

Evaluation of Quality characteristics and storage stability of peanut beverage added ginger, moringa leaf powder and Lime

Abstract

This research aimed at evaluating the quality characteristics of peanut beverage produced from added ginger (PNGI), moringa leaf powder (PNMO), lime (PNLI), moringa leaf powder plus ginger (PNMG), lime plus moringa leaf powder (PNLM) and lime plus ginger (PNLG). Peanut seeds were roasted at 80 °C for 20 min milled and blended with ginger (PNGI), with moringa leaf powder (PNMP), with lime (PNLI) with moringa leaf powder and ginger (PNMG) with lime and moringa leaf powder (PNLM) with lime and ginger (PNLM) into paste. Water was heated at 80 °C and added to the paste while stirring for 30 min. The mixture was further heated in a boiling bath and filtered with muslin cloth and cooled to obtain a drink which was flavored with pineapple, banana and milk flavor and sucrose was also added.

The peanut beverage was subsequently evaluated for proximate, physicochemical, microbial, and sensory properties. The results showed moisture content of PNGI ranged from 79.87 – 83.95 %, with sample PNLI having the highest value was not significantly different ($p \geq 0.05$) from PNMO, PNMG, PNLM and PNLG but sample PNGI having the lowest value, which was significantly ($p \leq 0.05$) difference form PNLI, PNMG and PNLG. The ash content ranged from 1.92 – 2.41 %, with sample PNGI having the highest value which was significantly ($p \leq 0.05$) different from PNLI and PNMG but not significantly ($p \geq 0.05$) different from other samples. The crude fat content ranged from 2.92 -3.07 %, of which sample PNGI having the highest value and sample PNLI having the lowest value which are not significantly ($p \geq 0.05$) different from one another. The crude protein ranged from 4.01 – 4.74 % of which sample PNGI having the highest value and sample PNLG having the least value which are not significantly ($p \geq 0.05$) different from one another. The carbohydrate contents ranged from 3.49 – 6.49 % with sample PNLI had the highest value which was not significantly ($p \geq 0.05$) different from sample PNGI and PNMO and sample PNMG having the lowest value which was significantly ($p \geq 0.05$)

difference from other sample except PNLG. pH of beverages decreased from 7.90 PNMG week 1 to 3.21 in PNLM in week 3. Total titratable acidity present in the beverages were PNGI in week 1 0.13, PNMO(0.17), PNLI(0.18), PNMG(0.12), PNLM(0.19) and PNLG(0.16). At week 3, PNGI(0.18), PNMO(0.23), PNLI(0.24), PNMG(0.82), PNLM(0.24) and PNLG(0.24). The beverages contained low number of total plate counts (1.9×10^2 - 2.8×10^4) and fungi/yeasts counts (1.2×10^4 - 4.2×10^6). Overall acceptability was high for all samples.

Keywords: Peanut beverage, moringa, stability, ginger, lime

1.0 Introduction

A beverage is any kind of liquid, which is specifically prepared for human consumption. Beverages always largely consist of water. There are various kinds of beverage worldwide and the most popular is water. (Rajeshkumar, 2006) other beverages include alcoholic beverage, non-alcoholic beverage, (carbonated beverages) fruit or vegetable juices and beverages. Organic beverage provides a lot of nutrients needed by the body which comes from sources like protein, carbohydrate, vitamins, materials and lipids that help in boosting blood circulation in the body, building of strong bones and teeth, prevents cancer, reduces diabetes and development of heart complication. Benefits(2011).

