PRODUCTION AND CHARACTERIZATION OF PEANUT BUTTER ENHANCED WITH ORANGE FLESHED SWEET POTATO

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Introduction

- Peanut (groundnut) production in the Uganda is 235,000 MT (FAOSTAT, 2012)
- Peanuts are utilized as; peanut butter, sauce, roasted, or confectionary, etc.
- Peanuts: high in oils and proteins replacing animals as source of protein (Settaluri et al., 2012).

Introduction

•Another important crop in Uganda is OFSP with the potential to combat VAD.

•VAD prevalence is 33% in children 0-59 months and 20% in women 15-50 years (UBOS, 2010)

•Therefore, OFSP was used to increase the pro-vitamin A content of peanut butter.

Why OFSP-peanut butter

- Peanut butter utilization is on increase in Uganda.
- Addition of OFSP to oil rich peanut butter could result into a nutritious product with high bioavailable β-carotene
- Enhancing peanut butter with OFSP may reduce the prevailing VAD in children.
- This study aimed at the production of shelf stable acceptable pro-vitamin A enriched peanut butter.

Objectives

Overall objective

To produce a stable and acceptable peanut butter enhanced with OFSP

Specific objectives;

1. To determine the nutritional composition of the developed pro-vitamin A-rich peanut butter from peanuts and OFSP
2. To determine the acceptability of the pro-vitamin A-rich peanut butter from peanuts and OFSP
3. To determine the shelf life of the pro-vitamin A-rich peanut butter from peanuts and OFSP

Hypotheses

- Addition of OFSP flour into peanut butter can enhance its pro-vitamin A content

- An acceptable shelf stable pro-vitamin-A rich peanut butter can be produced by combining peanuts and OFSP

Materials and Methods

Materials

- Peanuts (Valencia variety) from the National Semi-Arid Resources Research Institute (NaSRRI).
- OFSP (Naspot 10, 4 months maturity) from VEDCO Uganda.
- Chemicals and reagents- from Westford, Kampala, Uganda.

Fig 01: Production of peanut butter enhanced with OFSP- Ozcan & Seven (2003) with modifications to suit the available technology

Cost analysis

Materials/service	Unit cost (Ug shs)
Ground nuts (1 kg)	3,500
OFSP roots (0.75 kg)	300
Drying of OFSP/kg	10
Roasting of g.nuts/kg	500
Peanut grinding/kg	1,000
Packaging 4 tins	600
Transport costs	1,000
	6,910

Unit production cost= 1727.5/=

Chemical analysis

- Total pro-vitamin A carotenoid content-using a procedure described by Rodriguez-Amaya & Kimura (2004).
- M.C, protein, dietary fibre, fat/oil and total sugars analysis done according to AOAC (1999)

Sensory evaluation

Panel selection

- Fifty semi trained panelists were randomly selected.

Test procedure

- Four samples of the treatment combinations were presented to each participant.
- Sensory attributes were scored using the 9-Point Hedonic Scale

Shelf stability analysis

- Acid value and peroxide value- according to AOAC (1999).
- Enumeration of *S. auerus*- International Standard-ISO 21527-2 method
- Enumeration of Yeasts and Moulds- International Standard-ISO 21527-2 method
- Enumeration of Coliforms- International Standard- ISO 4832 method

Data analysis

- Data for sensory evaluation was summarized and analysed using SPSS (version 16).
- Means were tabulated and subjected to ANOVA using Genstat (13^{th} Edition)
- Means were separated using LSD ($P \leq 0.05$) to determine significant differences.

RESULTS AND DISCUSSIONS

Table 01: Proximate analysis

	%Moisture content	%Fibre content	%Fat content	%Sugar content	β-carotene (µg/100g)	% crude protein
Control sample	1.89±0.06^{a}	5.31±0.07^{a}	32.45±0.17^{a}	2.96±0.61^{a}	244±11.6^{a}	27.76±0.76^{a}
Treatment B	2.18±0.00^{b}	5.61±0.06^{ab}	32.53±0.25^{a}	9.19±0.02^{a}	795±111.5^{b}	25.79±0.34^{a}
Treatment C	2.14±0.06^{b}	5.87±0.08^{b}	31.12±0.26^{a}	16.45±3.03^{b}	1041±36.8^{c}	24.36±0.55^{a}
treatment D	2.13±0.00^{b}	6.25±0.14^{c}	30.83±0.58^{a}	25.51±0.11^{c}	1388±0.7^{d}	20.47±0.08^{a}

Values are means±Standard deviations. Means followed by the same letter in the same column are not significantly different ($P<0.05$). Treatment B (5% OFSP), treatment C (10% OFSP), treatment D (15% OFSP).

