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Studies on the Characteristic Properties of Fermented, Sun-Dried Orange-Fleshed Sweet Potato Flour

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ABSTRACT

Microbiological, functional, chemical and sensory properties of flours of two (2) cultivars of orange-fleshed sweet potato (centinnial and CIP 440293) being multiplied for distribution in South East and South-South Nigeria were investigated using standard techniques. The flours were observed to have good functional properties and high dry matter contents which were respectively 88.09 ± 0.00% and 86.0 ± 0.00%. The respective values for fat content (0.85 ± 0.00% and 1.75 ± 0.00 %), ash content (2.04 ± 0.00% and 2.40 ± 0.42%) and crude fibre content (2.90 ± 0.28% and 2.67 ± 0.00%) were low but the respective levels of carotenoids values (3.74 ± 0.00 and 5.28 ± 0.00 μg/g) were high indicating a promising source of pro-vitamin A. The sensory evaluation had no statistical difference among the parameters. The flours had high nutritive values with good functional and sensory properties. The microbial loads were within the acceptable limit of $< 10^5$ recommended by ICMSF, making the flour samples microbiologically safe and with appropriate packaging, the shelf life could be extended under good storage conditions.

Keywords: Orange-fleshed sweet potato, flour, sun-drying, physicochemical properties, functional properties.

Introduction

Sweet potato (*Ipomoea batatas (L.)* Lam) belongs to the *convolvulaceae* family and is a root crop cultivated in many countries. It is grown extensively in the tropical and subtropical zones (Islam *et al.*, 2002). Sweet potato has become an important global crop and is grown in diverse ecologies (Firon *et al.*, 2009) with a long history as a life saver. It has been recognized as having an important role to play in improving household and national food security, health and livelihoods of poor families in sub-saharan Africa (CIP, 2009). This is due to its wide range of agronomic and nutritional advantages capable of combating the food shortages, mal-nutrition that may arise as a result of increase in population and pressure on land utilization (Woolfe, 1992). Increased production and consumption of the oranged-fleshed sweet potato roots rich in β-carotene would improve the nutritional status of the Nigeria population. With recent introduction of orange-fleshed sweet potato OFSP varieties having high beta-carotene from high land areas of East Africa, there has been an upsurge of interest to include the roots and leaves as part of the food based strategy to compensate vitamin A deficiency in Nigeria. The clamour for the OFSP is due mainly to the health advantages over the white fleshed cultivars. The better health engendered by consumption of orange-fleshed sweet potato will ultimately translate to reduced expenditure on hospital bills, provision of sound body to engage in productive activities leading to more income generation in rural communities (Echendu *et al.*,

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2011). There is need to promote the consumption of OFSP involving households with young children in rural areas in Nigeria in regular consumption of OFSP which is rich in β-carotene, significantly alleviates the vitamin A deficiency in children (Low *et al.*, 2007). It is also important to create awareness on marketing and consumption of OFSP in Nigeria where new ways of consuming OFSP such as confectionery products; its use in bread making will produce nutritional benefits. Prolonged storage is achieved by drying (usually sun-drying) slices. During the period of drying, microorganisms settle on the exposed surfaces of the slices and the high moisture of the sweet potato permits the growth of these microorganisms during sun-drying. Sweet-potato flours are refined products from sun-drying which are produced by a milling machine. Orange-fleshed sweet potato flour produced by grinding dried sweet potato slices could either be used as whole flour or as a composite. Orange-fleshed sweet potato flour being a food product with high nutritional content can harbour a variety of bacteria including pathogenic and non-pathogenic forms (Berghofer *et al.*, 2003). Micro-organisms can cause diseases and food spoilage whenever they exceed their threshold as a result of increase in certain parameters such as moisture (Delong, 2001). Fresh roots can not be stored beyond three months under ambient temperature (Tomlins *et al.*, 2007). The processing of the roots into chips and flours could extend the shelf life of the sweet potato for more than three months. There is scanty information on the microbial, functional, chemical and sensory properties of fermented and sun-dried flours of orange-fleshed sweet potato which can be utilized as composite or whole flour. It is therefore the objective of this study to evaluate the microbiological, chemical, functional and sensory properties of the fermented, sun-dried orange fleshed sweet potato flour.

Materials and Methods

Materials

The study was carried out in the post harvest technology programme of National Root Crops Research Institute, Umudike, Umuahia, Abia State, Nigeria. Two orange-fleshed sweet potato cultivars: *Centinnial* and *CIP 440293* were harvested at maturity from the field trial of the institute.

Processing and storage of orange-fleshed sweet potato flour

Fresh undamaged oranged-fleshed sweet potato roots were washed with tap water peeled and chipped into 2 mm-thickness slices with the use of a manual chipping machine. Fermentation for a period of 24 h was carried out (Achi and Akubor, 2000). After steeping, the chips of each variety were laid out on clean polythene sheets for sun-drying. Each variety was sun-dried for 6 days with an average temperature of 32.9°C during the dry season. After sun-drying, the fermented chips were pulverized using a milling machine into flour with particle size of about 200 μm and the resulting flour was sieved with muslin cloth to obtain a fine flour. The flours were properly packaged in cellophane bags (1 kg) per bag, sealed and stored at ambient temperature (28 ± 2°C) for 12 weeks (3 months). From which samples were taken for microbial, chemical, functional and sensory evaluations at monthly intervals.

Microbiological analysis

Total viable counts of microorganisms in the orange-fleshed sweet potato flours were done by pour plate techniques (Morton, 2001). Five grams of the flours were dissolved in 45 ml sterilized water to obtain a dilution of 1:10, from which subsequent dilutions were made and appropriate aliquot used to determine the total viable counts (TVC) on Trypton soya agar plates incubated at 37°C for 48 h while potato dextrose agar plates used for the fungal counts were incubated at 25°C for 72 h. At the end of incubation period, colony forming units (cfu/g) were estimated using colony counter. Colonies were purified by sub-culturing on fresh Trypton soya Agar and gram stained for morphological examination and biochemical tests (*Catalase, coagulase, oxidase, citrate, glucose, sucrose, mannitol, lactose, maltose, and inositol*) were done for characterization and identification of the isolates,