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Study on Production and Quality Evaluation of Biscuits Made From the Blend of Cow Peas and Wheat Flour

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ABSTRACT

Cowpea is a sub-Saharan African indigenous legume and is primarily grown as an intercrop with millets, sorghum, groundnut and maize in the dry savanna regions. In certain parts of the tropics, protein-rich cowpea grains are eaten in various ways. In West Africa, the average cowpea grain yield is approximately 492 kg/ha, which is much lower than its potential yield. Wheat is the most significant food grain in the world, on the other hand. It provides the citizens of the world with around 20 percent of the total calories and proteins of food. In 43 countries, it is the main staple for at least 35 percent of the world's population. In Europe, over 30 percent of food calories are derived from wheat, while in some South-East Asian countries, where rice is the staple, less than 10 percent of calories are derived from wheat. Reliance on wheat varies widely with the geographical region. The effect on the rheological, baking and sensory characteristics of biscuits of blending 50 to 250 g kg-1 cowpea flour into wheat flour will be studied. The prevalence of protein energy malnutrition in developing economies is growing, especially in Kenya, owing to poverty and the dependence of consumers on plant sources to meet their energy needs. Food diversification is one method to eradicate the malnutrition of protein energy, and pulses have the ability to be used in cereal products to improve protein quality. For this purpose, different varieties of wheat will be used for the preparation of flour blends which, in this case, will be further assessed for their quality and potential application in baked goods, such as biscuits. Five blending ratios, including B1 (90:10), B2 (40:60), B3 (65:35), B4 (78:22), and B5 (53:47), respectively, will be prepared for the wheat and cowpea flour blends. For flour blend formulation, the D-optimal programmer for mixture design will be used. Biscuit and extruded cowpea and wheat blend products will be examined. Physical, functional, proximate, mineral and microbial consistency are the criteria of the quality characteristics to be used in value-added items. In addition, it will also investigate bioactive components and sensory consistency assessment. The biscuit samples will be prepared for a 10-minute holding time at a baking temperature of 205 °C. Extruded samples are also provided at feed moisture (18 and 21%), barrel temperature (100, 110 and 120 °C) and screw velocity (175 and 220 rpm).

Key Words *– Biscuits, Cow Peas*

INTRODUCTION

Biscuits are unleavened pastries which are mainly made using wheat flour as a major ingredient while some other ingredients such as shortening or other fats, along with sugar and egg by adding some milk and baking powder which is according to the requirements. Wheat flour is the most popular base flour used to bake cookies or biscuits and can be attributed specifically to "gluten" for its unique protein. For some items such as breads and biscuits, the presence of gluten is important as it forms an elastic structural network of dough that is a fundamental part of dough production for baking Cowpea is a leguminous crop grown in many Asian and African tropical and subtropical areas. It has been in use since the very early days of civilization as part of animal and human food. Its composition indicates that it has up to 22 to 25 percent proteins, which are primarily in the form of crude protein along with amino acids such as glutamic acid along with aspartic acid and lysine as a major content of amino acids. The composition of Cowpeas indicates that fat with very low cholesterol levels is present in very small quantities. The production data indicates that over the past few years, Kenya and Africa as a whole have been producing cow peas in enormous quantities. Increases in the presence of higher quantities of ingredients such as proteins and minerals are essential for intake in any possible form. Almost all African countries eat it because of its availability. Cow pea is part of regular development in Asian and African agricultural lands, so it has become the main subsistence for developing and developed countries. It is believed that wheat is a true nutritious staple food, but compared to cow pea, which provides a little more protein, its protein composition is lower. After studying the compositions of both wheat and cow pea, there is considerable interest in strengthening wheat flour to increase its protein content, mainly by using cowpea as a source, the lack of amino acids can be increased (Jayathilake et al., 2018). The use of cowpeas in bakery items has been restricted and there are some anti-nutritional factors, including raffinose and stachyose from the oligosaccharide family, such as some indigestible carbohydrate forms. It is a significant limitation, and further studies in structural structure and chemistry need to be discussed. Since the digestion of such large carbohydrates is difficult, it leads to abdominal problems, particularly flatulence, when anaerobic micro biome is present.

In order to improve the nutritional and sensory quality of biscuits, a research was carried out in Sweden in which cow pea flour, along with wheat flour, was used in fermented form. Different blending levels consisting of five groups consisting of wheat flour were used in the study in 0 percent, 5 percent, 10 percent, 15 percent, 20 percent along with 30 percent cowpea flour and the product produced was bread so that the appropriate analysis could be performed. All the findings showed that the blends can be used to make cowpea flour appropriate. The study showed that 10 parts of cowpea flour were the best composition for blends, while the remaining 90 parts were wheat flour.

