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THE UTILIZATION OF LOCAL FOOD MATERIALS IN FOOD BARS FOR DISASTER RESILIENCE AMIDST MODERN TRANSFORMATION

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ABSTRACT

Indonesia is a country that is prone to natural disasters. Landslide disaster are the 3rd highest disaster intensitas in Indonesia that happened in 2020.. According to data from the National Disaster Management Agency (BNPB), Indonesia experienced 12,254 disasters during the period 2015 to 2019. Various kinds of disasters such as floods, tsunamis, earthquakes, volcanic eruptions occur and usually have impacts that make it difficult for people to get aid, one of which is food. Providing emergency food easy to consume and contains high calories is important to do and to increase the nation's food security. The development of emergency food based on local products has been widely explored. Method The study is a literature review with the keywords food resilient, landslides, emergency food product, food bars in several databases such as proquest, science direct, pubmed, and google scholar.Result The study aimed to review food bars as food resilient using lokal food ingredients during landslide disaster.

KEYWORDS *Food Resilient, Landslides, Emergency Food Product, Food Bars*

INTRODUCTION

Disasters result in damage to various access points and food sources, making it somewhat difficult to find food with good nutritional content (Mariam, 2019). Disasters also isolate certain areas, making food an urgent necessity that must be met immediately. Indonesia is the world's largest archipelago, consisting of 17,504 islands. Indonesia is vulnerable to hydrometeorological disasters such as floods, droughts, erosion, landslides, and forest fires. Data from the National Disaster

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Management Agency (BNPB) shows that more than 78% of disasters that occurred between 2005-2015 were hydrometeorological (BNPB, 2016).

Landslides were the third most frequent disaster in Indonesia in 2020. This disaster can have significant impacts (Rizana & Alhadi, 2021). The impacts include damage to buildings, infrastructure, disruption of transportation routes, and a significant number of casualties. Landslides are one of the deadliest disasters in the country. Below is a summary of landslide disasters that resulted in numerous casualties in Indonesia:

Table 1. Summary of Landslide Conditions in Indonesia: (Kemenkes, 2016)

No	Date of Disaster	Location	Disaster Impact	Number of Victims
1	November 3, 2003	Bukit Selawang Village, Bahorok Subdistrict, Langkat Regency, North Sumatra	Landslide and flood	90 people died, hundreds injured (from minor to severe)
2	February 23, 2010	Tenjolaya Village, Pasirjambu Subdistrict, Bandung Regency, West Java	Landslide buried 50 workers' barracks, a tea processing factory, a sports hall, a cooperative, a subsidiary health center, and a mosque	33 people died, 17 injured, 11 missing, and 936 people evacuated
3	July 23, 2010	Waiteba Hamlet, Wamsisi Subdistrict, South Buru, Maluku	Landslide buried residents' homes	18 residents died buried by the landslide
4	January 27, 2013	Kampung Dukuh Nagari Village, Tanjung Sani, Tanjung Mutiara Subdistrict, Agam Regency, West Sumatra	15 houses buried by the landslide	25 people buried by the landslide
5	December 12, 2014	Jemblung Hamlet, Sampang Village, Karangkobar Subdistrict, Banjarnegara Regency, Central Java Province	Landslide buried dozens of houses and Banjarnegara-Pekalongan road	108 lives buried by the landslide, 125 people died

Landslides limit access to adequate food through infrastructure damage related to livelihoods. Landslides directly damage crops, livestock, and housing at the local level. This impacts food insecurity, malnutrition, and chronic hunger. Low food diversity also often occurs among non-agricultural disaster-affected communities compared to agricultural ones. Food security in disaster conditions is closely related to many aspects. At the national or international level, supply chains and trade face severe challenges (Cisneros-García et al., 2023; Nahalomo et al., 2023; Singleton et al., 2022).

