BODY COMPOSITION, BODY CONDITION SCORES AND CARCASS AND ORGAN COMPONENTS OF GRAZING ANGORA GOATS

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SUMMARY

This paper presents a study of body and carcass components of Angora goats slaughtered over the fasted liveweight (FLW) range of 11.2 to 48.1 kg (mean ± s.e., 30.7 ± 1.9 kg). Carcass weight and dressing % ranged from 4.5 to 23.4 kg (13.7 ± 1.0 kg) and 39.3 to 5 1.4% and carcass chemical fat ranged from 16.2 to 25.1%. Linear regressions and allometric growth equations are presented describing the increase of body components and organs relative to FLW. Regressions indicated that the carcass made up 52.3%, carcass fat 14.2%, perirenal fat 1.6%, omental fat 4.2%, skin 7.5% and the fat free carcass 38.1% of each kg increase in FLW. Three drought-affected goats had only half the carcass fat of normally grown goats. Regressions indicate that body condition score (CS) was a useful predictor of carcass and total body fat ($r^2 = 67\%$) and fat free carcass weight. Adult goats with CS > 3 had ≥ 4 kg of carcass fat. Use of CS with carcass weight accounted for ≈ 92% of the variation in carcass fat. Predictions of the effect of increasing CS and GR tissue depth on carcass components are made. The study identifies CS as a practical method to assess carcass and total body fatness of live Angora goats and recommends the use of CS to farmers and meat buyers.
Keywords: condition scores, carcass fat, goats.

INTRODUCTION

Angora goats represent about 50% of Australia's farmed goat flock (Anon. 1988) and are kept for mohair production and weed control. During breeding programs many kids are culled for poor fleece type and, together with older goats culled when fleece quality or quantity decline, are slaughtered for meat production. Although meat markets for goats are still developing, sales of goats for meat production will form an integral component of income from mohair producing flocks. There are no objective data available on likely meat yields or carcass composition of Angora goats grazed on pasture (McGregor 1985; Warmington and Kirton 1990). While Angora goat breeders have been advised to increase the body condition scores of their kids for prime kid production (McGregor 1983) and of breeding does (McGregor 1988), culled adult Angora goats are regarded as being too fat by most goat meat exporters who are generally handling slaughtered feral goats for export to Asia. Consequently many Angora goats are sold for meat production at only nominal prices. This study provides objective data on carcass and offal yields, carcass composition and fat depot development of Angora wether goats grazed under commercial grazing conditions and evaluates the usefulness of body condition scoring as a method for Angora farmers to estimate carcass fatness.

MATERIALS AND METHODS

The entire 1980 kidding of about 170 pure bred Angora wethers was purchased from the Australian Mohair Company, Tocumwal (NSW). The goats were born in August-September 1980, castrated at 2 months of age and weaned at 5 months of age. They arrived at Werribee in March 198 1, were grazed on irrigated and annual pastures and shorn every 6 months. Thirty goats were randomly allotted to 7 slaughter groups over the range of ages 6-51 months. Young goats slaughtered were typical of the type which may be culled as weaned kids following the first shearing in a breeding program. Older goats were typical of goats retained for mohair production. Goats were weighed monthly and slaughtered following a minimum of 3 months of growth. Slaughterings were spaced at least 3 months apart. However, 3 of the 30 goats were slaughtered after losing weight for 4 months while grazing dry annual pastures during summer 1981-82 (age 19 months, mean ± s.e. fasted liveweight (FLW) 18.5 ± 1.2). The slaughter procedure, organ measurements and methods of carcass sampling and analysis have been previously described (McGregor 1982). Additional measurements of carcass length, subcutaneous fat cover (McGregor *et al.* 1988), body condition score (CS) and GR tissue depth (McGregor 1990) were undertaken only on adult goats over 24 months of age ($n = 15$, FLW range 25.9 to 47.4 kg, mean ± s.e., 36.0 ± 1.6 kg). Experienced observers can reliably measure up to 3 additional levels of CS between each of the standard levels of CS (Russel *et al.* 1969). The method used has 2 levels of CS between each standard level e.g. 2, 2+, 3–, 3 etc., and has been extensively used in Victoria at the Pastoral Research Institute, Hamilton since 1960 (H. Birrell pers. comm.). In this experiment for the purposes of regression analysis, CS1 was given a value of 1, CS2 was valued at 4, CS3 valued at 7 and CS4 valued at 10. Thus CS2+ was valued at 5 and CS3– was valued at 6 (McGregor 1990).

