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NUTRIENT QUALITIES OF SELECTED BUSHMEAT IN NEW BUSSA AND ITS ENVIRONS, NIGERIA

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Abstract

This study assessed the nutritional qualities of selected bushmeats in New Bussa and its environs to advocate for their potential domestication through ranching because of the prospective impact on food security. Meat samples of dried Kobus kob (Kob), Sylvicapra grimmia (Duiker) and Tragelaphus scriptus (Bush buck) were identified and collected from hunters in the study areas. The samples muscles was filleted and analysed according to standard procedures. The results show that the percentage mean protein content of the three bushmeat species ranged from a significantly ($p<0.05$) high 70.60±0.88 in Kob to 64.92±0.17 in Bushbuck. Highest level of crude fat (8.64±0.61%) was recorded in Kob compared to 6.85±0.70 % and 6.29±0.16 % found in Duiker and Bushbuck respectively. All the sampled bushmeats were richer in essential macro minerals such as Ca, Mg, Na, K and P while the micro elements recorded for all bushmeat sampled were precariously high and significantly varied ($p<0.05$) across species. The bushmeat muscles were rich in proteins and other essential mineral elements such as iron, zinc, calcium of physiological importance; hence they are suitable almost in every diet. Therefore, these animals can be adopted for game ranching in a safe and adaptive environment.

Key Words: *Bushmeat, Nutrients, Muscles, Qualities, Food security, Environment*

Introduction

Wildlife is primary sources of animal protein for most rural households in forested regions of developing countries (Apaza *et al.,* 2002). Its utilization is critical for ensuring the food security and income of millions of people in tropical regions worldwide, especially for poor rural households (Nasi *et al.,* 2008), regardless of modernization and globalization of food habits (Popkin 2001). Food security of indigenous and rural populations most dependent on wild food sources, According to Maxwell and Wiebe (1999) food security essentially refers to the availability of food and access by all people, at all times, to sufficient amounts, for an active, healthy life. In other definitions, such as the one proposed by the World Food Summit, food security

should also include elements of access to safe and nutritious food (Pinstrup-Andersen, 2009).

Globally, game animals commonly referred to as bushmeat have a potential for meat production and serve as a good source of protein to rural poor in Africa (Fonweban and Njwe, 1990). It has been estimated that around 80 percent of rural households depend on wild animal protein as a supplement to their diet such as birds, reptiles, small mammals (including ungulates) and amphibians (Anstey, 1991) for up to 30 percent of their protein requirements (Nasi *et al.,* 2008). The meat of wild animals in particular has formed a part of the staple diet of forest dwelling peoples for millennia (Elliott *et al.,* 2002) and remains a primary source of animal protein, micro-nutrients and fat (Nasi *et al.,* 2011 and Alves *et al.,* 2016). The commercial benefits and valuable nutritional source derived from bushmeat consumption plays direct role in the livelihoods of nearly 150 million people in the world.

The association between wild meat and food security has sometimes included discussions around wild animals as a source of income, as well as its role in the practice of traditional medicine (Ordaz-Nemeth *et al.*, 2017) but, even though the procurement of wild meat may contribute indirectly to food security, it is the role it plays in fulfilling the nutritional wellbeing of users that remains relevant.

Bushmeat provides an equivalent and in some cases greater quality food than domestic meat of high protein and low fat (Hoffman, 2008). Wild animals provide relatively high level of carbohydrates (ranging from 1% in river hog to 6% in forest genet) compared with domesticated animals from similar environments (ranging from 0.8% in pork and beef to 1.3% in mutton) (Hoffman, 2008). The protein content of bushmeat ranges from 16-55% compared to 11-20% for domestic animals (Ajayi and Tewe, 1983; Falconer, 1990). The average protein value of wild meat is estimated at around 30g of protein per 100g of meat (Ntiamoa- Baidu, 1997).

Moreover, bushmeat contains high iron, calcium and vitamins compared to domestic meat (Ajayi and Tewe, 1983; Hoffman, 2008). Among these minerals, iron (Fe) deficiency is the most prevalent nutrient deficiency worldwide and results in negative consequences for brain metabolism, myelination, neurotransmitter function, motor development, physical activity, and emotional regulation (Pollitt, 2001; Lozoff *et al.,* 2006).

