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EVALUATION OF BREAD MAKING QUALITY OF FLOUR MADE FROM THE TWO LOCAL VARIATIES OF CASSAVA CULTIVATED IN KAZAURE LOCAL GOVERNMENT AREA

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Abstract*: Several factors such as processing methods, growing conditions and genotypic differences may influence the composition and physicochemical properties of cassava. This study is aimed to evaluate the proximate and pasting property of the two varieties of cassava TMS326 and TME419 cultivated in Kazaure Local Government area, Jigawa state, Nigeria. The proximate composition of flour from TMS 326 and TME 419 cassava roots were found no significant different. However, TMS 326 flour had higher carbohydrate (84.15%) compared to TME419 (82.64%). While The moisture, crude protein, fat content, fibre, ash, cyanide and amylose of TMS 326 and TME 419 has a mean percentage of 7.84and 8.79, 1.36 and 1.21%, 2.10 and 1.91%, 1.85 and 2.95%, 2.70 and 2.50, 6.98 and 3.99% and 27.11 and 24.22% respectively There were significantly ($p<0.05$) different in pasting property of starches and flours between the two cassava varieties (Table 2). Peak viscosity which is identified the swelling peak was found to be higher for the starch samples when compared with the flour. The peak viscosity of the starch samples showed that TMS 326 starch had higher peak viscosity (460.5 RVU) than the TME 419 sample (421.10 RVU). The Starch extracted from TME 419 was significantly higher cold paste viscosity (489.27 RVU) than starch from TMS 326 (329.9 RVU). The breakdown viscosity of the TMS 326 flours is lower when compared to that of TME419.While the TMS326 starch has higher breakdown viscosity than TME419 (Table 2). The starch pasting temperature of TMS 326 was 80.1^{o}C and that of TME 419 was 74.3^{o}C. The study concludes that differences in cassava varieties has effects on the physicochemical and pasting properties of flours prepared for both two varieties of cassava evaluated. TME 419 was observed to contain more crude fibre than TMS326 despite the similar source and can be regarded as a good source of fibre. TME 419 is found to have low protein content but highest in carbohydrates. Hence the flour blends obtained from the two varieties can be regarded as good material for bread baking and other baked products.

Key words: Physicochemical, proximate, pasting, cassava

I. INTRODUCTION

Cassava is a major staple crop in Nigeria, as cassava and its product are found in the daily meals of Nigerians. Currently, cassava is undergoing a transition from a mere subsistent crop found on the field of peasants to a commercial crop grown in plantations. This unprecedented expansion on this crop is attributed to its discovery as a cheap source of edible carbohydrate that could be processed into different forms of human delicacies and animal feeds. Cassava is drought-tolerant, staple food crop grown in tropics and subtropical areas. Cassava is to African peasant farmers what rice is to Asian farmers or wheat and potatoes are to European farmers (El-Sharkawy, 2003). Cassava (*Manihot esculenta* Crantz) is a perennial woody shrub with an edible root, which grows in tropical and subtropical areas of the world Cassava plays an important role in agriculture in many developing countries, like sub-Saharan Africa, because it can be cultivated well on poor soils and with minimum or low rainfall. Its wide harvesting window allows it to act as a famine reserve and invaluable in managing. It offers flexibility to resource-poor farmers because it serves as either subsistence or a cash crop. Furthermore, cassava is the source of raw materials for a number of industrial products such as starch, flour and ethanol (Stone, 2002). The production of cassava is relatively easy as it is tolerant to the biotic and edaphic encumbrances that hamper the production of other crops. Cassava's roots are used only to store energy, unlike the roots of sweet potato and yam that are reproductive organs. Despite their agronomic advantages, root crops are far more perishable than

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the other staple food crops. Once out of the ground, some root crops have a shelf life of only few days. Roots as living organs of plants continue to metabolize and respire after harvest. Cassava has a shelf life that is generally accepted to be of the order of 24 to 48 hours after harvest, Cassava utilization patterns vary considerably in different parts of the world (Andrew, 2002)..

