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The Physico-Chemical Composition and Sensory Acceptability of 'Kacang Koro' Talbinah

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ABSTRACT

Canavalia ensiformis or "Kacang koro" (Jackbeans), is one of the legumes with potential as an inexpensive source of high protein food. The production of products made from kacang koro pedang is expected to complement, reduce or even replace soy protein later, in order to control soybean needs and reliance. Underutilized and unexploited legumes such as Kacang Koro may offer a great potential in combating micronutrients deficiency and non-communicable diseases. Talbina is a milk-cooked barley syrup widely used to help treat stress symptoms, and may provide possible uses as a functional food. The goal of this study was to determine Kacang Koro's physicochemical properties and sensory acceptability of the Talbina. Five Kacang Koro-Talbina formulations were produced containing 20%, 40%, 60%, 80% and 100% Kacang Koro. The samples were analysed for their pH, colour and viscosity, proximate values, calories and tryptophan content. Formulation E (100% Kacang Koro) showed the most promise for its nutritive value composed of 14.8% carbohydrate content, 9.46% protein content, 1.10% fat content, 2.67% fibre content, and calorie content of 4.28 kcal/g. The sensory test revealed that the most accepted sample was formulation D (80% Kacang Koro). Considering this result, the use of Kacang Koro in food products such as Talbina may serve as a good alternative to soy in acceptance, nutrition enhancement and antioxidant properties for human consumption.

Keywords: *Kacang Koro, Talbina, sensory acceptability, physicochemical properties*

1. INTRODUCTION

Canavalia ensiformis (Kacang Koro) contains more protein than maize, parboiled rice, and egg. It has the potential to replace soybeans as a major source of protein in processed food in which the protein content is mostly the same as soybeans (30-40%). The protein hydrolysate is the mixture of polypeptides, oligopeptides, and amino acids formed by physical (heat or shear) or chemical (acid, alkali, or enzyme) hydrolysis from various animal and plant protein sources.

Talbina is a popular traditional food product in the Arab world with high potential applications as a functional food that is normally made from milk, barley flour and sweetened with honey [1]. It is somewhat thicker than cultured milk but still free-flowing and is white in colour. It is prepared by cooking ground roasted barley with milk for a few minutes and then sweetened with honey [2]. Talbina is famously recommended when sad events happen because of its effect on soothing hearts and soothing sadness [1]. Talbina is prescribed for seven diseases, including grief, high cholesterol levels, heart disease, cancer treatment, aging, diabetes and hypertension [3]. Aisha R. A. used to recommend At-Talbina for the sick and for those who grieved over a dead person. She used to say "I heard Allah's Apostle saying 'At-Talbina gives rest to the heart of the patient and makes it active and relieves some of his sorrow and grief'" [4]. Other than the Hadith and the cultural use, there is little scientific evidence regarding the use of Talbina in reducing symptoms of depression.

High intake of carbohydrates is associated with reduced feelings of depression and increased energy. The ingestion of carbohydrates stimulates serotonin production by increasing insulin release, which promotes amino acid reuptake of the body, except for tryptophan. This further raises the plasma-based ratio of tryptophan to broad neutral amino acids (tyrosine, phenylalanine, leucine, isoleucine and valine). This results in an increase in the supply of tryptophan to the brain, which is metabolized into serotonin [5].

Talbina that is made from barley (original) to Talbina made from other grains and legumes such as oats. However, there has been no attempt to produce Talbina using 'Kacang Koro' as of yet. Therefore, the aim for this study is to determine the physicochemical characteristics and sensory acceptances produced using Kacang Koro. Underutilized and unexploited legumes may be of great potential in combating micronutrients deficiency and non-communicable diseases. This product development of Koro-Talbina can be an alternative to increase the commercial value of the 'Kacang Koro'.

2. MATERIALS AND METHODS

2.1. Materials

All the ingredients used were bought locally in Kuala Terengganu except for 'Kacang Koro', was obtained from Kampung Pagar Besi, Kuala Terengganu.

