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Original Research Article

Formulation and Sensory Evaluation of Orange Fleshed Sweet Potato Puree Inclusion in Wheat-High Quality Cassava Flour Composite Bread for Pro-Vitamin A Enrichment

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Abstract

Bread is a baked product made principally from wheat flour and other ingredients like yeast, salt, sugar and baking fat. It is one of the fundamental food products, needed in human nutrition. Substitution of wheat flour with High Quality Cassava Flour (HQCF) up to 10% in bread production was established in Nigeria. This study formulated inclusion of Orange Fleshed Sweetpotato (OFSP) puree in wheat-HQCF bread making to enrich wheat- HQCF composite bread and assessed its sensory acceptance to serve as a nutraceutical food. The bread increased in loaf weight as the substitution of composite flour with OFSP puree increases (513.38 to 707.96 for 10:20:70and 40:10:50). While bread volume decreased (156.54–130.62cm^3 for 10:20:70and 40:10:50) with increase in OFSP puree inclusion. The highest reduction in loaf volume was in bread made from wheat flour, HQCF blended with OFSP puree 40% inclusion. Decreased specific volume (3.72 to 2.72 cm^3/g10:20:70and 40:10:50) was equally observed as the OFSP puree inclusion increased. The increase in OFSP puree substitution increased the bread acceptability. The degree-of -liking results showed colour and taste were the main drivers for consumer preference. The study suggests that the inclusion of OFSP puree up to 40% in wheat and HQCF composite flours in production of bread would further increase the utilization of locally grown cassava and OFSP crops and in turn reduce wheat importation for bread making.

Keywords: *Bread, High Quality Cassava Flour, Sensory Evaluation, orange fleshed sweet potato, Wheat flour.*

INTRODUCTION

Bread is a baked product made principally from wheat flour and other ingredients like yeast, salt, sugar and baking fat. Bread made from wheat flour is a staple of many diets enjoyed throughout the world (Renata and Janusz (2011). However, the price of this essential staple food is on the increase, due to the high cost of wheat importation. Hence, the need to source for alternative raw materials, for bread making that could be substituted into wheat flour. Research findings, came up with High Quality Cassava Flour (HQCF) to provide answer to this quest. This development of value-addition to cassava for production of HQCF, made Nigerian Government to look inward for the enactment of HQCF inclusion policy to reduce the amount spent on wheat importation (Olayimika et al., 2015). The policy on the substitution of wheat flour with HQCF up to 10% in bread production was then established in Nigeria (Olayimika et al., 2015). Sweet potato roots are most frequently used after boiling, baking or frying. They are also processed into starch, flour or puree to make secondary food products (Padmaja, 2009). Orange-fleshed sweet potato (OFSP) varieties are rich in beta-carotene and serve as less expensive source of dietary vitamin A. Although, the absorption and conversion of beta-carotene (pro-vitamin A) are less efficient than retinoid which are gotten from animal source, but a number of research has shown that daily consumption of about 125g of many OFSP varieties can supply recommended daily requirement of vitamin A for children and women who are not breast feeding (Ajaiyeoba and Akoroda). It also serves as a cheap source of pro-vitamin A. Orange-fleshed sweet potato is a good source of beta-carotene (Low et al 2009; Jaarsveld et al, 2005). In view of OFSP potential in vitamin A deficiency (VAD) control when consumed, different cultivars have been cultivated as part

of an effort to introduce vitamin A rich vegetables. Also, the price of wheat in the international market is increasing uncontrollably and the situation could remain like that for a long time. A report by the Nairametric.com (2023) shows that between October 2021 and September 2023, Nigeria imported #1.15 trillion of durum wheat.

Hence, the objective of the present study is to investigate the feasibility and acceptability of OFSP puree inclusion in wheat/HQCF composite flours for bread making, which may translate to postharvest losses reduction of OFSP and increase its utilization and reduction in wheat importation. As well as investigate the possibility of further substitution in bread making for nutrient fortification as a nutraceutical food by the use of OFSP. Reports on golden bread from OFSP and wheat flour abound, but there is dearth information on OFSP, Wheat flour and HQCF combination.

MATERIALS AND METHODS

Materials

Golden penny white wheat flour for bread making and other bread ingredients were purchased from Umuahia main market. Freshly cassava roots variety TME 419 and fresh Mother's Delight variety of Orange Fleshed SweetPotato roots were obtained from cassava and sweetpotato fields respectfully, all in National Root Crops Research Institute (NRCRI), Umudike, Nigeria.

