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Nutrient evaluation of infant food produced from orange fleshed sweet potatoes (*Ipomoea batatas*) and soybean blends (*Glycine max*)

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Abstract
Introduction: Complementary feeding is the gradual withdrawal of breast milk and introduction of other foods like semi-solid or solid foods to a baby; these new foods become a source of energy and nutrient intake.
Objectives: The specific objectives were to: (i) determine the proximate composition of orange fleshed sweet potatoes and soybean blends; (ii) determine the mineral composition of orange fleshed sweet potato and soybeans blends; (iii) determine the vitamin composition of the orange fleshed sweet potatoes and soybean blends; (iv) determine the sensory attributes of the orange fleshed sweet potatoes and soybean blends.
Materials and Methods: The Orange fleshed sweet potatoes and Soybeans (*glycine max*) were collected from National Root Crops Research Institute (NRCRI), Umudike, Nigeria and a market in Nasarawa State, Nigeria respectively. Padmaja. (2009) method was used in the production of Orange fleshed sweet potatoes flour. The complementary foods were formulated using a combination of orange fleshed sweet potatoes and soybeans in the proportion of 50%:50%; 60%:40%; 70%:30%; 80%:20%; 90%:10% respectively. Commercial complementary food (corn gruel) was used as a control. The porridge was prepared with a 100g of the complementary flour added to 100ml of hot water (60°C). The sample was kept separately in thermos flasks to maintain the serving temperature of -28°C as it was served to nursing mothers. The proximate, minerals, vitamins compositions of orange fleshed sweet potatoes and soybean blends were determine using standardized methods.
Results: Result obtained show that OFSP and SBB had moisture content 8.10g, protein 19.82g, fiber 4.70g, lipid 8.71g, ash 2.43g, carbohydrate 66.2g and energy 390kcal. There was significant difference $p< 0.05$ in the proximate analysis. OFSP and SBB had vitamin A content of 4743.5µg and vitamin C content of 12.36mg/100g. There was no significant difference $p>0.05$ in vitamins analysis. The mineral composition of OFSP and SBB had Iron 3mg/g, Calcium 18mg/g and Zinc 2mg/g. There was no significant difference $p>0.05$ in the mineral analysis.
Conclusion: Adequate complementary food can meet the nutritional needs of infants.

Keywords: nutrient evaluation, orange fleshed sweet potatoes, infant food, soybean

Introduction

Complementary feeding is the gradual withdrawal of breast milk and introduction of other foods like semi-solid or solid foods to a baby; these new foods become a source of energy and nutrient intake (Codex, 2003) [2]. It is an evident that the nutritional status of a child during the first 1000 days of life and early development has major effect on the child's well-being. Children are often weaned between 4-6 months (WHO, 1998) [16, 18]. The complementary feeding process varies widely among different cultures in terms of variety, quality and quantity of foods which are used. In developing countries, it is important for economic reasons that raw materials used in the production of complementary foods be sourced locally (Hofvander and Underwood, 1987) [6]. To reduce the incidence of malnutrition, tubers and roots offer a potential alternative to cereals as weaning edible materials. They form a major staple food group in most developing countries of Africa, Asia and Latin America (Nestle *et al.*, 2003) [10].

Malnutrition among infants and young children is common in developing countries like Nigeria. Many mothers in developing countries breastfeed for 12 months while some others breast feed for up to 24 months (Kazim and Kazim, 1979) [8]. When a baby reaches 4-6 months of age, breast milk alone is no longer sufficient to meet its nutritional requirements. Formulation of weaning foods rich in proteins, carbohydrates and other nutrients at high proportion to complement breast milk will bring about the end of the children high mortality rate typical of the developing nations (WHO/UNICEF, 1998; Codex, 2003) [2, 16, 18].

The most popular of this food group are cassava, yam, cocoyam, Irish potatoes (*Solanum tuberosum*) and sweet potatoes (*Ipomoea batatas*) which is a dicotyledonous plant that belongs to the family Convolvulaceae. Orange fleshed sweet potatoes which thrives well in almost all climates and matures in 3-4 months is one of the most promising plant sources of β-carotene which is believed to represent the least expensive, year round source of dietary vitamin A. Current varieties of Orange fleshed sweet potatoes contain 20-30 times more β-carotene than those of golden rice (Van Jaarsveld *et al.*, 2005) [15]. The outstanding features of orange fleshed sweet potatoes are the nutritional pro-vitamin A, compositional and sensory versatility in terms of its micronutrient contents and wide range of color, taste and texture (Degras, 2003) [3].

