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Full Length Research Paper

Effect of protein rich foods mixtures on the quality of formulated weaning food diet

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This work aimed at evaluating the effect of proteineous food mixtures on the quality of formulated weaning food diet. Protein contents of all the diets compared well with the control diet. Both melon and cowpea seeds increased the protein contents of Ogi. Diet with cowpea had the least fat content while that of melon had higher values in fat content. The crude fibre content of the experimental diets ranged from 2.43-3.30g/100g. These values were low when compared with that of the control diet (5.00g/100g). The ash contents of the formulated diets were lower than that of the control diet. The carbohydrate content of the diets compared favorably well with the control diet. The control diet had higher protein efficiency ratio (PER) and net protein ratio (NPR) followed by cowpea-melon-ogi diet. The animals fed with control diets increased in weight followed by the animal fed with cowpea-melon-ogi diet. The tissues, livers and kidneys of animals in the cowpea-melon-ogi group were found to have the highest weight when compared to cowpea-ogi and melon-ogi diet groups. The weight of kidney of melon-ogi diet group was almost the same with that of cowpea-ogi diet group but higher than the basal diet group. The organs of the animals fed with control diet had the highest total protein level followed by the cowpea-melon-ogi diet. This was due to the presence of protein mixtures in the experimental diet.

Keyword: Food diet, Protein, Carbohydrate and cowpea seed

INTRODUCTION

For the first few months of life, human infant subsists on a diet of breast milk. Breastfeeding is acknowledged to be the optimal way of both feeding and caring for young infants. Human breast milk provides the ideal food for human infants (UNICEF, 1998). It is the cheapest means of feeding a child during the first six months of life. According to Guitar (1986) during this period, growth and maturation occurs rapidly and the demands of the body for nutrients are comparatively higher than any other period of life. It has been discovered that there is an increase developmental activities, coupled with an increased expenditure of calories. The mothers' milk may be by the fifth or sixth months become insufficient to satisfy the baby's needs (Pollitt, 1994). In Nigeria, babies are normally breastfed for as long as possible, sometimes up to two years. However, as the child grows old, solid foods are introduced as from six months. The solid foods are supplementary to breast milk, which is usually inadequate for the rapid growth and development of the babies. Most of these foods are made from local foods like, maize, rice, sorghum, millet, yam, cassava, fruits and vegetables. The stage where supplementary food is introduced is called weaning period. Fashakin et al. (1991) defined the period of weaning as a transitional phase during which foods other than mother's milk supply an increasing proportion of the child's nutritional requirements and finally replaced breast milk altogether. In Nigeria, most infants are weaned on nutritionally deficient diets as they receive mainly starch gruels which are from cereals, roots and tubers. These products are deficient in quality proteins and accentuate protein deficiency diseases like kwashiorkor. The problem of protein energy malnutrition has always existed in rural and urban children between the ages of six and eighteen months because the foods are not balanced in the amount of protein, fat and carbohydrate (Abbey and Mark, 1988).

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In view of the child malnutrition, high price of imported commercial baby foods, high volume and high viscosity characteristics of starch based gruel and the formulation of weaning foods from locally available raw materials became focus of research. Germination process has been studied and found useful in increasing energy and nutrient density of infant diets (Desikarchar, 1980). However, protein modification and improvement had been reported as a result of germination (Chen et al., 1975). Furthermore, most traditional fermented food exhibit slight changes in essential amino acid and traditional fermentation dramatically improves the vitamin content of a wide variety of substrates (Odunfa, 1981). The research work aimed at processing and evaluating the formulated weaning food from germinated cowpea, fermented corn flour and defatted melon seeds flours.

MATERIALS AND METHODS

Corn, cowpea and melon were purchased at the Ife central market while commercial food (control diet) was purchased from one supermarket in Ife. The vitamin and mineral mix used were from a pharmaceutical company in Nigeria. Thirty albino rats (Wister strain) of both sexes were obtained from Department of Pharmacology and Physiology, University of Ibadan, Nigeria.

