TIMBOU-AFRICA PUBLICATION INTERNATIONAL JOURNAL AUGUST, 2025 EDITIONS.

INTERNATIONAL JOURNAL OF SCIENCE RESEARCH AND TECHNOLOGY

VOL. 9 NO. 9 E-ISSN 3026-8796 P-ISSN 3027-1991

COMPARATIVE, ANALYSIS OF THE NUTRITIONAL CONTENTS OF HOME MADE WEANING FOOD (TOM-BROWN) AND COMMERCIAL WEANING FOOD (CERELAC) SOLD IN LAFIA, NASARAWA STATE.

[1]S. K. EMGBA; [1]ABRAHAM G ADUGU; & [2]N.A TSAKU

[1]Department of Science Laboratory Technology, Isa Mustapha Agwai I Polytechnic, Lafia. [2]Faculty of Agriculture, Nasarawa state University, Shabu- Lafia Campus.

DOI: https://doi.org/10.70382/tijsrat.v09i9.057

ABSTRACT

The study aimed at the comparative analysis of the nutritional contents of homemade weaning food (Tom brown) and commercial weaning Food (Cerelac) in Lafia, Nasarawa State. The objectives of the study were to formulate a composite flour (weaning food tom brown) based on locally available cereals and legumes (millet, yellow maize, crayfish, ginger, garlic, turmeric, onion, clove, soybean, rice groundnut and

INTRODUCTION

Nutrition is the science that deals with the study of food constituents and their effects in the body. In humans and other mammals, nutrition starts at birth with breastfeeding. Breastfeeding is the nursing of an infant on the mother's breast Arnarson, A. (2019). Breastfeeding is the best start in life because the breast milk contains all the nutrients needed in appropriate proportion for the growing infant. Exclusive breastfeeding, according to NHS (2019) is highly recommended. This is an act of breastfeeding an infant from birth without giving water or solid foods until the child is six months old.Thereafter, breastfeeding continues with the addition of water and semi-solid foods till the child is two years old Berens P, Brodribb W (2019). This act helps to promote good health, growth and development before the child is weaned.

cereals were purchased from Lafia modern market of Lafia local government Area, Nasarawa state, Nigeria. composite flours were formulated based on protein basis of the food commodities used: millet yellow maize, crayfish, ginger , garlic ,turmeric, onion ,clove, soybean, rice and groundnut in equal proportions. Standard procedures of the association of official analytical chemists were used to determine the proximate chemical composition. The caloric value was calculated from crude protein, crude fat ,crude fibre, carbohydrate ,moisture and ash content. The results showed that sample (composite flour tom brown) contained ash (3.59%), crude protein (25.78%),crude fat (18.74%), crude fibre (3.69%),moisture (4.96%) and carbohydrate (46.93%). The energy fibre calculated gave 459.50kcal/100g. The overall results indicated that crude protein, lipid, fibre, ash, moisture, energy and carbohydrate contents of the composite flour were either comparable or higher than values in the proprietary formula. The researchers believe that complementary foods formulated from locally available food commodities have great potential in providing nutritious foods that are practical, food based approaches, aimed at combating the problem of nutrition among the infants and children in Nigeria in particular, and developing countries in general.

INDEX TERM: Tom brown, proximate analysis, composite flour, functional properties, nutrition and weaning.

Weaning is an introduction of soft, easily swallowed and digested foods to supplement the infant's feeding early in life Amir L.H (2019). It is also the time an infant's breastfeeding is gradually changed to semi solid foods to replace the nutrients which are present in breast milk Simpson KR, Creehan PS (2019).This should be carefully planned so that the diets contain all classes of nutrients in their correct proportion suitable for the child's growth and development. According to Lawrence RA and Lawrence RM (2019) weaning foods are especially formulated for infants aged between three and nine months for the transition between breastfeeding or bottle feeding and normal intake of semi-solid foods. Weaning period is a crucial period in an infant's life. At the age of five to six months, most infants begin to eat supplementary semi solid foods. At this stage, homogenized infant's foods play a major role in their nutrition Alex A, Bhandary E, McGuire KP (2020). There are many locally prepared weaning foods from legumes and cereals because they are readily available, affordable, acceptable, safe, and easily prepared.

