IJAAAR4 (1&2): 14-19,2007 *International Journal of Applied Agricultural and Apicultural Research*

Physical Characteristics of Camel Muscle Compared with Three Breeds of Cattle

Fakolade P. O.

Meat Science Laboratory, Department of Animal Science, University of Ibadan, Ibadan, Nigeria.

Abstract

The experiment was conducted to examine the physical characteristics of Camel muscle compared with (Gudali, Keteku and White Fulani) cattle.
Semimenbranosus muscles used were collected immediately after slaughter, trimmed off all surface fat, connective tissue and chilled for 24hours at 4°c. The meats used were allowed to thaw at room temperature and cut into fifteen chops/ kg with an average weight of 110g. The cooked weight, cooking loss, warner bratzler shear value, water holding capacity, cold shortening and thermal shortening were determined on fresh muscle of each animals.
The results of the study indicated that keteku breed had the highest ($p<0.05$) water holding capacity than camel, White Fulani and Gudali muscle. The cold shortening percentage for white Fulani was significantly lower ($P<0.05$) than camel, Gudali and Keteku. Thermal shortening percentage was scored highest ($P<0.05$) in camel, than the three breeds of cattle used for this study.
However, the significantly ($p<0.05$) lowest mean values of shear force and cooking loss were observed in keteku, while camel muscle had the significantly ($p<0.05$) highest while White Fulani and Gudali had similar values ($P>0.05$)for both traits respectively.

Key word: Cooking loss, shear force, cold shortening, water holding capacity.

Introduction

The characteristics of fresh muscle dictate its usefulness, its appeal and its adaptability to further processing to the consumer. Meat quality evaluation is important in improving meat production (Barbera & Tossone, 2006). Carcass quality is the measure of carcass palatability and acceptability to the consumer (Renand and Fisher 1997). So, consumer demand for meat product is determined by palatability, appearance, fat content, economic value, ease of preparation and convenience (Wand et al, 1995, Tschrihard, -Hoeischer, et. al, 2006).

Lack of facilities and the huge expenses involved in obtaining carcass information have severely limited knowledge of carcass composition of many types of beef cattle indigenous to Nigeria. The need for information is obvious if the quality of beef produced is to be maintained at high level demanded by consumer (Okubanjo et al; 2003).

Nowadays, problems facing meat industries include socio-cultural, financial, nutrition, management, disease and pest, and low genetic potential of local meat animal production in Nigeria. T&ese affect the carcass information which have solely lower the knowledge of carcass composition to the demand of consumer and researchers. (Kadim et al; 2006) reported that camel is a good source of meat in area where other animal production are not in efficient, and the demand for camel meat appears to be increasing especially in arid regions due to the fact that the meat is healthier as they produce carcasses with less fat, as well as having less levels of cholesterol in fat than other animals. (Kadim et al, 2006). The aim of this work is to evaluate the physical traits of camel meat compared with three breed of cattle. (Keteku, White Fulani, and Gudali muscle).

Material and Methods

The camel and breeds of cattle used (White Fulani, Gudali and Keteku), were identified based on visual appearance of the coat colour, the presence or absence of well developed cervico - thoracic hump, presence or absence of well developed horns and whether shot or long horn. Fifteen animals with five animals from each breed of cattle and camel were used for the study. Samples were obtained from the Teaching and research meat shop (abattoir) University of Ibadan and Agege abattoir.

The animals were weighed before slaughtering; the ages of the animals were estimated by direct counting of the erupted incision.

Cooking loss and thermal shortening

Samples for cooking loss were cut into steaks of approximately 4cm thick. Five steaks were selected in sequence from rib end to the loin end and each steak was weighed before broiling. Broiling was done at an oven temperature of 177°c with temperature stabilization for 5 minutes prior to the start of broiling. The steaks were boiled for 20minutes on each side to medium doneness and then cooked to room temperature to determine cooking loss and thermal shortening.

Cooking loss =

$$\frac{\text{Weight of raw sample - Weight of cooked sample X100}}{\text{Weight of raw sample}}$$

Thermal shortening =

$$\frac{\text{Length of raw sample - Length of cooked sample X100}}{\text{Length of raw sample}}$$

Shear Forces

Five cores of 0.5cm in diameter were removed from samples used for cooking loss using an electric coring machine. Cores were removed from five standardized core location on each steak. The core locations were center, ventral, media, dorsal and lateral. The coring was done parallel to the orientation of muscle fibre and each core was sheared at three locations with Warner Bratzler Shear force instrument.

