MEAT QUALITY PARAMETERS OF NIGERIA ORGANIC BEEF, CHEVON AND CAMEL MEAT

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Abstract - Organic animals are animals that are fed with only grass feed without hormones or medical pills. Research was conducted in a completely randomized design to evaluate, proximate and physico-chemical properties of some organic animals, beef, chevon and camel meat (CM). Results showed that the protein content of fresh CM (22.58%) was significantly higher than beef (19.57%) and chevon (20.83%). Drip loss values obtained from beef (2.46%) had significantly lower value compared to CM (4.03%) and chevon (3.53%). Beef had the lowest shear force value (6.68kg/cm^3), compared to CM (8.39kg/cm^3) and chevon (7.06 kg/cm^3). Cold and thermal shortening follows the same trends while water holding capacity tend towards the opposite way with beef having the significantly highest value and camel having the lowest value. Camel meat appears to have good quality of proximate and physico-chemical composition, compared to organically reared beef and chevon.

Key words: Organic animal, physico-chemical composition, proximate composition, and

I. INTRODUCTION

Healthy animals from organic farming help to ensure a safe food supply. Protein sourced from organic animals produces good quality food, such as meat, dairy products and eggs, at affordable prices [1]. The best organic farming system is the combination of scientific knowledge of ecology and modern technology with traditionally farming practices, based on naturally occurring biological processes [2]. Most Nigerian livestock farmers raise their animals on solely grass; animal are allowed to graze from the morning until evening before retuning back to their pen. Raising livestock and poultry, for meat and eggs is a traditional farming activity that complements the growing number of organic farms in an attempt to provide animals with natural living conditions and feed. In such practice, free-ranging outdoors with access to grazing and exercise, avoids crowding. Feed is also organically grown and drugs including antibodies are not ordinarily used because they are prohibited under the organic regulatory regime. Organic animals are treated differently from factory farmed farm animals. Organic animals eat grass and organic feed. This means the animals are usually very healthy due to the fact that “Organic farming starts at the bottom of the food chain by raising healthy soil, which grows healthy plants, which grow healthy animals, which make healthy humans. Organic farm animals tend to be healthier than conventional farm animals; they appeared robust and rarely get sick, due to the fact that they live farther apart than factory farmed animals [3]. When an organic animal gets a disease it might spread only to a few other animals. If a factory farmed animal gets sick then the disease could spread easily from animal to animal. This could happen because the factory farmed animals live right next to each other. To prevent this from happening conventional farmers give their animals antibiotics and hormones to make them grow faster. The animals store the hormones and antibiotics in their body. When the meat is eaten, these substances will still be there. This means that one might ingest bad chemicals into their body without knowing it. It is therefore the aim of this study to evaluate the meat qualities parameter of organic beef, chevon and camel meat.

II. MATERIALS AND METHODS

Chemical composition

Moisture, protein, ether extracts and ash content of fresh meat samples were determined according to A.O.A.C. procedures [4].

Physicochemical properties

Three replicate samples were used for the determination of all physicochemical properties.

Cooking loss
Cooking loss was determined as the percent loss in weight of muscles after boiling according to Okubanjo *et al*. [5].

Shear force determination
Warner Brazter shear force (WBSF) determination was performed on the boiled meat samples using the modified Warner Brazter shear force procedure by Bouton & Harris [6]. Three cores (1cm in diameter) were removed using an electrical coring machine. Each core was sheared at three locations parallel to the orientation of muscle fiber. The methods of Tsai *et al.* [7] and that of Barton-Gade *et al.* [8] were used for water holding capacity and drip loss determination, respectively.

Cold and Thermal shortening
Differences in length of (1cm in diameter) muscles were exposed to heat and cold condition according to the method of Fakolade [9], and the percent loss in length were determined.

Statistical analysis
Data were analyzed SAS [10] using the PROC ANOVA and means were separated using Duncan's Multiple range test.

III. RESULTS AND DISCUSSION

Chemical composition
The proximate composition of fresh muscle samples in Table 1 showed no significant difference, having a moisture content of fresh samples between 75.68% and 76.85%. This fell into the moisture content values of 72.4 -76.2% as reported by Ezekwe *et al*. [11], although moisture content could be affected by pre and post slaughtering handling, age, nutrition, and environmental conditions at the time of slaughter.