In Nigeria, the usual first weaning food is pap, called "akamu or ogi." It is made from fermented maize, millet or guinea corn and used traditionally as one of the weaning foods

TIJSRAT E-ISSN 3026-8095
P-ISSN 3027-1991

by the low income earners (Alex A, et al., 2020) and Zheng T (2020). Sometimes, soybean is milled into powdery form and used to make "soy ogi" (pap from soybean), which is a component of weaning foods. It can also be roasted, ground and used as supplement to pap for weaning babies (Awuchi, Chinaza G. *et al*., 2019) formulated sorghum – corn – crayfish mixture, called "blended ogi" which can serve as a weaning food.

According to Nnamani, C.V., *et al*., 2019), pap can be enriched by the addition of animal proteins such as milk or crayfish. It has also been reported that groundnut can be milled into powdery form and added to pap for nutrient enrichment and used as weaning food FAO. (2021)

In most developing countries of the tropics, during weaning period, protein shortage in the diets is common and is usually found in association with deficiency in calories. The low-income group constitutes the bulk of the population that are particularly at risk in such situation. They usually have no alternative than to depend on the local products from cereals and legumes which are cheaper than the animal products and commercial baby formulas Nielsen, S. S. (2019). In the Medical Centre, University of Calabar, Calabar – Nigeria, there are many locally prepared foods from legumes and cereals. One of these foods, commonly used as weaning formula, is called "Tom Brown". It is made up of maize, groundnut, soybean and guinea corn (Obiegbuna J. E., 2019). These foodstuffs are locally grown, usually roasted or fried and blended together to give a nourishing brownish diet, which is served as pap Catholic Relief Services (2021). "Tom Brown" is recommended and used as weaning food for children. However, there is paucity of information on the nutritional value of the product, "Tom Brown". The present study is designed to assess the nutritional compositional and health benefit of tom browns

MATERIALS AND METHODS

Collection and processing of Samples

The materials used for the preparation of "Tom Brown" weaning food (millet, yellow maize, crayfish, ginger, garlic, turmeric, onion, clove, soybean, rice and groundnut in equal proportions) and the Nestle Cerelac baby food were purchased from a local supermarket. Tom Brown weaning food was prepared from equal proportions. The cereals –millet, yellow maize, crayfish, ginger, garlic, turmeric, onion, clove, soybean, rice and groundnut were separately washed with tap water and air dried for 72 hours. The Soya beans were washed, air dried and fried until the colour turned brown. The groundnut was also fried, and the back peeled off. The crayfish was sorted and cleaned. The date palm fruits were crushed to remove the seed, washed with clean tap water and air- dried for 72 hours. The fried groundnut and soya beans, dried millet, guinea corn, yellow corn, date palm and crayfish were milled into a smooth homogenous powder by a blending was done using 242 Blender Stand mixer model and stored in airtight containers until the time for analysis.

The Nestle Cereals served as the control for assessing the nutrient levels of the composite blends against amounts of nutrients present in 65g (dry weight estimate of the daily intake of local weaning food of a 6-month old infant).

