

Effect of Baking on the β -carotene Content of Orange Flesh Sweetpotato (*Ipomoea batatas*) Puree Bread and OFSP Flour Bread

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Background

- ***Orange Flesh Sweetpotato (OFSP)*** is a biofortified crop rich in provitamin A carotenoids, and is being used a sustainable food based strategy to address vitamin A deficiency (VAD) in sub Saharan Africa (SSA).
- ***VAD is a public health problem in SSA.***
- ***About 125g of OFSP can provide 100% RDA*** for vitamin A for children.

Background

- *In SSA sweetpotato is now emerging as a healthy alternative food crops*
- *There are opportunities to incorporate sweetpotato in the urban markets as an ingredient in industrial food processing.*
- *The possibility of utilizing wheat-sweet potato composite flours in breads and baked goods have been investigated.*
- *Most of the work on OFSP processing in SSA has been focused on OFSP flour for making bread, buns, muffins and doughnut liked fried products (Mandazi).*

OFSP Puree vs OFSP flour

Making bread with OFSP flour commercial is not viable

- It takes roughly 5-10kg of fresh sweetpotato roots in order to make one kilogram of OFSP flour.
- OFSP Puree: conversion rate of 1.3kg of fresh roots to 1kg of OFSP puree
- It is hard to substitute more than 30% of wheat flour with OFSP flour to make bread
- With OFSP puree more than 50% wheat flour substitution can be achieved

OFSP Puree vs OFSP flour

- OFSP flour is easy to make and store than OFSP puree
- OFSP Puree requires a complicated cold storage system since puree is highly perishable
- OFSP Puree requires a complicated manufacturing process with proper GMPs and GAP in place
- CIP is investing in shelf-storable OFSP puree

Study Justification

The degradation of β -carotene in OFSP flour has been studied extensively, however, there is limited research showing the effect of baking on the β -carotene retention and vitamin A value of the baked products made with OFSP puree.

Study objectives

This study was designed to evaluate the β -carotene retention and Retinol Equivalence Activity (RAE) of OFSP bread made with 45% wheat flour substitution with OFSP puree compared to OFSP bread made with 10% wheat flour substitution with OFSP flour

Methodology

- ***OFSP fresh roots*** (Kabode) for puree collected in Homa Bay and analyzed for β -C content
- ***OFSP fresh roots*** (Tynung) for flour collected from Machakos for β -C content .
- ***OFSP puree*** collected and analyze for β -C content.
- ***OFSP flour*** collected and analyze for β -C content by High Performance Liquid Chromatography (HPLC), C30 column

Sample collection

OFSP flour Bread

- Baking of the bread was observed and samples of the dough and final bread collected for β -C analysis at FANEL at BecA

OFSP Puree bread

- Baking of the bread was observed and samples of the dough and final bread collected for B-C analysis at FANEL at BecA.

Baking Process

OFSP Flour Bread

- Wheat flour to OFSP ratio was 90:10 w/w, thereby substituting wheat flour by 10% OFSP flour.
- The oven pre-heated to 200°C.
- After mixing, the dough was cut and put in molds and baked for at 200°C for 20 mins.

OFSP Puree Bread

- The ratio of wheat flour to OFSP puree was 55:45 w/w.
- The oven was pre-heated to 200°C.
- Dough in metal molds and baked at 200°C for 20 mins.
- Bread allowed to cool
- Three loaves sampled

Carotenoid Extraction and Analysis

- Samples prepared and analyzed under yellow/golden lights
- Carotenoid extraction conducted with methanol/THF direction
- Carotenoid extraction conducted with mild saponification (KOH) and hexane
- Echinenone used at Internal Standard
- C30 Carotenoid S column for separation

OFSP Puree Bread Carotenoid Analysis

	Concentration mg/100g		
	all trans β -C	13 cis- β -C	9 cis β -C
OFSP Kabode Puree	4.31 (0.07)	1.19 (0.01)	0.04 (0.00)
OFSP Puree Dough	1.34 (0.10)	0.23 (0.06)	0.02 (0.00)
OFSP Bread Crumb	1.78 (0.50)	0.36 (0.01)	0.03 (0.01)
OFSP Bread Crust	1.18 (0.20)	0.53 (0.04)	0.24 (0.03)

OFSP Flour Bread Carotenoid Analysis

	Concentration mg/100g		
	trans β -C	13 cis- β -C	9 cis β -C
OFSP Fresh roots	9.64 (0.21)	1.25 (0.24)	0.27 (0.07)
OFSP Flour	15.29 (0.27)	3.36 (0.10)	0.46 (0.11)
OFSP flour dough	0.04 (0.01)	0.01 (0.00)	0.003 (0.00)
OFSP flour Bread Crumb	0.04 (0.00)	0.02 (0.00)	0.003 (0.00)
OFSP flour Bread Crust	0.05 (0.00)	0.02 (0.00)	0.007 (0.00)

Moisture Content of the Breads

OFSP Puree Bread		OFSP Four Bread	
OFSP Puree Dough	46.40	OFSP flour dough	43.06
OFSP Bread Crumb	43.79	OFSP flour Bread Crumb	38.48
OFSP Bread Crust	24.96	OFSP flour Bread Crust	19.97

Highlights

- **OFSP puree bread had on average of 1.5mg/100g. (1500ug/100g)**
- *OFSP flour bread had on average 0.04mg/100g (400ug/100g)*
- **OFSP puree bread will have (125 RAE/100g),
one slice 30g (37.5 RAE)**
- *OFSP flour bread will have 33 RAE/100g, i.e.
10 RAE per 30g slice.*

Take Home Message

- **OFSP puree is very nutritious, high beta-carotene content, 15ug/g.**
- **Beta-carotene is an antioxidant**
- **Two slices of OFSP puree bread will provide 20% of the RDA for preschool children**
- **½ loaf of OFSP puree bread provides 35% RDA vitamin A for adult women**

So What?

- 125g of OFSP provides 100% RDA for children
- 125g of OFSP puree bread provides 40% of RDA for children
- Our partners can advertise OFSP puree bread as a good source of vitamin A according to the FDA definition
- Our partners can advertise OFSP puree bread as good source of antioxidant (BC)

THE END