In disaster conditions, food that can be consumed immediately, is practical, and nutritious is needed. An alternative food that can be provided is emergency food. According to Food Law No. 18 of 2012, an emergency is a major natural disaster event that occurs beyond human ability to prevent or avoid even though it can be predicted. Essentially, emergency food products can be produced from any commodity. Ideally, emergency food is produced from ingredients that can be sourced domestically to create food security. Indonesia produces various types of food crops as sources of carbohydrates such as sorghum, sago, corn, sweet potatoes, cassava, and others. Most local food ingredients are used as raw materials for making flour but have not been maximally utilized (Apdita et al., 2023; Ekafitri & Faradilla, 2011). Based on this, it is important to understand how local food ingredients can be used in food bars to ensure food security during landslides.

RESEARCH METHOD

The method used in this research is a literature review study, which involves analyzing selected literature from various sources to form conclusions and generate new ideas. The literature sources consist of primary data in the form of national and international journals from the last 10 years (2014-2024). Data was searched using the Boolean search method. The journals used in this study discuss topics with keywords "disaster, landslide, food security, local food ingredients, and food bars." A total of 20 international journals and 13 national journals were obtained based on these keywords through searches using Google Scholar, NCBI, PubMed, and ProQuest. The screening criteria applied included full-text journal articles in English and/or Indonesian and open access types. Eight journals on the topic of food bars were summarized in the following table of international and national journal analysis.

Table 2. Analysis of International and National Journals

Journal	Authors/Year	Journal Number, Volume	Emergency Food Ingredients	Nutritional Content	Research Findings
Development of food products from local raw materials for disaster emergency buffer stock in Tasikmalaya Regency, West Java	Sumarto and Amalia Solihah Tajrifani, 2020 (A. D. Sumarto et al., 2016)	Disaster Management Dialogue Journal, Vol 11, No 2	- Flour - Snake fruit (Salak) - Manonjaya - Peanut flour - Kepok banana flour	- Protein - Fat - Carbohydrate	To develop emergency food products as buffer stock using local raw materials from Tasikmalaya Regency
Formulation of emergency food in the form of food bars based on white millet flour	Raden Baskara Katri Anandito, Siswanti,	Journal of Agritech, Vol 36, No 1	- White millet - Red beans	- Protein - Fat - Carbohydrate	The most accepted food bar formula had specific composition resulting in: energy 233.80 kcal/bar;

(Panicum miliaceum L.) and red bean flour (Phaseolus vulgaris L.)	Edhi Nurhartadi, Rini Hapsar, 2016 (Aprianty et al., 2018)				protein 10.99%/bar; fat 35.39%/bar
Formulation of food bar from rice bran flour and corn flour as emergency food	Inggita Kusumastuty, Laily Fandianty Ningsih, Ariek Rio Julia, 2015 (Luthfiyanti et al., 2011)	Indonesian Journal of Human Nutrition, E-ISSN 2355-3987	- Rice bran flour - Corn flour	- Energy 232.43 calories - Protein 6.35 grams/50 grams - Fat 9.41 grams/50 grams - Carbohydrate 30.58 grams/50 grams	Food bar formulation from rice bran flour and corn flour showed no difference in nutritional quality parameters
Analysis of acceptability and nutritional value of food bars with a mix of Bogor taro flour (Colocasia esculenta (L) Schott), red beans (Phaseolus vulgaris L.), and pumpkin (Cucurbita maxima) as emergency food	Della Juita, Vitria Melani, Eddy Poerwoto Boedijono, Putri Ronitawati, Mertien Sapang, 2017	Jurnal Esa Unggul, XIX, VI	- Bogor taro flour - Red beans - Pumpkin	- Energy 273.5 calories - Protein 34.15% - Fat 40.54%	Differences in acceptability of food bar formulations. Formula D2 had energy 273.5 calories, protein 14.3%, fat 34.15%, and carbohydrate 40.54%
Physicochemical properties of sago flour food bars fortified with sweet potato flour and eel fish flour	Rasulu, H., Rodianawati, I., Hasbullah, Albaar, N., Um Elekhoa, I., Kamaluddin, A.K., 2021 (Rasulu et al., 2021)	Journal of Earth and Environmental Science, Vol 709; DOI: 10.1088/1755-1315/709/1/012053	- Sago flour - Sweet potato - Eel fish flour	- Protein 0.37-3.64% - Fat 17.36%-18.10% - Carbohydrate 70.91-75.58%	Scanning electron microscopy (SEM) showed starch granules had large fibers and non-uniform density. Sago and sweet potato flour with 5% eel fish flour fortification recommended for further development. Additional nutrients like vitamins and minerals needed.