Experimental Design

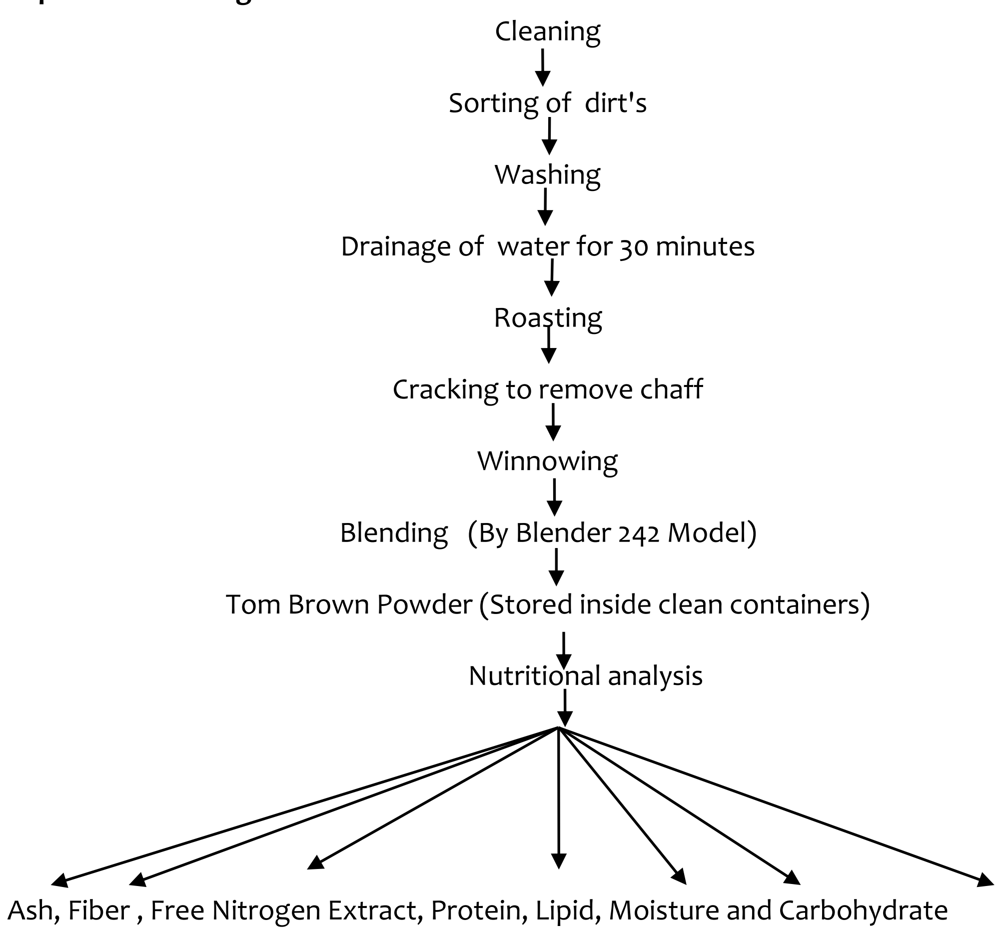

Figure 1: Flow Chart of steps for "Tom Brown" Preparation

Proximate Composition Analyses Of Tom Brown

The proximate components of Tom Brown were determined by the methods described in Pearson (Motosko C. et al., 2019) and Association of Official Analytical Chemist (2015).

Moisture Content

Dry matter was determined by oven drying at 105° C to a constant weight.

Five grams (5g) of sample will be weighed into pre-weighed drying dishes and kept in oven adjusted at 105 °C. After 6 hours, the sample was withdrawn, cooled in a desiccators and reweighed.

Moisture content of sample was calculated as follows:

$$\% \text{ Moisture content (M)} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where :

W_1 = Initial weight of crucible

W_2 = Weight of crucible + sample before drying

W_3 = Weight of crucible + sample after drying

Crude Protein Content (Macrokjeldahl Method)

Tom Brown sample (5g) was mixed with 15g potassium sulphate (K_2SO_4), 0.7 g mercuric oxide, copper sulphate ($CuSO_4$) as a catalyst and digested in a long necked Kjeldhal bottles with 40 ml concentrated sulphuric acid for approximately 2 hours. Distilled water (200ml) and 25 ml sodium thiosulphate solution (80g/L) was added. The contents of the digestive flask was mixed and boiled until at least 150ml distils into the receiver. Five (5) drops of methyl red indicator solution (0.5 g / 100 ml ethanol) was added to the mixture before titration with 0.1 M sodium hydroxide.

The percentage nitrogen obtained was multiplied by a conversion factor (6.25) to get the protein (Feeding stuff determination of nitrogen content and calculation of crude protein).

