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# DETERMINATION OF NUTRITIONAL VALUE OF DONKEY MEAT SOLD AT NKWO NGBO EBONYI STATE

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ABSTRACT
The aim of this work was to determine the nutritional value of donkey meat. The proximate analysis of minced carcass, was done and reported as moisture, dry matter, crude protein, total ash and organic matter. Moisture content was 68.35-74.72% and the dry matter content was 23-68-30.68%. Total ash content was also higher in donkey (5.10-8.19% as compared to 1.5% in beef, however, the organic matter content was slightly lower in donkeys (91.81-94.90%) compared to 98.5% reported in beef. The crude protein content 55.05-62.27 on dry matter basis. Mineral analysis revealed that donkey meat is rich in Fe, P, K, and Zn. For Ca, P, Mg, Cu and Mn, there was no signification difference between the cuts ($P < 0.05$). However, a significant difference was observed in K, N, Zn and Fe ($P < 0.05$).

KEYWORDS: Proximate composition, meat quality, mineral composition, donkey meat

## INTRODUCTION

Donkey, *Equus asinus* are domesticated animals that belong to equine family, which include horses, Zebras and the mules (Wilson, 1990). Though donkey is one of the man's oldest domesticated animals, it has been neglected as an object of scientific inquiry. Donkeys contribute to economic development as they are used in everyday life. They are even used more frequently than cattle and have taken the work that was in the past done by cattle, horses and machinery such as tractors (Starkey, 1994). Aganga *et al* (1994) reported that donkeys are used as important means of transport in Botswana where they are used mainly for carrying loads such as firewood, water drums as well as for riding by children and women.

Donkeys are tolerant to some tropical diseases and parasites. They are easily managed and can survive on poor quality feeds and thrive under adverse climatic conditions (Aganga *et al,* 2000).

A liberal meat supply has always been associated with a happy and virile people and has always been the main food available to settlers of new under developed territories (Romans and Zeigler, 1977).

People who eat the meat confessed that it is sweeter, softer and cheaper than beef. The composition of donkey meat cannot be described simply in terms of the different components and their percentages, since meat include the entire carcass along with the muscles fatty tissues, bones, tendons, edible organs and glands. This gives a wide range of components and thus of composition and nutritive value. The percentage of separate lean varies widely and it is inversely related to the fat content. It is interesting to note that the percentage of bone and tendon declines directly with the amount of meat. Variation in composition results in differences in nutritive value. Meat is composed of water, fat, protein, total mineral (ash) and a small proportion of carbohydrate (Pearson and Gillet, 1999). The composition is measured in terms of the major chemical components such as proteins, fats carbohydrates, mineral and moistures. The aim of this study is
to determine the nutritional value of donkey meat through carcass analysis to ascertain the lean meat yield; proximate composition of donkey meat, namely crude protein, moisture content, dry matter content, total ash and organic matter, and to determine mineral composition of donkey meat namely phosphorus, calcium, magnesium iron, zinc, manganese and copper.

## MATERIALS AND METHODS

Chemical Analysis: The donkey meat bought from Nkwo Ngbo in Ebonyi State of Nigeria were oven dried and ground. The dried ground samples were subjected to chemical analysis using the procedures of (AOAC, 1996) on meat and meat products. Proximate and mineral analyses were done.

Statistical Analysis: The experiment employed a completely Randomized Block design in which each donkey was treated as a replicate and the cuts as dependent variables. Data analysis was done using Analysis of variance (ANOVA) according to the statistical analysis system (Snedecor and Cochnan, 1989). Differences among sample means were tested for significance with Dumcan's multiple range test (Duncan, 1955) at a significance level ($P < 0.05$).

Proximate composition cuts: Hip (1), sir loin (2), Loin (3), Flank (4), rib (5), Plate (b) Chuck (7) Brisket (8) and shank (9). There were several distinctions between proximate composition in beef and donkey.

RESULTS

The result of the proximate analysis and mineral determination of the donkey meat are hereby presented in the following tables

Table 1: Proximate Composition of lean beef muscle tissues(%)

| Mineral | Moisture | Protein | Fat | Total ash | Dry matter | Organic matter |
|---|---|---|---|---|---|---|
| & composition | 75 | 18 | 3 | 1.5 | 26 | 98.5 |

Table 2: Proximate composition of donkey carcass

| Cuts | Moisture | Dry matter | Ash | Organic matter | P (Nx6.25) |
|---|---|---|---|---|---|
| 1 | 74.72 | 23.68 | 8.11 | 91.90 | 62.27 |
| 2 | 72.51 | 27.49 | 8.19 | 91.81 | 58.47 |
| 3 | 71.24 | 27.99 | 5.62 | 94.38 | 56.51 |
| 4 | 68.35 | 30.68 | 5.60 | 94.40 | 56.81 |
| 5 | 71.69 | 28.31 | 8.02 | 91.98 | 55.60 |
| 6 | 71.05 | 28.95 | 5.28 | 94.72 | 55.05 |
| 7 | 73.35 | 26.65 | 5.10 | 94.90 | 56.83 |

1:hip, 2: sirloin, 3: loin, 4: flank, 5:rib, 6:plate, 7:chuck, 8: brisket, 9: shank.

