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Evaluation and Chemical Analysis of Weaning Food Produced from Composite Flour of Millet and Cowpea

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Abstract

The study investigated the possibility of preparing weaning food using millet and cowpea flour and other blends such as sugar, salt, flavor and crayfish. Specifically, it generated baseline data on the sensory, nutritive and viscosity properties of the weaning foods. Millet, cowpea grains and other blends were processed into flour and formulated into different proportions (70:20:10), (60:30:10), (45:45: 10), (30:60:10), and (20:70:10) respectively. The nutritive composition of the flour from the blends as well as viscosity and sensory properties of the weaning foods were evaluated using standard methods. At ($P \leq 0.05$) the millet-cowpea foods had significantly high protein (14.10-19. 50%), moisture (7.0-7.60%), fat (4.20- 6.42%) and ash (1.10- 1.40%) while carbohydrate content decreases from (60.01-57.30%). There were no significant differences in appearance, flavor, texture and colors ($p \geq 0.05$). There were significant differences at ($P \leq 0.05$) in taste and general acceptability. This shows that Sample ZA with a mean value of 3.9 for taste and general acceptability is generally good to be used as weaning food if the technology is adopted.

Key words: Millet, cowpea, sensory evaluation, weaning food, viscosity and chemical composition.

Introduction

The issues in nutritional development in Nigeria as it relates to baby diet are of great importance to the growth and development of every child. Weaning is the gradual introduction of foods other than breast milk in the baby diet. The foods are solely introduced to complement breast milk, progressively replace it and eventually adopt the child to adult diets (Walkers, 1990). Weaning foods according to

Muhimbula, Zacharia and kimbo (2011) are generally introduced between ages of six months to three years where the breast feeding itself no longer meets the increasing nutritional requirement of the child.

Breast milk which is the baby's first food is inadequate to maintain the rapid growth and development of the baby after six months. Poor feeding practices as well as lack of suitable complementary foods are responsible for under nutrition with poverty exacerbating the whole issue (Opera ,Uchechukwu , Omadamino and Paul, 2012). The need to introduce appropriate weaning foods to child which will supply the additional safe sources of energy and protein is to complement the breast milk and fully aid the growth and development of the child. Failure to feed the baby with appropriate food could lead to malnutrition, a problem that is common with most children in developing countries of the world of which Nigeria is one (WHO ,2010).

The widely used traditional weaning food in Nigeria is cereal gruel from corn called "Kunu" (Hausa), "Ogi" (Yoruba) "Akamu" (Igbo). This cereal gruel, usually prepared from corn, as well as most cereal grains like sorghum and millet, will not support growth and development of the child if taken alone due to the fact that the quality of protein in corn is very poor. According to Mahimbula *et al*. (2012), cereal-based gruels are generally low in protein and are limiting in some essential amino acids, particularly lysine and tryptophan are inadequate to support proper growth and development of the child if consumed alone. Munasinghe, Silver, Rasika, Jayarathne and Saranda (2013) suggested that, for the production of adequate and complete weaning foods that are of complete essentials amino acid, a combination of blends of cereals, legumes and animal proteins are essentials.

Onuorah and Akinjide (2004) asserted that the consequences of weaning babies on food mainly low in carbohydrate in nature can be disastrous. Kwashiorkor, stunted growth, retarded mental development and low resistance to infection are some of the outcomes of weaning children on starchy foods.

WHO (2010) stated that malnutrition is the gravest single threat to global public health as it exist if the person has a poor diet that gives them the wrong balance of basic food groups and this is associated with prolonged consumption of food with poor nutritional value. Weaning foods according to Walker (1990) are foods that are given to babies when they are still being breast feed but the milk is not enough to maintain the nutritional and physiological needs of the babies. These foods are first given as gruels and then progressively given to the infant in some solid consistency.

Ghasemzadeh and Ghavidet(2011) identified characteristic of such foods as to have a soft texture with fibre content, low hot paste viscosity, be safe for consumption and show food storage properties. Deshpande and Poshadri (2011) mentioned that food

to be used as weaning foods should contain the baby's entire nutritional requirement at the right proportion and should be cheap for the masses to afford. Formulation of weaning foods according to Ahima (2011) should be easily accessible from local market at low cost and use frequently in most household. Two ingredients that can be used to formulate the simplest weaning food for babies according to Ahima (2011) are cereals with legumes in a ratio of 1:3 parts among other blends.

