

## Sensory evaluation of complementary foods based on cooking banana (*Musa sapientum*) and African yam bean (*Sphenostylis stenocarpa*).

## Evaluación sensorial de alimentos complementarios a base de plátano de cocción (*Musa sapientum*) y frijol africano (*Sphenostylis stenocarpa*).

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### ABSTRACT

This study evaluated the sensory properties of infant complementary food based on cooking banana (CB) (*Musa sapientum*) and African yam bean (AYB) (*Sphenostylis stenocarpa*). These raw materials were purchased from a local market in Umuahia North Local Government Area, Abia State. The legumes were picked and washed, boiled for 25 minutes and dehulled while cooking banana was washed, peeled, washed with warm water and sliced to 2mm thickness. The samples were separated dried, milled and sifted into fine flour with muslin cloth. The flours were blended to composites in various proportions (80:20, 60:40 and 40:60) the organoleptic attributes of these porridges were evaluated by 20 mothers. The sensory assessment showed that the formulated porridges had moderate acceptability. This could be because the judges were not familiar with these porridges. The

result was compared with "nutrend" (NuD) (a complementary food in the market produced by Nestle Foods Nigeria) and pap (PpE) (maize traditional complementary food).

*Keywords: Musa sapientum, Sphenostylis stenocarpa, food, nutrition.*

## RESUMEN

Este estudio evaluó las propiedades sensoriales de los alimentos complementarios para lactantes basados en el banano para cocinar (CB) (*Musa sapientum*) y el frijol africano (AYB) (*Sphenostylis stenocarpa*). Estas materias primas se compraron en un mercado local en el área del gobierno local de Umuahia North, estado de Abia. Las leguminosas se recogieron y se lavaron, se hirvieron durante 25 minutos y se descascarillaron mientras se lavaba, se pelaba, se lavaba con agua tibia y se cortaba a 2 mm de espesor. Las muestras se separaron secas, molidas y tamizadas en harina fina con tela de muselina. Las harinas se mezclaron con compuestos en diversas proporciones (80:20, 60:40 y 40:60). Los atributos organolépticos de estas papillas fueron evaluados por 20 madres. La evaluación sensorial mostró que las papillas formuladas tenían una aceptabilidad moderada. Esto podría deberse a que los jueces no estaban familiarizados con estas papillas. El resultado se comparó con "nutrend" (NuD) (un alimento complementario en el mercado producido por Nestlé Foods Nigeria) y pap (PpE) (alimento complementario tradicional de maíz).

*Palabras clave: Musa sapientum, Sphenostylis stenocarpa, alimentación, nutrición.*

## INTRODUCTION

Appropriate feeding practices are fundamental to survival, growth, development, health and nutrition of infants and children and to the well-being of the mothers (Katepa-Bwalya *et al.*, 2015). Most complementary foods marketed in developing countries are produced by roller drying or extrusion cooking. These are capital intensive technologies, and the foods produced have large dietary bulk that limits children's nutrient intake (Wakil and Onilude, 2009). It is therefore desirable to develop low-cost weaning foods from locally available resources adapting simple technologies, so that the foods can be produced by mothers, community, workers or government agencies and supplied at affordable price.

Several strategies may be used to improve the nutritive value of complementary foods. The traditional West African complementary foods could be improved by combining locally available foods that complement each other in such a way that the new pattern of amino acids created by this combination is similar to those recommended for infants (Uvere and Ene-Obong, 2013:). Many researches have been done on cereal/legume combination. Some of these combinations have been adopted in the food industries and the foods are available in the market (Matusso *et al.*, 2012; Satusap *et al.*, 2014; Patil, *et al.*, 2016).

At six (6) months, breast or infant milk would not satisfy all the baby's nutritional needs. It is important from development point of view to start giving other foods (Binmore *et al.*, 2006). In 2001, WHO issued a revised global recommendation that mothers should continue breastfeeding exclusively for six months. This recommendation is likely to influence national policies on the recommended age for first introduction of solids.

Globally, cooking bananas take fourth after rice, wheat and maize in human consumption. They are grown in 130 countries worldwide, more than any other fruit crop (International Institute of Tropical Agriculture (IITA), 2017). The banana is of great nutritional value. It has a rare combination of energy value, tissue building elements, protein, vitamins and minerals. It contains a large amount of easily assailable sugar, making it a good source of quick energy for excellent recovery from fatigue (The city kids' foundation (CKF) 2016). Bananas are high energy foods that are easily digested. They are rich source of vitamin A, vitamin B and C, potassium, magnesium and iodine (IFM, 2004; Appleby, 2017; IITA, 2017)

The under exploited legumes include African yam bean (*Sphenostylis stenocarpa*), bambara groundnut (*vigna subtenanean*) and pigeon pea (*Cajanus cajan*). African yam bean is grown primarily for its only seed, which is a nutritious pulse (Klu, *et al.*, 2005). There is relatively little information about the composition of African yam bean products. The seeds are rich in protein with relatively low fibre content. The protein is particularly rich in lysine, a value higher than that of soya bean (Heuze and Tran, 2016). Dockweiler (2017) suggested that if yam bean could be the important source of protein needed by the people of sub-saharan Africa. In Nigeria the usual first complementary food is called pap, "akamu, oji orkoko" and is made from maize (*zea mays*), millet (*penniestum americanum*), or guinea corn (unu.edu, 2017).

