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Production of biscuits from bambara, cassava and wheat flour blends

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Abstract

The effect of fortifying cassava and wheat flour with Bambara flour on the sensory quality of biscuit was investigated. Bambara is a legume of high protein content (18-32%). Blends of 10% Bambara flour and 90% cassava flour; 20% bambara and 80% cassava; and 10:45%: 30:35:35% of bambara, cassava and wheat flour respectively were prepared. The blends were analyzed for proximate compositions, water absorption capacity, pasting property and bulk density. The proximate composition revealed whole-wheat flour to be the richest in crude protein content of 5.99%, followed by blend of 30% bambara; 35% cassava, 35% wheat and 5.28% crude protein. Organoletic test however indicated that the blend (30:35:35) produced the most acceptable biscuit using 9 point hedonic scale of 5.2;6:0;5:0 for overall acceptability; colour and crispiness respectively. This indicates that there will be high acceptability of snacks produced from wheat and cassava flour fortified with bambara flour.

Key words: *Bambara; Wheat; Cassava; Biscuit*

Introduction

Bambara seed, commonly known as bambara groundnut (*Voandzeia subterranean* L. Thou) belonging to the family lenguminosea is one of the many natural food materials whose potentials have not been fully tapped in Nigeria. It is a native of West Africa and contains 18-32% protein on a dry weight basis. Its crude protein contains more methionine and other essential amino acids than is found in other legumes [1]. Its size, shape and colour vary considerably according to the cultivars (white, red and black seeds). Biscuit is a conventional food (snack) usually made from wheat (*Triticum Vulgare)* flour.

However, due to the huge importation bill on wheat; it is believed that by reducing the level of wheat flour incorporated in biscuit production with cassava flour the foreign exchange expenditure will be reduced significantly. Nigeria is the world's largest producer of cassava (*Manihot esculenta*).

In this study, various blends of cassava flour with Bambara flour were made with or without wheat flour. The physico-chemical properties of the blends were studied, in order to determine their suitability for making biscuit as a possible alternative to the conventional 100% wheat flour.

Materials and Methods

White bambara seed *Voandzeia sub-terranean* (L) Thou were obtained from a local market. The bambara seeds were manually sorted and cleaned to remove stones, shaft and immature nuts. The nuts were boiled for twenty (20) minutes, cooled and manually

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dehulled. The dehulled nut was oven dried at 60^{0}C for 8 hours and milled into flour of 250-300 micron particle size.

Cassava flour was obtained from the International Institute of Tropical Agriculture (IITA) Ibadan while the soft wheat flour (Golden Penny Brand) was obtained from the local market.

The six (6) blends were prepared as shown in Table 1. The proximate analysis of the six (6) blends were determined using the methods of A.O.A.C [2]..

Physico-chemical properties of the flours such as water absorption capacity and bulk density were determined using the method described by Sanni & Akinlua [3].

Table 1: Blends of Bambara; Wheat and Cassava flour used in biscuit production

Code	Bambara	Wheat	Cassava
ANI (100% wheat flour)	-	100%	-
NDI (100% cassava flour)	-	-	100%
CEL(10% Bambara : 90% cassava)	10%	-	90%
REB (20% Bambara : 80% cassava)	20%	-	80%
IFI (10% Bambara : 45% cassava : 45% wheat)	10%	45%	45%
SAM (35% wheat: 35% cassava: 30% Bambara)	30%	35%	35%

The biscuits were produced from the various blends by the method described by Morton [4].

A 20-man panelist was used to determine the organoleptic quality of the biscuit using a 9-point hedonic scale. The results obtained were statistically analyzed using Duncans ANOVA test as described in Ihekorenye [5].

Results and Discussion

Production of Bambara Flour: It was found that 2kg seed yielded 1.80kg flour, while 2kg bitter cassava roots yielded only 1.4kg flour. Thus, indicating that Bambara seed has a better yielding value than cassava root for flour production.

Proximate analysis of the flour blends: The results as shown in Table 2 indicated an average moisture content of 5.5% in the flour blends.

Flour of 100% wheat contained the greatest protein of 5.99%, while the blends of bambara, cassava and wheat of 30:35:35% respectively contained 5.28% protein. This reflects a closer protein content to 100% wheat flour. However, 100% cassava flour was found to be least in protein content, which is expected because cassava is a poor source of protein [3]. A 10% addition of bambara flour to cassava flour improved the protein content to 3.20%, indicating a fortifying effect of Bambara flour on it. The same trend was obtained for fat content, having 'SAM' blend with the highest value of 6.71%, "IFI" blend of 5.41% while whole-wheat flour "ANI" and cassava flour "NDI" only had 2.61% and 1.07% respectively.

Water Absorption Capacity

The sample containing 100% Cassava Flour had the highest value of 86.5% as the water absorption capacity (Table 2). Followed by the blend of 10% Bambara and 90% Cassava flour of 78.50%. The least value of 60.50% was recorded for 100% wheat flour (Table 2). It appeared that the starch granules in cassava absorb water more than in the wheat flour when subjected to similar conditions.

