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MICROBIOLOGICAL, PROXIMATE ANALYSIS AND SENSORY EVALUATION OF BAKED PRODUCTS FROM BLENDS OF WHEAT-BREADFRUIT FLOURS

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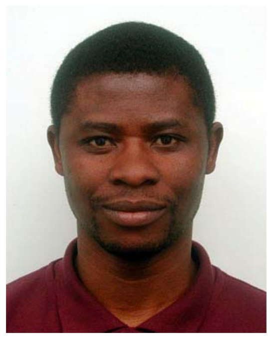

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ABSTRACT

The possibility of making bread of good nutritional, microbiological and sensory qualities from blends of wheat-breadfruit flours was examined. Blends of wheat flour (WF) with percentages of 0, 5, 10, 15, 20 and 25 of breadfruits flour (BF) were used in the production process. The proximate analysis, sensory evaluation and aerobic plate count (APC) of the bread samples were determined. The result of the proximate analysis of the whole wheat bread (WWB) and composite bread samples showed that crude protein contents (%) of 7.54 was recorded for the WWB while 7.33, 7.06, 6.97, 6.81 and 6.72 were recoded for the 5, 10, 15, 20 and 20 % breadfruit-wheat composite bread (BWCB). This shows that the crude protein decreased with increase in the BF substitution levels. A contrast trend was observed in the crude fibre contents (%) with the lowest value of 0.04 being recorded for the WWB and the highest value of 3.27 was obtained for the 25% BWCB. The ether extract (%) also decreased with corresponding increase in the BF levels, the WWB had the highest value of 1.10 while the lowest content of 0.75 was recorded for the 25% BWCB. The percentage ash contents of 0.65, 0.95, 1.14, 1.22, 1.41 and 1.70 were obtained for the percentages of 0, 5, 10, 15, 20 and 25 BF substitution levels. A similar trend was observed in the moisture content (%), ranging from 30.50 and 33.97. The percentage carbohydrate contents decreased with increase in the BF substitution, with the highest value of 60.17 being recorded for the WWB (0% BF Level). The sensory evaluation indicated that the composite breads were not significantly different ($p<0.05$) from the whole wheat bread with respect to internal texture, taste, appearance and general acceptability, up to 15% BF levels. The same observation was noted for crust, aroma and shape, showing no significant differences between the 10% BF levels and the WWB at the same probability level, however differences were observed at higher percentages of BF levels. The aerobic plate counts (log CFU/g) ranged from 1.10 to 2.22.

Key words: breadfruit, proximate analysis, composite bread

INTRODUCTION

Bread and other wheat containing baked products are widely accepted and consumed throughout the world. Bread is an important staple food, the consumption of which is steady and increasing in Nigeria [1]. It has been hitherto produced from wheat as a major raw material. In Nigeria wheat production is limited and wheat flour is imported to meet local flour needs for bakery products as such huge amount of hard earned foreign exchange is used every year for importation of wheat [2]. Efforts have been made to promote the use of composite flours in which flour from locally grown crops and high protein seeds replace a portion of wheat flour for use in bread, thereby decreasing the demand for imported wheat and producing protein-enriched bread [3].

Breadfruit is a fruit tree that is propagated with the root cuttings and the average age of bearing first crop is between 4 to 6 years [4]. It produces its fruit up to three times in a year and the number of fruits produced is very high. The fruit has been described as an important staple food of a high economic value [5]. It is commonly cultivated in several other tropical countries like West Indies, Ghana, Sierra Leone, Jamaica and Nigeria. The breadfruit pulps are made into various dishes; it can be pounded, fried, boiled or mashed to make porridge; it can also be processed into flour and used in bread ands biscuit making [4]. Breadfruit has also been reported to be rich in fat, ash, fibre and protein [6]. Despite the importance of this fruit, its production is faced with several problems including short shelf life and poor yield due to diseases [7]. The fruits are thus utilized in Nigeria within 5 days of harvesting because of their short shelf lives.

The successful use of composite flour has been variously reported in the literature. Olaoye *et al*.[3] reported the use of composite flour of wheat, plantain and soybeans in bread making. In a related study, Olaoye and his co-researchers [8] also published some findings in the use of wheat-breadfruit composite flour in biscuit making. According to the authors, good quality and acceptable baked products could be derived from composite flours with up to certain levels of breadfruit flour substitution in wheat flour. Also Esuoso and Bamiro [9] carried out some research findings on the use of composite flours of breadfruit-wheat in the production of baked products.

