JHER Vol. 27 No. 1 September 2020, pp. 47- 57

Proximate Analysis of Infant Complementary Food from Composite Flour of Corn, Groundnut and Soybean

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Abstract

This study analysed the proximate composition of the food of complementary weaning food developed from corn (Zea May L.), soyabean (Glycine max) and groundnut (Arachishypogaea). Specifically, the study determined the proximate composition of the gruel made from composite flours and the sensory characteristics of the sets of porridges. It was an experimental research. The raw materials were processed into flours using different methods. The flours were blended in ration to form composite flour which was used to prepare samples of gruel for infant complementary foods. The proximate compositions of the blends were analysed. Different flours of corn, groundnut and soya bean were blended in ration of 70:20:10.Sensory evaluation was carried out on the samples to determine the characteristics. The findings indicated adequate levels of moisture, protein, fat, ash, crude fibre, and carbohydrate and energy values. All the formulated complementary blended flour had high protein content. There were high levels of acceptability with no significant difference in the sensory characteristics of the three samples. Among the recommendations is that there should be awareness creation to the rural and poor urban mothers on the importance of local food items for complementary foods formulations which will go a long way to solve protein energy malnutrition in the home.

Keywords: Weaning, Corn, Soybean, Groundnut, Infant, Proximate

Introduction

The functions of food in the human body are immeasurable, especially for infants. Food performs the following functions in human life. It provides heat and energy to the body and materials that are used for growth, repair, and maintenance as well as for protection of the body from disease. Roughage in food helps bowl movement and prevents constipation. Food is necessary for good health and vitality (Nwankwo, 2010). The material in food that performs these functions are called nutrients. Nutrients are chemical substances that are used by the body for growth and health, and they are especially significant for infants' sustainable health (Judith, 2010).

According to the World Health Organization (WHO, 2013), an infant is a child younger than one year of age. Ngwu, (2005) defined infant as a child under one year of age, and is need of

special nutrition attention. Infants have specific characteristics which include suckling and sucking reflexes, frequent feeding of 8-12 per 24hours and liquid is more tolerated. From one to three months one cannot separate movement of tongue from head movements. Head control emerges, smiles and laughs. An infant's volume of food increases up to 6-8oz per feeding so number of feedings per day drops to 4-8 per 24hour, suckling pattern allows thin liquid to be easily swallowed (Enyioha, 2005).

Infancy is a period of rapid transition from a meal of virtually nothing but milk (either breast milk or infant formula) to a varied diet from nearly all food groups being consumed on a daily basis (Grummer-Strawn, Seanlem& Fen 2008). During infancy, growth is rapid and nutrients need are high per unit body weight when compared with an adult. Infants gradually develop the ability to chew, swallow and digest the wide variety of foods available to adults. Between the ages of six months and two years, baby's nutritional needs are quite different from those of older children and adults. (United Nations of International Children's Emergency Fund (UNICEF, 2012). At this period of rapid growth and development, they need complementary weaning food rich in protein which is important for baby's brain development and general growth especially between six months and two years (Adeyemi, 2005). A deficiency of iron which is in protein during the early years may have a profound influence on learning later in life.

Infants also need calcium and vitamin D which are essential to build strong, healthy bones and teeth. Calcium helps in heart, nerves, muscles and other body systems to work properly. They also need food rich in vitamin A which helps to maintain a strong immune system and it is good for normal growth and development, specifically baby's eyes. It also helps maintain healthy skin, teeth and bones. Also vitamin C is needed to help the body to absorb iron from iron rich food. Zinc is also needed to boost immune system speed the healing of wounds. Nucleotides is needed to promote the growth of "friendly" bacteria in the gut. They may also reduce the risk of diarrhoea (Wyeth, 2010). These nutrients are naturally found in most of the locally prepared infant weaning food produced with indigenous crops than conventional ones.

