

Characterization of Bread from Composite Flour of Cassava (*Manihot esculenta* Crantz) and Wheat (*Triticum* spp)

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ABSTRACT

In our efforts to promote LAUTECH diversified products for income generation, the characteristic of bread from composite flour of cassava (*Manihot esculenta* Crantz) and wheat (*Triticum* spp) was investigated. Cassava-wheat bread loaves were produced using conventional oven method. Hobart mixer was used for mixing the ingredients and *Saccharomyce cerevisiae* for fermentation. Control sample (A) was 100% whole wheat, Bread was produced from blends of wheat and cassava flour in ratio 100:0, 70:30, 50:50 and 10:90 for samples A, B, C and D respectively. The composite bread was evaluated for proximate analysis, physical attributes such as: loaf height, volume, weight, crumbling and for other sensory properties. Percent moisture was 11.67 (sample A) with the lowest of 10% in sample D. Physical height (cm) were 8.5, 5.5, 6.5 and 4.00 in samples A to D respectively while volume (cm³) were 1,100 in sample A to 16500 cm³ in sample D with the 90% cassava formulation. Sensory panellists preferred sample A and B with no repulsive odour Acceptability scores of 6.23 > 5.19 > 4.28 > 1.80 on the scale of 1-7 with 1 being the least accepted and 7 mostly accepted for samples A, B, C and D respectively. Considering minimizing cost without sacrificing quality favours sample B in this study. Future work would focus on better formulation than this initial report.

Keywords: Cassava-wheat bread, Composite Flour, Sensory Evaluation, Income Generation

Aims Research Journal Reference Format:

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1. INTRODUCTION

Agboola and Igene (2005 and Agboola et al. 2012) have emphasized the need for better utilization of African indigenous materials to produce better food products for feeding rapid population growth in Africa. One of the identified indigenous potential food materials is cassava (*Manihot esculenta* Crantz). Cassava is one of the highest crops in existence perhaps because it requires little cultivation and high toleration of adverse climatic condition and high resistance to disease than many other crops (Ajanaku and Nwinyi, 2012). Its utilization as a staple food throughout tropical areas is undisputed (Akoroda, 1992), while Tewe (2004) reported that it contributes about 46% of the agricultural gross domestic product. Utilization of cassava to variety of products beyond the African staple foods such as eba, lafun etc are areas of research in present times.

A food product that is acceptable and which consumption seems not to be connected with economic status, ethnicity, religious or geographical boundaries is bread. Zoe and Jeff (2003) noted bread being one of the oldest prepared foods and can be produced very quickly. Wheat (*Triticum* spp) is a major component used in producing bread, because of high gluten content, wheat flour is used to prepare bread, biscuits, confectionary products, noodles and vital wheat gluten products (Kumar et al., 2011). Alarming, Nigeria ranks the largest importer of wheat from the United States of America with 123 million bushels imported in 2010 more than any other country and spent 750 billion naira (\$4.6 billion) annually on its importation (Akinwumi, 2014).

Thus in Nigeria, utilization of cassava in producing bread to minimize wheat importation without sacrificing quality is gaining more attention from the government, individual and corporate bakers (Akinwumi, 2014). Thus the aim of this study is to determine the quality attributes of bread produced from cassava-wheat composite flour.

2. MATERIALS AND METHOD

Cassava tuber was obtained from Ladoke Akintola University of Technology Farm at the Faculty of Agriculture, Ladoke Akintola University of Technology, Ogbomoso, Nigeria. Wheat flour and ingredients (sugar, salt etc) were obtained from local markets while yeast (*Saccharomyces cerevisiae*) culture was obtained from the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. Cassava tubers were weighed, peeled and washed with clean water to remove debris; diced into smaller sizes and soaked in water for 4 days; dewatered after, and put inside a clean muslin cloth, hydraulic pressed to expel and drain off water for adequate removal as previously described by Onabolu (2016). Drying took place in a LAUTECH fabricated cabinet drier (Calibrated 0°C – 400 °C) temperature capacity using stainless trays, then milled using milling machine (No 1A Nulex Premium^R, Germany) and sieve into finer particles. Using convectional 5 quarter bowl mixer as a base, the proportionalities of the blend are wheat flour with 30% cassava (250gms), added water (150gms), *S. cerevisiae* powder (6gms), salt (5gms), sugar (15gms) and oil or shortening (5gms) with (1.25g) of sodium stearoyl-2 lactylase (SSL) as conditioner.

