

**Research Article****Chemical and Sensory Evaluation of Bread Sold in Benue and Nasarawa States of Central Nigeria**

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**Abstract:** The proximate composition, vitamin and mineral contents as well as sensory properties of some selected brands of bread sold in Benue and Nasarawa States were determined using standard methods of analysis. Fresh loaves of six of the most popular brands of bread, three from Benue (Top choice, Ostrich, Tito) and three from Nasarawa (Emziler, Canaan, Gods Promise), constituting samples A-F, were purchased from the respective bread factories within 4hrs of their production and used for the investigation. There were significant differences ( $p < 0.05$ ) in proximate composition with values ranging from 30.21-35.07% (moisture), 8.74-14.22% (crude protein), 2.00-8.10% (crude fat), 0.71-1.05% (crude fibre), 6.00-7.93% (ash) and 35.81-48.18% (carbohydrate), thus showing compliance with Standards Organisation of Nigeria (SON) specifications, especially in terms of moisture, protein, crude fibre and carbohydrate contents. The fat and ash contents of most of the bread samples were far above the specifications of 2.00% and 0.60% maximum, respectively. The mineral and vitamin contents were found to be quite high in all the bread samples. Sensory evaluation showed that sample C (Tito) was the most preferred followed by sample E, A, B, D in that order. Sample F (Gods Promise) was the least preferred in terms of sensory evaluation, but showed the highest compliance to SON specifications in terms of proximate composition. All the bread samples were found to be very rich in macro-and micro-nutrients.

**Keywords:** Bread, compliance, minerals, proximate composition, specifications, vitamins

**INTRODUCTION**

Bread is the loaf that results from the baking of dough which is obtained from a mixture of flour, salt, sugar, yeast and water (Ebuehi *et al.*, 2007). However, other ingredients like fat, milk solids, sugar, egg and anti-oxidant may be added. It is one of the staple foods in Nigeria that is consumed by people in every socio-economic class and is acceptable to both children and adults (Onuegbo *et al.*, 2007). Bread is a good source of carbohydrates and micronutrients nutrients such as vitamins and minerals. According to Kent (2002), bread celebrates the richest and simplest pleasures of daily living and in most European cultures. It is the single inevitable presence at the table during all the three meals of the day, for very few would contemplate a meal without bread. However, in Nigeria and other tropical countries, it relatively expensive since it is produced from wheat which, as a result of climatic reasons, does not grow well in the tropics and has to be imported (Edema *et al.*, 2004).

In recent years efforts have been made to promote the use of composite flours in which flours from high protein locally grown crops are used to replace a portion of wheat flour in bread production, thereby decreasing the demand for imported wheat while still

Table 1: SON specifications for white bread

S/No	Parameter	Specification
A	Specific Volume (Minimum)	4.0
B	% Moisture (Maximum)	40.0
C	% Total Solid Content (Minimum)	60.0
D	% Protein (Minimum)	10.0
E	pH of aqueous extract	5.3 - 6.0
F	% Ash content (Maximum)	0.6
G	Acid Insoluble Ash (Maximum)	5.0
H	% Fat Content (Maximum)	2.0
	(of which saturated)	5.0
I	% Crude fibre (Maximum)	0.5
J	% Carbohydrate (Maximum)	48.0
K	Energy (KJ/100g)	900-1000

Standards Organization of Nigeria (2004)

providing protein rich bread (Dhingra and Jood, 2002; Basman and Koksel, 2003; Greene and Bovell-Benjamin, 2004; Gernah and Chima, 2006). The use of non-wheat flour in bread making is practiced in many countries of the world for various reasons including some social, cultural, economic, agronomic and nutritional/ health reasons. For example, in Europe, the increasing incidence of celiac disease or allergic reactions/ intolerance to wheat gluten has caused food markets to be filled with wheat less breads (Gallagher *et al.*, 2004). The use of non-wheat flour for baking in Nigeria could be justified from both the agronomic and economic perspectives (Adebowale *et al.*, 2009).

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The use of cereals and legumes as well as roots and tubers for composite flour bread production requires innovative technologies and very good manufacturing practices for product standards to be met. The Standard Organization of Nigeria (SON, 2004) specifications for white bread (Table 1), among others, are as follows: moisture content 40% maximum, Protein 10% maximum, ash content of 0.6% maximum, fat content of 2.0% maximum, crude fiber of 0.5% maximum and carbohydrate 48% maximum. These specifications and others relating to chemical and physical properties of bread have to be stringently adhered to, before it can be approved for sale in the Nigerian market.

Therefore, the objective of this study was to evaluate the chemical (proximate composition, vitamin and mineral contents) and the organoleptic properties of these breads to confirm whether their qualities conform to SON specifications or not.

