BERKELEY PUBLICATION
AND RESEARCH INTERNATIONAL
03.28.2022
Journal of Health, Metabolism & Nutrition Studies Vol. 19 No. 3

FUNCTIONAL AND SENSORY PROPERTIES OF BISCUITS PRODUCED FROM WHEAT-FINGER MILLET FLOUR BLENDS

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ABSTRACT

Biscuits are rich sources of fat and carbohydrate and goosd sources of protein like lysine and tryptophan. The sensory properties of biscuits and functional properties of wheat-finger millet flour were investigated in this study. Wheat-finger millet flour were weighed and mixed in ratios of 95:5, 90:10, 85:15 and 80:20. All ingredients were mixed together with the blended flour, rolled, cut into circular shapes and then baked in the oven at 100°c for 30minutes to produce biscuits. The functional properties of the flour was determined using standard laboratory procedures while sensory evaluation of the biscuits was conducted. Data was analyzed using SPSS version 19. Results for functional properties showed that significant difference (P≤0.05) existed in the bulk density, water absorption capacity, oil absorption capacity, swelling capacity and swelling index among all the samples. Sensory evaluation scores showed

Introduction:

The term millet is derived from the French word "Mille" which means thousands with a handful of millet containing up of 1000 grains (Shaidi and Chandrakesara., 2013). Finger millet is a member of the millet group and also know as "Ragi" or "Tamba" (Jideani et al., 2012). Finger millet grains are cultivated in Nepal, a country in south Asia. (Jideani et al 2012).

Finger millet is a potential source of carbohydrate 81.5% protein 9.8% crude fibre 4.3% and minerals 2.7% it's a rich source of crude fibre and minerals which is remarkable higher than those of wheat (1.2% fibre, 1.5%) minerals and

ISSN: 1213-4406

significant difference (P≤0.05) in taste, appearance and texture while general acceptability showed no significant differences (P≤0.05) among samples. Nutritious and organoleptically acceptable biscuits were successfully produced from all the wheat – finger millet flour blends but the study recommends mass production of sample B(95:5 Wheat-Finger millet flour blend) because it produced the best biscuit quality in terms of functional properties and sensory evaluation scores among all formulated blends.

rice (0.2 fibre, 0.6% minerals), moreover its protein is comparatively well balanced; as it contains more lysine, threonine, tryptophan and valine than other millets. It ranks sixth in production after wheat, rice, maize, sorghum and "bajra" in India. Finger millet has the highest amount of calcium (344mg) and potassium 408mg among the millet grains. The cereal has low fat content (1.3%) and contains mainly unsaturated fat. The endosperm is attached to the seed coat is mainly used for the production of flour (Palanisamy et al; 2012).When milled into flour it is usually applied in the preparation of bakery products including biscuit, muffin, rusk, cake and bread which posses good texture, appearance, flavor and sensory acceptability. (Thapliyal and Singh, 2015).

Finger millet flour can be mixed with soy bean flour to make bakery products and also mixed with wheat flour to produce snacks (Shmelis et al., 2009).

Biscuits are nutritive snacks produced from unpalatable dough that is transformed into appetizing products through the application of heat in an oven. They are rich source of fat and carbohydrate, hence they are energy giving foods and also good sources of protein and minerals. They are ready to eat, convenient and inexpensive food product containing digestion and dietary principle of vital importance (Shmelis et al., 2009). The principal ingredients are flour, Sugar and water other ingredients include milk, salt, flavoring agent and aerating agent. (Shmelis et al., 2009).

Wheat (*Triticumspp*) is a grass that is cultivated word wide, globally it is the most important human food grain and ranks second in total production as a cereal crop behind maize, the third being rice, wheat grain is a staple

food used to make flour for leavened, flat and steamed breads, cookies, cakes, paster and also for fermentation to make beer and alcohol. (Thapliya et al., 2015). The husk of the grains are separated and milled to white flour. Wheat is considered to be a good source of protein, minerals, B group vitamins and dietary fiber. It has become the principal cereal being more widely used for the making of bread than any other cereals because of the quality and quantity of the characteristic protein called "gluten". Hence they are energy giving foods and also good sources of protein and minerals. (Shmelis et al., 2009). Attempts have been made to examine the physical and functional properties of malted composite flour for biscuits production (Deeptika and Arti 2019). Also the functional and sensory evaluation of biscuits produced from wheat, defatted soya bean and coconut flour (Obaroakpo, Iwanegbe and Ojokoh 2017) have been studied. However, this present study intends to investigate the functional and sensory properties of biscuits produced from wheat – finger millet flour.

