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Research Article

Proximate Composition of *Danwake* from Sorghum, Wheat and Cassava Bases

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Abstract

The proximate composition of *danwake* from sorghum, wheat and cassava were investigated. Seven (7) *danwake* flour blends, sorghum containing 5, 7, 11, 16 and 30% cowpea, wheat with 0% cowpea and cassava with 11% cowpea, were formulated. The *danwake* samples were processed following the traditional method [1]. Results from the data analyses showed that moisture and protein contents increased with the increase of cowpea addition in sorghum *danwake*. Fat and carbohydrate contents varied significantly ($p < 0.05$) whereas that of ash did not. Based on the proximate composition and the cost of cowpea, the best formulation among the 7 investigated was that of sorghum *danwake* containing 16 % cowpea.

Keywords: *Proximate Composition; Danwake; Sorghum; Wheat; Cassava*

Introduction

Danwake, an indigenous, stiff dumpling food of the people in the northern part of Nigeria is traced to be of the Nupe origin in Niger/ Kogi State. The product is originally prepared from beans flour/ sorghum flour, cassava flour/ beans flour, maize flour/ beans flour. Dry baobab leaves flour and trona ('kanwa') are also added. People believe that the addition of trona reduces flatulence and facilitates cooking of the beans [2]. The choice of cereal grains in danwake processing depends on individual needs and the availability of the desired blend components. The danwake flour blend is mixed with water to obtain dough which is moulded into small balls. The balls are cooked in boiling water for 15 to 30 min. They are thereafter removed from the cooking pan and placed in cold water to remove the mucilaginous foam which is drained off. The product is rinsed again with cold water and served with ground nut oil or any other vegetable oil, salt, magi and locally prepared spices ('yaji') containing ginger and red pepper. It is also served with vegetable soup. Danwake is eaten as breakfast, lunch and dinner. It is sold at all prices. One can buy danwake with 30 naira. Its short cooking time and capability to provides satiety for a longer period, make the product very convenient for both villages and citizens. However, nowadays, the use of various danwake flour blends, without the incorporation of the traditional ingredients as cowpea and sorghum, which ultimately affects the Physico-chemical and sensory properties of the product, is becoming a great concern with regard to preserving *danwake* quality and originality. Therefore, the present study sought to investigate the proximate composition of *danwake* from two traditional *danwake* bases, sorghum and cassava with cowpea as well as in a recent base, wheat without cowpea.

Materials and Methods

Materials

The materials composed of sorghum *Chakalari white* variety and cowpea flours were produced at the Food Processing Laboratory (FPL) of the Department of Food Science and Technology of the University of Maiduguri. Wheat flour, Cassava flour, Baobab leaves powder (*Kuka*) and potash (*Kanwa*), were purchased at Maiduguri Monday Market. The aforementioned materials were used to process: at FPL level, samples of sorghum based *danwake* containing 30% cowpea and also at processors' level, sorghum *danwake* with 5, 7, 11 and 16% cowpea as well as wheat and cassava *danwake* with 0% and 11% cowpea, respectively. Other materials used in *danwake* samples preparation included a locally made solar dryer and a kitchen grinder.

For samples analysis, an oven (Townson and Mercer Runcom, Cheshire, WA 71 PR, England) was used to determine moisture content while a Soxhlet unit was utilized for fat extraction. The ash content was determined using a Carbolite Furnace England and a (Gerhardt Bonn, 452644, Germany) digester, a distillation and titration units for crude protein determination.

Methods

Preparation of Danwake Samples

Danwake samples were produced by three different processors and also in the Food Science and Technology Laboratory, following the procedure described by [1]. According to the procedure, the *danwake* flour blend was mixed with water to produce dough. The dough was moulded into small balls which were cooked in boiling water for 15 to 30 min. During cooking, the balls were stirred using a metal perforated spatula, to avoid over boiling and their coalescence to form agglomerates. The cooked balls were thereafter cooled in cold water, and drained using a colander. They were dried for 72hrs in a solar dryer at a temperature of 38oC to 56oC. The dried samples were ground into powder using a manual kitchen grinder and thereafter used for proximate, vitamins, and minerals analyses.

Proximate Composition of Danwake

Moisture Content Determination

The moisture content of the danwake samples was determined using the two stage air - oven method. The wet danwake samples were left in tarred glass petri-dishes to dry for 14 to 16hrs at room temperature (37oC). The moisture loss was computed thereafter (stage 1). The moisture content of a portion of this air - dried danwake samples was determined using the method described by [3,4,5]. According to this method, 5g of the sample was weighed into porcelain dishes of known weight, which was thereafter placed in an oven (Townson and Mercer Runcom, Cheshire, WA 71 PR, England) for 2 to 3hrs at a temperature of 130ºC. They were removed from the oven, allowed to cool in desiccators and weighed. This procedure was repeated until constant weights were obtained (stage 2). The final moisture content of the sample was computed as the sum of percent moisture content at stages 1 and 2.