Table 3: Mineral Composition of donkey cuts, Macroelement (%) macro mineral

| Cuts | Ca | P | Mg | K | N |
|---|---|---|---|---|---|
| 1 | 0.095 | 0.182 | 0.081 | 0.414 | 9.997 |
| 2 | 0.112 | 0.195 | 0.074 | 0.358 | 9.362 |
| 3 | 0.124 | 0.184 | 0.061 | 0.362 | 9.012 |
| 4 | 0.159 | 0.167 | 0.061 | 0.357 | 9.368 |
| 5 | 0.120 | 0.182 | 0.064 | 0.399 | 9.043 |
| 6 | 0.146 | 0.174 | 0.057 | 0.382 | 9.091 |
| 7 | 0.121 | 0.167 | 0.066 | 0.287S | 8.901 |

Table 4: Trace Mineral Composition of Donkey (PPM)

| Cuts | Zn | Fe | Cu | Mn |
|---|---|---|---|---|
| 1 | 3.024 | 35.246 | 0.052 | 0.292 |
| 2 | 3.847 | 29.096 | 0.062 | 0.215 |
| 3 | 3.418 | 31.440 | 0.060 | 0.252 |
| 4 | 3.460 | 35.838 | 0.060 | 0.266 |
| 5 | 3.161 | 32.418 | 0.062 | 0.219 |
| 6 | 3.472 | 33.363 | 0.062 | 0.220 |
| 7 | 2.623 | 32.245 | 0.064 | 0.217 |

DISCUSSION

Moisture: The moisture content was lower for donkeys (68.35-74.72%)Table 2, and slightly higher for beef as shown by Libby (1975) and Srinivasan *et al* (1998), who reported mean values of 75 and 77.12% respectively. The lower moisture level in donkeys is due to the fact that water loss by donkeys is 2 to 4 times that of cattle and camels, under comparable conditions. Donkeys like other Equips dissipate heat mainly by sweating and the sweat glands are found all over the body. Sweating rates of 145g water/$m^2$ body area per hour occur at high

ambient temperatures and respiration rates can rise from normal 14 to 30 to as high as 130 breaths per min (Payne and Wilson, 1999).

Water is a major constituent (70-78%) of lean muscle tissue and within a muscle is inversely related to the fat content. The fatter the animal the less the moisture it contain.

The hip had a higher mean of moisture (74.72%), followed by the shank (73.35%) and the plate had the least means of (68.35%).

Dry Matter: The dry matter content for donkey was slightly higher (23.68-30.68) compared to beef (25%).
All the cuts were significantly not different ($P > 0.05$) except the hip which showed a lower mean value of (22.68%) and the plate with a higher mean of (30.68%) (Table 2]. This means that the dry matter is calculated as a residue after determining the moisture content.

Total Ash: The total ash content in donkey cuts too high (5.10 – 8.19%) compare to that of (1.5%). Ash content reflects to the mineral content but does not differentiate between minerals . Because of the relatively low content of minerals in fatty tissues, the fat level also indirectly influences the mineral or ash content of meat and meat products. (Pearson and Gillett, 1999).

Organic Matter: The organic matter was lower in donkey (91.81 – 94. 90%) and higher in beef. Organic matter in meat represents complex compounds of carbon [C, hydrogen (H) and oxygen (O) (Warriss , 20002). There was no significant different [$P > 0.05$) as shown by the Duncan's grouping (Table 2 ).

Crude protein: The protein content is high (55.05-62.75% ] on dry matter basis for donkey meat than the crude protein in beef. Warriss (2000) reported a protein content of 20% in beef. The mean value of crude protein in donkeys was 3 times higher than the value of crude protein in beef as reported by various author.

From the stand point of nutrition, the nitrogenous components of meat are the most important. Proteins are polypeptides or combinations of amino acids linked together into chains by the reaction of amino and carboxyl groups of adjoining amino acids by means of peptide linkages (Aganga *et al,* 2003).

