Quality Evaluation of Instant Noodles Produced From Composite Breadfruit Flour

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Abstract: Noodles are widely consumed throughout the world and their global consumption is second only to bread. Wheat flour and breadfruit flour were used in ratios of 100:0, 90:10, 80:20, 70:30, 60:40 and 50:50 to produce instant noodles from wheat-breadfruit composite flour. Proximate, chemical and sensory attributes were investigated. The moisture, ash, fat, crude fibre, protein and carbohydrate ranged from 2.50 to 3.50%, 0.80 to 1.74%, 5.0 to 18.0%, 0.86 to 1.26%, 12.4 to 19.0% and 64.4 to 69.8% respectively. The result obtained from the proximate analysis showed that increase in percentage of breadfruit flour in the noodles sample gave an increase on total ash, crude fibre and protein content respectively. Significant differences ($p< 0.05$) were observed in the chemical composition (free fatty acid and peroxide value) and the sensory attributes (colour, aroma, appearance, flavour, taste and texture) of the instant noodles produced from wheat-breadfruit flour. However, noodles produced from 100% wheat flour were the most accepted by the panelist.
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1. Introduction

Instant noodles are widely consumed throughout the world and it is a fast growing sector of the noodle industry (Owen 2001). The world instant noodle market is projected to reach 158.7 billion packs by the year 2010 (Anonymous 2008). This is because instant noodles are convenient, easy to cook, low cost and have a relatively long shelf-life. Noodle products are staple food in many parts of Asia, especially throughout South East Asia. Almost 40% of wheat products in Asian countries are consumed in the form of noodles. Traditional noodle is made from simple ingredients (wheat flour, water and salt) can be a complete meal since it contains carbohydrates, protein and trace amount of saturated fatty acids. Besides, noodles are often used as a convenience food due to its simple preparation, low cost and fast cooking characteristics. The instant noodle market is growing fast in Nigeria, unfortunately wheat flour which is usually used to produce instant noodles is a temperate crop that will not do well under tropical condition due to unfavourable soil and climatic condition. Many developing nation like Nigeria spend huge amount on the importation of wheat. One of the solutions is the use of flour from other source which is called composite flour (Sanni *et al.,* 2004). Composite flour can be described as a mixture of several flours obtained from roots and tubers, cereal, legumes etc with or without the addition of wheat flour (Adeyemi and Ogazi 1985). It can also be a mixture of different flours from cereal, legumes or root crops that is created to satisfy specific functional characteristics and nutrient composition.

In many developing countries the use of composite flours have the following advantages (a) saving of hard currency, (b) promotion of high-yielding, native plant species (c) better supply of protein for human nutrition, and (d) better overall use of domestic agricultural production (Berghofer 2000; Bugusu *et al.,* 2001).

Breadfruit (*Artocarpus altilis*) is widely cultivated to appreciable extent in south-west states of Nigeria. Present level of breadfruit production in the south-western Nigeria has been estimated to about 10million tones dry weight per year with potentials for exceeding 100million tones every year (Adewusi *et al.,* 1995; Ajayi 1997). Breadfruit (*Artocarpus altilis*) is a tree and fruit native to Malaysia and countries of the south pacific and the carribean. It is an important food in these areas (Taylor and Tuia 2007). 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 (Amusa *et al.,* 2002). It produces its fruit up to three times and the number of fruits produced is very high. The fruit has been described as an important staple food of a high economic value (Soetjipto and Lubis 1981). The bread fruit pulps are made into various dishes; it can be processed into flour and used in bread and its biscuit making (Amusa *et al.,* 2002). Breadfruit has also been reported to be rich in fat, ash, fibre and protein (Ragone 1997). Despite the importance of this fruit, its production is faced with

several problems including short shelf life and poor yield due to diseases (Olaoye *et al.,* 2007). The fruits are utilized in Nigeria within 5days of harvesting because of their short shelf lives. One way to minimize post-harvest losses and increase the utilization of breadfruit is through processing into flour. This is a more stable intermediate product.

