

## SENSORY EVALUATION AND PROXIMATE COMPOSITION OF COMPLEMENTARY FOOD FORMULATED FROM COMPOSITE FLOUR OF ORANGE FLESHED SWEET POTATO AND CATFISH

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### Abstract

*Complementary Foods (CF) are foods other than breast milk after exclusive breastfeeding. Infants become malnourished at this age when fed with CF of poor nutritional value. This study was aimed at conducting Sensory Evaluation (SE) and determining proximate composition of CF formulated from composite flour of Orange Fleshed Sweet Potato (OFSP) and catfish. Experimental research design was adopted. OFSP and catfishes were purchased from a farm in Port Harcourt and a market in Ijebu-Ode, Ogun State respectively. The food items were processed into flour at the JAGAEELaboratory, Ibadan. Twenty nursing mothers who attend Primary Health Centres in Ijebu-Ode Local Government Area were randomly selected for SE, gruel of OFSP and catfish flours were blended into 70:30, 60:40 and 50:50 with Cereal Based Custard as control, (Samples A-D respectively). The gruel was prepared in the respondents' presence for SE. Proximate Analysis (PA) was conducted on the samples using Association of Official Analytical Chemist. Sensory data were analysed using Duncan Multiple Range Test/Analysis of Variance. Sensory analyses showed Sample B as best in terms of overall acceptability ( $8.52 \pm 0.72^a$ ): CF formulated from OFSP and catfish had higher nutritional value and generally acceptable compared to control. PA result revealed protein content as higher ( $11.15 \pm 0.13^a$ ) in Sample A, while Sample D had the lowest protein ( $0.60 \pm 0.2^d$ ) content. Sample C had the highest ash content ( $2.12 \pm 0.06^a$ ) when compared with other samples. It is therefore recommended that awareness on preparing CF using OFSP and catfish should be created among nursing mothers.*

**Key Words:** Complementary food, Sensory evaluation, Proximate composition, Orange fleshed sweet potato, Catfish.

### INTRODUCTION

From birth to about six months of age, nature has provided the mothers' breast milk with nutrients that meet the nutritional demand of the infant for good growth and development, hence the promotion of Exclusive Breast Feeding (EBF) by nutritionists, paediatricians and World Health Organisation (WHO 2020). Beyond six months of age of being exposed to EBF, the nutritional requirements of the infants increase to the extent that they can no longer be met by the breast milk alone hence the need for the introduction of complementary foods. This is the period that is often referred to as "weaning" and also the period when the problem of malnutrition among the infants often manifests due principally, to inadequate consumption of foods of good nutrient content. (Akerele, et al, 2024). Introduction of nutritionally balanced complementary food is expected to address the nutritional needs for infants and

young children's proper growth and development. According to the Codex Alimentarius Commission, (CAC) 2018 complementary foods should be of appropriate nutritional quality and energy to complement the nutrients obtained from breast milk for infants and family food for younger children. In many developing countries, however, traditional complementary gruels are based on starchy staple foods, such as wheat, rice, maize or sorghum, that produce viscous porridges that are difficult for infants to consume. Consequently, the gruels are often over-diluted to reduce their viscosity which invariably reduces their energy density. Arising from the over-dilution and reduction in nutrient density, the infants are unable to consume enough quantity due to their small gastric capacities, hence they become malnourished (Akerele, et al, 2024). A number of complementary foods have been developed in Africa especially in Nigeria, but most of these complementary foods are cereal-based (Amagloh et al, 2017a). Over the years, the problem with malnutrition especially micro-nutrient deficiencies of vitamin A, iodine and iron led to the supplementation of complementary food. However, among three different approaches, namely supplementation programme through distribution of vitamin A capsules; fortification of common foods with micro-nutrients and improvement of dietary quality through diversification of foods, the third is an important food complementary based approach in achieving and maintaining adequate intake of micro-nutrient rich foods in the context of an adequate total diet (World Health Organization, (WHO) 2020). Food based approaches such as complementary form of orange fleshed sweet potato and dried cat fish are food based intervention aimed at increasing vitamins and protein intake of infants. Sweet potato (*Ipomoea batatas*) is another of the world's most important food crops and an important staple in Nigeria and other developing countries and because of its potential source of nutrients compared to yellow and white sweet potato varieties, orange sweet potato was selected for this study. Apart from its nutritional value, orange fleshed sweet potato is also known for its high yield, its harshness, its low demand on soil nutrients and cultivation input, as well as its storability and versatility in processing (Woolf, 2020). Protein from catfish is known to contribute about 4.8 per cent of total protein derived from ingested foods in Nigerian diets. (Tobor, 2018) The protein contents of fish and fish products are higher than those of other similar food items such as meat and eggs (Okapanefe 2019). Fish products have between 10.2 and 23.0 of protein per calories, other food items including eggs and meat provide between 0.8 and 9.6 grains per calorie (Borgstron, 2018). This study therefore formulated complementary food from orange fleshed sweet potato with dried catfish, conducted sensory evaluation and determined the proximate composition of the product.

