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Formula *Kahiguru* High Protein for Making of Food Supplement as Elimination Stunting

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Supplementary Feeding;

Abstract

In general, the objective of the study was to create a high protein "kahiguru" formula consisting of a mixture of green beans (Vigna radiata) flour, gude nuts (Cajanus cajan) flour and lemuru fish (Sardinella L.) flour. The preparation of kahiguru formula and supplementary feeding products (PMT) was made using a randomized block design. The nutrient content of kahiguru formula is the lowest protein content in formula A (25,2054%) and highest formula F (52,3365%); the lowest fat content in Formula A (3.6901%) and highest formula F (6.8923%). The highest amino acid arginine content in the formula F (3.033%), histidine in the formula D (4.744%), Isoleucine in the formula E (2.606%), Leucine in the formula F (2.920%), lysine in the formula B (12.765%), methionine in the formula D (3.828%), phenylalanine in the formula F (1.822%), threonine in the formula F (3.526%) and valine in the formula F (1.909%). Based on the amino acid content kahiguru formula can be made variations of PMT are preferred child under five years, such as cake, cookies, or brownies. The conclusion is 1) "kahiguru" formula containing high protein as the base material of PMT is a combination of green bean flour, gude bean flour and lemuru fish flour, 2) nutrient content of best kahiguru formula is formula "F" (20-20 -60) containing 52.3 grams of protein and 6.9 grams of fat, 3) high kahiguru formula containing amino acid hystidine (4.74%) is the formula "D"; methionine (3.82%) and isoleucine (2.60%) is the formula "E"; threonine (3.52%), arginine (3.03%), valine (1.90%), phenylalanine (1.82%), and leucine (2.92%) were the formula "F".

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Contents

1. Introduction

Nutrition programs in the field that are still a priority on the prevention of nutritional problems are Supplemental Feeding (PMT) extension and recovery. It seems that the provision of PMT has not produced an optimal impact so that specific studies by region are required.[1,2] The prevalence of stunting in Indonesia in 2013 amounted to 19.2%, in Bali as much as 19.5% and NTB as much as 24.7%. These data show that the prevalence of stunting in Bali and NTB is higher than the national prevalence.[3] Green beans *(Vigna radiata)* containing high protein (22.9%), gude beans *(Vigna radiata)* (20.7%) and lemuru fish *(Sardinella L.)* (16.0%), can be used as a basic formula for making PMT.[4,5,6,7,8,9,10] The third mixture of the ingredients is named "kahiguru" formula containing at least 25% protein. Basic ingredients that contain high in nutrients, especially proteins can be used as high-protein PMT as one of the efforts of diversification of PMT-based local wisdom.

In general, the objective of the study is to create a high protein "kahiguru" formula that can be used as a PMT to help meet the nutritional needs of the child under five stunting. Specific objectives of the study were: 1) Calculating the yield of green bean flour, gude bean and lemuru fish, 2) Creating "kahiguru" formula containing high protein as the basic ingredient of PMT, 3) Analyzing the nutrient content (protein and fat) of kahiguru formula 4) Analyze the amino acid content of kahiguru formula, 5) Make a PMT snack product based on kahiguru formula, 6) Analyze the content of nutrients (protein and fat) of PMT product, 7) Analyze the amino acid content of PMT product, 8) Conduct an organoleptic test to taste PMT products.

The results of this study are expected to add information in the field of science and technology, especially about the formula kahiguru high protein (≥25% protein) that can be used as the basic ingredients PMT. If possible the results of this study can be tested directly apply experimental methods to a child under five stunting to determine the effectiveness of this product. The Ministry of Health will have an additional alternative to PMT that can be applied nationally while maintaining local wisdom.

2. Research Method

This study design was a using randomized block design with 6 treatments kahiguru formula and 3 replications so that the research unit is 18 units.[11] The kahiguru formula that is designed is a mixture of green bean flour, gude flour and lemuru fish flour with some weight variation. The weight of green bean flour is 20 grams and the weight of gude bean flour and lemuru fish flour

varies. For example, the "kahiguru formula A" is a formula consisting of 20 grams of green bean flour, 70 grams of gude bean flour and 10 grams of lemuru fish flour. The composition of the formula can then be read in Table 1.

