TORBANGUN FLOUR-BASED FOOD BAR AS A FUNCTIONAL EMERGENCY FOOD PRODUCT FOR BREASTFEEDING MOTHERS

Tetty Herta Doloksaribu[1]*, Made Darawati[2], Herta Masthalina[1], Kiki Kristiandi[3], Andi Eka Yunianto[4]

[1]Politeknik Kesehatan Kementerian Kesehatan Medan,
[2]Politeknik Kesehatan Mataram
[3]Departemen of Food Agroindustry, Politeknik Negeri Sambas
[4]Faculty of Medicine, Universitas Lampung
Email : tettyhertadolok1000@gmail.com

ABSTRACT

Indonesian has a large risk of natural disasters therefore it is important to develop emergency food products for high-risk target groups such as lactating mothers. This study aimed to formulate torbangun flour into food bars that serve as essential nutritional support for breastfeeding mothers during emergency disaster situations. This experimental study using a completely randomized design. The research phase began by formulating materials for product development consisting of torbangun flour, sweet potato flour, green bean flour, pineapple pulp and guava pulp. Continued by processing food bars and organoleptic testing the products. The most prefered product was analyzed for energy content, protein, antioxidant activity and quercetin content. The results showed that the most preferred product was a food bar torbangun with a composition of 21% sweet potato flour, 28% green bean flour, 12% margarine, 12% granulated sugar, 11% eggs, 14% pineapple pulp and 2% torbangun leaf flour. Every 100 g of food bars contain 395 kcal of energy; protein 11 g; antioxidant activity of 30.29 mg / 100g AEAC (ascorbic acid equivalent antioxidant capacity) and quercetin content of 11.7 ppm. The food bar torbangun is recommended as a functional supplementary food for breastfeeding mothers in emergencies due to natural disasters.

Keywords: lactating mothers; emergency food; torbangun

INTRODUCTION

Indonesia has geographical, geological and hydrometeorological characteristics that cause a high risk of natural disasters such as tectonic earthquakes, volcanic eruptions, landslides, floods and tornadoes. Indonesian Disaster Information Data in the last 5 years, namely 2018 to 2023, has occurred as many as 18,081 disasters that have affected many people, with a death toll of 1683 people and several refugees of 1,982,456 people. During that period, the most frequent types of disasters were tornadoes, floods, and landslides (BNPN, 2022). The impact of the disaster caused residents to have to leave their homes and live in evacuation with all limitations. A more fundamental impact is the appearance of emergencies in all fields, including health emergencies.

Nutrition management, as part of the health response, plays an important role in the emergency response to disasters, improving and maintaining the nutritional and health status of affected communities, especially vulnerable groups (Irianti, 2021). Breastfeeding mothers are one of the vulnerable groups that need more nutritional intake compared to mothers who do not breastfeed in the same age group (Pangestuti, 2018). However, during the emergency response to a disaster, access to food is often minimal due to damaged infrastructure, limited clean water and sanitation facilities. In addition, disaster situations also increase the risk of breastfeeding mothers experiencing psychological impacts so that the secretion and production of breast milk (ASI) can be disrupted (Hasianna *et al.*, 2021). Fulfilling breastfeeding mothers' nutrition in disaster-affected areas and refugee camps plays an essential role in protecting against various malnutrition problems that may arise. In addition, the importance of breast milk for infants and toddlers, especially in emergency disaster response conditions, encourages various efforts to ensure that breastfeeding mothers' nutritional intake can be met (Doloksaribu, Syarief and Marliyati, 2015). One of the rapid response efforts to fulfil nutritional intake for breastfeeding mothers is providing additional ready-to-eat food (Sawant *et al.*, 2013). Therefore, it is crucial to develop emergency food products specially formulated as additional food for breastfeeding mothers using local food (Damanik and Wahlqvist, 2006). Torbangun is a type of local food that has lactagogue activity. Its easy-to-grow characteristics with a relatively short harvest age are one of its advantages compared to other types of food that also have lactagogum activity and are commonly consumed, namely katuk leaves (Damanik, 2009), (Rice *et al.*, 2011). The purpose of this study was to formulate torbangun flour in the form of a food bar as an additional food product for breastfeeding mothers in emergency disaster conditions.

