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Nutritional Assessment of Breakfast Foods Developed From Animal Polypeptide, Crayfish (*Euastacus Spp)* and Maize (*Zea Mays)*

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Abstract Breakfast is the first food taken after waking up from a night's sleep, most especially early in the morning before undertaking the day's activity. Breakfast foods vary widely according to culture, location and resources but should contain major nutrient, a carbohydrate such as grains or cereals, fruit and/or vegetables, a protein food such as eggs, meat or fish, and a beverage such as tea, coffee, milk or fruit juice, Coffee, and milk. The objective of this study is to prepare breakfast foods from animal polypeptide, maize and crayfish were the sole energy and protein source respectively. Diet 1, nitrogen free diet (Basal), diet 2 (Crayfish: fermented maize 10g: 100g), diet 3 (Crayfish: fermented maize15g: 100g), diet 4 control (milk based). The formulated breakfast diets were fed to 50 albino rats. A commercial product, milk based commercial breakfast (MBCB) was used as standard diet. The results revealed that the growth response, (non protein dietary) declined from 24.62- 23.79g, (protein dietary) increased from 23.36-45.74, 24.50-40.77, and 24.43-37.81g, for diets 1 2, 3, and 4 respectively. Animal polypeptide (Diet 2) at combination of 10g: 100g performed better than 15g: 100g combination. It may be suggested that (Diet 2) at combination of 10g:100g could have complete amino acid profile that could sustained body for daily activities and meet daily requirements when compared to other formulated dietary. Animal polypeptide (crayfish) supplement to energy obtained from maize at 10g: 100g promoted the best growth performance.

Keywords: *breakfast, optimum nutrient, polypeptide*

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1. Introduction

Breakfast foods vary widely according to culture and location, but should contain major ingredients, a carbohydrate such as grains or cereals, fruit and/or vegetables, a protein food such as eggs, meat or fish, and a beverage such as tea, coffee, milk or fruit juice, Coffee, and milk. Factors including eating patterns, breakfast skipping, eating meals away from home, age, sex, physical activity, and total energy intake determine body weight [13,14]. Crustacean is classified as an animal polypeptide, accounts for 36-45 per cent of crude protein, is a freshwater crustacean resembling small lobster, was reported to have high nutritive value with a superior biological value, true digestibility, net protein utilization, high content of essential amino acid, and protein efficiency is favourable compared to casein [3,6,8,9]. Crayfish are usually prepared for consumption by smoking, and occasionally preserved by sun-drying, and is a common delicacy in the diet, among the people of the Southern Western – Nigeria. Moreover, it may also be available at all the seasons, cheap, affordable and suitable to supply adequate nutrients to cater for breakfast estimated daily nutrient requirements to eradicate protein energy malnutrition (PEM), in the developing countries Zaglol and Eltadawy 2009. Nutritional information of crayfish has been highlighted to contain chemical composition and nutritive value of crayfish such as protein, fat, ash and cholesterol contents 20.88%, 1.76%, 1.52% and 13.575mg/100g respectively. Minerals contents level were 1.32%, 506.33 and 415.63 ug/g for phosphorous, iron and magnesium respectively [18]. In addition, health benefit of crayfish including supply of vitamin D and A, also present were mineral elements such as calcium, potassium copper, zinc and iodine, [15]. Amino acid pattern showed that Glutamic, Aspartic, Arginine and leucine were abundant essential amino acids and oleic acid represented 44% of total fatty acids. Crayfish showed high nutritional value as respect to higher content of total unsaturated fatty acids (73.689%) with 56.56% and 15.08% monoioneic and polyioneic (with w3 and w6) fatty acids, and also, high quality of protein which contain 55.703% essential amino acids (Zaglol and Eltadawy 2009 crayfish (Lobster) is noted to have medicinal value, non-toxic, contains very low carbohydrates weight reducer when consumption. It was reported that crayfish is not only the delicate white meat, it taste delicious, nutrient-rich, and highly digestible [6,8,9,10,15,18]. Hence the objective of the study is to

produce breakfast crayfish (animal polypeptide) and maize and nutritionally assess the quality and quantity of crayfish.

2. Materials and Methods

The Materials for the Formulations

The materials used for the study included Maize grains, crayfish (animal polypeptide), milk-based commercial breakfast. They were purchased from a local supermarket in Ile-Ife, South-West, Nigeria. Maize and crayfish were cleaned, sorted and all extraneous materials carefully removed, oven dried at 80 ^{O}C for 24hour, grinded with hammer mill into flour and packed into air tight polyethylene bags and stored in the refrigerator prior to animal experiment.

