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The Development of Torbangun Flour-Based Functional Supplementary Food for Breastfeeding Mother

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Abstract

Breastfeeding mother requires more nutrients than non-breastfeeding mother. The aim of the study was to develop a torbangun-based supplementary food product in a form of a ready-to-eat food for breastfeeding mother with baby up to six months old and to to analyze characteristics of organoleptic properties, nutritional content, physical and microbiological properties. This study was a single factor experiment with completely randomize design. Product was made from corn flour, isolated soy protein, skimmed milk powder and sugar powder. The product was formulated using three treatments and those were adding 9.6 g (F1) torbangun flour, 10.8 g (F2) and 12 g (F3). The results of this study indicated that the panelists preference by organoleptic test of F1, F2 and F3 products based on colour, taste, flavour, texture and overall was not significantly different ($p>0.05$). Most panelist (>95%) preferred and could accept the F3 product, which was added with 12 g torbangun flour. Therefore, this product was choosen and analyze further. The F3 product contained 376 kcal of energy in 100 g with water absorption index at 3.06 and the water solubility of 76.96%. Microbiological analyzes test showed that F3 was negative for *E.coli*, *Salmonella and S.aureus*, while the value of total plate count was still within tolerance.

Keywords: Breastfeeding mother; supplementary food; torbangun

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1. Introduction

Breastfeeding mother requires more nutrients than non-breastfeeding mother. According to the Recommended Dietary Allowances (RDAs) for Indonesian, breastfeeding mother in their first six months of breastfeeding needs 500 kcal more energy and 17g more protein than non-breastfeeding mother at the same age [1]. The additional nutrients are essential for mother's recovery process after delivery, improving mother's nutrition and health status, and restoring mother's nutrients [2].

The authors in [3] reported that the average of Indonesian mother's energy and protein consumption meets only 60% and 87% of RDAs. Individual food consumption survey in Indonesia in 2014 showed that many of the age group of 19-55 years are in the low intake category of the consumption of energy and protein. The survey result did not specifically reveal the consumption of energy and protein for breastfeeding mothers, however in general breastfeeding mothers are in the age group of 19-55 years old. Based on the survey 50% of the age group consume less than 70% energy and 33.8% consume less than 80% protein that recommended by RDAs [4]. Breastfeeding mother that lack of energy, protein, and nutrients in her diets is in risk of maternal depletion. Thus, since breastfeed is the most ideal food for baby in their first six month [5], it is required that the intake of nutrients for breastfeeding mother meets RDAs standards. One way to overcome the problem is to give them supplementary food.

The development of supplementary food based on element that comprise the function of lactogogue for breastfeeding mothers has not been done. Food product as such is expected to be used as an alternative food for breastfeeding mothers to improve their energy and protein intake and at the same time improving their breast milk secretion as lactagogue has such function. Moreover, the product is potentially supporting exclusive breastfeeding as one of the barriers of not giving breast milk is the lack of breast milk production [6,7], while lactogogue commonly used to increase breast milk production [8].

Torbangun or bangun-bangun (*Coleus amboinicus* Lour.) is the local foodstuff from North Sumatera province in Indonesia that has lactogogue function. Torbangun leaf has been used for generations of Batak tribe for breastfeeding mother. It is usually used as vegetables or made into soup and served for mothers right after delivery for 30-40 days. This tradition of consuming torbangun leaves is still practised by Bataknese lactating mothers with the aim to increase breast milk production or as lactogogue [9, 10,11,12].

Torbangun leaves functioned as lactogogue has been demonstrated by numerous studies on human [11,12,13], other than it can easily grow with relatively short time to harvest [14]. However, there has not been any food product formulized based on torbangun flour for breastfeeding mother. Therefore, this study was aimed to develop a torbangun based supplementary food product ready to eat for mother who breastfeed their infant up to six month-old baby and to analyze the characteristics of the organoleptic properties, nutritional content, physical and microbiological properties.

2. Materials and Methods

2.1. Materials

The main materials that were used for supplementary food product for breastfeeding mother were torbangun flour, corn flour, isolated soy protein, skimmed milk powder, and sugar powder.

2.2. Study Procedures

The research consisted of several stages. The study was begun with analyzing the proximate of basic ingredients of the product. The next steps were formulation of ingredients, processing ingredients into products, analyzing product's organoleptic, analyzing nutritional content, physical and microbiological properties from one selected product based on organoleptic test.

