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LITERATURE REVIEW
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Potential Raw Materials for Emergency Food Products in Southeast Asia

Potensi Bahan Baku Produk Pangan Darurat di Asia Tenggara

Nina Resti[1], Fitriyono Ayustaningwarno[2,3], Gemala Anjani[2,3], Ahmad Syauqy[2,3], Nuryanto Nuryanto[2,3], Ekowati Chasanah[4], Endang Yuli Purwani[5], Fan Zhu[6], Diana Nur Afifah[2,3,7]*

[1]Doctoral Study Program of Medical and Health Sciences, Universitas Diponegoro, Semarang, Indonesia
[2]Departement of Nutrition Science, Faculty of Medicine, Diponegoro University, Semarang, Indonesia
[3]Center of Nutrition Research (CENURE), Faculty of Medicine, Diponegoro University, Semarang, Indonesia
[4]Research Center for Marine and Inland Bioproducts, Research Organization (RO) of Earth and Maritime, National Research and Innovation Agency (BRIN), North Lombok, Indonesia
[5]Research Center for Agroindustry, National Research and Innovation Agency (BRIN), Cibinong, Indonesia
[6]School of Chemical Science, The University of Auckland, Auckland, New Zealand
[7]SDGs Center, Diponegoro University, Semarang, Indonesia

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Correspondent:
Diana Nur Afifah
d.nurafifah.dna@fk.undip.ac.id

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ABSTRACT

Background: The occurrence of natural disaster in Southeast Asia due to its location along the Asia Pacific Ring of Fire is high. The consequences of the natural disasters on various aspects, like that social, financial, and food security can be large. This initiative promotes the development of emergency food products to address the daily nutritional requirements of natural disaster victims, ensuring their survival. The specified standard is 2,100 kcal/day, emphasizing a balanced distribution of macronutrients (40-50% carbohydrates, 35-45% fat, and 10-15% protein).
Objectives: This literature review explored the potential raw materials for emergency food products in the Southeast Asia.
Methods: This review utilized databases from Google Scholar and PubMed websites, employing specific keywords for each identified category to gather the latest literature. The literature obtained was 10 article.
Discussions: This review explores solutions to the challenges posed by natural disasters in Southeast Asia, focusing on the potential use of locally available resources as raw materials for emergency food products. Raw materials, including Fish Hydrolyzate Protein (FPH), offer numerous benefits due to their bioactive contents, such as antioxidant, antihyperglycemic, antimicrobial, antitumor, ACE inhibitor activity, calcium binding, and anticoagulant properties, particularly beneficial for vulnerable groups. The review also delves into the elimination of raw materials, the nutritional content of various types of emergency food products, and innovative solutions for emergency food products in Southeast Asia.
Conclusions: The potential raw materials identified have the capability to yield innovative emergency food products with both excellent physicochemical quality and health potential.

INTRODUCTION

Natural disasters are events of natural origin that devastate various aspects of society, financial security, and access to food[1]. Countries in the Southeast Asia region can experience natural disasters due to their geographic location, which spans tectonic plate boundaries and is situated along the Pacific Ring of Fire[2]. Worldwide, natural disasters affect approximately 60,000 people per year over a decade, contributing to 0.1% of total deaths. From 2003 until 2013, approximately 2.500.000 people across 67 developing nations were affected[3]. Southeast Asia experiences a high frequency of disasters; from 1980 to 2016, there were approximately 7.723 cases of natural disasters, representing 64.97% of the total disasters[4]. In Indonesia, natural disasters from 2008 to 2018 amounted to 3.406 cases, including floods, landslides, earthquakes, and tsunamis[5].

Natural disasters in the Southeast Asia region, such as Indonesia is earthquake, flood, and landslide, have resulted in numerous casualties and significant damage to infrastructure[6,7]. Furthermore, natural disasters in Malaysia including floods, storms, epidemics, and extreme weather, causing damage to the agriculture and food sectors, with losses reaching US 8.48 million[8].

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Similar natural disaster in Vietnam such as flood and landslide, where losses in the agricultural sector were estimated to be 4.57% of GDP[8]. One of the landslides in Vietnam in Cop hamlet, Huong Phung commune, Huong Hoa district, Quang Tri Province which had a big impact not only in terms of the economy, damage to buildings, even claimed the lives of 22 soldiers[9].

Disasters make evacuees need emergency food product to meet people everyday nutritional needs, providing at least 2,100 kcal/day[10]. These emergency foodp products are not limited to natural disasters but also serve special conditions like war, famine, earthquakes, fires, landslides, or pandemics[10]. The nutritional requirements for emergency food products typically include 40-50% carbohydrates, 35-45% fat, and 10-15% protein[11]. The water content of the food products should not exceed 9.5%, and these products should be easy to distribute, often through packaging methods like the use of retort pouches.

Emergency food is essential during crisis management in situations like natural disasters or war[12]. The reality of emergency conditions often involves limited access, such as power outages and road closures, highlighting the interdependence of infrastructure during disasters[13]. Effective planning and stockpiling of non-perishable, nutrient-dense emergency food can significantly enhance survival rates and reduce the burden on relief efforts in such critical scenarios.