Methods

Variety TME 419 cassava roots freshly harvested roots were used to processed High Quality Cassava Flour (HQCF) according to method described by Abass, 2006 as shown in figures 1. The method described by Omodamiro and Ani (2015) was adopted in processing of OFSP puree as shown in figures 2. The HQCF was carried out at the cassava processing factory, while the OFSP puree was done at Product Development Programme, food laboratory all in NRCRI, Umudike.

Straight dough bread making method was employed in the preparation of the experimental breads. Four different inclusion ratios were used in making the wheat flour : HQCF : OFSP puree breads were formulated viz: Sample A was Wheat (60) : HQCF(10) : OFSP (30), Sample B was Wheat (70) : HQCF(10) : OFSP (20), Sample C was Wheat (50) : HQCF(10) : OFSP (40), Sample D was Wheat (20) : HQCF(20) : OFSP (60) and sample E was 100% wheat bread as the control for the four bread samples.

The bread was made by using conventional bread ingredients (Salt 1.5%; Sugar 6.0%; Yeast 5.0%; Vegetable oil 3.0% and EDC 0.3%) with little modification on the quantity of sugar (Shittu et al., 2007).

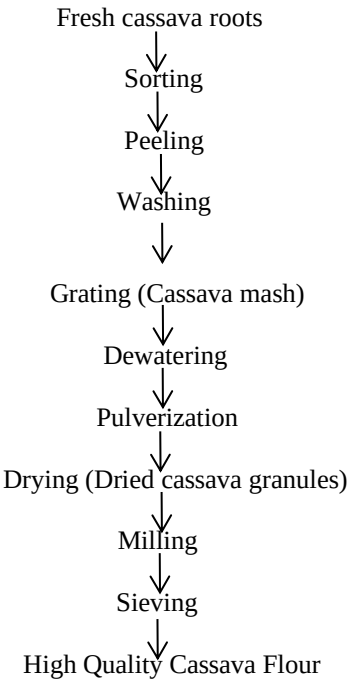


Figure 1: Production of High-Quality Cassava Flour (HQCF)

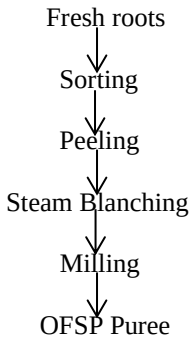


Figure 2: Production of Orange Fleshed SweetPotato puree

Determination of Physical attributes:

Physical characteristics such as bread weight, volume and specific volume, which were quality parameters of the bread were done adopting the methods described by Peluola et al., 2019.

Sensory Evaluation

The four baked bread formulated compositions were evaluated by taste panel procedures, where a randomly selected 20 semi-trained panellists, drawn from NRCRI Staff who are good and regular bread consumers and that are used to conducting sensory evaluation, also students of food science and technology from neighbouring university-Michael Okpara University of Agriculture, Umudike, conducted the sensory evaluation. Attributes evaluated were: colour, appearance, aroma, taste, after taste, in-mouth texture and general acceptability, for the degree of their likeness on 9-point Hedonic scale, where 1 = dislike extremely, 5 = neither like nor dislike and 9 = like extremely (Iwe, 2002).

Statistical Analysis

Data generated were subjected to statistical analysis using SPSS 22.0. Charts were plotted using Microsoft Excel tool.

