BODY MORPHOMETRICS, CARCASS AND MEAT CHARACTERISTICS OF AFRICAN ANTELOPE (*Antilope cervicapra*) FOUND IN AGO-IWOYE ECOLOGICAL ZONE OF OGUN STATE, NIGERIA

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Abstract: This study was carried out to evaluate the body morphometric, carcass and meat characteristics of African Antelope (*Antilope cervicapra*). Twelve antelopes of between 2 to $2^1/_2$ years old were purchased freshly from hunters that were previously instructed at Ago-Iwoye in Ogun State, Nigeria and were transported to the Meat Science Laboratory, Department of Animal Production, Olabisi Onabanjo University, Ayetoro Campus where this study was conducted. Body morphometric variables of the carcasses were taken and the carcasses were, dressed, eviscerated, fabricated and chilled at 4^0C for 24 h. The sensory evaluation of the meat was conducted using a 10 – man taste panel to assess the (*semi-membranosus* and *longissimus dorsi* muscles) which were boiled for 20 min at 160^0C and cooled to room temperature (27^0C). The panelists evaluated the meat for aroma, flavour, tenderness, juiciness, texture and overall acceptability using a 9-point hedonic scale. The results showed that the body morphometric, carcass and meat variables measured were very high, dressing percentage 59.36% and rib eye area 10.62 cm^2. The chilling loss of meat was very low (2.85%) while the proximate composition variables were high except the fat which was low and the meat was highly accepted by the panelists. This study was limited to the use of African Antelope carcasses and meat from Ago-Iwoye ecological zone in Ogun State, Nigeria so that bias would not be introduced into the study. The results from this study necessitated the conclusion that data obtained from body morphometric, carcass and meat of African Antelope were comparable to those obtained by previous workers on domesticated goat and therefore, recommended that African Antelope could be domesticated to complement the conventional ruminants so that adequate protein supply to the growing human population can be achieved.

Keywords: Antelope, Ago-Iwoye ecological zone, body morphometric, carcass, meat

Introduction

Population explosion continues unabated in all developing countries and the nutritional inequality of protein and energy has not been arrested. Although, animal protein shortage is of serious problem than that of energy as protein of high biological value from animals is limited in supply (Asibey, 1996). Most animals that furnish humans with protein are drawn mainly from domesticated ones and poultry. Though developing countries are endowed with varieties of domesticate animals and poultry, yet animal protein intake per caput is still below the requirement of 35 g/day by FAO (Child, 2007). In order to compensate for animal protein inadequacy in developing countries attention has to be diverted to wildlife and the most promising ones are rodents and antelopes (Antoonde Vos, 2008).

Antelopes are the easiest animals to hunt in the wild and have nutritional values similar to that of deer (Wheeler, 2008). They are very prolific, can serve as food for the majority who because of taboo restrict the consumption of certain species of domesticated animals and as delicacy for the urban dwellers who demand a variety of meat in their diets thus improving protein intake (Okubanjo 1990, Brooks *et al*., 1991). Antelopes are found in a wide range of ecological habitat of typically woodland, forest savannah and grassland plains in Eurosia and Africa and belong to the family *Bovidae*, sub-family *Bovidae antipinea* that thrives well on high roughages (Rundell and Woodford, 1994; Anon, 2008).

In terms of meat quality (Kingdom, 1997) reported that antelope carcass yields an average boneless meat tissue and furnishes average proximate composition, energy and cholesterol contents and high levels of essential amino acids comparable to lean beef. However, antelope is yet to break into the league of animals accepted for commercial production in economics of the world due to the fact that little or no interest has been shown towards its domestication, breeding, quantitative and qualitative assessment of its meat by the public and research institutes to provide adequate records. In this study therefore, the body parameters, carcass, and meat characteristics of African antelope (*Antilope cervicapra*) were evaluated.

