A COMPARISON OF THE FATNESS OF WEANED AND UNWEANED LAMBS

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SUMMARY

The possibility of manipulating the fatness of lambs by varying the time of weaning was investigated using 28 Hampshire- and 28 Southdown-cross lambs from Border Leicester × Romney ewes. Half the lambs were not weaned prior to slaughter and half were weaned at 80% of the same predetermined slaughter weight as their unweaned controls. Slaughter weights for each breed/sex group were chosen with the aim of producing carcasses with an average fat cover of 3 to 4 mm at the 12th rib. Growth rates of the weaned lambs were about 20% slower than the controls ($P < 0.001$) as they grew from 80 to 100% of their slaughter weights, and although most measures showed the unweaned lambs to be fatter, the differences were small and generally not significant. Measures of muscling and objective measurements of meat tenderness did not reveal any important treatment effects. Breed and sex effects are also discussed.

INTRODUCTION

Interest in possible methods of manipulating the fatness of lambs has increased in New Zealand recently as a result of changes in grade standards (Frazer, 1976).

The suggestion that leaner carcasses may be obtained by weaning lambs earlier without decreasing the average carcass weight and without changing the breed is supported by some evidence (Black, 1974; Searle and Griffiths, 1976; Robelin *et al.*, 1977). This effect has usually been attributed to the decreases both in the level of energy intake and in the ratio of energy to protein of the feed, which frequently accompany weaning. However, in most experiments the treatments have been imposed at quite low liveweights, usually less than 50% of typical New Zealand slaughter weights (Norton *et al.*, 1970; Ørskov *et al.*, 1976). The effects of similar treatments imposed at higher weights have been less clear-cut (Kellaway, 1973).

The experiment reported in this paper involved a comparison of the composition of lambs weaned at 80% of their slaughter weight, with control animals which were not weaned prior to being slaughtered at the same weight.

MATERIALS AND METHODS

The 56 lambs used were from a flock of mixed-age, first-cross Border Leicester × Romney ewes. They were selected early in November (8 to 10 weeks of age) in such a way that the group was balanced with regard to sex and breed of sire (Fig. 1) and with the aim of restricting the range of weights within each breed-sex group. Slaughter weights specified for each group are also shown in Fig. 1, together with the weaning weights at 80% of the slaughter weights. The lambs were weighed at weekly intervals and individual lambs were either weaned or slaughtered as the appropriate weight was attained. For the weaned group this involved being weaned in November, 4 to 6 weeks prior to slaughter.

Slaughter procedures followed normal commercial practice. The methods used to make the various measurements were those described by Purchas (1978) (experiment 2).

RESULTS AND DISCUSSION

Growth rates for the period from 80% of slaughter weight to the time of slaughter are shown in Table 1, together with carcass weights and dressing-out percentages. The absence of any breed or sex effect on growth rate can be attributed to the fact that those groups that might be expected to have grown faster (the Hampshire-sired lambs and the rams) had to be taken to higher weights (Fig. 1), and as a result were more adversely affected by the seasonal changes in pasture quality. The unweaned lambs grew 19.8% faster than the weaned lambs, but this effect was measured

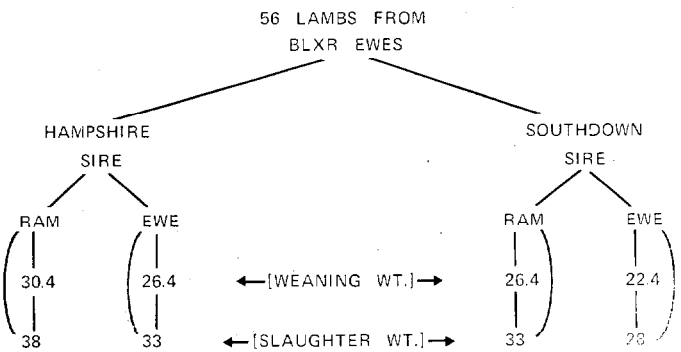

FIG. 1: *The experimental design showing how the 56 lambs out of Border Leicester, Romney cross ewes were evenly distributed with 14 in each breed-sex group. Half the lambs were weaned at the weights indicated while the others remained with their mothers until the appropriate slaughter weight was attained.*

TABLE 1: THE EFFECT OF BREED, SEX AND WEANING TREATMENT ON GROWTH RATE FROM WEANING TO SLAUGHTER, CARCASS WEIGHT AND DRESSING-OUT PERCENTAGE.