METHOD

This experimental study uses a completely randomized design with treatments, namely four types of formulas from torbangun food bars, each repeated three times. The food ingredients consist of torbangun flour, sweet potato flour, green bean flour, pineapple and guava, granulated sugar, eggs and margarine. The food ingredients used are types of local food that are easily obtained and affordable by the community's purchasing power. The consideration of using torbangun is because it can increase the secretion and production of breast milk or function as a lactagogue. The composition or amount of food ingredients used for the torbangun food bar

formula is intended so that the consumption of the product per day can contribute 2100 kcal of energy from 10-15% protein, 35-45% fat, and 40-50% carbohydrates.

Table 1. Ingredients composition based on formula type

Types of food ingredients (g)	Formula Type			
	N1	N2	J1	J2
Sweet potato flour	150	150	150	150
Green bean flour	200	200	200	200
Margarine	85	85	85	85
Sugar	85	85	85	85
Eggs	75	75	75	75
Pineapple pulp	100	100	100	100
Guava pulp	-	-	100	75
Torbangun flour	13,2	13,2	13,2	13,2

Margarine and granulated sugar that have been finely ground are mixed until they slightly rise and turn white

↓ ← Egg

Mixed with a mixer at medium speed

↓ ← Sweet potato flour, mung bean flour, torbangun flour

Mixed with a mixer at medium speed

↓ ← Pineapple or guava jam

Molding in a baking pan

↓

Baking in oven (temperature 160°, 20 minutes)
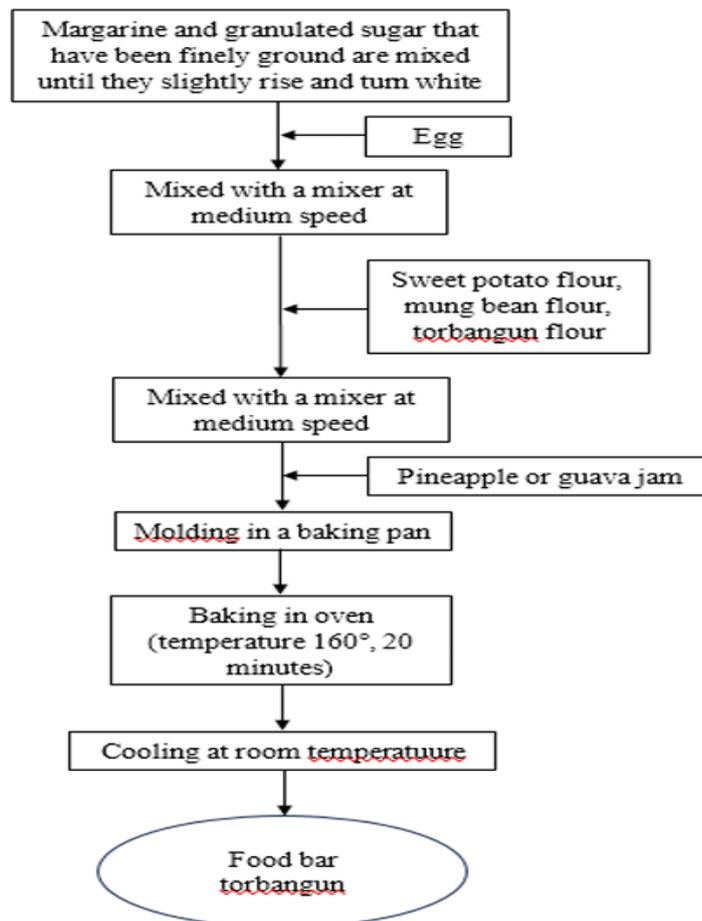
↓

