

EFFECT OF BLANCHING ON THE MINERAL COMPOSITION AND ANTINUTRITIONAL FACTORS OF ORANGE-FLESHED SWEETPOTATO (*Ipomoea batatas* L. Lam) FLOURS.

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ABSTRACT

Studies were conducted on the effect of blanching on mineral composition and antinutritional factors of flours produced from two improved orange-fleshed sweetpotato (OFSP) genotypes (CIP199004.2 and CIP440216). The results showed that the mineral contents of both unblanched and blanched OFSP flour samples differed due to processing and varietal effect, with the unblanched flour samples having slightly higher β -carotene content value than the blanched OFSP flour samples. The iron content of the unblanched CIP 440216 was slightly higher than the unblanched sample. The phytate content in unblanched OFSP flour samples was slightly higher than the blanched OFSP flour samples. The result obtained from tannins was generally low. These results suggest that blanching of OFSP leads to loss in nutrients and elimination of antinutritional factors.

Keywords: Orange-fleshed Sweetpotato Flours, Blanching, Mineral content, Antinutritional factors,

INTRODUCTION

Orange-fleshed sweet potato (*Ipomoea batatas* L. Lam) is one of the most promising plant sources of β -carotene which are believed to represent the least expensive, year-round source of dietary vitamin A available to rural poor families. In Eastern and Southern Africa, orange-fleshed sweetpotato (OFSP) is grown mainly for food security and it is a very good source of beta-carotene (Roots, 2003). Current varieties of OFSP contain 20-30 times more β -carotene than does golden rice; the outstanding features of orange fleshed sweet potato are the nutritional, compositional and sensory versatility in terms of its micronutrient contents and wide range of colours, taste and textures (Woolfe, 1992).

The β -Carotene in orange-fleshed sweetpotato (OFSP) is more readily released than that in dark-green leafy vegetables during cooking thereby enhancing bioavailability (Castenmiller and West, 1998); (De Pee and West, 1996). β -carotene availability in sweetpotato is significantly higher than that in other leafy vegetables and this could be due to the lack of chlorophylls in sweetpotato or other leafy vegetables, which are found to be inhibitors of pro vitamin A absorption (Tsou and Kan, 1985). β -carotene is considered the most important pro-vitamin A component in carotenoid rich foods (Parker, 1996; van Jaarsveld et al, 2005).

Antinutritive factors in sweetpotato include tannins, polyphenols and trypsin inhibitors. Tannins bind to both proteins and carbohydrates which have implications for commodities containing tannins, and condensed tannins are far more common, existing in the plant tissues of non-grain starch staples. Their presence causes browning or other pigmentation problems in fresh foods and processed products and acts as antinutritional factor by provoking astringent reaction in the mouth, thereby rendering the food unpalatable (Onimawo and Akubor, 2005). Tannins may decrease protein quality by decreasing digestibility and palatability. They are found in yam, sweetpotato and cereals. They also interfere with iron absorption (Onwuka, 2005).

MATERIALS AND METHODS

Materials

The two orange-fleshed sweetpotato genotypes (CIP 199004.2 and CIP 440216) used for the experiment were obtained from the germplasm of the Sweetpotato Programme, National Root Crops Research Institute (NRCRI) Umudike, Abia State; while the other ingredients (wheat flour, sugar, butter, baking powder, vanilla essence, vegetable oil and eggs) were purchased from the Umuahia Main Market.

Preparation of materials

The sweetpotato roots collected were washed with tap water, peeled with kitchen knives under water to reduce enzymatic browning and made into strips using the Chipping machine. Each of the striped samples was shared into two portions; one portion was unblanched, washed, drained and oven (Gallenkamp, model OV-160) dried while the other portion was blanched in hot water (90°C) for 5 minutes, drained and oven dried. The dried samples were milled using Hammer mill and later sieved (0.2mm) into flour for mineral and antinutritional analysis and food formulation.

Chemical analysis

Mineral composition was determined in triplicates using Rodriguez–Amaya (1999a) method for beta carotene determination and atomic absorption spectrophotometry for iron and zinc determination as described by Onwuka (2005). The method of Oberleas (1973) was used for tannins determination and the Folin-Denis spectrophotometric method by Pearson (1976) for phytate was analysis.

Statistical Analysis

Statistical analysis method used was SAS (1999) Package. Analysis of variance (ANOVA) and Fisher's Least Significance Difference (LSD) test was used to identify which of the means was significantly from the others ($P < 0.05$).

RESULTS AND DISCUSSION

Chemical composition

The chemical composition of both the unblanched and blanched orange fleshed sweet potato is presented in Table 1. The mineral levels of both unblanched and blanched OFSP flour samples differed due to processing. The β -carotene values of CIP 199004.2 flour samples were 3.48 $\mu\text{g/g}$ (unblanched) and 1.54 $\mu\text{g/g}$ (blanched) and CIP 440216 was 5.48 $\mu\text{g/g}$ (unblanched) and 4.24 $\mu\text{g/g}$ (blanched). The unblanched flour samples seemed to have a higher β -carotene content value than the blanched OFSP flour samples and this could be as a result of the processing method and varietal difference as reported by Rodriguez-Amaya (1997). Rodriguez-Amaya (1999a) reported that β -carotene content and vitamin are sensitive to heat and / or oxidation. It has been reported that heat treatment e.g. blanching may provoke some losses of carotenoids (Rodriguez-Amaya, 1997; Rodriguez-Amaya, 1999b; Rodriguez-Amaya, 2002). Although the β -carotene values of blanched OFSP flour samples were lower, the inactivation of oxidative enzymes may have assisted to prevent further and greater losses.

