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Proximate composition and economic values of four common sources of animal protein in South-western Nigeria

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ABSTRACT

The proximate composition,market prices and production cost per unit kilogram of four common meat types were investigated in the south-western area of Nigeria. The meat types were beef,broiler, African catfish and Tilapia and the parameters were crude protein (%),ether extract(%),ash(%),crude fibre(%) and nitrogen-free extract(%) and average market prices of the meat types. One hundred grammes of each of the meat sample were obtained from freshly slaughtered cow, broiler chicken and fishes. Each sample was subdivided into four replicates which were later subjected to proximate analyses in a completely randomized design (CRD) while current market prices of each of the meat samples were investigated. Beef had the highest crude protein and fat content, while broiler meat and African catfish had higher mineral content than others. However, none of the samples had crude fibre. Meanwhile, Tilapia (N42.00{US$ 0.28} per 100g fresh weight) was the cheapest while broiler meat was the most expensive(N57.00 {US$ 0.38} per 100g fresh weight). Beef had the highest level of crude protein than other meat types while Tilapia was the cheapest meat type in south-western Nigeria as at 2009 when this study was carried out.

Keywords: market prices, meat types, proximate composition.

Análisis proximal y valor comercial de cuatro fuentes comunes de proteína animal en el suroeste de Nigeria

RESUMEN

La composición proximal, precios de mercado y costo de producción por kilogramo de unidad de cuatro tipos de carne común se investigaron en la zona sur-occidental de Nigeria. Los tipos de carne fueron carne de res, pollo, pez gato africano y la Tilapia; los parámetros estudiados fueron: proteína cruda (%), extracto etéreo (%), cenizas (%), fibra cruda (%) y extracto libre de nitrógeno (%), y los precios medios de mercado de los tipos de carne. Para ello fueron seleccionados 100 g de cada una de las muestras de carne de res, pollo y peces recién sacrificados. La muestra se dividió en cuatro réplicas que fueron sometidas posteriormente a análisis proximales en un diseño completamente al azar (DCA), mientras que los precios actuales de mercado de las carnes fueron investigados. La carne de res tuvo el mayor contenido de proteína cruda y grasa, mientras que la carne de pollo y pez gato africano tuvo un mayor contenido de minerales. Sin embargo, ninguna de las muestras mostraron fibra cruda. Mientras tanto, la Tilapia fue la más económica (N42.00 o USA$ 0,28 por cada 100g de peso fresco) y la carne de pollo fue la más costosa (N57.00 USA$ 0,38 por cada 100g de peso fresco). La carne de res tuvo el más alto nivel de proteína cruda en comparación a otros tipos de carne, mientras que la Tilapia resulto ser el tipo de carne más barata en el suroeste de Nigeria, al momento de realización de este estudio.

Palabras claves: precios de mercado, tipos de carne, análisis proximal.

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INTRODUCTION

Most African countries have major problems of malnutrition in certain sectors of their population. Despite an increase in the pace of development,the problems have persisted probably due to the low production of food,its distribution and or its quality (Ojedapo *et al*., 2009). A number of researchers (Omoregie, 2001; Amaefule *et al.,* 2006; Adejinmi *et al*., 2007) have attributed the main cause of hunger and malnutrition in these countries to the unavailability of good quality feeds in terms of protein, energy and mineral content.

Among the various nutritional deficiencies identified in these developing countries, protein malnutrition has been reported to be most acute. Apart from the fact that protein intake is very low, most of it comes from vegetable sources (Nworgu *et al*., 2006). Developing countries in Africa and Asia are believed to own more than 60% of the world's cattle, over 90% of the buffaloes, about 50% of the sheep, pigs and poultry and the largest number of other grazing animals useful to human beings (FAOSTAT, 2000). In addition, some marine and wildlife species contribute immensely to non-conventional sources of animal protein.

South-western Nigeria constitutes a typical lowland rainforest zone characterised by thick vegetation with big trees, rivers and streams. Sources of edible meat in this study area include ruminants, non-ruminants and marine creatures. Among these, beef, broiler and two types of fish; African catfish and Tilapia (*Clarias lazera* and *Tilapia macrocephala* respectively*)* were chosen for this study because of their relative popularity as sources of animal protein, their ready availability and comparative cheapness to various income classes. Prices of protein diets soar in the markets everyday and various meat and meat products vary in their demand pattern due to differences in their cost, taste, environment, preference and consumption patterns. An attempt was therefore made to compare the proximate composition of beef, broiler and the fish types with a view to recommending an economically modest meat for the inhabitants of the study area.

MATERIALS AND METHODS

One hundred grammes of each of the meat type was obtained fresh and used for the proximate analysis. For the beef, the sample was excised from the loin eye area; the *Longissimus dorsi* (LD) while for the broiler, the thigh muscle area was used. Also the muscles of the back region of the fishes were selected.

Each meat sample was separately communited into fine fibre fragments in a meat homogeniser after which they were packaged in cellophane bags, labelled and stored in a frostless freezer at about -10 ^{o}C. Proximate analysis was carried out within 24 hours of storage with the methods of analysis described by the Association of Official Analytical Chemists (AOAC, 2000). Parameters investigated on dry matter basis included crude protein (CP),ether extract(EE),ash, crude fibre(CF) and nitrogen free extract (NFE).Each analysis was replicated four times in a completely randomized design(CRD).