2.1. Animal Experiment for 28 Days

Fifty (50) weaning albino rats were obtained from College of Health science animal breeding centre, Obafemi Awolowo University, Ile-Ife, Nigeria. The experimental animals were weighed and randomly allocated into metabolic cages previously labelled numbers 1-50. Their average weights and ages ranged from 26.62 to 42.06g and 3 to 4 weeks old respectively. The experimental animals were allocated into metabolic cages was pre-fixed with a cup and a small plastic bottle in order to supply food and water *ad libitum*. The experimental animals were acclimatized to the new environment by feeding them on animal pellet for seven days. The animals were reweighed and group into five of ten per group in such a way that the weights were close. They experimental diets were fed to the experimental animals *ad libitum* for 28days, in a feeding cup and water were supplied via a plastic bottle fixed to the cage. Daily consumption of dietary samples was carefully recorded and the weights were noted. Weights of the experimental animals were taken every three days. At the end of the experiment, that is twenty-eight days, the experimental animals were sacrificed in similar way as control group. Organs like kidney, liver and muscle of the hind leg were obtained, weighed and stored frozen at -10°C prior to nitrogen determination, [1,5,6,8,9,10].

2.2. Chemical Analysis

Chemical analysis included Protein (nitrogen x 6.25), moisture, fat, crude fibre carbohydrate, and vitamins of the ingredients and formulated diets were determined according to AOAC (2000). Energy value was determined using Combustion calorimeter, model e2K.

3. Ethical Consideration

This study was approved by the Ethical Review Committee of the Obafemi Awolowo University, Osun State, Ile-Ife, Nigeria.