Preparation of fermented corn flour

The grains were cleaned and steeped for 48 hrs to encourage fermentation. The fermented corn was washed and dried, milled, sieved, packaged in a polythene bag and stored in the refrigerator.

Preparation of germinated cowpea flour

The cowpea seeds were sorted, cleaned and steeped for 6 hrs. They were germinated for 72 hrs in the germinating chamber. They were thoroughly washed and dried in the cabinet dryer at 45 ^{o}C for 24hrs. The dried sprout were cleaned by winnowing, milled, sieved, packaged and stored in the refrigerator.

Preparation of defatted melon seed flour

The melon seeds were cleaned in water and the floating seeds and unwanted materials were removed. The seeds were dried and roasted for 5 min. They were milled and defatted using soxhlet extractor. The resulting product was dried and packaged.

Mineral and vitamin mixtures

The mineral mixture in gram per kilogram of the corn flour contain 5.40g calcium, 4.30g phophorus, 0.01g iron, 1.60g sodium, 6.60g potassium, 0.035g zinc. This was mixed for 10 min using kenwood mixer.

The vitamin mixture in milligrams per 50 g of corn flour contained 3.0mg vitamin A, 0.60mg vitamin D, 300mg vitamin E, 350mg vitamin C, 0.25 mg folic acid, 8.0mg thiamine, 3.0mg riboflavin, 40mg niacin, 3.0mg vitamin B6, 0.075 mg vitamin B_{12}, 2.5mg biotin and 15.0mg pantothenate and starch to make up to 50g. This was mixed for 10 min using kenwood mixer.

Experimental animal

The 30 rats were weighed and divided into six groups. One group of five animals served as the control for the experimental group and was sacrificed. Tissue from the liver, kidney and plantaris muscle of the hind-leg were removed, weighed and frozen till nitrogen was determined. The remaining animals were placed on experimental diet fed *ad libitum* over a period of 28days.

Analyses of the formulated diet and experimental animal

Proximate analyses of commercial (control) and experimental diet were carried out using AOAC (1990) methods. The weight of the experimental animals was studied and the organs such as the muscle, liver and kidney were collected and examined. Net protein ratio (NPR) and Protein efficiency ratio (PER) were calculated.

RESULTS AND DISCUSSION

Chemical composition and energy values of control and experimental diets were shown in Table 2. In terms of protein, all the diets compared well with the control diet. The protein contents of the experimental diets meet the normal requirement standards set for infant diet (FAO/WHO, 1992). Both melon and cowpea seeds increased the protein contents of Ogi by four and five times respectively since Ogi was reported to contain 3.40g/100g protein (Banigo and Muller, 1982). Diet with cowpea had the least fat content while that of melon had higher values in fat content. The high fat content obtained in melon-Ogi diet may be due to the fact that melon seeds are oilseeds despite the defatting. The fat content also meets the standard requirement for infant diet. The crude fibre content of the experimental diets ranged from 2.43-3.30g/100g. These values were low when compared with that of the control diet (5.00g/100g). A very low level of fibre content in weaning food has been recommended by Desikarchar (1980). Low fibre content will encourage high digestibility and absorption of the diets by the infants.

The moisture contents of all the diets were higher than

Table 1. Composition of experimental diet.

	Basal diet	**Cowpea-ogi diet (A)**	**Melon-ogi diet (B)**	**Cowpea-melon-ogi diet (C)**
Cowpea flour (g)		200	200	100
Corn flour (g)	809	609	609	609
Melon flour (g)				100
Vitamin premix (mg)	10	10	10	10
Mineral Premix (g)	16	16	16	16
Vegetable oil	100	100	100	100
Cod liver oil (g)	5	5	5	5
Sugar (g)	60	60	60	60

Table 2. Chemical composition and energy values of experimental diets in g/100g of diet (Mean ± SEM)