In Nigeria, orange fleshed sweet potatoes is widely processed into flour and found to attract higher prices from

consumers than from other varieties (Akoroda *et al.*, 2007) [1]. The crop is patronized as a daytime snack in school, offices and at homes (Indrasaris *et al*., 2005) [7]. It can also be eaten boiled, fried and in roasted form that remains in food condition for a longtime (Yeoh *et al.*, 2000) [19].

Legumes represent a major protein source consumed by a large section of the population of developing countries (Rodriguez-Amaya, 1997) [13]. Legumes are cheap sources of proteins and commonly consumed in diets of many household in West Africa including Nigeria.

This study is therefore aimed at producing infant weaning food using orange fleshed sweet potatoes blends with soybean flour and assesses their nutritional and sensory properties.

Materials and Methods

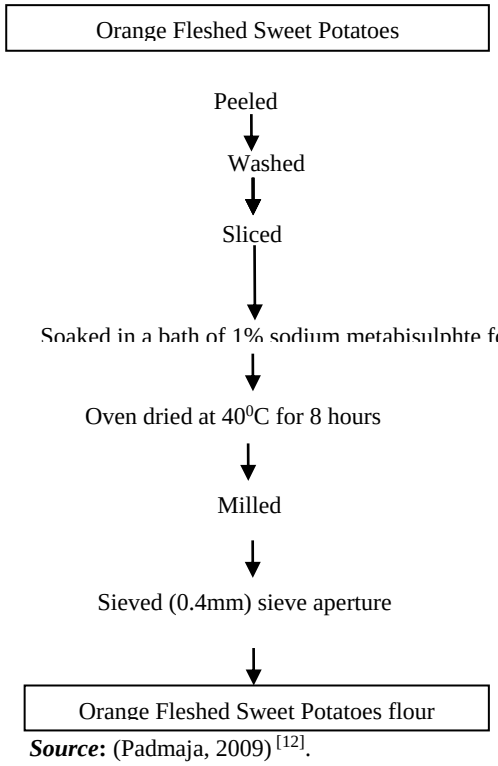
Source of Materials

The Orange fleshed sweet potatoes (OFSP) (*Ipomoea batatas*) used for the experiment were collected from the National Root Crops Research Institute (NRCRI), Umudike, Abia State, Nigeria and the Soybeans (*glycine max*) were purchased from kasuwa koro, Lafia market in Nasarawa State, Nigeria.

Sample Preparation

Production of orange fleshed sweet potatoes flour

The method used in the production of Orange fleshed sweet potatoes flour was from the Padmaja (2009) [12] method used in the preparation of sweet potato flour. The Orange Fleshed Sweet Potatoes were peeled, washed and sliced with kitchen knives. It was immediately immersed in a bath of 1% sodium metabisulfite for ten minutes to prevent enzymatic browning. The Orange Fleshed Sweet Potatoes were drained and oven dried at 40°C in a conventional air oven for eight hours (Gallen kamp Co. Ltd London England). It was dry-milled into powder and sieved with (0.4mm) sieve aperture into flour ready for use.



***Source*:** (Padmaja, 2009) [12].

Fig 1: Production of orange fleshed sweet potatoes flour.

Production of Soybeans flour

The Soybeans flour was prepared using the method described below. The flow chart is shown figure 2.

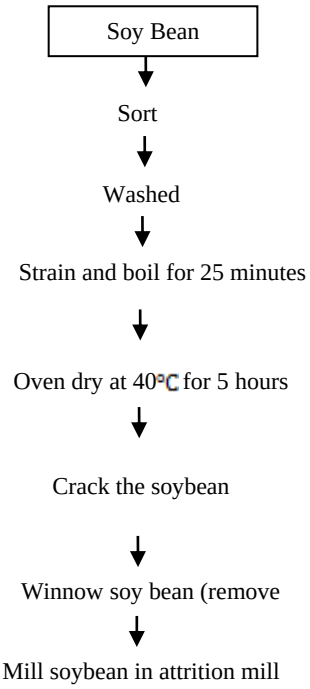


Fig 2: Production of Soybean

The soy bean was boiled for 25 minutes, dehulled, dried in the oven for 5 hours to enhance flavor and taste of the flour and also to improve digestibility. It was milled into powder, sieved and was ready for use.