Majority of cassava produced (90%) in Nigeria is used for human food (IITA, 2010). Cassava is very versatile and its derivatives and starch are applicable in many types of products such as foods, confectionery, sweeteners, glues, plywood, textiles, paper, biodegradable products, monosodium glutamate, and drugs (Stone, 2002). Cassava chips and pellets are used in animal feed and alcohol production. Animal feed and starch production are only minor uses of the crop in Nigeria. Cassava, in its processed form, is a reliable and convenient source of food for tens of millions of rural and urban dwellers in Nigeria (IITA, 2010). This study is aimed to evaluate the proximate and pasting property of the two varieties of cassava TMS326 and TME419 cultivated in Kazaure Local Government area, Jigawa State.

II. MATERIALS AND METHODS

Sample Collection

Cassava roots TME 419 and TMS326 were collected from Kazaure Local Government area, Jigawa State farmers.

Processing of Cassava into Flour

The cassava roots were processed a day after harvest. The roots were peeled by hand, and washed with tap water, grated with a motorized cassava grater, pressed in a sack using a manual screw press. The cassava mash was disintegrated in the cassava grater and dried in a solar dryer where the temperature varied between 35 and 48 °C. It was milled into flour using a disc-attrition mill. A motorized flour sifter with a 250 µm screen was used to remove fibers and bigger particles in order to obtain fine flour with a uniform particle size.

Starch extraction

Cassava roots (2 kg) were processed as described above for flour except that after grinding, the mash was submerged in 25 litres of potable water and sieving was done using a muslin cloth into a fresh bowl of water. The extract was allowed to settle for 24 hours. After settling, the supernatant was disposed and fresh water (10 litres) was added to the sediment. The washing procedure was repeated four times until a clean white starch was obtained. Starch slurry was pressed in a muslin cloth to remove excess water and the starch sample was sun dried for a total period of 24 hours, in a batch of 8 hours per day. Dried samples were milled and sieved.

III. PHYSICO-CHEMICAL ANALYSIS OF FLOURS

Proximate Composition of Two Varieties of Cassava Flours

Determination of moisture content: The method described by A.O.A.C (1980) was adopted; a clean crucible was dried to a constant weight in air oven at 110°C, was cooled in a desiccator and Weighed (W1). Two grams of finely ground sample was weighed into the previously labeled crucible and reweighed (W2). The crucible containing the sample was dried in an oven to constant Weight (W3). The percentage moisture content was calculated using the formula below:

$$\% \text{ Moisture content} = \frac{W2 - W3}{W2 - W1} \times 100$$

$W_{1=}$ is the weight of the dish, $W_{2=}$ the weight of the dish + the weight of the sample before drying and $W_{3=}$ the weight of the dish + the weight of the sample after drying.

Determination of ash content: The A.O.A.C (1980) method was used. The porcelain crucible was dried in an oven at 100°C for 10 min, cooled in a desiccators and weighed (W1). Two grams of the finely ground sample was placed into a previously weighed porcelain crucible and reweighed (W2), it was first be ignited and then transferred into a furnace which was set at 550°C. The sample was left in the furnace for eight hours for ashing. The crucible containing the ash was then removed; cooled in a desiccator and Weighed (W3).

The percentage ash content was calculated as follows:

$$\% \text{ Ash Content} = \frac{W3 - W1}{W2 - W1} \times 100$$

Determination of Crude Lipid Content by Soxhlet Method: A clean, dried 500 cm round bottom flask containing few anti-bumping granules were weighed (W1) with 300 c petroleum ether (40-60°C) for extraction poured into the flask filled with soxhlet extraction unit. The extractor thimble weighing twenty grams was fixed into the Soxhlet unit. The round bottom flask and a condenser were connected to the Soxhlet extractor and cold water circulation was connected/put on. The heating mantle was switched on and the heating rate adjusted until the solvent refluxing at a steady rate. Extraction was carried out for 6hours. The solvent was recovered and the oil dried in an oven set at 70°C for 1hour. The round bottom flask and oil was then Weighed (W2). The lipid content was calculated thus:

$$\% \text{ Crude Lipid content} = \frac{W2 - W1}{\text{Weight of Sample}} \times 100$$

