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Research Article

NUTRITIONAL EVALUATION OF SOME FORTIFIED TRADITIONAL WEANING MEALS FROM ORIADE LOCAL GOVERNMENT AREA OF OSUN STATE, NIGERIA

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Abstract

Nutritional status of traditional weaning meals used in OriadeLocal Government Area of Osun State Nigeria, were evaluated. Five different fortified weaning meals were labeled as Red beans based diet (RBD), White beans based diet (WBD), Groundnut based diet (GND), Soya beans based diet (SBD) and Sorghum based diet (SGD) were used to feed five groups of young rats of three weeks old. The initial weights of rats were noted and thereafter maintained on their respective diet for twelve weeks. The final body weights of the rats were also noted after the twelve weeks of experiment. The rats were then sacrificed and their liver, heart and kidney weights were noted and compared. The results revealed that soya beans based diet produced the best growth compared with other formulas and control. However, this study concluded by advising nursing mothers to complement these weaning formulas with one another to wean their babies since, if prepared hygienically may improve nutritional status of their babies.

Keywords: Cereals; legumes; nutritional status; fortified meals; weaning formula.

Introduction

Breastfeeding for the first 4-6 months is recommended by the World Health Organization (WHO, 2000; Essien *et al.*, 2010) after which some semi-solid foods may be introduced into the infant diet (Cameron and Hofvander 1983; Gaman and Sherrington 1983; WHO, 2000). The process of gradual introduction of infant to what will be its adult diet and withdrawing the supply of its mother's milk (weaning) takes place only in mammals, as only mammals produce milk. The infant is considered to be fully weaned once it no longer receives any breast milk. Therefore, consistency, frequency of food, calorie and nutrient densities are needed to be monitored closely (Packard *et al.*, 2009) for proper development and growth. Studies of nutritional status take into account the state of the body before and after experiments, as well as the chemical composition of the whole diet and of all materials excreted and eliminated from the body in urine and feces (Shils *et al.*, 2005).

Nutrition (nourishment or aliment) is the provision, to cells and organisms, of the materials necessary (in the form of food) to support life. The diet of an organism is what it eats, which is largely determined by the perceived palatability of foods (Berg *et al.*, 2002). Nutritional status in children is most critical during the weaning stages when both macro and micronutrients may be insufficient to maintain growth and development. Protein energy malnutrition and micronutrient deficiency, under-nutrition may occur together (Eka, *et al.*, 2010). Malnutrition in Nigeria and many other developing countries is as a result of limited sources of protein, vitamins and minerals of high biological values, particularly those of animal origin (Ogbonna *et al.*, 2010). Many protein origins (like groundnut, fish, crayfish, soybean, beans, and sesame) are underutilized. In these developing countries, malnutrition has been aggravated by poverty and high population growth rate and low research output. In order to overcome this inadequacy of a balanced diet among the vast majority of the poor masses of the growing population of Nigerians, the production of weaning foods with the desirable nutritive quantities and qualities is a must. Although several types of nutritious commercial weaning foods are available in Nigeria, most of them are priced beyond the reach of the majority of the poor population in the rural areas. Rural mothers therefore depend on available low-cost food mixtures, which consist mainly of un-supplemented cereals and pulses to wean their infants.

Therefore, there is the need to study the potentials of some low-cost traditional weaning diets of the rural areas, to evaluate their nutritive value in comparison with the commercial products in order to ascertain their suitability as weaning foods. This is the focus of this study.

Materials and Methods

Experimental Animals

Three weeks old thirty albino rats (Rattusnorvegicus) of both sexes weighing between 21 and 50 g were purchased from Central Animal Laboratory, College of Medicine, University of Ibadan, Ibadan, Oyo state, Nigeria. These rats were randomly divided into six (6) groups of five, acclimatized and fed with five different composed diets and commercial formula, and were kept under usual management conditions in conventional animal house of the Department of Biochemistry, Kwara State University, Malete, Nigeria.

Reagents

All reagents were obtained from Pascal scientific stores Nigeria Ltd, Akure and are products of BDH Laboratory, England.

Food samples

About 5000 g each of the food samples, (red beans, white beans, groundnut, soya beans, sorghum) and the commercial formula were obtained from Ijebu-Jesha Market, Osun state, Nigeria.

Methods

Red and white beans were thoroughly cooked, dried, milled and packaged. Groundnut sample was also fried and milled while soya beans and sorghum were soaked in distilled water for 24 hours and then milled and sieved using a clean white cloth. The filterates of soya beans and sorghum were allowed to stand for about 3 hours and then decanted. The residues were dried into powder. These processed food samples were then used in the formulation of different weaning meals which were then used to feed different groups of rats of three weeks old for twelve weeks.