Vulnerable groups require special attention during natural disasters and food assistance programs[14]. Among these groups, children, pregnant women, breastfeeding mothers, and the elderly are particularly susceptible to both physical and psychological health problems during natural disasters[15]. Factors contributing to the vulnerability of the elderly include limited access to elderly food, an heightened risk of degenerative and infectious diseases, psychosocial strain, and poverty[16]. In areas impacted by disasters, the elderly often face issues related to inadequate nutrition, characterized by low energy, carbohydrate, protein, and fat intake[16]. Therefore, the elderly require smaller but nutrient-dense and easily digestible food portions[17].

Factors contributing to malnutrition in the elderly include reduced appetite, decreased food digestion capacity, limited resources for buying and preparing meals, declining health, and psychological factors such as isolation and depression, that all of them ultimately impact older people's nutritional status[16]. One approach to improving the nutritional status of the elderly in disaster-affected areas is to provide energy-dense food in the forms of meals, snacks, and options for home delivery[18,19]. Furthermore, inadequate intake of nutritious food can exacerbate the problem of malnutrition, particularly in children and pregnant women, increasing the risk of infections[20].

The effect of natural disasters in Southeast Asia worsens the mental and physical health of victims[21]. Other impacts are often associated with an individual's health status or disruptions in nutrition and food security due to limited food resources, especially among vulnerable groups[22]. Mitigating malnutrition and improving the health of the elderly involves innovation in prepared food products that are nutrient-dense and offer health benefits[23]. Eat less food and the incidence of infections can lead to immune disorders, particularly in vulnerable populations, often accompanied by metabolic diseases[24]. Food products developed to by enhancing the immune system, rich in vitamins A, D, E, C, dietary fiber, zinc (Zn), selenium (Se), and iron[25,26]. World Health Organization (WHO) recommend that emergency food products that are efficient, convenient, easy to distribute, have a long shelf life, and meet the daily energy needs of around 2.100 calories per individual.

After a disaster occurs, food insecurity arises, food insecurity is a condition in which there is insufficient food available, leading to feelings of anxiety or depression in individuals[27]. Food insecurity has an impact on chronic health, leading to a decrease in the immune system, both directly and indirectly[28]. Low food security and disruptions in the quantity and quality of the diet can exacerbate the body's immune system[29]. The body will initiate an alert response, prompting the immune system to react more actively, particularly in vulnerable groups[30]. Increased immune activity is accompanied by a rise in metabolic rate, necessitating more food as an energy source, substrate for biosynthesis, and a source of regulatory molecules[30]. Hence, providing assistance with emergency food products, whether sourced locally is essential to meet the nutritional needs of the community and prevent the deterioration of the condition of natural disaster victims.

Some recent papers dealt with different aspects of emergency food product. Reviews about emergency food are rare, limited to discussing emergency food security interventions published by the Humanitarian Practice Network (HPN) by Daniel et al[31]. Product emergency food innovation in cookies from banana flour, soy flour, and Moringa leaf flour for study was to evaluate the nutritional compound, hardness, and organoleptic test. The recent original riset Hasan, et al.[32]. There is only original research that discusses the nutritional value of products, such as broccoli-soybean-mangrove food bar by fatmah et al. Meanwhile, there are no reviews that offer potential ingredients for emergency food.

Based on this existing background information, this review aims to identify local food ingredients suitable for emergency consumption, focusing on nutrient-dense options with bioactive components that promote health. A key focus is the innovative potential of fish protein hydrolysate as a raw material for emergency food products. The discussion encompasses food products in Southeast Asia, the identification of raw materials, nutritional properties of various emergency food types, and innovative solutions for emergency food product development in the region.

METHODS

This literature review explores the basic concepts of potential raw materials for emergency food products in Southeast Asia and their utilization in Fish Protein Hydrolysate (FPH) products. A detailed explanation regarding the databases used in preparing the literature review, namely Pubmed and DOAJ, searches for articles from 2015-2023. Journal searches use keywords and Boolean operators (AND, OR NOT, or AND NOT) which are used to expand or specify the search, making it easier to

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determine the journal to use. The keywords used in the search are *"(((snack bar) AND (food bar)) OR (military food product)) AND (emergency food product)"; "((raw materials) AND (emergency product)) AND (southeast asia)"; "(((fish protein hydrolysate) OR (hidrolizat protein ikan)) AND (potential)".* Researchers found 635 journals originating from keywords and Boolean through the Pubmed and DOAJ databases according to these keywords. The research journals were then screened for duplicates, a total of 484 journals from 2015 and below were selected. The assessment of the title and abstract according to the title totaled 113 journals. Then the journals were selected based on the suitability aspect of the results of appropriate articles related to emergency food products, potential Fish Hydrolyzate Protein (FPH), potential raw in Southeast Asia, and results not about policies during disasters regarding the provision of emergency food products and expenditures during natural disasters were excluded, 28 journals were obtained. Furthermore, 10 journals were selected according to the problem formulation and objectives, which were then reviewed and the steps are presented in Diagram 1.