% Nitrogen = Volume of acid required to titrate sample – volume of acid required to titrate blank multiplied by acid normality multiplied by 100 all divided by weight of sample.

% Protein = % Nitrogen x Conversion factor (6.25)

Mineral Ash Content

Mineral ash content was determined by heating 5 g of Tom Brown sample in a clean dry crucible. This was charred over a Bunsen flame in a fume cupboard to destroy most of the organic matter. The heated Tom Brown sample was further heated in a muffle furnace at about 500°C for about 3 hours until white ash remains. Heated Tom Brown sample was cooled in a desiccator and reweighed. Ash was calculated as follows:

$$\% \text{ Ash (dry basis)} = \underline{W_3 - W_1} \times 100$$

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P-ISSN 3027-1991

$W_2 - W_1$

Where:

W_1 = Initial weight of empty crucible

W_2 = Weight of crucible + sample before Charring and ashing

W_3 = Weight of crucible + white ash

Crude Fat Content (Soxhlet Method)

Five grammes (5g) of each Tom Brown sample was weighed into a small porcelain bowl and heated in an oven at 105°C for one hour. After cooling, the dry Tom Brown samples were transferred into a soxhlet thimble. The samples in the thimble were covered with glass wool and placed into a soxhlet apparatus (fat extraction unit). Dry and clean fat extraction flask (pre-weighed) was placed into the extraction unit together with about 300 ml of petroleum ether (boiling point 40 - 60°C) and was allowed to reflux for about 6 hours. Extraction was carried out on each Tom Brown sample. Finally, petroleum ether was evaporated off and the flask dried in an oven at 105°C for about 1 hour and then transferred into a dessicator to cool. The weight increase of the flask was estimated as corresponding to the fat content.

Fat was calculated as follows:

$$\% \text{ Fat} = \frac{\text{Weight of fat}}{\text{Weight of Sample}} \times 100$$

Crude Fibre Content

Crude fibre was determined after boiling 5g defatted sample in refluxing sulphuric acid and sodium hydroxide. The 5g sample was defatted and treated with light petroleum (boiling range 40-60°C), 0.255M sulphuric acid (about 200 ml H_2SO_4) and dilute sodium hydroxide (about 0.1313N 200 ml NaOH). The sulphuric acid was used to disperse the sample.

The mixture was heated to boiling point within 1 minute (the flask was heated in a liebig reflux condenser). The whole insoluble material was transferred to the filter paper by means of dilute hydrochloric acid. The final residue was filtered through with the aid of a pre- weighed filter paper used to line a buckner funnel connected to a vacumn pump. The insoluble matter transferred to the weighed filter paper was dried at 100°C to a constant weight. The filter paper and contents were incinerated to ash. The weight of the ash was subtracted from the increase of weight on the paper and insoluble material.

The difference in weight was reported as crude fibre :

% Crude fibre = the loss in weight after incineration x 100.

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Carbohydrate Content

Available carbohydrate was determined by difference (subtracting crude protein (%), moisture (%), fat (%), crude fiber (%) and ash (%) contents of the Tom Brown sample from 100).

Carbohydrates = 100 – {protein (g %) + fat (g %) + water (g %) + fibre (g %) + ash (g %)}

Energy Value Determination

The energy content of the samples was estimated by multiplying the number of grams of carbohydrates, protein, and fast by 4 kcal, 4 kcal, and 9 kcal, respectively.