Table 02: Sensory evaluation of freshly produced OFSP enhanced peanut butter

	Colour	Aroma	Oiliness	Spreadability	Taste	Flavour	Overall acceptability
Control sample	6.68±1.65^{a}	6.47±1.51^{a}	6.08±1.89^{a}	5.22 ±2.02^{b}	6.35 ±2.2^{a}	6.02±1.88^{b}	6.22±1.82^{a}
Treatment B	7.31±1.29^{a}	6.89±1.27^{a}	6.85±1.59^{a}	6.60 ±1.98^{a}	6.79±1.55^{a}	6.58±1.36^{b}	7.20 ±1.18^{a}
Treatment C	7.41±1.06^{a}	6.81±1.40^{a}	6.87±1.24^{a}	5.77 ±2.07^{b}	6.89±1.60^{a}	6.70±1.58^{a}	7.04±1.58^{a}
Treatment D	6.83±1.98^{a}	6.25±1.65^{b}	6.27±1.84^{a}	6.25 ±2.03^{a}	6.22±1.83^{a}	6.06±1.82^{b}	6.33 ±1.95^{a}

Values are means ± Standard deviations. Means followed by the same letter in the same column are not significantly different ($P<0.05$).

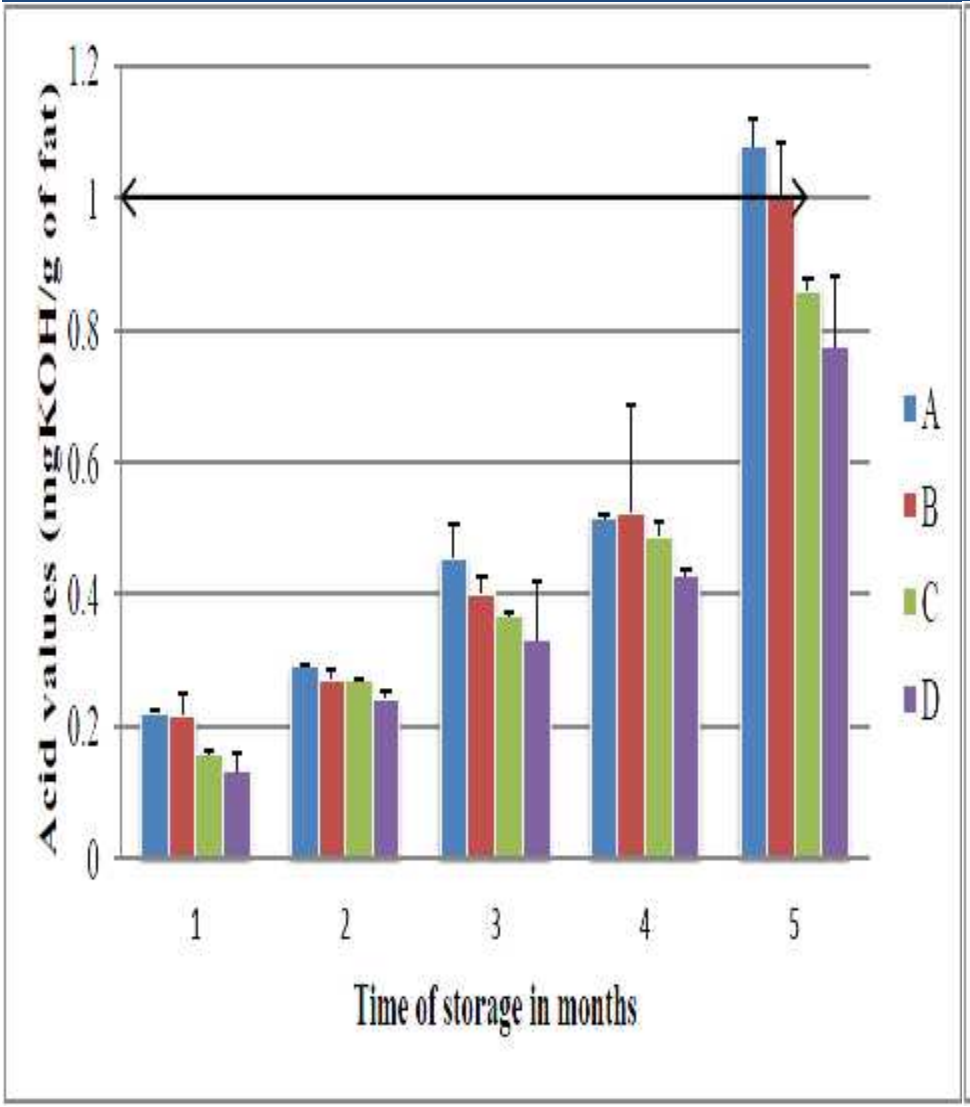
Shelf stability study of OFSP enhanced peanut butter