This may be attributed to the characteristic shape and size of the cassava and wheat starch [6]. Also 90% of the carbohydrate in cassava is starch while the wheat flour contained about 75% of starch [5] and the bambara nut flour contained 58.88% starch. Consequently, in the presence of water and even at elevated temperatures (above room temperature) the starch granules will imbibe water and lose their birefringence and crystallinity properties quickly with the gelatinization temperature of cassava at 70^0C, 60^0C in wheat flour [5,6] and 64.4^0C in bambara nut used in the study.

Table 2: Proximate Composition of Water Absorption Capacity of Bambara Flour Blends

		Moisture %	Crude Protein %	Total Fat %	Ash %	Carbohydrate	Water Absorption Capacity (%)
ANI	(100% Wheat Flour)	6.83	5.99	2.62	0.58	83.98	60.50
NDI	(100% Cassava Flour)	5.25	2.10	1.07	1.13	90.45	86.50
CEL	(10% Bambara) (90% Cassava)	4.25	3.20	3.86	0.13	89.66	78.50
REB	(20% Bambara) (80% Cassava)	4.73	3.28	4.03	1.34	86.62	65.60
IFI	(10% Bambara: 45% Cassava: 45% Wheat)	6.04	4.42	5.41	0.61	82.52	65.68
SAM	(35% Wheat: 35% Cassava: 30% Bambara)	6.83	5.28	6.71	0.84	80.34	68.50

Organoleptic Evaluation

The organoleptic assessment of the biscuit made from the six blends revealed that the biscuit made from 100% wheat flour had the highest preference in taste, crispiness and overall acceptability. However for colour, aroma and texture, the 10:45:45 (Bambara; cassava; wheat); 30:35:35 (Bambara: cassava:wheat) had the highest value respectively. This shows that the Bambara flour has a significant effect on the sensory qualities of the biscuit. The overall acceptability indicated that 30:35:35 (bambara: cassava: wheat) biscuit had a commensurate overall acceptability value of 5.6 to 5.8 obtained for 100% wheat flour.

Table 3: Mean Score of Organoleptic Evaluaton of Biscuits from Blends of Bambara, Cassava and Wheat Flour

Parameter	100% Wheat Flour	100% Cassava Flour	10% Cassava Flour	20%Bambara 90%Cassava Flour	10%Bambara 450% Cassava 45%Wheat Flour	30%Bambara 35%Cassava 35%Wheat Flour
Colour	5.4ab	4.3c	4.7	5.5a	6.0a	5.4ab
Taste	6.1	4.9b	4.8b	4.9b	4.8b	5.8a
Crispiness	5.9a	4.7b	5.4ab	5.4ab	5.3ab	5.6a
Aroma	5.4a	4.1b	5.2a	5.1a	4.5ab	5.6a
Texture	5.0ab	4.1c	5.2ab	4.5bc	5.0ab	5.3a
Overall Acceptability	5.8a	4.7b	5.0ab	5.1ab	5.2ab	5.6a

Each value represents mean score by 50 panelists
Mean values having the same letter within column are not significantly different (P>0.05)

It appears that a combination of "SAM" substitute ratio with code produced biscuit of superior textural property than in the 100% wheat. A similar situation was also observed with the aroma of the biscuits as revealed by the panelist used in this study while the biscuit from the ANI was most preferred in taste, crispiness and overall acceptability.

However, the biscuits made from "ANI" and "SAM" blend had same values in terms of colour. This shows that this combination of bambara, cassava and wheat flour for production of biscuit can adequately be acceptable as the use of 100% Wheat flour.

In terms of other quality in this study, there were only marginal differences in the rating values of the biscuit made from "ANI" over that of "SAM".

The marginal differences however could be attributed to inherent physico-chemical characteristics of the different flours used in the blend involving starch granules from different sources (cassava, bambara and wheat) of different physico-chemical characteristics mixed together to form different blends.

Bulk density

Table 4 shows that both "ANI" and "SAM" blends had the same bulk density values of 0.83g/ml. This was followed by the "NDI" of 0.80g/ml while "REB" blends had the least combination. However, there was similarity in the results obtained with the organoleptic characteristics of the biscuit and the bulk density values obtained for "ANI" and SAM" (Tables 3 and 4).

Conclusion

This study indicates that a blend of bambara, cassava and wheat flour (30:35:35) respectively can effectively be used for biscuit production in place of 100% wheat flour.

Table 4: Bulk Density of Wheat, Cassava and Bambara Flour Blends

Samples of Flour	Loose Bulk Density (g/ml)	Bulk Density (g/ml)
100% soft Wheat Flour (ANI)	0.54	0.83
100% Cassava Flour (NDI)	0.44	0.80
10% Bambara and 90% Cassava Flour Blend (CEL)	0.42	0.76
20% Bambara and 80% Cassava Flour Blend (REB)	0.40	0.74
10% Bambara, 45% Cassava Flour and 45% Wheat Flour Blend (IFI)	0.44	0.78
35% Wheat, 35% Cassava and 30% Bambara Flour Blend (SAM)	0.49	0.83

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