Parameter	**Cowpea-Ogi** (A)	**Melon-Ogi** (B)	**Cowpea-Melon-Ogi (C)**	**Control diet** (D)
Protein	17.64 ± 0.58	16.30 ± 0.20	23.65 ± 016	16.00 ± 0.37
Fat	6.40 ± 0.23	13.00 ± 0.80	10.00± 0.04	9.00 ± 1.20
Crude Fibre	3.30 ± 0.16	2.43 ± 0.14	2.83 ± 0.23	5.00 ± 0.40
Moisture	5.8 ± 0.95	8.02 ± 0.44	6.20 ± 019	4.00 ± 0.40
Ash	3.96 ± 0.58	3.00 ± 0.10	3.46 ± 012	5.00 ± 0.80
Carbohydrate	62.90 ± 1.45	56.65 ± 1.83	53.86± 1.49	64.00 ± 1.86
PER	1.79 ± 0.18	0.95 ± 0.12	2.36 ± 0.50	3.08 ± 0.31
NPR	2.85 ± 0.23	2.02 ± 0.35	3.28 ± 0.84	3.93 ± 0.35
Energy (kCal)	379.79 ± 3.02	408.80 ± 2.63	400.04± 3.64	401.00 ± 2.34

Table 3. Food Consumption over Experimental Period (g)

Experimental period	**Basal Diet**	**Cowpea-Ogi** (A)	**Melon-Ogi** (B)	**Cowpea-Melon-Ogi (C)**	**Control diet** (D)
7	83.80	86.70	88.80	94.30	116.60
14	180.30	208.80	209.30	232.80	267.30
21	261.00	368.50	377.60	415.90	457.60
28	332.10	541.10	548.80	592.40	671.20

that of the control diet. However, these values still fall within the expected range for weaning diet which must not exceed 10%. The ash content of the diet were lower than that of the control diet but fall within the recommended value for weaning food which must not exceed 5%. The carbohydrate content of the diets compared favorably well with the control diet. The most favourable protein efficiency ratio (PER) and net protein ratio (NPR) were apparent in groups treated with control diet and cowpea-melon-ogi whereas PER and NPR were inferior in groups receiving individual protein sources. The values of PER in cowpea-melon-ogi exceeded the recommended value which is 2.1 (PAG, 1982) while melon-ogi and cowpea-ogi fall below the recommended requirement.

Animal Feeding Experiment

During the 28 days experimental period the adaptation of the animals fed on each dietary sample and utilization of each diet were studied (Figure 1). Food and water were given to the animal *ad libitum*. The animals that depend on the basal diet for survival were found to become leaner and weaker each passing day of the experiment. Changes were observed on the skin and in their consumption rate. Loss of weight was dramatic from average weight of 36.96gm at day one to 25.56gm at twenty eight days (there was loss of an animal in this group). On the other hand, the animals fed with other diets increased in weight especially in the control diet group followed by the cowpea-melon-ogi (Fig.1). The weight of the animal fed on basal diet decreased with time as reported by Akindele et al (1974) and Fashakin et al (1991). This implies that ogi has a protein of poor biological value and does not support growth in rats. On comparing the rate of consumption of the diets as shown in Table 3, the rate at which cowpea-melon-ogi was consumed by the animal was high but a bit lower than that of the animal feeding on control diet.