The importance of wild animal meat in the diets of both rural and urban dwellers varies considerably depending on the availability and supply (de Merode *et al.,* 2004). In a consumer survey in southern Nigeria it was reported that 62% of the rural and urban people interviewed stated that the lack of bushmeat limited their consumption (Falconer, 1990). The number of meat meals has been reported to be higher in villages nearby protected area boundary and the weekly number of meat meals per household in all villages within 30 km of the Park boundary increased with the seasonal influx of migratory herbivores (Nyahongo *et al.,* 2009).

Bushmeat provides food, security, job opportunities and income generation for both rural and urban poor. However, despite extensive human reliance on wildlife for food, the impact of wildlife depletion on human health remains poorly understood. Much of the published literature on the use of wild meat is set against a gloomy prediction from the point

of view of biological sustainability (Fa *et al.,* 2002).

The precise value of bushmeat to human livelihoods and wellbeing still requires more detailed assessment especially its provision of human nutrition which require an assessment of itsnutritional quality. Hence, knowledge of the bioavailability of dietary nutrients of some wild animals (bushmeat) will advocates for their potential domestication through ranching because of the prospective impact on food security.

To respond to this need, this study analytically assessed the nutrient composition of bushmeat in terms of the variables (fat, moisture, carbohydrates, proteins, ash, fiber and mineral elements).

Methodology

Study Location

New Bussa is headquarter of Borgu Local Government Area of Niger state, Nigeria. It is located on latitude 9° 53′ N and longitude 4° 31′ E, covering a land mass of about 16,200 km^2. It has a population of about one hundred and two thousand three hundred and seventy (102, 370) people as revealed by 1996 census (NPC, 2015).