Data were analysed by linear regression analysis ($y = mx + c$) and relative growth coefficients (RGC) have been estimated using the allometric growth equation:

$$\log y = \log a + b \log x$$

where x is the FLW at slaughter, y is the component being assessed and b represents the RGC of the component relative to FLW.

Total body fat was calculated as the sum of carcass chemical fat, perirenal, omental, mesenteric and heart fat depots. Dressing percentage = (hot carcass weight minus perirenal fat)/fasted liveweight. Analyses were undertaken using GENSTAT 5.01 (Anon. 1987). All regressions are significant at the 1% level.

RESULTS AND DISCUSSION

At slaughter 2 goats were identified as cryptorchids (with a retained testis) and their data have been excluded from the analyses. Regression constants relating carcass components and organ growth to FLW and or carcass weight are given in Table 1. FLW ranged from 11.2 to 48.1 kg (mean ± s.e. 30.7 ± 1.9), carcass weight without perineral fat, ranged from 4.5 to 23.4 kg (13.7 ± 1.0 kg, see Fig.1) and dressing percentage ranged from 39.3 to 51.4%. Omental fat ranged from 106 to 2065 g and perirenal fat 28 to 672 g. Regression constants indicate that for each kg increase in liveweight the carcass increased 523 g, the skin 75 g, the head 52 g and the total heart, lungs and liver 30 g. Perirenal fat increased 16 g, omental fat 42 g, mesenteric fat 37 g and carcass chemical fat 142 g for each kg increase in FLW. The fat-free carcass increased 381 g compared with total body fat increase of 321 g for each kg increase in FLW. The growth of these components was similar to that of grazing dairy Saanen wether goats (McGregor 1982). Carcass weight, carcass fat percentage (excluding perirenal fat) and dressing percentage of the lightest and heaviest 4 carcasses were (mean ± s.e.) 5.8 ± 0.5 kg, 21.3 ± 0.9 kg; 16.2 ± 1.1%, 25.1 ± 0.1%; 41.0 ± 0.5%, 49.3 ± 0.6% respectively. The 3 drought affected goats had carcasses 6.6 ± 0.5 kg with 8.9 ± 1.2% fat, only half the fat content of the other normally grown goats of similar size in this study, and dressing percentage of 35.5 ± 1.0%.

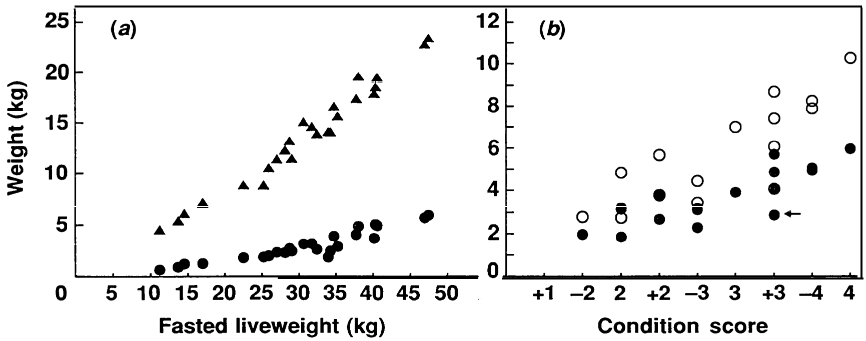

Fig. 1 The relationship between *(a)* fasted liveweight and carcass weight (▲) and carcass fat (●) and (b) condition score and carcass fat (●) and total body fat (○) of grazing wether Angora goats. Arrow indicates an outlier (see text).