## MATERIALS AND METHODS

**Source of Materials:** Three brands each of the most popular and commonly consumed breads in Benue and Nasarawa States of Nigeria were purchased directly from the factories within 4 h after production. These brands of bread included: Top Choice, Ostrich and Tito (from Benue State and Emziler, Canaan and God's Promise (from Nasarawa State), giving samples A-F. They were analysed immediately after purchase.

### Analyses:

**Chemical analyses:** Proximate Composition (moisture, crude protein, crude fat, crude fiber and ash contents) was determined using the method of AOAC (2005), while carbohydrate content was determined by difference according to Ihekoronye and Ngoddy (1985).

**Micronutrient (minerals and vitamin):** The concentration of some selected minerals and vitamin content in the six bread samples (A-F) were determined

using Atomic Absorption Spectrophotometer (AAS model: Perkin-Elmer 2380, USA 1976) and High Performance Liquid Chromatography (HPLC), respectively according to the method of AOAC (2005).

**Sensory evaluation of bread samples:** Sensory evaluation of the bread samples (using the attributes of taste, smell, texture and general acceptability) was carried out by a 15 member semi-trained panel of judges using a 5-point Hedonic scale as described by Larmond (1977) where 1 represents dislike extremely, while 5 represents like extremely.

**Statistical analysis:** Data obtained was subjected to analysis of variance (ANOVA) as described by Steel and Torrie (1990). Separation of means was by Duncan's Multiple Range Test.

## RESULTS AND DISCUSSION

**Proximate composition:** The results of proximate composition of the selected bread samples are as presented in Table 2. There were significant differences ( $p < 0.05$ ) in the moisture, crude protein, crude fat, crude fibre, ash and carbohydrate contents, with values ranging from 30 to 35, 8.75 to 14.22, 2 to 13, 0.70 to 1.052, 0.40 to 0.60 and 35.82 to 48.20%, respectively. These values fell within the ranges permitted by SON (2004) except for fat and ash contents which are higher. The moisture content of 30-35% for bread is good, compared to the maximum value of 40.00% specified by SON. The moisture content of foods is usually used as an indicator of food quality. It is important to measure the moisture content in breads because of its potential impact on the sensory, physical and microbial properties of the bread (Olaoye *et al.*, 2006).

The high values for protein, fat, fibre and ash could be as a result of the flours used in composite with wheat, as well as other additives used in producing these bread samples. This could also be the reason for

Table 2: Proximate composition of selected brands of bread sold in Benue and Nasarawa states (%)

Sample	Moisture	Ash	Fat	Protein	Fibre	Carbohydrate
A	34.83±0.58 <sup>a</sup>	6.10±0.04 <sup>c</sup>	4.0±0.00 <sup>c</sup>	8.74±0.00 <sup>a</sup>	1.05±0.00 <sup>a</sup>	45.13±0.01 <sup>b</sup>
B	34.93±0.01 <sup>a</sup>	7.00±0.00 <sup>b</sup>	8.10±0.01 <sup>b</sup>	13.12±0.00 <sup>b</sup>	1.05±0.00 <sup>a</sup>	35.81±0.00 <sup>f</sup>
C	34.93±0.09 <sup>a</sup>	4.06±0.01 <sup>d</sup>	13.07±0.01 <sup>a</sup>	10.93±0.01 <sup>c</sup>	1.00±0.00 <sup>a</sup>	36.67±0.33 <sup>c</sup>
D	35.07±0.04 <sup>a</sup>	7.93±0.02 <sup>a</sup>	4.03±0.00 <sup>c</sup>	12.03±0.03 <sup>c</sup>	0.78±0.01 <sup>c</sup>	40.30±0.03 <sup>c</sup>
E	34.97±0.02 <sup>a</sup>	5.97±0.02 <sup>c</sup>	4.07±0.01 <sup>c</sup>	14.22±0.10 <sup>a</sup>	0.91±0.10 <sup>b</sup>	39.93±0.03 <sup>d</sup>
F	30.21±0.14 <sup>b</sup>	6.00±0.00 <sup>c</sup>	2.00±0.00 <sup>d</sup>	13.13±0.00 <sup>b</sup>	0.71±0.01 <sup>d</sup>	48.18±0.05 <sup>a</sup>
LSD	0.55	0.14	0.10	0.10	0.06	0.31

Values are means±S.D. of triplicate determinations; Means with the same superscript within the same column are not significantly different ( $p > 0.05$ ); Key: A = Top Choice; B = Ostrich; C = Tito; D = Emziler; E = Canaan Empire; F = Gods Promise; LSD = Least significant differences

Table 3: Mineral composition of selected brands of bread sold in Benue and Nasarawa states (mg/100g)