A couple of techniques were used to obtain the price of each of the meat types in the study area. The first method used was the Consumer Panel Approach (CPA) where direct information on consumer prices was obtained. Then, prices from the various recognized meat shops were considered. In addition, price surveys were carried out in

the surrounding local markets for both live and slaughtered cow ,live and dressed broiler chickens and live and frozen fish types. The average of the prices obtained from these combined sources for each of the meat type concerned was assumed for the fresh samples in the study area. Dry weight of each meat type was obtained by determining the moisture content using the method earlier described by AOAC (2000).

Data generated were subjected to analysis of variance using the Statistical Analysis Software (SAS, 1999) and means where significant were separated with the Duncan's option of the same software.

RESULTS AND DISCUSSION

Table 1 shows the proximate composition of beef, broiler meat, African catfish and Tilapia. No significant($P>0.05$) difference was observed between the mean CP content of all the meat types analysed although it was highest for the beef sample and lowest for the Tilapia. The range was from 90.81% to 92.75%.

Meanwhile, significant ($P<0.05$) differences were observed between the mean EE, ash and NFE of the meat types analysed.

Table 1. The proximate composition of beef, broiler meat, African catfish meat and Tilapia meat (on dry matter basis) in 2009.

Parameters	Meat Types				
	Beef	Broiler meat	African catfish	Tilapia	SEM
%Crude Protein(CP)	92.75	92.21	91.99	90.81	2.50
% Ether Extract(EE)	4.59a	4.34b	3.18d	3.35c	0.10
% Ash	0.41b	0.62a	0.61a	0.40b	0.50
% Crude Fibre(CF)	nil	nil	nil	nil	___
% Nitrogen Free Extract (NFE)	2.25d	2.83c	4.22b	5.44a	0.40

abc: Means along the same row with different superscript are significantly (P<0.05) different.
SEM**:** Standard Error of Means.

For the EE content, the range was from 4.59% (beef) to 3.18%(African catfish) while for ash content, broiler meat ranked first(P<0.05) and for NFE, Tilapia ranked first. However, all the meat types analysed had no crude fibre.

Table 2 shows the average market prices of beef, broiler meat and the fish types in the study area as at the time of sampling. The average market prices of beef was N2229.24 (US$ 14.86) per kilogram (kg) dry weight while that of broiler meat was N2493.75 (US$ 16.62).That of African catfish was N2400.00 (US$ 16.00) and Tilapia cost N1932.00 (US$ 12.88) per kg dry weight. All prices were derived on the basis of dry weight of the edible portion of the samples.

The results of the crude protein as shown in Table 1 is in favour of the beef type with an average value of 92.75% which is superior to others (P<0.05). This observation is in agreement with those of Okubanjo (1997) who claimed that the trotters of cattle contain about 92.15% protein which was found to be superior to other sources of meat. However, Lawrie (1981) and Hamilton (1982) ranked fish and chicken above beef. These variations may be due to differences in sampling methods (Omojola and Adesehinwa, 2006) ,age, sex, genetic, and environmental factors(Maltin *et al.,* 2003).

The result of the EE content revealed that beef had the highest lipid content of 4.59% followed by broiler meat (4.34%), Tilapia (3.35%) while the least value came from African catfish (3.18%). The higher fat content of beef may be responsible for its juiciness and sweet aroma upon cooking and that of broiler meat.

Broiler meat and African catfish had higher values of mineral contents (0.62% and 0.61% respectively) indicating superiority over beef and Tilapia (0.41% and 0.40% respectively).Non-detectable amount of crude fibre in all meat types supports their high digestibility.

Table 2 shows that Tilapia was the cheapest source of meat in this study (N42.00{US$ 0.28} per 100g fresh weight) followed by African catfish (N48.00). Beef was N52.00 {US$ 0.35} per 100g fresh weight and broiler meat was the most expensive being N57.00 {US$ 0.38} per 100g fresh weight on the average. The meat types investigated have relatively higher and similar crude protein content. Beef contains higher fat than other meat types and this may be responsible for its juiciness and sweet aroma upon cooking.

The market price analysis suggests that the cheapest meat among these types investigated was Tilapia costing N420.00 {US$ 2.80} per kilogram fresh weight compared to N570.00 {US$ 3.80} for broiler meat and N520.00 {US$ 3.47} for beef and N480.00 {US$ 3.20 } for African catfish. At the price of N2229.24 {US$ 14.86} per kilogram dry weight of beef, one gram of CP will cost N2.07 {US$ 0.014}, while for broiler meat, African catfish and Tilapia, it would cost N2.30{US$ 0.015},N2.21{US$ 0.0147} and N1.75{US$ 0.012} respectively.

CONCLUSION

From these analyses, it could be concluded that beef is relatively superior to other meat types in term of protein and fat content while Tilapia was the cheapest source of animal protein in the study area as the time of this research.

Table 2. Average market prices of beef, broiler meat, African catfish meat and Tilapia meat in 2009.

Meat Types	N/100g fresh sample (Before drying)	Weight of sample (after drying)	N/kg dry weight
Beef	52.00b	42.87c	2229.24
Broiler Meat	57.00a	43.75c	2493.75
African catfish	48.00c	50.00a	2400.00
Tilapia	42.00d	46.00b	1932.00
SEM	3.00	3.00	

abc: Means along the same column with different superscript are significantly (P<0.05) different.
SEM: Standard Error of Means.

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