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Modification of Traditional Balinese Food as Disaster Emergency Food

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ABSTRACT

This study aimed to make disaster formula food based on traditional Balinese local food quality, nutritious, safe and in accordance with Balinese culture so that it can be accepted to cope with food availability in a state of disaster. The development of the disaster formula is based on the traditional Balinese jaja satuh meal made from glutinous rice flour and brown sugar with the substitution of treatment using green beans powder, peanuts, and cashews as a source of protein, and Moringa leaf powder as a source of food fiber. The study was designed in a randomized block design with six formulations and three replications. The results showed that the selected treatment of the formulation was F4 (20 g glutinous rice flour, 25g peanut powder, 5 g Moringa leaf powder, and 50 g brown sugar) with a degree of preference for color, aroma, texture, taste and overall acceptance of the like value.This formula has a water content of 7.18%, ash 1.34%, protein 16.41%, fat 13.53%, carbohydrates 61.48%, food fiber 18.87%, Fe 6.23 ppm and total energy of 433.27 per 100 gram formula. This formula is microbiologically safe with a shelf life more than 10 days. One portion of Balinese traditional local food-based disaster formula as much as 50 g can contribute energy of 216.64 kcal (10.31%), protein 8,205 g (16.41%), and fat 6.765 g (16.91%) for the standard emergency food is 2100 kcal, 50 g protein and 40 g fat.

1. Introduction

The emergency food product must be safe, palatable, easy to deliver, easy to use and nutrtionaly complete (1) During a disaster, the availability of safe, quality and nutritious food is very difficult to realize. (2)This needs to be anticipated by providing formula food made from local foods that are commonly consumed by local people. The development of traditional food to be used as ready-to-eat food in disaster management needs to be researched to increase the use of local resources and reduce dependence on imported foodstuffs.

One of the traditional Balinese foods that can be developed to meet these criteria is jaja satuh. Jaja satuh is a traditional food used in religious ceremonies in Bali, which is made from a mixture of glutinous rice flour and brown sugar so that it can be stored for a long period of time, more than one month (3)

However, this jaja satuh has not been able to provide balanced nutritional needs because it is only made from carbohydrate sources. Therefore, it is necessary to develop a formulation from jaja satuh by adding sources of protein, vitamins, minerals, dietary fiber, as well as sources of antioxidants that can increase body resistance in disaster conditions. Foodstuffs that can be used as an alternative to increase the nutritional content as a source of protein for nuts such as green beans, peanuts, and cashews that have been cultivated in Bali. Sources of vitamins, minerals and antioxidants can come from dried vegetables such as Moringa leaves (4)

This study aims to modify the traditional Balinese food jaja satuh by adding protein sources from three types of nuts (mung beans, peanuts, cashews). Moringa leaf powder as a source of dietary fiber, vitamins,and minerals (4)

The development of traditional Balinese food to become a disaster formula can be developed based on aspects of achieving energy and nutritional content. This can be achieved by modifying the selection and use of ingredients in order to achieve a nutritional composition that is in accordance with standard formula food for disaster victims. Aspects that can be developed to achieve food safety standards are modifications to processing methods, packaging methods and storage methods and distribution methods. Besides that, it is also necessary to monitor the hygiene and sanitation of modified food procurement. Meanwhile, to fulfill the sensory aspects of the food developed, it must be tested organoleptically to the target to be addressed(1).

Supplementation that can be done to increase the content of protein, minerals, and vitamins is to add protein sources such as nuts and sources of vitamins and minerals from dried vegetables. The type of beans that can be added is green beans because they have a color that is almost similar to glutinous rice flour. While vegetables that have the potential to be added are dried Moringa leaves because Moringa leaves contain good vitamins and minerals and are easy to dry.

2. Method

The research begins with determining the percentage of ingredients and the formulation of composite flour using a mixture of food ingredients to achieve the standard of energy and nutrient requirements.. The research design was experimental

with a randomized block design with 6 treatment formulations and 3 replications so that there were 18 research units (see Table 1).