Was studied considering changes in;

- Lipid quality:- Acid value and peroxide value
- Beta-carotene retention
- Microbial quality
- Sensory properties

Fig 02: Changes in acid and peroxide values of peanut butter samples with storage time

Acid values



Peroxide values

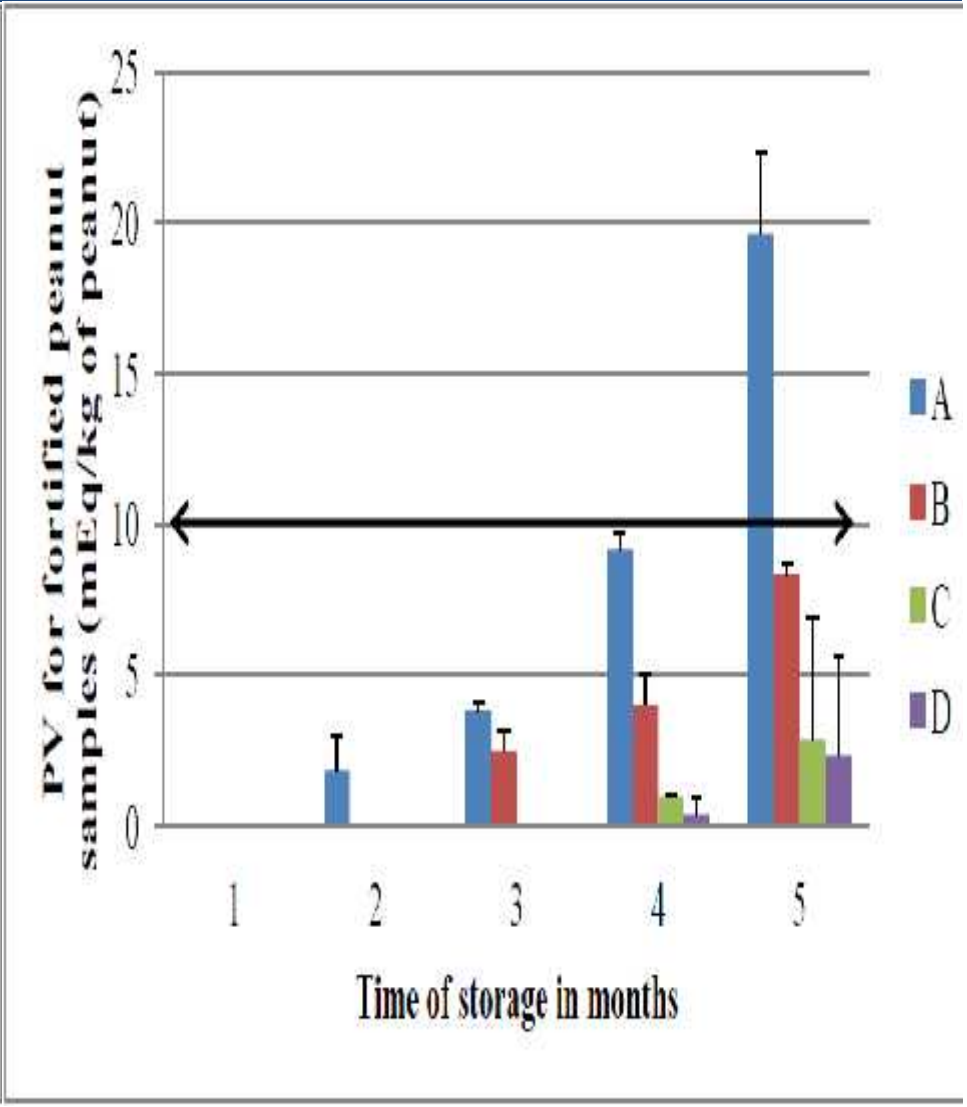


Table 03: Correlation of PV and AV with the independent variables: storage time and OFSP levels

Parameter	PV	OFSP ratio	Storage time (months)	AV
PV	1			
OFSP ratio	-0.4971*	1		
Storage time (months)	0.5852*	0.000	1	
AV	0.7580*	-0.1847NS	0.8955*	1

R^2 =68.9; Values with * have a significant positive or negative relationship at P≤0.05, NS=values are not significant