The use of composite flour for bread and confectioneries will help to reduce huge post harvest losses normally experienced with breadfruits in Nigeria and some other parts of Africa. It will also lead to increase in its output due to ready market, thereby enhancing the utilization of the crop. This study was aimed at processing breadfruit into flour and examining its performance in bread making, in terms of proximate composition, sensory and microbiological qualities, when used as blends with wheat flour.

MATERIALS AND METHODS

Materials

The breadfruits used for this study were collected from a local market in Ile-Ife, South-Western Nigeria. They were taken to the laboratory for immediate processing.

Processing of breadfruit into flour

The breadfruits were processed into flour as shown in Fig. 1. The breadfruits were thoroughly washed to remove any dirt and unwanted materials. They were then peeled and washed with clean water. The breadfruits were sliced, blanched for about 5 minutes and then dried in the oven at 105 ^oC for 1-3 hours, after which they were milled into flour. The flour was screened through a 0.25mm British standard sieve (Model BS 410).

BREADFRUITS
↓
CLEANING
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PEELING
↓
SLICING
↓
BLANCHING
↓
DRYING
↓
DRY MILLING
↓
SIEVING
↓
SCREENING
↓
BREADFRUIT FLOUR

Figure 1: Flow chart for the production of breadfruit flour

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Blend Formation

Six blends were prepared by mixing breadfruit flour with wheat flour in the percentage proportions of 0:100, 5:95, 10:90, 15:85, 20:80 and 25:75 respectively, using machine food processor (Kenwood KM 201, England).

Baking Process

The six blend formulations were baked using the straight dough method [10]. The baking formula was 56% wheat flour or the blend, 36% water, 3.4% sugar, 1.6% shortening, 1% skim milk powder, 1% salt and 1% yeast [11].

All ingredients were mixed in a Kenwood mixer (Model A 907 D) for 5 mins. The doughs were fermented in bowls, covered with wet clean muslin cloth for 55 mins at room temperature (29^{o}C), then punched, scaled to 250g dough pieces, proofed in a proofing cabinet for 90 mins at 30^{o}C, 85% relative humidity and baked at 250^{o}C for 30 mins. [2]

Proximate Analysis

The proximate composition of the breadfruit-wheat composite bread (BWCB) samples was determined using standard methods [12, 13, 14]. The samples were analyzed for moisture, ash, crude fibre, crude protein, crude fat and carbohydrate (by difference).

Sensory Evaluation

The sensory attributes, including crust, aroma, shape, internal texture, taste, appearance and general acceptability, were evaluated by a semi trained 10-member panel, using a 9-point Hedonic scale with 1 representing the least score (Dislike extremely) and 9 the highest score (Like extremely). Analysis of variance (ANOVA) was performed on the data gathered to determine differences, while the least significant test was used to detect significant differences among the means [15].

Microbiological Examination

The aerobic plate count was carried out on the BWCB samples using the method of Fawole and Oso [16]. Ten grams of each sample was taken aseptically and homogenized in 90 ml sterile distilled water, in a blender (Philips Type HR 2815i) for about 2 mins. Serial dilutions (using 1 ml of homogenates) were made in 9 ml sterile distilled water, dispensed in test tubes. One milliliter of each dilution was pour plated in sterile Petri dishes , using the plate count agar (PCA, oxoid), incubated at 37^{o}C for 24-36 hrs. Counts of visible colonies were made and expressed as log CFU/g sample.

RESULTS

Table 1 shows the proximate composition and aerobic plate count (APC) of the whole wheat bread (WWB) and breadfruit-wheat composite bread (BWCB) samples. The crude protein decreased with increase in the proportion of the breadfruit flour in the BWCB samples. The highest crude protein (%) of 7.54 was recorded for the WWB, and this value decreased gradually to the lowest value of 6.72 recorded for the 25% BWCB.

The crude fibre (%) of 0.04, 1.34, 1.96, 2.71, 3.01 and 3.27 were obtained for the WWB, 10%, 15%, 20% and 25% BWCBs respectively. This showed a corresponding increase as the amount of breadfruit flour increases, with the highest value of 3.27 being obtained for the

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25% BWCB. Breadfruit has relatively higher crude fibre than wheat and this could justify the result obtained for the bread samples.