Broccoli-Soybean-Mangrove Food bar as an emergency food for older people during natural disasters	Fatmah, F., Utomo, S.W., Lestari, F., 2021 (Fatmah et al., 2021)	International Journal of Environmental Research and Public Health, Vol 18, No 3686. DOI: 10.3390/ijerph18073686	- Broccoli - Soybean - Mangrove	- Energy 291.9 kcal - Protein 6.1 g - Fat 15.6 g - Carbohydrate 31.1 g	Broccoli-soybean-mangrove food bar can improve nutritional status (body weight and macronutrients) of elderly disaster victims
Physicochemical characteristics of food bar from composite flour (modified breadfruit, purple sweet potato, mocaf, and saga seeds)	Fadhlan, A., Nurminah, M., Karo, T., 2021 (Fadhlan et al., 2021)	Journal of Earth and Environmental Science, Vol 782. DOI: 10.1088/1755-1315/782/3/032081	- Modified breadfruit - Purple sweet potato - Mocaf (modified cassava flour) - Saga seeds	- Protein 8.51%-15.55% - Fat 12.36%-14.3%	Differences in sensory test results, color, and taste among treatments
Sensory characteristics and nutritional value of food bar with pumpkin seed flour substitution	Amalia, M.R., Nuryani, Santoso, B. (Amalia et al., 2022)	Scientific Health Journal, Vol 4, No 1. DOI: 10.36590/jika.v4i1.271	- Pumpkin fruit and seeds	- Protein 18.65 g - Fat 22.48 g - Carbohydrate 42.15 g	Significant differences in sensory test results for color, taste, and aroma across four food bar formulas

RESULT AND DISCUSSION

Food Security During Disasters

Disasters that frequently occur spontaneously can disrupt community activities, potentially hindering development and food security. This contradicts the goals of the Sustainable Development Goals (SDGs), specifically goal number 2, which is related to food security: "ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture."

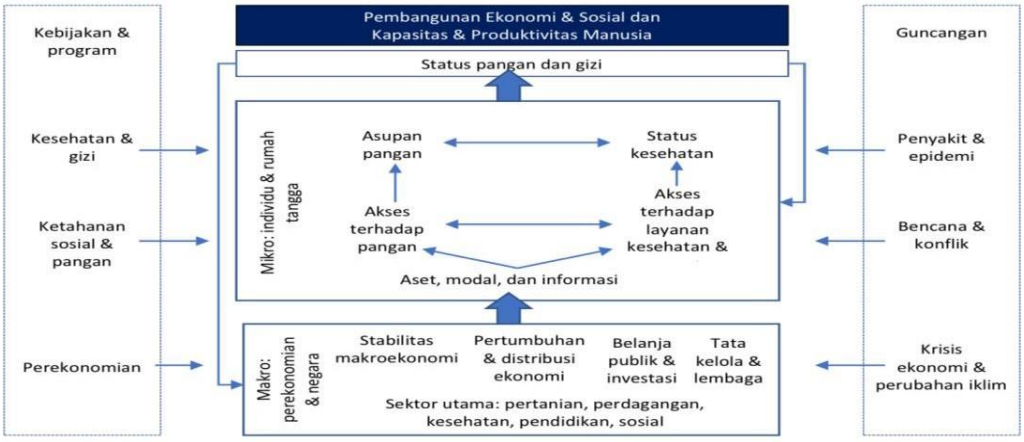
In disaster situations, there is a need for an emergency food supply framework. In sudden and unpredictable disaster conditions, the emergency food needs of the affected community change. Therefore, it is necessary to divide the emergency food supply process into several stages: initial, middle, and final, according to a comprehensive emergency management perspective. The provision of food by the government, based on the supply chain and emergency management perspective, includes eight domains: emergency food demand, emergency food supply, emergency food collection, emergency food supervision, emergency food transportation, emergency food distribution, emergency food supply information systems, and policy responses to emergencies (Liu et al., 2021).