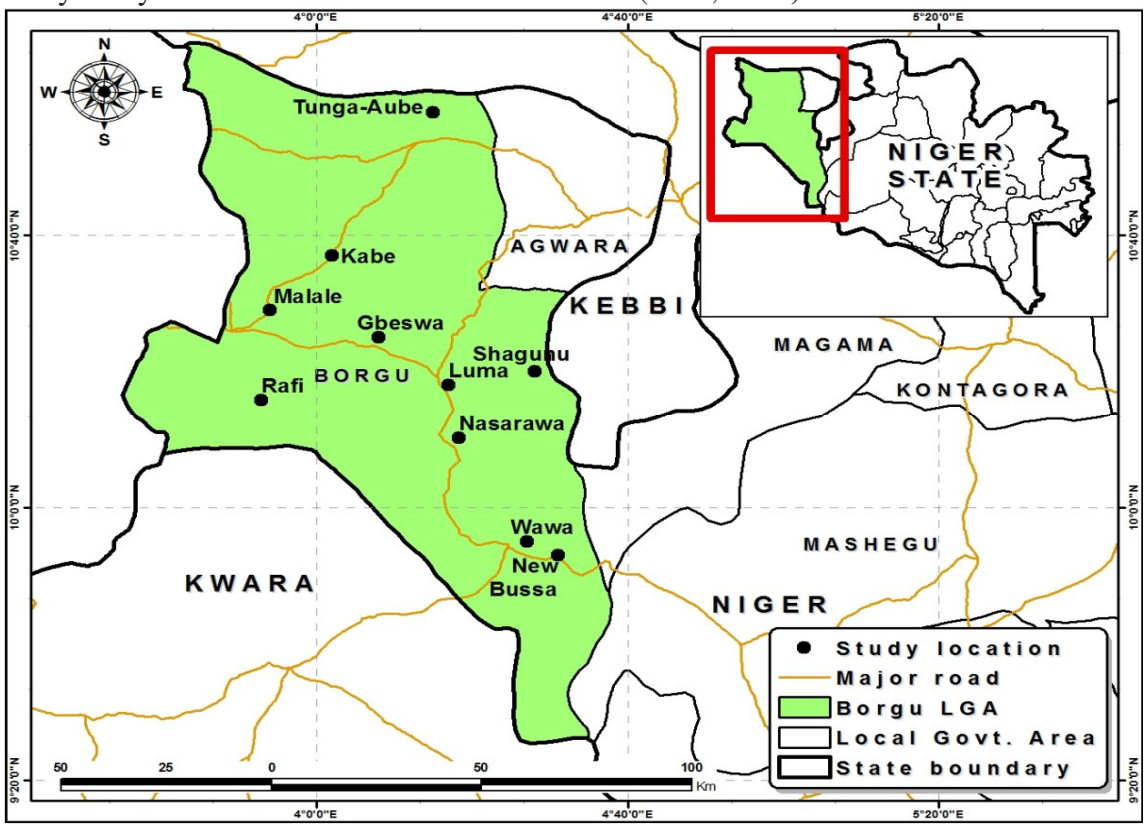

Fig. 1: Map of Borgu Local Government showing New Bussa and its environs

Meat Samples Collection and Chemical Analysis

A total of three (3) bushmeat samples were obtained for use in the study. Meat samples of dried *Kobus kob* (Kob), *Sylvicapra grimmia* (Duiker) and *Tragelaphus scriptus* (Bush buck) were identified and collected from hunters in the study areas. Prior to chemical analysis, samples muscle were carefully filleted, cleaned with running tap water and placed into sealed sterile plastic bags in readiness

for proximate analysis according to the A.O.A.C. (2000) while macro mineral elements, comprising Phosphorus, Calcium, Magnesium, Sodium, Potassium and trace elements (Manganese, Copper, Iron and Zinc) were carried out by Atomic Absorption Spectrophotometry (AAS) using a Perkin-Elmer spectrophotometer (AAnalyst 200 model) at Multi-disciplinary Central Research Laboratory, University of Ibadan, Ibadan, Nigeria.

All data generated were analyzed using descriptive statistics and Analysis of Variance (ANOVA) in Statistical Package for Social Sciences (SPSS 20.0). Three analytical determinations were carried out on each independent sample for every nutrient and the results presented in tables and are reported as means ± standard deviation (SD).

Results

Nutrient Composition of selected bushmeat (muscles) from New Bussa and its environs (g/100g of dry weight)

From the study, the percentage mean protein content of the three bushmeat species ranged from a significantly ($p<0.05$) high 70.60±0.88 in Kob to a 64.92±0.17 in Bushbuck (Table 1). The % mean ash 3.02±0.15 is significantly low in Bushbuck compared to 4.22±0.43 and 4.01±0.42 recorded for Kob and Duiker respectively. Highest level of crude fat (8.64±0.61 %) was recorded in Kob compared to 6.85±0.70 % found in Duiker and 6.29±0.16 % recorded for Bushbuck. The crude fibre values 0.17±0.01 % in Duiker was not significant ($p<0.05$) to 0.17±0.00 % found in Kob though both are significantly different to 0.11±0.01 % recorded in Bushbuck.

Table 1: Nutrient compositions of Some Selected Bushmeat (muscles) from New Bussa and its environs (% of dry weight)

Bushmeat samples	%Proximate composition (dry weight)					
	Crude Protein	Moisture	Ash	Crude fibre	Crude fat	Nitrogen Free Extract (NFE)
Sylvicapra grimmia (Duiker)	65.19±1.04^{a}	14.65±0.71^{b}	4.01±0.34^{b}	0.17±0.01^{b}	6.85±0.70^{a}	9.52±0.54^{b}
Tragelaphus scriptus (Bushbuck)	64.92±0.14^{a}	14.02±0.53^{b}	3.02±0.13^{a}	0.11±0.01^{a}	6.29±0.16^{a}	11.62±0.10^{c}
Kobus kob (Kob)	70.60±0.72^{b}	9.45±0.41^{a}	4.22±0.35^{b}	0.17±0.00^{b}	8.64±0.61^{b}	7.19±1.23^{a}

Note: Values are mean ± Standard Error Mean
Mean with different superscript within the same row are significantly different ($p<0.05$)

Macro-mineral composition of selected Bushmeat from New Bussa and its environs (g/100g of dry weight)

From the study, the sampled bushmeat are richer in essential macro minerals such as Ca, Mg, Na, K and P (see figure 1). Bushbuck contains significantly ($p<0.05$) high mean concentration of K (13.49±1.19 g/100 g) and Mg (1.38±0.14 g/100 g) while Kob has high level of Na (7.50±0.53 g/100 g) and P (1.09±0.11 g/100 g). Total Phosphorus of 1.09±0.11 g recorded for Kob is relatively higher to 0.98±0.07 g and 0.87±0.05 g found in Duiker and Bushbuck respectively.

