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# DEVELOPMENT AND QUALITY EVALUATION OF WHEAT/BREADFRUIT COOKIES.

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*Abstract*— **Composite cookies were produced from breadfruit and wheat flour. Mature breadfruit was sorted, washed, sundried, milled and sieved to obtain flour. The breadfruit/wheat flour was mixed in the ratio 0:100, 100:0, 20:80, 30:70, 40:60 and 50:50 respectively and used to produce cookies. Proximate analysis, quality and sensory evaluations were carried out on the cookies. The proximate composition of the cookies ranged in values with moisture from 11.40% - 11.95%, crude protein 10.22% - 12.50%, Fat 23.50% - 26.50%, Ash 3.09% - 8.10%. The crude fibre and ash content (%) increases with increase in the proportion of breadfruit flour (BF) level, with the 50% BF level having the values of 5.21 and 7.65 respectively. Lowest values of 10.32%, 24.01% and 40.97% were observed for cookies with 50% BF level in terms of crude protein, ether extract and carbohydrate respectively, showing decrease with corresponding increase in the BF levels. The moisture content of the cookies were all in the range of Intermediate Moisture Food (IMF) to which cookies belong. The result of organoleptic analysis revealed that there is no significant difference among the samples in terms of colour, taste and overall acceptability. However, there was significant difference in terms of texture due to dilution of wheat gluten by the incorporation of breadfruit flour. Spread ratio of the cookies ranged from 3.50-5.49. Acceptable cookies could therefore be produced from blend of wheat and breadfruit flours up to 20% level with improved constituents and reduced cost.**

*Index Terms*— **Breadfruits, Composite cookies, Organoleptic, Spread ratio, Proximate.**

## I. INTRODUCTION

Cookies are convenience snack products popular among young ones and even adults. They are nutritive snacks produced from unpalatable paste that is transformed into appetizing product through the application of heat in an oven (Kure *et al.,* 1998). They are ready-to-eat, convenient and inexpensive food product, containing digestive and dietary principles of vital importance (Kulkarni, 1997). Cookies are rich source of fat and carbohydrate hence are energy giving food and they are also a good source of protein and minerals (Kure *et al.,* 1998). The principal ingredients are flour, fat, sugar and water while other ingredients include milk, salt, flavouring agent and aerating agent (Wade, 1998).

Breadfruit (*Artocarpus altilis*) belongs to the Mulberry family *Moraceae* (Adewusi *et al.,* 1995). The plant grows in the tropics where it is used in a variety of food preparations. It is a fruit tree that is propagated with the root cuttings and the average age of bearing first crop is between 4-6 years (Amusa *et al.,* 2002). It is a native of Africa and Malay Peninsular. It is known as "Ukwa" in Igbo. "Barafuta" in Hausa while among Yorubas it is known as "Gberebutu" or "Jaloke" which is very popular in Ile-Ife. It can also be found in other parts of the continent (Omobuwajo, 2003).

The tree produces fruit twice in a year from March to June and from July to September with some fruiting throughout the year (Omobuwajo, 2003). The fruit has been described as an important staple food of a high economic value (Akanbi *et al.,* 2009). Breadfruit pulp are made into various dishes. It can be pounded, fried, boiled or mashed to make porridge (Amusa *et al.,* 2002). Breadfruit has also been reported to be rich in fat, ash, fibre and protein (Ragone, 1997).

In Nigeria, breadfruit is regarded as poor man's food. Its production is faced with several problems including short shelf life, poor yield due to diseases and poor awareness (Omobuwajo. 2003). The fruits are thus utilized in Nigeria within 5 days of harvesting because of their short shelf lives.

The use of composite flours in bread making has been reported by many researchers. Olaoye *et. al.,* (2006) investigated the use of supplementation of flours of soybean and plantains in wheat in the production of bread. The research workers were able to obtain acceptable bread samples with up to 15% supplementation of wheat with plantain flour. Mepba *et al.,* (2007) also produced composite breads and biscuits from mixed flours of wheat and plantain, with up to 30% supplementation of plantain flour. However, the quality attributes of the products tend to decrease with corresponding increase in the percentage substitution with plantain flour. However, a successful substitution of up to 10-15% of composite flour in the production of baked products will go a long way in reducing cost and enhance utilization. In their own findings (Giami *et al.,* 2004) were able to successfully make acceptable bread from composite flour of breadfruit and wheat.

