GROWTH, CARCASS AND MEAT QUALITY OF BUCK KIDS REARED TO PRODUCE 'CAPRETTO' CARCASSES

J.S. DHANDA, D.G. TAYLOR and *J.E. McCOSKER*

Department of Animal Production, The University of Queensland, Gatton College, Qld 4345

SUMMARY

Suckled buck kids from five genotypes were compared for growth, carcass and meat quality parameters. Boer x Saanen and Saanen x Feral kids had significantly (P = 0.05) better average daily gains than other genotypes. Very small differences were detected between genotypes with respect to muscle and subcutaneous fat deposition. Saanen x Angora kids deposited more fat as subcutaneous, intermuscular and internal fat. Boer x Saanen had significantly paler muscle colour compared to other genotypes. Sensory evaluation did not reveal any significant differences between genotypes for flavour, tenderness, juiciness and overall acceptability. Based on growth rate, carcass quality and the muscle colour recommended for 'Capretto' carcasses, Boer x Saanen kids had an advantage over other genotypes included in this study.

Keywords: growth, Capretto carcass characteristics, meat quality, buck kids

INTRODUCTION

Goats are an important source of meat and other products like fibre, milk, skin etc. and have the ability to use waste fibrous material not consumed by other species (Colomer-Rocher *et al.* 1992). The world's goat population was around 610 million in 1994, with over 90% of that found in developing countries (FAO 1994). There are 102 described breeds and a large number of mixed type of goats in the world (Acharya 1992) ranging in mature weight from 9 to 13 kg for the small tropical breeds to over 100 kg for the large European dairy breeds and South African Boer breed (Warmington and Kirton 1990). This diverse and vast genetic resource can provide a rapid method for improving traits of economic importance in goats.

Australia has around 2.5 million goats (FAO 1994). Australia is the world's largest exporter of goat meat with more than 90% of its goat meat production being exported and its goat meat industry relies heavily on the feral goat population (Holst 1990). As the quantity and quality of goat meat produced from feral goats is unreliable, there is a need to stabilise the industry by improving the available stock using suitable breeding and production systems. There is little published information relating to utilisation of the genetic potential of different goat breeds for maximising meat production (Anous and Mourad 1993).

Therefore, the objective of this study was to evaluate the performance of different goat genotypes for growth, carcass and meat quality, reared to produce 'Capretto' carcasses. A Capretto carcass is from a milk fed, suckling goat kid with a carcass weight in the range of 6 to 10 kg.

MATERIALS AND METHODS

Five different goat genotypes Boer x Angora (BA), Boer x Saanen (BS), Feral x Feral (FF), Saanen x Angora (SA) and Saanen x Feral (SF) were used in the trial. Five male kids from each genotype were randomly selected two weeks after birth and reared to produce Capretto carcasses. Kids were weighed weekly from birth to slaughter which occurred at a liveweight in the range of 14 to 20 kg. Average daily gain (g/day) and age at killing were recorded for each genotype.

Kids were fasted for 18 hours with access to water and liveweight was recorded prior to slaughter. Following slaughter and dressing, using standard commercial techniques, hot carcass weight and weights of some visceral organs (heart, liver, lungs, kidneys, gastro-intestinal tract), head and skin were taken. Weights of scrotal fat, kidney and pelvic fat, and omental fat were recorded. Empty body weight (EBW) was calculated by deducting the weight of stomach contents from liveweight at slaughter.

After chilling the carcasses for 24 hours, cold carcass weight and carcass length (from *symphisis pubis* to the anterior edge of middle of first rib) were recorded. Carcasses were split down the dorsal midline and the left half was separated into dissectible muscle, bone and fat, with the subcutaneous and intermuscular fat depots being recorded separately. Muscle to bone ratio and weights of some individual muscles (*Supraspinatus, Triceps, Vastus group* and *Gastrocnemius*) were also recorded. Eye muscle area (*Longissimus dorsi*) and pH of this muscle were measured at the 12th/13th rib position. Colour of the muscle was measured at the same site using the Fibre Optic Probe with values below 30 indicating dark meat and above 50 pale meat. Fat and muscle colour were also subjectively evaluated based on a 5-point scale. Fat colour score 1 was white and score 5 represented yellow fat, while score 1 in muscle colour represented pale and score 5 red muscle.