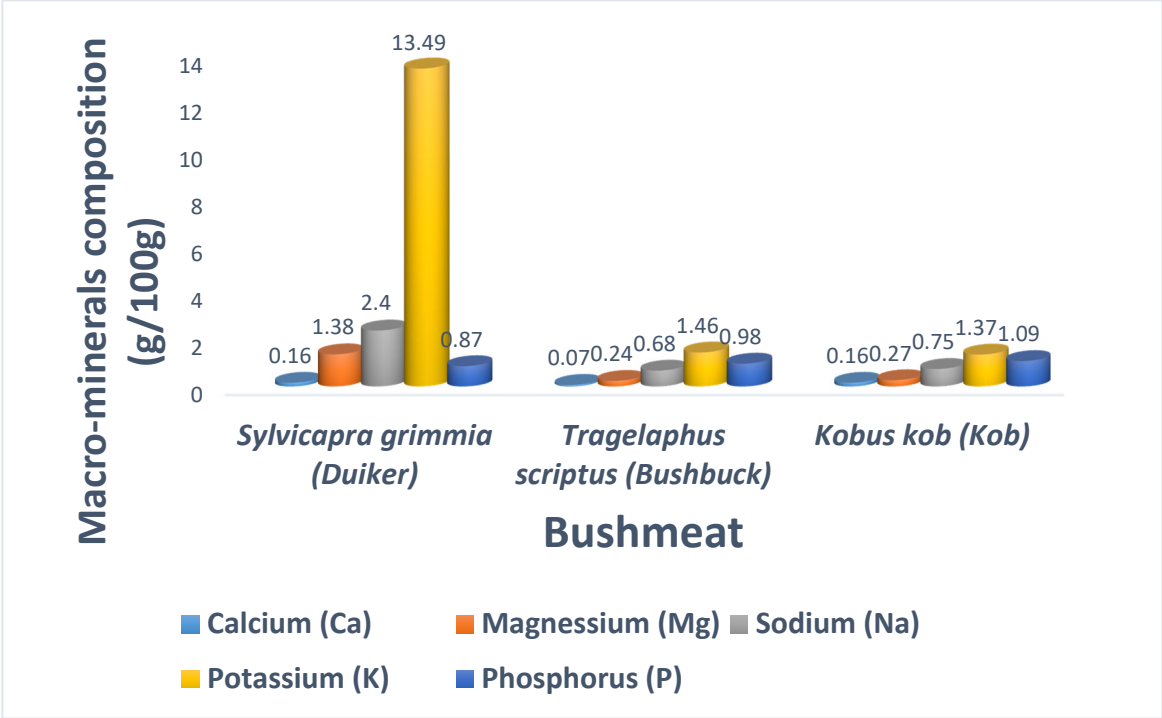

Fig. 2: Macro-mineral compositions of selected Bushmeat from New Bussa and its environs (g/100g of dry weight)

Micro-mineral composition in muscles of Bushmeat from New Bussa and its environs (µg/g of dry weight)

The micro elements recorded for all bushmeat sampled are relatively high and significantly varied ($p<0.05$) across species. 476±10.24 µg/g of Fe found in Duiker is considered comparatively higher while the lowest value of 226±22.00 µg/g was recorded for Kob. Zinc Concentration of 815±13.00 µg/g, 802±2.00 µg/g and 765±21.00 µg/g were recorded for Kob, Bushbuck and Duiker respectively. The mean values of Mn is much significant ($p<0.05$) high in Bushbuck (10±0.55 µg/g) and Duiker (9.55± 0.05 µg/g) compared to the quantity found in Kob (2.52±0.04) while there are significant different in the concentration of Cu in all samples (table 2).

