Carcass composition of New Zealand Saanen goats

F. COLOMER-ROCHER AND A.H. KIRTON

MAFTech, Ruakura Agricultural Centre, Hamilton.

ABSTRACT

Eighteen entire male Saanen goats (liveweight range 5 to 115 kg; carcass weight range 2 to 52 kg; age range young to mature) and 19 females (liveweight range 17 to 64 kg; carcass weight range 8 to 32 kg age range several months to mature) were slaughtered. Carcasses were dissected into fat, muscle and bone. Based on allometric regression relationships an increase in carcass weight from 10 to 30 kg was accompanied by a decline in carcass muscle from 60.5 to 59.9% for the males, but from 61.8 to 51.5% for females. The greater decline in muscle content for the female carcasses reflected an increase in carcass fat content from 10.6 to 33.7%, while for male carcasses the increase was only from 11.7 to 15.5%. Over the same increase in carcass weight, carcass bone decreased from 24.7 to 14.1% for females, but only from 23.4 to 20.4% for males.

Keywords Saanen goats; males; females; light; mature; fat; muscle; bone; carcasses

INTRODUCTION

Goats are becoming an increasingly important source of meat on a global basis because of their ability to use waste fibrous material not eaten by other species, because of their lean carcasses and because of their convenient size where refrigeration is not available for storage (Kirton, 1988). Although goat meat (chevon) is not readily available in New Zealand, the rapidly increasing numbers of goats being run for fibre production will make available expanding numbers of surplus stock for slaughter for meat.

The Saanen is one of the largest goat breeds, being only slightly smaller than the Boer (McGregor, 1984). Limited information is available on the meat production abilities of Saanen wethers (McGregor, 1980, 1982; Treacher *et al.*, 1987) or wethers and does (Butler-Hogg and Mowlem, 1985), with the only previous New Zealand goat carcass information covering much smaller male and female feral goats (Kirton, 1970).

The purpose of the present trial was to gather information on carcass characteristics of local male and female Saanens, on which no meat yield information is available.

MATERIALS AND METHODS

Animals and their Selection

Nineteen female and eighteen male Saanen goats were chosen to give the greatest possible live weight span available from the milking flock and associated males at the Ruakura Agricultural Centre. Whereas young male goats were available for the experiment from birth and could be carried through to heavier weights, female stock were available only after having been culled because they were considered less suitable future milkers.

Pre-slaughter and Slaughter Procedure

The goats were weighed off-pasture and transported from the Research farm to the Ruakura abattoir where they were fasted overnight without water and reweighed the following morning (starved live weight; SLW) before slaughter.

Each goat was rendered insensible by electrical stunning and the throat was cut severing the main blood vessels in the neck. The body was skinned and the head and feet were removed. The carcass was eviscerated but retained the tail, thymus, kidneys, perinephric fat, pelvic fat and, in the case of the male, the testes as is the case in Mediterranean countries (Colomer-Rocher *et al.*, 1987).

Carcass Measurements

Leg length measurements F and T, gigot width G

and carcass length (L) from the symphysis pubis to the anterior edge of the middle of the first rib were taken as described by Palsson (1939).

Carcass Analysis

Each carcass was split down the backbone by bandsaw. The left side had the thymus, tail, kidney and for the males, the testicles removed before the side weight was taken for dissection purposes. The side was cut into joints and dissected according to the procedures of Colomer-Rocher *et al.* (1987) into subcutaneous fat, intermuscular fat, muscle, bone and remainder (major blood vessels, ligaments, tendons and thick connective tissue sheets associated with some muscles). In addition, the long leg contained some kidney fat and the pelvic fat which were separately identified together with the kidney fat retained on the rib cut. The flank retained the cod fat (males) and udder fat (females). These fats were also removed separately and weighed. Dissection losses were always less than 2%.

The right side of each carcass was frozen, cut in pieces on a bandsaw and minced three times before being sampled for determination of ether-extract, protein and water.

Biometrical Analysis

To examine the relative growth of various components of the carcasses of male or female goats, allometric growth coefficients (Huxley, 1932) were calculated for each sex group and compared by regression analysis. These growth coefficients give the ratio of the specific growth rates of the carcass component and the carcass with a coefficient greater than one indicating that the component grows faster than the carcass as a whole, and a coefficient less than one indicating that the component grows more slowly than the carcass as a whole.

RESULTS AND DISCUSSION

The numbers of animals used, their live weights and carcass weights are given in Table 1. Because of stock availability, there was an absence of newborn females, and young males immediately beyond the kid stage. Despite this, a good spread

TABLE 1 Numbers and sexes of goats with means and ranges of starved live weights (SLW; kg) and hot carcass weights (HCW; kg)

	Females		Males	
	Mean	Range	Mean	Range
Number of animals	19		18	
SLW	35.1	17.0-63.8	56.0	4.7-115.0
HCW	16.0	7.5-31.7	26.6	2.3-51.8

TABLE 2 Allometric growth coefficients[1] relating weight of the chemical and dissectible components to carcass weight

Component	Females b±se	Males b±se	Sig. sex diff.
Chemical fat	1.92±0.157	1.43±0.046	**
Water	0.73±0.033	0.91±0.009	***
Protein	0.76±0.035	1.04±0.010	***
Subcutaneous fat	2.25±0.254	1.37±0.073	**
Intermuscular fat	1.79±0.117	1.26±0.034	***
Kidney fat	2.65±0.325	1.07±0.094	***
Udder/cod fat	1.48±0.387	1.23±0.112	ns
Pelvic fat	1.88±0.320	1.07±0.093	*
Total dissectible fat	2.05±0.158	1.25±0.046	***
Muscle	0.83±0.028	0.99±0.008	***
Bone	0.49±0.078	0.87±0.022	***

[1] Component weights regressed on hot carcass weights (using weights transformed to log base 10)

TABLE 3 Carcass components as a percentage of side weight and carcass measurements at selected carcass weights derived from logarithmic regressions.