Peanut beverage is a beverage created using peanuts and water. Recipes variations include lime, ginger, sweeteners and grains. It does not contain any lactose and is therefore suitable for people with lactose intolerance. Peanuts are roasted, dehulled sorted and grounded, and sometimes heated and then filtered through fine filter; the resulting liquid is considered the beverage. The shelf life of peanut beverage is dependent on many factors e.g. the type of peanut used in the preparation, the heating process and the method used in preserving it. peanut beverage are rich in essential nutrients, in a long serving, peanut provides 570 calories and are excellent source of several B vitamins, Vitamin E, several dietary minerals such as manganese (95 %), magnesium (525 DV) and potassium (48 % DV) and dietary fibre. They also contain about 25 % protein per 100g serving, a higher proportion than in many tree nuts (Conde Nast, 2015).

Moringa oleifera plants are among the most nutritious and useful botanical products available. The seed can be used in variety of ways including medicinal, nutritional supplements and for industrial and agricultural purpose. (www. themoringa.com/moringa _seeds, 2016). *Moringa oleifera* leaves are rich in phytonutrients, such as carotenoids (Saini *et al.*, 2014), tocopherols, and ascorbic acid. It has also been found to contain appreciable amount of total phenols and flavonoids which can be used as antioxidant (Vazquez-leon *et al.*, 2017).

In many parts of the world including Africa, the use of *Moringa oleifera* as a food fortificant is on the increase. In Nigeria, *Moringa oleifera* is known as “Ewe-ile” in Yoruba, “Samarin Dange” in Hausa and “Okwe oyibo” in Igbo. The tree grows to 8m high and 60 cm wide and the leaves are alternate with the old ones soon falling off. Leaflets are dark green above and pale on the under surface, variable in size and shape, but often rounded-elliptically Plate 3 seldom as much as 2.5 cm long (Orwa *et a.*, 2009).

Plant protein beverage as alternative source of dietary protein are desirable in developing countries such like Nigeria. However, the production process of peanut beverage is highly prone to microbial contamination, which reduces its shelf life. A large numbers of lactic acid bacteria, coliforms, molds and yeast have been reportedly implicated in its spoilage. As these microorganism use the carbohydrate content for fermentation processes which is undesirable. The broad objective of this study is to produce peanut beverage added ginger, lime and moringa leaves extract which can be consumed locally and internationally acceptable. Evaluate the proximate, physicochemical, microbiological and sensory qualities of ginger, lime and moringa leaves powder added beverages and to determine the storage stability of peanut beverage.

2.0 Materials and Methods

2.1 procurement of raw materials

The raw materials (sucrose, muslin clothes, plastics, flavours, ginger, and lime) were purchased from Kure ultra-modern market, Minna, Niger state. The peanuts were gotten from the International institute of tropical Agriculture Ibadan, Oyo state Nigeria while the moringa leaves were gotten from crop production research farm of Federal University of Technology Minna, Niger State.

The experiment was conducted at the Food Science and Technology department of school Agriculture and Agricultural Technology, Federal University of Technology, Minna, Niger state.

2.2 Preparation of Samples

Ten kilograms of matured and dried peanuts were manually cleaned to remove stones and damaged dirty seed, which was done by winnowing and hand picking.

2.3 Preparation of Peanut beverages

The peanut seeds were roasted at 80 °C for 20 min which made dehulling easier. It was then wet milled and blended with ginger (PNGI), with moringa leaf powder (PNMP), with lime (PNLI) with moringa leaf powder and ginger (PNMG) with lime and moringa leaf powder (PNLM) with lime and ginger (PNLM) into paste. Portable water was heated at 80 °C and then it was gradually added to paste obtained while stirring for about 30 min the mixture was further heated in a boiling bath (THELCO, model 83,USA) for 2 h at 10 °C. The mixture was filtered with muslin cloth and cooled to obtain a drink which was flavored with pineapple, banana and milk flavor and sucrose was also added, (Rustom *et al.*, 1995).