### **Purpose of the Study**

The purpose of this study is to formulate complementary food from orange fleshed sweet potato with catfish, conduct sensory evaluation and determine the proximate composition of the product.

### **Research Questions**

1. What are the sensory qualities of the complementary food prepared from orange fleshed sweet potato and catfish
2. What is the proximate composition of the complementary food prepared from orange flesh sweet potato and dried catfish

### **Materials and Methods**

The study was carried out in Ijebu-Ode Local Government Area, Ogun State, Nigeria using experimental research design. The population consisted nursing mothers who pay preliminary visits to four (4) out of the six (6) Primary Health Centres (PHC) within the study area, namely; Olisa Primary Health Centre, Ita-Alapo Primary Health Centre, Apebi Primary Health Centre and Iloti Primary Health Centre.

### **Sample Collection and Preparation**

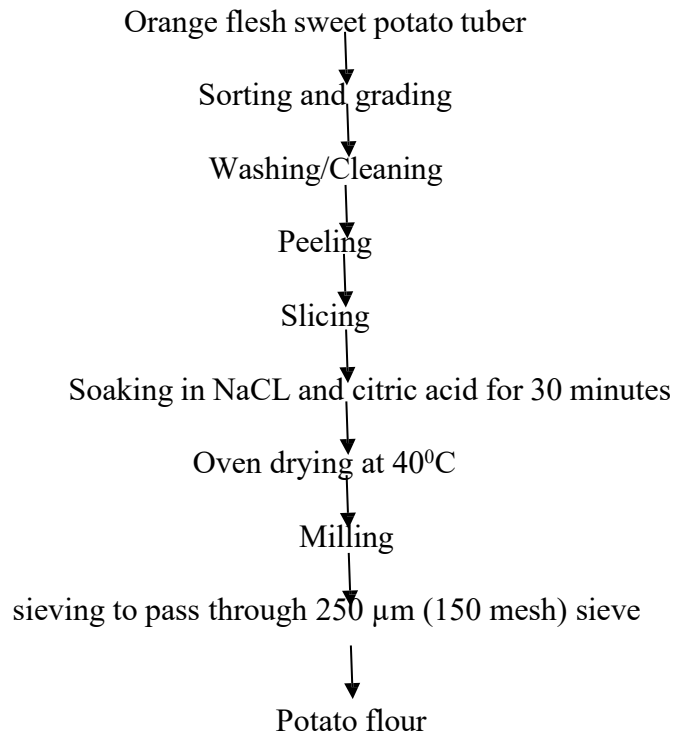
OFSPs were ordered from a farm in Port Harcourt, Rivers State, while CAF were purchased from Oke-Aje market in Ijebu-Ode, Ogun State, Nigeria.