Statement of problem

The challenges of finger millet being under utilized in developing countries coupled with the immense potential to process the grains into value added food and beverages has necessitated this study (Mamatha and Begum, 2013).

Justification

Utilization of finger millet in food formulation is increasing worldwide since they are rich sources of calcium, magnesium, phosphorus and dietary fibre which offers several health benefits like strengthening of bones in growing children and aging adult (Ma la et al., 2014). The effective use of these grains can help to prevent and manage some other nutritional disorders.

Aim and Objectives

The aim of this research work is to investigate the functional and sensory properties of biscuits produced from wheat –finger millet flour blend.

The objectives are;

1. To produce flour from wheat-finger millet.
2. To produce biscuits from wheat flour-finger millet flour blends.
3. To evaluate the functional and sensory properties of biscuits from refind wheat flour –finger millet flour blend.

MATERIALS AND METHODS

Finger millet flour, wheat flour butter, baking powder, flavor, nutmeg sugar and milk.

Sample size/sample collection

Finger millet grains were purchased from area 1 market in Mpape, Federal Capital territory (FCT) Abuja, Nigeria. Wheat flour and other ingredient (sugar, baking powder, milk and butter) from modern market, Bida Niger state.

Sample Production/Preparation-flow chart

Finger millet wassoaked for 12hours at 28◦c wash and dried in a hot air oven for 40minutes at 60◦c was milled with attraction mill, sieved and then the finger millet flour was ready.

Production of Wheat – Finger millet Biscuits

Finger millet flour and wheat flour were weighed and mixed in a bowl, while all ingredients were added such as butter, baking powder, sugar and milk andmixed together thoroughly, the mixture was rubbed in, the dough was roll out using rolling pin until flat. And was cut into circular shape, baked in the oven for 20minutes at 100◦c then cooled and packaged.

Finger millet grains

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Sorting (to remove unwanted particles)

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Soaking (12 hours for 28°c)