In Nigeria, noodles snacks industries has adopted the use of composite wheat flour as a substitute of whole wheat noodles thereby making the cost of noodles and other baked product to be reduced. Several research works have been carried out on the production of noodles from composite flour. For instance, the use of lupine as composite flour in noodles production (Vijay *et al.,* 2008), wheat and millet noodles (Poongodi *et al.,* 2009) and noodles from wheat and fermented cassava flours (Husniati and Anastasia 2013) to mention but a few. Information is however scanty on the use of composite flour from wheat and breadfruit for production of noodles. Although breadfruit is a highly perishable, underutilized fruit and need more attention because of its nutritional qualities. The aim of the research is therefore to produce noodles from composite flours of wheat and breadfruit flour and to determine its chemical composition as well as the sensory properties of the noodles.

2. Materials and Methods

2.1 Materials

Matured green ripe and wholesome breadfruit was purchased from a local market in Owode -Yewa, Ogun State. Commercial wheat flour (Golden penny), pure vegetable oil, tartrazine, iodized salt, guargum, sodium polyphosphate and calcium carbonate were purchased from kuto market in Abeokuta, Ogun state, Nigeria.

2.2 Production of Breadfruit Flour

The modified method of Olaoye *et al.,* (2007) was used for the preparation of breadfruit flour. The Breadfruit was thoroughly sorted to remove bad ones from the lot. The sorted fruit were washed to remove adhering soil and dirts. This was followed with peeling. After peeling, the tuber were sliced to facilitate rate of drying and ease milling operation, the sliced tuber were blanched at 60^{o}C, for 15min in order to inactivate enzymes that may cause browning reaction. These were then cooled, drained and followed by drying. After blanching, the chips were spread out uniformly on a stainless steel perforated tray and dried in a cabinet dryer at 65^{o}C for 24hrs. Following drying, the slices chips were milled using laboratory hammer mill (Fritsch, D-55743, Idar-oberstein-Germany) and the milled sample was sieved (using 250µm screen) to obtain the flour. The breadfruit flour was packed and sealed in polyethylene bags at ambient temperature (26±2^{0}C) and 760mmHg until further analysis

2.3 Blends Formulation

The blends of wheat and breadfruit were mixed together using a Kenwood mixer (Model HC 750 D, Kenwood, Britain, UK). The flour blends were prepared by substituting wheat flour for breadfruit flour in the percentage proportion of 100:0, 90:10, 80:20, 70:30, 60:40, and 50:50 respectively.

2.4 Production of Wheat-Breadfruit Instant Noodles

The method described by Sanni *et al.,* (2004) was used in the preparation of wheat-breadfruit instant noodles. All the ingredients were weighed out in the right proportion. Calculated amount of water was collected. The alkali mixture i.e. potassium carbonate, sodium carbonate, sodium phosphate and guargum were first mixed in a mixer with constant stirring for about 20minutes, they were added one after the other to prevent formation of lumps. The mixture of the high quality cassava flour, soybean flour and cassava starch were weighed and introduced into the mixer and the alkali mixture was added in a stepwise manner in a Kenwood mixer. The Kenwood major mixer was set at higher speed for 10mintes to allow thorough mixing and soften the dough. The dough was kneaded to form a sheet. The sheet was then further kneaded with kneading machine before moving to the slitting section of the same kneading machine where the slitters cut the kneaded dough into strands having a thickness of 1.00mm. The slitted dough was then steamed for about 2-4min before frying in an automatic deep fryer condition for about 60-120secs at the temperature of 140-160 ºC. The fried products were removed and allowed to cool and then packaged in the packaged material.

2.5 Proximate Composition of Wheat-Breadfruit Instant Noodles

Moisture content and crude fibre content of wheat-breadfruit instant noodles were determined by AOAC methods (2000). Crude protein was determined by the standard khjeldahl method, AOAC method (2000). Fat content of the samples were measured using Soxhlet extraction method according to AOAC method (2000). Ash content was determined by igniting 5g of sample in a furnace for 4hours at 550 ºC until light grey ash colour and constant weight was achieved by AOAC method (2000). Carbohydrate content were determined by difference method using the method of James (1995) The analyses were carried out in triplicates.