Materials and Methods

Twelve antelopes of mixed sexes between 2 and $2^1/_2$ years old determined according to Jensen (1998) were used for this study. They were purchased from local hunters at Ago-Iwoye after they were freshly killed and bled and then transported to the Meat Science Laboratory of the Department of animal Production, Olabisi Onabanjo University, Yewa Campus Ayetoro where they were processed within two hours post mortem. The carcasses were labeled AT1, AT2, AT3 and AT4, respectively.

Linear body measurement

The body measurements were taken on the carcasses before processing with the aid of a flexible steel tape in centimeters (cm) following the procedures of Jensen (1998). The measurements included body length which was taken following the contour of the body from the tip of the nose of anus along the vertebral column to the ischial tuberosity at a point of landmark of the caudal end. Fore limb length; was measured from the greater tuberosity of the humerus to the base of the nail of the longest toe. Hind limb length; was measured from the greater trocanter to the femur and the base of the longest toe. Length of head; was measured from the maximum distance from the tip of nose to the external occipital protuberance. Head width; was measured as the maximum distance between the two zygometic aches. Width of pelvis was measured from the upper edge of the lateral trocanter of the femur on one side to the same position on the other side with the knee flexed at right angles. Width of chest; was measured at width immediately behind the shoulder blade. Hearth girth; was measured at the smallest circumference immediately caudal to the shoulder at the same

level of width. Diameter of thorax; was measured by taking the cross width at the level of xiphoid process. Rump width; was measured as width between the hipbones (Tubercoxae). Rump height; was measured as distance from the top of the pelvic girdle to the ground. Height at withers; was measured as the distance between the most cranial palpable spinous process and the ground.

Processing of carcasses and muscle dissection

Carcasses of antelopes were shanked, skinned and eviscerated. They were dissected into two halves using a hand meat saw and chilled at 4^0c for 24 h after which they were fabricated into primal cuts-leg, loin, rack, shoulder, breast, belly and flank according to Okubanjo (1997).

Measurement of carcass and meat parameters

Dressed carcass weight, dressing percentage chilled carcass weight, chilling loss weights and lengths of external and internal organs were taken following the procedures of Attah *et al.* (2004). Muscles were dissected from pectoral (shank), pelvic limbs, flank, back and loin according to Apata *et al.* (2006).

Proximate composition

Proximate composition of two muscles semi-membranosus (SMB) and longissimus dorsi (LGD) was carried out using fresh and cooked samples of the meat according to AOAC (2000).

Sensory evaluation of meat

Semi-membranosus (SMB) and longissimus dorsi (LGD) muscles were broiled at 160^{0c} for 25 min with intermittent turning in a pre-heated oven. The meat samples were removed and cooled to room temperature (28^0C) and wrapped in transparent polythene bags and used subsequently for sensory evaluation. A total of 10 member taste panel was used for the sensory evaluation of antelope meat samples. The panelists were drawn from the students and staff population of the Department of Animal Production, Olabisi Onabanjo University, Yewa Campus, Ayetoro. They were semi-trained on how to fill the questionnaires to assess the meat samples for aroma, flavour, tenderness, juiciness, texture and overall acceptability. Each trait was scored on a 9-point hedonic scale on which 1= disliked extremely and 9 = liked extremely (AMSA, 1995).

Statistical analysis

The experimental design for the study was on completely randomized design while data collected were analyse using descriptive statistics such as means (X), Standard deviation (SD) and range (Steel and Torrie, 980).

Results and Discussion

Table 1 shows the mean linear body measurements of antelope, while Table 2 shows carcass characteristics of antelope. The body length of 71.75±0.95 cm, height of withers of 41.25±1.55 cm and heart girth 42.00±1.68 cm were comparable with those of Red Sokoto goats of the same age range (2 – 2.5 years) as reported by Hassan and Ciroma (2009). Heart girth is the most important morphometric trait. The rump width is associated with fat deposition and had a value of 10.48±1.18 cm which was comparable with that of West African Dwarf sheep with 6.78±0.09 cm as reported by Yakubu *et al.* (2005). The fore and hind limbs values of African antelope in Table 1 were also similar to those reported for West African Dwarf sheep 39.38±0.19 and 38.15±0.32 cm (Yakubu *et al.*, 2005).