The initial weights of each group of the rats were recorded before the commencement of the feeding while the final weights were also recorded after twelve weeks of feeding experiment. The weight gained by each group was then calculated. The rats were thereafter sacrificed using chloroform and the organ-body weight ratios of each group were also calculated.

Proximate analysis

Proximate analysis was carried out on both raw food samples and processed weaning meals using A.O.A.C. method (2005).

Diet composition

Table 1 describes the composition of different traditional diets with food samples fortified with crayfish in ratio 3:1.

Results

The results of proximate analysis of the raw food samples revealed that soya bean has the least moisture while groundnut has the highest. The protein content of soya beans was significantly higher ($P < 0.05$) compared to other raw food samples. The crude fat and ash contents of groundnut were significantly higher ($P < 0.05$) than white beans, red beans, soyabeans and sorghum samples studied. Sorghum has the highest percentage of crude carbohydrate while groundnut has the least compared with other food samples (Table 2).

The proximate analysis of composed traditional diets depicted soya bean diet (SBD) and groundnut diet (GND) to have the highest (44.71%) and the least (22.17%) of protein respectively. However, soya beans diet (SBD) has the least (8.94) while sorghum diet (SGD) has the highest (46.58) percentage carbohydrate content. The percentage ash contents of all the composed diets were not significantly different from one another. Furthermore, the percentage fibre composition of all composed diets were also not significantly different from each other except that of GND which was significantly higher ($P<0.05$) than all others (Table 3)

Table 1: Diet Composition

Food samples (g)	Diet 1(RBD)	Diet 2(WBD)	Diet 3(GND)	Diet 4(SBD)	Diet 5(SGD)
Red beans (RB)	75				
White beans (WB)		75			
Groundnut (GN)			75		
Soya beans (SB)				75	
Sorghum (SG)					75
Cray fish	25	25	25	25	25
Total	**100**	**100**	**100**	**100**	**100**

Diet 1(RBD) = Red beans diet; Diet 2(WBD) = White beans diet; Diet 3(GND) = Groundnut diet; Diet 4 (SBD) = Soya beans diet; Diet 5 (SGD) = Sorghum diet.

Table 2: Proximate Analysis of Raw Food Samples

Food Samples	Moisture content	Crude Fat	Crude Protein	Crude Ash	Crude Fibre	Total Carbohydrate
Red beans	9.25±0.28[c]	11.20±0.28[b]	11.32±0.28[b]	3.70±0.28[b]	2.25±0.71[a,b]	62.28±0.71[d]
White beans	8.50±0.35[b]	10.47±0.47[a]	24.34±0.04[d]	3.83±0.04[c]	2.49±1.20[a,b]	50.39±0.37[c]
Groundnut	9.40±1.98[e]	51.40±1.98[e]	14.34±0.47[c]	5.34±0.47[e]	3.40±0.01[b]	16.13±0.01[a]
Soya beans	7.83±0.04[a]	25.71±0.02[d]	42.37±0.04[e]	1.73±0.04[a]	1.03±0.52[a]	21.36±0.50[b]
Sorghum	9.28±0.18[d]	11.98±0.25[c]	9.13±0.18[a]	5.23±0.18[d]	1.58±0.25[a]	62.83±0.18[d,e]

Results are means of ± S.D of two independent determinations.

Table 3: Proximate Analysis of Composed Diets

Diets	Moisture content	Crude Fat	Crude Protein	Crude Ash	Crude Fibre	Total Carbohydrate
1. RBD	6.21±0.16[b]	9.31±1.57[b]	37.27±0.71[b]	6.00±0.71[a]	4.40±0.85[a]	36.81±0.57[b]
2. WBD	1.10±0.14[a]	14.70±0.14[a]	40.95±0.71[a]	6.50±1.41[a]	4.50±1.41[a]	32.25±1.41[a]
3. GND	7.40±0.14[c]	45.90±0.14[c]	22.17±0.24[c]	5.42±0.59[a]	9.43±0.57[b]	9.68±0.21[d]
4. SBD	9.25±0.35[d]	26.25±0.35[d]	44.71±0.30[d]	6.71±0.30[a]	4.14±0.08[a]	8.94±0.07[d]
5. SGD	7.30±0.28[c]	13.40±0.28[a]	23.17±0.64[c]	5.55±0.64[a]	4.00±0.71[a]	46.58±0.71[c]

Results are means of ± S.D of two independent determinations.