2.6 Chemical Analysis of Wheat-Breadfruit Instant Noodles

2.6.1 Determination of free fatty acid

The free fatty acid was determined according to the method of Sani (2015). 2.0g of the flour was

transferred into 250cm^3 Erlenmeyer flask followed by the addition of 100cm^3 of ethanol and 2cm^3 of phenolphthalein indicator. After mixing the content properly, it was titrated against 0.04M NaOH. The shaking continued until a slight pink colour which was steady for about 30 seconds was observed which signified the end point.

The % Free Fatty Acids was calculated using equation 1.

$$\%FFA = \frac{V \times M \times 28.2}{W} - - - - - - (1)$$

Where; % FFA = Percentage free fatty acid, V= Average volume of NaOH used (cm^3), M = molarity of NaOH, W =weight of the flour sample.

2.6.2 Determination of peroxide value

The peroxide value was determined using the method described by Sani (2015). 2.0g of the flour sample was weight into a clean dry flask and 22cm^3 of a mixture of 10cm^{3}of acetic acid and 12cm^{3}of chloroform was added, then 0.5cm^3 potassium iodide was also added. The flask was closed and allowed to stay with constant shaking for 1 minute. 30cm^3 of distilled water was then added and titrated against 0.1M of sodium thiosulphate ($Na_2S_2O_3$) solution until an initial yellow colour disappeared and a faint blue colour appeared. The titration continued after addition of 0.5cm^3 of starch indicator until there was a sudden disappearance of the blue colour which signifies the end point. The peroxide value is often reported as the ml of 20mM $Na_2S_2O_3$ per gram of sample. Thus peroxide value was calculated using equation 2.

$$Peroxide\ value = \frac{(S - B) \times M \times 1000}{W} - -(2)$$

Where; peroxide value= mEq of peroxide per 100g of sample, S=Sample titre value (cm^3), B=Blank titre value (cm^3), M= molarity of $Na_2S_2O_3$ (mEq/cm^3), W=weight of flour.

2.7 Sensory Evaluation of Wheat-Breadfruit Instant Noodles

The method described by Iwe (2002) was used. The sensory panel consisted of fifty consumers of noodles who were asked to score the wheat-breadfruit noodles using a 9-point hedonic scale based on their degree of likeness where 9= like extremely; 5= neither like nor dislike; 1= dislike extremely. Wheat-breadfruit noodles attributes evaluated were: Appearance, aroma, colour, flavour, taste, texture and overall acceptability.

2.8 Statistical Analysis

Data obtained were subjected to statistical analysis. Means, Analysis of variance (ANOVA) were determined using SPSS Version 21.0 and the differences between the mean values were evaluated at $p<0.05$ using Duncan's multiple range test.

3 Results and Discussion

3.1 Proximate composition of wheat-breadfruit instant noodles

Table 1 shows the proximate composition of instant wheat-breadfruit noodles. The moisture content of the noodles ranged from 2.50-3.50% with noodles produce from 100% wheat flour having the highest of 3.5% while noodles produce from wheat-bread fruit composite flour blends at 10% had the lowest moisture content. Significant differences ($p>0.05$) were not observed between the moisture content of the noodles. The moisture content of a food sample reflects the amount of solid matter in the sample. The higher the moisture content, the higher the rate of spoilage. Adebowale *et al.,* (2005) stated that moisture content is a measure of the water content and also an indicator of shelf stability. The values obtained for the moisture content of wheat-breadfruit instant noodles were within the expected moisture level reported by Enweere (1998). The ash content which is the total mineral present in wheat-breadfruit instant noodles ranged between 0.80 and 1.74. Noodles produce from wheat-bread fruit composite flour blends at 50% had the highest ash content, while noodles produced from 100% wheat flour had the lowest ash content. The result obtained in this study is an indication of the presence of inorganic nutrients in the noodles samples; therefore the increase in substitution of breadfruit flour will improve the nutritive value of the noodles. It can also contribute to the dietary intake of consumers or serve as special diet/meal. The fat content ranges from 5.0-18.0% with noodle produced from 100% wheat flour having the highest fat content and noodles produce from wheat-bread fruit composite flour blends at 50% having the lowest. The variation observed in this result might be as a result of the absorption of the fat during frying (Sanni *et al.,* 2004). Fat plays a significant role in the shelf life of food products and as such relatively high fat content could be undesirable in food products. This is because fat can promote rancidity in foods, leading to development of unpleasant and odorous compounds (Ihekoronye and Ngoddy 1985). The crude fibre content of wheat-breadfruit instant noodles increased as the substitution of breadfruit flour increases. The crude fibre content range between 0.86 and 1.26%, the increase in the crude fibre content might be attributed to the high fibre content in the breadfruit flour (Ajani *et al.,* 2012). The result obtained for this study were also similar to the report of Olaoye *et al.,* (2008) for crude fibre content of blends of wheat and breadfruit flour used for the production of baked products. Studies have shown that fibre plays a significant role in the prevention of several pathological diseases such as cardiovascular diseases, diverticulosis, constipation, irritable colon, cancer and diabetes (Slavin 2005;