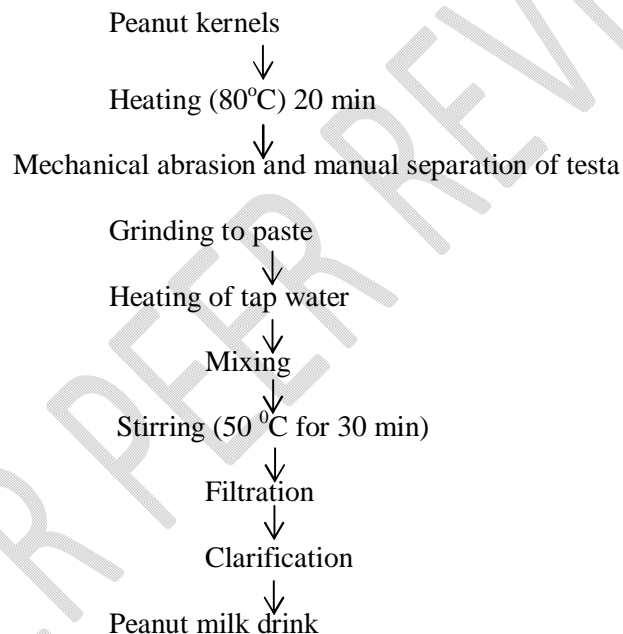


Fig 1: Flow chart for production of peanut beverages (Rustom *et al.*, 1995)

2.4 Preparation of ginger

Five grams of dried ginger were thoroughly washed with warm tap water to remove the dirt and knives were manually used to scrape adhering sands and stones.

2.5 Preparation of moringa leaves: The processing of moringa leaves into powder adopted the method described by de Saint Sauveur (2010). All leaflets were stripped from the leaf petiole. Diseased and

damaged leaves were discarded. Leaflets are washed in troughs using clean portable water to remove dirt. The leaves are washed again in 1 % saline for 3 min to remove microbes and finally washed again in clean tap water and allowed to drain. The washed leaves are allowed to drain for 15 min in perforated buckets. Leaf-lets were spread thinly on mesh trays tied on racks in a well-ventilated room, which is insect, rodent and dust proof. The leaves were turned over at least once, with sterile gloves, to improve uniform drying. Leaves completely dried within a maximum of 4 days. Dried leaves are milled using a stainless steel hammer mill. The leaf powders were sieved with the desired screen size. Recommended particle sizes are, fine (0.5 mm – 1.0 mm) .

2.6 Preparation of lime

Lime citrus were cut into halves and the liquid content of limes were squeezed with manually. This was done for 30 min until a reasonable quantity of lime of about 5 litres were obtained. The lime was then pasteurized at 65⁰C for 10 min.

2.7 Analytical methods

Proximate compositions

Determination of moisture content

The moisture content of the beverage was determined according to AOAC, 2012. Empty moisture dishes were cooled in desiccators for about 12 h. The dishes were weighed along with covers (W₁), five grams (% g) of samples were weighed into dishes and weighed again (W₂). The samples were placed in the air over with the container at 102 ⁰C and dried to a constant weight the dishes were then transferred into desiccators and cooled and then reweighed (W₃). A triplicate determination was made and the percentage calculated as below.

$$\% \text{moistrure content} = \left(\frac{\text{lossinweight}}{\text{weightofthesample}} \right) \times 100$$

Determination of crude Fat

Sample of 2 g was weighed into thimble and tightly ploughed with cotton wool. AOAC, (2012).The thimble was inserted into a soxhlet Extractor. Flat bottom flax of 500 mL of known weight containing 250 mL petroleum ether (B.PT.40-60 ⁰C) was fitted into the extractor. The three samples were extracted for 3 h at 60⁰C. The sample was removed and the solvent evaporated. The remaining oil in the flask was measured.

$$\%fat = \left(\frac{\text{weight gained by the flask}}{\text{weight of sample}} \right) \times 100$$