Adequate feeding is important to ensure that a child gets the right nutrients required for survival, and to enhance proper growth and development. The local cereals, for instance corn, fortified with, other local products like soya bean, groundnut, banana, vegetable, avocado pear etc can help supply nursing mothers with enriched complementary foods for their babies, instead of depending mainly on commercial or artificial product. (Ramakrisha, Ihanes, Raris, &Kamakarishnarao, 2006). Adequate nutrition during infancy and early childhood is essential to ensure the growth, health, and development of children to their full potential. Poor nutrition increases the risk of illness, and is responsible, directly or indirectly, for one third of the estimated 9.5 million, deaths that occurred in 2006

amongst children less than five years of age (Nor, Ahlberg, Dohorty, Zembe, Jackson and Ekstrom, 2015). Inappropriate nutrition can also lead to childhood obesity, anaemia, marasmus, kwashiorkor which are increasing public health problems in many countries, (Kimanu-Muraye, Kahn, Pettiford, Tollman, Dunger, Gomez-Oliver, & Norris, 2010).

Quality nutrition is highly needed in the early years of a child's life. The first year of a child's life is particularly important, as child grows and develops rapidly. According to Adeyemi (2005) the period of birth to one year is a "critical window" for the promotion of optimal growth, health and behavioural development. Optimal nutrition during this period lowers morbidity and mortality, reduces the risk of chronic disease and promotes better development overall. If the child is properly fed, he is expected to double his birth weight by the 6th month and triple it by the first birthday. The brain too requires a lot of nutrients to attain maximum growth during this period. In fact, optimal breast and complementary feeding are so critical that they could save about 222,000 lives per year (WHO, 2013; Beruk, Kebede&Esayas, 2016).

Complementary foods are adult foods other than breast milk given to infants that are modified in colour, texture and flavour, which contains the nutrients required of child (Felicity and Savage, 2000). Complementary feeding is the gradual introduction of adult foods in semi-solid form (like cereal gruel (*Pap*) mashed potatoes, beans, yam) and so on to babies without stopping breastfeeding (Enyioha, 2005). These complementary foods are easily reached and produced locally. No matter the economic status of a family, no nursing mother has any excuse of not producing adequate and nourishing complementary foods for her baby (Bender, 2019).There is need to use available local products like corn products fortified with soya bean, groundnut, fruits and vegetable puree for supply of required nutrients for her infant growth and development.

The high cost of fortified nutritious proprietary complementary foods is always unaffordable to most Nigerian families especially in the rural areas and amongst the low income families. Many families depend on inadequately processed traditional foods consisting mainly of un-supplemented cereals porridges made from corn, (*Zea May L*), sorghum, millet etc. Also the long process of using corn to produce starch gruel (pap) takes some few days for fermentation. There is also the problem of preservation, especially in the rural areas, where most women do not have refrigerator. Also, even the use of local way of descaling old water and putting new water every morning can be forgetful thereby affecting the flavour and taste of the gruel (pap). These have prompted the need to go into this work to produce infant food (consogran food) from corn (*Zea May L.)* in flour form fortified with soyabean (*Glycine max*) and groundnut (*Arachishypogaea*) flour using direct heat preparation. In the process of passing the food through heat directly, it is expected that flavour and taste will be improved, germs will be destroyed more effectively, making

the food more safe and hygienic for infant consumption. Low-cost, nutritive complementary weaning foods using corn, soybean and groundnut flours were formulated to meet the nutritional needs of families with infants. This will help to enhance the nutritional intake of the infants, thereby reducing malnutrition and the rate of death amongst children under-five (5) years of age.

This study thus, utilized the corn (*Zea may L*), soya bean (*Glycine max*) and groundnuts (*Arachishypogaea*) which are among the easily found local stuffs in composite flour blend were used for the production of infant foods.

Purpose/Objectives

The main purpose of this study was to analyse the proximate composition of complementary weaning food developed from corn (*Zea May L.)*, soyabean (*Glycine max*) and groundnut (*Arachishypogaea*). Specifically, the study determined:

1. proximate composition of the gruel made from composite flours
2. sensory characteristics of the sets of porridges

Research Questions

The study was guided by the following research questions:

1. What are the proximate compositions of the gruel made from the composite flours?
2. What are the sensory characteristics of the sets of porridges?

