Tropical Science
Trop. Sci. 2007, **47(1)**, 38–42
Published online in Wiley InterScience
(www.interscience.wiley.com) **DOI**: 10.1002/ts.190

Carcass and meat from intact and castrated Desert male goats of different ages

FM El-Hag[1]*, *MO Mudalal*[2], *M-K A Ahmed*[3], *AS Mohamed*[3], *MA Mohamed Khair*[1], *OE Elbushra*[1], *MA Mekki*[1], *TK Ahmed*[4] and *B Fadlalla*[1]

[1]Agricultural Research Corporation, El-Obeid Research Station, PO Box 429, El-Obeid, Sudan.
[2]Faculty of Natural Resources and Environmental Studies, University of Kordofan, El-Obeid, Sudan.
[3]Faculty of Animal Production, University of Khartoum, Khartoum, Sudan.
[4]Agricultural Research Corporation, Food Research Centre, Khartoum, Sudan.
*To whom correspondence should be addressed (faisalelhag@hotmail.com)

Abstract *Castrates consumed more feed and had higher feed intake as a percentage of body weight than intact Desert male goats. Older males had a higher dressing percentage than younger ones. Castration improved meat juiciness and tenderness scores and resulted in a relatively higher flavour score.* *Copyright © 2006 John Wiley & Sons, Ltd*

Key words: Desert goats, age, castration, meat, carcass, organoleptic scores

Introduction

Sudan Desert goats are found in arid and semi-arid areas of Sudan, especially in the Kordofan and Darfur regions, and are adapted to survive under adverse conditions of feed limitations and water scarcity (Mason and Mule 1960). Total annual red meat production in Sudan is estimated at 8830 tonnes, with goats contributing about 310 tonnes, and annual live goat exports to the Arab world exceed 16,500 head (MAR 2003). Despite the growing demand for goat meat worldwide, data on the meat producing characteristics of goats are scarce (Boyazoglu and Morand-Fehr 2001). This study investigated the effect of castration and age on performance of Sudan Desert male goats, and on the yield, chemical composition and organoleptic properties of their meat.

Materials and methods

Twenty-four Sudan Desert male goats were used: 12 were 3–5 months old and the other 12 were 10–12 months old, with average initial body weights of 9.0 ± 0.52 kg and 12.6 ± 0.54 kg, respectively. Each age group was subdivided into two similar subgroups based on initial body weight. One subgroup was randomly chosen and castrated manually, while the other was left intact. They were accommodated individually in shaded pens (2×3 m), treated for internal and external parasites, and allowed a week of adaptation. Each animal was provided with

individual feed and water troughs, with free access to water and *ad libitum* feeding. The feed was compounded from 18% groundnut seed cake, 9% wheat bran, 9% sorghum grain, 1% mineral block and 63% forage-legume hay mixture. The hay mixture consisted of *Cajanus cajan*, *Lablab purpureus* and *Cyamopsis tetragonoloba*, dried, ground and mixed in equal proportions. The chemical composition of the feed (dry matter basis) was 13.4% crude protein, 18.0% ether extract, 9.25 MJ kg^{-1} metabolisable energy, 0.91% Ca, 0.42% P and 400 IU kg^{-1} vitamin D_3. Body weight, girth and length were measured at the start and then weekly until the end of the experiment.

After feeding for 63 days during the hot summer months March–June 2003, 12 animals (three from each subgroup) were randomly chosen and slaughtered. The hot carcass weight was recorded. The components of the digestive tract were washed, stored with the other internal organs at −18°C for 24 h then weighed. After chilling, the cold carcass weight was recorded and the carcass was carefully divided into two equal halves along the midline. The left side was cut into five wholesale cuts: shoulder, breast, rack (ribs), loin and leg (Kempster et al. 1982).

The midrib eye muscle area of each carcass was dissected between the 9^{th} and 12^{th} ribs to determine lean muscle, bone, fat and connective tissue weights. The four components were then thoroughly mixed, ground and analysed for moisture, fat, protein and ash contents (AOAC 1990).

Samples from the *longissimus dorsi* muscle were selected, sliced into roughly equal proportions and boiled in water for 45 min with no salt or oil (Kempster et al. 1982). Five untrained panellists evaluated the juiciness, tenderness and flavour on a hedonic scale from 1 (excellent) to 5 (poor) (Watts et al. 1989).