Preparation of the complementary food flour

The complementary foods were formulated by weighing the flour samples using a sensitive scale (Santroius digital weighing balance). The flour was blended. A combination of orange fleshed sweet potatoes and soybeans was used in the proportion of 50%:50%; 60%:40%; 70%:30%; 80%:20%; 90%:10% respectively. This was used as a combination to meet the protein and energy needs of infants. A commercial complementary food (corn gruel) was used as a control. A combination of OFSP and Soybeans in the proportion of 100% respectively was used to prepare the complementary food blends.

Porridge preparation

A 100g of the complementary flour was added to 100ml of hot water (60°C). The sample was allowed to cool at room temperature of -28°C (serving temperature). The sample was kept separately in thermos flasks to maintain the serving temperature of -28°C as it was served to nursing mothers.

Proximate Analysis

Determination of moisture content

About 10g of the sample was poured into a previously weighed can. The sample in the can was dried in the oven at 105^{0}C for 3 hours. It was cooled in a desiccator and weighed. It was returned to the oven for further drying after which it was left to cool and weighed repeatedly at an hour interval until a constant weight was obtained. The weight of moisture lost was calculated as a percentage of weight of

sample analyzed. It was given by the expression below:

$$\% \text{ moisture content} = \frac{100}{1} \chi \frac{w_2 - w_3}{w_2 - w_1}$$

Where:
W_1= weight of empty moisture can
W_2 = Weight of moisture can+ sample before drying
W_3= Weight of moisture can+ sample dried to constant weight.

Determination of ash content

This was done by furnace incineration method. About 3g of the processed sample was poured into a previously weighed porcelain crucible. The sample was burnt to ashes in a muffle furnace at 55^0C. It was cooled in a desiccator and weighed. The weight of the ash was expressed in percentage of weight of sample analyzed as shown below:

$$\% \text{ Ash} = \frac{100}{1} \chi \frac{w_2 - w_3}{weight\ of\ sample}$$

Where:
W_1= weight of empty crucible.
W_2 = weight of crucible + ash

Determination crude fiber content

About 3g of the processed sample was boiled in 150mls of 1.25% H_2SO_4 solution for 30 minutes under reflux. The boiled samples was washed in several portions of hot water using a twofold Muslin cloth to trip the practices which were returned back to the flask and boiled again in 150mls of 1.25% NAOH for another 30 minutes under the same condition. After washing in several portion of hot water, the sample was allowed to drain dry before being transferred to a weighed curable where it was dried in an oven at 105^0c to a constant weight. It was burnt to ashes in a muffle furnace. The weight of fiber was calculated as a percentage of weight of sample analyzed. It was given by the expression below:

$$\% \text{ Crude fiber} = \frac{100}{1} \chi \frac{w_2 - w_3}{weight\ of\ sample}$$

Where:
W_2 = Weight of crucible +sample after boiling, washing and drying
W_3 = Weight of crucible + sample as ash

Determination of fat content

The solvent extraction fat method was used. About 3g of the processed sample was wrapped in a porous paper (Whitman filter paper) and put in a thimble. The thimble was placed in a soxhlet reflux flask and mounted in a weighed extraction flask containing 200mls of petroleum ether. The upper end of the reflux flask was connected to a water condenser.

The solvent (petroleum ether) was heated. It boiled vaporized and condensed into the reflux flask. Soon the sample in the thimble was covered with the solvent (petroleum ether) which remained the fat. The sample remained on the thimble and the reflux flask filled up.