Table1.
Kahiguru Formula based on Amount of Basic Material Green Bean Flour, Gude Bean Flour and Lemuru Fish Flour

KAHIGURU FORMULA	FLOUR		
	Green Beans (gram)	Gude Beans (gram)	Lemuru Fish (gram)
A	20	70	10
B	20	60	20
C	20	50	30
D	20	40	40
E	20	30	50
F	20	20	60

Preparation of supplementary feeding (PMT) products using randomized block design with 6 treatments and 3 replications so that the unit of research amounted to 18 units. The type of PMT made is chips using kahiguru formula with the addition of ingredients such as wheat flour, chicken egg, salt, and sugar. The shape of PMT resembles chips with a thickness of 2 mm, 1 cm wide and 4 cm long. The composition of the PMT material used can be read in Table 2.

Table 2.
Composition of PMT Making Material

PMT FORMULA	INGREDIENTS				
	Kahiguru Formula (gram)	Wheat Flour (gram)	Chicken Eggs (gram)	Salt (gram)	Refined Sugar (gram)
A	100	100	50	2	10
B	100	100	50	2	10
C	100	100	50	2	10
D	100	100	50	2	10
E	100	100	50	2	10
F	100	100	50	2	10

Tastes that include flavor, aroma, color, texture and overall are obtained by organoleptic tests, using a slightly trained panelist of 30 people. Protein analysis using kjeldahl micro method, amino acid analysis using HPLC method and fat analysis using Soxhlet method.[12] Organoleptic test data were analyzed using ANOVA to determine the taste of the best PMT product.[13,14]

3. Results and Analysis

3.1Result

a. Rendemen Flour Material Formula Kahiguru

The yield of fish lemuru flour is quite low ranging from 10.3% to 12.0% with an average of 11.07%. Rendemen of green beans flour ranged from 87.5% to 91.5% with an average of 89.9% and gude beans flour ranging from 89.0% to 92.1% with an average of 90.4%.

b. Nutrition Analysis

Green beans, gude beans, and lemuru fish flour after analyzed nutrients (water, ash, protein, and fat) in the laboratory obtained data as shown in Table 3.

Table 3.
Average Results of Nutrient Analysis Green Bean Flour, Gude Bean Flour, and Lemuru Fish Flour

Flour	Water (%)	Ash (%)	Protein (%)	Fat (%)
Green Beans Flour	6.8092	4.1082	24.8766	2.8257
Gude Beans Flour	10.2744	4.5863	24.0002	1.9376
Lemuru Fish Flour	13.0254	6.4609	73.1726	5.8697

The result of analysis of nutrient content of kahiguru formula at Udayana University Food Technology Laboratory as follows are protein content in formula A (25,2054%) and increasing until F (52,3365%); fat content in Formula A (3.6901%) and highest formula F (6.8923%). All formulas qualify as high-protein formulas because they contain over 25% protein. For more details can be read Table 4.

Table 4.
Average Results of Nutrition Analysis of Kahiguru Formula

KAHIGURU FORMULA	Water (%)	Ash (%)	PROTEIN (%)	Fat (%)
A (20-70-10)	9.9306	4.6443	25.2054	3.6901
B (20-60-20)	9.3450	4.5657	30.3877	3.8186
C (20-50-30)	9.2224	4.8937	35.2662	5.5467
D (20-40-40)	9.9686	4.9751	40.5011	4.9753
E (20-30-50)	10.2392	5.2455	43.7589	6.7030
F (20-20-60)	9.3564	5.4738	52.3365	6.8923

The highest amino acid arginine content in the formula F (3.033%), hystidine in the formula D (4.744), Isoleusine in the formula E (2.606), Leusine in the formula F (2.920), lysine in the formula B (12.765), methionine in formula D (3.828), phenylalanine of the formula F (1.822), threonine in the formula F (3.526) and valine in the formula F (1.909). For more details can be read in Table 5.