Materials and Methods

***Design of the Study*:** The design of the study was experimental research design.

***Materials*:** The proximate evaluations were conducted in the food laboratory of Home Economics/Hospitality Management and Tourism Department, MichealOkpara University of Agriculture Umudike, Abia State.Corn (*zeamays)*, soybean (*ghycine max*) and groundnut (*arachishypogaealinnaeus)* raw seeds were bought from mile 1 market (Diobu), Port Harcourt, Rivers State.

***Preparation of soybean flour*:** Defective grains (with holes), stones, dried pods and other debris were removed from the soyabeans.

- The beans were washed and soaked in water for a day. This was done to remove some of the anti-nutritive factors such as trypsin inhibitors and haemaglutinins present in the beans.
- The soaked beans were then placed in a nylon sieve and allowed to drain. It was lowered into a container containing already boiled water for about 20 minutes. This step is called blanching". This was done to make dehulling easier, and to inactivate enzymes activity.
- The water was drained off and discarded.
- The dehulled beans were oven dried at 60^0c for an hour using an electric oven, (Crompton, UK) to reduce anti-nutritive factors and improve upon the flavour of the final product. The roasted soybeans were milled into flour to obtain smooth

and consistent particle sizes and Kulkani's Flow Chart was used.

***Preparation of corn flour*:** Similar procedure was followed.

The corn was first sorted and washed. The grains afterwards were soaked for about a day to begin fermentation process.

- The soaked corn grains were washed and sieved to get rid of the water and foreign matter. It was allowed to drain off water, after which it was oven dried at 60^0c for an hour. The seed will be dry milled and sieved to obtain smooth and consistent particle sizes.

The Anigo's Flow Chart was adopted.

Preparation of groundnut flour:

- Defective grains (with holes), stones, dried pod and other debris were removed from the groundnut.
- The groundnut was roasted using an electric oven (Crompton, UK) for about 20 minutes. This was done for easy removal of groundnut haul and the anti-nutritive factors present in the groundnut.
- It was milled into paste and screw pressed using the manual screw plate press to reduce the oil content (detating) and also to obtain a groundnut cake. The groundnut cake was pulverized to smooth particle sizes, after which the groundnut flour will be oven dried at 60^0c for 20 minutes.

***Composite flour formulation*:** The three flours were properly mixed together to obtain a smooth composite flour. The flours were mixed to avoid lumps.

***Porridge Preparations*:** Composite flours were used to prepare three (3) samples of porridges. 100ml of clean cold water was poured in a saucepan and placed on fire after which 50g of each flour was mixed dry and gradually poured into the water with vigorous stirring using wooden spoon. As boiling was going on water was gradually added till desired colloidal solution is achieved. It was allowed to heat for about five to ten minutes, to really bring out the desired texture, and to make sure the starch grains are properly cooked. It was allowed to cool at room temperature, then infant milk was added to introduce animal protein into them.

Composite flour was formulated from the processed materials (corn, groundnut and soybean) seeds to contain the following percentages.

Sample No.	Blend	Ratio (w/w%)
CGS 1	Corn–groundnut-soybean	70:20:10
CGS 2	Corn –groundnut-soybean	70:10:20
CGS 3	Corn –groundnut-soybean	60:20:20

The samples were represented as CGS 1, CGS 2, CGS 3 and CGS 4.

Proximate Analysis: After the preparation of the porridges, the proximate composition, minerals, vitamins and functional properties of the formulated samples were determined to check their conformity with the standards.

***Moisture content analysis*:** The crucible used was washed and dried in the oven. The dried container was transferred to

desicator and weighed. Then, 2g of each of the samples were weighed and dried in the oven at a temperature of 1050 C for 2hrs. The container and samples were reweighed, took back to the oven and dried, put in the desicator and weighed again. This process was continued until a consistent result was obtained for each of the samples.

