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PRODUCTION AND DETERMINATION OF THE PROXIMATE COMPOSITION AND CONSUMER ACCEPTABILITY OF AN ENRICHED DUMPLING (MASOVITA) MADE OF MAIZE, SOYBEANS AND CASSAVA

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ABSTRACT

Objectives: The study aimed to produce and assess the proximate composition and consumer acceptability of an improved and enriched dumpling made from maize, soybeans and cassava.

Methodology and results: A dumpling meal, 'masovita', was formulated from maize, soybeans and cassava flours (3:4:3, w/w) and compared to two traditional dumpling meals, maize-cassava meal (3:2, w/w), 100% cassava flour meal and a commercial flour meal (Semovita). Parameters assessed were the proximate composition and consumer acceptability. Masovita has higher crude protein (19.66%), crude fat (9.0%) and energy content (386.8Kcal-g) than the traditional dumpling flours and Semovita. Masovita also compares favorably ($P<0.05$) with Semovita and other flour meals in taste, consistency, flavor and overall acceptability. Cassava flour has the least protein and fat contents and is the least accepted.

Conclusion and application of findings: The method for preparing masovita is simple and similar to what is practiced in the northern and some western parts of Nigeria where dumpling consumption is high. The *masovita* is acceptable to the consumers and therefore could be easily incorporated into Nigerian diets to increase protein availability.

Keywords: Dumpling, flour meals, fortification, Lafun, masovita

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INTRODUCTION

The staple foods in most developing countries are carbohydrate based starchy foods, e.g. cassava, yam, maize, sorghum and millet. These are often prepared into dishes that are eaten with soup (Ihekoronye and Ngoddy, 1985). Proteinous foods are usually expensive and beyond the reach of most of the populace. This scarcity has greater impact on children, whose physical and mental development requires nutritionally balanced diets. Malnutrition leads to wasting, stunting and underweight (Mahan & Escott-Stump, 2000).

Cassava *(Manihot* spp) and maize *(Zea mays*) are readily available rich sources of carbohydrate and energy. They are however low in protein and deficient in some micro nutrients (Oyewole *et al.*, 2003). Soybeans *(Glycine max*), which is known to have high protein and lipid contents (Okaka, 1995) has been used to fortify traditional foods such as *ogi* (Akinrele & Edward, 1972); *garri* (Sanni & Sobaniwa, 1997); *kunun zaki* (Ayo & Gaffa,

2002), cassava flour (Lafun) (Kuye & Sanni, 2002) and Tapioca flour (Samuel *et al.,* 2006). In Africa, and Nigeria in particular, the full potential of soybeans has not been fully exploited especially at the household level. Incorporation of soybeans into the existing and acceptable traditional foods is one possibility of increasing the protein component in diets, and thus reducing malnutrition.

The objective of this study was (1) to produce enriched flour for making dumpling meal by substituting part of the traditional maize-cassava flour with soybean flour; (2) assess the proximate composition and consumer acceptability of the dumpling produced using the enriched, improved flour.

MATERIALS AND METHODS

Preparation of flour samples: The maize, cassava, soybeans and semovita used for this work were obtained from a local market in New Bussa, Niger State, Nigeria. Cassava tubers were peeled, washed, steeped for 3 days, washed again, dried at 50°C and milled by machine. The maize was sorted, dehulled mechanically, soaked overnight, washed, dried and milled. The sorted soybeans were boiled in water for 20 min, partially dehulled, dried and milled as illustrated in figure 1. Each of the samples was packaged after cooling and kept at 4°C until formulation, analysis and preparation of dumplings.

A *masovita* sample was formulated by thoroughly mixing maize, soybean and cassava flours (3:4:3 w/w). A second sample was formulated by mixing maize and cassava flours (3:2 w/w) while the third sample was 100% cassava flour (lafun). Golden Penny semovita, industrially processed dumpling flour was used as the fourth sample.

Proximate analysis of the samples: The crude protein, crude fat, ash, moisture and carbohydrate contents were determined as described by AOAC (1990) while the energy value was calculated by multiplying the protein, fat and carbohydrate contents by Atwater factor of 4, 9 and 4 Kcal-g, respectively (Osborne & Voogt, 1978).

Preparation of dumplings: One liter of portable water was boiled and an appropriate quantity of each flour sample stirred into the hot water until a thick gel formed. The pots were covered and heated for 2 - 5 min until a smooth consistent cooked dumpling was formed.

Sensory evaluation: A panel of 12 judges that are familiar with dumplings assessed the samples for colour, flavor, texture, taste and overall acceptability. The scores were analyzed using ANOVA and the means separated by Tukey test (Ihekoronye & Ngoddy, 1985).

Maize, soybeans & cassava flours 3:4:3 w/w)	Soybeans	Cassava	Maize
–	–	–	–
Sorted	Sorted	Peeled	Milled
↓	↓	↓	↓
Dehulled (Mechanically)	Boiled	Washed	Sieved
Agitated (shaking)	↓	↓	↓
Soaked(Overnight)	Dehulled	Steeped	
↓	↓	↓	
Washed	Washed	Washed	
↓	↓	↓	
'masovita flour'			
Dried	Dried	Dried	
↓	↓	↓	
Milled	Milled	Milled	
↓	↓	↓	
sieved	Sieved	sieved	
↓			
Maize flour	Soybean flour	Cassava flour	Maize flour

Figure 1: Flow chart indicating the processing of maize, soybean, cassava and *masovita* flours.