Determination of crude protein

The protein content was determined using kjedahl techniques by AOAC (2012). Three grams of sample was weighed into kjedahl digestion flask with the addition of catalyst (Selenium). Analytical grade concentration tetraoxosulphate (VI) 10 mL was added to the flask. The kjedahl digestion flask content was heated for 4 h in a digestion chamber until a digest is obtained. The sample which now digested were allowed to cool, distilled water was used to dilute the digest and was made up to 100 mL. The digest were then transferred into the Markham's distillation chamber and 20 mL of 40 % NaOH was added unto 10 mL of boric acid of which contain bromocresol green/methyl red, 3 drops indicator until 50 mL of distillate was collected. The titration of distillate was done with standardized 0.1N HCl until pink colour was observed. The crude protein was calculated as shown below.

$$\%N = \frac{\left(\frac{S-B \times 0.1N \times 0.014 \times 10}{\text{weight of the sample}} \right) \times 100}{1}$$

$$\%crude\ protein = \%N \times 6.25$$

$$s = \text{sample titre value} - \text{blank titre values}$$

Determination of carbohydrate

The energy composition of the sample were determined by the standard method describe by AOAC (2012) using Atwater factor of 4.4 and 9 kcal of carbohydrate, crude protein and fat respectively. The total amount of energy present in each sample were calculated by multiplying carbohydrate content by 4, crude protein by 4 and fat content by 9 kcal respectively. The summation of these parameters after multiplication equal to the energy (kcal) in each sample.

2.8 Physicochemical Analysis

Determination of total titratable acid (TTA)

The procedure outline by AOAC (2012) was used to determine the TTA of the sample. One gram of the sample was weighed into a beaker containing 9 mL of distilled water. The sample was titrated against 0.1N NaOH to the end point (pink) using 3 drops of phenolphthalein. The total titratable acid as expressed as lactic acid was calculated as follows

$$\text{TTA (\% lactic acid)} = \frac{\text{Titretable value} \times (0.009) \times 100}{\text{Weight of sample}}$$

0.009= weight of lactic acid

pH Determination

pH determination was carried out as described by Afoakwa *et al.*(2006) using the glass electrode TOA pH meter

Determination of total dissolved solids (TDS)

The total solids was determined according to AOAC (2012), after determining moisture content, it was subtracted from 100 to get total dissolved solids.

A total dissolved solids (TDS) was calculated as 100 – moisture content.

2.9 Microbiological Analysis

Serial dilution was carried out by measuring 1mL of sample in nine millilitre of distilled water in the test – tube. One millilitre of the mixture was transferred into the second test – tube which was shaken vigorously to make up 10 mL. The process was repeated and 1ml hopped into the sink. 1ml of the sample diluted 10^{-3} was measured with the use of pipette and inoculated onto Sabouraud Dextrose Agar (SDA) for growth of both yeasts and moulds while for bacteria count, it was inoculated in nutrient agar (NA) plates. The SDA plates are incubated at 25 °C (room temperature) for 72 h. All the plates were counted using colony counter at the incubation period and results recorded

Sensory Evaluation

The samples were subjected to sensory evaluation using the 9 – point Hedonic scale as described by (Iwe, 2002). The evaluation panel was made up of 20 panelists of students of Food Science and Technology and Animal Production Technology. The sample were assessed organoleptically for colour, appearance, flavor, texture taste and overall acceptability using 9 – point Hedonic scale i.e. the rating for the sample was given numerical values, ranging from likes extremely with 9 point to dislike extremely with 1 point and the sample was randomly coded.