Moisture content (%) (stage 1 and 2) = (weight loss) / Initial weight) x 100

Ash Content Determination

The ash content was determined using a Carbolite Furnace England heated up to 550oC. Five (5g portion of the ground *danwake* powder was placed in washed, dried and pre-weighed crucible which was set in the furnace. The samples were incinerated overnight until a grey to white ash was obtained [6]. The crucibles containing the ash were cooled for 30 min in desiccators and weighed thereafter.

% Ash = (Weight of ash/Weight of sample) x 100

Crude Protein Content Determination

Kjeldahl nitrogen analysis was used to determine the protein content [7]. This technique commonly used in analytical chemistry measures nitrogen not only from protein but also from non-protein groups. Therefore, organic nitrogen from the sample was converted to ammonium sulfate by digestion with concentrated sulfuric acid, in the presence of a catalyst usually copper sulfate. The ammonium was determined from the ammonia liberated by distillation of the digest with an alkali. It was thereafter collected in a volume of boric acid and determined by titration using a standard Hydrochloric acid (HCl). Below are described the three steps, digestion, distillation and titration of the crude protein determination.

Digestion

A 1g powder of the *danwake* was weighed and placed in digestion tubes which were previously cleaned and labeled. One digestion tablet and 20 ml of concentrated sulfuric acid were added to each sample and gently stirred. An exhaust cap was fitted over each tube prior to transferring to the digester (Gerhardt Bonn, 452644, Germany) at a temperature of 200oC for 2hrs and 350oC for 3hrs digestion. The digestion was completed whenever the digest solution became light yellow or pale. The digest was made up to 100 ml using distilled water in a 100 ml volumetric flask.

Distillation

Five 5 ml of the digested sample was pippeted into the distillation unit. Then 15 to 20 ml of 40% NaOH was added and the system washed down with distilled water. At the receiving end of the distillation unit was placed a 100 ml conical flask containing 5 ml of boric acid and 2 to 3 drops of the mixed indicator of bromocresol green and methyl red. The steam was produced from a 1000 ml volumetric flask, containing water and white pebbles as anti-bumping, using a kerosene stove. Distillation took place while the produced ammonia was absorbed in the 4% boric acid. The distillate was collected up to 50 to 75 ml and thereafter titrated.

Titration

The boric acid distillate was titrated using 0.01 N HCl as the titrant. Percentage crude protein was determined by using the formula below, in which the percentage of nitrogen is multiplied by 6.25 a conversion factor commonly used for cereals.

$$\% \text{ Crude protein} = (A / B \times C/D \times I/E \times 100 / 1000 \times 6.25/1)$$

Where:

A = ml of standard HCl used for titration

B= ml of sample solution used for distillation

C= volume of sample made after digestion

D = weight of sample used for digestion

E = acid factor of HCL

Fat Content Determination

The principles of gravimetry and solvent fat extraction were used. The dissolved fat is recovered by evaporation. A Soxhlet extractor with reflux condenser was assembled on top of small flasks previously washed, dried in the oven, cooled and weighed. A 3g of the *danwake* ground powder was placed in "fat free extraction thimbles" and plugged lightly with cotton wool. The thimbles were set in the extractor and petroleum ether (boiling point 40 to 60oC) added until the 150 ml barrel was ¾ full. The heating system was set at 100oC for 4hrs and distillation of ether continued until it siphoned over once and until the flask was practically dried. The flask containing the oil was detached and further dried in the oven until constant weight was obtained [6].

$$\% \text{ Fat} = (\text{weight of oil} / \text{weight of sample}) \times 100$$

Carbohydrate Content Determination

The total soluble carbohydrates in each *danwake* sample was determined by difference [6] that is, the known amounts of moisture, ash, protein and fat were subtracted from 100 to obtain the total soluble carbohydrates.

Statistical Analysis

The statistical analysis was carried out using the Statistics Package for Social Sciences (SPSS) version 16. All the values expressed in percentage were obtained using the frequencies under the descriptive statistics. The means, their standard deviations, and differences significance, were computed through the independent samples T-test. The significance of the assessment was set at 5.00%.

Results and Discussions

The proximate composition of formulated *danwake* from different flour blends are given in (Table 1). The protein content ranged from 7.85f% to 22.37a%, fat from 1.00c% to 3.33a% and ash content from 3.17b% to 3.84a%. There were significant ($p < 0.05$) variations in the proximate composition of *danwake* samples. The addition of cowpea increased the protein content of the *danwake* samples as well as the moisture retention.