Fig 03: Beta-carotene retention of OFSP enhanced peanut butter with storage time

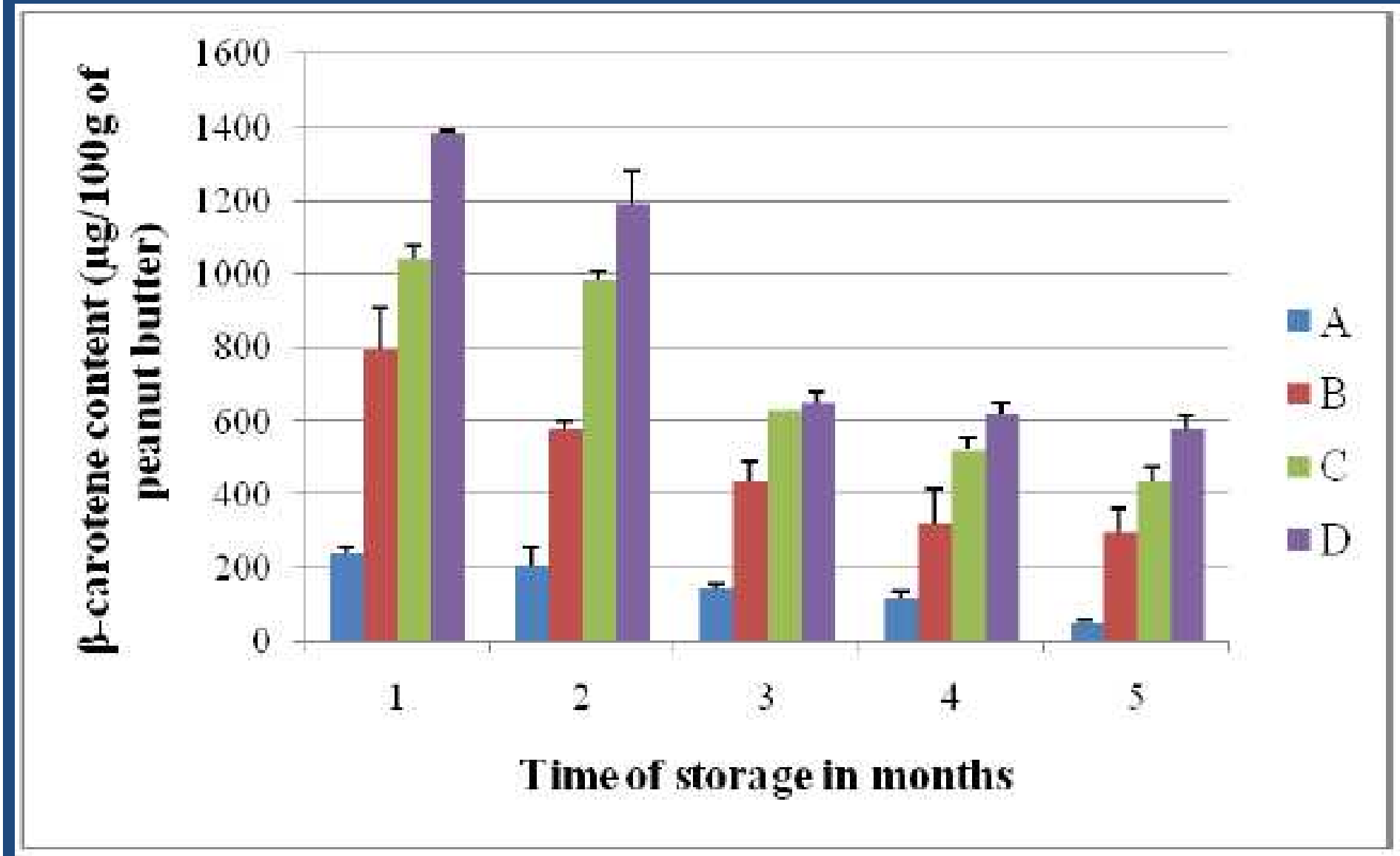


Table 04: Correlation of β-carotene retention with the independent variables: PV, storage time and OFSP levels

Parameter	β-carotene	OFSP ratio	Storage time (months)	PV
β-carotene	1			
OFSP ratio	0.7547*	1		
Storage time (months)	-0.5483*	0.000	1	
PV	-0.5843*	-0.4971*	0.5852*	1

R^2 =89.2; Values with * have a significant positive or negative relationship at P≤0.05,