Siphoned over, carrying its oil extract down to the boiling flask. This process was allowed to go on repeatedly for 4 hours before the defatted sample was removed, the sample received and the oil extract was left in the flask. The flask containing the oil extract was dried in the oven at 60^0c for 3 minutes (to remove the residual solvent), cooled in a desiccator and weighed. By difference, the weight of fat extract was determined and expressed as a percentage of the weight of the analyzed sample and is given by the expression below:

$$\% \text{ Fat} = \frac{w_2 - w_1}{weight\ of\ sample} \text{ x } \frac{100}{1}$$

Where:
W_1 = weight of empty extraction flask
W_2 = weight of extraction flask +fat extract

Determination of crude protein content using Kjeldahl method

This was done by the Kjeldahl method. The total nitrogen was determined and multiplied with 6.25 to obtain the protein content. About 1.0g of processed sample was mixed with 10mls of concentrated H_2SO_4 in a digestion flask. A table of selenium catalyst was added to it before it was heated in a fume cupboard until a clear solution was obtained (i.e. the digest) which was diluted to 100ml in a volumetric flask.

10mls of the digest was mixed with equal volume of 45% NAOH solution in a kjeldahl distribution apparatus. The mixture was distilled into 10mls of 4% boric acid containing 3 drops of mixed indicator (chromoseressol green/ methyl red). A total of 50mls of distillates was collected and titrated against 0.02N EDTA from green to deep red end point. The N_2 content and hence the protein content was calculated using the formula below:

$$\% \text{ protein} = \% N_2 \text{ x } 6.25$$

$$\% N_2 = \left(\frac{100}{w} \chi \frac{N\ X\ 14}{1000} \text{ x } \frac{Vt}{Va}\right) \text{T.Bik}$$

Where:
W = weight of sample
N = normality of titrant (0.02 H2SO4)
Vt = Total digest volume (100mls)
Va = volume of digest analyzed (10ml)
T = Titer value of sample
B = Titer value of Blank.

Determination of carbohydrate

Carbohydrate was calculated as the Nitrogen free extractive (NFE) by the following below:

%CHO (NFE) = 100% - (Protein + Fat + Ash +Moisture Content)
Energy value = (CHO x 4) + (CP X 4) + (0.1 X 9)

Carbohydrate content of the sample was determined by estimation using the arithmetic difference method described and was calculated and expressed as the nitrogen free extract as

$$\% \text{ Carbohydrate} = 100 - (MC + CF + CP + ASH + EE)\ \%$$

Where:
MC =Moisture content
CF =Crude fiber
P =crude protein
EE = Ether Extract (Fat)

Determination of Vitamins

The spectrophotometric method was employed in the determination of vitamins A content.

Determination of vitamin A

A 5g of sample was dissolved in 30mls of absolute alcohol (ethanol) and 3mls of 5% potassium hydroxide was added to it. The mixture was boiled under reflux for 30 minutes and was cooled rapidly with running water and filtered. 30mls of distilled water was added and the mixture was transferred into a separating funnel. Three portions of 50mls of the ether were used to wash the mixture, the lower layer was discarded and the upper layer was washed with 50mls of distilled water. The extract was evaporated to dryness and dissolved in 10mls of isopropyl alcohol and its absorbance was measured at 325nm.

$$\text{Vit. A (Mg/100g)} = \frac{100}{w} \text{ x } \frac{au}{as} \text{ x c}$$

Where:
au= absorbance of test sample
as = absorbance of standard solution
c = concentration of the test sample
w = weight of sample.

Vitamin C (ascorbic acid) determination

About 10g of the sample was extracted with 50ml EDTA/ TCA extracting solution for 1 hour and filtered through a whatman filter paper into a 50ml volumetric flask and made up to the mark with the extracting solution. About 20ml of the extract was pipette into a 250ml conical flask and 10ml of 30% KI was added and also 50mls of distilled water added. This was followed by 2ml of 1% starch indicator. This was titrated against 0.01ml $CuS0_4$ solution to a dark end point.

$$\text{Vit C (mg/100g)} = 0.88 \text{ x } \frac{100}{5} \text{ x } \frac{Vf}{20} \text{ x } \frac{T}{1}$$

Where:
Vf = volume of the extract
T = Sample titer – blank titer

Mineral Composition

Determination of calcium

This was done using the Versanale EDTA titrimetric method. About 20ml portion of the extract was dispersed into a conical flask and treated with pinches of making agents (hydroxylamine hydrochloride, sodium cyanide and sodium potassium Ferro cyanide). The flask was shaken and the mixture dissolved. About 20mls of ammonia buffer was added to it to raise the pH to 10.00 (a point at which calcium and magnesium form complexes with EDTA). The mixture was titrated against 0.02N EDTA solution using crochrone black-T as indicator. A reagent blank was also titrated and titration in each case was done from deep red to permanent blue end point. The titration value represents both Ca^{2+} and Mg^{2+} in the test sample.