2.2. Development of 'Kacang Koro' Talbina

Barley was poured into 50 °C hot water and allowed to cool down to room temperature to make the barley easier to dehull. 'Kacang Koro' was soaked overnight at room temperature (27 °C) and dehulled [6]. The dehulled samples were then pre-dried in a drying cabinet at 60 °C for 16 h, then dried in a 70-80 °C oven for 2 h [7]. The dried dehulled samples were separately ground in a sample mill (Model IKA) and sifted to 1 mm particle size. The dried Barley and 'Kacang Koro' was grinded using the 0.25mm milling screen and sieved using a sieve shaker. Flour samples was packed and stored in an airtight labelled container prior to analysis. 'Kacang Koro' Talbina was prepared based on the formulation stated in Table 1. Five formulations were produced by adjusting the kacang koro and barley ratios.

Table 1 Formulation for 'Kacang Koro'Talbina

Ingredients	Formulations					
	Control	A	B	C	D	E
Barley flour (g)	20	16	12	8	4	0
'Kacang Koro' flour (g)	0	4	8	12	16	20
Milk (ml)	120	120	120	120	120	120
Honey (ml)	7	7	7	7	7	7
Total (%)	100	100	100	100	100	100

2.3. Physical analysis

2.3.1. pH analysis

The pH value of the Kacang Koro Talbina samples were determined for room temperature (25 °C) that has been calibrated at pH 4 and pH 7. The pH meter was then rinsed with distilled water and cleaned in between the determination of sample pH. The Kacang Koro Talbina sample was prepared at a volume of 100 ml for pH determination.

2.3.2. Colour analysis

Kacang Koro Talbina was measured for its colour profile by placing a plastic cover and measured using a chromometer (Minolta CR400 chromameter, Japan). Measurement was initiated to read the colour of the Talbinas. The colour profile was measured as L*, a* and b* values. L* indicate lightness (with 0 = darkness to 100 = brightness), a* measured the extent of green colour (range from negative = greenness to positive = redness) and b* measured the extent of blue colour (range from negative = blueness to positive = yellowness) [6].

2.3.3. Viscosity profile analysis

This viscosity and thickness of the ‘Kacang Koro’ Talbina sample was carried out using a Brookfield DV-IT+Pro Viscometer (Essex, England). The data was collected and analysed from the shear force values to obtain for the maximum force required to shear through each sample.

2.4. Chemical analysis

2.4.1. Proximate analysis

The proximate values (protein, fat, ash, moisture, and carbohydrate) of Kacang Koro Talbina samples were determined according to the Association of Official Analytical Chemists’ procedure.

2.4.2. Calorie content

Bomb calorimeter was used to determine the calorie content of the ‘Kacang Koro’ Talbina. The sample was weighed (1 g), and placed in the crucible. The crucible was then placed in its container, 10 cm of fuse wire was inserted in its slot, and the wire was formed as ‘U’. The bomb charger was attached and the fill switch was pressed and the oxygen was filled until the pressure reached 420 PSI. The bomb was then inserted into the bomb bucket, followed by filling the tank with 2000 ml of water. The analysis started and the heat of combustion (cal/g) was recorded after inserting the length of the remaining fuse wire [6].

2.4.3. Tryptophan content

Tryptophan content was determined using the spectrophotometric technique (Thermo Spectronic Genesys, USA). Two milliliters of sample was added with 0.1ml formaldehyde, and 1 ml of 85% sulphuric acid was then added. The mixture was let to react and stirred efficiently on a Vortex at room temperature (25 °C). After 4 h, the samples were measured at 445 nm. Results were recorded and calculated.

2.4.4. Sensory evaluation

Sensory evaluation was carried out using a 7-points hedonic scale acceptance test. A total of 50 untrained panels from UMT were randomly chosen for the analysis. A 20 g of Talbina were used in a serving. Permutation was carried out according to the master sheet prepared. The Talbina were tested for their colour, appearance, odour, hardness, flavour and overall acceptance.

2.5. Statistical analysis

All data were reported as mean± standard deviation using one-way Analysis of variance (ANOVA) as a method of mean comparison (Minitab software version 14.0). All analyses were carried out in triplicate. The significant mean difference of mean was measured using post hoc Fisher’s Least Significant Difference (LSD) test at $p<0.05$.