***Ash Content Analysis*:** The temperature was regulated at 575 ± 250 C until it was carbonized, calcinated until black particles were no more. The crucible and content were placed in a desiccator and weighed.

***Crude fiber analysis*:** About 2g of each of the samples were weighed and placed in a hot 200ml of 1.25% H2SO4 and boiled for 30 mins.

Crude Fat:The defatted samples were carefully removed and the solvent recovered. Further, the flask and oil were oven dried until all the solvent was gone. The flask and the content were reweighed.

Crude Protein: Twenty grams (20g) of the samples were weighed and carefully transferred to a kjeldahl flask containing boiling chips. The same procedure also was carried out for the blank experiment. Titration was against standard 0.1N HCl.

Carbohydrate Analysis: The total carbohydrate content was determined by difference as described by Sarkiayaji and Agar (2010).

Sensory evaluation:

Selection of panel of judges: A panel of ten judges comprising the students and staff were randomly selected from the Department of Home Economics, Ignatius Ajuru University of Education, Port Harcourt.

Instrument for data collection: The 9-point hedonic scale was used to collect data from the judges.

Data collection method/procedure: Each of the ten judges was served with each of the samples and to taste and express their opinions on the 9-point hedonic scale ranging from 9 = like extremely to 1 = dislike extremely. They were also served a glass of water each to rinse their mouths before and after each tasting.

***Data Analysis Procedure*:** The results of the sensory evaluation were analysed using means and standard deviations. Analysis of variance (ANOVA) was used to analyse the null hypotheses at 0.05 level of significance to establish the significance of the difference among the multiple blends and control. At 5 points and above the mean was taken as (liked) accepted while at below 5 points, it was taken as (disliked) not accepted.

Findings/Results: The results were presented in the following tables.

Research Question 1: What are the proximate compositions of the gruel made from the composite flours?

Table 1: Proximate composition of the gruel made from the composite flours

Samples	Dry Matter	Moisture	Crude Protein	Fat	Crude Fibre	Ash	Carbohydrate	Energy
	%	%	%	%	%	%	%	%
CGS1	44.93^{d}±0.12	5.13^{b}±0.12	16.03^{d}±0.01	7.06^{d}±0.01	1.10^{d}±0.02	2.14^{e}±0.01	18.56^{a}±0.0720	1.83^{d}±0.45
CGS2	45.45^{c}±0.03	4.55^{c}±0.03	17.14^{c}±0.02	9.02^{c}±0.02	1.50c±0.00	2.64^{c}±0.02	15.14^{b}±0.03	210.33^{c}±0.13
CGS3	6.12^{b}±0.04	5.88^{d}±0.04	20.13^{a}±0.02	9.84^{a}±0.02	1.86^{a}±0.02	2.98^{a}±0.02	11.32^{c}±0.05	214.48^{b}±0.03

Values are means of data of triplicate determination. Values with the same column having the same super script are not significantly different (P>0.05)

Table 1 above shows that there is no significant difference in the scores of the three samples. The table shows that CGS3 had the highest content for dry matter (46.12^{b}±0.04), while CGS1 had the lowest at 44.93^{d}±0.12. The table also shows that CGS3 had the highest contents in moisture (5.88^{d}±0.04), crude protein (20.13^{a}±0.02), ash (9.84^{a}±0.02) and energy (214.48^{b}±0.03) respectively. CGS2 was highest in carbohydrate (15.14^{b}±0.03).

Research Question 2: What are the sensory characteristics of the sets of porridge?