The chemical analysis also showed positive results in terms of the increase in amino acid content. It was concluded that in terms of chemical, physical and nutritional characteristics of baking products such as breads, mixing cowpea flour with wheat flour is very useful Another research was performed to determine the effects of mixing of flours on the functional and sensory properties of baking products. For this analysis, biscuits were made from four distinct blend compositions that included wheat, rice, gramme and potato composite flours. The five classes consisted predominantly of wheat flour as the base and other flours in various concentrations. Functional properties such as emulsion operation, swelling ability, oil absorption

capacity and composite flour bulk density were found to be enhanced. Although the findings for sensory assessment of biscuits were moderately in the category of like. It has been concluded that biscuits can be produced using composite flours and blends (Hallén et al., 2004). Analysis using cassava and cowpea was arranged in order to research the combination of cowpea flour with other foods. The two flours were blended and used for the preparation of cookies to replace wheat flour. Cookies were used as control with 100 percent wheat. In tests, chemical analysis showed that an increase in the amount of substitution of cassava flour resulted in a decrease in the protein content of the composite flour while the protein content increased with the addition of cowpea flour. The study concluded that cow pea blending can increase protein along with other useful composition and nutrition benefits (Olapade & Adeyemo, 2014).

OBJECTIVES

1. To analyze and determine the Nutritional composition, Production and Quality evaluation of biscuits made from cowpea and wheat flour blend.

2. To study the effects of blending technology at different levels of wheat flour with cowpea on the physical and nutritional properties of the end product.

Production of composite biscuits

The recipe used to produce the composite biscuit is shown in Table 1. Seven blends were obtained. The fatwas creamedwithsugar untilfluffy, the other dry ingredients were added, then liquid ingredients. Water (5ml) were added to obtain the desired dough and the dough was vigorously kneaded with a doughmixer (Hobart, H600)for 30 min, (Okaka, 1997). The dough was placed on a flat rolling table and kneaded lightly for 5 min as to acquire the required thickness. It was cut into round shapes using amanualbiscuit cutter. The cut doughs were arranged on greased trays and baked in the oven at 200 oC for 20 min. The hot baked biscuits were allowed to coolfor 15 min and packaged in cellop

Proximate composition of biscuits

The moisture, ash and fat contents were determined using AOAC (1984) while protein content was determined by Micro Kjeldahlmethod (Pearson, 1976). The carbohydrate content was by difference.

Break strength of biscuit

Okaka and Isiel (1990) methods were used. Biscuit of known thickness (0.4cm) was placed centrally between two parallel metal bars (3cm was low in carbohydrate content and according to Ihekoronye and Ngoddy (1985), wheat flour has a very high content of starch. The mean spread ratio of the samples of composite biscuits is shown in Table 3. Wheat (100%) sample (control) had the lowest flow/spread ratio of 4.54 compared to the other samples. Significant differences existed among the samples at $p < 0.05$). breadfruit/wheat flour(10:90%)formulation of biscuit had a very high break strength and compared favourablywith100% wheat flour biscuit which had the highest break strength. Significant differences ($p < 0.05$) exist in odour, taste, texture, colour and general capability of the biscuits as shown in Table 5. Sample AXZ (100%) wheat (control), was not significantly different from samples XAB (10:90%), AZX (20:80%) and ABC (60:40%)

breadfruit/wheat biscuits respectively but were significantly different from others. These three samples compared favorably with AXZ (100%) wheat in terms of odor. The taste of sample AXZ(100%) wheat biscuit was not significantly different from XAB (10:90%), AZX(20:80%) and ABC(60:40%) breadfruit/wheat biscuits respectively but was significantly different from others. This equally means that the three samples compared favorably with AXZ (100%) wheat in terms of taste. There was no significant difference in samples AXZ (0:100%), XAB (10: 90%), AZX (20:80%) breadfruit/wheat biscuits respectively in terms of texture but significant differences exist in other samples. This means that the two samples are as good as AXZ(100%) wheat biscuit with respect to their texture. The Aroma showed that AXZ (100%) wheat biscuit was not significantly different from sample XAB (10:90%) breadfruit/wheat biscuit but significant differences exist between the other samples. The color of the samples showed no significant difference between AXZ (100%) wheat biscuit and XAB(10:90%) breadfruit/wheat biscuit but they were significantly different from the other samples. This implies that 100% wheat biscuit compared, favorably with 10:90 breadfruit/wheat biscuit in terms of color. General acceptability showed that AXZ (100%) wheat biscuit was not significantly different from XAB(10:90%) breadfruit/ wheat biscuit, but was significantly different formal the other samples. Therefore ,sample AXZ(100%) wheat could be compared with sample XAB (10: 90%) breadfruit/wheat in terms of general acceptability. Sensory valuation of composite flour biscuits from breadfruit/wheat flour showed that substitution of the breadfruit flourto 10% level was statistically comparable to wheat flour for biscuit production.

RESEARCH METHODOLOGY

Basically, the wheat flour (Triticum aestivum) and cowpea beans (Vigna unguiculata) will be used to develop the composite/blended wheat-cowpea mixture.