Ihekorenye and Hyoddy (1995) identified pearl millet to be higher in protein than most cereals. Typical analytical figure for millet grains shows a protein content 9-10, fat content 3-4.5, fiber content 2, carbohydrates content 75-85, ash content 1-2, and food energy values of 414 calories. Cowpea and millet is another indigenous food commodity in Africa consumed in various form in different African countries.

Ossai and Malamo (1999) sensory evaluation of formulated weaning food from germinated grains found out that the mothers used for the study dislike the germinated over the ungerminated product.Many food processors and researchers are searching for ways of minimizing the poor nutritional effect of feeding babies, especially those over six months of age. Food based approaches used in combination with nutrition education programmes can be used as a strategy to overcome the nutritive deficiencies. One of such strategy according to Martin, Lawal and Kulwa (2010) is the blending of Legumes with cereals or fortification of legumes into solely cereal-based diets and other blends. Improved processed foods for this reason, commercially processed foods such as cereal, babeena and nutrends are now available. Unfortunately, these foods are relatively expensive and popularly used by the few high income groups who can afford them (Munasinghe, Silver, Rasika, Jayarathne and Sarander, 2013). Researchers are therefore, looking for ways of complementing the universally accepted local cereals in order to produce weaning foods that would support growth and optimal health at relatively low cost and ease of processing. Locally available legumes and cereals: cowpea and millet can be used due to their high protein and iron and energy content. As these millet-cowpea-crayfish are relatively low cost source of energy, iron and protein. It is for this stated reasons that lead to the production of composite flour from cowpea and millet, crayfish as weaning foods.

This study seeks to augment the effort of previous researchers of similar study like that of Anigo, Ameh, Ibrahim and Dabauchi (2010), Martin, Lawal and Kulwa (2010) and Eshun , Baffour and Ackah(2013). The data obtain from this research can serve as a useful guide for nutritional related professionals and industry during weaning food products formulation.

Objective of this Study

The general objective of this study was to carry out sensory evaluation and chemical analysis of this food produced from composite flour of millet and cowpea

Specifically, the study

1. carried out sensory evaluation of the formulated weaning food made from blends of millet and cowpea with other blends.
2. determined the nutritional value of the formulated weaning foods from millet and in addition with other blends
3. determined the physical characteristic of the formulated weaning food made from millet and cowpea in addition with other blends

Materials and Methods

***Plans of the study*:** The simple recipes for weaning foods were composed of only two major ingredients. Cereal (pea millet) with legumes (cowpeas) mix and this is called basic mix. However, other ingredients must be added to make a complete meal. These include sugar. Salt, flavor and Cray fish of a constant proportion. Based on this principle, the following material and methods were used in the procurement and procedure for the preparation of different composite flours used in the mixture.

***Procurement of materials*:**Peal millet (*Pennisetum nigritarum*), cowpea (*Vigna unguiculata*), granulated sugar and salt, crayfish and food flavor were purchased from Gombe main market, Gombe, Nigeria.

Step by Step Procedure of Processing of Millet Flour: Dust, dirt, chaff and damaged grains were removed from the millet grains by winnowing and hand picking. The millet grain was then washed and soaked in tap water in the ratio 1:3 weight/volume (i.e.1 part of Millet to 3 parts of water) for 10 minutes. The green color of the millet is undesirable and therefore, is greatly reduced by soaking in water .The grains were put into a basket to drain the water and then spread on mat for sun drying at atmospheric temperature of 42^0c for 7hrs and later milled into flour. Local sieve of 0.06 mm in diameter was used (Unohah and Akinjede, 2004) to sieve the flour to obtain a finer particular size.

***Step by Step Procedure of Processing of Cowpea Flour*:** Cowpea grain (*Vigna unguicalata*) was sorted to get rid of foreign matter and damaged grains. The grains were washed and then soaked in tap water 3 times it weight by volume for 20 minutes and then drained off. Dehulling was carried out after soaking in a mortar and pestle then washed with water to remove the skin. The grains were then pre-cooked in water at ratio 1:3 w/v for 30 minutes using moderate heat Pre-cooking helps in destroying the anti-nutritional factors present in peas. Sun drying of the pre-cooked peas was carried out for 48hrs at an average of atmospheric temperature of 43^0c.The cowpea was roasted in a frying pan for 15 minutes until golden brown and then milled. Commercial grinding machine was used for milling. The

flour is then sieved using local sieve to obtain finer flour.