- Proximate analysis of basic ingredients

Proximate analysis was done for torbangun flour, corn flour, isolated soy protein and skimmed milk. Proximate analysis includes water content analysis (gravimetric method), ash content (dry ash method), fat content (Soxhlet method) that was done according to the national standards of SNI 01-2891-1992 [15], protein content (Microjeldahl method) according to the standard of AOAC 960.52-1961 [16], and carbohydrate content using by difference method. Sugar powder proximate data was known from the list of Indonesia food compositions [17].

- Ingredients formulations for product development

Formulation of the ingredients was done to meet energy and protein daily requirements for breastfeeding mothers. The stage of formulation for product development used completely randomize design with single factor, amount of torbangun flour. Formulations were done with three levels of treatment, each with two replicates that was adding torbangun leaves flour consecutively 9.6 g (F1), 10.8 g (F2) and 12 g (F3) is referred to as F1, F2 and F3.

- Processing into ready-to-eat product

The formula compiled F1, F2 and F3 respectively processed into ready-to-eat powder form by modifying the making of instant cereal beverage powder on corn and soybean [18]. The treatment started with mixing corn flour and soy protein isolate evenly, then creating dough by adding water (1:4). The dough was then heated at gelatinisas temperature (92^{o}C) to obtain the form of a slurry mixture. The mixture then dried with a drum dryer (140^{o}C; 3 rpm) to produce thin sheets and then powdered with a disc mill and sieved to 80 mesh size. Furthermore, the composite flour dry mix with powdered skim milk, powdered sugar and torbangun flour.

- Organoleptic test of product

Organoleptic test was done by 40 panelists who are breastfeeding mothers, living at the working area of Puskesmas Bantar Jaya, Sub-district Rancabungur, Bogor district. Organoleptic test used 3-point hedonic scale: (1) dislike (2) neither like nor dislike and (3) like.

- Selected product analysis

One out of three products was selected for further analysis based on the result of the organoleptic test. Selected product analysis included proximate analysis, physical properties and microbiological tests. Analysis of physical properties included water absorption and solubility in water, whereas microbial for *E.coli, Salmonella, S.aureus* and total plate count.

2.3. Data Analyzed

The organoplectic test was analyzed descriptively according to mode value and the panelists' acceptance percentage from each of the products. Kruskal Wallis test was used to determine the effect of treatment for the panelists' preference level that include colour, taste, flavour, texture and overall of the product.

3. Results and Discussion

3.1. The nutrient content of the ingredients for product development

The nutrient content of the ingredients used on product development are presented in Table 1. Besides isolated soy protein, the major component contained in the ingredients used for formulation was carbohydrates. The isolated soy protein is added with purpose to be source of protein of the end products. The levels of protein in skimmed milk powder was 35.6% and it was only half of the value stated on [17] and was not in accordance with the quality of milk requirement according to [19] wherein the protein content of whole milk or low fat milk minimum of 23% while fat-free milk at least 30% of protein content. Proximate analysis results shown in Table 1 was used as consideration to design the quantity of each ingredients used in formulation phase besides the result from food processing experiment.

Table 1: The nutrients content of ingredients for product development (% wet weight)

Ingridients	Water	Ash	Fat	Protein	Carbohydrate
Torbangun flour	8.79±0.04	7.92±0.01	9.17±0.00	20.91±0.01	53.21±0.05
Corn flour	12.31±0.15	0.86±0.01	3.36±0.00	3.86±0.01	79.61±0.16
Isolated soy protein	3.49±0.03	6.15±0.03	0.20±0.03	17.12±0.12	73.04±0.08
Skimmed milk powder	6.08±0.02	3.54±0.02	1.93±0.01	70.93±0.11	17.52±0.15
Sugar powder*)	5.40	0.60	0	0	94

Note : *) Nutrient content according to [17].

3.2. Organoleptic test of the product

Consumers' acceptance of a new product is the most important factor that needs to be considered other than the various advantages of the product [20]. Consumers' acceptance of F1, F2 and F3 products was based on organoleptic test. The organoleptic test was conducted by 40 consumers as panelists who are breastfeeding

mothers who living in the area of Puskesmas Bantar Jaya, Rancabungur subdistrict, Bogor regency of West Java Province. Organoleptic tests used 3-point hedonic scale, those are (1) dislike (2) neither like nor dislike, and (3) like.