Food security is the availability of food for humanity that is sufficiently guaranteed for every individual at all times according to their needs so that they can

remain healthy and active. According to the World Health Organization (WHO), there are four main components of food security: availability, access, utilization, and stability. These four aspects must be fulfilled to achieve food security in disaster conditions (Kafi et al., 2023; Nahalomo et al., 2023; Sioen et al., 2017; Tambur & Saputra, 2021).

In the food security and nutrition analysis conducted by the Food Policy Research Institute (IFRI) and the World Food Programme (WFP), the perspective on food security and nutrition encompasses not only individual and household food intake and access but also macroeconomic conditions, various policies and programs, and obstacles such as disaster conditions and climate change that can affect individual and household food intake and access (Arif et al., 2020).

Table 2. Strategic Review Analysis of Food Security and Nutrition in Indonesia



(Source: Arif *et al*, 2020)

In the event of a disaster, the National Agency for Disaster Management (BNPB) develops various ready-to-eat foods for food aid, distributed to various regions as buffer stock, including canned food, fried rice, mixed rice, and chicken curry. The Regional Disaster Management Agency (BPBD) allocates funds from the Regional Budget (APBD) to create food reserves such as instant noodles and biscuits (Lloyd et al., 2024). Emergency food during a disaster must meet two categories: nutritional considerations and functional aspects. The nutritional considerations category includes several subcategories, such as special food formulas for emergencies and food diversity. The functional food category includes packaging, cultural norms, and price (Ainehvand et al., 2019).

Food Bars as Emergency Food

Food bars are products made from a variety of dry ingredients in a solid form, combining various dry materials such as cereals, nuts, and dried fruits. These are mixed together with binders such as syrup, nougat, caramel, or chocolate, forming a more complex dough. Food bars are one of the processed emergency food products being developed based on local food ingredients to meet nutritional needs

during emergencies. The binders used in food bars help form the bars and contribute to their low water activity (WA), which inhibits microbial growth and extends shelf life. The bar shape of food bars facilitates packaging and space-saving, making distribution more efficient (Amalia et al., 2022; Bemfeito et al., 2021; Dwijayanti, 2016; Pandin et al., 2022; Purnama et al., 2019).

According to the US Agency for International Development (USAID) (2021), food bars can be considered an emergency food product because they are safe to consume, easy to distribute, have acceptable sensory quality, and are nutritionally adequate. The nutritional content of food bars is supported by the mixing process of the ingredients used.

According to the Food Law No. 7 of 1996, an emergency is a natural disaster, severe famine, or other events beyond human control to prevent or avoid, even if they can be predicted. Emergency Food Products (EFP) are foods with high energy and nutrient content for natural disaster victims, intended for immediate consumption during emergencies for 3-7 days.

The development of emergency food must consider the following factors (Research & Ration, 2002):

1. Safety;
2. Acceptable colour, aroma, texture, and appearance;
3. Ease of distribution;
4. Ease of use;
5. Complete nutrition.

The nutritional content of recommended ingredients includes (Zoumas et al., 2002):

1. Carbohydrate sources: wheat flour, corn, oats, and rice flour.
2. Protein sources: legume products such as protein concentrates or isolates; milk powder such as casein and its derivatives; the combination of cereal base and protein must have an amino acid score ≥ 1.0.
3. Fat sources: partially hydrogenated soybean oil, canola oil, sunflower oil.
4. Sugars: glucose, high fructose corn syrup, maltodextrin.
5. Vitamins and minerals can also be added to enhance the product profile.

Developing food bars using local food ingredients can significantly contribute to food sustainability, especially in emergency situations (Fadhlan et al., 2021; Puspita et al., 2019). Emergency food products must meet human energy needs of 2100 kcal (Mariam, 2019). Some important implications of using local food ingredients as emergency food include:

1. **Food Independence:** Reducing dependence on imported materials and strengthening local food security.
2. **Support for Local Farmers:** Increasing demand for local agricultural products, providing economic benefits to farmers.
3. **Diverse Nutrition:** Utilizing the diversity of local ingredients allows for the production of food bars with more complete nutritional content.
4. **Food Waste Reduction:** By using local food ingredients that may not be optimally utilized, food bars can help reduce food waste.