Some authors observed that in certain communities the low income families do not make a special effort to prepare complementary foods for infants, who are fed modified or unmodified foods from the family pot (Nnakwe, 2017; unu.edu, 2017). People from low-income groups seldom feed meat, eggs, or fish to their infants, because of socio-economic factors, taboos, and ignorant (O'Donnell, 2015; unu.edu, 2017).

The economic situation in Nigeria has equally made it difficult for a lot of households to afford animal sources. In order therefore, to prevent protein energy malnutrition, availability of cheaper plant protein sources such as pulses and legumes need to be harnessed for appropriate infant feeding (Amao, 2013). There is a good potential for improving the diet of infants (complementary foods) and thereby improving the child's nutritional status, through the incorporation of cooking banana and African yam bean in the diet (Adebayo and Ibraheem, 2015).

Meat, fish, milk and eggs contain good quality protein but often they are unaffordable because of their high prices (Amao, 2013). Also, commercial complementary foods are equally expensive and unaffordable to many families. It is therefore necessary to find a substitute hence, the need for formulation of complementary food using cooking banana and African yam bean (Adebayo and Ibraheem, 2015). These pulses and legumes are locally available, easily accessible and inexpensive. Mothers will be able to prepare these foods in their homes.

However this work formulated low-cost and accessible complementary food using cooking banana and African yam bean and evaluated the developed complementary food using organoleptic methods.

## MATERIALS AND METHODS

Cooking banana (*unere nkpunkpu/musa spp*) used was slightly ripped with African yam bean (*Odudu/akidi/sphenostylis stenocarpa*). These legumes were purchased from a local market while cooking banana was cut from the farm.

One big head of cooking banana (slightly ripe) was washed, peeled, washed with warm water, 2350g was sliced to 2mm, dried, milled and finely sifted with muslin cloth. One thousand grammes (1000g) of whole grain of African yam bean (white spp) were picked,

washed, boiled for 25 minutes, dehulled, dried, roasted, milled and finely sifted into flour with muslin cloth.

The complementary foods were formulated by weighing the samples, using a sensitive scale (Sartorius digital weighing balance). The flours were blended in these ratios. Cooking banana + African yam bean = 80:20 (CAA), 60:40 (CAB) and 40:60 (CAC) where Nutrend (NuD) (a Nestlé complementary food product) - 100% and Pap (PpE) (flour) - 100%

Proportions were prepared from composite flours as well as the controls. One hundred grammes of each flour blends mixed with 500ml water. The slurry was heated with continuous stirring at 75°C and allowed to boil for 10 minutes with constraint heating. The gruel was allowed to cool at room temperature to 40°C (serving temperature). The samples were kept separately in thermos flasks to maintain the serving temperature of 40°C chemical Analysis.

Twenty mothers were randomly selected from the mother and child health clinic of the Umuahia North Local Government for sensory evaluation. The porridges were coded and 200ml of each was presented to the judges from a thermos flasks. The attributes evaluated were colour, taste, texture and overall acceptability on a 7 – hedonic scale of:

1. Dislike extremely,
2. Dislike moderately
3. Dislike,
4. Undecided
5. Like,
6. Like moderately
7. Like extremely. Were, nutrient a complementary food formulated by Nestlé foods and maize gruel (*pap/ogi*) were used as positive and negative controls, respectively.

Means and standard deviation were calculated for variables. Analysis of variance and Duncan New multiple Range Test (DNMRT) were used to separate and compare means of the various proportions (mixes).

## RESULTS AND DISCUSSION

Table 1 depicts the organoleptic attributes of porridges based on blends of cooking banana and African yam bean flours in their different proportions or mixes. The pap colour had highest score (5.15). However, the value was similar ( $P>0.05$ ) to the NuD, the CAB and the CAA and deferred ( $P<0.05$ ) from the CAC porridge. The colour was much more preferred to the other samples. Nutrend (NuD) had highest taste (5.35) ( $P<0.05$ ) followed by the PpE (5.15) and the CAA (4.90). These values for taste deferred from ( $P<0.05$ ) those of the BBB and the CAC porridges. The texture and overall acceptability of all the samples were significantly different ( $P<0.05$ ) from each other. The preference to pap colour could be attributed to mothers' familiarity to PpE also the PpE (pap) retained its colour after drying (Osueke and Iwu, 2003; Afolayan *et al.* 2010; Adeoye-Agomoh and Ezenwa, 2015). The highest taste for the NuD (Nutrend) could also be attributed to its enhanced flavor and mothers' familiarity as was earlier observed (Chikwendu and Obizoba, 2003; Adeoye-Agomoh and Ezenwa, 2015).