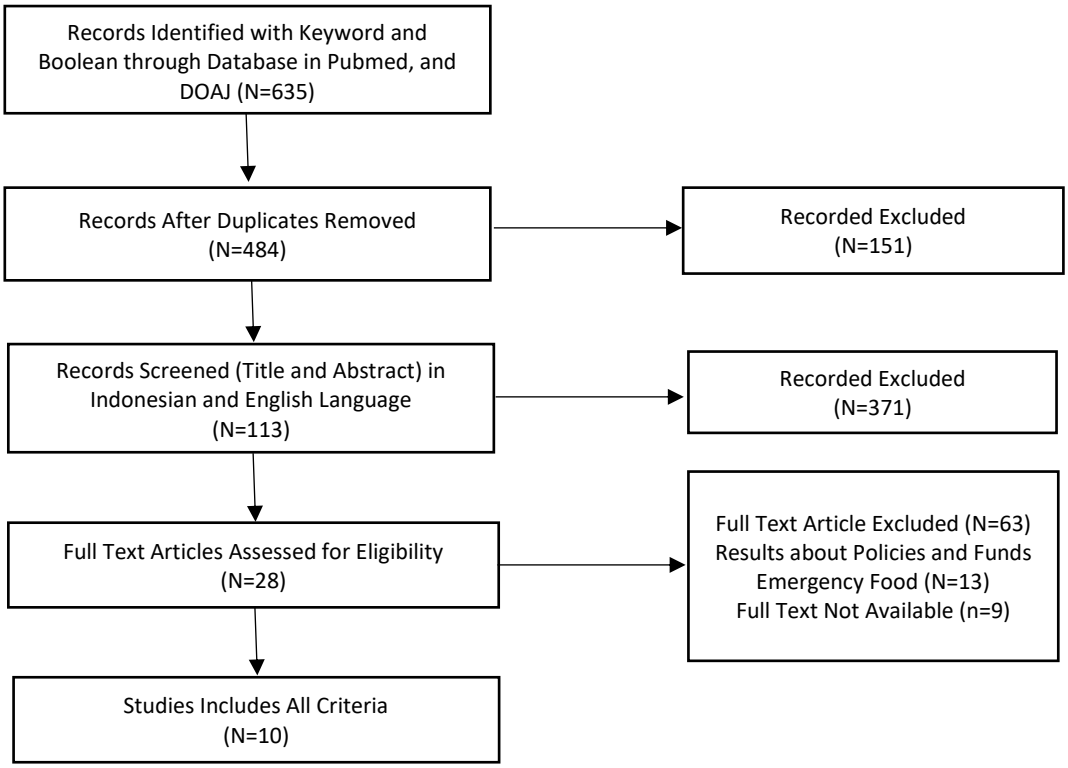

Diagram 1. PRISMA Flow Diagram in this Literature Review

DISCUSSIONS

This review will discuss several points regarding emergency food. This review including products bar and nutritional content, as well as the bioactive potential of local raw materials in Southeast Asia. Apart from that, the discussion began with an explanation of the nutritional requirements for emergency food products, including energy, protein, fat, and carbohydrates.

Energy is needed by the body so that all metabolic reactions that characterize living things can occur. The energy used by living creatures or consumed or released by living creatures is expressed as kcal[33]. The recommended energy content in emergency food must be 2,100 kcal with an energy density of between 233 - 250 kcal per 50 g. Energy is needed and sought in high amounts in the development of emergency food products using linear programming (LP) models[35]. In addition to family meals, additional food should be supplied, especially for children who are malnourished. This food should take the form of snacks with an energy value of 350-400 kcal and 15-20 g of protein per day[36].

Protein is a macronutrient as a source of amino acids. Proteins have many function, including structural components; biocatalysts, in the form of enzymes; antibodies; lubricants; messengers, in the form of hormones and cytokines, receptors; and transporters[37]. The recommended protein content in emergency food is 10-15% of total energy. The protein required is high because refugees are susceptible to stress and mental illness during disaster occurs. So, protein is needed to maintain health, physically and mentally[38,39]. Protein in the emergency food should have a minimun PDCAAS (Protein Digestibility-Corrected Amino Acid Score) of at least 1[40]. This score means that, after protein digestion, it provides 100% or more of the required essential amino acids per unit of protein[41].

Fat is a macronutrient that is rich in energy because it produces 9, than twice the energy value of carbohydrates per g. Fat has a function as energy storage, membrane component and substrate for the synthesis of hormones[37]. The recommended fat content in emergency food is 35-45% of total energy with saturated

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fat content of 10% of total energy and PUFA of 7-10 % of total energy[34]. The fat content in emergency food plays a crucial role, serving as a significant source of energy[42]. Paying attention to fat is essential due to its potential to alter the properties of the food, leading to undesirable changes such as rancidity. Moreover, fat can impede the gelatinization process as some of it is absorbed by the granule surfaces, resulting in the formation of a hydrophobic layer around the starch granules[43].

Carbohydrates are main source of energy for humans 4 calories. The recommended carbohydrate content in emergency food is 40-50% of total energy with a minimum total sugar content 7-11.7 g (12-20% of total energy) and a maximum of 14.7 g (25% of total energy)[34]. Explanation of the product bar requirements will be presented in table 1.

Table 1. Requirements of Product Bar According to USDA and Indonesian Standards (SNI 01-4216-1996)

Observation	USDA[44]	Indonesian (SNI 01-4216-1996)[45]
Moisture Content (%)	11.26	-
Fat Level (%)	10.91	1.4-14
Protein (%)	9.3	25-50
Calorie Value (kcal)	120.93	120
Hardness Test (gF)	-	-

Bar Products and Military Food Product for Emergency Situation

Food bars are indeed a type of food product that comes in a solid form. They are typically designed to be convenient, portable, and have a relatively long shelf life[46]. Food bars can vary in terms of their ingredients and nutritional content, but they are generally created to provide a convenient source of energy and nutrients[47]. Food bars, as a type of emergency food, offer the advantage of having a low cost, with extended storage time[48].