Table 5.
Average Results of Amino Acid Analysis of Kahiguru Formula

AMINO ACID (AA)	FORMULA					
	A	B	C	D	E	F
AA Essential						
Arginine	1.565	1.289	0.228	0.065	1.962	3.033
Hystidine	0.150	0.108	4.521	4.744	0.777	1.074
Isoleusine	0.750	0.570	1.136	1.012	2.606	1.239
Leusine	1.298	0.862	0.099	0.872	0.431	2.920
Lysine	2.031	12.765	1.865	1.994	0.128	4.291
Metionine	0.039	0.859	1.539	0.545	3.828	0.085
Phenylalanine	1.587	0.701	0.598	0.503	1.051	1.822
Threonine	2.921	2.129	1.099	1.196	2.301	3.526
Valine	0.791	0.304	0.149	0.211	0539	1.909

c. Supplemental Feeding Products (PMT)

The lowest protein content of PMT products was formula A (22.01%) and the highest was formula F (28.85%). The lowest fat content was formula A (19.61%) and the highest was formula F (22.73%). For more details can be read Table 7.

Table 7.
Average Results of Nutritional Analysis of Supplemental Feeding (PMT) Products

PMT	Water (%)	Ash (%)	Protein (%)	Fat (%)
FORMULA A	3.5684	2.4862	22.0131	19.6176
FORMULA B	6.8713	2.4403	22.7672	18.2990
FORMULA C	4.6779	2.3575	25.5312	19.8248
FORMULA D	7.6532	2.6036	25.3268	18.9824
FORMULA E	6.9786	2.6793	25.3093	21.7056
FORMULA F	6.7256	2.7662	28.8556	22.7384

PMT based kahiguru formula with the highest amino acid content of amino arginine (0.400%) formula E, histidine (2.881%) and isoleusine (1.297%) formula D, lysine (1.123%), phenylalanine (1.723%) and threonine (1.161%) formula F. For more details can be read Table 8.

Table 8.
Average Results of Amino Acid Analysis Supplemental Feeding (PMT) Product

AMINO ACID (AA)	PMT PRODUCTS WITH BASIC FORMULA					
	A	B	C	D	E	F
AA Essential						
Arginine	0.300	0.269	0.331	0.369	0.400	0.368
Hystidine	2.067	2.365	2.799	2.881	2.854	0.366
Isoleusine	0.643	1.099	1.264	1.277	1.297	0.565
Leusine	0.024	0.126	0.156	0.156	0.160	1.479
Lysine	0.547	0.062	0.080	0.075	0.076	1.123
Metionine	1.547	1.611	1.823	1.883	1.942	0.073
Phenylalanine	1.069	0.454	0.496	0.503	0.513	1.723
Threonine	0.622	0.641	0.731	0.734	0.717	1.161
Valine	0.260	0.259	0.278	0.272	0.257	0.023

Based on the organoleptic test, followed by ANOVA and duncan obtained results as follows are the preferred taste are formulas A and B, the flavor is formula B, the colors are formulas A, B and C, the textures is formula A and the preferred overall are formula A and B. For more details can be read Table 9.

Table 9.
Organoleptic Test Results of Supplemental Feeding (PMT)

KAHIGURU FORMULA	TASTE	AROMA	COLOR	TEXTURE	OVER ALL
A	3.21 a	3.05 a	2.92 ac	3.76 a	3.32 a
B	2.97 ab	3.37 b	3.08 ab	3.49 b	3.26 a
C	2.81 bc	2.86 a	3.02 ab	3.21 c	2.90 b
D	2.70 bc	2.56 c	3.16 b	3.21 c	2.66 bc
E	2.66 cd	2.46 c	2.69 d	3.0 d	2.66 bc
F	2.40 d	2.33 c	2.78 cd	2.84 e	2.54 c

3.2 Discussion

Protein content of green bean flour (24,87%), gude bean flour (24,00%) and lemuru fish flour (73,17%) after made formula containing protein as follows: formula A (25,20%), formula B (30.38%), formula C (35.26%), formula D (40.50%), formula E (43.75%) and F (52.33%). These data show that the more fish lemuru flour added to the formula the higher the protein content.