Cooling at room temperatuure

↓

Food bar torbangun

Image 1. Flowchart of Torbangun Food Bar Production

The organoleptic properties of torbangun food bars were tested using a 2-stage hedonic test. The first stage was conducted by semi-trained panellists using seven hedonic scales, namely (1) immensely dislike, (2) dislike, (3) rather dislike, (4) normal, (5) somewhat like, (6) like, and (7) very like. The second stage was conducted by consumer panellists using three hedonic scales, namely (1) dislike, (2) normal, and (3) like. In the first testing stage, two types of the most preferred formulas were selected from the four types of torbangun food bar formulas tested by the panellists. Furthermore, the second stage of organoleptic properties testing was conducted to determine the most preferred product. The semi-trained panellists in the first stage of organoleptic properties testing were students who had taken courses on organoleptic testing and lecturers in Food Technology at the Nutrition Department of the Ministry of Health Polytechnic of Medan. The consumer panellists in the second stage of organoleptic properties testing were breastfeeding mothers of babies aged 0-6 months in Lubuk Pakam, North Sumatra and West Lombok, West Nusa Tenggara. The number of semi-trained panellists was 28, while the consumer panellists were 84. The panellists' overall preference for the product was obtained based on the sum of the panellists' assessment scores, which were 40% from the colour score and 20% each from the aroma, taste, and texture scores. Data from the organoleptic test results were analyzed descriptively based on the average level of panellists' preference for the type of torbangun food bar formula. Proximate analysis, antioxidant activity, and quercetin content were carried out on the torbangun food bar, which consumers preferred. Proximate analysis (water content, ash, fat, protein and carbohydrate by different) was carried out under SNI 012891-1992 (BSN, 1992). Antioxidant activity analysis using the DPPH scavenging activity method, and the results were expressed in ascorbic acid equivalent antioxidant capacity (AEAC). Analysis of quercetin content was carried out using the HPLC method.

RESULTS AND DISCUSSION

In this study, the yield of torbangun flour was 8.8%. The yield is the weight of the flour produced compared to the net weight of the ingredients used. Torbangun leaves in the Indonesian Food Composition Table (TKPI) are grouped into vegetables with a water content of 92.5% (Siswanto *et al.*, 2014). The high water content in fresh torbangun leaves will cause the food to be more easily damaged due to internal biological activity (metabolism) or destructive microbes

(Medicine, 1995). Therefore, processing fresh torbangun leaves into torbangun flour can be an alternative form to increase its shelf life. In addition, processing torbangun leaves into torbangun flour makes it more flexible in its use for manufacturing and developing various food products (Doloksaribu, Syarief and Marliyati, 2015). The general description of the torbangun food bar produced in this study is that it is slightly greenish yellow, has a distinctive aroma of a combination of sweet potatoes and green beans, has a sweet taste with the aroma of pineapple or guava and a crunchy texture in the mouth. The average value of the preference of semi-trained panellists for the organoleptic properties (colour, odour, taste, texture, and overall) of torbangun food bars based on the type of product formula is presented in Table 2.

Table 2. The average value of semi-trained panellists' preference for the organoleptic properties of the product

Torbangun food bar	Organoleptic characteristics				
	Colour	Aroma	Taste	Texture	Overall
Formula 1 (F1)	4.43 ± 1.24 [a]	4.25 ± 1.26 [a]	4.32 ± 1.28 [a]	4.57 ± 1.47 [a]	4.71 ± 1.18 [a]
Formula 2 (F2)	3.82 ± 1.31 [a]	3.35 ± 1.50 [b]	3.35 ± 1.51 [b]	4.14 ± 1.38 [a]	3.96 ± 1.32 [b]
Formula 3 (F3)	4.50 ± 1.30 [a]	4.93 ± 1.51 [a]	4.39 ± 1.45 [a]	4.71 ± 1.23 [a]	4.75 ± 1.19 [a]
Formula 4 (F4)	4.14 ± 1.20 [a]	3.68 ± 1.24 [b]	3.96 ± 1.50 [a]	4.39 ± 1.27 [a]	4.32 ± 1.32 [a]

*)Numbers followed by different letters in the same column indicate P-value<0.05

Based on the statistical analysis results, it was found that the average preference of semi-trained panellists for the aroma, taste, and overall of the torbangun food bar was significantly different (p0.05). This indicates a significant effect of the level of formula type treatment on the aroma, taste, and overall of the torbangun food bar. Table 1 shows that the average value of panellists' preference for the colour, taste, aroma, texture, and overall torbangun food bar F3 is higher than that of products F1, F2, and F4. The results of statistical tests show that the average value of panellists' preference for the taste and overall of the F3 product is significantly different from that of product F2. Based on the results of the first stage of organoleptic testing, the torbangun food bars selected for organoleptic testing in the second stage by consumer panellists are torbangun food bars F1 and F3.