Food bars are typically made by combining various ingredients, such as oats, nuts, seeds, dried fruits, protein sources (like whey or plant-based proteins), sweeteners, and flavorings[49]. They may also include vitamins and minerals to enhance their nutritional value[50]. While food bars can be a convenient option for on-the-go snacking or as a supplement to your diet, it's essential to read the nutrition labels to understand their content and ensure they meet your specific dietary needs and preferences[51]. Additionally, it's advisable to incorporate a variety of whole foods in your diet to ensure a well-rounded intake of nutrients[52].

Snack bars can be made emergency food products made using nutrient-enriched ingredients in solid and durable form. These snack bar products are resistant to pressure, possess a lengthy shelf life due to their moderate water content, and can be manufactured using modern or traditional methods[53]. In Indonesia, snack bar products are typically created by combining local food ingredients, like bananas as a source of carbohydrates, and green beans or bean sprouts as a source of protein and fat, which are subsequently processed into flour[53].

Emergency food products are also usually used by soldiers during emergency situations such as war. In Indonesia there are several types of army ration food. The T2SP ration consists of chicken rice with rujak seasoning, black pepper beef rice and fish rice with tomato sauce. The TB1 ration contains biscuits without additional toppings or sweeteners. The FD3 ration is powdered milk mixed with cereal. Army rations are canned or packaged food that is easy for military soldiers to serve and consume in combat areas. Military rations are portable, easy to consume, and can be stored for long periods of time. The rations have been nutritionally measured to maintain soldiers' stamina[54]. In several countries around the world, military food is served, such as forestiere, boiled ham, tomato sauce, candy, biscuits, chocolate chunks, and crackers.

Ingredients for Emergency Food Products in South East Asia

The following are recommendations for several raw materials in table 2 that can serve as basic ingredients for making emergency food products. These materials offer the dual advantage of nutritional value and bioactive content, providing benefits for health. The recommended food ingredients can inspire new product innovations.

Table 2. Ingredients for Emergency Food Products into four essential aspects: Material, Potential, Nutrition, and Bioactive Compounds

Material	Potential	Nutrition (/100 g)	Bioactive Compound	Citation
Sweet Potatoes (Ipomoea Batatas)	Antioxidant, antimicrobial	Energy: 86 - 106 kkal Protein: 1.5 Lipids: 0.1 Carbohydrates: 21,3-22 Dietary fiber: 3 Calcium: 39-63 Iron: 0.6-1.3 Magnesium: 15-37 Vitamin A: 1-1371	Anthocyanins and β-carotene	[55]

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Material	Potential	Nutrition (/100 g)	Bioactive Compound	Citation
Fish Hydrolisate Protein (FPH)	antioxidant, antimicrobial, anti-tumor, ACE inhibitor activity, calcium binding, and anticoagulant properties	Vitamin C: 3 Protein:74% Lipid:1.37% Lysin:79,99% Metionin: 87,17% Thyrosin: 68,29% Tryptophan: 71,53%	Bioactive peptide	56
	Digestible energy and ileal digestible essential amino acids, and could improve nutrient digestibility, immunity, and intestinal health of piglets			57
Mocaf Flour (Cassava Modified Flour)	a gluten-free	Protein: 1.2% Fiber: 0.4%, and 3.4%	-	58
Green Bananas (Musa Paradisiaca L.)	Source of dietary fiber	Starch: 73.6-79.4%	Gallocatechin, α-sitosterol, malic acid	59
	Antimicrobial and antioxidant			60
	Resistance starch	Resistant starch: 47.3 - 54.2%		61
Soy Flour	High protein	Moisture content: 4.80% Ash content: 3.88% Protein content: 41.64% Fat content: 28.44% Carbohydrate: 21.24%	isoflavone	62
	Anti-inflammatory, anticancer, antioxidant	Essential amino acids contents	Flavonoids, phenolic acid, and saponin	63
Full Cream Milk Powder	Physical properties such as: texture, taste, aroma, colour, and viscosity		Caprine and ovine	64
		Fat: 26-29% Protein: 25-27%		65

Ingredients Used for Emergency Food Product

Discussion of ingredients that are often used for emergency food, both in the context of natural disasters and for military needs during war. Ingredients such as sweet potatoes, green bananas, and soybeans are processed into flour and innovatively transformed into bars or cookies. This is because they contain nutritional content and bioactive components that are beneficial for health.

Sweet potatoes *(Ipomoea Batatas L.)* hold promise for the production of emergency food products due to their sensory attributes, including various colors in the flesh and skin, as well as appealing taste and texture for consumers[55]. This potential is particularly significant in the Southeast Asia region, where Asia and Africa contribute to 85% of the world's production of sweet potatoes[66]. Sweet potatoes can be processed into flour, serving as an effective replacement for wheat flour in the production of bakery goods[67]. Additionally, antioxidant extracts from orange sweet potatoes can be used in making noodles[68]. Sweet potatoes are rich in various bioactive components, including steroids, alkaloids, glycosides, terpenoids, saponins, and polyphenols[69]. The dominant bioactive components are phenolic compounds, such as phenolic acids and flavonoids (quercetin, myricetin, lutein, and apigenin)[8,69].