This means the contribution of lemuru fish flour is very important to increasing the protein content of the formula.

Amino acids consist of essential amino acids and non-essential amino acids. Essential amino acids are needed by the body in small quantities but the body can not produce itself, so it must be consumed from food. The essential amino acids required by children are the amino acid arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine.

The composition of the amino acid content of a foodstuff will greatly determine the quality of its protein content. Consumption of nutrients, especially protein in a child under five to consider the composition of amino acids so that it can play a maximum role in body growth. Rarely there is one food that contains amino acids can meet the needs of the body so that the required variety of food in daily consumption.

Amino acids arginine one of its functions is to stimulate growth hormone, histidine (repair body tissue), isoleucine (helps the production of non-essential amino acids), Leucine (protein synthesis controller), lysine (maintaining normal cell growth), methionine (body tissue and protein synthesis), phenylalanine (control of appetite and weight regulator), threonine (enhances immune system function), valine (stimulates muscle coordination and repair damaged tissues), tryptophan (vitamin synthesis material).[15,16] Based on the amino acid content kahiguru formula which varies as shown in table 5, can be made variations of PMT have preferred child under five, such as cake, cookies, or brownies.

Judging from the protein content of PMT products can be stated that all the PMT made based kahiguru formula has a protein content above 25%. This indicates that PMT already has a high protein content and can be applied in the field on monthly activities *posyandu*. Based on the Regulation of the Minister of Health of Indonesia Nomor: 51 of 2016, About Standard Production of Nutritional Supplements required minimum energy content of 400 kcal, protein 8-12 grams, fat 10-18 grams.[17]

To supplement the needs of amino acid threonine, phenylalanine, leucine and lysine can consume PMT based on the "kahiguru" formula. To complement the needs of arginine amino acids, methionine and isoleucine can consume PMT based kahiguru "E" formula. Mataram, IKA (2017) research, revealed that one of the causes of nutrient intake is low protein consumption.[18] These high protein PMT pods can serve as an effort to overcome the lack of protein consumption in a child under five so that optimal growth occurs in the next period. Based on taste, aroma, color and overall after analyzed with ANOVA and continued with Duncan it can be concluded that the preferred product by panelist is PMT product based formula B.

4. Conclusion

Conclusions this research are 1) The "kahiguru" formula contains a minimum protein of 25% as a base material of PMT is a combination of green bean flour, gude bean flour and lemuru fish flour, 2)The nutrient content of the best kahiguru formula is the kahiguru "F" formula (20-20-60) containing 52.3 grams of protein and 6.9 grams of fat, 3) The high kahiguru formula containing the amino acid hystidine (4.74%) is the formula "D"; the high kahiguru formula containing the amino acid metionine (3.82%) and isoleucine (2.60%) is the formula "E"; high kahiguru formula contains amino acid threonine (3.52%), arginine (3.03%), valine (1.90%), phenylalanine (1.82%), and leucine (2.92%) is the formula " F ", 4) The best protein content of PMT product is PMT product with the formula of kahiguru F (protein 68.17%), 5) PMT product with a high content of amino acid hystidine (2,88%) is PMT with the formula "D"; PMT products with a high content of amino acid arginine (0.40%), methionine (1.94%), and isoleucine (1.29%) were PMT with the formula "E"; PMT products with high amino acid threonine (1,16%), phenylalanine (1,72%), leusine (1,47%) and lysine (1,12%) were PMT with formula "F" and 6) Based on the organoleptic test the preferred PMT product is a product of the kahiguru "B" formula (20-60-20) with a protein content of 30.38%.

Based on the research results can be suggested that is Kahiguru B formula used as the basic material of PMT making which is preferred by toddlers to be applied to *posyandu* activities and It needs to be pursued for the development of recipes so that the resulting PMT products are more varied by using the existing formula.

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