4. Results and Discussion

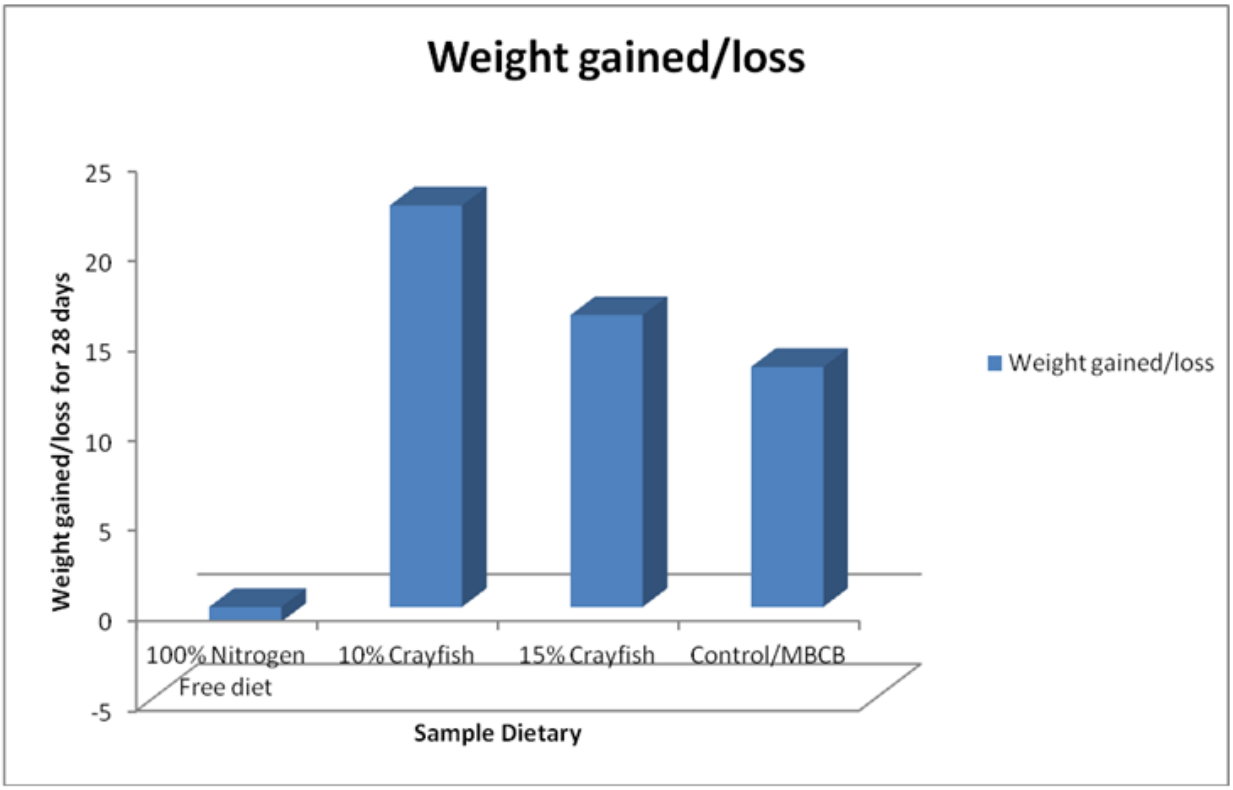

Figure 1. Weight gain/loss of experimental animal during 28 days

Diet 1, nitrogen free diet (Basal) diet 2 (Crayfish: fermented maize 10:100), diet 3 (Crayfish: fermented maize15:100), diet 4, milk based commercial breakfast.

Figure 1 showed the growth rate and response to dietary intake of the experimental animals for 28 days, the growth response gave the highest result at 10:100 crayfish inclusion (diet 2), followed by 15:100 crayfish (diet 3),

milk-based diet (diet 4), and nitrogen free dietary (diet 1) respectively. Diets 2 promoted growth more than the animals fed with control diet, diet 2 may have complete amino profile when compared to other formulated diets. Some workers had previously reported that 10:100 crayfish diets inclusion with animal protein source may result in balance diet and meet the estimated daily nutrient requirements for breakfast foods, [3,6,7,8,9,13,14]. Nitrogen retained and weight gained, was higher in 10:100 crayfish diet compared to 15:100 crayfish (animal inclusions), whereas 10:100 crayfish with less protein promoted growth than 15:100 inclusion. Researchers have demonstrated adequate nutrients intake, this may be because nutrient intake has reached optimum at 10:100 inclusion, hence, more than 10:100 animal protein inclusion may not be utilized by body, hence could lead to excess and hence result in diet-related diseases' (FAO/WHO/UNU, 1985, 1991 1998, Schusdziarra *et a*l 2010, 2011). However, diet 1, nitrogen free diet could not support growth, and found to decrease the weight of the animals in group 1. This may be due to the fact that the diet1 compared with dietary 2,3 and control diet, it lacked adequate nutrient such as protein, deficient in essential amino acid, such as lysine and tryptophan, it had earlier reported not nutritionally adequate to enhance growth and conformed to previous studies but could only be energy source to breakfast [3,6,8,9].

Table 1. Chemical composition (%) of the ingredients

Dietary	Protein %	Moisture %	Fat %	Ash %	Crude fibre %	CHO %	Caloric value (Kcal)	Vitamin Cmg/100g	VitaminB1 B1mg/100g
1	-	4.30±03	2.22±03	4.50±02	5.25±04	83.73±04	355±03	5.45±03	15±02
2	12.65±02	5.98±03	4.38±02	2.26±02	0.52±02	74.21±02	446±04	17.50±02	1.5±02
3	15.50±03	3.56±03	5.30±02	2.20±03	0.75±02	72.69±03	467±02	15.30±03	1.2±04
4Control	15.5±02	2.50±02	9.0±04	2.60±02	2.95±02	67.45±02	413±02	17±02	17±02

The data are mean ±SD values of three determinations with different superscript in a column are significantly different (P < 0.05). Foot note: Diet 1, nitrogen free diet (Basal) diet 2 (Crayfish: fermented maize 10:100), diet 3 (Crayfish: fermented maize15:100), diet 4, milk based commercial breakfast (MBCB).

Table 1 composed of chemical analysis (%) of the ingredients which including protein, moisture, fat, ash, crude fibre carbohydrates, Vitamin C mg/100g, Vitamin B1 mg/100g and caloric values. The ingredients were nutritional adequate to formulate a breakfast food that will meet the estimated daily nutrient requirements for breakfast foods, [3,4,11].