Statistical Analysis

The data obtained were subjected to statistical analysis (SPSS, 2000) using one way ANOVA where significant differences ($p < 0.05$) of the responses of the 15 panelists existed and mean separation was also done using Duncan Multiple Range Test (Duncan, 2003),

3.0 Results and Discussion

Table 1: Proximate composition of peanut beverage samples

Sample	Moisture (%)	Ash (%)	Crude fat (%)	Crude Protein (%)	Carbohydrate (%)
PNGI	70.80 ^b	2.41 ^a	3.07 ^a	4.74 ^a	6.45 ^a
PNMO	81.72 ^{ab}	2.10 ^{ab}	2.86 ^a	4.37 ^a	6.46 ^a
PNLI	83.43 ^a	1.99 ^b	2.92 ^a	4.43 ^a	6.49 ^a
PNMG	83.95 ^a	1.92 ^b	2.93 ^a	4.14 ^a	3.49 ^c
PNLM	82.19 ^{ab}	2.10 ^{ab}	3.01 ^a	4.46 ^a	4.29 ^b
PNLG	82.74 ^a	2.19 ^{ab}	2.97 ^a	4.01 ^a	3.82 ^{ac}
$\pm SE$	0.7	0.09	0.10	0.40	0.19

Data are mean \pm Standard error of duplicate determination

Tables 1 shows the proximate composition of peanut beverage added ginger, lime moringa leaf powder, moringa leaf power plus ginger, lime plus moringa leaf powder lime plus ginger. The moisture content ranged from 79.87 – 83.95, with sample PNLI having the highest value was not significantly difference ($p \geq 0.05$) from PNMO, PNMG, PNLM and PNLG but sample PNGI having the lowest value, which was significantly ($p \leq 0.05$) difference from PNLI, PNMG and PNLG. The ash content ranged from 1.92 – 2.41, with sample PNGI having the highest value which was significantly ($p \leq 0.05$) different from PNLI and PNMG but not significantly ($p \geq 0.05$) different from other samples. The crude fat content ranged from 2.92 -3.07, of which sample PNGI having the highest value and sample PNLI having the lowest value which are not significantly ($p \geq 0.05$) different from one another. The crude protein mean core ranged from 4.01 – 4.74 of which sample PNGI having the highest value and sample PNLG having the least value which are not significantly ($p \geq 0.05$) different from one another. The carbohydrate mean score ranged from 3.49 – 6.49 with sample PNLI had the highest value which was not significantly ($p \geq 0.05$) difference from sample PNGI and PNMO and sample PNMG having the lowest value which was significantly ($p \geq 0.05$) different from other sample except PNLG.

Physicochemical properties of peanut beverage add ginger, moringa leaf powder, lime, moringa leaf powder plus ginger, lime plus moringa leaf powder and lime plus ginger.

The physicochemical properties of peanut beverages are shown in Table 2. At first week, the storage pH ranged from 5.96-7.90 and there was significant different (≤ 0.05). TTA at week one ranged from 0.12-19 with no significant ($p \geq 0.05$) difference between sample PNMO, PNLI, PNLM and PNLG but were significant difference from PNGI and PNMG. That of TDS ranged from

Table 2: Physicochemical properties of the various peanut beverages produced

Parameters	Weeks	PNGI	PNMO	PNLI	PNMG	PNLM	PNLG	$\pm SE$
pH	1	6.74 ^d	7.40 ^c	7.90 ^a	7.60 ^b	5.96 ^c	5.97 ^c	0.00
	2	6.73 ^d	7.41 ^c	7.91 ^a	7.61 ^b	5.96 ^c	5.96 ^b	0.00
	3	5.84 ^a	5.23 ^a	5.41 ^a	5.23 ^a	3.21 ^b	4.38 ^b ^c	0.00
TTA (%)	1	0.13 ^d	0.17 ^{ab}	0.18 ^{ab}	0.12 ^d	0.19 ^a	0.16 ^{cab}	0.00
	2	0.15 ^{cab}	0.21 ^{ab}	0.19 ^a	0.14 ^{cd}	0.20 ^{ab}	0.18 ^{ab}	0.00
	3	0.18 ^{ab}	0.23 ^b	0.24 ^b	0.82 ^d	0.24 ^b	0.24 ^b	0.00
TDS (%)	1	98.56 ^b	99.46 ^a	99.52 ^a	99.10 ^a ^d	98.90 ^b	99.20 ^{ab}	0.12
	2	98.10 ^c	97.49 ^{cb}	98.02 ^b	98.02 ^{cb}	97.00 ^a	96.13 ^b	0.12
	3	90.61 ^a	89.35 ^a	92.56 ^c	92.56 ^c	94.60 ^d	91.35 ^{ac}	0.12

99.1099.56 of which sample PNMO, PNLI, PNMG and PNLM were not significant from one another but sample PNGI and PNLM were significant (≤ 0.05) difference from PNMO and PNLI.