Developing food bars from local food ingredients is an innovative and sustainable strategy to support food sustainability. By integrating food processing

technology, nutritional understanding, and appreciation of local wisdom, we can build a more resilient food system in the face of disasters and food crises.

Nutritional Profile of Food Bars

Food bars made from local food ingredients not only support environmental sustainability and the local economy but also provide a unique nutritional profile tailored to the tastes and nutritional needs of the local community. Developing products that consider both nutritional and sustainability aspects is crucial for strengthening food security and public health.

The Recommended Dietary Allowance (RDA) is the average daily intake level sufficient to meet the nutritional needs of individuals based on age, gender, and energy requirements. According to the Regulation of the Minister of Health of the Republic of Indonesia (2019), each person has specific energy needs based on their age and gender.

Generally, food bars are designed to be calorie-dense and nutritious, consisting of a combination of carbohydrates, proteins, fats, and vitamins and minerals. The assumption is that victims will consume only this one type of food product in a day, with no other food sources available. The product must meet the energy requirement of 2100 kcal and can be divided into nine bars, each equivalent to two servings, with each serving providing 116 kcal or about 233-250 kcal per bar.

Based on the summary of the journal analysis, it is found that the nutritional and energy content of all the food bar studies generally meet emergency food standards. Each 50-gram food bar contains 233-235 kcal, meaning that nine food bars can meet the daily energy needs of the consumer. It is assumed that the consumer or disaster victim will consume only these food bars for one day, without consuming other foods. This energy-dense and nutritious product is crucial when other food sources are not yet available at the disaster site.

A food bar contains macronutrients, namely carbohydrates, proteins, and fats. Carbohydrates are the primary energy source in food bars. Common carbohydrate sources include natural sugars from fruits, honey, agave syrup, and complex carbohydrates from grains like oats, quinoa, and rice. Complex carbohydrates provide longer and more stable energy, while natural sugars offer a quick energy boost. The second important macronutrient is protein, which is vital for muscle recovery and building. Protein sources in food bars can come from nuts (such as peanuts, almonds, and soybeans), grains, and isolated whey or plant proteins. The third macronutrient is fat, generally derived from natural sources like nuts, seeds, and vegetable oils. Fats provide longer-lasting satiety and are essential for the absorption of certain vitamins. Monounsaturated and polyunsaturated fats found in nuts and seeds are considered healthier than saturated fats. The addition of local foods can enhance the nutritional variety of a food bar. Vitamins and minerals from fruits complement the micronutrients in a food bar.

Potential of Local Food-Based Food Bars

Food bars have significant market potential, especially in the context of emergency preparedness and response. The government, non-governmental

organizations, and individuals aware of the importance of emergency preparedness are the primary target markets. Product development can focus on improving taste quality, reducing production costs, and adjusting nutrition to meet the specific needs of various population groups.

Several regions in Indonesia have food commodities that can be utilized as emergency food during disasters. Tasikmalaya, for instance, has a local food potential in Manonjaya salak (snake fruit), a distinctive commodity (A. D. Sumarto et al., 2016). This commodity can contribute carbohydrates and energy to the emergency food products to be developed (Aprianty et al., 2018; Y. L. Sumarto et al., 2018). Other local food sources that can be used as raw materials for emergency food include peanuts and kepok bananas. Peanuts have a relatively high protein and fat content (Directorate of Community Nutrition, 2018). Kepok bananas can be an additional source of energy, carbohydrates, and minerals in the emergency food products to be made (Directorate of Community Nutrition, 2018).