3. RESULTS AND DISCUSSION

Kacang koro-Talbina was successfully developed based on the alteration of Kacang koro and Barley ratios Kacang koro-Talbina producd were kept in chill temperature (4 °C) prior to the physicochemical and sensory analysis.

Figure 1 Six formulations of Kacang koro-Talbinah

3.1. Physical Analysis

Table 2 Physical Analysis Kacang Koro Talbina

	pH	Viscosity	L*	a*	a*
Sample S	6.41±0.24[a]	7133.33±24.74[a]	74.01±5.21[ef]	0.44±0.01[a]	15.21±2.93[cd]
Sample A	6.55±0.29[a]	3190.35±79.55[b]	74.43±4.78[e]	0.09±0.04[aa]	16.23±2.58[bc]
Sample B	6.61±0.31[a]	13966.68±89.47[c]	77.74±4.44[cd]	-0.69±0.08[bc]	17.51±2.96[c]
Sample C	6.56±0.57[a]	216.74±97.21[de]	79.78±5.25[bc]	-1.07±0.08[cd]	18.79±4.29[b]
Sample D	6.56±1.38[a]	180.51±79.58[e]	82.60±4.37[ab]	-1.87±0.48[cd]	20.75±3.51[c]
Sample E	6.52±0.24[a]	150.52±69.28[e]	83.80±.3.27[a]	-2.54±0.11[d]	21.89±4.47[a]

Values represent the mean ± standard deviation. Values with the same superscript letters in the same row are not significantly different ($p > 0.05$), where formulations: Control = S, Talbina (0% Koro flour); A = Talbina (20% Kacang Koro flour); B = Talbina (40% Kacang Koro flour); C = Talbina (60% Kacang Koro flour); D = Talbina (80% Kacang Koro flour); E = Talbina (100% Kacang Koro flour).

3.2. pH Value

The data showed that there was no significant difference in the acidity of all Talbina samples ($p > 0.05$) among themselves (Table 2). The pH ranged from 6.41 to 6.62 and the Talbina regulation had a pH of 6.41. Milk has a pH of 6.5 to 6.7, making it slightly acidic since milk contains lactic acid, which acts as a donor of hydrogen, which increases its acidity as it degrades and is sour in taste. The pH is slightly different depending on whether the milk is skimmed, whole or evaporated. The insignificant pH between samples could be caused due to the effect of reconstituted milk that was heated is soluble at pH below 6.7 regardless of heating temperature [8].

3.3. Viscosity analysis

Table 2 also illustrates that the viscosity was significantly different ($p < 0.05$) between all the Talbina formulations except for formulation D and E. The viscosity of Kacang Koro-Talbina varied between from 150 to 7133 N/ml. The addition of Kacang Koro flour into the Talbina, caused a less viscous texture compared to the control sample (Sample S). This could be caused by the amount of flour used in formulations and the properties of Kacang Koro-flour. The viscosity of the samples could be due to the properties of binding capability and absorption capability of barley [9] and Kacang koro flour, respectively. High amylose starches have been found to reassociate more readily than high amylopectin starches. This is because the linear chains (amylose molecules) can orient parallel to each other, moving close enough together to bond [10]. Also, the binding capability and absorption capability of Kacang Koro flour might be affected by the swelling power and lower amylose starch content. Kacang Koro flour has higher swelling power which might indicate weak bonding forces within the starch granules according to a study [11].

3.4. Colour profile analysis

3.4.1. L (Lightness)*

The result proved that the lightness (L* value) were significantly different ($p < 0.05$) between all Talbina formulations except for control (S) and sample A (Table 2). The result also showed that the Sample E exhibited the highest L* value (83.81) and the control (S) had the lowest L* value (74.01). The trend of the lightness was increasing as the Kacang Koro flour percentage is increased. The results could be due to Kacang Koro flour which is lighter in colour compared to barley flour [12].