Results and Discussions

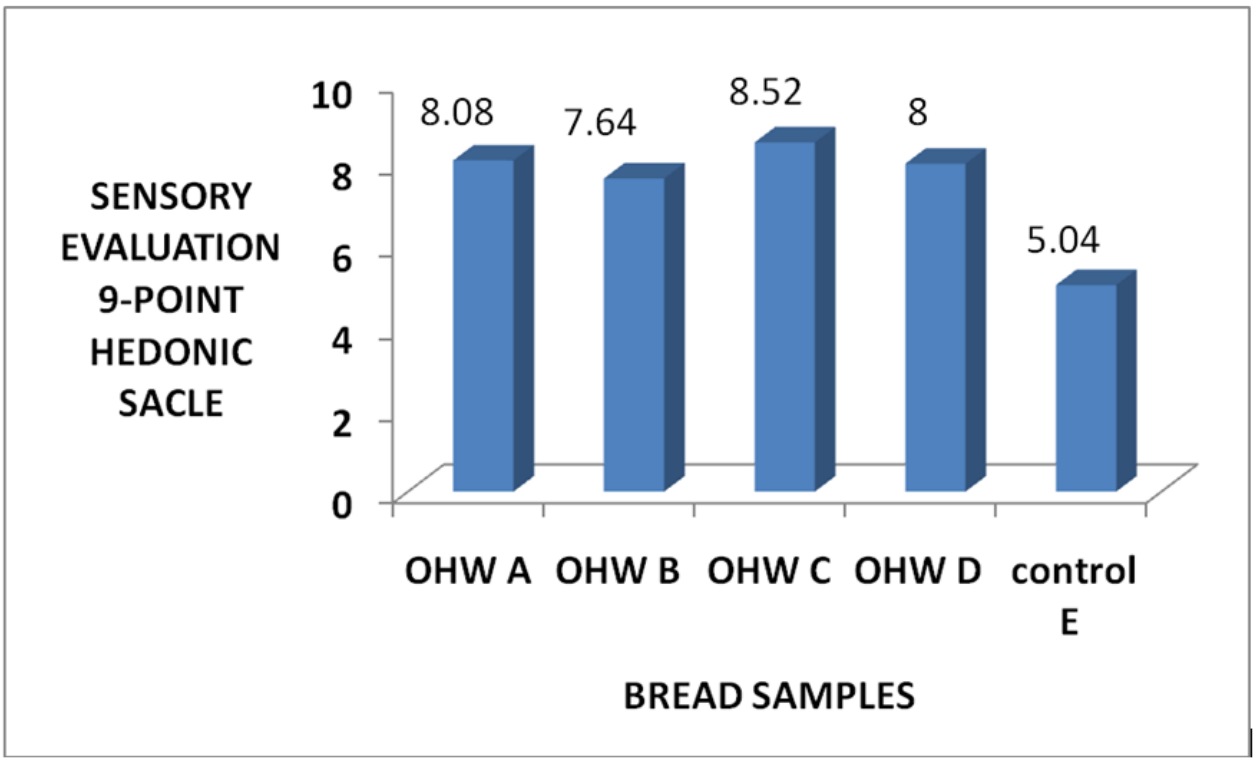
Physical characteristics such as bread weight, volume and specific volume, of the bread varied significantly (P>0.05) among breads made with OFSP puree of different substitution ratios, as shown in Table 1. The bread increased in loaf weight as the substitution of composite flour with OFSP puree increases (513.38 to 707.96 for 10:20:70and 40:10:50). While bread volume decreased (156.54–130.62cm^3 for 10:20:70and 40:10:50) with increase in OFSP puree inclusion. The highest reduction in loaf volume was in bread made from wheat flour, HQCF blended with OFSP puree 40% inclusion. Decreased specific volume (3.72 to 2.72 cm^3/g10:20:70and 40:10:50) was equally observed as the OFSP puree inclusion increased. kunyanga and Imungi, 2010 reported similar observation. The reduction could be attributed to dilution effect on gluten with the addition of non-wheat flour to wheat flour causing less retention of carbon IV oxide (CO_2) gas which resulted in loaf volume depression. Among grains, wheat flour is unique because it has the potential to produce gluten, a protein that impacts strength and elasticity to dough causing rise in loaf volume of baked bread (Sweta et al., 2012).

Table 1: Some physical attributes of wheat: HQCF flours and OFSP puree substitution bread

Samples	Ratio (%)	Bread Weight (g)	Bread Volume (cm^3)	Bread Specific Volume (cm^3/g)
OHW A	30:10:60	582.33	138.23	3.21
OHW B	10:20:70	443.72	156.54	3.72
OHW C	40:10:50	707.96	130.62	2.72
OHW D	20:20:60	513.38	142.21	3.61
Wheat (control) E	100	355.29	162.75	4.35