Table 2: Summary of mean on sensory characteristics of the sets of porridges

Sample	Taste	Aroma	Texture	Appearance	Firmness Overall	Acceptability
CGS 1	6.6±0.01^{a}	6.6±0.01^{a}	5.8±0.10^{a}	6.6±0.04^{a}	6.4±0.06^{a}	6.5±0.10^{a}
CGS 2	6.4±0.02^{a}	6.7±0.03^{a}	6.1±0.02^{a}	6.6±0.04^{a}	6.6±0.01^{a}	6.5±0.04^{a}
CGS 3	6.2±0.04^{a}	6.4±0.02^{a}	6.0±0.00^{a}	6.2±0.02^{a}	6.2±0.02^{a}	6.2±0.03^{a}

Mean values with the same superscript down the column are not significantly different (p<0.05)

Table 2 above shows the mean scores on sensory characteristics of the sets of porridges. The table shows there is no significant difference in the sensory characteristics of the three samples. The CGS2 had the highest scores in aroma (6.7±0.03^{a}), texture (6.1±0.02 ^{a}) and firmness (6.6±0.01 ^{a}) respectively. CGS1 had the highest score for taste (6.6±0.01^{a}), while CGS1 and CGS2 were same for appearance (6.6±0.04 ^{a}).

Discussion of the Findings

The result for proximate content and energy value of the flour blends made from corn (C), groundnut (G), soybean (S) is presented in Table 1. The samples were formulated at the different ratio CGS1 (70C 20G 10S), CGS2 (70C 10G 20S), CGS3 (60C 20G 20S).The moisture content value of the formulated blends ranged from 4.55 to 5.88%. There was

significant was no difference ($p>0.05$) in the formulated blend samples. The moisture value observed to be relatively the same in all the formulated blend samples. The moisture content value recorded in this study was slightly lower to the ranges of 6.24 to 8.06% and 6.28 to 7.14% reported by Okoye and Mazi (2011) and Nor et al. (2015) for complementary food blends of sorghum and African yam blends and complementary food from quality protein maize respectively. The low content observed in this study shows the storage stability of complementary foods and other flour based product (Adeyemi, 2005). This is particularly important for the preservation of the samples.

The crude protein value of the formulated blends samples ranged from 16.03 to 20.13%. The formulated blend samples had high protein content, this could be attributed to the fact that soybean was present in the mix. WHO (2013) reported that infant up to 1 year require the Recommended Dietary Allowance value ranges which ranges from 13 g/d; the formulated blends were all above this range. The result obtained in this study shows that crude protein was higher in the blend that had 20% soybean substitution indicating that the formulated blends samples will be a good source of protein for infants. Protein plays a vital role like tissue replacement; deposition of lean body mass, growth and in infancy rapid growth requires high protein per kilogram of weight than that of an older children (Nor, et al, 2015; Change, He& Chen, 2018).

In the ash content, there was no significant difference ($p<0.05$) in the formulated samples. The ash value of the samples and control ranged from 2.14 to 2.98% with CGS3 having the highest value. The data obtained in this study was slightly higher than the range of 1.03 to 2.69% reported by Judith (2010) and within the range of 1.44 to 3.46% reported by Okoye and Mazi (2011) for complementary food from sorghum and African yam bean flour. The ash content of the formulated samples increased as the groundnut and soybean substitution increased. The high ash content of the formulated samples and control indicates that they are good sources of mineral (Okoye and Mazi, 2016). Minerals are important to the proper functioning of many body processes. They are necessary players in nervous system functioning, other cellular processes, water balance, and structural (e.g. skeletal) systems (Okafor and Usman, 2015).

In terms of fat content, there was no significant difference ($p>0.05$). The fat content of the formulated samples ranged from 7.06 to 9.84%. The fat content increased as the substitution of groundnut and soybean increased in the formulated samples. Soybean is necessary in complementary foods because it adds fat and protein (Okafor and Usman, 2015). The fat content recorded in this study was higher than the range of 1.05 to 2.06% reported Enyioha (2005) for complementary food from malted cereals, soybean and groundnut but was within the range of 3.61 to 8.08% reported by Okafor and Usman (2015) for complementary food in south west Nigeria. Fat plays a vital

role in the diet of infants and young children because it gives essential amino acids, aids absorption of fat soluble vitamins, increases dietary density and sensory qualities (Enyioha, 2005).