The fat content (%) of the breads assumed a similar trend with crude protein, though the decrease with increase in the breadfruit flour proportion was very minimal. The highest value of 1.10 was obtained for the WWB while lowest value of 0.75 was recorded for the 25% BWCB.

The highest ash content (1.70%) was obtained for the 25% BWCB, showing that there was increase in this parameter with increase in the percentage breadfruit flour levels. The ash contents of 0.65, 0.95, 1.14, 1.22 and 1.41 were recorded for the bread samples produced with 5%, 10%, 15% and 20% breadfruit flour (BF) substitution levels respectively. This indicates that the lowest ash content was obtained for the bread sample produced with 0% breadfruit flour substitution, i.e. the whole wheat bread. Breadfruit has higher ash content than wheat.

The moisture content increased with increase in the proportion of breadfruit flour in the bread samples. The highest value of 33.97 was observed for the 25% BWCB while the lowest 30.50 was obtained for the WWB. The respective values obtained for the 5%, 10%, 15% and 20% BWCBs are 30.80, 31.50, 32.20 and 33.15.

The carbohydrate content (%) ranged between 53.59 and 60.17 with the highest value recorded for the 25% BWCB. There was therefore reduction in the carbohydrate content as the BF level increases.

The aerobic plate count, APC, (log CFU/g) of the bread samples ranged from 1.10 to 2.22, with then highest being recorded for the 25% BWCB while the lowest was obtained for the WWB. Counts of 1.21, 1.47, 1.70 and 1.90 were obtained for the respective 5, 10, 15 and 20% BWCBs.

The hedonic mean scores of the bread samples are presented in Table 2. The mean scores generally ranged between 4.3 and 8.5 for the sensory attributes tested, including crust, aroma, shape, internal texture, taste, appearance and general acceptability. The whole wheat bread (WWB) was observed to have the highest mean hedonic scores in terms of all the attributes while lowest scores were recorded for the bread produced with 25% breadfruit flour substitution level.

DISCUSSION

During the processing of breadfruits into flour, the sliced breadfruits were subjected to blanching. This was done in order to eliminate any enzyme activity that could otherwise affect the sensory quality adversely, especially in terms of colour. Enzymes are known to induce browning reactions in fruit, leading to undesirable colouration of the product [17].

The highest protein content observed in the whole wheat bread (WWB) samples than in the breadfruit wheat composite bread (BWCB) was expected. The protein content of wheat has been reported to be higher than in breadfruit and this could be responsible for the lower values of crude proteins in the BWCBs, as the proportion of breadfruit flour increases [13, 18]. A chemical analysis of breadfruit carried out by Udio *et al.* [19] revealed that the crude protein was lower than in wheat. It should be stressed that the protein contents of wheat (gluten) is of utmost importance as is responsible for the elasticity of and good dough formation during bread making [17].

The crude fibre of the bread sample was observed to increase with increase in the level of breadfruit flour substitution in the composite flour used in their production. A similar observation has been reported by Esuoso and Bamiro [9] as well as Amusa *et al.* [4]. The research workers were able to note higher crude fibre contents in the bread produced with breadfruit–wheat flour blends, especially as the percentage substitution of the breadfruit flour increased in the composite flour. Crude fibre has been known to promote health as it aids the digestive system of human [15]. This indicates that the BWCBs could attract acceptability by many people especially in Africa, where most of our diet are bulky, consisting mainly of carbohydrates and fat.

The ether extract (fat) of the bread samples were generally minimal. The minimal fat contents obtained for the samples could be very significant, as fat plays a vital role in the determination of shelf life of foods. Too high amount of fat is very undesirable in food items. This is mainly because suck high levels can initiate and accelerate spoilage by promoting rancidity, leading to off flavours and odorous development [15, 17]. Although shelf life studies are yet to be carried out, the bread samples obtained during the course of this research work may have good and reasonable shelf life, with the bread containing the highest breadfruit flour having the highest possibility. Shelf life studies are very important in food processing and this work intends to further on this.