Orange-feshed sweet potato (OFSP) is a root crop largely grown in tropical countries. It is rich in ß-carotene, polyphenols, ascorbic acid, carbohydrates, dietary fbre and essential minerals[70]. Sweet potato plays a crucial role in the traditional diet of many regions all over the world as it contains low fat, high dietary fiber, diversity in term of micronutrients and phytochemicals that are insufficient in wheat. Sweet potato retains distinctive flesh colors, such as purple, yellow, orange, white and cream. From various flesh colors, orange-fleshed sweet potato is a biofortified special type, which is a good source of carotenoids (such as β-carotene) that belong to provitamin A with strong antioxidant capacities due to its conjugated double bonds[71].

Green bananas *(Musa Paradisiaca L.)* are a source of resistant starch that is frequently studied in flour form for its potential nutritional benefits, including reduced starch digestibility[72]. This flour is used in snacks, food bars, and bread to reduce the glycemic response and postprandial insulin levels, making it a helpful tool in managing obesity. Supplementation with green banana flour and branched fructans (agavins) has demonstrated a protective effect due to the prebiotic capacity of this dietary fiber, countering metabolic disorders in obese mice[59].

Many food products now incorporate vegetable protein, such as soybeans, into flour to increase nutritional content. Nutrient content of soybean per 100 g (edible portion) is energy 721 kJ, water 63 g, 18.2 g, fat 9 g, total carbohydrate 8.4 g, fibre 6 g, thiamine 0.1 mg,

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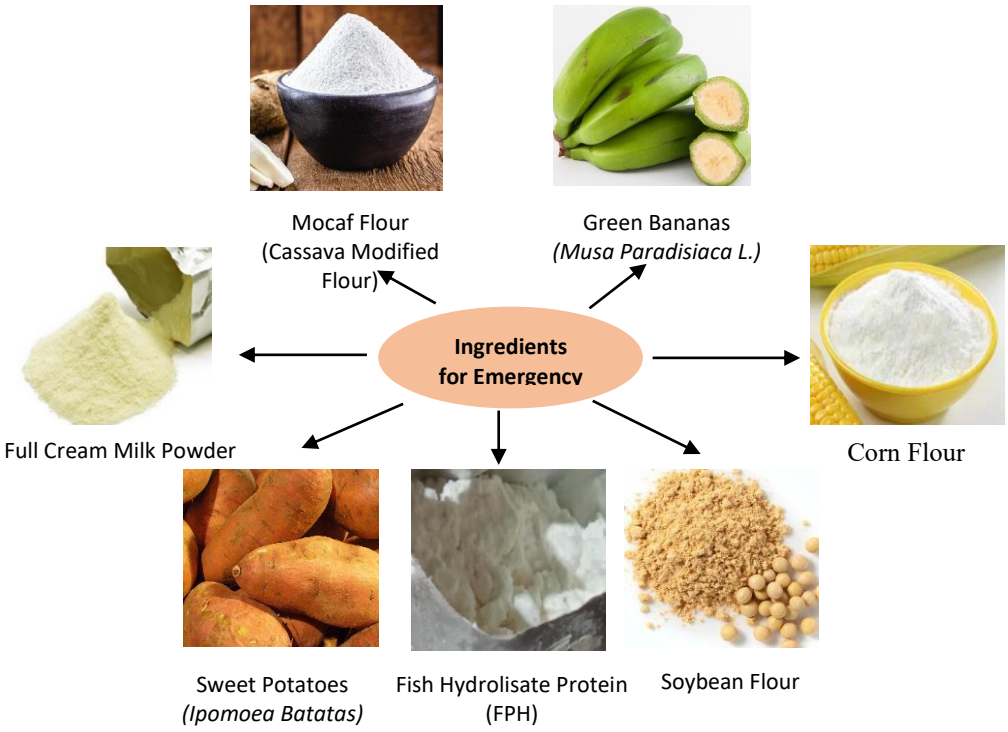
niacin 0.4 mg, calcium 102 mg, and iron 5.1 mg[73]. Raw soy flour contains high levels of potassium (1178.6 mg), calcium (216.77 mg), and magnesium (247 mg) per 100 g[74].

One excellent source of high-quality proteins is milk. All of the essential amino acids are present in reasonable amounts. The main source of saturated fatty acids (10% of fat is myristic) found in milk fat, butter, and cream tends to increase plasma Low-Density Lipoprotein (LDL) cholesterol[75]. One dairy product that is created from whole milk is full cream milk powder for ingredient in emergency food product. Because of its extended shelf life when stored properly, it is frequently used as a long-lasting food product and in emergency preparedness. A good source of protein, calcium, and other vitamins and minerals is full cream milk powder. It's a handy backup in case fresh milk isn't easily accessible because it can be reconstituted by combining it with water to make liquid milk.

Make sure the product you select has the appropriate amount of nutrients. Retaining the fat content of whole milk, full cream milk powder offers dietary fat and other nutrients for emergency food products made from a blend of raw ingredients. Reconstituted full cream milk powder can be drunk as a beverage or used in a multitude of recipes, such as baking and cooking. It is an ingredient in emergency cream soup products because it is a convenient and adaptable solution for long-term food storage in kits or survival situations. In emergency food products and recipes, powdered milk can be used for thickening or adjusting viscosity, among other uses. The following are numerous ingredients that can be used as raw materials for emergency food products, as indicated in images 1.



