IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 3, Issue 6 Ver. IV (Nov.-Dec. 2014), PP 57-61
www.iosrjournals.org

Formulation of local ingredient-based complementary food in South-west Nigeria

[1]Akinola O.O., [2]Opreh O.P., [3]Hammed I.A.
1,3Department Nutrition and Dietetics Federal Polytechnic,
P.M.B. 231, Ede, Osun State.
[2]Seventh-day Adventist Hospital, P.M.B.5513, Ile-ife, Osun State.

Abstract:
Background: *South-west Nigeria favourably supports growth and production of different food crops and with an ingredient such as crayfish children's complementary foods can be derived all year round. Suitability and adequacy of different products from crayfish, yellow maize, millet, sorghum, soybean, groundnut, and carrot as complementary food items was investigated.*
Objective: *Formulation of nutritionally adequate complementary foods from local ingredients.*
Method*: Food items bought in a local market were processed and arranged into three different food sample packages and analyzed. Sample A- soybean: millet: guinea corn: yellow maize: groundnut (20:20:20:20:20); sample B- soybean: millet: guinea corn: yellow maize: groundnut: crayfish (15:20:20:20:10:15) and sample C- soybean: millet: guinea corn: yellow maize: groundnut: crayfish: carrot (20:15:15:15:20:15:10).*
Results: *The chemical composition of the formulations were as follows: for samples A, B and C*
Protein 18.15%: 16.64% and 21.46%; Fat 4.03%, 3.61% and 8.08%; Fibre 1.17%, 1.24% and 1.53%; Ash 5.21%, 5.36% and 7.52%; Moisture 10.36%, 9.55% and 7.26%; Carbohydrate 61.06%, 63.18% and 54.14% respectively.
Conclusion: *The study revealed that it is possible to prepare nutritionally adequate and acceptable complementary diet from readily available and affordable food items.*
Keywords: *complementary food, crayfish, carrot. Yellow maize, millet, guinea corn, soybeans, groundnut.*

I. Introduction

Infancy is a period of rapid physical growth as well as physiological, immunological and mental development when nutritional requirements are at their highest. Most brain development for which protein, cholesterol, zinc and essential fatty acids are crucial requirements occur in the first two years after birth (14). Malnutrition does not only persist but remains widespread in many developing countries despite abundant varieties of food sources or items. The WHO and UNICEF are very much concerned about this trend. Protein Energy Malnutrition (PEM) and micronutrient deficiencies among infants, children and pregnant women have been shown to be directly and individual associated with more than 50% of all childhood morbidity and mortality in the developing world (19).Result of the 2001-2003 food consumption and nutrition survey showed a steep increase in the incidence of child wasting between 6-12 months, which is the period of complementary feeding for most children (31).

Breast milk satisfies the nutrient and energy requirements of the infant for the first 4- 6months; subsequently the nutritional composition of the breast milk increasingly becomes inadequate to meet the infant's requirement. Therefore, to be able to meet the changing requirements of the infant there is the need to supplement the breast milk with a nutritious diet, which could be a proprietary formula or locally prepared at home, while breast feeding continue for at least 2 years (18). Thus, there is a gradual shift from breast milk feeding to semisolid or solid food complementary feeding (22)

Research has shown that PEM in children is the result of frequent use of maize pap (koko) and millet gruel during the weaning period (12, 15);being weaning foods which are very low in good quality proteins. Kwashiorkor, a protein deficiency syndrome, a major debilitating disease of children in many developing countries is significantly due to low purchasing power, poverty and ignorance of the majority of the population which denies them access to adequate weaning food (24, 25, and 26). When the diets are based mainly on cereals and are inadequate especially in the younger children marasmus becomes commoner than Kwashiorkor (3). Marasmic-kwashiorkor results from mixtures of deficiencies that cause either.

In most developed societies, nutrient fortified cereals are the first complementary foods introduced to the infant, followed by fruits, vegetable, and meat products. In developing countries, although a number of convenient fortified proprietary formulas are available, they are often too expensive and out of the reach of most families. The use of home-based complementary food that can be readily prepared, available, and affordable, is

one feeding option that has been recommended (10,11,20,21) to stem the deleterious effect of malnutrition on infant and young children. The use of high nutrient dense food stuffs such as cereal, legumes, vegetables and animal food products to prepare complementary foods for infants and children has been suggested by a number of researchers (7, 20, 29 and 30) Cereals that are generally used are known to be relatively low in lysine and tryptophan, but fair in sulphur – containing amino acids (methionine and cysteine) (12, 17). Legume-proteins should complement the protein in cereal grains since the chemical and nutritional characteristic of legumes make them natural complements to cereal-based diets. (2).