1. Sample Collection and transportation

Both cowpea samples and hard wheat variety (raw materials) will be collected from Kenya Agricultural Research and Livestock Institute (KARLO). All research samples will be packed with polypropene carrier bags and stored at dry conditions at the room temperature in the school food engineering laboratory for further use. Other important ingredients to be purchased from local market and will include margarine, eggs, nutmeg, vanilla essence and sugar.

2. Preparation of Cowpea Bean Flour

The cowpea beans will be sorted to remove the unwholesome and defected ones and the foreign materials. The sorted beans will be parboiled for 5 minutes for easy removal of skin and the black eyes. The parboiled cowpea beans will thereafter be dehulled to remove the outer covering including the black eye. The dehulled beans will be dried in convention oven at a temperature of 1500℃ for 3hours. The oven-dried cowpea beans will thereafter be milled into refined bean flour referred to as supreme quality bean flour and finally stored in an airtight container.

3. Blend formulation

The cowpea grains will be steeped in tap water at 28 °C and decorticated. De-hull cowpea grain will be dried at 52 °C and milled with laboratory miller (CIT-LDM-15, USA) sieve size of 750

µm. Blended flour for cowpea and wheat flour will be prepared as B0 (0:100), B1 (90:10), B2 (40:60), B3 (65:35), B4 (78:22), B5 (53:47), B6 (100:0) (wheat to cowpea flour), respectively using D-optimal mixture software.

4. Blend formulation

The various blends formulated from a mixture of cowpea and wheat flours will be mixed separately with the same quantity of other ingredients (350 g flour, 115 g sugar, and 50 mL baking fat, 10 g milk powder, 0.25 mL vanilla, 1.75 g salt, 71 mL water and baking powder 2 g). The fat will be creamed with sugar until fluffy, and other ingredients will also be added. The batter will be kneaded on a rolling table to acquire the desired thickness. The batter will later be cut to square shape with the aid of knife cutter. It will be baked in the oven at 205 °C for 10-minutes, cooled and packaged for further use.

5. Biscuit product development

The various blends formulated from a mixture of cowpea and wheat flours will be mixed separately with the same quantity of other ingredients (350 g flour, 115 g sugar, and 50 mL baking fat, 10 g milk powder, 0.25 mL vanilla, 1.75 g salt, 71 mL water and baking powder 2 g). The fat will be creamed with sugar until fluffy, and other ingredients will also be added. The batter will be kneaded on a rolling table to acquire the desired thickness. The batter will later be cut to square shape with the aid of knife cutter.

6. Extrusion process

The blended samples will as well be fed manually through a rotatable and screw operated conical hopper using Twin-screw extruder. The hopper, which is mounted vertically above the end of the extruder, equipped with a screw speed which is adjusted to 7 and 8 rpm and water pump stoke level will be adjusted to give 18 and 21% feed moisture; respectively. The blended flour will be extruded at a screw speed of 175 and 200 rpm, barrel temperature (100, 110,120 °C), and feed moisture (18 and 21%) with 1.0 mm die diameter of extrusion. The barrel temperature at zone three will be controlled with a temperature sensor probe fit which is controlled by cold water motorize pump. Experimental samples will be collected when a steady state (constant temperature and torque) is achieved. The extradite products will be kept on aluminum foil with benches to dry. Finally, all samples will be packaged in polypropene bags for further analysis.

7. Methods of analyzing the blended flour

PH of flour -The pH values of the blended flours will be determined using the official association of analytical communities (AOAC) method

- Bulk density and dispensability of the flour- bulk density of flour will be determined with leveled flask tube which will be weighed and filled with a sample to 5 mL by constant tapping.

- Proximate composition analysis- Moisture content, crude fat, crude protein, ash, the crude fiber of sample will determine according to AOAC official method.

- Mineral concentration-This method will be described by AOAC official method number 984.27, using atomic absorption spectrophotometer (AAS).
- Bioactive compounds-Phytate content will have to be determined
- Microbiological Analysis- The microbiological analysis (total aerobic bacteria, yeast, and molds) sample will also be carried out. Plate count agar (PCA) and potato dextrose agar (PDA) will be used in this case for enumeration of bacteria, yeast, and mold; respectively
- Sensory quality attributes- The biscuit and extrudate samples with controls will be presented separately for specific number of semi-trained panelists in food engineering laboratory for sensory acceptance tests. All samples will be tested by each individual of untrained panelist for color, appearance, flavor/aroma, crispness, and overall acceptability. The samples will then be evaluated on nine (9) hedonic scale method.

CONCLUSION

The study showed that the use of composite flour for the production of bambara nut and cowpea flour biscuits substituted for wheat flour increased the nutrient content of high-protein, crude fat and crude fibre biscuits. In terms of balancing the vulnerable diet community, an improvement in the carbohydrate content of T5 compared with the initial value of wheat is also encouraging. The overall acceptability of T5 is a rationale for the recommendation of 25 percent bambara nut flour, 25 percent cowpea and 50 percent wheat flour for the production of biscuits, which will improve market nutritional requirements and increase the economic value of bambara nut and cowpea for potential use in biscuit production.

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