

MEASURING CASHMERE CONTENT AND QUALITY OF FLEECES USING WHOLE FLEECE AND MIDSIDE SAMPLES AND THE INFLUENCE OF NUTRITION ON THE TEST METHOD

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SUMMARY

The relationships and reliability of midside sampling in estimating cashmere content (yield), production and fibre diameter of entire shorn fleeces was determined in Australian farmed cashmere goats. Midside sampling overestimated cashmere yield and cashmere weight by 29.7% and underestimated cashmere fibre diameter by 0.3 μm . The proportional overestimation occurred over a wide range of cashmere yields (28.6-68.9%), nutritional treatments (below maintenance to *ad libitum* feeding), liveweight changes (-6.0-+10.0 kg) and cashmere production levels (71-446 g). The reliability of entire fleece samples and midside samples for measuring cashmere content, ranking animals, for fleece and animal valuation and scientific research are discussed. Samples from the entire fleece are recommended for evaluation of cashmere goats.

Keywords: cashmere, fleece measurement, yield, diameter, valuation.

INTRODUCTION

Traditional assessment of cashmere production from goats has relied on combing the cashmere from the fleece once moulting has occurred in spring. Cashmere production reported for Chinese goats is the combed weight of fibre which includes some guard hairs, quantities of scurf, grease and relatively large amounts of dust and soil (McGregor *et al.* 1991). Since cashmere production began in western countries, shorn fleeces have been evaluated for commercial cashmere content. During the early 1980's Dawson International PLC assessed cashmere content of entire shorn fleeces by first willowing the fleece to mix the fleece and then dehairing in a laboratory scale dehairer.

It has been found that samples taken from 3 sites along the midline (neck, midside and hindquarter) and then bulked together, compared favourably with entire mixed fleece testing for estimating mean fibre diameter and cashmere yield content (Couchman and McGregor 1983). Following an assessment of 6 sites (neck, shoulder, 3 midside sites and hip) for estimating mean cashmere diameter from entire mixed fleeces it was concluded midside samples were better at estimating over the range of diameters found in feral goat fleeces (Pattie *et al.* 1984) than the other sites. Australian cashmere growers were advised by Hopkins (1984) of 2 options in testing fleeces; (i) sending entire fleeces to the Australian Wool Testing Authority (AWTA) for subsampling either by hand blending or by grid sampling an unmixed fleece, or (ii) taking midside samples which were "generally representative of the entire fleece". During the development of the laboratory dehairing technique Couchman (1986) observed that when tested in a processors laboratory, midside samples overestimated cashmere yield compared to the yield obtained from dehairing the remainder of the fleece. Couchman and Holt (1990) reported differences between midside sample and entire fleece grid sample estimates of cashmere yield. However, neither Couchman (1986) or Couchman and Holt (1990) corrected upwards the entire fleece cashmere yield estimates for the removal of the higher yielding midside sample, which often represents 20-25% of the entire fleece. Cashmere growers in Australia and the USA currently use both midside and grid sampling in evaluating cashmere goats. Midside site samples have been used to evaluate wool sheep for many years but recent studies with Merino sheep have shown that caution should be used when predicting the diameter characteristics of processed wool based on the results of midside sampling (Butler *et al.* 1991).

This paper investigates the relationship and reliability of midside sampling in estimating the mean cashmere content (yield) of raw entire shorn fleeces, the influence of nutritional management on the reliability of sampling method and the cashmere production and quality of farmed cashmere goats.

MATERIALS AND METHODS

Cashmere castrated male (wether) goats (n = 35) born in spring 1983 on a commercial property in Victoria, were transferred to the Institute in February 1984. Following shearing in August 1984, the goats were grazed at pasture, housed on 7 November and shorn on 3 December. They underwent a range of nutritional treatments over the next 7 months (see McGregor 1988) resulting in individual liveweight changes ranging from loss of 6.0 kg to gains of 10.0 kg. Energy intakes ranged from 220 to 644 g

DDM/day. On 19 June 2 sets of fleece samples were taken:

- (i) Midside samples. Taken prior to shearing from an area of 15 cm x 10 cm centred over the last rib, midway between the back and belly line. Samples were removed from both sides of the goats.
- (ii) Shorn fleece grid samples. After weighing the shorn fleece to the nearest gram it was bagged and sealed. Later the fleece was laid out on a 3 m² table and 20 subsamples drawn from the grid and bulked. The sample desired was 40 g and several further random draws were taken if the sample weight was < 40 g.

Samples were sent to the AWTa, Sydney for cashmere yield (% unscoured weight of cashmere in raw fleece) using Couchman's (1986) method and cashmere mean fibre diameter (μm) using the Fibre Diameter Analyser. Entire fleece cashmere weight was calculated as:

(shorn fleece weight x shorn fleece cashmere yield) + (midside sample weights x midside cashmere yield). Midside estimates of entire cashmere weight were calculated as:

(shorn fleece weight + midside sample weights) x midside cashmere yield.

Data was statistically analysed following log transformation. Quadratic regressions were fitted to the log transformed data but were no better than linear regressions. Linear regressions were used to assess predictive value of midside measurements compared to entire fleece measurements and to test if the relationships were dependent on cashmere fibre diameter. The regression coefficient for yield and cashmere weight were not different from 1. Analyses of variance using nutritional treatment (feeding at, above or below maintenance energy requirements (McGregor 1988)) were then performed on the ratios $\log(\text{entire fleece cashmere yield/midside cashmere yield})$ and $\log(\text{entire fleece cashmere weight/midside estimates of entire cashmere weight})$ to determine the proportional relationship between entire fleece and midside yield testing. Following analysis the results were back transformed.