RESULTS AND DISCUSSION

Analysis of the proximate composition (Table 1) showed that soybean flour has the least moisture content compared to the other flours that were used to produce *masovita*. A 40% substitution of maize flour in the maize-cassava flour by soybean flour reduced its moisture content by 49.5%. Soybean flour has been reported to have a high water absorption capacity (Ribotta *et al.,* 2005; Samuel *et al.,* 2006), which could explain the significant reduction in moisture content of soy-maize flour formulation (Lasekan & Akintola, 2002). Fortification using soybean reduced the available water and thus would extend the shelf life of *masovita* meal by reducing its susceptibility to microbial spoilage.

Results further show that soybean fortification increased the crude fat of the traditional maize - cassava flour from 1.3 to 9.0% (Table 1). Samuel *et al.* (2006) reported similar findings, with fortification using soybean increasing the fat content of tapioca flour from 0.97 to 4.52%. Soybeans are rich in lipids of excellent qualities (Asiedu, 1989). Of all the flours that were analysed *masovita* had the highest protein content (19.66%). Semovita contains 10% protein while maize-cassava and 100% cassava flours have 7.3 and 2.45% protein, respectively. There is therefore an over 100% increase in the protein content of *masovita*, when compared to the maize - cassava and cassava flours. A similar increase has been reported for soy – maize snacks (Lasekan & Akintola, 2002) and soy fortified *kunun zaki* (Ayo & Gaffa, 2002). This is a desirable attribute especially for a developing country like Nigeria where other sources of protein are expensive. *Masovita* also has higher fibre content than the maize-cassava and sole cassava flours. However, the carbohydrate content of *masovita* is lower than that of Semovita, maize-cassava and cassava flours.

Table 1: Proximate composition of maize soybean, cassava, maize - cassava, *masovita* and Semovita flours.

Nutrient (%)	Maize	Soybean	Cassava	Masovita	Maize & cassava	*Semovita
Moisture	9.9	8.4	10.2	9.74	19.3	-
Crude fat	0.9	19.5	0.45	9.0	1.3	1.2
Protein	5.2	38.4	2.45	19.66	7.3	10
Crude fiber	0.5	3.6	0.25	1.7	0.8	-
Ash	0.5	5.1	1.2	3.1	1.6	-
Carbohydrate (NFE)	83.1	28.6	85.45	56.79	69.7	72
Energy (Kcal-g)	361.3	443.5	355.65	386.8	319.7	338.8

Values are means of duplicate analysis. *Quoted on the package of Golden Penny® Semovita.

It has previously been noted that the total carbohydrate decreases with increasing soybean fortification (Lasekan & Akintola, 2002; Lasekan *et al.,* 2004; Samuel *et al..,* 2006). This could be a desirable attribute for weight watchers and diabetic patients who require less carbohydrate and high protein intake. Decreased carbohydrate content and increased protein content also contributes to the highest energy content (386.8Kcal-g) of the *masovita*. The synergetic effect of low carbohydrate, high protein and high energy contents of *masovita* is an additional advantage over other flours.

Ash content, which is an indication of the presence of mineral elements, is also higher in the soybeans fortified *masovita* than in the traditional maize-cassava and sole cassava flours. Fortification thus increases the ash content. The protein, ash, fibre and crude fat content of the 100% cassava flour (lafun) were the least. It would seem that pure cassava flour is not a good source of nutrients, and it would be advisable to always fortify it before consumption. This is especially pertinent among the low-income earners whose staple foods are cassava based.

The *masovita* dumpling also compares favorably ($P<0.05$) with traditional maize - cassava and Semovita dumplings in texture and overall acceptability (Table 2). In other similar studies, the inclusion of soymilk has been reported to have no significant effect on flavor and texture of *warankashi* (Aworh *et al.*, 1987). These results indicate that *masovita* has potentially high acceptance in areas where maize - cassava and sole cassava flour dumplings are staple foods. A significant difference ($P<0.05$) however exists between *masovita* and maize - cassava flour dumplings in taste and flavor, with *masovita* being more preferred.

Table 2: Sensory scores for quality attributes of cassava flour, masovita, maize- cassava and Semovita dumplings.

Quality attributes	Cassava flour	Masovita	Maize-cassava	Semovita
Colour	6.75b	6.92b	7.98a	8.24a
Taste	5.67c	7.80a	6.58ab	8.0a
Consistency (Texture)	6.75b	7.25a	7.0a	7.5a
Flavor	6.58b	8.5a	7.17ab	8.33a
Overall acceptability	6.5b	8.0a	7.52a	8.69a

Means followed by the same letter across the row are not significantly different (P<0.05).

When comparing *masovita* and the industrially produced semovita no significant difference in taste and flavor was observed. *Masovita* can therefore compete favorably with Semovita in the market. A significant difference (P<0.05) in the colour of *masovita*, maize-cassava and Semovita dumplings was detected, which could be due to the slight brown discoloration imparted by the soybean flour. Similar low sensory scores for colour of soy – fortified *kunun zaki* and *soy-warankashi* have been reported (Aworh *et al*., 1987; Ayo & Gaffa, 2002). To increase acceptance the colour of *masovita* could be improved by optimizing the processing conditions and by the use of improved varieties of soybeans. The dumpling made from pure cassava flour was the least accepted.

This study has demonstrated that fortifying the traditional maize - cassava dumpling meal with 40% soybean increases the nutritional content considerably. The processing methods are simple and not very different from what is practiced in the northern and some western parts of Nigeria where dumpling consumption is high. The formulated *masovita* is acceptable to consumers and therefore it could be easily incorporated into Nigerian diets to address malnutrition.

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