Mean protein content of fresh beef, chevon, and camel meat obtained in this study were 19.57, 20.83 and 22.58%, respectively. The value for camel meat fell within the range of 20.50 - 22.70 % as reported by Forrest *et al.* [12], while that of fresh beef is comparable to the range of 18.90 - 19.70 [11] in mature Sokoto Gudali bulls. It was also noticed that the protein content obtained for each animal fell within the range of 16-23% recorded by Hedrick *et al*. [13]. The highest protein content observed for camel meat could be due to what was reported by Kadim *et al.* [14]. They reported that camel meat is a good source of high protein, even in a harsh climate region and that it contained a very high percentage of protein compared to other red meat. Hedrick *et al.* [13] also reported that camel meat had higher protein content than beef.

Table 1. Proximate composition (g/100g) of raw organic beef, camel and chevon.

Parameters	Meat types		
	Beef	Camel	Chevon
Moisture	76.58±1.75	75.68±0.16	76.85± 1.73
Protein	19.57±0.15[b]	22.58±0.68[a]	20.83± 0.21[b]
Ether extract	2.90±0.20	3.10±0.20	2.82± 0.30
Ash	1.50± 0.26	1.05±0.09	1.31± 0.35

Means in the same row with similar superscripts are not significantly different (P > 0.05).

Ether extract content of the fresh meat type had no significantly differences although Kadim *et al*. [14] observed that the fat content percentage is usually affected by age, feed and the breed used to produce meat. Babiker & Yousif [15] noticed that camel fat was significantly lower than beef, but in this study, it was observed that for each muscle, there were no significant differences for fat content among the muscles.

Ash content is an indicator of the mineral content and profile of the meat. The ash content of the three species were also similar (P>0.05). The values of 1.50, 1.05 and 1.31% obtained in this study for raw beef, camel and chevon, respectively, were comparable with the range of 1.1 - 1.4% [16] for Najdi camel meat; however, the values were relatively lower than 1.4 -1.6% reported by Bouton & Harris [6] for Ndama cattle. Apart from protein content, no significant differences were observed in other nutrients. The difference observed in protein content could be attributed differences in animal species.

Physicochemical properties
The result of the physicochemical properties of the different muscles is shown in Table 2. The mean cooking loss obtained had no significant differences with 19.30% for beef, 21.26% for

camel, and 20.36% for chevon. The cooking loss percents observed in this study were lower than 39.5% and 43.0% for roasted or braised camel meat [17]. Water holding capacity (WHC) followed a decreasing trend of beef > chevon > CM. WHC plays a very unique role in meat quality, as it affect meat juiceness, tenderness and overall acceptability. Forrest *et al*. [12] noticed that meat with low WHC will have high drip loss during and before processing. This was observed in this study, as beef had the highest WHC with the least drip loss (2.46%), while camel meat which had the least WHC had the highest drip loss of 4.03%. Chevon was intermediate with drip loss of (3.3%).

Table 2. Physico-chemical properties of raw muscles from organic beef, chevon, and camel meat.

Parameters	Meat types		
	Beef	Camel	Chevon
CL (%)	19.30 ± 0.16	21.26 ±1.25	20.36 ±2.33
WHC (%)	68.12 ±1.08[a]	43.35±1.01[c]	57.67±1.15[b]
DL (%)	2.46±0.16 [c]	4.03±0.89 [a]	3.53±0.40 [b]
SF (kg/cm^2)	6.68±0.29 [c]	8.39 ±0.35 [a]	7.06±0.43 [b]
TS (%)	17.41± 1.69 [c]	34.77±2.80 [a]	27.85±0.99 [b]
CS (%)	3.46±0.16 [c]	4.53±0.40 [b]	9.05±0.89 [a]

Means in the same row with similar superscripts are not significantly different (P > 0.05). CL = Cooking Loss. WHC = Water holding capacity. DL = Drip Loss. SF = Shear Force. TS = Thermal Shortening. CS = Cold Shortening.

Shear force differed significantly between fresh meat types. Camel meat had the highest (8.39 kg/cm^2) followed by chevon (7.06 kg/cm^2) while the least value (P < 0.05) was obtained in beef (6.68 kg/cm^2). The values obtained in this study compared with the values of 7.73 – 8.10 kg/cm^2 obtained for Najdi camel meat [17]. Camel muscle had earlier been reported to have higher amounts of connective tissue than beef [15], which could probably be the reason why camel meat shear force was less tender than beef. Miller *et al.* [18], in establishing consumer threshold values for tenderness, classified beef with Warner Bratzler shear values of >5.7 as being very tough, 4.9 – 5.7 as intermediate and < 3.0 as tender. Based on these classifications, all three meat types may be considered to be tough, which could probably be as a result of the type of feed given to the animals. Since the animals are organically treated, they were not allowed access to grains and concentrate like conventional animals, and thus produced less fatty marbling muscle which helped to increase tenderness in muscle. Cold shortening have been recognized in recent years as a result from a low temperature in the muscle before the onset of *rigor mortis*, which causes contraction in muscle resulting to reduction in the length of muscle from the initial length [13]. The smallest cold shortening percentage recorded for beef muscle could be due to the lowest shear force value recorded, which shows that such meat appeared more tender than the others. Hedrick *et al.* [13], observed that tenderness of the muscle decreases as the degree of cold shortening increases. The muscle from these organic animals appear to be highly nutritious, with its protein quality ranging from 19 - 22%, showing that the animal was fed with quality organic feed. The lower ash content might indicate that it has less or no residues in their tissues that might result from accumulation of antibiotics and hormones used to treat common occurrence of diseases and sickness.