A repeat titration was done to determine Ca^{2+} alone in the test sample. This was done in similarity with the above titration. However, 10% NaOH was used in place of ammonia buffer and solechrome dark blue indicator in place of crochrone black-T.

From the values obtained, the Ca^{2+} and Mg^{2+}content were calculated as follows:

$$\text{Ca/Mg (mg/100g)} = \frac{100}{w} \; x \; T - B \; \left(Nx \frac{Ca}{Mg}\right) \frac{Vt}{Va}$$

Where:
W = weight of sample
T = Titer value of sample
B = Titer value of blank
Ca = calcium equivalent
Mg = Magnesium equivalent
N= Normality of Titrant (0.02N EDTA).

Determination of Zinc and Iron

About 0.5g of the grounded sample was weighed into a 100ml Pyrex conical flask, 5ml of the wet acid digestion reagent (H_2SO_4 selenium-salicylic acid) was added and allowed to stand at ambient temperature for about 16 hours. The ample was placed on a digestion block, and heated at 20^0c for about 2 hours. The sample was removed from the block on the digestion stand temperature raised to about 80^0c - 150^0c. The digestion continued until a profuse white perchloric fumes emerges, a clear digest indicating the completion of digestion. The sample was removed from the hot plate, allowed to cool and made up in a 100ml volumetric flask with distilled waters. The digest was used for the determination of zinc and iron using Atomic Absorption Spectroscopy (A.A.S) (Tuzen *et al.*, 2007) [14].

$$\text{Zinc (Mg/100g)} = \frac{100}{w} \; x \; \frac{x}{10^s} \text{ x } \frac{Vf}{Vx} \text{ x D}$$

Sensory Evaluation

Twenty (20) nursing mothers were randomly selected from the department of mother and child health clinic at the Federal Medical Centre in Umuahia, Abia State for sensory evaluation. The porridge was coded and about 50ml of each was presented to the panelist from a thermos flask. Water was equally provided to the panelist to rinse their mouth after each taste to avoid any carry-over taste from one sample to another. The attributes evaluated were based on Colour, Taste, Flavor (Aroma), Mouth feel and General Acceptability on a 9-point Hedonic scale of: 9= Like extremely, 8=Like very much, 7=Like moderately, 6=Like slightly, 5= Neither like nor dislike, 4=Dislike slightly, 3=Dislike moderately, 2=Dislike very much, 1=Dislike extremely. Corn pap, a complementary commercial food was used as a control.

Statistical Analysis

Mean and Standard deviation was calculated for all variables. Analysis of variance and Duncan New Multiple Range Test (DNUMRT) were used to separate and compare means of the various mixers. A statistical software package known as Statistical package for the social sciences (SPSS, Version 20) was used to run the data for easy computation.

Results

Table 1: Mean values of Energy and proximate Composition

Food Sample (%)	MOISTURE (g/100g) M S.D	PROTEIN (g/100g) M S.D	FIBER (g/100g) M S.D	LIPIDS (g/100g) M S.D	ASH (g/100g) M S.D	CHO (g/100g) M S.D	EV (kcal) M S.D
OFSP:SBB (50:50)	7.40^{d} ±0.03	19.82 ^{a} ±0.16	3.4d^{b} ±0.01	8.71^{d} ±0.00	2.38^{a} ±0.00	58.39^{f} ±0.02	390.8^{a} ±0.21
OFSP:SBB (60:40)	7.11 ^{d} ±0.07	18.40 ^{b} ±0.14	3.62^{d} ±0.01	7.11 ^{c} ±0.21	2.43^{a} ±0.00	61.35^{e} ±0.00	383^{b} ±0.16
OFSP:SBB (70:30)	8.0 ^{b} ±0.03	17.4 ^{c} ±0.03	3.8^{c} ±0.04	5.83 ^{c} ±0.01	2.39^{a} ±0.00	62.45^{f} ±0.03	372.03^{c} ±0.13
OFSP:SBB (80:20)	7.91 ^{c} ±0.02	16.88^{d} ±0.01	4.23^{b} ±0.00	4.240^{b} ±.014	2.36^{a} ±0.00	64.40^{e} ±0.00	363.2^{d} ±0.18
OFSP:SBB (90:10)	8.10^{a} ±0.014	16.02 ^{e} ±0.01	4.70 ^{a} ±0.01	2.71^{b} ±0.00	2.31^{a} ±0.01	66.20^{f} ±0.00	353.1^{d} ±0.04