Table 1. Traditional Balinese Food-Based Disaster Food Modification Treatment

Ingredients	F1	F2	F3	F4	F5	F6
Glutinous rice flour (g)	25	20	25	20	25	20
Green beans (g)	20	25	0	0	0	0
Peanuts (g)	0	0	20	25	0	0
Cashew nut (g)	0	0	0	0	20	25
Moringa leaf powder (g)	5	5	5	5	5	5
Brown sugar (g)	50	50	50	50	50	50

Based on the calculation of the formulation in Table 1, it can meet energy needs in the range of 300 -320 kcal for 1 formula of 15% of the 2100 kcal energy requirement required for energy adequacy standards in disaster management guidelines (5) (6) (7). The organoleptic test used in testing this disaster formula is the level of preference test (hedonic test) conducted by 35 moderately trained panelists with a range of 5 scales (very like, like, neutral, dislike, and very dislike (8) Chemical qualitiy analysis of the proximate method includes: analysis of moisture content by oven heating method, protein analysis by Kjeldahl method, fat analysis by Soxhlet method, ash content by dry ashing method and carbohydrate content by calculation method by different. Determination of dietary fiber content by gravimetric method, determination of iron content by Spectrophotometer method. Microbiological quality analysis by Total Microbes and E coli contamination. Data analysis to determine the effect of different material modifications on organoleptic quality characteristics (color, aroma, texture, and taste), chemical quality (moisture content, ash content, fat content, protein content, carbohydrate content), microbiological quality (total microbes) was carried out by Analysis of Variance (ANOVA), then continued with Duncan's mean difference test.

3. Result and Discussion

Physical Quality

The physical qualities of the disaster formula include a greenish-white color, a slightly hard texture but easy to bite, and a sweet taste. The shape and color of the formula are as shown in Figure 1.

Figure 1. Physical Form of Disaster Formula Products

Nutritional values

There are six emergency food products (F1, F2, F3, F4, F5, and F6) that were produced and had their nutritional values analyzed, as shown in Table 2.

Table 2. Average Value of Moisture , Ash , Protein , Lipid , Carbohydrate , Fiber , and Iron Content in Disaster Formula

Treatment	Moisture (%)	Ash (%)	Protein (%)	Lipids (%)	Carbohydrate (%)	Fiber (%)	Iron (ppm)
F1	7.81 b	1.81 a	14.57ab	0.88 e	74.84a	5.58 c	6.26 a
F2	7.99 a	1.76 a	15.10ab	1.12 d	74.03a	8.90 c	6.47 a
F3	7.18 d	1.37 b	14.40ab	10.56 c	66.51b	16.36 ab	6.04 a
F4	7.18 d	1.34 b	16.41a	13.53 a	61.48c	18.87 a	6.23 a
F5	7.63 c	1.38 b	14.46ab	10.56 c	65.97b	13.85 b	5.48 a
F6	7.31 d	1.44 b	12.71b	12.41 b	66.13b	14.25 b	5.10 a

Note: The average value followed by different letters in the same column the same showed significantly different on Duncan's test ($p<0.05$).

Energy Content Analysis

Based on calculations with reference to the energy content of 1 gram of carbohydrates as much as 4 kcal, 1 gram of protein as much as 4 kcal, and the content of 1 gram of fat as much as 9 kcal, the content per 100 grams of the disaster formula is according to the treatment as shown in Table 3

Table 3. Energy Content of Disaster Formula per 100 grams

Treatment	Carbohydrate		Fat		Protein		Total Energy(kkal)
	g	Kkal	G	Kkal	G	Kkal	
F1	74.84	299.35	0.88	7.95	14.57	58.28	365.58
F2	74.03	296.11	1.12	10.08	15.10	60.40	366.59
F3	66.51	266.04	10.56	95.01	14.40	57.59	418.64
F4	61.48	245.91	13.53	121.74	16.41	65.63	433.27
F5	65.97	263.89	10.56	95.07	14.46	57.83	416.79
F6	66.13	264.51	12.41	111.72	12.71	50.84	427.07

The results of the calculation of the energy content in Formula 4 show the highest energy content compared to the other formulas. because this formula contains the highest fat content compared to other formulas. The difference in the composition of protein, fat and carbohydrates from the treatment of the formulation as an energy source also resulted in differences in the energy content varying from the formula witha range of 365.58 kcal to 433.27 kcal per 100 g

Microbiological Analysis

The analysis of the safety of the disaster formula was carried out on the total microbial and *E. coli* contamination. The average values of total microbes and *E.coli*are presented in Table 4.

