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COMPARATIVE STUDY OF THE NUTRITIONAL AND SENSORY QUALITIES OF A TRADITIONAL AND A COMMERCIAL WEANING FOOD

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Abstract: **Flours of soyabean, cornstarch, crayfish, plantain and dried fish (bonga) were mixed to obtain the traditional weaning food (TWF). The material balance method was used in obtaining the proportions of the flours for mixing with 70% cornstarch flour and 30% enriched soyabean. The proximate nutrient, some mineral concentrations, sensory evaluation and some vitamin composition of the formulated food were compared with Nestle Nutrend, a commercial weaning food (CWF). The TWF was superior in terms of protein and carbohydrate content but the CWF had more sensory scores. The moisture content of the TWF (9.72 $\pm$ 0.09%) was significantly higher (P<0.05) than that of the CWF (3.46 $\pm$ 0.02%) while the crude fibre and the fat contents were significantly higher in CWF when compared with TWF (P<0.05). the mineral analysis showed that potassium, iron and magnesium were significantly (P<0.05) higher in TWF while CWF had higher content of phosphorus, sodium and calcium (P<0.05). vitamin analysis showed that there was no significant difference in niacin, thiamine and ascorbic acid contents. The traditional weaning food is comparable to the commercial weaning food and can serve as a substitute to the commercial weaning food.**

Keywords: **Weaning food, Nutritional qualities, Sensory qualities.**

1. INTRODUCTION

Exclusive breastfeeding for the first four to six months is the World Health Organization (WHO)'s recommended method of feeding full-term infants by healthy well-nourished mothers. (WHO, 2000)

The growth of the infant in the first or second years is very rapid and breastfeeding alone will not meet the child's nutritional requirements. After about four months of age the child needs supplementary feeding (Ijarotimi and Famurewa, 2006). As the child grows older it is necessary to supplement the breast food with other foods, because breast milk alone is not sufficient both in quantity and quality to meet the nutritional requirements of the child. These other foods start as liquid food and slowly progress to solid foods. This is termed the weaning process (the introduction of foods other than breast-milk into an infant's diet while slowly reducing breastfeeding). (WHO, 2000)

Complementary foods (weaning foods) as described by Brown and Lutter (2000), are the foods introduced into an infant's diet in addition to breast-milk. WHO has also defined complementary food as any food whether manufactured or locally prepared, suitable as a complement to breast-milk or to infant formula, when either becomes insufficient to satisfy the nutritional requirements of the infant. (WHO, 1981)

Several types of commercial weaning foods are marketed in many countries including Nigeria. Even though these foods are available and nutritious, most of them are priced beyond the reach of the majority of the populations in the rural areas. Rural mothers therefore depend on available low-cost food mixtures to wean their infants.

Osuchukwu *et al* (2013) reported on the nutritional qualities of some traditional foods used for weaning in Nigeria. Five diets were investigated; cornstarch flour + enriched soyabean was found to meet most of the requirements for weaning food.

The present study was aimed at:

- Formulating a nutritionally balanced weaning food from locally available food stuffs.
- Assessing the proximate, sensory qualities, some mineral and vitamin composition of the formulated weaning food and comparing them with those of Nestle Nutrend, a commercially prepared weaning food.

2. MATERIALS AND METHODS

Collection of Samples

The food stuffs were purchased in a local market in Owerri, Imo State, Nigeria. For the purpose of comparison, Nestle Nutrend (for six months to 1 year old) a product of Nestle Nigeria Plc was purchased from the same market.

Processing of Local Raw Materials

The plantain fingers were washed, cut into pieces and dried in an oven for 24 hours at 65^{o}C. The chips were ground into flour using a blender. The flour was stored in an air tight container.

Foreign materials and stones were picked out of the maize seeds. The maize seeds were washed and steeped in water for 48 hours for fermentation. Then the fermented corn was milled, sieved and the resulting filtrate left in a bucket to settle. Water was decanted. The cornstarch was sundried for 48 hours and ground into fine flour with hand mill.

Soyabean seed was sorted, washed and soaked for 48 hours then dehulled and sundried. They were then dry-milled to obtain the soyabean flour.

The crayfish and dried fish were sorted and ground into powder, then stored in an air tight container.

Product Formulation

Each product blend preparation was weighed using electronic weighing balance to obtain the required quantity. Then they were thoroughly mixed, 70% of cornstarch and 30% of enriched soyabean (which comprised of 15% unripe plantain flour, 10% crayfish, 5% dried fish and 70% soyabean). The products were milled thoroughly to form a uniform mixture using a laboratory blender.