Cold Shortening

Core samples of meat 1cm by 1cm were stored in refrigerator for 24hours at 4°c. The percentage difference in length is the cold shortening.

Water Holding capacity

Samples obtained from thermal shortening and cooking loss were used. Meat sample from those 1cm x 1cm x 1cm were weighed individually and then pressed between two filter papers with a plexi glass for over a minutes using a vice. Samples were then ovendried at 70°c for 24hours to determine the moisture content. The amount of water released from the sample were measured indirectly by measuring the area for the filter paper wetted, relative to the area of pressed samples.

$$\text{WHC} = 100 - \frac{[(Ar - Am \times 9.47)]}{Wm \times Wo}$$

Where Ar = Area of water released form meat Cm^3

Am = Area of meat sample Cm^2

Wm = Weight of meat Sample in mg

Wo = Moisture content of meat

9.47 = Constant factor.

Statistical Analysis

Data collected were analyzed in a completely randomized design of statistical system (SAS 1996).

Results and Discussion

Table 1: Physio - chemical properties of Meat samples

Physical Properties	Meat Samples				
	Camel	Gudali	Keteku	White Fulani	SEM
Cold Shortening %	2.40^b	3.60^a	2.20^b	2.90^b	0.19
Thermal Shortening %	23.0^a	13.43^b	14.83^b	15.84^b	3.10
Cooking loss %	37.76^b	33.40^a	23.35^C	33.24^a	1.90
Shear force (kg)	7.19^a	6.16^b	4.68^d	5.99^C	1.12
Water holding Capacity %	44.12^C	58.84^b	68.12^a	57.88^b	0.94

$^{abc;}$ means on the same row with different superscript are significantly different (P<0.05).

The Physio-chemical properties of meat samples are shown in Table 1. The mean cold shortening obtained for Gudali (3.60%) was significantly higher (P<0.05) than famel, keteku and white fulani values of 2.40%, 2.20% and 2.90% respectively, while keteku had the least significant (P<0.05) value. The high degree of cold shortening observed in Gudali muscle could be attributed to the fact that Gudali carcasses used, had a poor insulating subcutaneous fat cover which are susceptible to muscle toughing through the effects of cold shortening.

In response to thermal shortening, camel was (P<0.05) higher in percentage (23.00%) than cattle breed which were observed to have no significant (P>0.05) different among them; with values rising from 13.43%, 14.83% and 15.84%. The higher value observed for camel muscle could be probably due to high connective tissue in the muscle, which was as a result of its usage i.e. for transportation, and merchandise in deserts and semi arid area.

Cooking loss is a combination of liquid and soluble matter lost from the meat during cooking. At increasing centre temperatures, the water content of fat and protein content decrease indicating that the main part of the cooking loss is water (Heyman et al; 1990). Water was lost probably due to heat induced protein denaturation during cooking of meat, which causes less water to be entrapped within the protein structures held by capillary forces. In this study, keteku had the lowest significant value (23.35%) compared to camel, Gudali and white Fulani muscle with values (P>0.05) (37.76%, 33.24% and 33.40% respectively. The values observed in this study were similar to those values reported by (Aaslyng et al; 2003) for cooking loss 1 (19.5% - 28.4%) and cooking loss 2 (22.5% - 33.5%) respectively. When evaluating the cooking loss at 68°c centre temperature right after taking out of the oven (cooking loss 1) and after 20 minutes rest wrapped in foil (cooking loss 2). Also the value observed can be compared to (15-40%) moisture loss described by (Boles and Sheard, 1999; Chen and Trout 1991; Sheard et al, 1998) with reference to a number Fakolade of different variables, composition, additives, cooking methods, oven temperature, sample dimension.

The moisture loss values obtained for keteku muscles was lower than the (33.23% -37.95%) reported by Babiker and Yousif, (1990) for the desert camel meat. The lower mean values observed for keteku muscle fell within the range of (27.69% - 29.69%) reported by (Omojola and Adesehinwa, 2006) for cooking loss of scalded, singled and conventionally dressed rabbit carcasses.