For crude fibre, there was no significant difference ($p<0.05$) in the formulated samples with the values ranging from 1.10 to 1.86%. The formulated blends were all low in crude fibre which will be to its advantage as these could help increase the nitrogen utilization and absorption of micronutrients. Foods used for complementary feeding should not contain much crude fibre generally as an adult meal, due to fibre can displace the energy rich foods that children under two years of age need for growth (Okafor and Usman, 2015; Ekeh, 2017).

Carbohydrate content was observed not to be significantly different ($p<0.05$) amongst the formulated samples. The carbohydrate content value ranged from 11.32 to 18.56%. The range obtained in this study was slightly similar to the range 14.10 to 13.18% of the reported by Adeyemi (2005) for complementary food in South west Nigeria. In the formulation of a complementary food for infants, the ratio of carbohydrate to fat and protein must be considered (Enyioha, 2005; Bender, 2019). The energy value of the formulated samples ranged from 201.83 to 214.48 kcal/100g. The energy value obtained in this study was lower than the range of 448.08 to 472.76 kcal/100g as reported by Okafor and Usman(2015) for complementary food from maize, soybean and peanut fortified with Moringa*oleifera* leaf powder. The differences in the energy value of the formulated samples could be attributed to the differences in their protein, fat and carbohydrate content (Okoye and Mazi, 2011). The formulated samples were all observed to be a good source of energy.

There was no significant difference ($P<0.05$) in any of the determined. CGS1sample was rated best (6.6) with respect to taste followed by CGS2 and CGS3 samples. Aroma and texture were scored best in CGS2 sample with respective scores of 6.7 and 6.1 respectively. CGS1 and CGS2 samples were rated same with respect to appearance while CGS3 had the lowest value. The firmness grades ranged from 6.2 to 6.6 in which CGS3 and CGS 2 samples were rated lowest and highest respectively. The results of the overall acceptability grouped CGS1 and CGS2 samples as the most acceptable. These results are similar with the reports of Adegbehingbe (2014) and Oyewole and Isah (2012) that locally produced foods have high level of acceptability because of the natural taste and high nutrient values. The acceptability rates of the tastes and texture imply that the flours were well-grounded and un-soured. The implication of these findings is that the samples will be ideal and acceptable to the infants.

Conclusion

This study has shown that the use of different ratio blends of corn (*zea may l*), groundnut (*arachishypogaea*)and soybean (*glycine max*) flours in formulating a complementary food has given a product with good nutritional, functional and organoleptic acceptance. Protein is a serious problem in Nigeria

complementary food. The formulated blends had high protein content which will enable this problem of protein energy malnutrition in Nigeria to be resolved. Samples CGS3 had the highest. The formulated blends met the Recommended Dietary Allowance (RDA) for babies in their protein value. The moisture content of the formulated blends were lower than the recommended value for dry flour meaning that they will have good storing ability.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. awareness to the rural and poor urban mothers should be created by educating them on utilizing our local food items such as combination of corn, groundnut and soybean flour as a complementary food will go a long way to solve protein energy malnutrition and will also help in feeding their babies with diverse meals.
2. formulated blends can also serve as breakfast meal for adult because it has good carbohydrate content for energy.
3. formulated complementary food samples should be enriched more with other mineral food sources to improve its contents.

References

Adegbehingbe, K.T. (2014) Production of *masa* using maize-sorghum blends. *International Journal of Science and Research.* 3(8), pp 484-489.

Adeyemi, A. (2005). Prospect for Upgrading trade traditional technology for complementary food manufactures. *Preceding of the 13th annual conference of food science and technology, balogh Edited Edition 85-94.*

Bender, D. A. (2019).Protein-energy ratio.A dictionary of Food and Nutrition. Encyclopedia.com. Retrieved on the 20th of Oct. 2016 from *http;//www.encyclopedia*.com.

Beruk, B. D., Kebede, A. and Esayas, K. (2016). Effect of Blending Ratio and Processing Technique on Physicochemical Composition, Functional Properties and Sensory Acceptability of Quality Protein Maize (QPM) Based Complementary Food. *International Journal of Food Science and Nutrition Engineering*, 5(3): 121-129.