Dietary diversification, supplementation and fortification of locally available foods could also result in improved micro- nutrient intake of infants and younger children during complementary feeding period.

This study was part of an exploratory effort on the improvement on nutritional quality of traditional complementary food. It was designed to use staple foods stuffs to formulate composite blends that can provide the needed nutrients for nourishing infants and children and are readily available and affordable to both rural and urban poor mothers in particular.

II. Materials And Methods

Sources of materials:

The food materials used such as yellow variety of maize (zea maize), soybean (glysine max), guinea corn, millet, groundnuts, carrot and crayfish were bought from a local market in Osogbo, Osun State capital, Nigeria. It was ensured that the food materials were fresh and of good quality and viable.

Processing Methods

The seven ingredients used for the formulations were processed separately into powdery flour forms; the processing methods are as shown in fig. 1.

The major ingredients were classified into three samples. The three samples were prepared and the composite was formulated by combining the flour obtained in different proportions. Each sample was weighed to 100g.

A: soybean - millet – guinea corn - maize-groundnut (20:20:20:20:20)

B: Soybean – millet – guinea corn – maize - groundnut – crayfish (15:20:20:20: 10:15)

C: Soybean – millet – guinea corn – maize – groundnut – crayfish – carrot (20:15:15:15:10:15:10)

III. Chemical Analysis

Proximate analysis was carried out on each of the composite in duplicate.

Protein determination was by Kjeldahl method (5), fat, fiber, ash, moisture content and carbohydrate by (5).

IV. Data Analysis

Both macro- and micro-nutrients values were analyzed using SPSS soft ware (Version 16.0) to determine mean, standard deviation and percentages. T- test was used to test for statistical significance of nutrients' content.

V. Results

Chemical composition of the complement food formulations on dry weight basis:

Table1 shows the Mean in the same column with the same superscript which were not significantly different at P>0.05

Table 1: proximate determination of samples

Sample A.	%Protein	%Fat	%Fiber	%Ash	%Moisture	%Carbohydrate
S:G:GU:M:Y	18.15± 1.20[a]	4.03± 0.81[a]	1.12± 0.06[a]	5.21± 0.07[a]	10.36± 0.61[a]	61.06± 0.41[a]
Sample B						
S:G:GU:M:Y:CR	16.64± 0.65[a]	3.61± 0.31[a]	1.24± 0.03[a]	5.36± 0.18[a]	9.55± 0.21[a]	63.18± 0.79[a]
Sample C						
S:G:GU:M:Y:CR:CA	21.46± 1.48[a]	8.08± 1.37[b]	1.53± 0.07[a]	7.52± 1.16[b]	7.26± 0.37[a]	54.14± 3.11[b]

Table 2 shows the protein content of the samples ranges between 16.64%- 21.46%; fat content 3.61% - 8.08%, fiber: 1.172 – 1.55%, Ash: 5.12 - 7.52%, moisture content 12.3 - 7.26 and carbohydrate 54.14 – 63.18%.

Table 2: Chemical Nutrients composition of formula foods

Product	% Prot	%Fat	%Ash	%Moisture	%Carbohydrate
Sample A	18.15	4.03	5.21	10.36	61.06
Sample B	16.64	3.61	5.36	9.55	63.18
Sample C	21.46	8.08	7.52	7.26	54.14

Table3 showed the mean macronutrients of the three samples with the RDA. It was discovered that the mean macronutrients like protein (21.46g) met over 100% of their Recommended Daily Allowance (RDA). However, the fat content is lower (8.08g) than that of RDA.