Determination of crude fibre: The sample (2 g) was weighed into a round bottom flask, 100 cm 0.25 M sulphuric acid solution was added and the mixture boiled under reflux for 30 min. The

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hot solution was quickly filtered under suction. The insoluble matter washed several times with hot water until it become acid free. It was quantitatively transferred into the flask and 100 cm of hot 0.31 M, Sodium Hydroxide solution was added, the mixture boiled under reflux for 30 min and filtered under suction. The residue washed with boiling water until it become base free, dried to constant weight in an oven at 100°C, cooled in a desiccator and weighed (C1). The weighed sample (C1) was then incinerated in a muffle furnace at 550°C for 2hours, cooled in a desiccator and reweighed (C2).

Calculation: The loss in weight on incineration = C1-C2

$$\% \text{ Crude fibre} = \frac{C1 - C2}{\text{Weight of original sample}} \times 100$$

Determination of crude protein: The ground defatted sample (91.5 g) in an ashless filter study was dropped into a 300 cm Kjeldahl flask. The flask was then transferred to the Kjeldahl digestion apparatus. The sample was digested unit a clear green colour obtained. The digest was cooled and diluted with 100 cm with distilled water. Distillation of the digest: Into 500 cm Kjeldahl flask containing anti-bumping chips and 40 cm of 40% NaOH were slowly added to the flask containing mixture of 50 cm 2% boric acid and 3 drops of mixed indicator was used to trap the ammonia being liberated. The conical flask and the Kjeldahl flask was then placed on Kjeldahl distillation apparatus with the tubes inserted into the conical flask, heat was applied to distill out the NH_3 evolved with the distillate collected into the boric acid solution. The distillate was then titrated with 0.1 MHCl.

Calculation:

$$\% \text{ N2} = \frac{14 \times M \times Vt \times V_{100}}{\text{Weight of sample (mg)} \times Va}$$

% Crude Protein = % N2 (Nitrogen) × 6.35

where, M = Actual Molarity of Acid V = Titre Value (Volume) of HCl used V t = Total volume of diluted digest Va = Aliquot volume distilled

Determination of carbohydrate by (difference): The total carbohydrate was determined by difference. The sum of the percentage moisture, ash, crude lipid, crude protein and crude fibre were subtracted from 100 (Muller and Tobin, 1980).

Calculation:

% Total carbohydrate = 100 - (% moisture + % Ash + % fat + % Protein + % Fibre)

Calorific value: This was done by summing the multiplied values for crude protein, fats, and carbohydrate (exclude crude fibre) by the following factors (4, 9 and 4).

Amylose content of flours
100 µl of a sample solution composed of approximately 50 mg of flour and 6 ml UDMSO (0.6 M urea in 90% Dimethyl sulfoxide) was mixed with 900 µl absolute ethanol. The samples were centrifuged (2000 g, 15 min), was behed with 2 ml 95 % ethanol and centrifuged again. After decanting the solvent, 100 µl UDMSO was added to the pellet and placed 15 min in a boiling water bath for complete dissolution. 5 ml 0.5 % trichloroacetic acid (TCA) and 50 µl iodine solution (1.27g I2 and 3.00 g KI per litre) were added and mixed immediately. After 30 mins at room temperature, absorbance was read at 620 nm with water as reference. The amylose content of the flour will be calculated using a standard curve.

Pasting properties
To analyze pasting properties of cassava flours upon heating and subsequent cooling, a Rapid Visco Analyzer (RVA)was used. RVA General Pasting Method (STD1) was employed. Total running time were 13 mins and the viscosity values were recorded every 4 seconds by Thermocline Software as the temperature increased from 50°C to 95°C before cooling to 50°C again. Rotation speed was set to 960 rpm the first 10 seconds and to 160 rpm until the end. 3.00 g of flour and 25.0 ml of distilled water were placed into a canister. A paddle was inserted and shaken through the sample before the canister was inserted into the RVA.