Table 4. Average Value of Total Microbes and E.coli Contamination in Disaster Formula

Formula	Total microbes (TPC/gram)	Condition (TPC/gram)	*E.coli* (MPN/gram)	Standard E.Coli (MPN/gram)
F1	4.870	10.000	0	0
F2	1.010	10.000	0	0
F3	7.435	10.000	0	0
F4	1.867	10.000	0	0
F5	5.860	10.000	0	0
F6	2.517	10.000	0	0

Based on the results of microbial analysis in the disaster formula, all total microbialtreatments met the food safety requirements, as well as for *E.coli* contamination.

Evaluation of sensory properties

Evaluation of the sensory properties of the disaster formula was carried out byhedonic tests on color, aroma, texture, taste, and overall acceptance with a scale range

Table 5
Average Hedonic Test Value of Color, Aroma, Texture, Taste, and Overall Acceptance of Disaster Formula

Treatment	Hedonic test average value				
	Color	Aroma	Texture	Taste	Overall Acceptance
F1	3.51 b	3.40 b	3.66 bc	3.29 c	3.57 b
F2	3.60 b	3.54 b	3.60 bc	3.57 b	3.51 b
F3	4.03 a	4.37 a	4.00 a	4.31 a	4.43 a
F4	4.09 a	4.40 a	3.89 ab	4.49 a	4.57 a
F5	3.51 b	3.43 b	3.51 c	3.66 b	3.54 b
F6	3.34 b	3.43 b	3.63 bc	3.60 b	3.34 b

Note: The average value followed by different letters in the same column shows a significant difference in Duncan's test ($p<0.05$)

Preferred color is F3 or F4; the preferred aroma is F3 or F4; preferred texture is F3 or F4; The preferred taste is F3 or F4 and overall preferred is F3 or F4.

Color is a very important component for the quality or degree of acceptance of a food ingredient, the aroma of food arises due to the formation of volatile compounds that easily evaporate, and, taste is a factor assessed by panelists after color, aroma and texture that can affect the acceptance of food products. Taste arises as a result of chemical stimuli that can be received by the taste buds or tongue. A good taste can attract attention so that consumers tend to like food from its taste. Even though the components of aroma, color, and texture are good but consumers do not like the taste, consumers will not accept the food product (8) (9)

Determination of Selected Formula

Based on the results of sensory evaluation of color, aroma, texture, taste and overall acceptance, the selected formula from this study was Formula F4 with the formulation of ingredients: glutinous rice flour 20 g, peanut powder 25 g, Moringa leafpowder 5 g and brown sugar 50 g, but not statistically significantly different from formula F3 with the formulation of ingredients: 25 g glutinous rice flour, 20 g peanut powder, 5 g moringa powder and 50 g brown sugar. This shows that the use of peanutsin the modified formulation of the traditional satuh food, which is usually only made from glutinous rice flour and brown sugar, provides a sensory

evaluation with a better level of acceptance compared to the substitution of ingredients using green beans or cashews.

4. Rating standard portions

Based on the assessment of the standard portion of the selected formula,namely F4 from 35 panelists, after being presented with a standard portion of 4 (four) portion choices, namely: 3 pieces (30 g), 5 pieces (50 g), 7 pieces (70 g) and 10 pieces (50 g). 100 g) then the data is obtained as in Table 6.

Table 6
Selected Formula Portion Standard Assessment

Standard Portion	N	%
3 pieces (30 g)	8	22.86
5 pieces (50 g)	20	57.14
7 pieces (70 g)	7	20.00
10 pieces (100 g)	0	0.00
Jumlah	35	100.0 0

Based on the data from Table 7 shows that most (57.14%) of the authors statedthat the correct portion for the selected disaster formula was 5 pieces (50 g). Based on the comments given by the panelists, this is due to the sweet taste so it is less able to spend if the portion is more than 50 g for one consumption.