### **Processing of orange-fleshed sweet potato flour**

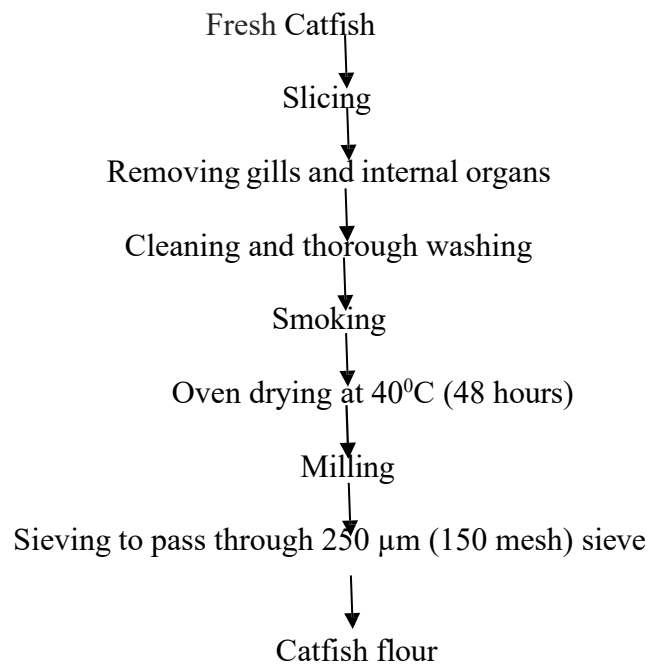
The sweet potato flour was produced using the method described by Singh *et al.*, (2008), modified by Igbabul, (2014). The OFSP tubers (20g) were sorted, peeled and sliced into thin pieces manually. The potato slices were then first immersed in 1% NaCl solution and in a solution containing potassium metabisulphite (1%) and citric acid (0.5%) for 30 min to prevent browning reactions and enhance the colour of the flour. They were thereafter dried in the hot air oven at 40°C for 48 hours milled using the hammer milled and sieved into fine flour using 250 µm (150 mesh). The weight of the chipped OFSP before drying was 18kg, after processing into flour, it weighed 10kg. The flour was packed into a high-density polyethylene bag and stored in a cool dry room temperature ready for formulation, gruel preparation and analyses.

### **Processing of Catfish flour**

Fresh catfishes weighing 20kg were produced into flour using modified Bakare et al; (2020). They were sliced, cleaned, washed, gills and internal organs removed, cleaned and washed thoroughly, smoked and dried in the hot air oven at 40°C for 48 hours. The dried catfish was then milled and sieved into fine flour using 250 µm (150 mesh). After processing into flour, it weighed 11kg, which was packed into a high-density polyethylene bag and stored in a cool dry room temperature ready for formulation and analysis. Hot air oven drying was used being the most acceptable method of drying agricultural products. According to Ogunlakin *et al* (2020), oven drying methods have better effect on nutritional and functional properties of food items than direct sun drying method. This process was carried out at JaaGee Laboratory Ibadan, Oyo State, Nigeria.



**Figure 1:** Flow chart for production of orange fleshed sweet potato flour. Source: Modified Singh *et al.*, (2008) by Igbabul *et al.*; (2014)



**Figure 2:** Flowchart for production of catfish flour. Modified from Bakare *et.al*, 2020)

#### Preparation of the gruel

According to World Food Programme (WFP) (2018) on standard for production of complementary food; 70g of orange-fleshed sweet potato flour and 30g of dried catfish flour was cooked with 250ml of water as sample A. 60g of orange-fleshed sweet potato and 40g of

dried catfish flour was cooked with 250ml of water as sample B. 50g of orange-fleshed sweet potato and 50g of dried catfish flour was cooked with 250ml of water as sample C and 100g of the weaning mix in form of custard was mixed together with 250ml of water also as the control Sample D. (Table 1)