Table 2: Micro-mineral composition in muscles of Bushmeat from New Bussa and its environs (µg/g of dry weight)

Animals samples	Macro-mineral compositions (mg/kg of dry weight)			
	Iron (Fe)	Manganese (Mn)	Copper (Cu)	Zinc (Zn)
Sylvicapra grimmia (Duiker)	479±10.24^{c}	9.55±0.05^{b}	7.55±0.05^{ab}	765±21.00^{a}
Tragelaphus scriptus (Bushbuck)	373±3.00^{b}	10±0.55^{b}	7.60±0.20^{b}	802±2.00^{b}
Kobus kob (Kob)	226±22.61^{a}	2.52±0.04^{a}	7.00±0.52^{a}	815±13.00^{b}

Note: Mean values ± Standard Error Mean
Mean with different superscript within the same row are significantly different ($p<0.05$)

Discussion

The nutritional contents of dry weight of the sampled bushmeat is remarkable in terms of the variables analyzed (proteins, ash, fat, fiber, carbohydrate, moisture, mineral elements (macro and micro elements). This corroborate the findings of Alves *et al.* (2016) that bushmeat is a good sources of animal protein, fat and essential mineral elements and are suitable almost in every diet while Neumann *et al*. (2003) substantiate that animal source foods, such as bushmeat, are rich in energy, protein, and micronutrients that have greater bioavailability than vegetable sources.

Crude protein varies among the bushmeat species, ranging from 64% to above 70% of the dry weight sample. Botha (2010) had earlier reported variability in fresh samples of some wild animal species. High level of protein found the sampled bushbucks, duikers and kobs confirmed that bushmeat provides an equivalent dietary need and in some cases greater quality food of high protein to catfish (Adelakun *et al.*, 2017). High protein composition in sampled bush meat may be responsible for the inference of Nasi and Fa (2015) that bush meat figures strongly in rural economies not only as a traded item, but also as a pillar of livelihood safety, including food security. Hence, bush meat accessibility is usually responsible for better nutritional status of children from villages in the close wildlife protection park (Blaney *et al*., 2011). The meat fat composition in the study fall within the range of 1-10% reported for bushmeat in earlier studies (Dinet, 2011).

The mineral elements in the sampled bushmeat exhibit significant variability across the wildlife species. This conforms to Ernst (1998) who confirmed that content of trace elements in game meat products depends on the animal species and the quality of animal nutrition. The important minerals of game meats were studied by Aust (2009) iron, zinc, copper, manganese and selenium. The iron from meats can be absorbed in higher amount (15-30%) and more useful for the human body than from vegetal resources. A well balanced nutrition can prevent iron deficiency. The daily zinc demand can be taken in with average meat consumption, and calculated with absorption of 20-40%. The zinc has an important role in several physiological processes. The minerals are responsible for several physical, chemical and physiological processes of the animals. The efficiency of the utilization of minerals in the animals is higher if the sources are animals rather than plants (Adam, 2009). However, the macro minerals quantities found in the three different species are of great concern because of the high concentrations and these could imply that the animals are contaminated probably as result of the state of their precarious environment. Wild animals are efficient users of native vegetation, according to Schleich *et al* (2010) many terrestrial ecosystems where game animals inhabit are usually contaminated with potentially toxic trace elements from the accumulation of agricultural pesticides, fertilizers, industrial effluents, waste disposal and mining (Schleich *et al*., 2010). These wastes are usually high in heavy metals which can be absorbed by plants and later found in high concentrations in animal tissues and finally humans (Schleich *et al*., 2010). High concentrations of these micro mineral elements (heavy metals) in the bushmeat are a critical issue that needs to be addressed in order to ensure consumer safety.

Conclusion

This study has analytically assessed the nutrients composition of bushmeat to provide information on the bioavailability of dietary nutrients of some wildlife and advocates for their potential domestication through ranching because of their prospective impact in alleviating malnutrition. It is established in this study that bushmeat contain great amount of essential nutrients, hence will continues to play an important role in terms of dietary diversity for human population. It is evident that *Kobus kob* has significantly higher crude protein composition when compared to *Tragelaphus scriptus* and *Sylvicapra grimmia* though all the bushmeat sampled in the study are adequately rich in proteins and other essential mineral elements of physiological importance such as iron, zinc, calcium; hence they are suitable almost in every diet, though, the precariously high concentration of micro-elements like iron, copper and zinc probably as a result of habitat contamination is a bio-indicator of acute contamination in the samples and could pose a great danger to consumers of these bushments because of their adverse effects on the recipient which include cancer and mutation. However, these animals can be adopted for game ranching because of their relevance to global food security.

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