Mean values with same superscripts in the same column has a significantly different ($P<0.05$)
Where: a,b,c,d,e,f represent the Duncan test; OFSP = Orange fleshed sweet potatoes; SBB = Soya Beans Blend; S.D = Standard deviation; M = Mean sample; MC =Moisture content; P = Protein; F= Fiber; ASH= Ashing; CHO = Carbohydrates; EV = Energy value

The result obtained from the proximate composition in table 1 show that sample OFSP90:SBB10 had the highest moisture content (8.10g), followed by sample OFSP70:SBB30 with the moisture content of 8.0g. Sample OFSP60:SBB40 was the lowest with the moisture content of 7.11g. There was significant difference (P<0.05) in the moisture content of the experimental samples. The protein of the sample show that sample OFSP50:SBB50 had the highest protein content (19.82g), followed by sample OFSP60:SBB40 with 19.82g protein. Sample OFSP90:SBB10 was the lowest with the protein content of 16.02g. There was significant difference (P<0.05) in the protein of the experimental sample. Sample OFSP90:SBB10 had the highest fiber content of 4.70 g followed by sample OFSP80:SBB20 with fiber content of 4.23g and sample OFSP70:SBB30 was the lowest with fiber content of 3.8g. There was significant difference (P<0.05) in the fiber content of the experimental sample. Lipids were highest in sample OFSP50:SBB50 with 8.71g, followed by sample OFSP60:SBB40 with a lipid content of 7.11g. Sample OFSP90:SBB10 was the lowest with lipid content of 2.81g. There was a significant difference (P<0.005) in the lipid content of the experimental sample.

Ash content of the sample showed that sample OFSP60:SBB40 had the highest ash content of 2.43g followed by sample OFSP70:SBB30 with 2.43g. Sample OFSP90:SBB10 had the lowest ash content of 2.31g. There was no significant difference (P>0.05) in the ash content of the samples.

Carbohydrate was highest in sample OFSP90:SBB10 with 66.2g, followed by OFSP80:SBB20 with carbohydrate content of 64.40g. Sample OFSP50:SBB50 was the lowest with carbohydrate content of 58.39g. There was a significant difference (P<0.05) in the carbohydrate content of the samples.

Table 2: Vitamin composition of Orange fleshed potatoes and soybean blends per 100g

Sample (%)	β-carotene (µg) M S.D	Vitamin C (mg) M S.D
OFSP:SBB (50:50)	2912.0 ±2.83	9.8 7 ±0.00
OFSP:SBB (60:40)	3212.5 ±2.12	10.37 ±0.03
OFSP:SBB (70:30)	3655.5 ±3.54	11.16 ±0.02
OFSP:SBB (80:20)	4163.0 ±0.14	11.86 ±0.01
OFSP90:SBB10 (90:10)	4743.5 ±0.21	12.36 ±0.01

Where: M =Mean sample; S.D = Standard deviation; OFSP = Orange fleshed sweet potatoes, SBB =Soybean blends

Table 2 presents the vitamin composition of orange fleshed sweet potatoes and soybean blends.

Vitamin A was highest in OFSP90:SBB10 with vitamin A content of 4748.5g, followed by sample OFSP80:SBB20 with vitamin A content of 4163.0g. Sample OFSP: SBB had the lowest vitamin A content of 2912.0g. There was no significant different (P>0.05) with the entire experimental sample.