Images 1. Ingredients for Emergency Food Product

Bioactive Fish Protein Hydrolisate (FPH)

Bioactive protein hydrolysates have the potential to be used in food formulations[76]. When protein hydrolysates are incorporated into food products, they can lead to chemical reactivity effects on various molecules, particularly reducing sugars, which can alter the product's structure[76]. There is also resistance to the loss of bioactivity in fish peptides when subjected to thermal and non-thermal processing techniques in aqueous solutions[77].

Consuming fish products provides health benefits due to their nutritional content, comprising essential amino acids, minerals, vitamins, and polyunsaturated fatty acids[78]. Regrettably, fish protein is often underutilized and discarded as waste[78]. However, this fish waste can be transformed into FPH through an enzymatic hydrolysis process[79]. FPH possesses the potential for various valuable properties, features like calcium binding, anticoagulant, antimicrobial, anti-tumor, and antioxidant activity. This potential makes FPH a highly superior nutritional ingredient for nutraceutical products[79]. Images 2 presents various potential fish hydrolyzate proteins, including antimicrobial, satiating, antioxidant, anorexigenic, anticoagulant, and ACE inhibitor properties.

The antioxidant activity of FPH derived from fish protein has been established as a valuable source of potential antioxidant peptides[80]. The enzymatic hydrolysis process breaks the peptide bonds, rendering the peptides free and active in prooxidant metal ions chelating, absorbing oxygen radicals, and inhibiting lipid peroxidation in the food system[80]. Among the most effective antioxidant peptides are as proline, serine, tyrosine, and valine[80].

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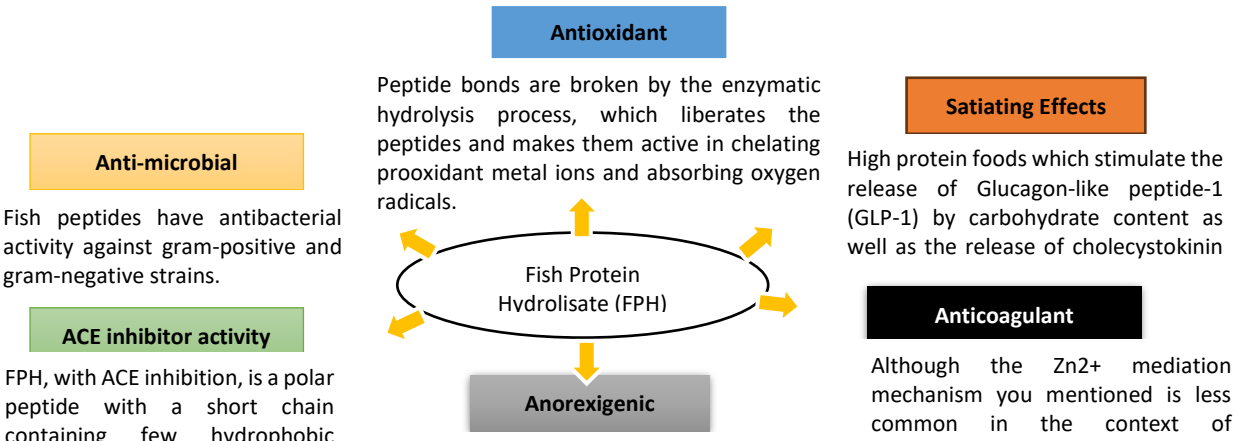

Images 2. Potential of Fish Protein Hydrolisate

Antimicrobial peptides serve as a defence mechanism against microbial intrusion in fish function[79]. These peptides work against of bacteria that are both gram-positive and gram-negative[79]. For instance, this peptides have demonstrated possess antimicrobial qualities with a Minimum Inhibitory Concentration (MIC) of 4.3 mg/ml against Bacillus cereus and Staphylococcus aureus[79]. In the case of anchovy (Septipinna taty) hydrolysate generated with assistance of pepsin, it displayed stronger antibacterial action, with an MIC ranging from 28.38 to 56.75 µg/ml against Proteus vulgaris CICC 20.049, Bacillus megaterium CICC 10.324, Pseudomonas fluorescens CICC 20.225, and Escherichia coli CGMCC 1.1100[81].

Fish peptides' capacity to damage bacterial cell membranes or obstruct bacterial cell functions may be the source of their antibacterial activity. However, depending on the target bacteria and the peptide's structure, different mechanisms may be used by fish peptides to achieve their antibacterial effects. It's crucial to remember that a number of variables, such as the peptides' concentration, source, and the particular bacterial strains under investigation, can affect how effective fish peptides are as antibacterial agents. Furthermore, research on the antibacterial properties of fish peptides is still ongoing, and it is unclear how these compounds might be used in real-world situations like food preservation or medical treatments.