RESULTS AND DISCUSSION

The Comparative Analysis of the Nutritional Contents of Homemade Weaning Food (Tom Brown) And Commercial Weaning Food (Cerelac) of this Study are presented in Table 1

Table 1: Comparison of the Nutritional Result of the Control (Commercial Weaning Food Cerelac), Sample (Homemade Weaning Food Tom Brown) and Expected Value

.S/N. Test Performed	Control (Cerelac)	Sample (Composite Flour)	Expected (Based on NAFDAC/FAO)
1. Moisture (%)	**1.77**	**4.96**	**15.0max**
2. Ash (%)	**2.57**	**3.59**	**2.5 stated**
3. Crude protein (%)	**16.68**	**25.78**	**20**
4. Crude fat (%)	**14.55**	**18.74**	**10**
5. Crude fibre (%)	**2.48**	**3.69**	**2.5**
6. Total carbohydrate (%)	**64.43**	**46.93**	**68.0 stated**
7. Energy (Kcal/100g)	**455.39**	**459.50**	**422.0 stated**
8. Appearance	**Off White Cereal**	**Brown Cereal**	

Values are means ± standard deviation of triplicate determination.

The moisture content value of the sample was found to be 4.96 % which is higher than the moisture content of the control found to be 1.77 %. The value of the result is in compliance with the NAFDAC limit with a maximum of 15.0 %. This implies that the shelf life of the sample will be less compared to the control since the higher the moisture content, the more susceptible to microbial attack during storage Hurst NM (2019) and Hale TW,et al., 2019).

The fat content was found to be 18.74 % in the composite blend. The fat content of the composite blend was higher than that of control which was 14.55 %. The fat values obtained are higher than the 10% recommended by (FAO, 2022) for weaning food formulation. This high content implies that the storage life of the flour blends may decrease due to their high-fat content resulting in high susceptibility to oxidative rancidity (Napso T, et al., 2020) and Brodribb W (June, 2023) Dietary fats function in the increase of palatability of food by absorbing and retaining flavours (Brewster J.L. *et al*., 2019). Also, diet providing 1-2% of its caloric of energy as fat is said to be sufficient to human beings. The ash content gives an indication of the mineral composition preserved in the food materials (Hale TW,et al., 2019; Awuchi, C. G. *et al*., 2019).

The ash content was found to be 3.59 % in the sample. Higher ash content indicates a higher mineral content. The ash content was higher when compared with the control which implies that infant feeding on the flour blend will not suffer mineral deficiency. The fibre content was found to be 3.69 % in the local diet which is higher than the fibre content of the control found as 2.46 %. UNICEF. (2019) and Lawrence RA, Lawrence RM (2019), reported that the fibre content of infant cereals should be between the ranges of 0.3 % to 2.5 %. The fibre content of the composite blend and the control were found to be higher than the recommended limit. The protein content of the local diet was found to be 25.78 % which was higher than the control which has a value of 16.68 %.

The crude protein of the composite blend compared favourably with the value recommended by FAO (2022) that a protein of 20 % is designated for any weaning food. The percentage protein is equally high enough to prevent protein-energy malnutrition in an adult who depends on it as its protein source. The composite blend may be another cheap source of plant protein for the marginal resource communities of Nigeria. (Effionge *et al*., 2019) stated that any plant food that provides about 12 % of the caloric value from protein are considered good sources of protein. Therefore, the blended food meets this requirement. Carbohydrate content contributes to the bulk of the energy of the formulation (Ip S, Chung M, et al., 2020).

The carbohydrate content in the composite blend was found to be 46.93 %. The high carbohydrate yield of this food blend makes them ideal for babies since they require energy for their rapid growth. The carbohydrate content was not comparable to that of the control.

Conclusion

This study revealed that the composite blend formulated from locally available food commodities meets the recommended micronutrient (minerals) requirements of infants and children, and is highly nutritious compared to the control. Thus, the composite blend is considered safe as the anti-nutrients were destroyed during processing and values are within recommendation by FAO, WHO and (Johnston M, et al., 2019) The procedure for its processing is equally easy and energy saving

E-ISSN 3026-8095
P-ISSN 3027-1991

Recommendations

a) Large scale studies should be conducted to compare the nutritional content of health outcomes of home-made and commercial weaning foods.
b) Sensory evaluation studies should be conducted to assess the acceptability of home-made and commercial weaning foods among infants and caregivers
c) Cost-effectiveness analysis should be conducted to compare the economic viability of home-made and commercial weaning foods.

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