Elleuch *et al.,* 2011). Hence, wheat-breadfruit instant noodles could be acceptable in places where fibre diets and lower fatty foods are desired (Akanbi *et al.,* 2011). The protein content of the noodles ranged from 12.4 to 19.0 with noodles produced from 100% wheat flour having the lowest and noodles produce from wheat-bread fruit composite flour blends at 50% having the highest. The increase in the protein content of wheat-breadfruit instant noodles might be due to high percentage of protein in those blends. Wheat and breadfruit flour has been reported to be rich in protein. (Ragone 1997; Olaoye *et al.,* 2008; Akanbi *et al.*, 2011). Protein makes enzymes, hormones, and other body chemicals and also an important building block of bones, muscles, cartilage, skin, and blood. Significant differences ($p<0.05$) were observed in the carbohydrate content of wheat-breadfruit instant noodles. The highest carbohydrate content was observed in noodles produced from wheat-bread fruit composite flour blends at 50%. High percentage of carbohydrate content in all the noodles produced from wheat-breadfruit composite flour suggested that the noodles were good source of energy.

Table 1: Proximate composition of wheat-breadfruit instant noodles (%)

WF: BF	Moisture Content	Total Ash	Crude Fat	Crude Fibre	Protein Content	Carbohydrate Content
100:0	3.50^{a}	0.80^{a}	18.0^{a}	0.86^{d}	12.4^{a}	64.4^{c}
90:10	2.50^{a}	1.23^{ab}	10.0^{b}	0.97^{c}	15.8^{c}	69.5^{b}
80:20	2.80^{a}	1.44^{b}	8.00^{b}	1.15^{c}	17.0^{bc}	69.6^{b}
70:30	3.00^{a}	1.62^{b}	7.00^{bc}	1.18^{b}	18.9^{b}	68.3^{a}
60:40	2.60^{a}	1.67^{ab}	6.60^{bc}	1.22^{a}	18.3^{c}	69.6^{a}
50:50	3.20^{a}	1.74^{a}	5.00^{bc}	1.26^{ab}	19.0^{b}	69.8^{a}

Mean values with different superscripts within the same column are significantly different ($p<0.05$); WF- Wheat flour, BF- Breadfruit flour

3.2 Chemical composition of wheat-breadfruit instant noodles

The free fatty acid and peroxide value for breadfruit noodles are presented in table 2. The free fatty acid values ranged from 0.40-0.60% with noodles produced from wheat-bread fruit composite flour blends at 40% recording the highest. The free fatty acid is a measure of the extent to which the glyceride in the oil has been decomposed by lipase or other action (Pearson's 1991; Sanni *et al.,* 2004). Rancidity is accompanied by free fatty acid formation i.e spoilage of the oil and is used as a condition for the edibility. The higher the free fatty acid value, the more prone is the oil to spoilage (Sanni *et al.,* 2004).