Fish Hydrolyzate Protein (FPH) has the ability to improve glycemic parameters by increasing insulin secretion and inhibiting the activity of the enzyme dipeptidylpeptidase-4 (DPP-4)[82]. Numerous studies have demonstrated FPH's capacity to enhance insulin secretion in vitro[83]. Sources of protein from processed fish include skin, bones, scales, and viscera, which contain bioactive FPH[84]. Hydrolysates produced from oysters (Crassostrea gigas) by Bacillus sp. SM98011 shown antitumor activity. Oysters' polypeptides have a protein content of 45% to 75%, which has been confirmed through a hydrolysis or enzymatic fermentation process[85].

Peptides with ACE-inhibiting activity from fish protein include those from Southern blue whiting, salmon, and tilapia hydrolysates[86]. FPH, with ACE inhibition, is a short-chain polar peptide with a minor proportion of hydrophobic acids, making it a recommended ingredient in nutraceutical products for improving health[87]. The term "ACE inhibition" describes a substance's capacity to inhibit the angiotensin-converting enzyme (ACE), which includes peptides. This inhibition is frequently linked to possible health benefits and may have an impact on blood pressure regulation. The claim that FPH is a short-chain polar peptide with few hydrophobic amino acids implies that FPH may contain peptides with characteristics that make them more soluble in water (polar) and have a limited number of hydrophobic (water-repelling) amino acids in relation to FPH and ACE inhibition. Phosphopeptides from fish bones extracted from hoki (Johnius belengerii) bones using tuna intestinal raw enzymes disintegrate hoki bone matrices and solubilize the calcium for easier digestion[88]. Peptides derived from fish can serve as a dietary supplement to enhance calcium intake[89].

Peptides derived from fish proteins can serve as anticoagulants. For instance, anticoagulant proteins from Yellowfin sole form an inactive complex through Zn2+ mediation[79]. Global trends show that with the rising demand for nutritious food, the development of many more health promotion and disease prevention products from FPH is to be expected. Peptide-based anticoagulants are frequently engineered to selectively target particular proteins or clotting factors in the coagulation cascade, like factor Xa or thrombin. They may engage in direct or indirect interactions with these proteins to suppress their function and thereby stop blood clot formation. The sequences and structures of these anticoagulant peptides usually enable them to attach to their target molecules and obstruct the clotting process.

FPH has been shown to reduce gaining weight in both in vivo and human investigations by decreasing the expression of neuropeptide-Y in the hypothalamus and associated protein mRNA[82,90,91]. These molecules have an

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orexigenic role in central brain appetite regulation. However, FPH has not yielded significant results in increasing the expression of Pro-Opiomelanocortin (POMC) or Cocaine and Amphetamine-Related Transcript (CART) mRNA, which play an anorexigenic role[90].

FPH has a weakness as an emergency food product due to its lingering bitter taste, despite attempts to mitigate it through various methods[34]. The choice of fundamental ingredients in FPH production significantly impacts the taste, making it highly desirable to avoid ingredients that contribute to bitterness[92]. Additionally, FPH has a very sticky texture, making it suitable for blending with other materials. It's important to note that FPH can only be consumed by individuals without fish allergies to prevent any potential adverse effects.

Nutritional Properties of Different Types of Emergency Food Products in Southeast Asia

The nutritional value of a product is indeed an important factor to consider when combining ingredients to achieve a desired level of nutrition. By taking into account the existing ingredients and product types, it becomes possible to create a product that meets expectations while minimizing any shortcomings of previous versions. This approach can be crucial in ensuring that the end product is both healthy and satisfying for consumers. The several examples of emergency food products in Southeast Asia that possess nutritional value in table 3.

Cookies and food bars made from cereal flour, tubers, and nuts the requirements for emergency food content. However, they contain only around 7% protein, which falls short of the standard of 10-15%. Nevertheless, this product offers the advantage of high iron content (2.63-3.85 mg), zinc content (1.28-1.79 mg), and calcium content (190.05-231.06 mg) per 50g, which can partially greet the nutritional needs of those affected by disasters, especially the vulnarable and undernourished children[97].

The best composition for emergency food in the form of cookies is a mixture of banana flour (20%), soy flour (20%), and moringa flour (5%). In terms of nutritional adequacy, this emergency food already meets the required standards, providing a minimum of 233 kcal per 50 g and 7.9 to 8.1 g of protein. This product is the simplest to consume, delicious, without a bitter aftertaste, and the best option in comparison to other recipes[32].

Emergency food products, including those available in Southeast Asia, often face challenges in meeting all the necessary macronutrient and micronutrient requirements. These products are primarily designed to provide basic sustenance during emergencies, such as natural disasters or humanitarian crises, where access to regular food sources may be limited[99]. While they can help prevent hunger and malnutrition in the short term, there are indeed limitations and opportunities for improvement, especially regarding their health effects and nutritional quality[100]. Some emergency foods can be difficult to digest, especially for vulnerable populations like children, the elderly, or those with digestive issues. Developing formulations that are more easily digestible and suitable for a wider range of people is an area of improvement.

Innovations in flavor and texture can help improve acceptance, particularly among children[101,102]. The production, packaging, and distribution of emergency food products can have environmental and sustainability impacts[103]. Innovations may involve finding more sustainable sourcing and production methods. Innovations in this field can help address these weaknesses and contribute to more effective and nutritionally balanced emergency food solutions[104]. Collaborative efforts between governments, NGOs, food scientists, and the business world can participate a significant part in driving these improvements. It's also important to continually evaluate the effects of these products regarding the wellbeing and health of the populations they serve.