Table 1: Mean linear body measurements of Antelope (cm)

Variables	$\bar{X}$	SD	Range		
			Min		Max
Body length	71.75	0.96	71.00	–	73.00
Forelimb length	32.75	3.50	29.00	–	37.00
Hindlimb length	38.63	0.29	36.00	–	41.50
Length of head	15.00	0.00	15.00	–	15.00
Head width	6.63	0.85	5.50	–	7.50
Width of pelvis	13.28	1.52	11.60	–	15.00
Width of chest	9.08	2.15	8.00	–	12.30
Heart girth	42.00	1.68	39.50	–	43.00
Diameter of thorax	10.83	0.89	10.00	–	12.00
Shoulder length	34.88	1.03	33.50	–	36.00
Height at withers	41.25	1.55	40.00	–	43.50
Rump length	14.75	2.06	12.00	–	15.10
Rump width	10.48	1.18	9.40	–	11.50
Shin circumference	5.00	0.00	5.00	–	5.00

Table 2: Mean carcass characteristics of Antelope

Variables	$\bar{X}$	SD	Range		
			Min		Max
Weights of animals (g)	7310	0.80	6.50	–	8.30
Dressed carcasses weight (g)	434	0.46	3.80	–	4.75
Dressing percentage (%)	59.36	2.47	56.63	–	62.50
Chilled carcass weight (g)	419	0.49	3.70	–	4.66
Chilling loss (%)	2.85	0.62	2.11	–	3.66
Empty body weight (g)	715	0.85	6.34	–	8.23
Carcass length (cm)	40.00	0.82	39.00	–	41.00
Rib eye area (cm^2)	10.62	1.85	8.40	–	12.32

Table 3: Mean weights and lengths of internal offals of African Antelope

Variables	Weight and length of internal offals range					% Relative to body weight Range			
	$\bar{X}$	SD	Min.		Max	$\bar{X}$	SD	Min.	Max
Body weight (g)	7310	8000	659	-	830.00	100.00	-	-	-
Grastro intestinal tract full (g)	892.50	56.79	830.00	-	950.00	12.35	1.89	10.00	14.62
Gastro intestinal tract empty (g)	723.75	73.41	620.00	-	790.00	9.98	1.47	9.05	12.15
Small intestine full (g)	132.75	52.52	100.00	-	210.00	1.78	0.50	1.46	2.53
Small intestine empty (g)	33.00	7.70	22.00	-	25.00	0.27	0.29	0.29	0.97
Large intestine full (g)	143.75	32.76	115.00	-	185.00	1.99	0.50	1.39	2.43
Large intestine empty (g)	37.50	10.41	25.00	-	50.00	0.51	0.10	0.38	0.60
Small intestine (cm)	765.50	68.48	694.00	-	838.00	9.37	0.01	0.21	1.00
Large intestine (cm)	283.00	23.48	249.00	-	302.00	25.35	0.06	1.00	1.12
Lung and traches (g)	115.50	13.20	100.00	-	130.00	1.58	0.03	1.54	1.61
Oesophagus (g)	14.25	4.99	10.00	-	21.00	0.19	0.05	0.13	0.25
Oesophagus (cm)	24.00	4.97	18.00	-	29.00	298.96	0.15	0.25	0.32
Liver (g)	121.75	9.25	110.00	-	132.00	1.69	0.27	1.33	1.93
Spleen (g)	32.50	6.45	25.00	-	40.00	0.44	0.04	0.38	0.48
Heart (g)	52.50	5.00	50.00	-	60.00	0.73	0.12	0.60	0.88
Kidney (g)	24.00	4.55	20.00	-	30.00	0.34	0.09	0.24	0.44
Reproductive organs (g)	97.50	89.86	35.00	-	230	1.26	1.03	0.54	2.77
Rumen full (g)	402.50	215.46	180.00	-	680.00	5.37	2.46	2.77	6.57
Rumen empty (g)	168.75	58.36	90.00	-	220.00	2.27	0.61	1.38	2.69
Bladder empty (g)	23.50	5.07	19.00	-	30.00	0.33	0.09	0.24	0.46
Omentum (g)	8.75	2.50	5.00	-	10.00	0.19	0.17	0.08	0.44
Mesenteric fat (g)	32.50	8.10	25.00	-	44.00	0.37	0.17	0.15	0.58