The traditional weaning food composition

Traditional weaning food	Cornstarch flour	Enriched soyabean
	70%	30%

Proximate Analysis

Standard procedure of AOAC (2000) and Onwuka (2005) were used to determine the proximate composition of each diet. The moisture content was determined by oven-drying at 105^{o}C to a constant weight (Onwuka, 2005). Ash content was determined by incinerating in a furnace at 550^{o}C (AOAC, 2000). Fat content was determined by continuous extraction in a Soxhlet apparatus for 14 hours using petroleum ether as solvent. (AOAC, 2000) Crude protein content was evaluated by digestion of the sample using Kjeldahl's method; nitrogen content was converted to protein content by multiplying by a factor of 6.25. Crude fibre was determined as described by Onwuka (2005); and subsequently the carbohydrate content was determined by using the following relationship: % carbohydrate = 100 – [% moisture + % ash + % fat + % crude fibre + % protein].

Energy Value of the Foods

The energy value of the TWF and CWF were calculated using the Atwater conversion factors of 4, 9 and 4 for multiplying crude protein, crude fat and carbohydrate respectively.

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Mineral Analysis

The method described by AOAC (1980) was adopted. Calcium, phosphorus, magnesium, iron, potassium and sodium were analyzed from the triple acid digestion. 1.0g of the food sample was weighed into 150ml beaker and 10ml of conc. HNO_3 was added in the beaker and allowed to soak thoroughly. 3ml of 60% $HClO_3$ was added and the mixture was heated slowly at first until frothing ceased. Heating continued until HNO_3 evaporated and the heating was stopped as charring occurred. 10ml of conc. HNO_3 was added and heating continued until white fumes were observed. The digest was allowed to cool and 10ml HCl was added. The solution was transferred to 50ml volumetric flask. The volume of the solution was made up to the mark with distilled water and then transferred to a bigger flask. The solution was further diluted to 100ml with distilled water (calcium, phosphorus, magnesium, potassium, sodium and iron) were measured using spectrophotometer and were calculated using the formula:

Metal conc. in mg/kg (Dry weight basis) = $\frac{A \times B}{G}$

Where A = result from spectrophotometer

B = the volume (1000ml)

G = quantity of sample

Vitamin Analysis

Vitamin A in the form of ß-carotene was analyzed using the method described by AOAC (1980). Ascorbic acid was determined by extraction with 0.5% oxalic acid solution.

Niacin and thiamine were determined by solid-phase extraction and anion-exchange liquid chromatography.

Sensory Evaluation

The formulated weaning food and the commercial weaning food were subjected to sensory evaluation using a 10 member panelists.

Panelists were requested to express their perception about the products by scoring the following attributes: Appearance, Aroma, Taste, After taste, Mouth feel, consistency and overall acceptability.

Sensory scores were based on a nine point hedonic scale where 1 is dislike extremely and 9 is like extremely.

Samples for sensory evaluation were prepared thus: 25g of the TWF was added into 175ml of cold water to get 200ml of the product. This was placed on fire for 2minutes with constant stirring to form a fine paste. This was done about 20 minutes prior to the test.

The commercial weaning food was prepared by adding 30g of the sample to 170ml of hot water to get a constant 200ml of the product ready for the test.

The prepared foods were served in plastic cups in equal amounts.

3. RESULT AND DISCUSSION

Table 1: Proximate and Energy Composition of Traditional Weaning Food (TWF) and Commercial Weaning Food (CWF)

Component	TWF	CWF
Moisture (%)	9.72 ± 0.09^b	3.46 ± 0.02^a
Protein (%)	13.88 ± 0.09^b	11.61 ± 0.10^a
Fat (%)	4.34 ± 0.02^b	8.70 ± 0.04^a
Carbohydrate (%)	67.91 ± 0.23^a	66.91 ± 0.22^a
Ash (%)	3.17 ± 0.06^a	2.35 ± 0.07^a
Crude fibre (%)	1.24 ± 0.02^b	6.96 ± 0.04^a
Energy content	366.22 ± 129.33^a	392.38 ± 119.55^a

Values are given as mean $\pm$ SD. Values in the same row with different superscripts are significantly ($p<0.05$) different.

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The proximate and energy composition of the two foods show some differences. The CWF supplies more fat and energy than TWF. TWF however, supplies more carbohydrate and protein than the CWF (nutrend). The crude fibre was rated significantly (P<0.05) low in traditional when compared with CWF (6.96 ± 0.04%).