Emergency Food Product Innovation Solutions in Southeast Asia

Recommend that the raw materials for emergency food products be sourced from local foodstuffs that are nutrient-rich, culturally and religiously accepted, safe for consumption, and do not have harmful effects[26]. The selection of food groups should involve identifying and evaluating various categories, including cereals, nuts, fruits, meats, dairy, eggs, fish, and fresh vegetables[20]. The chosen food ingredients should ideally fulfill the energy, protein, fat, and carbohydrate requirements for emergency food. In addition to that, addressing specific health needs may necessitate functional foods containing phytochemicals, probiotics, and prebiotics to enhance the immune system[20].

There is still minimal innovation in emergency food products in the Southeast Asian region, as indicated by various literature and articles. Raw materials like Food Hydrolyzate Protein (FPH) are abundant in nutrients and can be utilized to bring innovation to emergency products by incorporating multiple ingredients, resulting in a texture and taste that is widely acceptable. FPH, known for its high protein content and good digestibility, proves to be beneficial for human consumption. In addition to its economic advantages and high-quality nutritional content, utilizing FPH from less desirable fish catches helps in minimizing waste and has been extensively developed. The strength of this literature review lies in its presentation of several ingredients that are useful and have the potential to be used as emergency food products, considering both nutritional and health aspects. Additionally, it presents various existing products, facilitating a comparison of results and encouraging thoughts about better future innovations. However, the shortcomings of this literature review include its failure to provide a discussion regarding government policies related to optimizing natural disaster products and handling costs associated with food products in the event of a disaster. Suggestions for further research include examining the effect of emergency food products on several biomarker profiles of diseases that are relevant to the health sector.

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Tabel 3. Nutrition value of emergency food products in Southeast Asia: Best Formulation Insights

Name of the Best Formulation Product	Country	Nutrition Value								Citation
		Energy (kcal)	Carbohydrate (%)	Protein (%)	Fat (%)	Dietary Fiber (%)	Water Content (%)	Ash Content (%)	Antioxidant (%)	
Food Bar Cassava and Skipjack Flour with Added *Moringa Leaf* Extract and Chitosan	Indonesian	230.57	60.76	13.26	17.80	-	6.55	0.96	7.41	[10]
Food Bar Lindur Flour and Soy Flour	Indonesian	252.5	47.7	6.9	22.5	15.79	4.03	1.84	-	[93]
Broccoli-Soybean-Mangrove Food Bar	Indonesian	291.9	31.1 g	6.1 g	15.6 g	-	-	-	-	[16]
Snack Bar Combination of Banana and Mung Bean Flour	Indonesian	710.6	63.92	8.99	19.34	1.48	5.07	2.69	-	[53]
Snack Bar of Modified Sweet Potato Flour	Indonesian	200.38	-	13.96	-	3.45	-	-	-	[94]
Onggok Composite Flour Snack Bar *(Manihot Esculenta)*	Indonesian	-	-	11.6	-	8.23	3.27	1.24	-	[95]
Cereal Flakes from Ipomoea Batatas and *Setaria Italica*	Indonesian	-	70.88 -70.40	7.44-7.19	18.79-18.09	5.28 -4.98	0.61-2.51	2.29 -1.91	-	[96]
Food Bar from Flour of Cereals, Tubers, Pulses, and Local Freshwater Fish	Indonesian	248.54-252.82	44.50-48.70	7.10-7.90	44.20-47.92	-	-	-	-	[97]
Cookies from Banana Flour, Soy Flour, and *Moringa* Leaf Flour	Indonesian	279.67	21.06	7.34	18.45	-	-	-	-	[32]
Food Bars from Fishing Tuna Flour Fortification Modified Tapioca Starch	Indonesian	203.85	64.94	15.45	12.59	-	3.97	2.69	-	[98]

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Strengths and Weaknesses of the Research

This research effectively highlights the use of locally available, nutrient-rich raw materials for emergency food products, ensuring cost-effectiveness and cultural suitability. The focus on innovative solutions, such as Fish Protein Hydrolysate (FPH), demonstrates potential for addressing immediate and long-term nutritional needs during disasters. However, the study lacks analysis of government policies, cost optimization strategies, and clinical impacts on health biomarkers. Future research should address these gaps to enhance the effectiveness and sustainability of emergency food products through collaborative efforts among governments, NGOs, and private sectors.

CONCLUSIONS

The study that is being described has significant ramifications for society and the subject of food nutrition, particularly when considering Southeast Asia. Many health benefits, such as antioxidant, anti-hyperglycemic, antibacterial, anti-tumor, ACE inhibitor activity, calcium binding, and anticoagulant qualities, can be obtained from the use of fish hydrolyzate protein (FPH). Given the high prevalence of diet-related health problems in Southeast Asia, these advantages may have a positive effect on public health there. Using FPH components to create nutrient-dense emergency food products is a potential strategy. It is important to expect exceptional physicochemical quality in the creation of these emergency food products. It makes sure that the products are not only appealing and effective at meeting nutritional needs, but also taste nice and have a desirable texture in addition to providing important nutrients.

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AUTHOR CONTRIBUTIONS

NR, DNA: conceptualization and investigation; NR, AS, GA: methodology; NR: data interpretation; NR, AS, GA, N: manuscript preparation; NR, DNA, AS, GA, N, EC, EYP: writing, review and editing.

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