The CAA and CAB textures (Table 1) were acceptable to the mothers as the AYB could be used in least gelation concentration (Aremu *et al.*, 2007). Overall acceptability had similar scores which indicated that this new complementary foods are acceptable and could be adopted (Adeoye-Agomoh and Ezenwa, 2015).

The higher colour and taste of Nutrend and PAP (4.90, 5.15 and 5.35 and 5.15) were much more preferred to other products by the judges. This could be due to off colour and taste imparted by cooking banana. On the other hand, the similarities in both colour and taste of the CAA and CAB (3.90, 3.90 and 4.90) blends (Table 1) suggest that more than 50% of the judges accepted the two attributes.

The similarities of texture and overall acceptability of both nutrend and blends demonstrated general acceptability of the products. However, the preference by the mothers for colour of the Pap over the blends could likely be that they have been familiar with it (Elkalifa and Bernhardt, 2010). The taste preference of the nutrend over the other blends could be attributed to its enhanced flavor as an existing commercially prepared complementary food (Adeoye-Agomoh and Ezenwa, 2015). The scores of all the porridges showed that mothers accepted the texture of the blends. The porridges were cooked starch granules break open and water. They then swell, making the gruel (Aremu *et al.*,

2007).further interaction of amylose, amylopectin and starch granules led to gelatinization of the gruel.

Table 1. Sensory characteristics of porridges based on blends of cooking banana, African yam beans and controls (nutrend and pap/*akamu/Ogi*) flours.

Sample	Colour	Taste	Texture	Overall Acceptability
Nutrend (NuD)	4.90 <sup>a</sup> ±1.89	5.35 <sup>a</sup> ±1.63	4.80 <sup>a</sup> ±1.67	5.25 <sup>a</sup> ±1.60
Pap/Ogi (PpE)	5.15 <sup>a</sup> ±1.39	5.15 <sup>a</sup> ±1.39	4.80 <sup>a</sup> ±1.44	5.50 <sup>a</sup> ±1.15
CAA	3.90 <sup>b</sup> ±2.10	4.90 <sup>a</sup> ±1.25	5.45 <sup>a</sup> ±1.05	5.55 <sup>a</sup> ±1.39
CAB	3.90 <sup>b</sup> ±1.83	4.10 <sup>b</sup> ±1.74	4.65 <sup>a</sup> ±1.50	5.15 <sup>a</sup> ±1.69
CAC	3.65 <sup>b</sup> ±2.16	3.90 <sup>b</sup> ±1.62	5.05 <sup>a</sup> ±1.43	4.70 <sup>a</sup> ±1.95
LSD	1.1878	0.9645	0.8985	0.9914

\**abc* means with similar superscript letters in the same column were not different ( $P>0.05$ )

Scores were based on a 7 – point hedonic scale.

Sample	Overall Acceptability
Nutrend (NuD)	5.25 <sup>a</sup> ±1.60
Pap/Ogi (PpE)	5.50 <sup>a</sup> ±1.15
CAA	5.55 <sup>a</sup> ±1.39
CAB	5.15 <sup>a</sup> ±1.69
CAC	4.70 <sup>a</sup> ±1.95

The similar ( $P>0.05$ ) scores in overall acceptability might be due to the desirable taste and texture of the porridges (Addo and Akeredolu, 2005; Adeoye-Agomoh and Ezenwa, 2015). Comparable ( $P>0.05$ ) acceptability of the porridges by the mothers showed that they would be acceptable by infants and young children in place of the traditional maize complementary food (Pap) and the expensive commercially prepared complementary food (nutrend).

The porridges based on these blends were moderately accepted as well as the Nutrend (commercial complementary food) and the pap (corn gruel). All the blends (CAA,

CAB and CAC) were most organoleptically accepted. This shows that these blends are most likely to be accepted by consumers which should be promoted. Cooking banana and African yam bean therefore seem to be good raw materials for the production of complementary foods.

Based on the findings of this study, the following recommendations were made: 1) Other starchy foods and legumes need to be investigated to diversify their food uses and reduce the gap of micro nutrients; 2) Nutrition education is imperative to achieve these goals; 3) It is imperative to employ other processing techniques to improve nutritional quality of complementary foods based on starchy fruit and legume foods; 4) The cooking banana: African yam bean should be recommended for more and colour taste enhancement.

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