Sample	Ca	Cu	Fe	Mg	Mn	Na	P	Zn
A	65.37±0.30 <sup>ad</sup>	0.16±0.01 <sup>ad</sup>	2.32±0.05 <sup>ac</sup>	79.51±0.08 <sup>a</sup>	22.23±0.20 <sup>a</sup>	302.90±0.90 <sup>a</sup>	293.40±1.20 <sup>a</sup>	2.15±0.08 <sup>ad</sup>
B	67.63±0.75 <sup>b</sup>	0.17±0.02 <sup>ac</sup>	1.99±0.02 <sup>b</sup>	70.85±0.37 <sup>b</sup>	19.07±0.37 <sup>b</sup>	319.30±1.00 <sup>b</sup>	280.90±0.50 <sup>b</sup>	1.96±0.08 <sup>b</sup>
C	59.74±0.09 <sup>c</sup>	0.12±0.01 <sup>b</sup>	2.45±0.12 <sup>cd</sup>	85.60±0.15 <sup>c</sup>	12.82±0.15 <sup>c</sup>	285.40±1.00 <sup>c</sup>	286.20±0.30 <sup>c</sup>	2.23±0.02 <sup>d</sup>
D	64.52±0.82 <sup>a</sup>	0.13±0.01 <sup>bc</sup>	2.21±0.12 <sup>a</sup>	77.16±0.15 <sup>d</sup>	17.89±0.15 <sup>d</sup>	260.60±1.60 <sup>d</sup>	294.50±0.80 <sup>c</sup>	2.10±0.02 <sup>a</sup>
E	70.91±0.33 <sup>c</sup>	0.18±0.01 <sup>c</sup>	2.49±0.09 <sup>d</sup>	112.22±1.68 <sup>c</sup>	25.46±0.39 <sup>c</sup>	347.80±1.10 <sup>c</sup>	312.12±0.50 <sup>c</sup>	2.35±0.01 <sup>c</sup>
F	61.84±1.03 <sup>f</sup>	0.15±0.01 <sup>de</sup>	2.55±0.08 <sup>d</sup>	92.49±0.99 <sup>f</sup>	320.50±16.40 <sup>b</sup>	320.00±1.10 <sup>a</sup>	2.16±0.10 <sup>a</sup>	2.16±0.10 <sup>a</sup>
LSD	1.14	0.01	0.21	1.44	0.62	12.04	1.76	0.09

Values are means±S.D. of triplicate determinations; Means with the same superscript within the same column are not significantly different ( $p > 0.05$ ); Key: A = Top Choice; B = Ostrich; C = Tito; D = Emziler; E = Canaan Empire; F = Gods Promise; LSD= Least significant differences

Table 4: Vitamin content of selected brands of bread sold in Benue and Nasarawa states (mg/100g)

	Vit. A	Vit. B <sub>1</sub>	Vit. B <sub>2</sub>	Vit. B <sub>6</sub>
A	5.203±0.025 <sup>a</sup>	0.220±0.020 <sup>a</sup>	0.084±0.001 <sup>a</sup>	1.963±0.025 <sup>a</sup>
B	5.803±0.031 <sup>b</sup>	0.163±0.015 <sup>b</sup>	0.0730±0.002 <sup>b</sup>	2.103±0.050 <sup>b</sup>
C	5.083±0.025 <sup>a</sup>	0.223±0.012 <sup>a</sup>	0.054±0.003 <sup>c</sup>	1.6700±0.056 <sup>c</sup>
D	4.997±0.032 <sup>a</sup>	0.160±0.010 <sup>b</sup>	0.093±0.007 <sup>a</sup>	1.923±0.025 <sup>a</sup>
E	5.600±0.313 <sup>b</sup>	0.300±0.020 <sup>a</sup>	0.093±0.003 <sup>d</sup>	2.470±0.020 <sup>d</sup>
F	5.627±0.101 <sup>b</sup>	0.233±0.015 <sup>a</sup>	0.073±0.002 <sup>b</sup>	2.33±0.025 <sup>c</sup>
LSD	0.240	0.020	0.000	0.06

Values are means±S.D. of triplicate determinations; Means with the same superscript within the same column are not significantly different (p>0.05); Key: A = Top Choice; B = Ostrich; C = Tito; D = Emziler; E = Canaan Empire; F = Gods Promise; LSD = Least significant differences

Table 5: Mean sensory scores of selected brands of bread sold in Benue and Nasarawa states