At week two of the storage the pH ranged from 5.96-7.91 with sample PNLI having the highest value while sample PNLM and PNLG having the lowest value. TTA at week two ranged 0.21-0.14 with sample PNGI had the highest value and sample PNMG having the lowest value, sample PNGI, PNMO, PNLI,

PNLM, and PNLG were significant ($p \leq 0.05$) different from PNMG of which PNMG was not significant ($p \geq 0.05$) different from PNGI. For that of TDS ranged from PNMG of which PNMG was not was not significant ($p \geq 0.05$) different from PNGI. for that of TDS ranged from 98.10-95.90 which sample PMGI had the highest and PNLM had the lowest value, sample PNGI, PNMO and PNLI, PNMG and PNLG were significant ($p \geq 0.05$) difference from PNLM. However at week three of the storage the PH ranged from 2.21-5.84 with sample PNGI having the highest value with sample PNLM had the least value but was significant ($p \leq 0.05$) different from sample PNGI, PNMO, PNLI and PNMG except PNLG. TTA ranged from 0.18-0.82 with sample PNMG having the highest value while PNMO having the least value but not significant ($p \geq 0.05$) different from PNGI, PNLM, and PNLG except PNLI that significant ($p \leq 0.05$) different from PNMG and other sample.

Table 3: Total plate count and mould/yeast count of peanut beverage samples at the end of week three

Beverages/parameters	Total plate count (cfu/ml)	Mould/Yeast count (cfu/ml)	Maximum acceptable standard (cfu/ml)
PNGI	2.0×10^1	1.4×10^4	3.0×10^5
PNMO	2.3×10^2	1.2×10^4	3.0×10^5
PNLI	1.9×10^2	2.8×10^3	3.0×10^5
PNMG	2.4×10^2	2.8×10^4	3.0×10^5
PNLM	2.6×10^4	3.8×10^3	3.0×10^5
PNLG	2.8×10^4	4.2×10^6	3.0×10^5

Table 3: shows the microbial analysis of peanut beverage samples. The total plate count on samples (PNGI, PNMO, PNLI, PNMG, PNLM and PNLG) ranged from 1.9×10^2 cfu/ml – 2.8×10^4 cfu/ml while the mould/yeast counts ranged from 1.2×10^4 cfu/ml to 4.2×10^6 cfu/ml at the end of week three. The microbial contents of the peanut beverage did not exceed the maximum acceptable standard (3.0×10^5 cfu/ml) as given by regulated body. For this reason, the peanut beverage were all microbial stable and for local and international consumption.

Table 4: Sensory properties of peanut beverage sample at week one

Sample	Colour	Appearance	Flavor	Texture	Taste	Overall acceptability
PNGI	7.67 ^a	7.60 ^a	7.93 ^a	7.00 ^a	8.13 ^a	7.70 ^a
PNMO	7.40 ^a	7.13 ^a	7.36 ^a	7.27 ^a	7.53 ^a	7.40 ^a
PNLI	7.13 ^a	6.87 ^a	6.06 ^b	6.07 ^b	5.73 ^b	6.30 ^{ab}

PNMG	7.60 ^a	7.40 ^a	7.73 ^a	7.27 ^{ab}	7.45 ^a	7.50 ^a
PNLM	7.70 ^a	7.60 ^a	7.36 ^a	7.20 ^{ab}	7.45 ^a	7.50 ^a
PNLG	7.73 ^a	7.53 ^a	7.80 ^a	7.67 ^a	7.73 ^a	7.70 ^a
$\pm SE$	0.3	0.3	0.3	0.4	0.4	0.4