3.4.2. a (Redness)*

The Kacang Koro Talbina sample redness was found to be significantly different ($p < 0.05$) in all samples produced (Table 2). Sample S exhibited the highest a* value (0.44) which while least a* value (greenish colour) was Sample E (-2.51). The findings may be attributed to the Kacang Koro flour, which is greener in colour compared with the redder barley flour. It is also possible that control S can indicate the presence of mycotoxin in the barley flour during processing [13]-[14].

3.4.3. b (Yellowness)*

Table 2 also shows the b * (yellowness value) of the Kacang Koro Talbina sample is significant ($p < 0.05$) for the remainder of the formulation between sample A and E. The yellow colour of Talbina varies from 15.21 to 21.89. Sample E with the highest value of Kacang Koro flour (100%) also has the highest yellow colour value (21.89) while sample S, B, C, and D showed no significant difference between them. The yellowness of the Talbina was higher in the Kacang Koro-Talbina that contained the higher percentage of Kacang Koro flour which was similar to a study about cowpea flour with a range of value of 11.38 to 13.14 [12].

3.5. Chemical analysis

3.5.1. Proximate analysis

Sample C and E Kacang Koro-Talbina, exhibited the highest moisture content (70.3, 70.6) followed by sample S (65.26), sample D (69.55) and E (69.87), respectively (Table 3). The results show that Kacang Koro-Talbina was affected by the percentage of Koro flour present in the formulations at 20% and 80% which decreased the moisture content of the Kacang Koro-Talbina. Choi et al. [15] reported that water absorbability is highly related with gelatinization and the eating quality. Schoch and Elder [16] reported that the swelling behaviour of the starch may be affected by structural arrangements of their constituent amylose and amylopectin. It may be assumed that the reason why the 100 % Kacang Koro-Talbina has the highest moisture content is due to its low amylose starch, which helps to absorb more water [15].

Table 3 Proximate Analysis Kacang Koro Talbina

	Moisture	Fat	Ash	Protein
Sample S	65.25 ± 5.54^{e}	3.19 ± 0.04^{a}	0.80 ± 0.06^{cd}	3.45 ± 0.31^{ef}
Sample A	63.25 ± 6.64^{f}	$2.08\pm.0.5^{b}$	0.97 ± 0.08^{c}	4.27 ± 0.24^{e}
Sample B	69.86 ± 3.42^{bc}	$0.68\pm.0.02^{e}$	0.99 ± 0.04^{bc}	5.95 ± 0.18^{cd}
Sample C	70.26 ± 6.64^{b}	1.09 ± 0.31^{dcd}	1.15 ± 0.05^{b}	6.30 ± 0.11^{c}
Sample D	69.54 ± 2.28^{cd}	1.20 ± 0.18^{cc}	1.27 ± 0.03^{b}	8.51 ± 0.24^{ab}
Sample E	70.62 ± 3.28^{a}	1.10 ± 0.03^{c}	$1.33\pm.0.04^{a}$	9.46 ± 0.31^{a}

	Fibre	Carbohydrate	Tryptophan	Calorie
Sample S	0.69 ± 0.02^{e}	26.61 ± 5.54^{b}	0.0008 ± 0.0002^{a}	4.26 ± 0.01^{a}
Sample A	0.43 ± 0.02^{ef}	28.97 ± 6.64^{a}	0.001 ± 0.0002^{a}	3.71 ± 0.03^{b}
Sample B	1.26 ± 0.01^{d}	21.24 ± 3.42^{c}	0.001 ± 0.0001^{a}	4.33 ± 0.02^{a}
Sample C	2.14 ± 0.01^{bc}	19.07 ± 6.64^{cd}	0.001 ± 0.0001^{a}	4.08 ± 0.01^{a}
Sample D	2.51 ± 0.01^{ab}	16.95 ± 2.28^{d}	0.001 ± 0.0001^{a}	4.21 ± 0.01^{a}
Sample E	2.67 ± 0.01^{a}	14.79 ± 3.28^{de}	0.001 ± 0.0001^{a}	4.27 ± 0.02^{a}

Values represent the mean ± standard deviation. Values with the same superscript letters in the same row are not significantly different ($p > 0.05$), where formulations: Control = S, Talbina (0% Kacang Koro flour); A = Talbina (20% Kacang Koro flour); B = Talbina (40% Kacang Koro flour); C = Talbina (60% Kacang Koro flour); D = Talbina (80% Kacang Koro flour); E = Talbina (100% Kacang Koro flour).