Cassava-wheat composite flour formulated are: Sample A = 0% cassava:100% wheat and served as a control sample. B = 30% cassava and 70% wheat; C = 50% cassava: 50% wheat and sample D = 90% cassava flour and 10% wheat. Bread was made from blends of flour and other ingredients were added to form dough. Hobart (2005) mixer was used to mix for 3 mins at No 2 speed until mix to full development and allowed 10mins rest after mixing. The dough were fermented in bowls, covered with muslin cloth for about 90mins at room temperature of $27 \pm 1^{\circ}\text{C}$ as described by Giami et al. (1992), rolled out and cut into desired sizes for moulding and moulded dough was put on oil pan and allow to proof in a proofing chamber at 40.5°C and 85-90% humidity for about 70 mins. Bread were baked for about 15mins in a conventional oven at 187.7°C and allowed to cool on the racks after complete baking.

2.1 Proximate Analysis

Moisture content was determined using oven method. A well cleaned platinum dish containing sample was placed in a thermostatically controlled oven at 103°C for 1 hr and subsequently placed in 160°C oven for 3 hrs and %moisture determined. Percent ash, protein, fat and protein contents were also analyzed according to AOAC (2006) methods .

2.2 Sensory evaluation

Sensory characteristics of the composite bread vs control sample were conducted by a trained panel of 15 members comprising of staff and students of LAUTECH Department of Food Science and Engineering (FSE) to determine the preference for odour, smoothness, shape, texture, taste, colour and crumbling on hedonic scale of 1 to 7 as described by Larmond (1977) and Agboola *et.al* (2012b) where:

- 7 = like extremely
- 6 = like very much
- 5 = like slightly
- 4 = Neither Like nor dislike
- 3 = dislike slightly
- 2 = dislike very much and
- 1 = dislike extremely

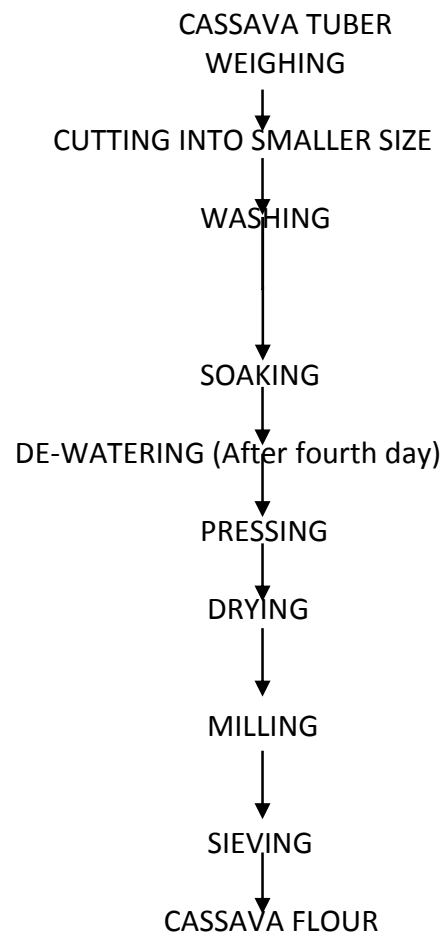


Fig 1: Flow chart for production of cassava flour (Onabolu & Bolanga, 1998)