Shelf power

After observing the shelf life for 10 days on the selected formula, F4, then based on observations of the organoleptic quality characteristics which include aroma, color, texture and taste, the organoleptic quality characteristics have not deviated. Thisshows that the F4 formula has a shelf life of 10 days. Based on the results of the study, the quality characteristics that were influenced by the treatment of different formulations of materials in the manufacture of traditional Balinese local food-based disaster formulas were chemical quality which included Water content, ash , protein , lipid , carbohydrate,t and fiber , but had no significant effect. on Fe levels. Carbohydrate values are in the range of 61.48 to 74.8%. The total carbohydrate amount was appropriate with recommended, i.e. 46 to 70%, with donations valued at 40 to 50% energy. Carbohydrates play an important role in determining the characteristics of the material, such as flavor, color, texture and others. FAO/WHO indicates that the proportional carbohydrate should be of a sufficient quantity in the emergency food to give a sense of function,palatability, stability and metabolic functions (10). The emergency food should have lipids in amount of 18.2 to 23.4%. This products have a lipid content of 0,88% to 13,53% , which is lower than the targeted. Lipids as an effective source of energy will maintain the health of the human body. One gram of oils and lipids can produce 9 kcal. The protein content of emergency food was in the range of 12.71 to 16.41%. Based on the nutritional requirements, the emergency food should contain 15,8 to 16,2%. of protein of the product (10), so the product that is eligible is F4 with protein content 16,41%. The fiber content of emergency food was in the range 5,58 to 18,87%.. Fiber is an important food component for digestion (11). The difference in the composition of protein, fat and carbohydrates from the treatment of the formulation as an energy source also resulted in differences in the energy content varying from the formula with a range of 365.58 kcal to 433.27 kcal per 100 g. Total microbial and E.coli contamination showed that all formulations were below standard and free from E.coli contamination. This indicates that all formulations have met food safety requirements, because the product contains a low water , which is below 10%, so that low water content can inhibit microbial growth. Based on the evaluation of sensory properties using the hedonic test (preferred test) with a range of 5 scales (1 = very dislike, 2 = dislike, 3 = neutral, 4 = like, and 5 = very like) with 35 moderately trained panelists, different formulations in the manufacture of traditional Balinese food-based disaster formulas, the preference level ranges from neutral to likes. The highest level of preference being F4 formula (20 g glutinous rice flour,

25 g peanut powder, 5 g Moringa leaf powder, and 50 g brown sugar). The best formula with the following considerations: it has the highest level of suitability, the highest energy content and meets food safety standards based on total microbial analysis and is free of E.coli contamination. The product description of the best formula is as shown in Table 7. In one serving (50 g) of this disaster formula food, it can contribute energy of 216.64 kcal (10.31%), protein 8.205 g (16.41%), and fat 6.765 g (16.91%) for food standards. emergency 2100 kcal, 50 g protein and 40 g fat.

Table 7
Description of Modified Traditional Balinese Food as the best Disaster Food

Material formulation	Glutinous rice flour	20 g (20%)
	Peanut powder	25 g (25%)
	Moringa leaf powder	5 g (5%)
	Brown sugar	50 g (50%)
Quality criteria	Criteria	Total/ description
A. Physical		
Color	Normal	Greenish white
Texture	Normal	a bit hard
Taste	Normal	Sweet
B. Chemical		
Moisture	%	7,18
Ash	%	1.34
Protein	%	16,41
Lipid	%	13,53
Carbohydrate	%	61,48
Fiber	%	18,87
Iron	Ppm	6,23
Energy	Kcal	433,27
C. Microbiology		
Total microbes	10000 TPC/g	1867
E.coli	0	0
D. Sensory/organoleptic		
Color	Like	4,09
Aroma	Like	4,40
Texture	Like	3,89
Taste	Like	4,49
Overall acceptance	Like	4,57
E. Standard portion	G	50
F. Storability	Day	10

CONCLUSION

Modification of traditional Balinese jaja satuh food into food in a disaster situation with the formulation: 20% glutinous rice flour, 25% peanut powder, 5% Moringa leaf powder and 50% brown sugar with 16.41% protein content, 13.53% fat, carbohydrates 61.48%, fiber 18.87%, Fe 6.23 ppm with energy content of 433.27 kcal per 100 grams. The nutritional content of one serving of formula as much as 50 gram are protein 8,205 gram, lipid 6,765 gram, carbohydrate 30,74 gram, fiber 9,435 gram, and energy 216,635 kcal.

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