Table 4: Mean weights of external offals of African Antelope

Variables	Weight and length of internal offals range				% Relative to body weight Range			
	X̄	SD	Min.	Max	X̄	SD	Min.	Max
Body weight (g)	7,310.00	80.00	650 -	830	100.00	-	-	-
Head (g)	481.25	26.58	460.00 -	515.00	6.62	0.51	5.90-	7.08
Neck (g)	200.00	21.60	180.00 -	230.00	2.75	0.25	2.41-	3.03
Four feet (g)	110.00	14.14	90.00 -	120.00	1.51	0.16	1.31-	1.69
Skin (g)	557.50	63.44	490.00 -	640.00	7.93	0.81	6.99-	8.76
Tail (g)	11.50	2.38	10.00 -	15.00	0.16	0.03	0.13-	0.20

The mean dressed carcass weight and dressing percentage shown on Table 2 were comparable with those reported by Mahgoub and Lodge (1998) for Omani sheep and goats as well as those reported for Impala antelope (*Aepyceros melampus*) and for those antelopes from Mara in Kenya (Hoffman, 2000; Hoffman *et al.*, 2005). The dressing percentage value of goat reported by Dnanda *et al.* (1999) and those of pronghorn male and female antelopes (Field *et al.*, 2003) and of West African Dwarf sheep reported by Uwechue (2000) were very similar to those values observed on antelopes used in this study. The percentage values of offals observed in antelopes used in this study were very close to those reported by Taiwo (1980) on Nigerian Dwarf sheep as compared with the empty body weight (Tables 3 and 4). Also, the percentage of head to the body in antelopes used in this study (Table 4) which was 6.62%, appeared within the range of values reported for female (5.3%) and 7.1% for male pronghorn antelope by Field *et al.* (2003); however, the percentage skin to the body 7.93% was greater than those of 5.1 and 5.9% reported for the pronghorn antelope by Hoffman (2000). The dressing percentage of antelope carcass in this study was 59.36% which was higher than the value reported for Zebu cattle by Clottey (1992) and that reported for West African Dwarf sheep 45.78% by Uwechue (2000) (Table 2). It was documented that the higher the dressing percentage of any animal carcass the more meatier the animal; it therefore, means that antelope is more meatier than Zebu cattle or WAD sheep. The rib eye area value of antelope used in this study with 10.62 cm^2 also buttress the report of Means *et al.* (1999) who reported lower value of rib eye area for ram.

Table 5: Mean weight of some selected muscles of Antelope and their relative percentage to chilled half carcass weight

Muscles	Weight of muscles (g)		% Relative to chilled half carcass weight	
	X̄	S.D	X̄	S.D
Half carcass weight	2127.50	235.28	100.00	-
Semi tendinosus	42.50	5.00	2.01	0.19
Biceps femoris	140.00	14.72	6.59	0.23
Semimenbranosus	103.00	4.76	4.87	0.41
Adductor	42.50	5.00	2.01	0.19
Tensor fascialatae	26.25	4.79	1.26	0.35
Quadriceps femoris	138.75	8.54	6.55	4.04
Gastrocenemius	52.50	5.00	2.47	2.28
Triceps brachii	51.25	1.89	2.27	0.45
Trapezius	30.00	11.54	1.42	0.16
Latissimus dorsi	38.75	1.89	1.83	0.16
Pectoral muscle	55.00	5.77	2.47	0.23
Serratus ventralis thoraxis	55.75	9.54	2.66	0.65
Rhomboideus	20.75	0.96	0.99	0.15
Supraspinatus	30.00	4.08	1.42	0.16
Subscapularis	17.50	2.38	0.83	0.15
Rectus abdominis	12.50	2.89	0.59	0.11
Internal abdominal oblique	29.50	6.03	1.39	0.29
External abdominal oblique	40.50	0.33	1.92	0.19
Transverse abdominis	21.75	2.36	1.03	0.06
Gluteus medius	67.50	5.00	3.19	0.28
Psoas major	42.00	2.16	1.99	0.21
Longissimus dorsi	238.75	16.52	11.27	0.75
Brachiallis	12.50	2.89	0.59	0.11
Biceps brachii	12.50	2.89	0.59	0.11
Intraspinatus	10.00	4.08	1.42	0.16