3.5.2. Ash

Table 3 also illustrates the ash content of five formulations of Kacang Koro-Talbina samples. The result showed that there was a significant difference ($p < 0.05$) between the formulations except for sample S, C and D. The highest percentage of ash content was 1.34% which belongs to formulation E while the lowest percentage of ash content of Kacang Koro-Talbina was 0.97%. Sample S exhibited the lowest ash content out of all Kacang Koro-Talbina sample (0.80%). This shows that the addition Kacang Koro flour caused a significant increase to the ash content of Kacang Koro-Talbina. During processing of 'Kacang Kacang Koro', the major constraint in the utilization of the bean was the difficult method of preparation; the long cooking time, the traditional method of dehulling the bean which involved manual removal of hulls from individual soaked beans [17]. Due to the difficult processing method, there is a chance that the Kacang Koro flour was somehow contaminated which results in a significant increase of ash content, especially

3.5.3. Protein

The results show that there is a significant difference in protein content ($p < 0.05$) between all formulations except for formulation C and E (Table 3). Sample E (9.46%) exhibited the highest protein content while sample S (control) depicted the lowest protein content (3.46%). The trend shows a correlation between high protein content percentages and an increased percentage of Kacang Koro flour. The variations in the proximate composition could be attributed to environmental conditions, type of soil and genetic factors [12].

3.5.4. Fat

The results also showed that fat content in Kacang Koro Talbina ranges 3.19% to 0.68%. Sample showed the highest protein content (2.09%) and the lowest protein content was found in Sample B (0.68%). The result shows that Kacang koro flour at 40% can influence the percentage of fat content. Newman et al. [18] quoted that amylose content of barley starch varies from 0 in zero amylose to 5 in waxy, 20-30 in normal and up to 45% in high-amylose barley which could alter the fat content of the end product. The variations in the proximate composition could be attributed to environmental conditions, type of soil and genetic factors [12]. From previous studies, it can be assumed that 'Kacang Koro' has similar properties as cowpeas, which has low amylose content. Further extrapolation from this point suggests that due to presence of high percentage of Kacang Koro flour in Koro-Talbina, contributes to increased percentage of fat content [12].

3.5.5. Fibre

The results showed that there was a significant difference ($p < 0.05$) between all Kacang Koro Talbina sample produced (Table 3). The highest fibre content was found in Sample E (2.67%) while Sample A (0.43%) exhibited the lowest Fibre content. The trend illustrates that the higher the percentage of Kacang koro flour, increases the fibre content. This study was in line with the finding by Olalekan and Bosede [7] who found that cowpea and 2 other legumes had negligible amounts of fibre). The variations in the proximate composition could be attributed to environmental conditions, type of soil and genetic factors [12]. It is commonly known that starch, protein, and dietary fibre are the major components of barley. Despite this, the study shows the formulation with the highest percentage of barley flour has a low percentage of fibre content.

3.5.6. Carbohydrate

Table 3 also shows that there was a significant difference ($p < 0.05$) between all Kacang Koro-Talbina samples, except for samples C and D. The highest carbohydrate content of Kacang Koro-Talbina was formulation A with 29% and the lowest percentage of carbohydrate content was formulation E with value of 14.8%. From figure 4.12, the trend shows that the carbohydrate content of Kacang Koro-Talbina decreases as the percentage of Kacang koro flour increases. Li et.al. [19] reported that barley is an excellent source of complex carbohydrates, which constitute about 80% of barley grain weight. The carbohydrate content correlates with the pasting, water absorption and other functional properties. It was also found that variability in amylose and amylopectin ratio can significantly affect barley starch swelling and gelatinization as well as pasting and retrogradation properties [20]. The variations in the proximate composition could be attributed to environmental conditions, type of soil and genetic factors [12]. The carbohydrate content of Kacang Koro-Talbina increases as the percentage of barley flour increases. This could be due to barley as a good source of complex carbohydrates [19].