Table 2. Average food consumption over the 28 days of theexperimental period

Dietary	Time in Days					
	5	10	15	20	25	28
1	22.77^{a}±04	45.24^{a}±02	66.05^{a}±02	84.26^{a}±04	96.88^{a}±03	112^{a}±04
2	35.68^{bc}±02	78.82^{d}±02	106^{d}±04	155^{d} ±04	192^{d}±03	206^{d}±03
3	36.86^{d}±03	77.92^{b}±03	102^{b}±03	152^{b} ±02	182^{b}±02	205^{c}±03
4Control	36.52^{b}±02	78.20^{c}±03	104^{c}±02	150^{c} ±03	182^{c}±02	204^{b}±02

The data are mean ±SD values of three determinations with different superscript in a column are significantly different (P < 0.05). Foot note: Diet 1, nitrogen free diet (Basal) diet 2 (Crayfish: fermented maize 10:100), diet 3 (Crayfish: fermented maize15:100), diet 4, milk based commercial breakfast (MBCB)

Table 2 presents the average food intake for over the 28 days of the scheduled for the animal experiment. The combination of dietary 10:100 crayfish had the best consumption, followed by 15:100 crayfish; then milk based commercial diets and nitrogen free diets. This may be because balance diet, appropriate formulation of diets determine amount of nutrient intake in quality and quantity, [6,8,9,12,16].

Table 3. The average nitrogen retained in various tissues of experimental animals

Dietary	Liver(mg/g)	Kidney(mg/g)	Muscle(mg/g)
1	35.62^{a}±02	44.50^{a}±02	46.70^{a}±03
2	57.40^{d}±02	54.23^{c}±04	56.60^{d}±04
3	56.60^{c}±03	53.30^{d}±02	55.50^{c}±02
4Control	56.22^{b}±03	52.28^{b}±03	55.38^{b}±02

The data are mean ±SD values of three determinations with different superscript in a column are significantly different (P < 0.05). Foot note: Diet 1, nitrogen free diet (Basal) diet 2 (Crayfish: fermented maize 10:100), diet 3 (Crayfish: fermented maize15:100), diet 4, milk based commercial breakfast (MBCB).

Table 3 reports the average nitrogen content retained in various organs of the animal experimental animals including the liver, kidney and tissue nitrogen are general reflection of dietary nitrogen content level. The average nitrogen retained in diets 2, 3, and 4 organs of experimental animals were similar but highest retention of nitrogen was found in experimental animals fed on diet 2 compared with the control sample, while the average nitrogen retained in diet 1 (non protein dietary) organs of animal experimental animals was lowest compared with diets 4 (milk based diet). All diets have enough nutrients except 1 which could be retained by experimental animals muscle for daily activities. Hence the amino acid profile of all breakfast foods are complete and that the diets can liberate more nitrogen that is sufficient to supply to the body organ, this is in agreement with previous findings [6,8,9,18].

Table 4. Average weight in grams of various organs of the experimental animal

Dietary	Liver(g)	Kidney(g)	Muscle(g)
1	3.206^{a}±02	3.204^{a}±03	3.423^{a}±02
2	4.106^{d}±03	4.999^{d}±02	3.440^{b}±03
3	4.102^{c}±02	4.890^{c}±02	3.450^{c}±02
4 (control)	4.086^{b}±02	4.653^{b}±04	3.530^{d}±02

The data are mean ±SD values of three determinations with different superscript in a column are significantly different (P < 0.05). Foot note: Diet 1, nitrogen free diet

(Basal) diet 2 (Crayfish: fermented maize 10:100), diet 3 (Crayfish: fermented maize15:100), diet 4, milk based commercial breakfast (MBCB)

Table 4 presents the various internal organs of the experimental animal such as livers, kidneys and selected muscles ranged from to 3.206 to 4.106, 3.204 to 4.999 and 3.440 to 3.530 respectively. The data above revealed that the weight of the animals take after the size of the organs obtained from the experimental animals, that is the higher the animal the higher the organ, dietary intake determines the body weight, other workers confirmed this, [2,5,6,8,9,10].

5. Conclusion

Animal polypeptide (Diet 2) at combination of 10g: 100g performed better than 15g: 100g combination. It may be suggested that (Diet 2) at combination of 10g:100g have complete amino acid profile that might sustained body for daily activities and meet daily energy intake when compared to other formulated dietary. Animal polypeptide (crayfish) supplement to energy obtained from maize at 10g: 100g promoted the best growth performance. However crayfish (Lobster) is noted to have medicinal value, highly digestible, non-toxic, contains very low carbohydrates, has weight reducer tendency could be succor to obesity patients and eradicate protein energy malnutrition (PEM), in the developing countries.

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