The tissues of animal fed on basal diets were found to

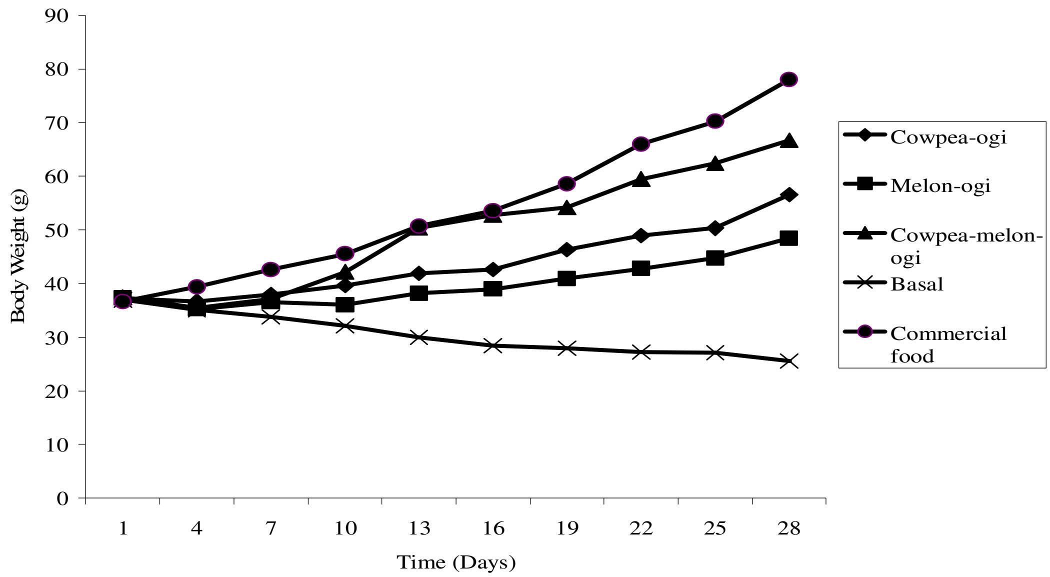

Figure 1. Average weight changes over the experimental period

Table 4. Weight of various tissues of Experimental animals in grams (Mean SEM)

Tissues	Control (Zero day)	Basal Diet	Cowpea-Ogi (A)	Melon-Ogi (B)	Cowpea-Melon-Ogi (C)	Control diet (D)
Liver	1.67 ± 0.22	1.02± 0.17	2.49± 0.24	2.64 ± 0.18	3.58± 0.38	3.60 ± 0.18
Kidney	0.27± 0.30	0.16 ± 0.06	0.40± 0.03	0.47 ± 0.08	0.68 ± 0.05	0.68 ± 0.09
Muscle	0.35 ±0.42	0.29 ± 0.17	0.85± 0.10	0.89 ± 0.15	1.01 ± 0.28	1.02 ± 0.22

The zero day animals (control) are the animal sacrificed on the first day of the experiment. The tissues collected from these animals served as the initial level for the other animal's tissues at the end of the experiment

Table 5. Total protein level (mgN) in various tissues of experimental animals

Tissues	Control (Zero day)	Basal Diet	Cowpea-Ogi (A)	Melon-Ogi (B)	Cowpea-Melon-Ogi (C)	Control diet (D)
Liver	50.18± 0.10	40.98±0.96	76.08±0.08	60.08±0.20	82.37±0.45	101.25±0.09
Kidney	26.83±0.38	20.64±0.47	47.20±0.05	35.34±0.25	50.82±0.63	63.93±0.10
Muscle	38.59±0.36	23.91±0.03	37.38±0.27	30.73±0.31	54.86±0.75	63.58±0.12

The zero day animals (control) are the animal sacrificed on the first day of the experiment. The tissues collected from these animals served as the initial level for the other animal's tissues at the end of the experiment

be smaller than those of animals from other experimental groups (Table 4). The livers, kidney and muscle of animals in the cowpea-melon-ogi were found to have the highest weight when compared to cowpea-ogi and melon-ogi diet groups. The animals in the control diet group showed a clear lead over all other group followed by the animal fed with cowpea-melon-ogi group (Table 5). This was due to the presence of protein mixtures (cowpea and melon) in the experimental diet.

CONCLUSION

Based on the findings of the investigation, it may be concluded that local resources have great potentials in the formulation and preparation of infant weaning foods. Cowpea-melon-ogi diet was potentially viable in the formulation of an infant weaning diet and this product would be cheaper and more accessible. Also, this will go along way in ameliorating the usual symptoms of protein energy Malnutrition (PEM) commonly prevalent in the developing country.

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