Table 2 also shows the vitamin C composition of the blends. Vitamin C was highest in OFSP90:SBB10 with vitamin C content of 12.36g, followed by sample OFSP80: SBB20 with vitamin C content of 11.86g. Sample OFSP50:SBB50 had the lowest content of vitamin C (9.8700%). There was no significant difference (P>0.05) between the experimental samples.

Table 3: Mineral Composition of Orange Fleshed Potatoes and Soya bean Blends per 100g

Food Sample (%)	Ca (mg) M S.D	Fe (mg) M S.D	Zn (mg) M S.D
OFSP:SBB (50:50)	18.5^{c} ±0.01	3.4^{b} ±0.03	2.3^{a} ±0.02
OFSP:SBB (60:40)	17.5^{c} ±0.00	2.9^{b} ±0.00	1.9^{a} ±0.02
OFSP:SBB (70:30)	15.0^{c} ±0.00	2.4^{b} ±0.02	1.5^{a} ±0.00
OFSP:SBB (80:20)	14.0^{c} ±0.01	1.8^{b} ±0.07	1.0^{a} ±0.00
OFSP:SBB (90:10)	13.3^{c} ±0.00	1.3^{b} ±0.01	0.7^{a} ±0.00

Mean values with same superscripts in the same column has no significantly different (P>0.05)

Where: a,b,c represent the Duncan test, M = Mean sample; S.D = Standard deviation; OFSP = Orange fleshed sweet potatoes; SBB = Soybean blends.

Table 3 shows the mineral composition of orange fleshed sweet potatoes and Soybean Blend. Calcium was highest in OFSP50: SBB 50 (18.5mg), followed by sample OFSP60:SBB40 with 17.5mg calcium. Sample OFSP: SBB had the lowest calcium content of 13.3mg. There was no significant different (P>0.005) for all the samples.

Table 3 shows iron was highest in OFSP50:SBB50 with 3.4mg, followed by OFSP60: SBB40 with 2.9mg. Sample OFSP90: SBB10 had the lowest iron content of 1.3mg. There was no significant difference (P>0.005) with the experimental samples.

Table 3 also shows zinc was highest in sample OFSP 50: SBB 50 with zinc content of 2.3mg followed by sample OFSP60:SBB40 with zinc content of 1.9mg. Sample OFSP 90: SBB10 had the lowest value of 0.07mg. There was no significant difference (P>0.005) in the zinc content of the experimental samples.

Table 4: Sensory analysis of orange fleshed sweet potatoes with soya beans blends

Food Sample (%)	Colour M S.D	Flavor M S.D	Taste M S.D	Mouth feel M S.D	General Acceptability M S.D
Pap (control)	5.94^{a} ±2.68	5.40^{a} ±2.68	5.55^{a} ±2.56	5.02^{a} ±2.65	5.85^{a} ±2.66
50:50	5.17^{a} ±2.33	5.60^{a} ±2.43	4.85^{ab} ±2.74	5.15^{a} ±2.74	4.85^{a} ±2.91
60:40	5.83^{a} ±2.57	6.35^{a} ±1.69	5.60^{ab} ±2.33	5.70^{a} ±2.00	5.45^{a} ±1.93
70:30	5.67^{a} ±2.17	5.05^{a} ±2.06	5.75^{ab} ±2.02	5.35^{a} ±2.35	4.65^{a} ±2.52
80:20	5.94^{a} ±2.39	5.56^{a} ±2.26	5.96^{ab} ±2.50	5.75^{a} ±2.02	5.40^{a} ±2.39
90:10	6.67^{a} ±2.000	5.60^{a} ±2.19	6.65^{b} ±2.08	6.15^{a} ±2.37	6.30^{a} ±2.36

Mean values with the same super scripts in the column has no significantly different (P>0.05).

Where: a,ab,b represent the Duncan test; M = Mean sample; S.D = Standard deviation

Table 4 presents the sensory evaluation of the complementary food blend. PAP was used as the control. For colour; sample 90:10 was most acceptable by the panelist with the highest value of 6.67 followed by sample 80:20 with a value of 5.94 and the lowest was sample 50:50 with a value of 5.94. However colour of all sample were acceptable by the panelist.