Table 3. The average value of consumer panellists' preference for the organoleptic properties of the product

Torbangun food bar	Organoleptic characteristics*)				
	Colour	Aroma	Taste	Texture	Overall

Formula 1 (F1)	2.6 ± 0.54 [a]	2.4 ± 0.75 [a]	1.9 ± 0.71 [a]	2.4 ± 0.59 [a]	2.4 ± 0.43 [a]
Formula 3 (F3)	2.6 ± 0.52 [a]	2.9 ± 0.40 [b]	2.6 ± 0.53 [b]	2.7 ± 0.59 [b]	2.7 ± 0.35 [b]

[*] Numbers followed by different letters in the same column indicate P-value<0.05

The statistical test results showed that the average value of consumer panellists' preferences for the smell, taste, texture and overall of the F1 torbangun food bar was significantly different from F3 (p<0.05). The average value of consumer panellists' preferences showed that product F3 was preferred to product F1. Sawant et al. explained that organoleptic properties are essential quality factors directly related to product acceptability (Sawant *et al.*, 2013). Based on the acceptability of the product by consumer panellists in this study consisting of the Batak, Javanese, Sundanese and Sasak tribes, the resulting torbangun flour food bar is expected to be an alternative form of broader torbangun utilization, not only among the Batak tribe.

The torbangun food bar most preferred by consumers (F3) has an energy content of 100 grams of 395 kcal (Table 4).

Table 4. Proximate levels and antioxidant activity of selected products

Tested characteristics	per 100 g product
Water % b/b	14,20
Ash % b/b	2,41
Fat % b/b	11,90
Protein % b/b	11,00
Carbohydrate % b/b	60,90
Energy (kkal)	395,00
Antioksidant activity (mg/100g)	30,29

Food bar torbangun F3 has an antioxidant activity of 30.29 mg/100g AEAC. This shows that 100 g of this product can reduce DPPH free radicals, equivalent to 30.29 mg of vitamin C (Ellong *et al.*, 2015). The antioxidant activity of this product is higher than that of tomato juice and bran drinks. The results of research conducted by Damayanthi *et al.*, (2010) found that the antioxidant activity of tomato juice and bran were 1.87 mg/100g and 28.74 mg/100g AEAC, respectively. This product also contains components that have lactagogue properties based on the quercetin content of 11.7 ppm. Torbangun leaf plants have lactagogum components that can facilitate the flow of breast milk in breastfeeding mothers (Medicine, 1995), (Damanik *et al.*, 2001), (Panche,

Diwan and Chandra, 2016). The F3 torbangun food bar has a composition of 21% sweet potato flour, 28% green bean flour, 12% margarine, 12% granulated sugar, 11% chicken eggs, 14% pineapple jam (without sugar) and 2% torbangun leaf flour. The weight of the torbangun flour food bar produced per piece (bar) in this study was around 30-35 grams, so 100 grams of product is equivalent to 3-4 pieces. Referring to the 2019 AKG, mothers breastfeeding their babies for the first 6 months need additional energy requirements of 330 kcal and 400 kcal for the second 6 months. So, to meet the additional energy requirements for breastfeeding mothers, the amount of product consumed should be around 100 grams/day.

CONCLUSION

The yield of torbangun flour in this study was 9%. The type and amount of fruit added significantly affected the smell, taste, and overall taste of the torbangun food bar. The torbangun food bar with a composition of 21% sweet potato flour, 28% green bean flour, 12% margarine, 12% granulated sugar, 11% chicken eggs, 14% pineapple jam (without sugar) and 2% torbangun leaf flour had the highest average preference value compared to other products. Every 100 g of the selected food bar based on the acceptance test contained 395 kcal of energy, 11 g of protein, 30.29 mg/100g (AEAC) antioxidant activity and 11.7 ppm quercetin content. The most preferred torbangun food bar, every 100 g can meet additional energy requirements for breastfeeding mothers. The resulting product has the potential as a functional emergency food to meet additional energy requirements for breastfeeding mothers while also being able to facilitate the secretion and production of breast milk based on its lactagogue content.