The *Vastus group* of muscles were used for determining cooking loss and tenderness. The muscles were weighed before cooking in a plastic bag in a water bath at 85^0C for 45 minutes, until an internal temperature of 70^0C was achieved. Samples were cooled and weighed and percent loss in weight was recorded as cooking loss. Muscle cores with cross sections of 1x1 cm and at least 3 cm long were cut parallel to the muscle fibres and shear force values were taken using Warner-Bratzler shear force apparatus. Organoleptic evaluation was carried out on *Supraspinatus, Triceps* and *Gastrocnemius* muscle samples after using the same cooking method as for shear force measurements. The attributes (flavour, tenderness, juiciness and overall acceptability) were assessed by eight semi-trained panellists, using a 9-point hedonic scale with 1 being disliked extremely and 9 being liked extremely.

Data were analysed using the SAS General Linear Models (GLM) procedures with genotype being the only independent variable in the model (SAS 1989).

RESULTS

Meat quality attributes are presented in Table 1. A pH of 5.8 from SF carcasses was significantly higher than 5.6 from Boer crosses, that is BA and BS kids. Fibre optic probe values and subjective evaluation of muscle colour (based on a 5-point scale) indicated that BS kids had significantly paler carcasses than FF and SF. Shear force values ranged from 2.9 to 3.7 kg/cm^2, but there was no significant difference in tenderness between different breed types.

The growth, carcass and slaughter floor measurements are presented in Table 2. Birth weights of different genotypes ranged from 2.5 to 3.5 kg, with BS weighing highest and FF kids lowest at birth. Average daily gain of BS and SF kids (164 and 162 g/day respectively) were significantly higher than FF and SA kids (128 g/day each) and thus BS and SF kids took significantly less time to reach the required liveweight at slaughter. Carcasses from FF kids were significantly shorter (47.39 cm) as compared to SF (50.69 cm) but they had significantly higher eye muscle area (8.6 cm^2) than all other genotypes except SF. Dissectible carcass composition indicated that muscle (60 to 62%) and subcutaneous fat component (4 to 6%) did not vary much between genotypes. SF and BS carcasses had lower intermuscular fat (3%) and muscle to bone ratio (2.3 to 2.4 : 1) and higher bone component (25 to 26%). There were no significant differences between different genotypes in weights of shoulder muscles (*Supraspinatus* and *Triceps*), while SF and FF carcasses had the heavier long leg muscles (*Vastus* and *Gastrocnemius*). There were no significant differences between different genotypes in weights of head and skin (around 1 kg). Weights of heart and empty gastro-intestinal tract also did not differ significantly. Liver of SA kids was significantly heavier (270 g) than BA and SF kids (236 and 234 g respectively) and lungs of FF kids were significantly lighter in weight than BS and SA kids. SA kids deposited more fat as kidney and pelvic and omental fat while FF kids had significantly higher scrotal fat than BS and SF kids.

Table 1. Least square means (± s.e.) of meat quality attributes of buck kids from five genotypes

	Genotypes					
Attributes	BA	BS	FF	SA	SF	s.e.
pH	5.64^{B}	5.69^{B}	5.70^{AB}	5.69^{AB}	5.83^{A}	0.05
Fibre optic probe value	44.33^{AB}	53.00^{B}	36.66^{A}	44.60^{AB}	38.80^{A}	3.28
Shear force value (kg/cm^2)	3.16	2.91	3.63	2.96	3.76	0.37
Percent cooking loss	34.47^{BC}	34.06^{B}	38.99^{A}	37.25^{AC}	34.02^{B}	0.91
Subjective evaluation						
Fat colour (1-5)	1	1	1	1	1	0.00
Muscle colour (1-5)	1.67^{AB}	1.40^{B}	2.00^{A}	1.80^{AB}	2.00^{A}	0.18
Flavour (1-9)	5.96	6.20	5.67	6.12	6.10	0.19
Tenderness (1-9)	5.50^{A}	6.12^{B}	5.80^{AB}	6.02^{AB}	6.20^{B}	0.21
Juiciness (1-9)	5.58	6.00	5.75	5.65	5.85	0.16
Overall acceptability (1-9)	5.80	6.15	5.67	6.02	5.80	0.19