Table 4: Growth Response of Experimental Rats Fed Different Composed Traditional Diets

Diets	Body weight		
	Initial	Final	Percentage increase
1. RBD	21.44±0.27	28.08±0.47	30.97[c]
2. WBD	37.42±0.35	43.18±0.52	15.39[b]
3. GND	49.33±0.17	63.61±0.98	28.94[d]
4. SBD	42.80±0.29	58.67±0.77	37.07[f]
5. SGD	36.04±0.55	40.99±0.49	13.73[a]
6. Cerelac	39.18±0.32	48.03±0.31	22.58[c]

Results are means of ± S.D of two independent determinations.

Table 5: Body-weight Ratio of Rats Reared on the Formulated Traditional Diets

Diets	Liver	Kidney	Heart
1. RBD	0.076±0.001[f]	0.012±0.001[e]	0.006±0.001[a]
2. WBD	0.060±0.011[e]	0.011±0.001[d]	0.008±0.001[b]
3. GND	0.047±0.003[b]	0.006±0.001[b]	0.012±0.001[d]
4. SBD	0.057±0.001[d]	0.007±0.001[c]	0.014±0.001[e]
5. SGD	0.030±0.002[a]	0.005±0.000[a]	0.009±0.001[c]
6. Cerelac	0.054±0.001[c]	0.005±0.000[a]	0.012±0.001[d]

Results are means of ± S.D of two independent determinations.

The result revealed that SBD had the best growth while SGD produced the least even when compared with cerelac, the positive control (Table 4).

Those Rats fed with RBD have better growth in their liver and kidney while the least growth was found in the rats fed with SGD. SBD produced the best growth in the heart of rats that were maintained on it (Table 5).

Discussion

Moisture content of food is an important index of their susceptibility to microbial spoilage. When the moisture content is on the high side, it encourages the growth of microorganisms (Temple *et al.*, 1996).This thus predisposes such food to degradation and enhances its perishability. This is an important consideration in local feeding methods in this Local Government Area and Nigeria as a whole because most nursing mothers often prepare large quantities of "dry" infant foods and keep in containers, to avoid frequent processing in order to save time and energy for other works. The low moisture content would therefore indicate low growth of bacteria and fungi.The moisture contents of both raw and composed diets (except white beans) agree closely with those reported for legumes by Arkroyed and Doughty (1964) and Ige*et al.*, (1984).

The ash contents of the diets are slightly above the recommended range (1.5-2.5%) for seeds and tubers for animal feed formulation by Pomeranz and Clifton (1981). This might be due to the inclusion of crayfish, an animal product, in all the diets and hence a high level of mineral elements in these diets.

Legumes and cereals are known to have reasonable amount of carbohydrate, hence the observed results. In addition, very high protein content level contributed to low carbohydrate.

The highest percentage of crude fat in GND could be attributed to the inclusion of oil-dense groundnut in the diet. This attribute tends to agree with the recommendations by FAO/WHO (1998) that vegetable oils be included in foods meant for infants and children, which will not only increase the energy density, but also be a transport vehicle for fat-soluble vitamins (Eka*et al.*, 2010).

The protein contents of all composed diets meet the Recommended Dietary Allowance (RDA) reported for protein (13-14) up to one year (Gutherie, 1989).

Legumes are known to be fairly rich in amino acids and fats (Ogbonna *et al.*, 2010). In addition, soya bean is also known to be richer in proteins compared with many other legumes. This may have contributed to the best growth recorded in the rats that fed on SBD.

Although the weights of the animals were not the same at the initial grouping but their percentage increase of the growth response can be calculated by finding their growth difference between their initial body weight and final body weight. The study has clearly demonstrated that soya bean based diet; SBD has a better growth effect compared with other formulas including cerelac (positive control). Although protein percentages of the composed diets differ at the beginning of the experiment, their growth effects on rats depend on their quality and not their quantity. This is manifested in the better growth response of rats fed with GND, which contained less (22.17%) protein and those rats fed with SGD, which contained more (23.17%).It is advisable however, that legumes and cereals may be combined together to achieve better nutritional status. Legumes can be combined with grain because grains have the amino that legumes lack and lack some of the amino acids that legumes have. Legumes are known to lack some essential amino acids (like methionine and tryptophan), which are present in cereals. Similarly, cereals also lack some essential amino acids (like lysine and isoleucine) but are present in legumes. Therefore, their combination will ensure the supply of all the essential amino acids necessary for the well-being of growing children. Nursing mothers of these Local Government Areas could combine some of these formulas and prepare these complementary foods hygienically to wean their babies. It will not be difficult to achieve this because all the food materials needed are readily available locally and cheaply. These formulas could ameliorate the problem of not being able to afford expensive commercial formulas.

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