The data were analysed as a 2 × 2 factorial experiment (age group vs castration) in a randomised complete block design (Steel and Torrie 1980). In order to compensate for differences in live weights at the start of the experiment, initial body weight was used as a covariate adjustment factor for the analysis of data on live animals and carcass yield (final body weight, weight gain, feed consumption, body measurements, carcass weights, dressing percentage). Similarly, hot carcass weight was used as a covariate adjustment factor for the analysis of data on carcass components (weight of wholesale cuts, internal organs, midrib eye muscle composition) (Ülker et al. 2002). Statistical analyses were performed with MSTAT-C software (Freed 1992).

Results and discussion

Castrates consumed significantly more total feed and had significantly higher feed intake as a percentage of body weight than intact male goats (Table 1). Zemmelink et al. (1985) reported that dry matter intake of goats can be higher than 3% of body weight if a high quality feed is offered, and this was achieved in the present trial (intact males 3.1%, castrates 3.9%). The overall daily weight gain was 0.13 kg day^{-1}, which was higher than the 0.063 kg day^{-1} reported by El Muola et al. (1999) but lower than the 0.40 kg day^{-1} observed by Akinsoyinu et al. (1975) in West African Dwarf goats. The overall feed conversion ratio (feed : gain

Copyright © 2006 John Wiley & Sons, Ltd

DOI: 10.1002/ts

Table 1. Effect of castration on Sudan Desert male goat performance, body measurements, internal organs and organoleptic scores

Parameter	Intact males	Castrates	SE±
Performance			
Initial body weight (kg)	10.7	10.9	0.15^{NS}
Final body weight (kg)	18.8	19.1	0.72^{NS}
Total feed consumption (kg)	32.0	37.4	1.64*
Daily feed consumption (kg)	0.508	0.575	0.148*
Feed intake as % of body weight	3.1	3.9	0.14**
Body measurements			
Initial body length (cm)	47.8	45.0	0.54**
Final body length (cm)	51.2	49.3	0.66*
Change in body length (cm)	3.4	4.3	0.06**
Internal organs			
Testis (kg)	0.07	0.03	0.007**
Heart (kg)	0.06	0.09	0.004**
Liver (kg)	0.21	0.27	0.014*
Spleen (kg)	0.02	0.04	0.004*
Organoleptic scores			
Juiciness	1.86	2.19	0.076*
Tenderness	1.77	2.18	0.083*
Flavour	2.04	2.34	0.10^{NS}

Differences significant at *$p < 0.05$, **$p < 0.01$; NS = differences not significant.

Table 2. Effect of age group on Sudan Desert male goat performance, body measurements and carcass characteristics

Parameter	Age group 3–5 mo.	Age group 10–12 mo.	SE±
Performance			
Initial body weight (kg)	9.0	12.6	0.15**
Final body weight (kg)	17.8	20.1	3.15^{NS}
Body measurements			
Initial body length (cm)	44.7	48.1	0.54**
Final body length (cm)	48.3	52.1	0.66**
Change in body length (cm)	3.6	4.0	0.06**
Carcass characteristics			
Hot carcass weight (kg)	6.4	7.9	0.37*
Dressing percentage (%)	38.7	41.1	0.81*

Differences significant at *$p < 0.05$, **$p < 0.01$; NS = differences not significant.

weight ratio) of 4.5 : 1 indicated a higher weight-gain efficiency than the range of 5.05 : 1 to 6.56 : 1 reported by Babiker et al. (1985): this difference may be attributable to differences in the ages of the goats or feeding regimens between the two studies.

As expected, older Desert male goats had significantly higher initial body weight, and initial and final body length, than younger ones (Table 2). The absolute increases in body length were significantly different between the two age groups, with the older males showing

Copyright © 2006 John Wiley & Sons, Ltd

DOI: 10.1002/ts

greater growth, as previously noted by Owen (1975). Although the final body weights of the two age groups were not significantly different, due to high variability among individuals, the older males were shown to yield significantly higher hot carcass weight than the younger ones, and the dressing percentage from the older goats was also greater (Table 2). However, there were no significant differences in carcass yield or dressing percentage between castrates and intact male goats. This contradicts the findings of Singh et al. (1996) who found that castration significantly improved dressing percentage.