	Sex	Carcass weight (kg) 5	10	20	30	40	50
Carcass component (%)							
Muscle	F		61.8	55.1	51.5		
	M	60.9	60.5	60.1	59.9	59.8	59.7
Bone	F		24.7	17.4	14.1		
	M	25.6	23.4	21.5	20.4	19.7	19.2
Subcutaneous fat	F		2.9	6.9	11.4		
	M	2.1	2.7	3.5	4.1	4.5	4.9
Intermuscular fat	F		5.4	9.3	12.7		
	M	5.2	6.3	7.5	8.4	9.0	9.5
Kidney fat	F		1.3	4.0	7.8		
	M	1.6	1.7	1.8	1.8	1.8	1.9
Pelvic fat	F		0.4	0.8	1.1		
	M	0.4	0.4	0.4	0.5	0.5	0.5
Udder/cod fat	F		0.3	0.4	0.4		
	M	0.2	0.2	0.3	0.3	0.3	0.3
Total dissectible fat[1]	F		10.6	22.0	33.7		
	M	9.9	11.7	14.0	15.5	16.7	17.6
Total chemical fat	F		13.2	24.9	36.1		
	M	7.4	9.9	13.4	15.9	18.1	19.9
Total water	F		60.7	50.3	45.1		
	M	67.2	63.2	59.4	57.3	55.8	54.7
Total protein	F		21.1	17.9	16.3		
	M	18.8	19.4	19.9	20.3	20.5	20.7
Carcass measurements (cm)							
F	F		32.3	34.1	35.8		
	M	22.9	25.6	31.0	36.3	41.7	47.1
T	F		21.6	23.6	25.5		
	M	15.6	17.4	20.9	24.5	28.1	31.7
L	F		60.6	69.7	78.8		
	M	39.0	45.8	59.4	73.0	86.6	100.2
G	F		18.5	21.2	24.0		
	M	12.4	14.2	17.7	21.1	24.6	28.1

[1] Including pelvic fat

of live weights and carcass weights was achieved providing data suitable for allometric regression analysis. The heaviest male was above the weight range (90-100 kg) reported by McGregor (1984) as the mature weight of Saanen, presumably male, goats. The males were much larger than the females as reported for feral and other goats (Kirton, 1970). While the upper weight figures are likely to be representative of adult Saanens, the lower end of the range is missing for the females.

Allometric growth coefficients relating the weight of the carcass component to carcass weight are given in Table 2. Growth coefficients for muscle and protein were significantly higher for the male than the female confirming the pattern found for other species (eg. sheep - Fourie *et al.*, 1970). For males, muscle growth occurred at a similar rate to carcass weight (b value 0.99) whereas the lower female muscle growth coefficients point to a declining proportion of muscle with increasing weight (see Table 3). The male bone growth coefficients were larger than those for the females, but both were below 1.0 pointing to a declining proportion of bone in the

goat carcass with increasing weight, also a normal finding with the goat (Owen, 1975; Owen *et al.*, 1983) and other species (Fourie *et al.*, 1970). Because bone growth declines at a faster rate than muscle, muscle:bone ratios increase with increasing carcass weight and age.

The growth coefficients for chemical and for carcass dissectible fat were all larger for the female than for the male (except for udder/cod fat) and were all larger than 1.0. This result is similar to that found for sheep (Fourie *et al.*, 1970) and predicts an increasing proportion of fat in the carcass with increasing carcass weight. These results are reflected in the predicted (from the allometric regressions) carcass composition values given in Table 3. Despite the absence of the birth sample from the female goats the fat content of the female carcasses trebled while the males only doubled by maturity.

Although almost all goat carcasses studied were leaner than is normally found in lamb carcasses apart from those found in the A and YL grades which average under 20%, it should be recorded that the mature female goat carcasses were relatively fat with a value of 30% being comparable to values obtained from fatter lambs. McGregor (1984) has reported fat values of 32% in grain fed Angora x feral does also showing it is possible to produce fat goats. Recent data on concentrate fed 29 kg Saanen wethers (Treacher *et al.*, 1987) reporting 24.6% fat makes them considerably fatter than the males and not too dissimilar to the females in the present trial.

No information is available on changes in the fat content of goat carcasses with season. As such changes are known to occur in deer and may occur in sheep (Bray, 1988), information is required on this matter for goats also, if a goat meat industry is to provide carcasses to meet a market specification. The castrate goat may grow faster (Raghavan, 1988) and can also be expected to be fatter than the entire male, although another study (Louca *et al.*, 1977) reported that entire males grew faster until they reached 9 months and then their growth slowed while that of castrates continued. As this is likely to be one of the main types of animal available for slaughter for meat production in New Zealand, carcass information is urgently required on the factors influencing the composition of wether goat carcasses.

Compared at the same weight, female carcasses were longer (L), had longer leg measurements (F, T) except for F at the 30 kg stage presumably because of fat build up in the crutch. Female carcasses were wider at the hips (G) than males of the same weight (Table 3).

While the feral goats traditionally slaughtered for meat production in New Zealand have averaged around 10 kg (Kirton, 1976) the Saanen goats slaughtered in this trial, apart from the lightest group, produced carcasses (mature females and most male groups) that were heavier than the bulk of mature sheep carcasses slaughtered for export. Clearly the use of the Saanen male would be one possibility for increasing the weights of goats in New Zealand if meat returns ever increased sufficiently to warrant running goats for this purpose and heavier carcasses were required.

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