Table 3: The mean Macronutrients of the sample products

Products	Mean ± SD	RDA(6-12mo)age	%RDA met
Protein	21.46 ± 14.8^{b}	11	236%
Fat	8.08 ± 1.37^{b}	31	27%
CHO	54.14 ± 3.11^{b}	95	90%

RDA: (27)

VI. Discussion

The use of locally available food stuffs to formulate diets (blends) particularly in a developing country where gross malnutrition was largely being attributed to inadequate intake of food materials due to inability of parents and families to afford the proper diets (especially animal source foods) is a common practice. This study shows there was variation in the nutrient compositions of the three samples but samples C has more nutrient composition compared to the other formulated composite.

Sample C has the highest protein content (21.46g) compare to RDA of 9.1-11g (27), the high protein here could be attributed to the crayfish and soybean. However, it is expected that the amino acid of these foods will complement that of cereal flour limiting on lysine and tryptophan. The protein is above recommended amount of 20% for any formulated complementary foods. The protein is needed for tissue replacement, deposition of lean body mass, and growth and because of rapid growth in infancy protein requirements are to be high per kilogram of weight than that of older children (28). Diet of infants should be supplemented with additional sources of high-quality protein such as cereals mixed with formula which is not possible for most families in this setting.

The fat content of sample C (soybean + groundnut + Guinea corn + millet + yellow + maize + crayfish + carrot) having the highest value of fat compared to other blended flour but is lower than the recommended 10% (4). Fat is important in the diets of infants and young children because it provides essential fatty acids, facilitates absorption of fat soluble vitamins, and enhances dietary energy density and sensory qualities (8, 9). The percentage of energy from fat in complementary foods that would be needed to achieve a level of 30-45% of energy from fat in the total diet depends on the level of breast milk intake and the fat content of the breast milk (9). Fat may help to prevent undesirable weight grain in infant and it also reduces rancidity when exposed to hot or warm air. It has been recommended that, during the complementary feeding period (6-12 months), a child's diet should derive 30%-40% of energy from fat (23). From the finding here, the fat content of these formulations can be enhanced with negligible strain on resources since oils are readily available.

The low fibre content, varying from 1.17 – 1.53% compared to RDA (27) may be advantage as this could help to increase the nitrogen utilization and absorption of some other micro nutrients. Foods used for complementary feeding should not in general contain as much fiber as the adult diet, because fibre can displace the energy-rich foods that children under two years of age need for growth. (23)

The Ash content in the composition varying from 5.12% - 7.52% reflects **this gives an information** on **the mineral composition of the formulated samples. it shows that the composition will be in mineral composition, and therefore the formulated complementary food will not be mineral deficient such as iron and some vitamins like vitamin A due to blended carrot in sample C. (1)**

The moisture content values of 7.26 - 10.30% reported in the study is above the 5% moisture content recommended for dry food (3, 7). Hence, the lower the moisture content, the better the keeping quality. Thus the items may not be stored for a long period of time.

The formulated complementary foods were found to contain carbohydrate in the range of 54.1%-63.18%, when formulating diets for infants, the ratio of carbohydrate to fat and protein must be taken into consideration (13).

VII. Conclusion

Proper selection and combination of local household foodstuff can be used to formulate multi mixes that can be used as home-based complementary foods. The blends formulated in this study could be used by rural and urban mothers to feed their infant and children during the complementary feeding period. It ensures availability and affordability as well as help in alleviating some economic and time related constraints faced in child feeding practices. The study was an exploratory effort on the improvement of the nutritional quality of traditional complementary foods, which made use of stable foodstuffs to formulate composite blends that can be nutritious, readily available and avoidable to both rural and poor urban mothers.