The increase in the ash contents of the bread samples, with corresponding increase in the breadfruit flour (BF) substitution in the composite flour was not surprising. Breadfruit has been reported to contain on average higher ash contents than wheat [6, 18]. This could mean that making bread with breadfruit flour supplementation will help in enhancing the mineral intake of many people. It should be noted that ash content is indicative of the amount of mineral contained in any food sample. This would also help many people in their nutritional intake, especially in meeting daily mineral requirement.

Moisture is a very important factor in the keeping quality of breads and high moisture can have an adverse effect on storage stability. The bread sample containing the highest BF may therefore have reduced shelf life in comparison with other samples, though it will be necessary to carry out shelf life studies in order to ascertain this.

The carbohydrate contents of the breads decreased with increase in the BF levels. This could probably be due to higher carbohydrate contents in wheat than its breadfruit counterpart.
The aerobic plate counts of the bread samples were minimal and within safe and acceptable levels [17, 19]. However, the bread samples should be well packaged and kept after processing in order to prevent post processing contamination and proliferation of spoilage microorganisms, which would otherwise reduce their shelf life and quality attributes.

The mean scores generally decreased with increase in the BF levels in all the sensory attributes tested. There were no significant differences ($p<0.05$) between the WWB and BWCB samples, up to 10% BF level in terms of crust, aroma and shape, and up to 15% in terms of taste, internal texture, appearance and general acceptability. In the sensory attribute of crust, the 15 and 20% BWCBs were not significantly different from each other, however these two were significantly different from the 25% BWCB ($p<0.05$). This observation was also same for aroma, shape and internal texture. With respect to taste and general acceptability, the 20% and 25% BWCB samples did not show any significant difference from one another at the same probability level.

CONCLUSION

These findings indicated that the nutritional quality of bread could be enhanced by breadfruit flour supplementation, especially in terms of ash and fibre. Breads of acceptable sensory attributes could be produced with up to 15% breadfruit flour level. This would be of economic importance in many developing countries, such as Nigeria, and Africa as a whole in promoting the use, utilization and processing of local crops.

Table 1: Proximate composition and Aerobic plate count of whole wheat and breadfruit-wheat composite bread samples

Parameter/Bread sample	A	B	C	D	E	F
Crude protein (%)	7.54	7.33	7.06	6.97	6.81	6.72
Crude fibre (%)	0.04	1.34	1.96	2.71	3.01	3.27
Ether Extract (%)	1.10	1.03	0.91	0.87	0.81	0.75
Ash (%)	0.65	0.95	1.14	1.22	1.41	1.70
Moisture (%)	30.50	30.80	31.50	32.20	33.15	33.97
Carbohydrate	60.17	58.55	57.43	56.03	54.81	53.59
APC (log CFU/g)	1.10	1.21	1.47	1.70	1.90	2.22

A - Bread produced from 100% wheat flour

B - Bread produced from composite flours of 95% wheat and 5%breadfruit

C - Bread produced from composite flours of 90% wheat and 10% breadfruit

D - Bread produced from composite flours of 85% wheat and 15% breadfruit

E - Bread produced from composite flours of 80% wheat and 20% breadfruit

F - Bread produced from composite flours of 75% wheat and 25% breadfruit

APC – Aerobic plate count

Table 2: Hedonic sensory mean scores of the whole wheat and breadfruit-wheat composite bread samples

Attribute/Bread sample	A	B	C	D	E	F
Crust	7.5[a]	7.2[a]	6.9[a]	5.7[b]	5.7[b]	4.3[c]
Aroma	7.4[a]	7.1[a]	6.9[a]	5.9[b]	5.5[b]	4.3[c]
Shape	8.5[a]	8.1[a]	7.8[a]	6.3[b]	6.1[b]	5.2[c]
Internal texture	7.9[a]	7.6[a]	7.3[a]	7.0[a]	5.5[b]	4.5[c]
Taste	7.2[a]	6.9[a]	6.6[a]	6.3[a]	5.3[b]	4.7[b]
Appearance	7.6[a]	7.4[a]	7.1[a]	6.9[ac]	6.1[bc]	5.6[b]
General acceptability	7.5a	7.3[a]	7.0[a]	6.8[a]	5.3[b]	5.0[b]

Mean scores in rows with same letters are not significantly different ($p<0.05$).

A, B, C, D, E and F are as defined in Table 1

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