Data are mean \pm Standard error of duplicate determination

Mean with common superscript are not significantly different ($p < 0.05$)

Table 4 shows the sensory properties of peanut beverage. The value for colours ranged from 7.13-7.73 with PNLG had the highest value while sample PNMG had the lowest and were not significantly ($p \geq 0.05$) different between the samples of which samples PNLM had the highest value while sample PNLI had lowest. Value and were not significant ($p \geq 0.05$) difference between each other. Flavor shows no significant ($p \geq 0.05$) difference between the samples of which sample PNGI had the highest value while sample PNLI had the lowest texture show that no significant ($p \geq 0.05$) different between the samples, sample PNLG had the highest value while sample PNLI had the lowest value. For that of taste, mean score ranged from 5.73-7.73 with sample PNLG had the highest value and sample PNLI with the lowest value Sample PNLI show significant ($p \geq 0.05$) difference from other samples.

General acceptability shows no significant ($p \geq 0.05$) difference between the samples, PMGI had the highest value while PNLI had the lowest value.

Table 5: Sensory properties of peanut beverage sample at week two

Sample	Colour	Appearance	Flavor	Texture	Taste	Overall acceptability
PNGI	6.67 ^a	6.87 ^{ab}	7.40 ^a	7.13 ^{ab}	8.13 ^a	7.19 ^c
PNMO	5.27 ^a	4.80 ^c	6.40 ^{cb}	6.13 ^b	7.53 ^a	5.90 ^a
PNLI	6.60 ^a	6.93 ^a	5.60 ^c	6.07 ^b	5.6 ^c	6.30 ^b
PNMG	6.40 ^a	6.27 ^b	7.27 ^b	7.33 ^a	7.27 ^{ab}	6.90 ^b
PNLM	6.13 ^a	6.33 ^b	6.00 ^c	7.27 ^{ab}	6.23 ^{cb}	6.30 ^b
PNLG	7.07 ^a	7.40 ^a	7.33 ^a	7.67 ^a	7.13 ^{ab}	5.84 ^a
$\pm SE$	0.4	0.4	0.3	0.3	0.5	0.4

Data are mean \pm Standard error of duplicate determination

Mean with common superscript are not significantly different ($p < 0.05$)

Table 5 shows the sensory properties of peanut beverage at week two. The scores for colour ranged from 5.27 – 7.07 with sample PNLG having the highest value, which was not significantly ($p \geq 0.05$) different from others. The value for appearance ranged from 4.80 – 7.40 with sample

PNLG having the highest mean score while PNMO had the lowest. Sample PNMO was significantly ($p \leq 0.05$) difference from other samples. Flavour ranged from 5.60 – 7.40 which sample PNGI was the highest, which was not significantly ($p \geq 0.05$) different from PNLI, while sample PNLI had the lowest and was not significantly ($p \geq 0.05$) different.

PNMO, PNLG and PNLM for that of texture ranged from 6.13 -7.33 with sample PNMG having the highest and shows no significantly ($p \geq 0.05$) different between PNGI, PNLI, PNLM and PNLG but significantly ($p \geq 0.05$) from PNMO only. For taste ranged from 5.60 – 7.87 with sample PNGI had the highest value and significantly ($p \leq 0.05$) difference from sample PNLI and PNLM while sample PNLI was the lowest and was significantly ($p \leq 0.05$) difference from sample PMGI, PNMG and PNLG.

For overall acceptability the means value ranged from 5.84 – 7.19 of which sample PMGI ha the highest value, which was significantly ($p \leq 0.05$) difference from PNLG had the lowest value and was significantly ($p \leq 0.05$) difference from PNGI, PNLI, PNMG and PNLM.