Physical and Sensory characteristics of pork loin roast cooked to three internal temperature gave values range of (20.89 - 25.78%) reported by (Soniran and Okubanjo, 2002) were seen to be lower than ($P<0.05$) the values observed in this study and (Colmenero et al; 2003) also reported values of (19.6% - 23.6%) for cooking loss of restructured beef.

Cooking loss depends on raw meat qualities and is of interest because it is expected to explain part of the variation in juiceness. It also influences the appearance of the meat. A high cooking loss give an expectation of a loss and is also of a great economic importance to the catering industry.

Aaslying et al; (2003) reported that raw meat quality influenced the cooking loss at a certain temperature. A higher cooking loss was observed for muscle with low water holding capacity. For cooking loss, some raw meat qualities are better suited for some cooking procedures than for others. On the other hand, if the meat has to be cooked to 70°c centre temperature with pH below 5.4 and the cooking loss must maximally reach, for example 25% then the meat should be cooked as steaks on a pan. For comparison, meat from a pure breed e.g. Duroc or from a standard pig can be cooked at all three cooking procedures and still not exceed 25% cooking loss, Keteku was observed in this study not to exceed 25% cooking Joss.

The mean shear force value in this study showed that the shear force value of Gudali and white Fulani muscle were similar ($P>0.05$) 5.76kg and 5.99kg while the least value was recorded for keteku breed (4.68kg) and the highest shear force observed in camel muscle (7.19kg). The values observed were higher than (2.92kg - 3.15kg) reported by Soniran and Okubanjo, (2002) for shear force of physical and sensory characteristics of pork and loin roast cooked to three internal temperature, but lower than (7.73kg - 8.10kg) reported by Abdelbary and Mohammed, (1995) for shear force value and standard errors of Najdi camel meat. He also reported that shear values are lower for younger camels than for older camels. Muscle with higher shear force will have longer cooking time. Differences in shear force may represent changes in the elastic characteristic of the connective tissues of different muscles which had different mechanical properties as mentioned.

The values obtained in this study for shear force fell in range of (3.16kg - 6.27kg) reported by Kembi and Okubanjo, (2002) for Yield and physical properties of raw ALLBEEF and soybean extended beef patties after dehydration.

Camel muscle was reported to have higher connective tissue than cattle breed and this contribute to the higher values observed in shear force for camel muscle. Thus camel muscle when cook appeared to be very tough but in establishing consumer threshold values for muscle tenderness, Okubanjo et al (2003) and Miller et al (2001) classified beef with Warner Bratzler shear values of 5.7 as being very too tough and above 3.0 to 4.9 as intermediate and below 3.0 as tender. Base on these classification, camel muscle was observed to be very tough, Gudali and white Fulani to be tough while keteku appears to be intermediate, which is acceptable to consumers. Okubanjo et al ;(2003) deduced that breed has a significant effect on the meat quality. In this study keteku produced the best meat quality, compared to white Fulani, Gudali and camel muscle.

Water holding capacity (WHC), which is the ability of meat to retain its water during application of external forces such as cutting, heating grinding and pressing. WHC could be loss by evaporation from meat surface as exudates or when muscle is cut. The mean WHC obtained in this study was lower ($P<0.05$) in camel muscle 44.12% while the highest value ($P<0.05$) was observed in keteku muscle 69.09%. Gudali and white Fulani muscle had similar values statistically ($P>0.05$).

The values observed fell in the range (42.22-66.97%) for characteristics of scalded, singled and conventionally dressed rabbit carcasses reported by Omojola and Adesehinwa, (2006) but were greater than the values (1.34 - 1.97%) reported by Babiker and Lawrie, (1983) for comparisons of effects of postmortem treatments on water holding parameters and (2.10% - 2.32%) reported by Babiker and Yousif, (1990) for WHC of quality attributes of desert camel meat.

Thermal treatment reduces the water holding capacity and protein denaturation and coagulation by heating reduces the space within the myofibullar protein network with a consequent decrease of water thus lowering the WHC (Hamm, 1969). While Tornberg (2005) reported that cooking inclduced structural changes and in turn decreased the water holding capacity of the meat.

Conclusion

From the result, it can be deduced that animal type and breed has a significant effect on the quality, with keteku producing the best meat quality, compared to other animal muscles used.