***Formulation of Blends*:** Millet and cowpea flour were mixed with other blends such as sugar, salt flavor and crayfish at different proportions using ZA, FT, EB, PC and FY as represented as follows: **ZA** constitute 70% of millet, 20% of cowpea, 4% of sugar, 1% of salt, 1% of flavor and 4% of crayfish**, (70:20:4:1:1:4); FT** constituted 60% of millet, 30% of cowpea, 4% of sugar, 1% of salt, 1% of flavor and 4% of crayfish, (**60:30:4:1:1:4); EB** constituted 45% of millet, 45% of cowpea, 4% of sugar, 1% of salt, 1% of flavor and 4% of crayfish, **(45:45:4:1:1:4); PC** constituted 30% of millet, 60% of cowpea, 4% of sugar, 1% of salt ,1% of flavor and 4% of crayfish**, (30:60:4:1:1:4); LY** constituted 20% of millet, 70% of cowpea, 4% of sugar, 1% of salt, 1% of flavor and 4% of crayfish**, (20:70:4:1:1:4).**

Table 01: Formation for the Weaning Foods

Ingredients	Samples code				
	ZA	FT	EB	PC	LY
Millet	70	60	45	30	20
Cowpea	20	30	45	60	70
Sugar	4	4	4	4	4
Salt	1	1	1	1	1
Flavor	1	1	1	1	1
Crayfish	4	4	4	4	4

Key: **ZA**= 70% millet, 20% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish**. FT**= 60% millet, 30% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish**=** 45% millet, 45% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish. **PC=**30% millet, 60%cowpea, 4% sugar, 1% salt ,1% flavor and 4% crayfish**.LY**= 20% millet,70% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish**.**

***Determination of Sensory Properties*:**Ten (10) member panel consisting of students and staff of Home Economics Department in Federal College of Education (Tech) Gombe, Nigeria who were mostly mothers were selected based on their familiarity with weaning foods for the sensory evaluation.

The formulated ZA, FT, EB, PC and ZY blend of millet flour to cowpea flour were prepared in gruels and given to the panelist for sensory evaluation. Tap water was provided to rinse the month between evaluations. The panelists were instructed to evaluate the coded samples for appearance, flavor, texture, color, taste and general acceptability. Each sensory attribute was rated on a 9-point Hedonic scale ranging from excellent (5), very good (4), good (3), fair (2) and poor (1).

Statistical Analysis

Data were analyzed by analysis of variance. The difference between mean values was determined by the

Least Significant Difference (LSD) test. Significance was accepted at 0.05 significant levels.

Results and Discussion

Table 1: Mean Sensory Scores of weaning food produced using varying ratio of millet, cowpea and other blends.

Attributes	**Samples code**				
	ZA 70.20:10	**ET** 60:30:10	**EB** 45.45:10	**PC** 30.60:10	**LY** 20.70:10
Appearance	3.5[a]	4.3[a]	4.3[a]	4.2[a]	3.8[a]
Flavor	3.5[a]	3.3[a]	3.3[a]	3.3[a]	3.2[a]
Texture	3.3[a]	3.4[a]	3.4[a]	3.3[a]	3.2[a]
Color	3.0[a]	3.4[a]	3.4[a]	3.4[a]	3.2[a]
Taste	3.9[ab]	3.3[a]	3.3[a]	3.3[a]	2.5[a]
General acceptability	3.9[ab]	3.3[a]	3.3[a]	3.3[a]	2.3[b]

Key: **ZA**= 70% millet, 20% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish**. FT**= 60% millet, 30% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish. **EB=** 45% millet, 45% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish. **PC=**30% millet, 60%cowpea, 4% sugar, 1% salt ,1% flavor and 4% crayfish**.LY**= 20% millet,70% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish**.**

Table 1 shows that the means in the row with common superscript are not significantly different ($p > 0.05$) scores are based on the 9- points Hedonic scale example, excellent = 5, very good = 4, fair = 2, poor = 1

Table 1 indicates mean sensory scores of the samples. There were no significant differences ($p > 0.05$) between the samples with respect to appearance, flavor, color and texture. With respect to the taste and general acceptability, the sample prepared using 70:20 ratio had scores of 3.9 respectively for taste and general acceptability. Almost all the samples were accepted except sample LY (20:70) with the mean of 2.3 that was not accepted. This shows that Sample ZA was generally accepted to be used a weaning food for infants.