**Table 1: Formulation ratios of the Complementary Food**

| <b>SAMPLES</b> | <b>OFSP</b> | <b>CBC</b> | <b>CATFISH</b> | <b>WATER</b> |
|----------------|-------------|------------|----------------|--------------|
| Sample A       | 70g         | 0g         | 30g            | 250ml        |
| Sample B       | 60g         | 0g         | 40g            | 250ml        |
| Sample C       | 50g         | 0g         | 50g            | 250ml        |
| Sample D       | 0g          | 100g       | 0g             | 250ml        |

**Key:** **OFSP:** Orange-Fleshed Sweet Potato  
**CBC:** Cereal based Custard

### Data analyses

#### Proximate analyses of the samples

Moisture (AOAC method 950.46B), ash (AOAC method 920.153), crude protein (AOAC method 955.04) contents were determined according to Association of Official Analytical Chemists procedures (AOAC 2012). Carbohydrate levels were calculated by the equation: % carbohydrates = 100% - (% moisture + % protein + % ash + % lipid), while energy values were estimated using the formula: energy value (kcal/100g) = 4 × protein (%) + 9 × lipid (%) + 4 × carbohydrate (%). Crude fiber content of flour was determined by trichloroacetic acid.

#### Preparation of Gruel

For each of the samples, 200g of each of the composite flour was dissolved in 50 ml of water (at room temperature) to form a slurry. Nine hundred (900) ml of boiling water was added to the slurry and stirred until it gels. The samples were allowed to cool to 40°C for sensory evaluation

#### Sensory evaluation

Sensory attributes of the gruels was carried out using fifty (50) un-trained panellists consisting mothers of infant and young children who pay preliminary visits to Primary Health Centres (PHC) within the study area. They were randomly selected from four (4) out of the six (6) PHCs, their consent was sought prior to participation in the sensory evaluation process. Prior to commencement of the exercise, respondents were trained to rinse their mouths after tasting each sample of the complementary food to avoid overlapping effect on taste. The respondents rated their preference for color, taste, texture, flavor, appearance, consistency and overall acceptability of gruels from the 16 experimental samples using the standardized 9 point hedonic scale that ranged from; 1 = disliked extremely to 9 = liked extremely. The gruels of CF formulated with OFSP and catfish and, the conventional cereal based custard were prepared in the presence of the respondents at each of the health centres. The study was conducted in a designated room, they were seated a distance away from each other and were asked not to communicate with each other during evaluation process. The Samples were coded as samples A-D and were served in a random order. Each respondent received 500mls of sachet of water to rinse her mouth following tasting of each sample.

### Sensory analysis of the different composites

The data was subjected to analysis of variance (ANOVA) using the IBM SPSS statistics version 23 and the differences between significant mean values were separated at ( $P \leq 0.05$ ) probability level using Duncan Multiple Range Test.

### Ethical Consideration

Ethical approval was sought from the Research Committee of the Directorate of Education, Research and External Relations (DEER) of Tai Solarin University of Education. Permission was also obtained from the authorities in charge of the Ogun State General Hospital, Ijebu-Ode, and also the heads of the PHCs to involve the mothers attending the postnatal clinic in the study. Also consent of the mothers were sought after explaining the objectives of the study to them, and none of the respondents was forced to participate in the study as this was in accordance with the Helsinki declaration.

## RESULTS

**Table 2: Sensory attributes of gruel prepared from different composites of orange fleshed sweet potato and catfish four; and cereal based custard**