Means within rows with different superscripts are significantly different at P = 0.05

Table 2. Least square means (± s.e.) of growth, carcass and slaughter floor measurements of buck kids from five genotypes

	Genotypes					
	BA	BS	FF	SA	SF	s.e.
Birth weight (kg)	3.23^{AB}	3.54^{A}	2.50^{B}	2.62^{B}	3.28^{A}	0.23
Liveweight at slaughter (kg)	14.53^{AB}	14.82^{AB}	14.13^{B}	13.88^{B}	15.62^{A}	0.42
Average daily gain (g/day)	139.3^{AB}	164.6^{A}	128.3^{B}	128.2^{B}	162.2^{A}	11.1
Age at slaughter (days)	88.0^{AB}	76.6^{A}	98.6^{B}	100.6^{B}	83.0^{A}	6.00
Hot carcass weight (kg)	6.60^{AB}	6.68^{AB}	6.80^{AB}	6.32^{B}	7.19^{A}	0.26
Empty body weight (kg)	13.17	13.57	13.15	12.81	13.97	0.46
Dressing percentage (EBW)	50.07	49.18	51.67	49.35	51.47	0.83
Cold carcass weight (kg)	6.43^{AB}	6.36^{AB}	6.60^{AB}	6.16^{B}	7.02^{A}	0.25
Loss in carcass weight (%)	2.46	4.72	2.88	2.49	2.45	0.88
Carcass length (cm)	48.41^{AB}	49.78^{AB}	47.39^{B}	48.61^{AB}	50.69^{A}	0.89
Eye muscle area (cm^2)	7.16^{BC}	7.33^{B}	8.64^{A}	6.53^{C}	7.76^{AB}	0.28
Dissectible composition (%)						
Muscle	61.12^{AB}	62.00^{AB}	62.66^{A}	60.37^{B}	61.88^{AB}	0.71
Subcutaneous fat	5.31^{AB}	4.14^{B}	5.41^{AB}	6.60^{A}	5.19^{AB}	0.65
Intermuscular fat	4.64^{AC}	3.34^{AB}	4.59^{ABC}	5.30^{C}	3.05^{B}	0.49
Bone	23.19^{A}	26.17^{B}	23.37^{A}	23.86^{AC}	25.04^{BC}	0.52
Muscle : bone ratio	2.64^{B}	2.37^{A}	2.69^{B}	2.53^{AB}	2.47^{AB}	0.06
Individual muscles weights						
Supraspinatus (g)	51.26	51.32	53.10	51.48	60.76	3.98
Triceps (g)	123.0	120.9	128.9	136.7	137.3	6.30
Vastus group (g)	135.5^{ABC}	128.6^{B}	158.7^{AC}	136.1^{BC}	157.5^{A}	7.44
Gastrocnemius (g)	64.7^{AB}	60.1^{B}	67.6^{AB}	58.1^{B}	70.5^{A}	3.49
Weights of visceral organs and fat depots (g)						
Head	1051.9	1063.1	1000.5	1012.1	1050.6	30.95
Skin	1165.7	1106.0	987.8	1032.9	1091.4	53.86
Heart	68.4	71.1	61.0	62.5	65.7	4.26
Liver	236.6^{A}	249.5^{AB}	247.9^{AB}	270.0^{B}	234.3^{A}	8.21
Lungs	161.7^{AB}	193.6^{A}	128.7^{B}	180.7^{A}	158.0^{AB}	13.19
Gastro-intestinal tract (full)	3431.4^{AB}	3513.9^{AB}	3202.0^{B}	3309.2^{B}	3825.2^{A}	177.3
Empty gastro-intestinal tract	2071.3	2270.5	2219.7	2244.6	2174.8	114.2
Contents	1360.0^{AB}	1243.5^{B}	982.3^{B}	1064.6^{B}	1650.3^{A}	118.5
Scrotal fat	23.06^{AB}	17.94^{B}	37.53^{A}	26.34^{AB}	21.52^{B}	4.52
Kidneys,kidney and pelvic fat	144.50^{ABC}	110.94^{A}	179.53^{B}	188.80^{C}	128.02^{AB}	18.21
Omental fat	86.50^{AB}	73.46^{A}	144.60^{BC}	167.78^{C}	122.26^{ABC}	19.65