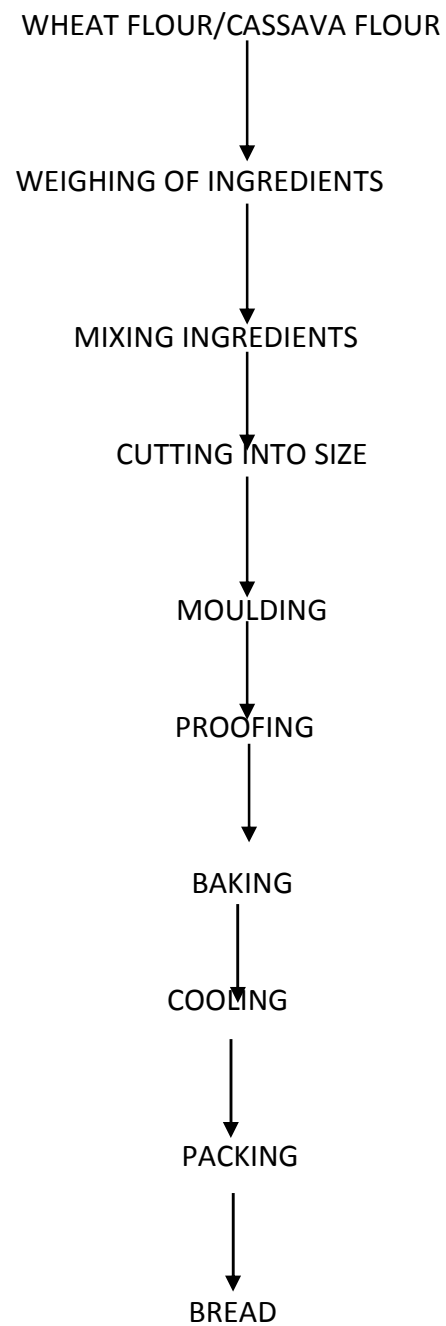


Fig 2: Flow chart for Production of Bread

2.3 Statistical analysis

All data obtained were subjected to analysis of variance (ANOVA) using the procedure of Statistical Package for Science and Social Sciences (SPSS). Means were separated using Duncan Multiple Range Test at 5% level of probability as described by Steel and Torrie (1980).

3. RESULTS AND DISCUSSION

The pictures of the produced bread are depicted in Fig. 3 where Sample B with 30% cassava and 70% wheat is the most accepted sample of all the treated samples. Proximate results are also presented in Table 1. Values of moisture obtained ranged from 10.23% (Sample B) to 11.68% (Sample A), were within the values reported by Sanni et.al. (2006) and they are low enough to ensure a stable shelf life of dried products like bread. Highest protein value of 10.67% was obtained in sample A. Protein values ranged from 2.13% to 10.67% with sample D having the lowest protein value and highest carbohydrate value of 82.67%. This inverse relationship between protein and carbohydrate which agreed with the reported work of Oboh and Akindahunsi (2003). The same trends were observed for %ash where sample D has lowest ash value of 1.94% as contrast with highest value of 2.34% in sample A with the lowest carbohydrate content. Result on fat content of the lowest value of 1.03% in sample D with high carbohydrate and sample A with 1.49%. is expected.



Sample A 100% Wheat flour



Sample B: 30% cassava:70% wheat flour



Sample C :50% cassava:50% wheat flour



Sample D: 90% cassava:10% wheat flour

Plate 1. Bread produced from different ratios of cassava and wheat flour.

Table 1: Proximate Composition of bread produced from cassava-wheat composite flour

Sample	Moisture %	Protein %	Fat %	Ash %	Fibre %	Carbohydrate %
A	11.67± 0.367b	10.67±1.028d	1.49± 0.082c	2.34± 0.118c	0.93±0.107a	72.88±0.365b
B	10.23 ±0.030a	8.79± 0.322c	1.31±0.035b	2.16±0.051b	1.81±0.075c	68.53±0.4739a
C	10.66 ±0.438a	5.52± 0.308b	1.26± 0.092b	2.11±0.082b	1.56±0.093b	78.880±0.272c
D	10.45± 0.500a	2.13± 0.298a	1.03±0.050a	1.93±0.055a	2.37±0.105d	82.67±0.392d

Means in the same column followed by different alphabets are significantly different (p<0.05)

- A 100% Wheat flour (Control)
- B 70% Wheat flour and 30% Cassava flour
- C 50% Wheat flour and 50% Cassava flour
- D 10% Wheat flour and 90% Cassava flour

Table 2: Physical evaluation of bread produced from cassava-wheat composite flour

Sample	Height (cm)	Weight (kg)	Volume (cm ³)	Water absorption (ml)
A	8.5 ± 0.00 ^c	0.4 ±0.00 ^a	1,100 ± 7.07 ^a	500 ± 15.55 ^a
B	6.0 ±0.84 ^b	0.6 ± 0.01 ^b	1,300 ±2.82 ^b	540 ±2.82 ^b
C	5.5 ± 0.14 ^b	0.8 ± 0.04 ^c	1,330 ±5.65 ^c	600 ±8.48 ^c
D	4.0 ± 0.14 ^a	0.9 ± 0.028 ^d	1,650 ±14.14 ^d	650 ±4.24 ^d