| Sample | Aroma                        | Colour                 | Taste                  | Texture                | Appearance             | Consistency            | Overall Acceptability  |
|--------|------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| A      | 8.67±0.80 <sup>a</sup>       | 8.39±0.80 <sup>a</sup> | 8.31±0.90 <sup>a</sup> | 8.22±0.72 <sup>a</sup> | 8.34±0.75 <sup>a</sup> | 8.30±0.78 <sup>a</sup> | 8.35±0.87 <sup>a</sup> |
| B      | <b>8.64±0.61<sup>a</sup></b> | 8.38±1.05 <sup>a</sup> | 8.40±0.79 <sup>a</sup> | 8.47±0.67 <sup>a</sup> | 8.38±0.73 <sup>a</sup> | 8.35±0.75 <sup>a</sup> | 8.52±0.72 <sup>a</sup> |
| C      | 8.57±0.74 <sup>a</sup>       | 8.34±0.72 <sup>a</sup> | 8.18±0.72 <sup>a</sup> | 8.21±0.74 <sup>a</sup> | 8.24±0.71 <sup>a</sup> | 8.12±0.71 <sup>a</sup> | 8.23±0.88 <sup>a</sup> |
| D      | 8.01±1.55 <sup>a</sup>       | 7.84±1.63 <sup>a</sup> | 6.83±2.03 <sup>b</sup> | 6.84±2.03 <sup>b</sup> | 6.82±2.01 <sup>b</sup> | 6.63±2.05 <sup>b</sup> | 6.75±2.26 <sup>b</sup> |

Values are means of 180 respondents. Mean values in the same row with different superscripts are significantly different ( $p > 0.05$ ).

A: Gruel made from composite flour of 70g OFSP and 30g catfish

B: Gruel made from composite flour of 60g OFSP and 40g catfish

C: Gruel made from composite flour of 50g OFSP & 50g catfish D:

Gruel made from 100g CBC

OFSP: Orange fleshed sweet potato, CBC: Cereal based custard

Sensory analyses of the gruel of the CF formulated using different composites of OFSP and catfish and CBC are described in Table 2. Finding showed that sample B is the best in terms of overall acceptability (8.52±0.72<sup>a</sup>). Sample D is the least accepted of all the samples (6.75±2.26<sup>b</sup>).

**Table 3: Proximate analyses of different flour composite of orange fleshed sweet potato and catfish four, and cereal based custard in %/100g**

| Sample | Moisture                | Protein                 | Fat                    | Fiber                   | Ash                    | Carbohydrate            |
|--------|-------------------------|-------------------------|------------------------|-------------------------|------------------------|-------------------------|
| A      | 65.43±0.25 <sup>c</sup> | 6.85±0.08 <sup>c</sup>  | 1.42±0.04 <sup>b</sup> | 0.36±0.12 <sup>a</sup>  | 1.93±0.03 <sup>b</sup> | 24.01±0.14 <sup>b</sup> |
| B      | 67.58±0.28 <sup>b</sup> | 9.62±0.06 <sup>b</sup>  | 1.51±0.04 <sup>b</sup> | 0.37±0.03 <sup>a</sup>  | 1.75±0.06 <sup>c</sup> | 19.17±0.24 <sup>c</sup> |
| C      | 68.98±0.13 <sup>a</sup> | 11.15±0.13 <sup>a</sup> | 2.59±0.08 <sup>a</sup> | 0.17±0.03 <sup>b</sup>  | 2.10±0.10 <sup>a</sup> | 15.00±0.19 <sup>d</sup> |
| D      | 62.25±0.25 <sup>d</sup> | 0.60±0.20 <sup>d</sup>  | 0.50±0.10 <sup>d</sup> | 0.30±0.10 <sup>ab</sup> | 1.40±0.10 <sup>d</sup> | 34.95±0.55 <sup>a</sup> |

Values are means of triplicate determination. Mean values in the same row with different superscripts are significantly different ( $p>0.05$ ).

A: 70g OFSP with 30g Catfish;

B: 60G OFSP with 40g Catfish;

C: 50g OFSP with 50g Catfish;

D: 100g CBC.

Where OFSP: Orange fleshed sweet potato,

CBC: Cereal based custard.

Table 3 described the result of the proximate analyses. Findings revealed that protein content is higher ( $11.15\pm 0.13^a$ ) in Sample A, while Sample D had the lowest protein ( $0.60 \pm 0.2^d$ ) content. Sample C had the highest ash content ( $2.12 \pm 0.06^a$ ) when compared with other samples. The different values on the superscript for moisture content, shows a significant difference in the moisture content of all the samples ( $p>0.05$ ).