Table 2: Chemical composition of wheat-breadfruit instant noodles

WF:BF	FFA %	Peroxide value (meq/kg)
100:0	0.40^{b}	5.40^{b}
90:10	0.40^{b}	5.00^{b}
80:20	0.50^{b}	6.50^{a}
70:30	0.50^{b}	6.00^{a}
60:40	0.60^{a}	6.20^{a}
50:50	0.40^{b}	5.20^{b}

Mean values with different superscripts within the same column are significantly different ($p<0.05$); WF- Wheat flour, BF- Breadfruit flour, FFA- Free fatty acid

The peroxide value ranged from 5.0-6.5meq/kg with noodles produced from wheat-bread fruit composite flour blends at 20% recording the highest recording the highest value. Significant differences ($p<0.05$) was observed in the peroxide value of wheat-breadfruit instant noodles. Peroxide value is usually used as an indicator of deterioration of fats. As oxidation takes place, the double bonds in the unsaturated fatty acid break down to produce secondary oxidation products which indicate rancidity (Ihekoronye and Ngoddy 1985). The result obtained for peroxide value in this study is very low, hence wheat-breadfruit instant noodles can be stored for a very long time without getting spoilt.

3.3 Sensory score of wheat-breadfruit instant noodles

Table 3 shows the result of the sensory evaluation of wheat-breadfruit instant noodles. There were significant differences ($p<0.05$) in all the attributes measured. The values of the sensory score decreases as the substitution of breadfruit flour increases. The values of appearance and aroma attributes ranged from 2.30-5.50 and 3.20-6.10 respectively. Noodles produced from 100% wheat flour had the highest likeness for appearance and aroma while noodles produced from wheat-bread fruit composite flour blends at 50% had the lowest likeness. There were significant differences ($p<0.05$) in both colour and flavour attributes. Noodles produced from 100% wheat flour had the highest likeness in terms of colour and flavour with values of 5.90 and 6.33

respectively, while noodles produced from wheat-bread fruit composite flour blends at 50% had the lowest values of 2.90 and 3.20 in term of colour and flavour respectively. The taste and texture of the noodles ranged from 3.00-6.40 and 3.00-6.20 respectively. Noodles produced from wheat-bread fruit composite flour blends at 50% had the lowest likeness while noodles produced from 100% wheat flour had the highest likeness. Significant differences ($p<0.05$) were observed among samples of noodles in terms of overall acceptability. Noodles produced from 100% wheat flour had the highest value of likeness with 6.20, while Noodles produced from wheat-bread fruit composite flour blends at 50% had the lowest value of 3.40. It was observed that likeness of noodles sample decreases with increase in breadfruit flour substitution. However, noodles produced from 100% wheat flour were acceptable by the panelist. This could be due to the familiarity of the panelists with noodles prepared from wheat flour.

Table 3: Sensory score of wheat-breadfruit instant noodles

WF:BF	Appearance	Aroma	Colour	Flavour	Taste	Texture	Overall Acceptability
100:0	5.50^{c}	6.10^{a}	5.90^{a}	6.30^{a}	6.40^{a}	6.20^{a}	6.20^{a}
90:10	5.30^{c}	4.90^{b}	5.20^{a}	4.80^{b}	4.90^{b}	4.80^{b}	4.90^{b}
80:20	5.00^{c}	4.80^{b}	5.00^{a}	4.90^{b}	4.90^{b}	4.80^{b}	5.00^{b}
70:30	3.30^{b}	4.20^{b}	3.90^{b}	4.20^{b}	4.00^{b}	4.00^{b}	4.00^{c}
60:40	2.90^{b}	3.80^{b}	3.20^{b}	4.00^{b}	3.60^{b}	3.40^{b}	3.70^{c}
50:50	2.30^{a}	3.20^{b}	2.90^{b}	3.20^{b}	3.00^{c}	3.00^{b}	3.40^{c}

Mean values with different superscripts within the same column are significantly different ($p<0.05$); WF- Wheat flour, BF- Breadfruit flour

4. Conclusion

The study shows that instant noodles can be produced from wheat-breadfruit composite flour. There was a total increase in the total ash; crude fibre and crude protein content of the noodles an there was an increase on carbohydrate and fibre content of the noodles and this suggest that breadfruit flour incorporated into wheat flour has potential as an ingredient in healthy noodle production. However, noodles produced from 100% wheat flour was acceptable.

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