If researchers like these are encouraged and commercialized, it will help in reducing wastage normally associated with our local crops in Nigeria and Africa as a whole, as well as maximizing their utilization. It is therefore a serious challenge to researchers in Africa and especially Nigeria to help in finding out how many of our crops could be maximally utilized to prevent associated waste due to lack of proper storage facilities and awareness about the nutritive value of such crops.

This study therefore aimed at processing breadfruits flour and examine its performance in cookies production in terms of proximate composition and sensory qualities when used as composite flour.

## II. MATERIALS AND METHODS

### *A. Materials*

The breadfruits used for the study were collected from a local market in Ile-Ife, Osun State, Nigeria.

### *B. Methods*

### *C. Production of Breadfruit Flour*

Mature breadfruits were thoroughly washed to removed dirt and unwanted materials. They were then peeled, decoreds and washed with clean water. The fruits were sliced and then dried in the hot air oven at about 6-8 hrs, after which they were milled into flour. The flour was screened through a 0.25 mm British sieve (Model BS 410) (Giami *et al*., 2004) and then packaged in polythene bag for further use. Figure 1 shows the production of breadfruit flour.

### *D. Blend formation*

Six blends were prepared by mixing breadfruit flour with wheat flour in the ratio of 100:0, 0:100, 20:80, 30:70, 40-60 and 50:50 respectively using kenwood mixer.

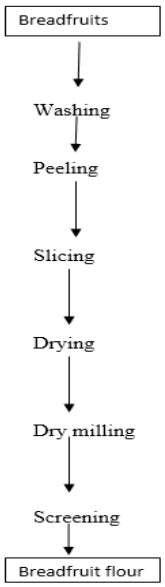


***Figure1***: Flow chart for the production of Breadfruit flour

**Table1: Blend codes and designation**

| Blend codes | Designations |
|---|---|
| A | 0%BF: 100%WF |
| B | 100%BF: 0%WF |
| C | 20%BF:80% WF |
| D | 30%BF: 70% WF |
| E | 40%BF:60%WF |
| F | 50%BF:50%WF |

WF-Wheat flour BF- Breadfruit flour

Cookies production

Cookies were produced from the six blends formulation (Figure 2). The baking formula is as described by Ihekoronye, (1999). All ingredients except flour and sodium bicarbonate were added with continued mixing. The paste was then placed on cutting board. Rolled out until uniform thickness and textures were obtained. Cutter was used to cut into desired shapes and sizes. The cut and shaped paste were then arranged in greased tray and baked at about 220 $^{o}$C for 15 mins, it was then allowed to cool, packed and stored (kure *et al*, 1998).

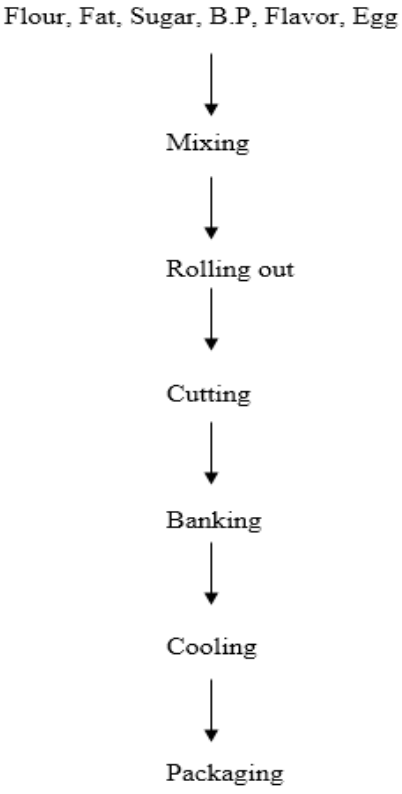


Figure 2: Flow chart for cookies production.

*E. Proximate Analysis*

The proximate analysis of the breadfruit supplemented cookies samples was determined using the methods of Egan *et al*, (1981). The samples were analyzed for moisture, ash, crude fibre, crude protein, crude fat and carbohydrate (by difference).

*F. Spread Ratio*

The diameter of the samples were taking in centimeter. While the height and weight were obtained for all blends. The spread ratios determined using the ratio of diameter to height (Giami *et al.,* 2004).