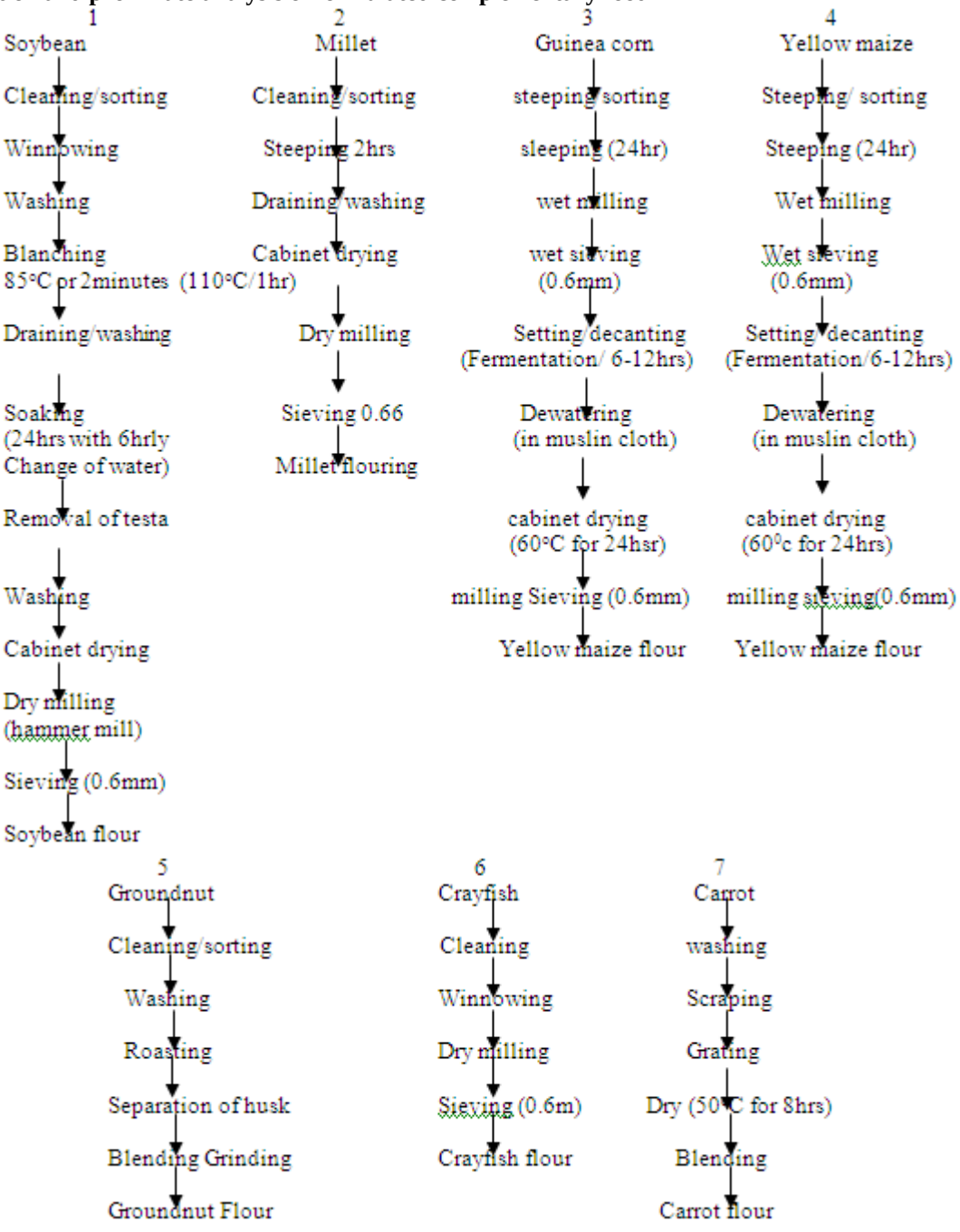
VIII. Recommendation

Research studies should be carried on most common foods consume and accessible to the rural and poor urban people.

The composite formulated in this study can be recommended as complementary foods.