Table 05: Microbial quality of peanut butter with storage time

	Control A cfu/g	Treatment B cfu/g	Treatment C cfu/g	Treatment D cfu/g
1st month				
Yeasts and molds	N.D	N.D	N.D	N.D
S. aureus	N.D	1.0×10^{1}	1.5×10^{1}	4.0×10^{1}
Coliforms	N.D	N.D	N.D	N.D
2rd month				
Yeasts and molds	N.D	N.D	N.D	N.D
S. aureus	N.D	1.2×10^{0}	6.0×10^{0}	3.4×10^{1}
Coliforms	N.D	N.D	N.D	N.D
3rd month				
Yeasts and molds	N.D	N.D	N.D	N.D
S. aureus	N.D	N.D	4.35×10^{0}	1.7×10^{1}
Coliforms	N.D	N.D	N.D	N.D
4th month				
Yeasts and molds	ND	ND	ND	ND
S. aureus	ND	ND	2.12×10^{0}	1.0×10^{1}
Coliforms	ND	ND	ND	ND
5th month				
Yeasts and molds	ND	ND	ND	ND
S. aureus	ND	ND	ND	5.1×10^{0}
Coliforms	ND	ND	ND	ND

N.D= Not Detected

Table 06: Sensory property changes of the peanut butter with storage time

	Color	Aroma	oiliness	Spreadability	taste	Flavour	Overall acceptability
Control							
Month 1	6.68±1.65^{a}	6.47±1.51^{a}	6.08±1.89^{b}	5.22±2.02^{b}	6.35±2.2^{a}	6.02±1.88^{b}	6.22±1.82^{b}
Month 3	6.89±1.25^{a}	6.39±1.33^{b}	6.31±1.43^{b}	5.47±1.94^{b}	6.16±1.37^{b}	6.47±1.20^{b}	6.37±1.29^{b}
Month 5	7.14±1.48^{a}	6.25±1.87^{b}	6.22±1.85^{a}	6.02±1.87^{b}	6.20±1.55^{b}	6.25±1.42^{b}	6.50±1.44^{b}
Treatment B							
Month 1	7.31±1.29^{a}	6.89±1.27^{a}	6.85±1.59^{a}	6.60±1.98^{a}	6.79±1.55^{a}	6.58±1.36^{b}	7.20±1.18^{a}
Month 3	7.12±1.28^{a}	6.58±1.48^{b}	7.00±1.22^{a}	6.79±1.55^{a}	6.81±1.55^{a}	6.81±1.21^{b}	7.12±1.16^{a}
Month 5	7.45±1.27^{a}	6.60±1.44^{b}	6.83±1.54^{a}	6.25±2.03^{a}	6.97±1.45^{a}	6.75±1.57^{a}	7.06±1.26^{a}
Treatment C							
Month 1	7.41±1.06^{a}	6.81±1.40^{a}	6.87±1.24^{a}	5.77±2.07^{b}	6.89±1.60^{a}	6.70±1.58^{a}	7.04±1.58^{a}
Month 3	6.97±1.17^{a}	6.14±1.23^{ab}	6.10±1.46^{b}	5.54±1.80^{b}	6.43±1.51^{b}	6.41±1.26^{b}	6.47±1.23^{b}
Month 5	7.14±1.48^{a}	6.60±1.42^{b}	6.52±1.54^{b}	5.85±1.81^{b}	6.83±1.62^{a}	6.91±1.2^{a}	6.87±1.10^{b}
Treatment D							
Month 1	6.83±1.98^{a}	6.25±1.65^{a}	6.27±1.84^{a}	6.25±2.03^{a}	6.22±1.83^{a}	6.06±1.82^{b}	6.33±1.95^{a}
Month 3	7.35±1.31^{a}	6.81±1.51^{b}	6.72±1.46^{a}	6.00±1.83^{b}	6.89±1.77^{a}	6.81±1.37^{a}	6.91±1.47^{a}
Month 5	7.58±1.04^{a}	7.10±1.11^{b}	7.00±1.48^{a}	6.68±1.96^{a}	7.16±1.11^{a}	7.29±0.98^{a}	7.43±1.16^{a}

Values are means±Standard deviations. Means followed by the same letter in the same column are not significantly different ($P<0.05$).

Conclusion

- The method used was able to produce an acceptable product
- β-carotene in OFSP enriched peanut butter increased with increased addition of OFSP
- Product enriched with 15% OFSP had the highest β-carotene.
- Shelf stable OFSP enriched peanut butter product contained adequate β-carotene

Recommendations

- Determination of the consumption rate of the OFSP enhanced peanut butter to meet recommended daily vitamin A intake.
- Determining effectiveness OFSP enhanced peanut butter to change vitamin A status of individuals
- Determination of OFSPs potential to reduce the oxidation of oils and levels to use.

Acknowledgement

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THANK

YOU