However, the hip was significantly different ($P < 0.05$) from other cuts, showing a higher mean of (62.27%) crude protein. The Sirloin, Flank and the brisket were also significantly different ($P < 0.05$), showing the mean of 58.47, 58.54 and 55.05% respectively. Other cuts were not significantly different ($P > 0.05$). From this data (Table(2) it was establish that the hip, Flank and the Sirloin were relatively higher in crude protein compared to other cuts.

Phosphorus and calcium: Mineral analysis revealed that donkey meat is good in nitrogen, phosphorus, potassium, zinc and iron. Meat is a good source of dietary phosphorus and iron but low in calcium (Pearson and Gillett, 1999). However calcium is the most abundant mineral element in the animal's body. It is an important constituent of the skeleton and teeth. Calcium is essential for the activity of a number of enzyme system including those necessary for transmission of nerve impulses (Aganga *et al.,* 2003). This explain why the calcium content was low in the flesh of beef as well as in the donkey cuts. The data on donkey cuts agree with Pearson and Gillett (1999), By showing a P mean ranging from 0.167-0.195% which was higher than that of Ca (0.095-0.160%) Table 3 ). However there was no significant different between the donkey cuts ($P > 0.05$) in both P and Ca.

Nitrogen: The nitrogen content was higher (8.810- 9.99%) indicating higher levels of cruds protein. The hip was in n (9.997%) and brisket was lower (8.810%). The Sirloin and the Flank were not significantly different 9.362 and 9.368% N respectively. Other cuts differed significantly ($P < 0.05$).

Magnesium: The magnesium levels were also higher in donkeys (0.057-0.08%) as compared to 0.018-0.33%) found in beef. Magnesium is closely associated with calcium and phosphorus and about 70% of the total Mg is found in the skeleton. Magnesium is an enzyme activator, for example in systems with thiamine pyrophosphate as a cofactor and oxidative phosphorylation is reduced in Mg deficiency. It is an essential activator of phosphate transferase, activates pyruvate carboxylase, pyruvate oxidase and the reactions of the tricarboxylic acid cycle.

Thus it can be seen that Mg is a key element in cellular biochemistry and function (McDonald *et al* 1995). The Mg concentration was not significantly different in donkey cuts (P > 0.05).

Potassium: The K levels donkey ranged from (0.287 – 0. 414%) where as it ranged from (0.184-0.415%) in beef. The concentration of K was highest among minerals that were quantified in semi membranes muscle of donkey. Potassium is important in osmotic regulation of the body fluids and in acid base balance in the animal. It plays important part in nerve and muscle excitability and in carbohydrate metabolism (Aganga *et al.,* 2003). The hip had slightly higher K levels (0.414%) and the Chuck was lower (0.287%). The brisket and the shank were not significantly different and all other cuts showed significant difference (P > 0.05).

Iron: The iron concentration in donkeys was the highest (30.958 – 35. 838ppm) when compared to other trace minerals, zinc, copper and manganese. The Flank was higher in iron (35.835pmm) and the Sirloin was lower (29.096ppm). Other cuts were significantly different (P > 0.05). Meat is a major source of iron. Iron in meat has a high bioavailability, the main reservoir being as a component of the haem protein Myoglobin. Iron deficiency is the most common nutritional deficiency in the world (Warriss, 2003). More than 90% of the iron in the body is combined with proteins, e.g haemoglobin, which contain about 3.49/kg of the element. It has a major role in host biochemical reactions, particularly in connection with enzymes of the electron transport Chain (Cytochromes). Electrons are transported by the oxidation and reduction activity of bound iron (McDonald *et al,* 1995).

Zinc: Zinc was the second in abundance after iron in the donkey cuts (3.024-3.794ppm). The Sirloin and the brisket were not significantly different and the chuck had the lowest mean (2.623ppm). Other cuts were significantly different (P > 0.05). Zinc has been found in every tissue in the animal's body. The element tends to accumulate in the bones rather than the liver, which is the main storage organ of many other trace elements. High zinc concentration has been found in the skin, hair and wool of animals. It is an activator of several enzyme systems and involves in cell replication and differentiation, particularly in nucleic acid metabolism. It is also involved in production, storage and secretion of hormones, in immune system and electrolyte balance.

CONCLUSION: The investigation revealed that donkey meat is a good quality meat. The results indicatethat the meat is very high in crude protein compared to beef, and high in important minerals such as Fe, Zn, K and P. Therefore donkey meat consumption should be encouraged. Research in donkey production and utilization should also be encourage so that farmers can rear donkey for income generation.

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