The percentage of panelists' acceptance of the product was calculated by comparing the number of panelists who provide score by scale 2 (ordinary) and scale 3 (like) over the total panelists. Results showed that the acceptance of products ranged from 88% to 100%, and overall reception was good where more than 90% panelists can accept the product (Table 2). Panelists' preferences of the overall product was the value obtained based on the sum of the results of the vote from the penalists as follows: 40% of the valuation of colour, each 25% of the valuation of taste and flavour as well as 10% of the valuation of the texture. Colour percentage was higher because consumers' acceptance of a food product often begins with the acceptance of appearance or colour.

Table 2: Percentage of panelists' acceptance of the product (%)

Product	Colour	Taste	Flavour	Texture	Overall
F1	100	88	98	95	98
F2	100	98	95	100	100
F3	98	98	98	100	100

The colour decription of the generated product was greenish with specific flavour of a mixture of corn and torbangun flavour. It had smooth texture in mouth with a mix of sweetness and unique flavour of torbangun that was a slightly bitter taste. Mode value of panelists' valuation of the colour, taste, flavour, texture and overall of each product are presented in Table 3.

Table 3: Mode value and percentage of panelists' preferences on products

Characteristics	Product F1 Mode (%)	Product F2 Mode (%)	Product F3 Mode (%)
Colour	3 (70%)	3 (60%)	3 (55%)
Taste	3 (50%)	2 (53%)	3 (70%)
Flavour	3 (68%)	3 (53%)	2 (48%)
Texture	3 (68%)	3 (60%)	3 (75%)
Overall	3 (70%)	3 (60%)	3 (62%)

The mean value of panelists' preferences on product F1, F2 and F3 in terms of colour, taste, flavour, texture and overall were above the 2nd and 3rd category from the grading scale (Table 4). Kruskal Wallis test showed that the average of panelists' preferences on those items did not differ significantly ($p > 0.05$). Therefore, the F3 product was selected for further analysis based on the consideration of its highest proportion of torbangun flour that has lactagogue benefits. Furthermore, the acceptance of all organoleptic parameters towards product F3 was above 95%.

Table 4: Mean value of panelists' preferences of the products

Products	Colour	Taste	Flavour	Texture	Overall
F1	2.7±0.5[a]	2.4±0.7[a]	2.7±0.5[a]	2.6±0.6[a]	2.7±0.6[a]
F2	2.6±0.5[a]	2.4±0.6[a]	2.5±0.6[a]	2.6±0.5[a]	2.6±0.5[a]
F3	2.5±0.6[a]	2.7±0.5[a]	2.5±0.6[a]	2.8±0.4[a]	2.6±0.5[a]

Note: Means with the same superscript in the same column are not significantly different at 0,05 significance level.

3.3. Content of nutrition, physical and microbiological analysis of selected products

Based on the results of the proximate analysis as shown in Table 5, F3 product contains 376 kcal of energy in 100 g. The energy content was calculated based on 4 kcal/g protein; 9 kcal/g of fat and 4 kcal/g carbohydrates. The nutritional adequacy rate for mother who breastfeed in the first six months requires an additional 330 kcal of energy sufficiency and 20 g protein [21]. Therefore, if a mother who is breastfeeding her infant aged less than six months takes the F3 product three times a day, 33 g per serving (3x33 g), could contribute to the fulfillment of 110% extra energy and 60% of additional protein requirement.

Table 5: The nutrients content of F3 product (% wet weight)

Component	% wet weight
Water	4,36±0,11
Ash	2,53±0,04
Fat	0,73±0,10
Protein	12,15±0,30
Carbohydrate	80,23±0,49

The ready-to-eat powder product F3 showed its physical properties of water absorption index at 3.06 and the water solubility of 76.96%. Corn flour are ingredients for F3 formula that contribute to a high water absorption capability [22]. The results of microbiological analysis showed negative results for *E. coli, Salmonella* and *S.aureus*. The value of total plate count $<1.0 \times 10^1$ (colonies/g) that was still within tolerance limits allowed for the requirements of instant powder made from milk powder and cereals with or without the permitted additional food ingredients and food additives max. 5×10^5 colonies/g [23].

4. Conclusion

The average of panelists' preferences for colour, taste, flavour, texture and overall of of all was not significantly different. All developed product had good acceptance by the panelists in terms of colour, taste, flavour, texture, and overall. F3 product contained 376 kcal of energy and protein 12.15 g per 100 g with water absorption index at 3.06 and the water solubility of 76.96%. Microbiological analyzes test showed that F3 was negative for *E.coli*, *Salmonella and S.aureus*, while the value of total plate count is still within tolerance.

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