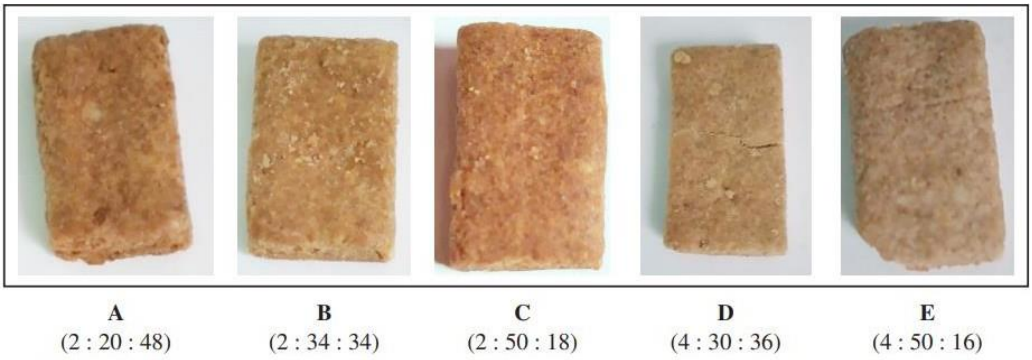


Figure 1. Manonjaya salak flour food bar: peanut flour: kapok banana flour (Sumarto &; Tajrifani, 2020).

Challenges in Developing Emergency Food

Emergency food development faces various obstacles. This must be addressed to ensure the availability of nutritious and easily stored food in emergency situations. Here are some of the main obstacles in emergency food development: (1) Meeting Nutritional Needs. Emergency food must be able to meet the nutritional needs needed by the body, according to age and gender, in this case protein, carbohydrates, fats, vitamins, and minerals. Providing balanced food in limited conditions (disasters) is often a challenge. (2) Stability and Shelf Life. Emergency food must have a long and stable shelf life under a wide range of environmental conditions, including extreme temperature changes and high humidity. This demands the use of advanced preservation and packaging technology. In disaster conditions, such technology is difficult to do. (3) Food Safety. Food safety is a top priority. Emergency food must be free of microbiological, chemical, and physical contaminants that can be harmful to health. (5) Creativity in emergency food development. The development of emergency food based on local Indonesian raw materials into various processed foods is sometimes unacceptable to victims of natural disasters. Lack of food diversification

and reliance on one or a few specific types of pagans can also increase the risk of food shortages during crises. (6) Acceptance by Consumers. Emergency food must be acceptable in terms of taste, aroma, and texture by different groups of people who may have diverse food preferences and boundaries. The rice consumption habits of Indonesian people make it difficult to receive food products other than rice. This fact demands education to the public that rice as a source of carbohydrates can be replaced with other commodities such as corn, cassava, wheat, sweet potatoes, sorghum, sago, hotong, arrowroot, and others that are widely found spreading in various parts of Indonesia. (7) Availability and Sustainability of Resources. Emergency food development shall consider the availability and sustainability of resources, including raw materials and energy used in production. (8) Production Costs. High production costs can be an obstacle, especially in providing large amounts of emergency food needed during disasters or other emergency situations. (9) Distribution and Logistics. Distributing emergency food to affected areas is often difficult due to infrastructure damage or other logistical constraints.

Countermeasures Strategy

To overcome obstacles in emergency food development, several strategies can be applied, such as: (1) Technological innovation and product development. Development of preservation technologies such as freeze drying and vacuum packaging to extend shelf life. (2) Optimization of nutrition, taste, and form of emergency food. Further research needs to be done to create formulations with more complex macro and micronutrient nutrients according to age and gender, as well as taste textures that are acceptable to the Indonesian people. (3) Community and stakeholder participation. Conducting educational socialization on the importance of emergency food preparation and proper storage methods. Drying stakeholders can also be involved for the development and distribution process.

CONCLUSION

Indonesia is an area that is prone to disasters both natural, social and technological disasters. Indonesia has a geographical condition that is very prone to disasters. The existence of emergency food consumed for disaster victims can overcome the problem of hunger and malnutrition as long as public kitchens cannot be used optimally. Emergency food that can be consumed immediately such as *food bars* with sufficient nutritional value for the body's needs will greatly help victims after natural disasters that currently often hit Indonesia. The superiority of *food bars* whose manufacture can be combined using local local food ingredients can be a superior value in itself as emergency food when a disaster occurs.

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