Allometric equations were better than linear regression equations at predicting the growth of fat deposits but no better at predicting the growth of other measured components or parameters (Table 1). The carcass and major fat depots all grew relative to liveweight. The fastest growing fat depots were subcutaneous fat (+7.8%), omental fat (+7.4%) and perirenal fat (+6.8%). The RGC of these fat deposits and for the carcass are substantially less than those reported for dairy Saanen goats (McGregor 1982).

Regression constants relating liveweight, carcass parameters and fat deposits to CS of adult Angora wethers are given in Table 2. CS was significantly correlated to all measured variables. CS was a useful practical predictor of carcass fat and total body fat (accounting for ≈ 67% of the variation) but only a fair predictor of subcutaneous fat, GR tissue depth and fat free carcass weight (variation accounted for 43 to 54%). Regression constants indicate that increasing CS of these adult Angora wethers from 2+ to

Table 1. Regression constants (± s.e.) relating carcass components (kg) to fasted liveweight (FLW, kg) or hot carcass weight (CW, kg) of pasture fed Angora wether goats (n=25)

C, linear regression constant; M, linear regression coefficient; a, allometric regression constant; b, relative growth coefficient of component relative to FLW or CW

CL, carcass length (cm); GR, tissue depth (mm), SC, subcutaneous fat depth at 13th rib (mm)

Component	C	M(s.e.)	r	r.s.d.	a	b(s.e.)	r	r.s.d.
Carcass weight.	–2.303	0.523(0.021)	0.98	1.00	22.5	1.015(0.006)	0.98	0.91
Carcass weight[A]	–2.634	0.542(0.024)	0.98	1.07	21.0	1.016(0.007)	0.98	0.97
Skin	0.298	0.075(0.009)	0.85	0.43	0.714	1.036(0.021)	0.87	0.40
Head	0.542	0.052(0.005)	0.89	0.24	–37.0	0.999(0.021)	0.88	0.25
Feet	0.219	0.017(0.002)	0.85	0.10	–1.63	0.983(0.022)	0.85	0.10
Lungs	0.046	0.011(0.001)	0.89	0.05	–0.861	0.975(0.018)	0.90	0.05
Liver	0.047	0.013(0.002)	0.82	0.08	–1.113	0.979(0.025)	0.82	0.08
Carcass fat	–1.434	0.142(0.012)	0.92	0.59	1.156	1.039(0.014)	0.94	0.51
Carcass fat[A]	–1.687	0.159(0.015)	0.91	0.69	1.123	1.042(0.015)	0.93	0.59
Carcass protein	–0.322	0.088(0.004)	0.98	0.17	24.8	1.003(0.008)	0.98	0.18
Fatfree carcass	–0.869	0.381(0.014)	0.98	0.66	–46.9	1.007(0.006)	0.98	0.66
Perirenal fat	–0.196	0.016(0.002)	0.79	0.11	0.029	1.068(0.027)	0.85	0.10
Omental fat	–0.619	0.042(0.006)	0.80	0.29	0.056	1.074(0.025)	0.87	0.24
Mesenteric fat	–0.520	0.037(0.016)	0.49	0.38	–7.9	0.923(0.135)	0.44	0.39
Total body fat	–5.74	0.321(0.047)	0.88	1.33	7.70	1.020(0.045)	0.87	1.16
Carcass fat[B]	–0.899	0.278(0.017)	0.96	0.42	2.62	1.053(0.018)	0.97	0.36
Carcass fat[AB]	–1.061	0.310(0.021)	0.95	0.50	2.48	1.058(0.021)	0.96	0.43
Carcass protein[B]	0.087	0.167(0.005)	0.99	0.13	–9.34	0.975(0.010)	0.99	0.12
CL	67.15	1.19 (0.09)	0.94	3.92	–92.2	0.971(0.012)	0.95	3.52
CL[B]	73.54	2.19 (0.17)	0.93	4.21	–78.0	0.908(0.020)	0.97	3.10
GR depth	–7.05	0.407(0.109)	0.69	2.64	–40.7	0.968(0.083)	0.66	2.74
SC fat	-2.74	0.127(0.025)	0.76	0.73	0.106	1.078(0.059)	0.77	0.71