Figure 1

Production and proximate analysis of formulated complementary food



Reference

[1]. WHO (2000): Complementary feeding: family foods for breast fed children: 48-52
[2]. Altschul, A.M (1974). New protein foods Vo1 1a Academic Press Pp 20-21
[3]. Atimo T. (1982). Nutritional diseases among Nigerian children J. of Nutr Sc. 3(1). 42-47.
[4]. FAO (1966). Gram Legume in African 3rd ed. FAO, Rome pg 82-83.
[5]. AOAC (2005) Official methods of Analysis 18 ed. Association of official Analytical chemist, Washington.
[6]. Atimo T. (1986) The Cultural significance of food and the nutritional values of Nigeria Foods with reflect of trace elements nutritive. A seminar paper on Nigeria food culture University of Ibadan. Nov 1986
[7]. Badamosi E.J. Ibrahim L.M & Temple V. (1995) Nutritional Evaluation of a locally formulated weaning food; JUTH-PAP. West African. J. Biol. Sci 3:85-93.
[8]. Bier DM, Brosnan JT, Flatt JP, Hanson RW, Weird W, Hellerstein MK, Jequier E, Kalhan S, Koletzko B, Macdonald I, Owen O, Uauy R. **(**1999**).** Report of the Working Group on lower and upper limits of Carbohydrate and fat intake. Europ J. Clin Nutr 53: S177-8.
[9]. Dewey K.G, Brown K.H.(2002) Update on technical issue concerning complementary feeding of young children in developing countries and implications for intervention programs. Food Nutr. Bull, in press
[10]. Fashakin J.B., Ogunshola F. (1982) The utilization of Local foods in fermentation of weaning foods Trop. Paed 28:93-6
[11]. Federal Ministry of Health (FMOH) (1999) Food based dietary guideline for Nigeria nutritional division, Abuja.
[12]. FAO (1997). Preventing micronutrient malnutrition A guide to food-based approaches. A manual for policy makers and Programmers Planners food and Agricultural organization of the United National and International life Science Institute. Washington DC Pp. 2-6.
[13]. Gibney M (1995). Consumption of sugars. Workshop on the Evaluation of the Nutritional and Health Aspect of sugar AMJ.Clin Nutr 62: (suppl) 1935- 1945.
[14]. Guthrie A.H. (1989). Introductory Nutrition. 7th ed. Times Mirror/Mosby college publisher, Pp 485-76.
[15]. Naismith D.J. (1973). Kwashiorkor in western Nigeria. A study of Traditional Weaning foods with particular respect to energy and linoliec acid Br. J. Nutr. 80:567-76
[16]. Nnam N.M. (2002). Evaluation of complementary foods based on maize, groundnut, Pawpaw and maize flour blends Nigeria J. Nutr. Sci. 23 (1&2) 8-18
[17]. Okoh P.N. (1998). Cereal grains. In; AU Osagie and OU Eka (eds), Nutritional
[18]. Okoye Z.S.C. (1992). Biochemical Aspect of Nutrition Prentice Hall of India, New Delhi Pp147-195.
[19]. SCN (2004). Nutrition for improved development outcomes 5th report on the world nutrition situation standing committee on Nutrition (SCN) Geneva.
[20]. Temple V.J., Badamosi E.J, Ladeji O and Solomon M (1996). Proximate chemical composition of three locally formulated complementary foods. West Afr. J. Biol Sci 5: 134-143
[21]. WHO (1981). International code of marketing of Breast milk Substitute 1981 WHO Geneva
[22]. WHO/UNICEF (1995).Global Prevalence of Vitamin A Deficiency: Micronutrient Deficiency information system. Working page 2 General: WHO
[23]. Klim Fleischer et al (2001).Feeding and nutrition of infants and young children; energy and macronutrients: WHO European Series; No 87: Pp 45-80
[24]. Hanzen H.N, Shen D.G, Shi F, Gilmose J.N (2013). Family poverty affects the rate of human infant brain growth. Plosone 8(12).e80954. doi.10:1371/Journal Pone 0080954.
[25]. Joan L, Andy B, Kelly B. (2013). Effects of poverty on childhood brain development: The mediating effect of care giving and stressful life events. JAMA pediatric.167 (12)1135-1142.
[26]. Opreh O.P, Abioye-Kuteyi A.E, Aboderin A.O, Giebel H (2008). The pattern of Malaria infection in under fives in Ile-ife, Nigeria. Trans Roy Trop Med. & Hyg.102:868-874.
[27]. Mahan L.K, Escott-Stump S. (2008).Krause's Food Nutrition Therapy: Nutrition during infancy, 12 ed. Saunders Elsevier Pub. Pg 199-221.
[28]. Rodriguez N.R. (2005). Optimal quality and composition of protein for growing children, J.am Coll Nutr. 24:150s.
[29]. Onofiok, N.O,and Nnanyelugo D.O. (1998). Weaning foods in West African. Food and Nutrition Bulletin. The UN University
[30]. Omoruyi F, Osagie U.A, and Adamson I (1994). Blood Protein and tissues enzymes in malnourished rats rehabilitated with corn-crayfish-protein diet. Bioscience Research Communications 6-8.
[31]. llTA (2004). Summary proceedings of the stakeholder meeting for the project on Micronutrient Enrichment of maize and plantain in Nigeria: A sustainable approach to mitigate hidden hunger. International Institute for Tropical Agriculture 7-8th September 204.