IV. STATISTICAL ANALYSIS

The data obtained was analyzed using SPSS 16.0 in which One-Way Analysis of Variance (ANOVA) with a level of significance of $p>0.05$ was performed.

V. RESULTS AND DISCUSSION

Proximate Composition, Cyanide and Amylose content of two varieties of Cassava Flours

The proximate composition of flour from TMS 326 and TME 419 cassava roots were found no significant different (Table1). TMS 326 flour had slightly higher carbohydrate (84.15%) compared to TME419 (82.64%). Cassava is known to be the rich source in carbohydrates including starch, similarly finding indicated high carbohydrate content (83.63%) for TME 419 grown in Abia state, Nigeria Uchechukwu- Agua *et al.,* (2015), The moisture, crude protein, fat content, fibre, ash, cyanide and amylose of TMS 326 and TME 419 has a mean percentage of 7.84and 8.79, 1.36 and 1.21%, 2.10 and 1.91%, 1.85 and 2.95%, 2.70 and 2.50, 6.98 and 3.99% and 27.11 and 24.22% respectively this were believed to low. Previous research on five different varieties of cassava reported low values for crude protein (1.2-1.8%), crude fat (0.1-0.8%), crude fibre (1.5- 3.5%) and total ash (1.3-2.8%) contents (Charles *et al.,* 2005). Cyanide content of TMS 326 was higher twice than that of TME 419 reported in this study (Table 1). The cyanide contents of cassava root in this study were much lower than values (12-13 mg/100 g) reported by previous authors (Idowu and Akindele, 1994;

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Oyeyinka *et al.,* 2019). However, some authors reported cyanide contents of 4.9 mg/100 g for cassava variety TME 419 grown in a different location (Uchechukwu-Agua *et al.,* 2015). Differences in the cyanide contents may be due to variation in the type of cassava variety used and other growing conditions. Other factor such as pH may influence the cyanide content of cassava (Uchechukwu-Agua *et al.,*2015). Hydrogen cyanide is anti-nutritional factor in cassava roots and is toxic for humans when consumed above some levels. For instance, consumption above 50-100 mg/kg cyanide related to acute poisoning, with reported lethality in adults (Halstrom and Moller, 1945). The amylose content (approx. 27 %) of flour from TMS 326 was higher than TME 419 variety (approx. 24 %) (table 1). Differences in the amylose is related to genetic properties of differences cassava species, origin, physiology and environmental growth conditions (Hoover *et al.,* 2010). In this study, both the two cassava varieties were cultivated in the same conditions and time Hence, the genetic differences between the two cassava varieties is due to variation in amylose content. The ratio of amylose to amylopectin in starch is known to alter the starch functional and physicochemical characteristics. The amylose contents of the starches in this study are higher than the values (average of 19%) reported for starch extract from two cassava varieties grown at two different locations (Aldana and Quintero, 2013) but lower than the value (29.29%) reported previously by Nwokocha *et al.,(*2009).

Table 1: Proximate, cyanide composition and amylose content of cassava flour (%)

Parameters	TMS 326	TME 419
Moisture	7.84±0.11	8.79±0.01
Protein	1.36±0.06	1.21±0.08
Fat	2.10±0.13	1.91±0.16
Fibre	1.85±0.08	2.95±0.14
Ash	2.70±0.03	2.50±0.09
Carbohydrate	84.15±0.12	82.64±0.05
Cyanide (mg/100 g)	6.98±0.05	3.99±0.01
Amylose content	27.11±0.52	24.22±1.3