For taste; sample 90:10 was most acceptable by the panelist with the highest value of 6.65 followed by sample 80:20 with a value of 5.96 and the lowest was sample 50:50 with a value of 4.85. All samples were acceptable for taste and there was no significant difference (P>0.05).

For flavor, sample 60:40 was highest with 6.35 followed by sample 50:50 with a value of 5.60 while pap as the control had the lowest value with (5.40), there was no significant difference (P>0.05). However all samples were generally acceptable for flavor (aroma).

For mouth feel; Sample 90:10 was the most acceptable by the panelist with the highest value of 6.15, followed by sample 80:20 with a value of 5.75. Pap was the lowest with a value of 5.02. However, the samples were acceptable for mouth feel and there was no significant difference (P>0.05).

For general acceptability; sample 90:10 with a value of 6.30 was the most generally accepted by the panelist, followed by pap with a value of 5.85. The lowest was sample 70:30 with a value of 4.65. The samples were generally accepted by the panelist.

Discussion

There was significant difference (P<0.05) in the moisture content of the experimental samples. The Lower the moisture content of food, the higher it's keeping quality. Moisture indicates shelf life when properly packed and stored (Etudaiye *et al.*, 2000) [5].

There was significant difference (P<0.05) in the protein of the experimental samples. The recommended daily allowance for protein for children 0-6 months and 7-12 months is 9.1g and 11g respectively (WHO, 2001) [17]. Protein is used for proper growth and development of the body, muscle structure, tissue repairs and maintenance of muscle mass.

There was significant difference (P<0.05) in the fiber content of the experimental sample. Fiber can help prevent high blood sugar level and keep blood sugar level under control (Lijuan *et al.*, 2000) [9]

There was significant difference (P<0.005) in the lipid content of the experimental sample. The recommended daily allowance for lipid is 10-23g/100g (Codex, 2003) [2]. Fat provides essential fatty acids, facilitates absorption of fat soluble vitamin and enhances dietary energy density and sensory qualities.

There was no significant difference of (P>0.05) in the ash content of the experimental samples. The ash content represents the mineral or inorganic residue of a biological material. It gives an idea of the amount of the total mineral content of the food material.

There was significant difference (P<0.05) in the carbohydrate content of the experimental sample. Inadequate energy obtained from carbohydrate would force the body to utilize protein as a source of energy (WHO, 1998) [17].

The blends are a good source of beta carotene which is the precursor of vitamin A. The blends produced being rich in vitamin A is a good for a complementary food for infants as it will help to solve the problem of vitamin A deficiencies in children.

There was no significant difference (P>0.05) in the vitamin C content of the samples. The recommended daily allowance for vitamin C for children 0-5 years is 35µg.

There was no significant different (P>0.005) in the calcium content of the samples. The recommended daily allowance for calcium is 48mg/g (Van Jaasveld *et al.,* 2005) [15]

There was no significant difference (P>0.005) in the iron content of the samples. Iron in human is highly bio-available, the concentration is low and human milk provides only a very small portion of iron required (WHO, 2001) [17]. After the age of six (6) months nearly all iron must come from the complementary food. It had been estimated that complementary food need to provide 97g of iron required for infants age 9-11 months (Dewey, 2001) [4].

There was no significant difference (P>0.005) in the zinc content of the experimental samples. According to Van, Jaasveld *et al.,* (2005) [15], the recommended daily allowance for infant, 6-12 months was 0.29mg/g.

All samples were accepted by the panelist for colour, taste, mouth feel and flavor (aroma). There was no significant difference (P>0.05). Therefore, the samples were generally acceptable by the panelist.

Conclusion

The composite flours of OFSP and Soybean blends produced a suitable base for the production of complementary foods. There was a high level of protein in the blends with SBB. Soybean is an economically important crop which serves as a source of good quality protein for children. Mineral composition of OFSP and SBB were in appreciable level. Vitamin compositions of complementary blends were high in vitamin C and β- Carotene. Sensory evaluation showed that among the six complementary foods OFSP (90) and SBB (10) had higher nutrient and was most accepted by the panelist. This study revealed that the complementary food produced can meet the micro and macro nutrient needs of infants.

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