Change, S., He, W. & Chen, C. (2018). *Complementary Feeding and growth of infant and young child in China. Biomedical and Environmental Science* 21(3): 264-268.

Ekeh, S.O. (2017). Effects of malting on the dehulling characteristics of African yam bean (SphenostylisStenocarpa) seeds and the functional properties of the flour. *Journal of Food Science and Technology*, 39(4):406 – 409.

Enyioha, S.A. (2005). *Complementary Foods.A guide for mothers and health workers.*Kaduna: Nigeria Slim Line Communications Limited.

Felicity, J. I. and Savage, C. J. (2000). Proximate Composition, Energy Content And Sensory Properties Of Complementary Foods Produced From Blends Of Sorghum And African Yam Bean Flour. *International Journal of Scientific and Technology Research*, 5(7):274-277.

Grummar–Strawn, L.M.,.Scanlon K.S & S.B. Fen (2008).Infant Feeding and Feeding Transitions during the first year of life.*suppiArticle*, 122. 36-42.

Iwe, M.O. (2002). *Handbook of sensory method and analysis*. Enugu: Rejoint Communication Service. Limited.

Judith, E.B. (2010). *Nutrition through the life cycle.International student Edition.*Second Edition. Accra: Uppsa Publications.

Kimani-Murage, E.W., Kahn, K., Pettifor Jim, Tollman, S.M., Dunger, D.B., Gomez-Olive, X.F.,& Norris, S. (2010). The Prevalence of Stunting, Overweight and Metabolic Disease Risk in Rural South African Children. *Biomed Central Public Health* 10 (158):1-13.

Nor, B., Ahlberg, B.M., Dohort, T. Zembem Y. Jackson D. Ekstrom, E.C. (2012). Mother's Perceptions and experience of infant feeding witsin a community-based peer counseling intervention in South Africa. *Journal of Maternal child nutrition* 8(4)448-458.

Ngwu, E.K. (2005). Innovative infant feeding practices and Nutrition.*Journal of Home Economics Research*; 2(2), 25-32.

Nwankwo, U.P. (2010). *Introduction to food and nutrition.In home management for sehls and colleges* edited by Madichie W.N. and Nnubia U.E. 2010 pg. 139.

Okafor, G. I. and Usman, G. O. (2015).Physical and Functional Properties of Breakfast Cereals from Blends of Maize, African Yam Bean, Defatted Coconut Cake and Sorghum Extract. *Food Science and Quality Management*, 40:25-34.

Okoye, J. I. and Mazi E. A. (2011).A' development and quality evaluation of soy-fortified custard.*ABSU Journal of Environment, Science and Technology*, 1:99-104.

Oyewole, O.A. and Isah, P. (2012).Locally fermented foods in Nigeria and their significance to National economy: A review.*Journal of Recent Advances in Agriculture.*1(4), pp 92-102.

Ramakrisha, V. Ihanesi Rani, P. and Ramakarishnarao, P. (2006).*Anti-nutritional factors during ciermination in Indian Bean. Dotichorslabiabl) seeds. World Journal of Diery and food sciences 1:6-11.* United Nations Children's Find (UNICEF) (2012). Complementary feeding http/wwwunicef.org/ nutrition/index-24826html.Retrieved March 16th, 2013.

Sarkiyayi, S. and Agar, T. M. (2010).Comparative Analysis on the Nutritional and Anti-nutritional Contents of the Sweet and Bitter Cassave Varieties.*Adv. J. Food Sci. Technol.* **2**(6): 328-334.

World Health Organization (WHO) (2013).*Global Database on Child Growth and Malnutritio*n http://www. who.int/nutgrowthad.about (introduction/en/index 5. html (accessed on 01/08/13).

Wyeth, P. (2010). (S.M.A. progress) feeding from first tastes to family foods. Nutritional lips to help meet infant growing needs.

UNICEF.(2012). *Children Nutrition in Developing Countries*. Washington: UNICEF.