Results are presented in triplicates as mean± SD

Pasting properties of flour and starch extracted from two varieties cassava

There were significantly ($p<0.05$) different in pasting property of starches and flours between the two cassava varieties (Table 2). Peak viscosity which is identified the swelling peak was found to be higher for the starch samples when compared with the flour. This is may be due to the presence of non-starch components such as fibre and proteins that may limit the absorption of water leading to low peak viscosity. Cassava flour from TMS 326 revealed higher fat and protein contents as indicated in Table 1, this may account for the lower swelling power when compared with the flour from TME 419 cassava. The peak viscosity of the starch samples showed that TMS 326 starch had higher peak viscosity (460.5 RVU) than the TME 419 sample (421.10 RVU). Factors such as starch granule size, chain length distribution of amylopectin chain and amylose content may influence the peak viscosity of starch. In general, low amylose starch displays high peak viscosity. However, in this study, TME 419 with a lower amylose revealed low peak viscosity, this may due to some other factors that are responsible for the different in peak viscosity. Huang *et al.,* (2007), reported that the effect of chain length distribution on the physicochemical properties of cowpea and chickpea starches. These authors reported that cowpea starch with more proportions of long chain amylopectin exhibited higher peak viscosity (Huang *et al.,* 2007). Hence the higher proportions of long chain amylopectin of TMS 326. Cold paste viscosities of flour and starch samples were generally higher than their hot paste viscosities (Table 2). And it may be due to the influence of temperature on viscosity of biologically active materials. The Starch extracted from TME 419 was significantly higher cold paste viscosity (489.27 RVU) than starch from TMS 326 (329.9

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RVU), which could be due to the difference in carbohydrate contents of the cassava varieties (Table 1). Breakdown viscosity referred to the susceptibility of the starch granule to disintegrate during heating and this may affect the stability of the flour product (Oyeyinka *et al.,* 2019). The breakdown viscosity of the TMS 326 flours is lower when compared to that of TME419.While the TMS326 starch was has higher breakdown viscosity than TME419 (Table 2). The starch pasting temperature of TMS 326 (80.1^{O}C) and TME 419 (74.3^{O}C) and found to be are within the range of the values (60-80^{O}C) reported for tuber starches (Ezeocha and Okafor, 2016; Farhat *et al.,* 1999). Pasting temperature is the temperature at which the sample will become cooked. The different in pasting temperature of the starches may be due to differences in the granules size. TMS 326 starch was bigger than the TME 419. Big starch granules may require longer time to hydrate and melt compared with starch granules that are small. Cassava starch has low pasting temperature (average 68°C) hence, it forms pastes much easier compared to starches with high pasting temperatures such as potato (average 72°C) (Moorthy, 2002) and rice (average 69.5°C) (Cameron *et al*., 2007). This is due to the low stability of cassava starch granules on heating which makes them loose their molecular structure easily (Novelo-Cen and Betancur-Ancona, 2005).

Table 4: Pasting properties of flour and starch extracted from two varieties cassava

Parameters	TMS 326		TME 419	
	Flour	Starch	Flour	Starch
PV (RVU)	246.8±4.32^{a}	460.5±7.70^{b}	347.7±1.48^{c}	421.1±12.4^{b}
HPV (RVU)	78.2±0.25^{c}	225.1±2.82^{b}	80.9±0.79^{c}	335.7±4.82^{a}
CPV (RVU)	185.9±2.56^{c}	329.9±0.85^{b}	142.8±0.14^{d}	489.9±0.27^{a}
BDV (RVU)	169.3±1.04^{c}	221.2±0.25^{b}	232.9±3.29^{a}	98.2±0.02^{d}
PT (^{O}C)	69.7±0.25^{c}	81.1±0.04^{a}	61.8±0.31^{b}	74.3±0.40^{b}
Peak time (min)	5.68±0.12^{a}	4.16±0.01^{c}	4.28±0.03^{b}	4.48±0.03 bc

Mean± SD. Mean with different superscript along the row are significantly different (p<0.05) PV: Peak viscosity; HPV: Hot paste viscosity; CPV: Cold paste viscosity; BDV: Breakdown viscosity; PT: Pasting temperature.

VI. CONCLUSION

The study concludes that differences in cassava varieties has effects on the physicochemical, and pasting properties of flours prepared for both two varieties of cassava evaluated. TME 419 was observed to contain more crude fibre than TMS326 despite the similar source and can be regarded as a good source of fibre. TME 419 is found to have is low protein content but highest in carbohydrates. Hence the flour blends obtained from the two varieties can be regarded as good material for bread baking and other baked products.

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