Moisture content was rated high in TWF (9.72 ± 0.09%) with significant difference (P<0.05) when compared with CWF (3.46 ± 0.02%). This would imply that the diet could not be kept for a long time. Ash content of the commercial weaning food (2.35 ± 0.07%) was lower than that of the traditional weaning food (3.17 ± 0.06%).

Table 2: Selected Mineral Composition of Traditional Weaning Food (TWF) and Commercial Weaning Food (CWF)

	Ca (mg/100g)	Mg (mg/100g)	P (mg/100g)	Na (mg/100g)	Fe (mg/100g)	K (mg/100g)
TWF	46.76 ± 2.31^b	8.0 ± 1.3^b	112.9 ± 0.2^b	42.2 ± 0.2^b	30.5 ± 0.0^b	81.0 ± 0.1^b
CWF	370.7 ± 17.3^a	5.6 ± 1.3^a	260.7 ± 1.0^a	163.4 ± 0.4^a	21.9 ± 0.0^a	63.2 ± 0.2^a

Values are given as mean ± SD. Values in the same column with different superscripts are significantly (p<0.05) different.

The concentration of iron in the formulated food was 30.5mg/100g while that of commercial weaning food was 21.9mg/100g. This means that the TWF will supply more iron than the CWF. The concentration of calcium, sodium and phosphorus were however, far lower in the TWF than nutrend. Hence, there is need to improve on the concentrations of Ca, Na and P in the formulated food by fortifying the TWF with these minerals as calcium and phosphorus are essential for the formation of strong bones and teeth. Magnesium content rated higher in the TWF and shows significant difference (P<0.05) from the value obtained from commercial weaning food. Magnesium helps to hold calcium in the enamel of the teeth, hence the need for this traditional weaning food as this will help babies during the period of teeth formation. Potassium content in the TWF (81.0 ± 0.1) rated higher when compared to CWF (63.2 ± 0.2). However, the value obtained rated significantly low when compared to the value obtained for diet 4 (349.50mg/100g) in an initial study (Osuchukwu *et al*; 2013).

Table 3: Some Vitamin Composition of the Traditional Weaning Food and Commercial Weaning Food

Weaning Food	Niacin (mg/100g)	Thiamine (mg/100g)	ß-Carotene (mg/100g)	Ascorbic acid (mg/100g)
TWF	0.12 ± 0.00^a	0.04 ± 0.00^a	463.23 ± 0.75^b	33.16 ± 0.05^a
CWF	0.09 ± 0.00^a	0.05 ± 0.00^a	1345.33 ± 7.02^a	37.40 ± 1.56^a

Values are given as mean ± SD. Values in the same column with different superscripts are significantly (p<0.05) different.

There was significant difference in the ß-carotene content of the weaning foods. The CWF had very higher ß-carotene content than the TWF. The TWF should be fortified with vitamin A.

Table 4: Sensory Scores of the Traditional Weaning Food and Commercial Weaning Food

Food	Taste	Aroma	Appearance	Month feel	After taste	Consistency	Overall acceptability
TWF	7.4 ± 1.57^a	7.1 ± 1.37^a	5.8 ± 2.25^a	6.7 ± 2.54^a	7.6 ± 1.57^a	7.1 ± 1.85^a	6.7 ± 2.58^a
CWF	6.8 ± 1.81^a	7.9 ± 0.87^a	7.9 ± 0.73^a	7.1 ± 1.72^a	7.4 ± 0.84^a	7.1 ± 1.28^a	7.8 ± 1.22^a

Values are given as (n ± SD), n is the mean of 10 samples and SD is the standard deviation. Values in the same column with different superscripts are significantly (P<0.05) different.

Although the formulated food was superior to the commercial weaning food in terms of the protein and carbohydrate, the sensory scores revealed that the formulated food was less preferred than the commercial product. Nestle nutrend had a strong vanillin flavor and this contributed to its higher sensory scores. The traditional weaning food also had a good taste

and aroma due to the soya bean content. However, if vanillin flavor is added to the traditional weaning food, its acceptability will definitely increase.

4. CONCLUSION

The study successfully produced a nutritious diet with acceptable sensory attributes. However, it was less preferred than the commercial product (Nestle nutrend). The CWF had a strong vanillin flavor unlike the TWF. This observation suggests that vanillin could be added to the formulated food as a means of improving the sensory qualities. This will increase the acceptability of the formulated diet. The result also showed that the TWF can meet the nutritional needs of infants and young children due to the good content of iron, protein, magnesium and carbohydrate. And hence, can serve as a substitute to the more expensive commercial products if the mineral contents such as calcium, phosphorus and sodium are increased.

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