RESULTS

The weight of midside samples was (mean $\pm$ SE) 62 ± 13 g ranging from 50 g for goats fed at low energy intakes (liveweight loss) to 69 g ($P < 0.02$) for goats fed to grow. Entire fleece weights, following correction for midside samples taken from both sides of the goats ranged from 248-650 g with a mean 437 ± 88.1 g. Entire fleece cashmere weight ranged from 71-446 g and cashmere yield ranged from 28.6-68.9%. Midside samples produced results which were different to entire fleece samples (Table 1). For every goat, midside samples estimated cashmere yields as greater than the entire fleece sample (range +0.5-+31.0%) with a corresponding increase in estimated cashmere weight (range +3-+131g). Entire fleece mean cashmere diameters ranged from -0.66-+1.03 μm relative to midside cashmere diameters.

Table 1. Cashmere production and cashmere characteristics of 35 goats measured by entire fleece sampling or midside sampling. Entire fleece measurements include midside production

Character	Entire fleece		Midside sample	
	Mean	SE	Mean	SE
Cashmere weight (g)	213	60	272	88
Cashmere yield (%)	48.10	10.08	61.51	10.74
Cashmere diameter				
Mean (μm)	17.42	0.49	17.12	0.75
SD (μm)	3.584	0.348	3.586	0.468
CV (%)	20.51	1.65	20.92	2.10
Median (μm)	16.42	0.53	16.03	0.65
Mode (μm)	16.27	0.80	15.53	0.95

The linear regression co-efficients for log transformed relationships between midside and entire fleece measurements are given in Table 2. The inclusion of cashmere fibre diameter did not improve the predictive value of regressions for cashmere yield or cashmere weight. As the regression coefficients were not different from 1 for cashmere yield and weight, proportional relations were determined (Table 3) for the range of nutritional treatments. Nutritional treatment did not significantly affect the proportional relationship between sampling methods ($P > 0.15$).

Table 2. Regressions of entire fleece measurements on cashmere yield, weight and diameter measurements estimated using midside samples

Dependent variable	Regression co-efficient	±SE	Independent midside variable	R	RSD
Cashmere weight	1.041	(0.076)	Cashmere weight	0.92	0.0627
Cashmere yield	1.066	(0.146)	Cashmere yield	0.78	0.0628
Cashmere diameter	0.717	(0.065)	Cashmere diameter	0.89	0.0073

Table 3. The influence of energy nutrition relative to liveweight maintenance (M) on the proportional relationship between entire fleece measurements and midside sample estimates of cashmere yield and cashmere production following log back transformation. The values are for midside relative to entire fleece samples

	Energy nutrition treatment			Mean	SEDA
	<M	M	>M		
Cashmere yield	1.153	1.346	1.300	1.297	0.0329
Cashmere weight	1.175	1.334	1.303	1.297	0.0315

ASandard error of difference between means not back transformed.

DISCUSSION

Midside sampling overestimated cashmere yield and weight by a proportional 29.7% (Table 3). As this proportional overestimation occurred over a wide range of cashmere yields, nutritional treatments, liveweight changes and levels of cashmere production it is likely to occur in a range of production environments where Australian derived cashmere goats are farmed. These results differ from Couchman and Holt (1990) who used 24 fleeces containing 35-233 g cashmere. They reported a linear regression coefficient of 1.004 for the relationship between cashmere yield estimates of grid and midside samples with a constant yield difference of 6.83% units (at the mean, a relative difference of 17.2%). Couchman (1986), using 12 fleeces tested in a processors laboratory, observed that, at the mean, cashmere yield estimates of midside samples were 5.0% units or a relative 11.6% greater than estimates derived from dehairing the remainder of the fleece. Errors associated with the removal of the higher yielding midside sample prior to “entire” fleece sampling and the failure to adjust upwards the estimated cashmere content of entire fleeces mean that Couchman (1986) and Couchman and Holt (1990) have overestimated the error of midside sampling.

The midside site also tended to underestimate mean entire fleece cashmere fibre diameter (Table 1) an observation recorded previously for midline sites on Australian farmed goats (Couchman and McGregor 1983) and for midside sites of feral goats (Pattie *et al.* 1984). The midside site produced a similar standard deviation for mean cashmere diameter but coefficient of variation (CV) tended to be higher and the variation in CV greater as mean cashmere diameter was 0.3 µm less. These changes in mean cashmere diameter and CV were associated with a reduction in the median and mode of the cashmere diameter frequency distribution (Table 1).

Midside samples are therefore inappropriate for purposes of measuring cashmere production, fleece valuation or estimating the sale value of livestock. However the correlation (repeatability) between entire fleece and midside estimates of cashmere weight and cashmere diameter were high (0.92 and 0.89 respectively, Table 2) indicating that ranking animals on midside samples suffered only a small decline in accuracy compared to ranking on entire fleece measurements. If breeders and researchers require measurements of individual fleeces to determine quantity of cashmere then samples from the entire shorn fleece are required. This research suggests that scientific research which has used midside sampling for estimating cashmere yield may have considerably and proportionally overestimated cashmere production and may have systematic errors in analyses and results.

In conclusion, cashmere goats can be ranked on cashmere weight or diameter on the basis of midside or entire fleece samples. For the determination of actual levels of production, and valuation of fleeces, entire fleece samples must be used as midside samples considerably overestimate cashmere content (yield) and underestimate the mean cashmere fibre diameter of entire shorn fleeces.

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