*G. Sensory Evaluation*

It was carried out using multiple comparison test. Nine panelists were used to evaluate the samples for Taste, Odour, Texture, Aroma, Colour and General Acceptability. The data collected were thereafter analyzed statistically to determine if there is significant difference among the samples in terms of all the parameters (Odedeji and Odetayo, 2000).

## III. RESULT AN D DISCUSSION

Proximate analysis result and spread ability of the whole wheat, whole breadfruit and breadfruit supplemented cookies samples are as presented in Tables 1 and 2.

The crude protein decreased with increase in the proportion of the breadfruit flour (BF) level in the cookies samples. The highest crude protein was recorded for whole wheat cookies (WWC) (That is 0% BF level) and this value decreased gradually to the lowest value of 10.22 recorded for 100% breadfruit and 10.32 recorded for 50% breadfruit supplemented cookies. The protein content of wheat has been reported to be higher than its breadfruits counterpart and this could be responsible for the lower values of crude protein in the cookies samples as the amount of breadfruit flour increases (Kure, *et al.*, 1998).

The crude fiber (%) ranged between 1.03 and 6.05 and this showed a corresponding increase with increased in the proportion of breadfruit flour. Breadfruit has relatively higher crude fibre than wheat flour. This could justify the results obtained for the different cookies sample. This observation can be supported by finding of Esuoso and Bamiro, (1995), as well as Mepba *et al.,* (2007).

**Table 2:** Proximate Composition of Wheat flour, Breadfruit flour and Wheat/ Breadfruit flour blends

| Parameter | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| Crude Protein (%) | 12.50 | 10.22 | 11.67 | 11.55 | 10.95 | 10.32 |
| Crude Fibre (%) | 1.03 | 6.05 | 2.27 | 3.45 | 4.99 | 5.21 |
| Ether Extract (%) | 26.50 | 23.50 | 25.27 | 24.23 | 24.17 | 24.07 |
| Ash (%) | 3.09 | 4.76 | 5.11 | 6.15 | 6.79 | 8.10 |
| Moisture (%) | 10.50 | 11.95 | 11.40 | 11.65 | 11.80 | 11.84 |
| Carbohydrate (by difference) | 46.38 | 40.17 | 44.28 | 42.97 | 41.30 | 40.97 |

Crude fibre is known to aid the digestive system of human (Ibekoronye and Ngoddy, 1985). This thus means that breadfruit supplemented cookies could attract good acceptability by many people as well as health organization.

The values obtained for the ash contents indicated that 50% breadfruit supplemented cookies has the highest value of 8.10. The ash content level followed the same pattern as crude fibre. It had been observed that, breadfruit contain higher ash content than wheat (Ragone, 1997). It then follows therefore that incorporation of breadfruit flour in the production of cookies could enhance the mineral intake of many people. Ash is an indicative of the amount of mineral contents in any food sample.

The fat content followed the same trend as crude protein. The highest value of 26.50 was recorded for whole wheat cookies while the lowest value of 23.50 was obtained for the 100% breadfruit cookies. Fat plays important role in the shelf life of food products. High fat content food products tends to deteriorate quickly (Ihekoronye and Ngoddy, 1985).

The moisture contents of the cookies ranged between 10.50 and 11.95 with the wheat cookies having the lowest value, this can be due to the fact that sun drying method was used for breadfruit flour production. These values recorded for all the samples fall within the range of intermediate Moisture Food (IMF) which is 15% and thus may not have adverse effect on the quality attributes of the product (Kure *et al.,* 1998).

The carbohydrate contents were high for all the samples analyzed. This was expected as the ingredients ( Wheat and Breadfruit) comprised majorly carbohydrate.

Physicochemical and functional properties of the wheat flour, breadfruit flour and the blends were shown in Table 3. The pH value was between 6.09% and 6.28% indicating a low level of acidity of samples and the values compared with Ph 6.07 obtained for breadfruit pulp fruit by Adepeju *et al.,* (2011). The pH of the flour suspension is important since some functional properties are affected by pH.