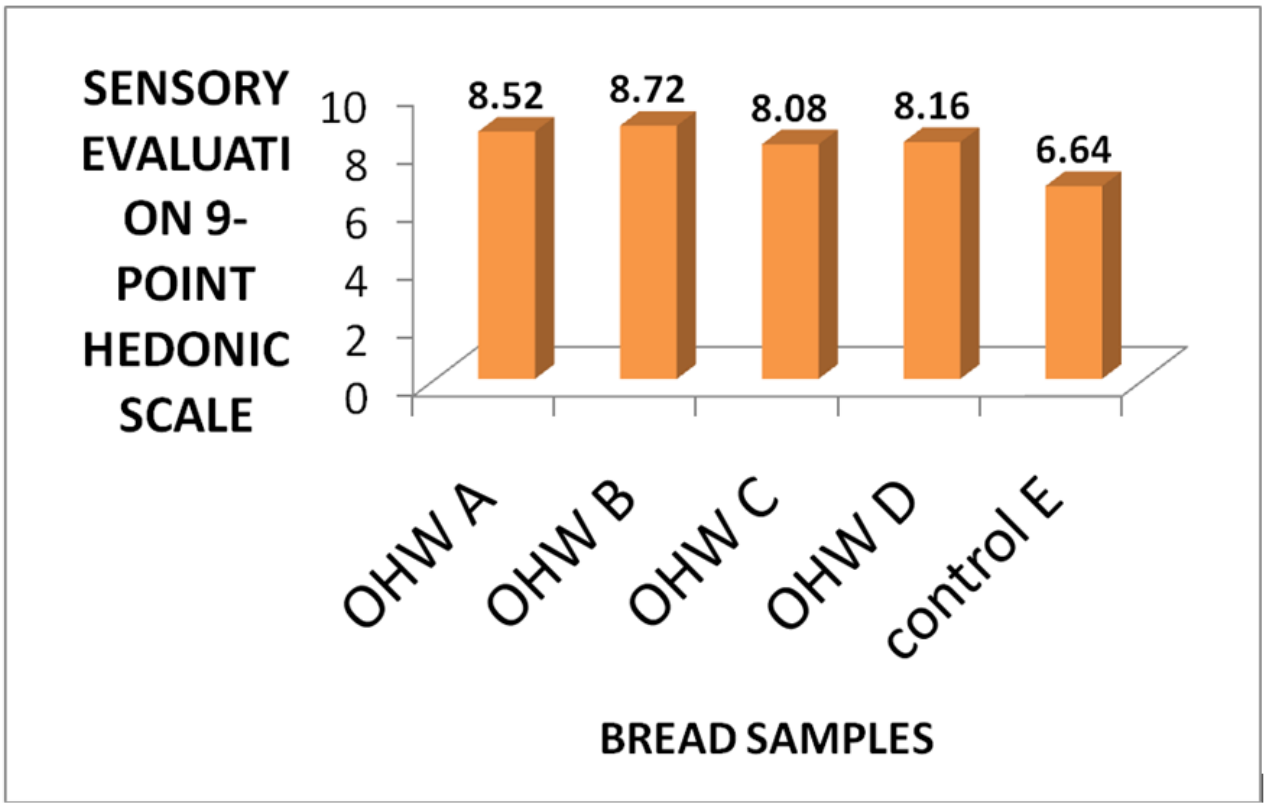
O = Orange-fleshed sweet potato (OFSP), H = High Quality Cassava Flour (HQCF), W = Wheat.

The mean degree of liking of all sensory attributes (appearance, colour, aroma, taste, after taste, in-mouth texture) among bread samples differed significantly (p<0.05). All the bread samples showed degree of golden colour except the control that was 100% wheat flour conventional bread. All the bread was acceptable by the panellist. It was observed that an increase in OFSP puree inclusion increased the sensory acceptability of each bread sample. The degree-of -liking results showed colour and taste were the main drivers for consumer preference. This is in line with the report of Omodamiro et al.,2013, where the colour of the OFSP roots was the main attribute, the panellist cherished. This could serve as alternative to using artificial colour additives in this type of bread making.



Sample A = Wheat (60): HQCF (10): OFSP (30), Sample B = Wheat (70): HQCF (10): OFSP (20), Sample C = Wheat (50): HQCF (10): OFSP (40), Sample D = Wheat (20): HQCF (20): OFSP (60) and sample E = 100% wheat bread

Figure 3: Results of colour acceptance of wheat: HQCF: OFSP and wheat breads



Sample A = Wheat (60): HQCF (10): OFSP (30), Sample B = Wheat (70): HQCF (10): OFSP (20), Sample C = Wheat (50): HQCF (10): OFSP (40), Sample D = Wheat (20): HQCF (20): OFSP (60) and sample E = 100% wheat bread.