↓

Washing

↓

ISSN: 1213-4406

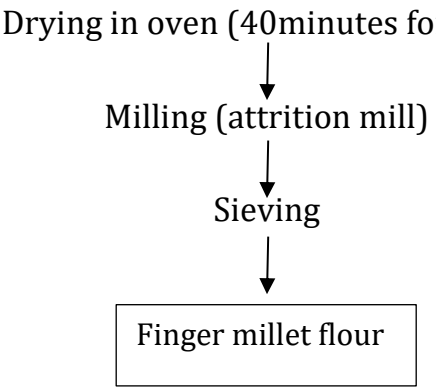

Fig 1. flow chart for the production of finger millet flour

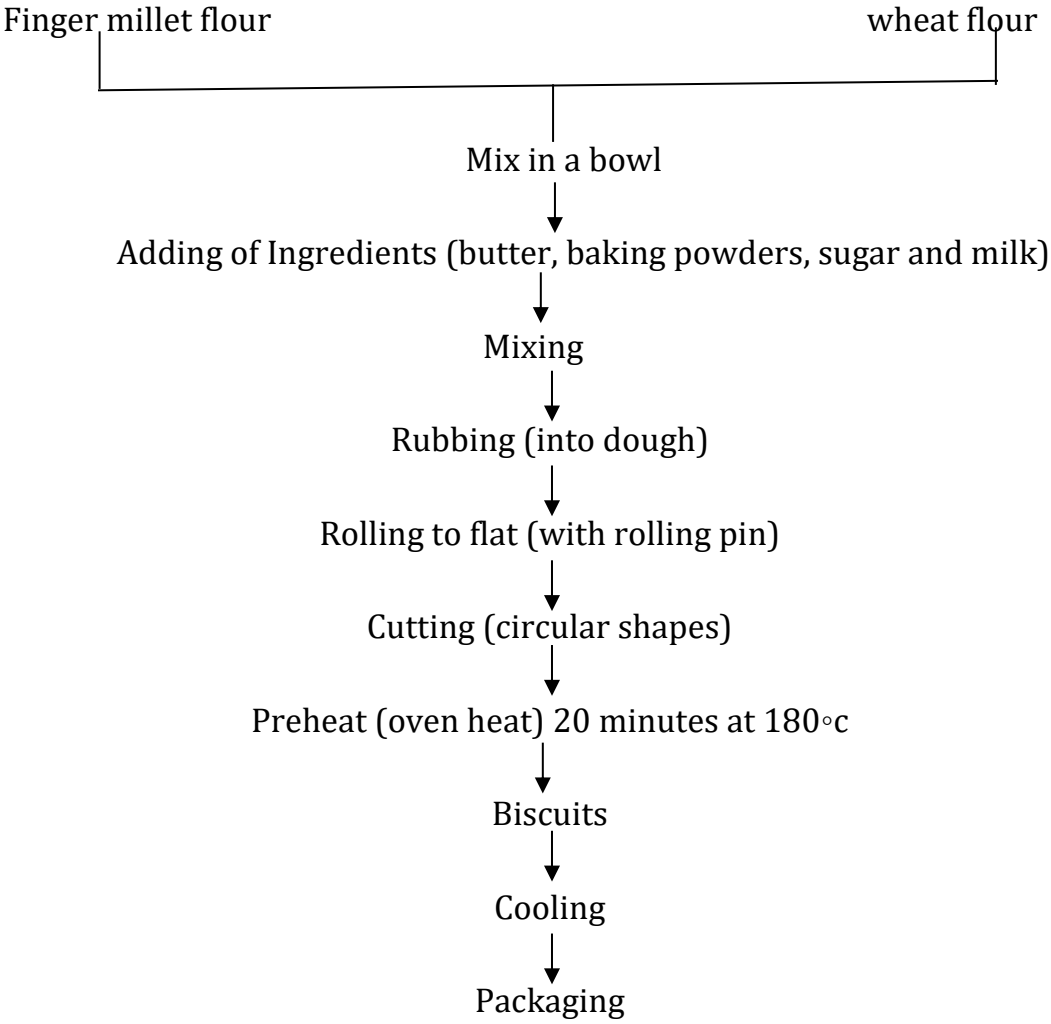

Fig 2 flow chart for the production of wheat-finger millet biscuits.

ISSN: 1213-4406

SAMPLE ANALYSIS

Functional properties

The water absorbsion capacity, bulk density, swelling index, oil absorption, gelling point and boiling point were determined by the method described by Obaroakpo et al., (2010).

Table 1: Formulation of flour blends

Wheat flour (g)	Finger millet flour (g)
100%	0%
95%	5%
90%	10%
85%	15%
80%	20%

Table 2: Ingredient proportion for finger millet biscuits

Ingredient	proportion
Butter	200g
Baking powder	5g
Milk	1 cup - 100g
Sugar	100g 0.1
Salt	0.25g
Nutmeg	10g
Vanilla flavor	25g

Statistical Analysis

All data generated from the experiment v ıalyzed in duplicate and means subjected using analysis of variance (ANOVA) and Duncan Multiple Range Test(DMRT) to test significant differences between means ($P<0.05$)

RESULTS

Table 3 Functional Properties of Biscuits

SAMPLES	BULK DENSITY	WAC	OAC	SC	SI
A	$0.965^{a}\pm0.02$	$232.91^{a}\pm0.21$	$101.05^{a}\pm0.58$	$622.95^{a}\pm0.34$	$8.350^{a}\pm0.05$
B	$0.715^{b}\pm0.01$	$218.00^{b}\pm0.10$	$100.97^{ab}\pm0.01$	$614.55^{b}\pm0.45$	$7.900^{b}\pm0.00$
C	$0.665^{c}\pm0.01$	$216.51^{c}\pm00.29$	$100.97^{ab}\pm0.01$	$579.90^{c}\pm0.51$	$6.953^{c}\pm0.25$
D	$0.665^{c}\pm0.01$	$210.95^{d}\pm0.55$	$100.97^{ab}\pm0.01$	$426.70^{c}\pm0.59$	$5.760^{d}\pm0.00$

ISSN: 1213-4406

E	0.610^{d}±0.00	200.44^{e}±0.27	100.9^{b}±0.00	360.58^{d}±0.24	3.650^{e}±0.56

Values are means ± S.E of duplicate of determination. Means not followed by the superscript are significantly different (P≤0.05).

KeyWAC = Water Absorption Capacity, OAC = Oil Absorption Capacity, SC= Swelling Capacity, SI= Solubility Index
A= Wheat flour 100%.
B= Wheat flour 95%, finger millet 5%
C= Wheat flour 90%, finger millet 10%.
D= Wheat flour 85%, finger millet 15%.
E= Wheat flour 80%, finger millet 20%.