Table 3: Physicochemical and Functional properties of wheat/breadfruit flour.

| Sample | pH | Bulk density g/ml | Least gelation capacity(%) | Foaming capacity(ml) | Oil absorption capacity(%) | Water absorption capacity(%) |
|---|---|---|---|---|---|---|
| A | 6.09 | 0.36 | 9.00 | 47.0 | 120.3 | 286.4 |
| B | 6.28 | 0.69 | 10.00 | 35.0 | 134.6 | 264.7 |
| C | 6.24 | 0.57 | 11.00 | 40.0 | 132.7 | 262.0 |
| D | 6.22 | 0.63 | 11.00 | 42.0 | 132.6 | 260.3 |
| E | 6.16 | 0.62 | 11.00 | 42.0 | 130.8 | 259.0 |
| F | 6.12 | 0.62 | 11.00 | 40.0 | 130.2 | 258.0 |

The bulk density ranged between 0.36 and 0.69 g/ml. The highest value was recorded for sample B (100% BF). This result indicated that sample B is denser than all other samples. All the samples had significantly lower densities. The bulk density values obtained in this work are comparable with those reported for some indigenous flours (0.57-0.69 g/ml) by Chau and Cheung ,(1998) and (0.58-0.77 g/ml) by Adebowale *et al.,(* 2008).

The gelation capacity of the samples (9.00-11.00 %) showed that at concentration below 9 % , none of the product gel . The lower the LGC, the better gelling ability of a food component. Sample A (100%WF) had the lowest LGC. The LGC for the

other samples were higher. The importance of this high LGC to the cookies is however that it will have reduced viscosity, plasticity and elasticity.

Water absorption capacity is the ability of flour to absorb water and swell for improved consistency in food. It is desirable in food systems to improve yield and consistency and give body to the food (Osundahunsi *et al.,* 2003).The WAC ranged from 258.0 (sample F) to 286.3% (sample A). There was a significant difference between the WAC of the whole wheat flour (286.3%) and the breadfruit flour (264.7%).The difference may be attributed to the difference in their carbohydrate contents. WAC for the samples were higher than those reported for native red (24%),Osundahunsi *et al.*, (2003), yam flour (88.48%) by Jimoh and Olatidoye (2009), (271.7%) reported for fermented maize flour by Fasasi *et al*.,(2007). The oil absorption capacity of the samples were lower than the values reported for raw (230%) and heat processed (350%) Jack fruit flour (Odoemelam, 2005) and fermented maize flour (Fasasi *et al.,* 2007) but compared favourably with that of bambara groundnut flour (Sirivongpaisal, 2008). Fat absorption is an important property in food formulations because fat improve the flavour and mouthfeel of foods (Odoemelam, 2003).

The result of the spread ratio in Table 3, ranged from 3.50 to 5.45. The lowest value was obtained for 100% whole wheat cookies while the highest was observed in the 100% breadfruit cookies. The lower the spread ratio the better the crispness and acceptability of baked products.

**Table 4:** Spread ratio of wheat, whole breadfruit and supplemented breadfruit cookies

| | Diameter (Cm) | Height (Cm) | Weight(Cm) | Spread(Cm) |
|---|---|---|---|---|
| A | 22.42 | 6.40 | 17.01 | 3.50 |
| B | 28.44 | 5.18 | 17.50 | 5.45 |
| C | 24.64 | 6.10 | 17.00 | 4.04 |
| D | 25.85 | 5.62 | 17.00 | 4.60 |
| E | 26.50 | 5.48 | 17.00 | 4.83 |
| F | 27.30 | 5.20 | 17.00 | 5.25 |

The sensory analyzes for the cookies samples are shown in Table 4. The F-sample source are lower that the Q-factor for Texture, Taste, Colour, Aroma and General Acceptability.

**Table 5:** Sensory evaluation of whole wheat whole breadfruit and breadfruit supplemented cookies.

| Parameter | F-Sample | Q-Factor |
|---|---|---|
| Texture | 1.80 | 3.01 |
| Taste | 2.04 | 3.01 |
| Colour | 1.92 | 3.01 |
| Aroma | 1.75 | 3.01 |
| Overall Acceptability | 1.80 | 3.01 |

However, there was difference in terms of texture due to dilution of wheat gluten by the incorporation of the breadfruit. The cookies sample obtained at 20% Breadfruit level supplementation was more acceptable.

## IV. CONCLUSION

This study concluded that acceptable cookies could be produced from breadfruit supplemented flour up to 20% level in all sensory attributes tested. It can also be concluded that quality of cookies or other food products could be improved with breadfruit flour in terms of crude fibre and ash.

The use of breadfruit in food products will go a long way in enhancing its utilization and thus prevent wastage of this valuable fruit, which will eventually reduce cost of production.

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