Means with different alphabets within the same column are significantly different (p <0.05)

- A 100 Wheat flour (Control)
- B 70% Wheat flour and 30% Cassava flour
- C 50% Wheat flour and 50% Cassava flour
- D 10% Wheat flour and 90% Cassava flour

Physical properties of the composite cassava-wheat bread are presented in Table 2. Height of the samples ranged from 4 cm (sample D) to 8cm (sample A). Sample A has the lowest weight of 0.4 kg contrast to sample D with highest weight of 0.9 kg. It could be noted that on the same Table 2, sample D with high carbohydrate content has highest water absorption capacity (WAC) of 650ml as against A with the lowest WAC of 500 ml. The volume of bread samples ranged from 1100 cm³ (sample A) to 1650 cm³ (sample D). With more volume in sample D, more space is created that could hold more water resulting in a significant weight in D as being reported (p<.05). Mahar et al.(2003) noted that the knowledge of bread volume can be used to modify the dough mix to produce bread of appropriate quality. Water absorption capacity (WAC) ranged from 500 ml (sample A) to 650 ml (sample D) with 90% cassava as shown in Table 2. Kulkarni et al.(1991) reported improvement in reconstituted dough with addition of flour causing high WBC and as well contributing to loose structure of starch polymer while low value of volume indicates compactness of the structure (Ajanaku and Nwinyi, 2012). In other to minimize the addition of chemicals to the produced bread, only 1.25g sodium stearoyl-2-lactylase (SSL) was added as conditioner as it has been shown to increase loaf volume in wheat-legume flour blends (D'apponia, 1977). Whichever argument one takes favours the most acceptable composite cassava 30%:70% wheat evaluated by 15 sensory panellists in this study. In Table 3, sensory panellists ranked sample A and sample B as most acceptable in terms of all the attributes evaluated without a repulsive odour.

Table 3: Sensory attributes of bread from cassava-wheat composite flour

Sample	Colour	Taste	Odour	Texture	General Acceptability
A	6.23 ± .014 ^d	5.85 ± .014 ^d	5.80 ± .028 ^d	5.95 ± .014 ^d	5.90 ± .014 ^d
B	5.19 ± .014 ^c	5.00 ± .014 ^c	4.28 ± .014 ^c	4.76 ± .014 ^c	4.85 ± .014 ^c
C	4.28 ± .014 ^b	3.76 ± .014 ^b	3.52 ± .014 ^b	3.95 ± .028 ^b	3.95 ± .014 ^b
D	1.80 ± .014 ^a	1.61 ± .014 ^a	1.71 ± .014 ^a	1.80 ± .014 ^a	1.57 ± .014 ^a

Means in the same column followed by different superscripts are significantly different (p<.05)

- A 100% Wheat flour (Control)
- B 70% Wheat flour and 30% Cassava flour
- C 50% Wheat flour and 50% Cassava flour
- D 10% Wheat flour and 90% Cassava flour

Although the result in this study agrees with Jones *et al.* (2004) and Kumar *et al.* (2011) that the whole-wheat bread is good for health and has a key advantage over other temperate crops in its uniqueness of its gluten content for dough forming which allows it to be processed into range of breads, yet, its problematic high cost elucidated in the introductory part of this manuscript favours our sample B formulation without sacrificing bread quality and thus so recommended to bakers in order to minimize cost.

4. CONCLUSION

Many works have been published on cassava-wheat bread as individuals continue to strive for which formulation works better for them. This study should lead to better formulation for allowable % of cassava to wheat in Nigerian under our own working environment. With 30% cassava:70%wheat being acceptable by panellists consisting of highly trained food scientists, the investigators intend to reformulate, retest for sensory evaluation and expand production for commercialization in LAUTECH community in the first instance and beyond; all in efforts to boost campus entrepreneurship and Internal Generating Revenue (IGR) for the institution, community and the nation.