ACKNOWLEDGEMENT

REFERENCES

BNPN (2022) *Potensi Ancaman Bencana*, *Badan Nasional Penanggulangan Bencana*. Available at: https://www.bnpb.go.id/potensi-ancaman-bencana (Accessed: 31 January 2023).

Damanik, R. *et al.* (2001) 'Consumption of Bangun-Bangun Leaves (*Coleus amboinicus Lour*) to increase breast milk production among Batakneese women in North Sumatra Island , Indonesia', *Procceeding of the Nutritional Sosiety of Australia*, 10(4), p. S67.

Damanik, R. (2009) 'Torbangun (*Coleus amboinicus Lour*): A Bataknese Traditional Cuisine Perceived as Lactagogue by Bataknese Lactating Women in Simalungun, North Sumatera, Indonesia', *J Hum Lact*, 25(1), pp. 64–72. Available at: https://doi.org/10.1177/0890334408326086.

Damanik, R. and Wahlqvist, M.L. (2006) 'Lactagogue effects of Torbangun , a Bataknese traditional cuisine', *Asia Pac J Clin Nutr*, 15(2), pp. 267–274.

Damayanthi, E. *et al.* (2010) 'Aktivitas Antioksidan Bekatul Lebih Tinggi Daripada Jus Tomat Dan Penurunan Aktivitas Antioksidan Serum Setelah Intervensi Minuman Kaya Antioksidan', *Jurnal Gizi dan Pangan*, 5(3), p. 205. Available at: https://doi.org/10.25182/jgp.2010.5.3.205-210.

Doloksaribu, T.H., Syarief, H. and Marliyati, S.A. (2015) 'Pertumbuhan bayi dan pemberian asi eksklusif oleh ibu penerima konseling menyusui dan makanan tambahan torbangun (', *J. Gizi Pangan*, 10(2), pp. 77–84.

Ellong, E.N. *et al.* (2015) 'Polyphenols , Carotenoids , Vitamin C Content in Tropical Fruits and Vegetables and Impact of Processing Methods', *Food and Nutrition Sciences*, 6, pp. 299–313. Available at: https://doi.org/10.4236/fns.2015.63030.

Hasianna, S.T. *et al.* (2021) 'The Use of Torbangun Leaf Powder (Coleus amboinicus L) in Increasing Prolactin in Breastfeeding Wistar Rats and Body Weight of The Litters Penggunaan Serbuk Daun Torbangun (Coleus Amboinicus L) dalam Meningkatkan Kadar Prolaktin pada Tikus Wistar Meny', *Journal of Medicine and Health*, 3(1), pp. 26–33.

Irianti, B. (2021) 'Effectiveness of Torbangun Leaf Soup in Increasing Breast Milk Production in Breastfeeding Women in Dince Safrina Pratama Clinic , Pekanbaru City', *Journal of Midwifery and Nurnsing*, 3(2), pp. 72–75.

Medicine, I. of (1995) *Estimated Mean per Capita Energy Requirements for Planning Energy Food and Rations*. Edited by L.H. Allen and C.P. Howson. National Academy Press. Available at: https://doi.org/10.17226/9095.

Panche, A.N., Diwan, A.D. and Chandra, S.R. (2016) 'Flavonoids: An overview', *Journal of Nutritional Science*, 5. Available at: https://doi.org/10.1017/jns.2016.41.

Pangestuti, D.R. (2018) 'Nutritional Status of Exclusive Compared to Non Exclusive Breastfeeding Mother', *Jurnal Gizi dan Pangan*, 13(12), pp. 11–16. Available at: https://doi.org/10.25182/jgp.2018.13.1.11-16.

Rice, L.J. *et al.* (2011) 'Plectranthus: A plant for the future?', *South African Journal of Botany*, 77(4), pp. 947–959. Available at: https://doi.org/10.1016/j.sajb.2011.07.001.

Sawant, A.A. *et al.* (2013) 'Physical and sensory characteristics of Ready-To-Eat food prepared from finger millet based composite mixer by extrusion', *Agricultural Engineering*

International: CIGR Journal, 15(1), pp. 100–105.

Siswanto *et al.* (2014) *Survei Konsumsi Makanan Individu Indonesia 2014*, *Badan Penelitian dan Pengembangan Kesehatan RI*. Jakarta: Kementerian Kesehatan Republik Indonesia.