Sample	Appearance	Smell	Taste	Texture	General Acceptability
A	4.00 <sup>a</sup>	3.80 <sup>a</sup>	3.93 <sup>a</sup>	4.07 <sup>a</sup>	4.07 <sup>a</sup>
B	4.00 <sup>a</sup>	4.00 <sup>a</sup>	3.87 <sup>a</sup>	4.13 <sup>a</sup>	4.00 <sup>a</sup>
C	3.87 <sup>a</sup>	4.40 <sup>a</sup>	4.47 <sup>a</sup>	4.20 <sup>a</sup>	4.40 <sup>a</sup>
D	3.33 <sup>b</sup>	2.80 <sup>b</sup>	2.20 <sup>b</sup>	3.60 <sup>b</sup>	2.93 <sup>c</sup>
E	3.67 <sup>b</sup>	3.40 <sup>b</sup>	4.20 <sup>b</sup>	3.67 <sup>b</sup>	4.20 <sup>a</sup>
F	3.00 <sup>b</sup>	2.27 <sup>c</sup>	2.13 <sup>c</sup>	3.20 <sup>c</sup>	2.47 <sup>c</sup>
LSD	0.68	0.68	0.59	0.57	0.63

Values are means± S.D. of triplicate determination; Means with the same superscript within the same column are not significantly different (p>0.05); Key: A = Top Choice; B = Ostrich; C = Tito; D = Emziler; E = Canaan Empire; F = Gods Promise; LSD = Least significant differences

the wide range and significant differences (p<0.05) in the values for all the nutrients. Generally therefore, all the bread samples were found to be very rich in macro-nutrients which are necessary for growth and maintenance of the body.

With respect to proximate composition, sample F (Gods Promise, from Nasarwa State) showed higher compliance with SON (2004) specifications

**Mineral composition:** Results of the mineral composition of the six selected bread samples are as presented in Table 3. Calcium, iron, magnesium, copper, sodium, manganese, phosphorus and zinc were detected in all the brands. There were significant differences (p<0.05) in the mineral values among the bread samples. This is in agreement with previous report of Ebuehi *et al.* (2007) with bread samples in Lagos metropolis in Nigeria.

The metabolic functions of minerals for life cannot be overemphasized and has been extensively reported in literature (Champe and Harvey, 1994). Both copper and iron are required in mammalian nutrition to prevent anemia. Zinc and copper also form metaloprotein and enzymes from which copper cannot be dissociated without loss of activity (Champe and Harvey, 1994). Calcium is an important constituent of body fluids and bone formation in conjunction with phosphorus (Ebuehi *et al.*, 2007). Calcium also plays a major role in nutrition including bone formation, maintenance and growth, tooth formation, blood clot formation, absorption of vitamin B12 and contraction of muscles. Magnesium catalyses ATP to DAD, conducts nerve impulses and helps the body to adjust to cold environment (Justina, 2009).

**Vitamin content:** Table 4 presents the vitamin (A, B<sub>1</sub>, B<sub>2</sub> and B<sub>6</sub>) content of the selected bread samples. There were significant differences (p<0.05) in the vitamin content of among the bread samples which are

generally rich in vitamin A but low in the B group. It may be suggested that consumption of these breads would promote vision since they are rich in vitamin A-a fat soluble vitamin, which is a component of the visual pigment of the rod and cone cells of the eye (Champe and Harvey, 1994). Similarly vitamin A has been implicated in the support of spermatogenesis in the male and prevention of foetal re-absorption in the female. It has also been shown to regulate biosynthesis of glycoproteins which are common constituents of cell membranes.

Thiamine (Vit.B<sub>1</sub>) and Riboflavin (Vit.B<sub>2</sub>) are energy releasing water soluble vitamins since they are the precursors of co-enzymes-thiamine pyro-phosphate (TPP) and Flavine Adenine Dinucleotide (FAD), respectively. Pyridoxine (Vit.B<sub>6</sub>) is the precursor of pyridoxal phosphate which functions as co-enzymes for transamination, de-carboxylation, deamination and condensation. The indication is therefore that consumption of these bread samples will promote good metabolism and health.

**Sensory attributes:** Sensory scores of the selected bread samples are presented in Table 5. Sample (C) was generally more preferred followed by sample (E), (A), (B), (D) and (F) in that order. There were significant differences (p<0.05) among the bread samples in the sensory scores of the different attributes. This could be due to the different ingredients, baking procedures and manufacturing practices used in producing the different bread samples. This observation is in conformity with the findings of Ebuehi *et al.* (2007) with selected bread brands in Lagos, Nigeria.

## CONCLUSION

This study showed that the most popular brands of bread sold and consumed in Benue and Nasarwa States of Central Nigeria are very rich in macro-and micro-

nutrients which are essential for normal growth and healthy human development. Going by their proximate composition all of them are generally compliant with SON specifications and are therefore qualified for the market.

Organoleptically, sample C (Tito Bread, from Benue State) was the most preferred, followed by sample E, A, B, D and F in that order. Though sample F (Gods Promise, from Nasarwa State) was the least preferred in terms of sensory evaluation, it showed the highest compliance to SON specifications in terms of proximate composition.

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