Quality Evaluation of Instant Noodles Produced From Composite Breadfruit Flour

Tijani, Akeem O.¹, Oke, Emmanuel K.², Bakare, Henry A.³ and Tayo, Tawakalitu R.¹

¹ National Biotechnology Development Agency, Owode Yewa, Ogun state, Nigeria
² Department of Food Science and Technology, Federal University of Agriculture, Abeokuta, Nigeria
³ Department of Hospitality and Tourism, Federal University of Agriculture, Abeokuta, Nigeria

kennyoke35@gmail.com

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.

Keywords: Breadfruit, wheat, instant noodles

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 (Soetjipoto 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
sliced tuber were blanched at 60°C for 20 min to facilitate rate of drying and ease milling operation, the adhering soil and dirt were removed. This was followed by peeling. After peeling, the tuber were sliced to obtain chips. The chips were then dried in a laboratory oven (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°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 guar gum were first mixed in a mixer with constant stirring for about 20 minutes, 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 10 minutes 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 2-4 min before frying in an automatic deep fryer condition for about 60-120 secs at the temperature of 140-160°C. 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 kjeldahl 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 4 hours at 550°C 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 250cm³ Erlenmeyer flask followed by
the addition of 100cm³ of ethanol and 2cm³ 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 (cm³), 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 22cm³ of
a mixture of 10cm³ of acetic acid and 12cm³ of
chloroform was added, then 0.5cm³ potassium iodide
was also added. The flask was closed and allowed to
stay with constant shaking for 1 minute. 30cm³ of
distilled water was then added and titrated against
0.1M of sodium thiosulphate (Na₂S₂O₃) solution until
an initial yellow colour disappeared and a faint blue
colour appeared. The titration continued after addition
of 0.5cm³ 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 Na₂S₂O₃ per gram of sample. Thus
peroxide value was calculated using equation 2.

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

Where; peroxide value = mEq of peroxide per
100g of sample, S=Sample titre value (cm³), B=Blank
titre value (cm³), M= molarity of Na₂S₂O₃ (mEq/cm³),
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 (Ihekoroonye 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 (%)

<table>
<thead>
<tr>
<th>WF: BF</th>
<th>Moisture Content</th>
<th>Total Ash</th>
<th>Crude Fat</th>
<th>Crude Fibre</th>
<th>Protein Content</th>
<th>Carbohydrate Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>100:0</td>
<td>3.50&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.80&lt;sup&gt;a&lt;/sup&gt;</td>
<td>18.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.86&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>64.4&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>90:10</td>
<td>2.50&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.23&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.97&lt;sup&gt;b&lt;/sup&gt;</td>
<td>15.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>69.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>80:20</td>
<td>2.80&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.44&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.15&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>69.6&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>70:30</td>
<td>3.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.62&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.18&lt;sup&gt;b&lt;/sup&gt;</td>
<td>18.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>68.3&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>60:40</td>
<td>2.60&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.67&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.60&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.22&lt;sup&gt;b&lt;/sup&gt;</td>
<td>18.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>69.6&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>50:50</td>
<td>3.20&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.74&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.26&lt;sup&gt;b&lt;/sup&gt;</td>
<td>19.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>69.8&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>WF:BF</th>
<th>FFA %</th>
<th>Peroxide value (meq/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100:0</td>
<td>0.40&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.40&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>90:10</td>
<td>0.40&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.00&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>80:20</td>
<td>0.50&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.50&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>70:30</td>
<td>0.50&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.00&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>60:40</td>
<td>0.60&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.20&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>50:50</td>
<td>0.40&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.20&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

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 spoil.

### 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

<table>
<thead>
<tr>
<th>WF:BF</th>
<th>Appearance</th>
<th>Aroma</th>
<th>Colour</th>
<th>Flavour</th>
<th>Taste</th>
<th>Texture</th>
<th>Overall Acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>100:0</td>
<td>5.50a</td>
<td>6.10a</td>
<td>5.90a</td>
<td>6.30a</td>
<td>6.40a</td>
<td>6.20a</td>
<td>6.20a</td>
</tr>
<tr>
<td>90:10</td>
<td>5.30a</td>
<td>4.90b</td>
<td>5.20a</td>
<td>4.80c</td>
<td>4.90a</td>
<td>4.80a</td>
<td>4.90a</td>
</tr>
<tr>
<td>80:20</td>
<td>5.00a</td>
<td>4.80b</td>
<td>5.00a</td>
<td>4.90c</td>
<td>4.90a</td>
<td>4.80a</td>
<td>5.00a</td>
</tr>
<tr>
<td>70:30</td>
<td>3.30b</td>
<td>4.20b</td>
<td>3.90c</td>
<td>4.20c</td>
<td>4.00a</td>
<td>4.00a</td>
<td>4.00a</td>
</tr>
<tr>
<td>60:40</td>
<td>2.90b</td>
<td>3.20b</td>
<td>3.20b</td>
<td>4.00b</td>
<td>3.60b</td>
<td>3.40b</td>
<td>3.70c</td>
</tr>
<tr>
<td>50:50</td>
<td>2.30b</td>
<td>3.20b</td>
<td>2.90c</td>
<td>3.20b</td>
<td>3.00a</td>
<td>3.00b</td>
<td>3.40c</td>
</tr>
</tbody>
</table>

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.

### Correspondence to:
Oke, Emmanuel Kehinde.
Department of Food Science and Technology, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria
Telephone: +2348131363795
Email: kennyoke35@gmail.com

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