Table 6: Sensory properties of peanut beverage sample at week three

Sample	Colour	Appearance	Flavor	Texture	Taste	Overall acceptability
PNGI	6.20 ^a	6.80 ^a	7.00 ^a	6.80 ^a	6.60 ^a	6.70 ^c
PNMO	4.87 ^b	5.87 ^{cb}	5.60 ^b	6.27 ^b	6.27 ^a	5.90 ^b
PNLI	6.27 ^a	6.33 ^c	6.80 ^{ab}	6.13 ^a	6.13 ^a	6.33 ^a
PNMG	6.20 ^a	5.40 ^c	6.13 ^{ab}	6.53 ^a	6.53 ^a	6.28 ^a
PNLM	6.27 ^a	6.53 ^{ab}	5.87 ^{ab}	6.53 ^a	6.20 ^a	6.30 ^a
PNLG	6.00 ^a	6.40 ^{ab}	6.20 ^{ab}	6.33 ^a	6.33 ^a	6.30 ^a
$\pm SE$	0.4	0.3	0.4	0.2	0.3	0.4

Data are mean \pm Standard error of duplicate determination

Table 6: shows the sensory properties of the peanut beverage at the end of week three. The mean score for colour ranged from 4.87 – 6.27, with sample PNLI and PNLM have the highest value were not significantly ($p \geq 0.05$) difference from PMGI, PNMG and PNLG but were significantly ($p \leq 0.05$) difference from sample PNMO which had the lowest value. For the appearance the mean score ranged from 5.40 – 6.80 with the mean score ranged from sample PNLI, PNLM and PNLG while sample PNMG had the lowest value, and was significantly ($p \geq 0.05$) difference from PNGI, PNLI PNLM, and PNLG except PNMO that were not significantly ($p \geq 0.05$) difference. Flavor shows mean score from 5.6 -7.00, with sample PNGI

had the highest value and sample PNMO had the lowest of which sample PNGI, PNLI, PNMG, PNLM and PNLG were not significantly ($p \geq 0.05$) difference but PNMO was significantly ($p \leq 0.05$) difference from PNMO and PNLI. That of texture ranged from 6.13 – 6.80, while taste ranged from 6.13 -6.60.

Conclusion

The sensory evaluation results showed that sample PNGI (peanut beverage + ginger) had the best overall acceptability which was most preferred by the panelists. It the least amount of bacteria, yeast and mould contamination. The pH and Total Dissolved solids (TTS) of the sample decreases but Total Titretable Acidity (TTA) increased as the storage days increased. This led to increase in the alcoholic content in week three after which it was no longer acceptable. Sample PNMO (peanut nut and moringa leaf powder) and sample PNLI (peanut beverage +lime) all add good sensory qualities but less storage stability. Sample PNMG (moringa leaf powder + ginger) and PNLM (lime + moringa leaf powder also had good taste, mouth feel and overall acceptability, but less stable, probably free of less added ginger. Conclusively, it is advisable to add ginger to peanut beverage to give it a more storage stability free of microbial contamination than lime or moringa leaf powder.

Recommendation

Attention should be given to the use of ginger by food processors in increasing the shelf life of peanut beverage due to its preservative quality. Further studies should be done on other preservatives like, *phyllanthus*, combination of lime and lemon.

References

Afoakwa, E.O., Budu, A.S. and Mertson, A.B..(2006). Application of response surface methodology for optimizing the pre-processing conditions of Bambara ground nuts (*Voandzei subterranean*) during canning, *International Journal of Food Engineering* 2:1-8.

AOAC (2012) *Official Methods of Analysis*. The Association of Official Analytical Chemists, Washington D.C., USA

Iwe, M.O (2002), *Handbook of Sensory Methods and Analysis*.

Conde Nast. National Nutrient Database, Versiob SR- 21. 2014. Retrieved 15 January 2015.

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