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REFERENCES

1. Agboola, H. A. and Igene, J. O. (2005). Wilberforce University/University of Benin (Nigeria) Research Partnership: The Development of a Model Pilot Plant Production System for improved Processing of Kilishi (Sun-dried meat) as a way of Promoting Local Free Market Enterprise. Closed up Report. United Negro College Fund Special Programs (UNCFSP). USAID World Conference, 1444, I Street, N. W. Suite 500, Washington, D.C.
2. Agboola, H. A., Arise, A. K., Arise, R. O, Joseph, J.K and Akiode, S. O.(2012a). Acceptability and nutritional attributes of Moringa oleifera-enriched maize flour. Proceeding, Nigeria Institute of Food Science Technology (NIFST) 3rd Half Yearly Western Chapter Conf., on Traditional Food Processing Technologies: Past, Present and Future Trends. UIL-NIFST/2012/088. Abstr. p. 53-54.
3. Agboola, H. A., Arise, A. K., Arise, R. O., Joseph, J. K. and Akiode, S.O. (2012b). Acceptability and nutritional attributes of Moringa oleifera-enriched maize flour. J. Agric. Res. & Dev. 11(1):355-361.
4. AOAC (2006). Official Method of Analysis of the Association of Official Analytical Chemist. 15th Ed. Arlington, Virginia, USA.

5. Akinwumi, A. (2014). 'No going back on cassava-wheat bread policy.' Tribune, April 7, p.41.
6. Ajanaku, K. O. and Nwinyi, O. C. (2012). Nutritive value of sorghum ogi fortified with groundnut seed. Food Tech.7:82-88.
7. Akorada, M. O. (1992). Root Crops for Food Security in Africa. Proceedings of the crops, Africa Branch, Kampala Uganda. Fifth Triennial Symposium of the International Society for Tropical Root. Nov. 22-28. p. 65-91.
8. D'appolonia, B. L. (1977). Rheological and baking studies of legume-wheat flour blends. Cereal Chem. 54: 53-63.
9. Giami, S. Y., Amasisi, T. and Ekiyor, G. (1992). Comparison of bread making properties of composite flours from kernels of roasted and boiled African breadfruit (*Treculia africana*) seeds. J. Raw Materials 1 (issue 1): 16-25.
10. Hobart (2005). Instruction Manual. Hobart Model F-10/Hobart. Troy, Ohio, USA.
11. Jones, A., Jefferey, G and Hamelian, K. (2004). Bread: A Baker's Book of Techniques and Recipes. J. R. Fraser, National Flour Survey 1946-1950. Journal of the Science of Food & Agriculture. 2: 193-198.
12. Kulkarni, K. D., Kulkarni, D. N and Ingle, U. M. (1991). Sorghum and malted and soybean weaning food. Properties and nutritive value. Food Nutrition. Bulletin 13: 322-327.
13. Kumar, P., Yadava, R. K., Gollen, B., Kumar, S., Verma, R. K. and Yadav, S. (2011). Nutritional content and medicinal properties of wheat: A Review. Life Sci. & Medicinal Research 2011:1-10.
14. Larmond, E. (1977). Laboratory methods for sensory evaluation of food, Publication 1284, Canadian Department of Agriculture, Ottawa, Canada.
15. Mahar, A. R., Hollington, P. A., Virk, D. S. and Witcombe, J. R. (2003). Selection for early heading and salt-tolerance in bread wheat. Cereal Research Communication 31: 81-88.
16. Oboh, G and Akindahunsi, A. A. (2003). Biochemical changes in cassava products (Flour and gari) subjected to *Saccharomyces cerevisiae* solid media fermentation Food Chemistry vol. 82: 599-602.
17. Onabolu, A. A. and Bolanga, M. (1998). New food products from cassava. IITA Publication, Ibadan, Nigeria. P. 14-16
18. Onabolu, A. A. (2016). Cassava processing, consumption and dietary cyanide exposure. IHCAR Karohimska, Institute. Sweden, pp. 6-7.
19. Sanni, S. A. Adebawale, R. A., Olayiwola, I. O. and Maziya-dixon, B. (2006). Chemical composition and Pasting properties iron fortified maize flour. Journal. Food Agriculture Environmental. 6: 172-175.
20. Steel, R. G. D. and Torrie, J. H. (1980). Principles and Procedures of Statistics. A Biometric Approach. 2nd Ed. McGraw-Hill Book Co., New York.
21. Tewe, O. O. (2004). The Global Cassava Development Strategy: Food and Agriculture Organisation of United Nations Publishers, Rome. Pp. 30-36.
22. Zoe, T. and Jeff, H. (2003). Artisan Bread in Five Minutes a Day
<http://www.amazon.com/gp/aw/d..>