Figure 4: Results of General acceptability of wheat: HQCF: OFSP and wheat breads

Conclusion and Recommendations

The study shows that the use of OFSP puree up to 40% substitution into wheat and HQCF composite flours gave acceptable golden bread, statistically preferred ($p<0.05$) to 100% wheat bread. The study suggests that the inclusion of OFSP puree up to 40% in wheat and HQCF composite flours in production of bread would further increase the utilization of locally grown cassava and OFSP crops and in turn reduce wheat importation for bread making. We recommend that OFSP puree could be substituted in wheat/HQCF flour blends in bread making for sustainable source of pro-vitamin A.

References

1. Abass, A. B. (2006). How to make High Quality Cassava Flour (HQCF). International Institute of Tropical Agriculture, Ibadan, Nigeria. 14Pp. Printed by colour Athman Mgumia Dar es Salaam, Tanzania.
2. Ajaiyeoba, A.I. (2001). Vitamin A deficiency in Nigerian children. African Journal of Biomedical Research. 4:107-110.
3. Akoroda, M. (2009). In: The Sweetpotato. DOI 10.1007/978-1-4020.9475-0_11, ©Springer Science + Business Media. LLC 233 Spring Street, New York, USA.Pp441-468.
4. https://nairametrics.com/2023/12/06/nigeria-spends-n970-22-billion-on-wheat-import-in-12months-nbs/) accessed on 20th September, 2024.
5. Iwe MO (2002). Handbook of Sensory Methods and Analysis. Rojoint Communication Services Ltd, 65 Adelabu St. Uwani-Enugu
6. Jaarsveld, P.J., Faber, M., Tanumihardjo, S.A., Nestel, P., Lombard, C.J., and Benade, A.J. (2005). Beta-carotene-rich orange-fleshed sweet potato improves the vitamin A status of primaryschool children assessed with the modified-relative-dose-response test. American Journal ofClinical Nutrition 81: Pp1080-1087.
7. Kunyanga, C. N. J. K. Imungi (2010). Quality Characteristics and Acceptability of Bread Produced with Supplementation of Dolichos lab lab BeansFood Science and Technology Research Vol. 16 No. 6 P 593-598
8. Low, J. Kapinga, R. Donald, C., Cornelia L., John L. and Maria, A. (2009). Challenge Theme Paper 3: Nutritional Impact with Orange-FleshedSweetpotato(OFSP).Unleashing Potential of OFSP in Sub-Saharan Africa. CIP Social Science Working Paper.Colombia Pp73-105.
9. Olayimika, O. M., Oose, M. O., Apantaku, O. S., Adebowale, A. A. and Ashimolowo, O. R. (2015). Baker's Willingness to Utilize High Quality Cassava Flour (Hqcf) for Bread Production: Experience from Ogun State, Nigeria. International Journal of Applied Agricultural and Apicultural Research. IJAAAR 11 (1&2): 146-155
10. Omodamiro, R. M and Ani, J.C (2015). Novel Food Product from Blends of OFSP, Maize and Edible Agro Waste (Okara): Implication from waste to wealth. International Journal of Engineering Sciences and Management. Vol.5(4).
11. Omodamiro R. M.., S. O. Afuape., C. J. Njoku., I. I. M. Nwankwo., T. N. C. Echendu1 and T. C. Edward (2013). International Journal of Biotechnology and Food Science Vol. 1(5), pp. 97-101, ISSN: 2384-7344
12. Padmaja G (2009). Uses and Nutritional Data of Sweetpotato. In: The Sweetpotato. DOI: 10.1007/978-1-4020.9475-0_11, ©Springer Science + Business Media.LLC 233 Spring Street, New York, USA. pp183- 233.
13. Peluola-Adeyemi O. A , Adepoju P.A, Lawal S.O (2019). Physical Properties of Bread from Wheat– Cassava Flour Composite Using Response Surface Methodology (RSM). American Journal of Food Science and Technology. 2019, 7(4), 122- 126. DOI: 10.12691/ajfst-7-4-3
14. Renata Rozylo and Janusz Laskowski (2011). Bread: Physical properties.DOI:10.1007/978-90-481-3585-1231. https://www.researchgate.net/publication/259623726_Breads_Physical_Properties/
15. Shittu, T.A, Raji, A.O and Sanni LO (2007). Bread from composite cassava-wheat flour: I. Effect of baking time and temperature on some physical properties of bread loaf. Food Research International 40: 280-290.
16. Sweta R., Amarjeet, K., Baljit S., Minhas, K.S (2012). Quality characteristics of bread produced from wheat, rice and maize flours. J Food SciTechnol 49(6):786–789

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