Means within rows with different superscripts are significantly different at P = 0.05

DISCUSSION

Ultimate muscle pH was in the range of 5.6 to 5.8, which is quite normal. BS kids had very pale muscle colour as denoted by higher fibre optic probe values and lower subjective scoring, than other genotypes. This could be due the fact that kids from Saanen mothers got more milk than others. Shear force values were in the range of 2.9 to 3.7 kg/cm^2, which were low as compared with values (4.0 kg/cm^2) in Desert goats (Babiker *et al.* 1990) and very low compared with 3.6 to 7.6 kg/cm^2 in the adult Florida native goat and its crosses with Nubian and Spanish breeds of goats (Johnson *et al.* 1995). This variation may be due to differences in age, liveweight and the types of muscles used by these workers. Percent cooking loss was similar to that (34%) reported by Babiker *et al.* (1990) in Desert goats. Sensory panel ratings did not differ significantly between genotypes which is in agreement with the results of Griffin *et al.* (1992) in Angora and Spanish goats.

BS and SF kids had significantly higher birth weights than FF kids. The birth weight of a kid depends primarily on the size of the breed to which it belongs (Morand-Fehr 1981). Mature weight of males from Boer and Saanen breeds is in the range of 80 to 120 kg compared to 27 to 36 kg for Feral goats (Warmington and Kirton 1990). Results in this study indicated that BS kids had better average daily gains than FF and SA kids. Kids of larger mature sized breeds had better average daily gains (Warmington and Kirton 1990). Average daily gains of 128 to 164 g achieved in this study are higher than those reported by Potchoiba *et al*. (1990) in milk-fed Alpine kids. Due to better average daily gains BS kids reached the required liveweight at slaughter earlier than other kids. Dressing percentage of kids ranged from 49 to 51%, which is in agreement with the results of Potchoiba *et al*. (1990). Johnson *et al.* (1995) did not find any difference in dressing percentages between different breed-types which is in agreement with the findings of this study. Eye muscle area for different genotypes in the study ranged from 6.5 to 8.6 cm^2, which is on the higher side compared with 6.8 cm^2 reported for milk fed Alpine kids (Potchoiba *et al*. 1990). Carcass composition indicated that BS and SF kids were leaner as compared with other genotypes especially SA kids. The percent carcass composition is in agreement with the results of Johnson *et al.* (1995) with respect to the lack of differences in muscle and few differences in fat content between breeds. Higher weights of some muscle like *Vastus* and *Gastrocnemius* in SF and FF kids may be due to higher muscle content than other kids.

Weights of head and skin (around 1 kg) of the buck kids found in the present study are similar to Omani Batina bucks (Mahgoub and Lodge 1996), if compared on percentage of liveweight basis. Weights of heart, liver and lungs were lower, and gastro-intestinal tract was similar in weight, compared with Alpine bucks killed at 20 kg liveweight (Potchoiba *et al*. 1990). Amounts of scrotal and kidney and pelvic fat were less than that reported by Colomer-Rocher *et al.* (1992) in New Zealand Saanen buck kids, and kidney and pelvic fat was the same as that observed by Potchoiba *et al*. (1990) in Alpine kids at the same carcass weight. Saanen cross kids in the present study deposited more internal fat than Boer cross kids. Male kids from dairy breeds (Alpine and Saanen) deposited more fat as visceral than carcass adipose tissue (Morand-Fehr *et al.* 1985).

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