Castrates had significantly lower testis weights and significantly higher heart, liver and spleen weights than intact males (Table 1). Forrest et al. (1975) attributed such differences to hormonal changes associated with castration, but no observations on hormonal profiles of castrates and intact male goats were made in the present study.

Overall, leg and shoulder cuts constituted over 65% of the whole cold carcass yield. Lean : bone ratios for intact males and castrates were 1.97 : 1 and 1.85 : 1, respectively, but the difference was not significant. These values are similar to those reported by Lanza et al. (2003) for lambs. The midrib eye muscle had mean crude protein content of 20.4% and fat content of 35.3%, which were within the ranges reported by El Muola et al. (1999). These proportions were not significantly affected by age or castration. Meat from castrates achieved significantly higher scores for juiciness and tenderness than meat from intact males (Table 1), but scores for flavour were not significantly higher for the meat of castrates.

Acknowledgements

We acknowledge the technical assistance of MS Hamid, BM El Fakki and A Fadelmulla.

References

Akinsoyinu AO, Mba AU, Olubajo FO (1975) Studies on energy and protein utilization for pregnancy and lactation by the West African Dwarf goat in Nigeria. East African Agricultural and Forestry Journal 41: 167–176.

AOAC (1990) Official Methods of Analysis (13th edn). Washington DC, USA: Association of Official Analytical Chemists.

Babiker SA, Maglad M, Koudoda ME (1985) Effect of castration on performance and carcass characteristics of male Sudan Desert goats. World Review of Animal Production 21: 11–13.

Boyazoglu J and Morand-Fehr P (2001) Mediterranean dairy sheep and goat products and their quality. A review. Small Ruminant Research 40: 1–11.

El Muola IHA, Babiker SA, El-Khidir OA and Ibrahim SE (1999) Meat production from female goat kids compared with males. Journal of Agricultural Science 133: 223–226.

Forrest JC, Aperle ED, Hedrik HB, Judge MJ, Merkel RA (1975) Principles of Meat Science. San Francisco, CA, USA: WH Freeman and Co.

Freed RD (1992) MSTAT-C Software Programme (Version 2.10). East Lansing, MI, USA: Crop and Soil Sciences Department, Michigan State University.

Kempster AJ, Cuthbertson A, Harrington G (1982) Carcass Evaluation in Livestock Breeding, Production and Marketing. St Albans, UK: Granada Publishing Ltd.

Lanza M, Bella M, Priolo A, Fasone V (2003) Peas (*Pisum sativum* L.) as an alternative protein source in lamb diets. Growth performance and carcass and meat quality. Small Ruminant Research 47: 63–68.

MAR (2003) Planning Administration Annual Report. Khartoum, Sudan: Ministry of Animal Resources.

Mason IL, Mule JP (1960) The Indigenous Livestock of Eastern and Southern Africa. Khartoum, Sudan: Printing and Publication House, University of Khartoum.

Copyright © 2006 John Wiley & Sons, Ltd

DOI: 10.1002/ts

Owen JE (1975) The meat producing characteristics of indigenous Malawi goats. Tropical Science 17: 123–138.
Singh CN, Saikia S and Bruah DK (1996) Effect of method of castration on carcass characteristics of male kids. Journal of the Assam Veterinary Council 6: 30–33.
Steel RGD, Torrie JH (1980) Principles and Procedures of Statistics: A Biometrical Approach (2nd edn). New York, USA: McGraw-Hill.
Ülker H, Gökdal Ö, Temur C, Budag C, Oto M, de Avila DM and Reeves JJ (2002) The effect of immunization against LHRH on body growth and carcass characteristics in Karakas ram lambs. Small Ruminant Research 45: 273–278.
Watts BM, Ylimaki GL, Jeffery LE, Elias LG (1989) Basic Sensory Methods for Food Evaluation. Ottawa, Ontario, Canada: International Development Research Centre.
Zemmelink G, Tolkamp BJ, Meinderts JH (1985) Feed intake and weight gain of West African Dwarf goats. In: Sheep and Goats in Humid West Africa (Sumberg JE and Cassaday K, eds.), pp. 29–33. Addis Ababa, Ethiopia: International Livestock Center for Africa.

Copyright © 2006 John Wiley & Sons, Ltd

DOI: 10.1002/ts