source for children less than five years. Biscuit is also expected to meet the requirement from FAO and National Standard of Indonesia [26], and accepted by children less than five years. The National Agency of Drug and Food Control [27] mentioned that food is classified as protein source when it reaches minimum 20% of the Recommended Dietary Allowance (RDA).

Color has important role in determining consumer acceptance since it is the first impression for the consumer. Formulated biscuit (F15) was more accepted than standard biscuit (F0). Independent T-test showed very significant diffence ($p<0.01$). This difference was related to the material of the biscuit. Formulated biscuit (F15) had more interesting color which was brown from brown rice, while the standard biscuit (F0) had beige color. The flavor of biscuit determines the acceptance of a product. Based on independent T-test, formulated biscuit (F15) was very significantly ($p<0.01$) more accepted than standard biscuit (F0). Taste is the attribute of food involving tongue as the sensor. There was no difference ($p>0.01$) in taste between formulated biscuit (F15) and standard biscuit (F0) based on independent T-test. Texture is also important attribute determining the acceptance of a product. There was significant difference ($p<0.01$) between texture of standard and formulated biscuit. Overall, there was no significant difference ($p<0.05$) between standard biscuit (F0) and formulated biscuit (F15).

5. Study limitations

As the limitation of this study, the study did not assess the durability of the biscuit in various packages.

6. Conclusions

Five hundred gram *blondo* was made from 15 pieces of *blondo*, 800 g snakehead fish flour was made from 10 kg snakehead fish meat, while 950 g brown rice flour was made from 1 kg of brown rice. The best formulation of biscuit added by *blondo*, snakehead fish flour and brown rice flour was formula 15 with 50% blondo, 12% snakehead fish flour and 40% brown rice flour. Proximate analyses showed that water, ash, fat, protein and carbohydrate content of the biscuit was 17 g, 1.3 g, 10.8 g, 23.8 g, 61 g and 437 kcal, respectively. The acceptance test conducted to 55 panelists in Pare-Pare City showed score of 6.1 or in “like extremely” category for formulated biscuit and score of 5.3 or in “like” category for standard biscuit. There was no difference in preference level in term of color, flavor, taste and texture attributes. This showed that most of the respondents in Pare-Pare City could not differenciate biscuit with *blondo*, snakehead fish flour and brown rice flour with standard biscuit.

Acknowledgement

The author would like to express the gratitude to stakeholders involved in biscuit formulation, analysis, material preparation and other activities in this study so that the paper was completed according to the schedule. The stakeholders were: Ministry of Agriculture through KKP3N research grant, Supersemar Foundation, Integrated Laboratory Unit of Bogor Agricultural University, Pare-Pare City Health Office, Lompoe and Lumpue Community Health Center in Pare-Pare City.

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