Iron content values

The iron content of the unblanched CIP 440216 had a slightly higher value of 0.84 mg/g than unblanched CIP 199004.2 (0.63 mg/g). The unblanched CIP 199004.2 and CIP 440216 were similar to that reported by Anonymous (1980).

Holland et al (1991) reported that these minerals are present in varying amounts depending on the variety and that they provide sufficient quantity to meet a portion of the recommended daily allowance (RDA). This range reflects the varying bioavailability of iron in the OFSP flour samples. It has been reported (Gibson, 1994; Allen and Ahluwalia, 1997) that iron is present in non-heme forms in starchy roots, tubers, legumes, staple cereals, dairy products, egg and plant foods, and is much less available (low bioavailability) with absorption rates ranging from 2 – 20%. The iron content obtained from both unblanched and blanched OFSP flours falls within the mean iron requirement for growth (mg/day) as reported by Hallberg (1981) and Hallberg (1982)

Zinc content values

The zinc content showed that the unblanched OFSP flour samples had slightly higher zinc content than the blanched OFSP flour. Unblanched CIP 440216 had 0.40 mg/g and unblanched CIP199004.2 had 0.24 mg/g and the zinc content of the blanched OFSP flour samples ranged from 0.20 mg/g (CIP 199004.2) to 0.30 mg/g (CIP 440216) which was within the range as has been reported (Anonymous, 1980).

The variation between the unblanched and blanched OFSP flour samples may be due to the processing method and difference in varieties as reported by Sandstrom (1989) that large variations in zinc content can be found between otherwise nutritionally similar food sources and that food processing and preparation could also affect the zinc content of food by leaching into the cooking water or canning media during food preparation.

Zinc like iron can be bound by phytate (Sandstrom, 1989) and Onimawo (2001). Sandstrom (1989) reported that the relation between zinc content and absorption seems not to be valid for diets with a high content of inhibitory substances and that the content of zinc is also dependent on variety and growing location.

Antinutritive Factors

The phytate and tannins levels in both unblanched and blanched OFSP flour samples are shown in Table 2. The phytate content in unblanched OFSP flour samples ranged from 1.04% (CIP 440216) to 1.06% (CIP 199004.2) while tannin was from 0.20% (CIP 440216) to 0.25% (CIP 199004.2). The blanched flour samples have phytate and tannin ranging from 0.46 to 0.68% and 0.14 to 0.15%, respectively.

The phytate content in unblanched OFSP flour samples tended to be higher than the blanched OFSP flour samples. This may be as a result of the processing method as it affected the phytate content through leaching process. Tannin content of the flours was generally low. These variations in tannic acid content of OFSP flour samples maybe as a result of the difference in varieties and the blanching. Enwere (1989) however, reported that yams, potatoes and sweet potato are blanched to inactivate polyphenols oxidase which causes enzymatic browning and discoloration in the peeled or wounded raw tubers.

The presence of tannins can cause browning or other pigmentation problems in both fresh food and processed products, and they act as antinutritional factor by provoking an astringent reaction in the mouth thereby making the food unpalatable. They also form complex proteins, precipitate proteins in the gut, reduce digestibility / inhibits digestive enzymes and microorganisms.

This has nutritional implication for both human and livestock in that there is damage to the intestinal tract through absorption of tannic acid toxicity in the gut. They also interfere with the absorption of iron and could produce carcinogenic effect (Rao and Desothale, 1987; Onimawo and Akubor, 2005; Onwuka, 2005).

CONCLUSION

Orange-fleshed sweet potato qualified as an excellent source of β -carotene (vitamin A precursor). This root vegetable is a very good source of iron and is better utilized in their raw (unblanched) forms as nutrients were retained. When it comes to a potentially problematic substance like phytic acid (phytic acid can sometimes block absorption of desirable nutrients like zinc and iron), tannin and phytate were found to be in small quantities and could be attributed to the processing method used.

Table 1. Mineral composition of unblanched and blanched Orange-fleshed sweet potato flour samples.

Parameter	β -carotene ($\mu\text{g/g}$)	Iron (mg/g)	Zinc (mg/g)
CIP 199004.2U	3.48	0.63	0.24
CIP 199004.2B	1.54	0.51	0.20
CIP 440216U	5.48	0.84	0.40
CIP 440216B	4.24	0.54	0.30

CIP = International potato center. U= Unblanched; B = Blanched

Table 2. Antinutritive factors of unblanched and blanched Orange-fleshed sweet potato flour samples.

Samples	Phytate (%)	Tannin (%)
CIP 199004.2U	1.06	0.25
CIP 199004.2B	0.46	0.15
CIP 440216U	1.04	0.20
CIP 440216B	0.68	0.14

CIP = International potato center. U= Unblanched; B = Blanched

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