3.6. Calorie content

Table 3 show that the calorie content of the Kacang Koro-Talbina sample ranged from 3.72 k/cal to 4.33 k/cal, (which was low calorie content). The calorie content of the Kacang Koro-Talbina was not influenced by the amount of Kacang koro flour in the sample. The calorie content may be contributed by other ingredients that had a constant amount in all the formulations such as, honey which was 10.2% of weight in gram in all Kacang Koro-Talbina samples.

3.7. Tryptophan content

Table 3 shows a low tryptophan content in Kacang Koro-Talbina samples that ranged from 0.86 mg to 1.17 mg. Comai et.al. [21] quoted that protein tryptophan content is higher in soybeans and lower in peas (502 and 192 mg/100 g of dry flour, respectively) than in the other legumes, which also contain non-protein tryptophan like cowpeas. However, in general grains usually possess a higher protein tryptophan content than legumes like barley. Tryptophan appears to be bound to water-soluble proteins and to proteins soluble at pH 8.9. This could also explain the low protein tryptophan content because the pH of Kacang Koro-Talbina ranges from 6.41 to 6.62. The tryptophan content of the Kacang Koro-Talbina was not influenced by the percentage of Kacang koro flour in the Kacang Koro-Talbina. It could be due to the type of barley used in this study was pearled barley [11].

3.7. Sensory evaluation

Table 4 Sensory Evaluation kacang koro talbina

Formulation	Attributes					
	Colour	Odour	Viscosity	Taste	After-Taste	Overall Acceptance
S	3.86 ± 0.24[d]	4.56 ± 0.14[a]	4.23 ± 0.15[a]	4.33 ± 0.19[a]	4.46 ± 0.13[a]	4.53 ± 0.31[a]
A	4.37 ± 0.14[cd]	4.26 ± 0.19[a]	4.35 ± 0.24[a]	4.53 ± 0.29[a]	4.54 ± 0.12[a]	4.33 ± 0.25[a]
B	4.83 ± 0.21[ab]	4.21 ± 0.16[a]	4.41 ± 0.21[a]	4.33 ± 0.28[a]	4.26 ± 0.18[a]	4.37 ± 0.48[a]
C	4.73 ± 0.23[bc]	4.26 ± 0.13[a]	4.35 ± 0.19[a]	4.06 ± 0.14[a]	3.93 ± 0.15[b]	4.26 ± 0.34[a]
D	5.13 ± 0.37[a]	4.28 ± 0.14[a]	4.33 ± 0.16[a]	4.43 ± 0.15[a]	4.26 ± 0.17[a]	4.53 ± 0.25[a]
E	5.12 ± 0.11[a]	4.52 ± 0.21[a]	4.11 ± 0.19[a]	4.13 ± 0.12[a]	3.93 ± 0.18[b]	4.07 ± 0.24[a]

[a-d]means values with different letters were significantly different within column ($p < 0.05$), where formulations: Control = S, Talbina (0% Kacang Koro flour); A = Talbina (20% Kacang Koro flour); B = Talbina (40% Kacang Koro flour); C = Talbina (60% Kacang Koro flour); D = Talbina (80% Kacang Koro flour); E = Talbina (100% Kacang Koro flour).

3.8. Colour acceptability

Table 4 showed that there was a significant difference ($p < 0.05$) sensory colour acceptance between of Kacang Koro-Talbina samples. Samples D and E showed the highest colour acceptance (5.13%) while the lowest colour acceptance was observed in the control that had a greyish white colour while sample D and E had a white yellowish appearance. (3.87%). The trend illustrates that the higher the percentage of Kacang koro flour, increases the sensory colour acceptance. The trend illustrates that the higher the percentage of Kacang koro flour, increases the sensory colour acceptance but only until a certain point before panellists dislike it. The colour acceptance of the Kacang Koro-Talbina might be influenced by the percentage of Kacang koro flour in the Kacang Koro-Talbina [7].