Sample	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Carbohydrate (%)
Sorghum *danwake* (5% cowpea)	66.69^{g}	15.11^{e}	$2.6\ 7^{b}$	3.67^{a}	72.05^{b}
Sorghum *danwake* (7% cowpea)	70.30^{d}	15.55^{e}	2.67^{b}	3.50^{a}	71.45^{b}
Sorghum *danwake* (11% cowpea)	73.88^{c}	16.29^{d}	3.33^{a}	3.84^{a}	70.58^{b}
Sorghum *danwake* (16% cowpea)	73.95^{b}	19.25^{b}	2.84^{a}	3.67^{a}	68.25^{c}
Sorghum *danwake* (30% cowpea)	82.47^{a}	22.37^{a}	2.33^{b}	3.17^{b}	65.31^{d}
Cassava *danwake* (11% cowpea)	68.33^{f}	7.85^{f}	1.00^{c}	3.84^{a}	79.65^{a}
Wheat *danwake* (0% cowpea)	69.32^{e}	17.48^{c}	2.33^{b}	3.38^{a}	68.31^{c}

Table 1: *Proximate Composition of Danwake.*

Moisture

As the results showed, the moisture content varied from 66.69g% to 82.47a%. *Danwake* from sorghum with 30% and 5% cowpea had the highest and the lowest moisture contents, respectively. The moisture content increased with the increased cowpea incorporation. However, cassava *danwake* with 11% cowpea had lower moisture content than sorghum *danwake* with 7% cowpea. This is probably due to the presence in sorghum *danwake* of the husk which was not removed prior to the *danwake* processing. Therefore, the existence of this bran may have increased the moisture retention already increased by the presence of cowpea. Likewise, the moisture content (69.32c%) of wheat *danwake* with 0% cowpea was greater than the moisture content of (68.33f%) of cassava *danwake* with 11% cowpea as well as that (66.69g%) of sorghum *danwake* with 5% cowpea. This may be due to the presence in wheat of gluten, an elastic substance, which had probably contributed to moisture retention.

Protein

The protein content of sorghum *danwake* containing 30% cowpea was the highest followed by that of sorghum *danwake* with 16% cowpea. The protein content of cassava based *danwake* containing 11% cowpea flour was the least (7.85f%). The addition of cowpea improved the protein content of the *danwake*. Other workers have reported similar increase in protein content with the addition of cowpea flour. The significance of this is that the protein content of some *danwake* samples was adequate and those who consume *danwake* would surely obtain adequate protein.

1. Values are means of two determinations.
2. Means within the same column not followed by the same superscripts are significantly ($p < 0.05$) different.
3. Moisture values are expressed on the dry matter basis.
4. Protein, fat, ash, and carbohydrate were determined on the dry matter basis.

Fat

There were significant ($p < 0.05$) variations in the fat content of *danwake* samples. The lowest fat content of 1.00c% was obtained from cassava based *danwake* and the highest from the sorghum *danwake* containing 11% cowpea flour. The fat content of the danwake samples might have been influenced by the fact that whole grains [8,9,10,11] were used in making the products and the low fat in cassava based *danwake* due to the low fat content of cassava (raw material). Generally, the low fat may be due to the fact that the germ found in the whole milled sorghum was sieved during milling.

Ash

There were no significant ($p > 0.05$) variations in the ash content of *danwake* samples with the exception of sorghum *danwake* with 30% cowpea which was significantly ($p < 0.05$) different. The ash content of *danwake* samples might have been influenced by the addition of trona/ (potash), an impure evaporated mineral sodium sesquicarbonate salt found in saline Salt Lake deposit and the use of the whole grains in the preparation of *danwake*. Other workers reported similar ash content of 0.30 to 6.00% for *danwake*.

Carbohydrate

There were significant ($p < 0.05$) variations in the carbohydrate content of *danwake* samples. Cassava based *danwake* as would be expected had the highest carbohydrate content of 79.65a%. There is usually an inverse relationship between protein content and carbohydrate content. Anything that reduces starch synthesis such as drought causes increased protein content [11]. [1] reported similar variations in carbohydrate content of *danwake* samples.

Conclusions

The proximate composition analyses of *danwake* showed that moisture and protein contents increased with the increase cowpea incorporation. There were significant ($p < 0.05$) variations in the fat and carbohydrate contents of the samples of *danwake*. There were no significant ($p > 0.05$) variations in the ash content of the samples of *danwake* with the exception of sorghum danwake with 30% cowpea which was significantly ($p < 0.05$) different. Considering the proximate composition and the cost of cowpea, the best formulation among the 7 developed was that of sorghum *danwake* with 16% cowpea. This study provides information on the nutritional values of a food which is consumed daily in both rural and urban places of Nigeria. It also draws the attention of the community on the risk of losing the originality of the product.

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