Table 2: Chemical composition of formulated weaning food

Parameter (%)	**ZA** 70:20:10	**ET** 60:30:10	**EB** 45:45:10	**PC** 30:60:10	**LY** 20:70:10
Protein (%)	14.10	14.40	16.20	17.80	19.50
Fat (%)	4.20	4.70	5.10	5.70	6.42
Ash (%)	1.10	1.10	1.20	1.30	1.40
Moisture (%)	7.0	7.10	7.20	7.40	7.6o
Carbohydrate (%)	60.01	59.80	58.30	58.0	57.30

Mean value and standard of two determinations

Key: **ZA**= 70% millet, 20% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish**.** **FT**= 60% millet, 30% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish.**EB=** 45% millet, 45% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish. **PC=**30% millet, 60%cowpea, 4% sugar, 1% salt ,1% flavor and 4% crayfish.**LY**= 20% millet,70% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish**.**

Table 2 presents the chemical composition of the various weaning foods ZA,FT, EB, PC, and LY from the analysis, the protein content of 19.50% , fat of 6.42% and moisture content of 7.0.

Table 3: Viscosity Test Determinants

Sample	Viscosity (cent poise)
ZA (70:20:10)	1050
FT (60:30:10)	910
EB (45: 45:10)	420
PC (30:60:10)	320
LY (20:70:10)	240

Key: **ZA**= 70% millet, 20% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish**.** **FT**= 60% millet, 30% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish.**EB=** 45% millet, 45% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish. **PC=**30% millet, 60%cowpea, 4% sugar, 1% salt ,1% flavor and 4% crayfish.**LY**= 20% millet,70% cowpea, 4% sugar, 1% salt, 1% flavor and 4% crayfish**.**

Table 3 indicates that viscosity increases with increase in millet flour ratio and with increase in cowpea ratio the viscosity decreases. Therefore, the viscosity of ZA has fallen with the range of 1000- 3000 cp which is ideal for weaning food.

Discussion of findings

Sensory scores revealed that the formulated sample ZA which constituted 70% millet and 20% cowpea was generally accepted to be used a weaning food for infants due to an appealing flavor, taste, texture and general acceptability. Similar results were reported by Martin, Lawal and Kulwa (2010) in the study of assessing nutrient content acceptability of soybeans based complementary foods. Chemical composition indicated that protein contents increases with increase in cowpea and carbohydrates contents decrease with decrease in millet. All the five samples presented adequate amount of proteins, fats, and carbohydrates and this is an indicative that they could be used in intervention programmes aimed at alleviating protein–energy malnutrition. This finding is similar to findings of Maha, Eltimay, Islam and Elfadil (2013). However, for the purposes of infant acceptability of the diet based on sensory parameters, sample ZA was preferred. The moisture content of 7.0 is high compare to that of Amankwah,

Banmah, Nuamah, Oldhan, Nraji and Paul (2009) but is adequate in line with the FOA (2003) recommendation. This further shows the blended flour ZA can have a long shelf life time. The calculated protein and carbohydrate contents for ZA is acceptable as recommended (WHO, 2010) .From the analysis, the diet is said to be highly nutritious.

The viscosity increases with increase in millet ratio and decrease in cowpea ratio. Therefore, the viscosity of ZA has fallen with the range of 1000- 3000 cp which is ideal for weaning food. This showed that some starches tend to retrograde more than the other. Millet was shown to have very high amylase activity about ten times higher than cowpeas (Filli, Jideani, & Abubakar, 2012). This was probably responsible for increased viscosity observed. This increased in viscosity is to enhance better flow of food in the throat of infants.

Conclusion

The study demonstrated the production of composite flour from millet and cowpea for weaning food preparation. Sensory evaluation indicated that all samples showed no significant differences in appearance, color, flavor and texture. Sample ZA (70%: 20 %,) millet and cowpea flour shows a significant difference in taste and general acceptability and were most acceptable and preferred to the panelist. The chemical analysis of ZA (70%: 20 %,) millet: cowpea shows that food improves the protein contents and gives higher overall energy value. The physical characteristics of the blends especially the viscosity indicates that gruel prepared from ZA yields higher and more acceptable viscosity. The result obtained in this study equally showed that the potentials existed for blends of ZA (70:20:10) and is a sources of income generation for the populace and a good weaning food for infants if the technology is adopted and improved.

Recommendations

The following recommendations were made based on the findings of the study.

1. Further studies should be done on the formulated blends to determine its keeping quality.
2. Microbial analysis should be carried out to show if the formulations were microbial safe for consumption.
3. Government at all level should fund the agricultural sector to develop varieties of millet and cowpea that would adapt to the climate of various geographical areas in Nigeria.

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