## DISCUSSION OF FINDINGS

The need to formulate CF using OFSP and catfish, to account for improved nutritional status of infant and young children, by feeding them with CF prepared using locally available food materials become evident in the nutritional value of OFSP and catfish as against the usual cereal based CF. From the findings of the study, the CF formulated with 50:50 orange-fleshed sweet potato and dried catfish (Sample C) had the highest protein, moisture, fat, and ash content, while Sample A (70:30) has the highest carbohydrate and fibre content. This corroborates findings from the studies of Esan, *et al.*, (2014), Tobor (2018), Kent (2018), Takalata, *et al.*, (2018) and Woolf (2020). In Esan, *et al.*, (2014), it was reported that the addition of sweet potato and date palm fruits can be relied upon to provide the recommended iron intakes, specifically for the infants. The 60:40 (Sample B) formulations was of the best texture, appearance and taste, but the one with 70:30 was most preferred in terms of colour and aroma. Furthermore, it was found out from the study that sample B was the best in terms of overall acceptability ( $8.52\pm 0.72^a$ ) followed by Samples A and then, C. This is in line with a study conducted by Pillay, (2019), and Talukder, *et al.*; (2019) at Uganda, it was found that weaning food made from OFSP was more acceptable to children and mothers than the traditional maize weaning porridge, Ugandan farmers found a definite preference for OFSP based complementary foods over others. In this study, there was a significant difference between the acceptability of cereal-based custard; and complementary food prepared with orange fleshed sweet potato and dried catfish. Furthermore, result showed that the complementary food formulated with 70% orange fleshed sweet potato and 30% dried catfish are most preferred for their colour and aroma while that formulated from 60% orange fleshed sweet potato and 40% dried catfish has the highest score for consistency. The sensory evaluation of samples of formulated CF prepared by Esan, *et al.*: (2014) showed that the composites with the highest percentage of sweet potatoes were rated highest for taste, colour, texture and overall acceptability. There was no significant difference between the sensory attributes of Samples A to D, while a significant difference ( $p>0.05$ ) existed between the

sensory evaluation of Cereal Based custard; and complementary food formulated from orange fleshed sweet potato with dried catfish. There is no significant difference in the acceptability of complementary foods formulated from orange fleshed sweet potato with dried catfish, while a significant difference existed between the acceptability of CBC and complementary food formulated from OFSP with dried cat. The proximate analysis revealed that Sample C has the highest ash content and mineral content. According to Wheatley, et al., (2018) mineral plays critical roles in the lives of infants and young children. It also has the highest protein content and this is similar to the study conducted by Nantudu and Howell (2019). The high fiber content of sample B could be attributed to the quantity of orange fleshed potato flour used, fibre would help in easy digestion in infants (Gordon, 2019), and also add bulk to food, thus facilitating bowel movement (peristalsis). Increasing Dietary fiber increases stool bulk, causes flatulence and decreases appetite (Abeshua et al., (2016), Rolfe et al., (2018) There is no significant difference in the moisture and ash content of the CF prepared with the composite of OFSP and dried catfish and CBC.

### **CONCLUSION**

Complementary food formulated from orange fleshed sweet potato and dried catfish have high nutritional quality (with high protein, moisture, fibre, fat, and ash content), and the sensory attributes (texture, appearance, taste, consistency, colour and aroma) were acceptable to the respondents.

**RECOMMENDATIONS:** It is therefore recommended that awareness on preparing CF using OFSP and catfish should be created among nursing mothers. Furthermore, nutrition education highlighting the nutrition quality of orange fleshed sweet potato and catfish is encouraged to be delivered to nursing mothers at the primary health centres, social media and the likes. It is equally suggested that Government grants loans to farmers to encourage cultivation of orange fleshed sweet potato and catfish.

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