References

Aaslyng D. M., Bejerholm. C, Ertbjerg. P. J., Bertram. C. H., (2003) Cooking loss and juiceness of pork in relation to raw meat quality and cooking procedure. Food quality and preference, vol 14 (2003) Pp 277-288.

Abdelbary A. D., and Mohammed A. A., (1995) Nutrient composition of Najdi -camel meat. Meat science 39 Pp71-78.

Babiker S. A., and Lawrie R. A., (1983). Post - mortem electrical stimulation and high temperature ageing of Hot-deboned Beef. Meat science vol. 8 p 1-20

Babiker S. A., and Yousif O. Kh., (1990). Chemical composition and quality of camel meat. Meat science vol 27 Pp 283-187.

Barbera S., and Tassone S., (2006) Meat cooking shrinkage: Measurement of a new meat quality parameter J. of Meat Science Online Open access **XXX** 2006 **XXX XXX.**

Boles J. A., and Shend., P. J. (1999). Effects of raw binder system, Meat cut and prior freezing on restructured beef. Meat science, 53 (4), 233 - 239

Colmenero F. Jimenez., Serrano A., Ayo J., Solas M. T., Cofrades S., and Carballo. J. (2003) Physicochemical and sensory characteristics of restructured beef steak with added walnuts. Meat Science vol 65. Pp 1391-1397.

Chen C. M., and Trout, G R. (1991), Sensory instrumental texture profile and cooking properties of restructured beef steaks made with various binders. Journal of food science 56 (6), Ppl457 - 1460.

Hamm, (1969). Properties of meat proteins in Lawrie R.A. Edn - Protein as human food. West port, Conn. Avi public co. Pp 167-185.

Heyman, H., Hedrick. H. B., Karrach, M. A., Eggema. M. K., and Eller Sieck, M. R. (1990). Sensory and chemical characteristics of fresh pork roasts cooked to different centre temperature. Journal of food science 55, Pp 613-617.

Kadim, I. T., Mahgoub, O., Almarzooai W., Al-Zadjali S., Annamalai K., and Mansour M. H. (2006). Effects of age on composition and quality of muscles longissinus thoracis of the Omani Arabian camel (camelus dromedaries) Meat Science Vol 73 Pp 619-625.

Miller, M.F., Carr, M.A, Ramsey, C.B., Crockett, K. L. and Hoover, L.C., (2001). Consumer thresholds for establishing the value of beef tenderness.J. Anim Sci. Vol 79 (12) Pp 3062-3068.

Okubanjo A. O., Omojola, A.B., Ogunsola, O.O., Adewumi, M.K., Ajiboro O.G, Alabi G.F., and Babayemi .O.J. (2003). Meat characteristics of Bunaji, Gudali and Keteku breeds of cattle. Trop. Animal production Invest 6:185.

Omojola A. B. and Adesehinwa A. O. K. (2006). Meat characteristic of Scalded, singed and conventionally dressed rabbit carcasses. @ International Digital Organization for Scientific Information, Online Open access volume 1 No 1 CCC-CCC2006.

Renard. G. and Fisher A. V. (1997). Comparison of methods for estimating carcass fat content of young charolais bull in performance testing station. Livestock production science 51 Pp 205 -213.

SAS Institute (1996); SAS users guide version 6:12 SAS Institute Inc. Raleigh N. C.

Sheard. P. R. Nute, G R. and Chapell, A. G. (1998). The effect of cooking on the chemical composition of meat product with special reference to fat loss. Meat science 49 (2) 175-191.

Soniran, 6. G, and Okubanjo A. O. (2002) Physio-chemical and sensory characteristic of pork loin roast cooked to three internal temperatures Nig. J. Animal prod. Vol 29 (1) P138 - 141.

Tornberg E., (2005). Effects of heat on meat proteins - implications on structure and quality of meat products. Meat science Vol. 70 Pp 493-508.

Tshirhard - Hoeisher, T. E., Baird, B. E., King D. A., Mckenna D. R. Savell J. w. J. (2006) Physical chemical and historical characteristics of 18 lambs muscles. Meat Science 73 (2006) Pp 48-54.

Wand, C. E., Trent A., and Hid H. Hildebrand, J. L., (1995). Consumer perceptions of lamb compared with the meat, sheep and Goat Research Journal of meat science Vol. 11 Pp 64 - 70.