Table 4 **Sensory evaluation of Biscuits produced from wheat- finger millet flour blends**

SAMPLES	TASTE	APPEARANCE	TEXTURE	General Acceptability	
A	8.200^{a}±0.17	7.700^{a}±0.23	7.450^{ab}±0.19	8.100^{a}±0.20	
B	7.550^{ab}±0.29	6.700^{b}±0.30	7.700^{a}±0.27	7.530^{a}±0.26	
C	6.800^{b}±0.43	7.400^{ab}±0.21	7.200^{ab}±0.22	7.600^{a}±0.22	
D	7.700^{ab}±0.27	7.300^{ab}±0.35	7.600^{ab}±0.22	7.550^{a}±0.27	
E	7.100^{b}±0.32	7.100^{ab}±0.28	6.700^{b}±0.44	7.500^{a}±0.30	

Values are means ± S.E of duplicate of determination. Means not followed by the superscript are significantly different (P≤0.05).

Key A= Wheat flour 100%
B= Wheat flour 95%, finger millet 5%.
C= Wheat flour 90%, finger millet 10%.
D= Wheat flour 85%, finger millet 15%.
E= Wheat flour 80% , finger millet 20%.

DISCUSSION

Functional Properties

Bulk density is a measure of heaviness of flour. Bulk density gives indication of the relative volume of packaging material required. It is also important in infant feeding where less bulk is desirable (Obaroakpo,Iwanegbe and Ojokoh,2017). In the present study, the bulk density of wheat flour (sample A), was significantly higher than the other samples(composite flour blends).This may be due to the addition of finger millet(Deeptika and Arti2019). T 19 n agreement with the findings of

Deeptika and Arti (2019). Adetuyi et al., 2009) which also reported that bulk density of wheat flour decreased after it had been blended with soya bean.

The Water Absorption Capacity presents the ability of product to associate with water under conditions where water is limiting in order to improve its handling characteristics and dough making potential(Obaroakp, Iwenegba and' Ojoko 2017). Water capacity is important in bulking and consistency of products as well as baking application. WAC gives an indication of the amount of water available for gelatinization (Edema et al., 2005) WAC in this study revealed that wheat flour (sample A) was significantly higher and became lower when finger millet flour blend was added this could be due to less availability of polar amino acids in the blended flour and this effect could probably result to loose association of finger millet flour (Falola et al., 2011).

Oil Absorption Capacity (OAC): is important since oil acts as flavor retainer and enhances the mouth feel of foods (Aremu et al., 2007). It can be expressed as the grams of oil blend per 100 gram of the sample in dry basis (Deshpande and Proshecha, 2011). OAC of the study, varied from 100. 94 to 101.05 showing that composite flour had higher OAC. This could be the result of as hydrophobic characters of protein in flour. the presence of protein exposes more non-polar amino acids to the fat and enhances it, as a result of which the flour absorbs more oil (Oluwalana, Oluwamukomi, Fagbemi and Oluwafemi, 2011). The findings of this research is however similar to the report by Deepika and Aarti (2019) in the production of biscuits from wheat flour. Adetuyi et al.,(2009) also reported similar findings in the production Of biscuits from wheat flour and soybean flour.

Swelling Capacity is regarded as a quality criterion in some good formulations such as bakery products. swelling Capacity is an evidence of non-covalent bonding between molecules within starch granules and as a factor of the ratio of α- amylose and amy 22 n ratios (Osungbaro et al., 2010). The increase in Swelling capacity could be attributed to the increase in the carbohydrate content of the blends (Osungbaro et al., 2010).

The swelling power is an Indication of the presence of amylase which influences the quantity of amylose and amylopectin present in the finger millet. It also indicates the degree of exposure of the internal structure of the starch present in the flour to the action of water (Kafila, 2010). In this study the swelling capacity decreased with addition of finger millet flour.

This result was similar to the findings of Adetuyi et al., (2009) and also by Deepika and Arti, (2019).

Sensory Evaluation

Table2 indicates that all the biscuit samples produced from different ratios of Finger millet-wheat flour blends were generally accepted in all attributes evaluated as none scored l ` :he minimum acceptable rating of 5 on the 9 points hedonic scale. Hc , the results were similar to the finding of physical and functional properties of malted composite flour for biscuits production (Deeptika and Arti 2019), who reported similar values. The high scores given to wheat flour biscuits (Sample A) may be as a result of the familiarity of the panelist to the products.

CONCLUSION

Nutritious and oganoleptically acceptable biscuits was successfully produced from wheat – finger millet blends.

The functional properties showed similarities as there was significant($P<0.05$)increase in bulk density, water absorption capacity, oil absorption capacity, swelling capacity and solubility index.

The sensory result showed decrease in all the attributes evaluated with the addition of finger millet to the blends.

RECOMMENDATION

This research work recommends Sample B(95:5 Wheat-Finger millet flour blend) among the formulated blends because it was the best product in terms of functional properties and sensory evaluation.

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