[A]Includes perirenal fat. [B]Related to carcass weight.

Table 2. Linear regression constants (± s.e.) for relationships between fasted liveweight (FLW kg), carcass components (kg) and total body fat (kg) and either body condition score or GR tissue depth (mm) of adult Angora wether goats (n = 15)

C, linear regression constant; M, linear regression coefficient; SC, subcutaneous fat depth at 13th rib (mm)

Body condition score CS 1 = 1, cs2 = 4, cs3 = 7, cs4 = 10

Dependent	Body condition score*				GR tissue depth			
variable	C	M(s.e.)	r	r.s.d.	C	M(s.e.)	r	r.s.d.
FLW	20.74	2.286(0.554)	0.73	4.40				
Carcass wt[A]	7.56	1.378(0.284)	0.79	2.26	10.66	0.801(0.165)	0.79	2.26
Fat free car.wt.	7.30	0.858(0.207)	0.73	1.65	9.31	0.489(0.123)	0.72	1.69
Carcass protein	1.62	0.193(0.046)	0.74	0.37	2.095	0.106(0.028)	0.69	0.39
Carcass fat[A]	0.259	0.519(0.096)	0.82	0.76	1.351	0.312(0.051)	0.85	0.70
Total body fat	–0.260	0.909(0.171)	0.81	1.36	1.747	0.533(0.098)	0.82	1.34
SC fat	–0.831	0.392(0.114)	0.66	0.91	0.079	0.230(0.067)	0.68	0.91
GR tissue depth	–0.56	1.224(0.336)	0.68	2.67				

[A]Excludes perirenal fat.

3+ was associated with an increase in FLW of 6.9 kg, carcass weight 4.1 kg, carcass fat 1.56 kg, total body fat 2.73 kg, fat free carcass weight 2.57 kg, subcutaneous fat at the 13th rib 1.2 mm and GR tissue depth 3.7 mm. Predicting carcass weight and fatness from GR tissue depth was of similar accuracy to using CS (Table 2) but GR depth was more robust as a predictor. For example, the exclusion of 1 set of data (the lowest carcass fat value for CS 3+, see Fig. 1) altered regression constants for GR only very slightly but for CS r^2 for carcass fat increased to 78% and the regression coefficients increased in value 3 to 5%. An increase in GR depth of 3mm equated with an increase in carcass fat of 936 g. The use of either CS or GR or both with carcass weight enabled the precision of predicting carcass fat and total body fat to be increased substantially by 25% units ($R^2 = 0.91$ to 0.93).

In conclusion, the study confirms body condition scoring as a very useful practical method to assess carcass fatness of live Angora goats. Since body condition score was as useful as GR tissue depth (which can only be measured in an abbatoir) when used with carcass weight, in estimating carcass fatness and fat free carcass weight, farmers and buyers of goats for meat should use body condition score on farms to ensure that over fat Angoras are not used for lean meat production. While these carcasses had only moderate levels of fat (16–25%) adult goats with CS > 3 had ≥ 4 kg of carcass fat. Such carcasses would need to be trimmed for use in boneless goat meat export markets. Drought-affected goats had very low levels of carcass fat (8.9%). The dressing percentage of these goats increased with liveweight. The regressions provide a basis for estimating carcass weight, carcass fatness and offal yields of grazing Angora goats.

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