3.9. Odour acceptability

The results showed that there was no significant difference ($p < 0.05$) between all samples tested (Table 4). The range of score for odour acceptance in Kacang Koro-Talbina samples were from 4.2% to 4.57%. The trend illustrates that the odour acceptance was not affected by the different percentages of Kacang Koro flour. Control (S) showed to be the best formulation liked by the untrained panellists while the least liked formulation was formulation B. There were complaints from panellists that the odour was unpleasant and that was similar to soybeans.

3.10. Viscosity acceptability

The results showed that there was no significant difference ($p < 0.05$) for viscosity acceptance between all samples (Table 4). The viscosity acceptance was not affected by the different amounts of Kacang Koro flour used in the samples. However, sample B showed to be the most liked by the panellists while the least was sample E. The panellists noted that the B sample had the right balance of viscosity while the E sample was complained of being too diluted.

3.11. Taste acceptability

Table 4 also shows acceptance of the taste of Kacang Koro-Talbina, which shows that there was no significant difference ($p < 0.05$) between all formulations. The data showed that the different amounts of Kacang Koro flour used in the samples were not affected by the taste. However, the most accepted sample was A, while the least liked formulation was C.

3.12. After-Taste acceptability

The results showed that there was no significant difference ($p < 0.05$) in after-taste acceptance among all samples tested, ranging from 3.9 % to 4.47 % (Table 4). The results showed that the different percentages of Kacang Koro flour were not affected by after-taste acceptance. However, sample A was shown to be the best formulation preferred by untrained panellists, while sample E was the least preferred. Sample A was said to have a pleasant aftertaste while sample C was complained to have a bitter aftertaste.

3.13. Overall Acceptability

Overall acceptance of Kacang Koro-Talbina samples does not significantly vary between all samples ($p < 0.05$) (Table 4). The phenomenon shows that the different quantities of Kacang Koro flour did not impact the overall sensory acceptance. Sample D, however, proved to be the best formulation the untrained panellists liked while Formulation E was the least liked formulation. One panellist commented that sample D has a unique taste that he had never encountered before while most panellists agreed that sample E tasted like watered down soybean drink despite having the highest nutritive value out of all five formulations.

4. CONCLUSION

Sample E shows the highest potential for its nutritional value composed of 14.8% carbohydrate content, 9.46% protein content, 1.10% fat content, 2.67% fibre content and 4.28 kcal/g calorie content. The sensory evaluation revealed the highest value of overall accepted formulation was sample D. There was no significant difference in odour, viscosity, taste, after taste or overall acceptability. The physical analysis that had been conducted were pH, colour analysis and viscosity profile analysis. In the colour analysis, sample D had Lightness (L*) value of 82.61, redness (a*) value of -1.87, and yellowness (b*) of 20.76 that resulted in light yellowish colour. Viscosity profile analysis showed that formulation D low viscosity value which was the second best liked by panellists. Considering this finding, Kacang Koro could serve as a good source to enhance nutritionally and sensory acceptance especially in yogurt drink or Talbina product.

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REFERENCES

[1] M. M. Badrasawi, S. Shahar, Z. Abd Manaf, H. Haron, Effect of Talbina food consumption on depressive symptoms among elderly individuals in long term care facilities, randomized clinical trial. Clinical Interventions in Aging, 8 (2013), 279-285.

[2] S. E., Aly, A. S. Hathout, A. F. Sahab, Application of Hazard Analysis Critical Control Points in Dairy Products: A Case Study of Probiotic Talbina. Nature and Science, 9 (7) (2011), 102-113.

[3] H. E. Miller, F. Rigelhof, L. Marquart, A. Prak-ash, M. Kanter, Whole-grain products and antioxidants. Cereal Foods World, 45 (2000).

[4] Al-Bukhari, [Food. Hadith 5417]. In Sahih Al-Bukhari, 1st ed. Damascus: Dar Ibn Kather; 2002: 1379. Arabic.

[5] J. Axe, Get More Tryptophan for Better Sleep, Moods and Fewer Headaches, (2016).