IV. CONCLUSION

Meat from organically fed animal could have a lower percentage of fat and ash (minerals), indicating that such meat might have less intramuscular fat that could lead to health problems and less antibodies and hormones accumulation. Although in this study the meat used appeared to be less tender as shown by the high shear force values found in each meat type.

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REFERENCES

1. IFAH (2005). Healthy animals - Safe food, an article on the improving the quality of life animals and people.
2. Perlo, F., P. Bonato, G. Teira, R. Fabre and S. Kueidar, (2006). Physiochemical and Sensory properties of chicken nuggets with mechanically deboned chicken meat: Research note. *Meat Sci 72:* 785-788.

3. Chen, A. (2002). Organic Meat: Healthy Animals Make Healthy Humans. Published on February 10, 2002.
4. AOAC (2000). Association of Official Analytical Chemist (Official Method of Analysis). 17th Edition Washington. D.C.
5. Okubanjo, O.A., Omojola, A.B., Ogunsola, O.O., Adewumi, M.K., Ajiboro, G., Alabi, G.F., Babayemi, O.J. (2003). Meat Characteristics of Bunaji, Gudali and Keteku breeds of cattle. Trop. Anim. Prod. Invest. 6: 185-193.
6. Bouton, P.E., Harris, P.V. (1978). Factors affecting tensile and Warner-Bratzler shear values of raw and cooked meat. J. Texture Studies. 9: 395-413.
7. Tsai, T.C., Ockerman, H.W. (1981). Water binding measurement of meat. J. Food Sci. 48: 687-707.
8. Barton-Gade, P.A., Demeyer, D., Honikel, K.O., Joseph, R.L., Puolanne, E., Severmi, M., Smulder, F.J., Tornberg, E. (1993). Reference Method for W. H. C. in Meat and Meat Products. Procedure recommended by an OECD Working Group, International 39th Congress of Meat Science and Technology, August 1-6, (1993), Calgary, Alberta, Canada.
9. Fakolade, P.O. (2008). Quality and nutritive value of Kundi, an intermediate moisture meat. PhD Thesis, University of Ibadan, Ibaban, Nigeria. Page 104-127.
10. SAS. (1998). Statistical Analysis System Institutes User's guide SAS Institute Inc. NC. 54: 365-367.
11. Ezekwe, A.G., Okonkwo, T.M., Ukaegbu, U.G., Sangode, A.A. (1997). Preliminary study of bulls. Niger. J. Anim. Sci. Prod. 24(1): 79 -85.
12. Forrest, J.C., Aberle, E.D., Hedrick, H.B., Judge, M.D., Merkel, R.A. (1975). Principles of Meat Science. Freeman WH and Co. San Francisco.
13. Hedrick, H.B., Aberle, E.D., Forrest, J.C., Judge, M.D., Merkel, R.A. (1994) Principles of Meat Science 3rd ed. Kendall Hunt Publishing Co. Dubuque, Iowa.
14. Kadim, I.T., Mahgoub, O., Al-Mar-Zoogi, W., Al-Zadjali, S., Annamalai, K., Mansour, M. (2006). Effects of age on composition and quality of muscle longissimus thoracis of the Omani Arabian Camel. (Camelius dromedaries). Meat Sci. 73: 619-625.
15. Babiker, S.A, Yousif, O.K. (1990). Chemical composition and quality of camel meat. Meat Sci. 27: 283-287.
16. Dawood, A.A. (1995). Physical and sensory characteristics of Najdi – Camel meat. Meat Sci. 39(1): 59 – 69.
17. Dawood, A.A., Alkanhal, M.A. (1995). Nutrient Composition of Najdi-Camel meat. Meat Sci. 39: 71-78.
18. Miller, M.F., Carr, M.A., Ramsey, C.B., Crockett, K.L., Hoover, L.C. (2001). Consumer thresholds for establishing the value of beef tenderness J. Anim. Sci. 79: 3062-3068.