Table 6: Mean proximate composition of raw and cooked *semi–membranosus* and *longissimus dorsi* muscles

Variables (%)	Raw meat				Cooked meat			
	SMB		LNG		SMB		LNG	
	X	SD	X	SD	X	SD	X	SD
Moisture	71.80	1.56	71.15	1.77	53.70	53.70	52.95	0.07
Crude protein	17.20	0.57	17.10	0.57	33.50	0.42	34.65	0.49
Fat	6.50	1.41	6.50	1.13	5.25	0.92	5.20	0.42
Ash	1.40	0.14	1.65	0.07	3.35	0.21	2.95	0.21
NFE	3.10	1.65	3.60	1.60	4.30	0.56	4.25	0.52

Table 7: Mean sensory scores of *semimembranosus* and *Longissimus dorsi* muscles of Antelope

Variables	Semimembranosus			*L. dorsi*		
	X	SD	Range	X	SD	Range
Aroma	5.30	0.37	4.00-4.60	5.88	0.87	2.80-4.90
Flavour	6.23	0.34	3.90-4.70	4.65	0.44	4.30-5.30
Tenderness	5.75	0.31	5.50-6.20	4.20	0.68	4.40-5.90
Juiciness	5.65	0.70	5.80-6.40	5.33	0.66	4.50-5.90
Texture	5.85	0.49	5.20-6.40	4.18	0.62	4.30-5.70
Overall acceptability	7.33	0.79	5.50-7.00	5.53	1.25	3.90-6.90

The values of muscles obtained on antelopes used in this study compared very well with the values of the same muscles and offals reported by Taiwo (1980) for the Nigerian Dwarf Sheep (Table 5). The results of proximate composition of raw and cooked semi-membranosus and *longissimus dorsi* muscles of antelopes used are presented on Table 5. Protein and ash contents were higher in cooked meat probably as a result of coagulation of nutrients in the meat during cooking and subsequent decrease in moisture content as the latter could have been lost into the surrounding juice during cooking as broth. Conversely, the values of fat decreased in cooked meat perhaps due to melting action of heat on fat during cooking. The values obtained from proximate composition of antelope meat in this study were very close to those reported by Field *et al.* (2003), indicating that antelope meat is high in protein and low in fat contents. Previous reports of Okubanjo (1990); Hoffman and Fereira (2003) and Mostert and Hoffman (2007) corroborated that antelope meat has high nutritive value as indicated in this study.

The results of the taste panel indicated that antelope meat was highly accepted (Table 7). This could be due to high gamey flavour, aroma and juiciness as well as highly textured two muscles *semi-membranosus* and *Longissinus dorsi* of antelopes tested in this study. These results agreed with those of Field *et al.* (2003) who reported high sensory values for antelope meat. In conclusion, the results from this study revealed that body morphometrics, and carcass characteristics of antelope found in Ago-Iwoye ecological zone of Ogun State were well comparable with those of cattle, sheep and goats which are the most commonly domesticated ruminants animals. It was also observed that meat from antelope was well accepted due to its high gamey flavour, aroma as well as texture and juiciness. Livestock producers and scientists alike should therefore, expedite the process of completely domesticating antelope so as to complement the conventional ones to improve protein availability for the teaming population of the world especially in the developing countries.

Conflict of Interest

Authors declare that there is no conflict of interest.

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