[6] W. N. I. Wan Mohamad Din, Z. Mohd Zin, M. A. A. Abdullah, M. K. Zainol, The effects of different pre-treatments on the physicochemical composition and sensory acceptability of 'Kacang Koro' energy bars. Food Research, 4 (4) (2020), 1162-1171.

[7] A. J. Olalekan, B. F. Bosede, Comparative study on chemical composition and functional properties of three Nigerian legumes (Jack Beans, Pigeon Pea and Cowpea). Journal of Emerging Trends in Engineering and Applied Sciences (JETEAS), 1 (1) (2010), 89-95.

[8] S. G. Anema, Effect of Milk Concentration on heat-induced, pH-dependent dissociation of casein from micelles in reconstituted skim milk at temperatures between 20 and 120 °C. Journal of Agriculture and Food Chemistry, 46 (6) (1998), 2299–2305

[9] M. J. Lee, N. Y. Lee, Y. K. Kim, J. C. Park, I. D. Choi, S. G. Cho, J. G. Kim, H. K. Park, K. H. Park, K. J. Kim, H. S. Kim, Physicochemical properties of pearled hull-less barley cultivars with normal and low amylose content. Food Science and Biotechnology, 20 (1) (2011), 55-62.

[10] E. Shimelis, M. Meaza, S. Rakishit, Physicochemical properties, pasting behaviour and functional characteristics of flours and starches from improved bean (*Phaseolus vulgaris L*) varieties grown in East Africa. Agricultural Engineering International, 3 (2006), 1-18.

[11] A. O. Ashogbon, E. T. Akintayo, Morphological, functional and pasting properties of starches separated from rice cultivars grown in Nigeria. International Food Research Journal, 19 (2012), 665-671.

[12] S. Hamid, S. Muzzafar, I. A. Wani, F. A. Masoodi, Physicochemical and functional properties of two cowpea cultivars grown in temperate Indian climate. Cogent Food and Agriculture, 1 (1) (2015).

[13] V. Baliukoniene, B. Bakutis, H. Stankevicius, Mycological and mycotoxicological evaluation of grain. Annals of Agriculture and Environmental Medicine, 10 (2) (2003), 223-227.

[14] P. W. Maenetje, M. F. Dutton, The incidence of fungi and mycotoxin in South African barley products. Journal of Environmental Science Health, 42 (2) (2007), 229-236.

[15] H. C. Choi, J. H. Chi, S. Y. Cho, Varietal difference in water absorption characteristics of milled rice, and its relation to the other grain quality components. Korean J. Crop Sci., 44 (1999), 288-295.

[16] T. J. Schoch, A. L. Elder, Starchs in the food industry. In: Uses of Sugar and Other Carbohydrates in the Food Industry. Industrial and Engineering Chemistry (ed). Washington: American Chemical Society, (1955).

[17] S. O. Alagbaoso, N. C. Ihediohanma, R. O. Enwereuzoh, D. C. Okafor, A. A. Nwakudu, I. M. Agunwa, Effect of pH and Temperature on Functional Physico-chemical Properties of Asparagus bean (*Vigna sesquipedalis*) flours and moin-moin production from the flour. European Journal of Food Science and Technology, 3 (2) (2015), 85-105.

[18] R. K. Newman, C. W. Newman, H. Graham, The hypocholesterolemic function of barley β-glucans. Cereal Foods World, 34 (1989), 883-885.

[19] J. H. Li, T. Vasanthan, B. Rossnagel, R. Hoover, Starch from hull-less barley: I. Granule morphology, composition, and amylopectin structure. Food Chemistry, 74 (2001), 395-405.

[20] S. G. You, S. M. Kim, Molecular characteristics and functional properties of barley starches with varying amylose content. Journal of Food Science and Nutrition, 10 (2008), 207-213.

[21] S. Comai, A. Bertazzo, L. Bailoni, M. Zancato, C. Costa, G. Allegri, Protein and non-protein (free and protein-bound) tryptophan in legume seeds. Food Chemistry, 103 (2007), 657-661.