	Overall Mean	*Hampshire minus Southdown*	*Ram minus Ewe*	*Weaned minus Unweaned*
Growth rate (g/day)	200	4	18	−36***
Carcass wt (kg)	15.9	2.1***	2.2***	−0.6*
Dressing-out (%)	50.3	−0.8	−1.7**	−1.9**

over a set weight range rather than over a common period of time, so it may have been amplified by the seasonal changes in pasture quality.

Breed and sex differences in carcass weight were specified by the experimental design, but the 4% higher carcass weight of the unweaned group indicated that the selection for equal weights was not entirely successful. This was partly due to the higher dressing-out percentage of the unweaned lambs ($P < 0.01$). Significantly lower dressing-out percentages of ram lambs have been reported previously, although mainly in comparison with wethers (Field, 1971; Purchas, 1978).

The experimental design aimed to avoid sex and breed effects on the level of carcass fat cover, and the fat depth measurements shown in Table 2 indicate that this was achieved. However, for other measures the Hampshire-sired lambs were fatter than the Southdown-sired lambs (Table 2). The carcasses of the ram lambs were of similar fatness to those of the ewe carcasses, which were

TABLE 2: THE EFFECT OF BREED, SEX AND WEANING TREATMENT ON SOME MEASURES OF FATNESS

	Overall Mean	*Hampshire minus Southdown*	*Ram minus Ewe*	*Weaned minus Unweaned*
Kidney + pelvic fat wt (kg)	0.33	0.06**	−0.02	−0.02
Omental fat wt (kg)	0.42	0.10***	0.04	−0.02
Fat depth C (mm)	3.51	0.78	−0.38	−0.42
Intramuscular fat (%)	3.25	0.38	−0.36	−0.08
Rib-cut subcutaneous fat wt/muscle wt	0.38	0.08**	−0.04	−0.06*
Rib-cut intermuscular fat wt/muscle wt	0.28	0.04**	0.00	−0.04***

on average 2.2 kg lighter. For all the measurements listed in Table 2 the weaned lambs were less fat than the non-weaned lambs, but this effect was statistically significant only for the dissected subcutaneous and intermuscular fat weights of the 5 rib-cut, when these weights were expressed as a ratio with rib-cut muscle weight.

Although this weaning effect is in the expected direction, it may be attributable partly to the slightly lower mean carcass weight of the weaned lambs. It is not, however, large enough to be of much practical significance. A small or non-existent effect of weaning on fatness of lambs is consistent with the results of a number of experiments with lambs, where higher levels of nutrition have not necessarily been associated with increased carcass fatness at a particular weight (Burton and Reid, 1969; Andrews and Ørskov, 1970; Kellaway, 1973; Murray and Slezacek, 1976; Purchas, 1978). A nutritional treatment which has been shown to have consistently significant effects on lamb carcass composition has been a change in the protein to energy ratio in the diet, as might be brought about by a change from a mainly-milk diet to an all-pasture diet at an early age (Norton *et al.*, 1970; Black, 1974; Kemp *et al.*, 1976). The results in Table 2 suggest that either the lambs were too old or too heavy to be influenced by the change in diet at weaning, or that at 80% of their slaughter weights their intake of milk was not high enough to make weaning a very clear-cut nutritional change. Milk production or intake was not measured in this study, but based on information on similar ewes it was unlikely to have been as much as one litre a day at the time of weaning (Rattray *et al.*, 1975).

The measures of muscling given in Table 3 indicate that the Southdown carcasses were slightly better muscled than those from the Hampshire-sired lambs, that there was a small sex effect in

TABLE 3: THE EFFECT OF BREED, SEX AND WEANING TREATMENT ON SOME MEASURES OF MUSCLING

	Overall Mean	*Hampshire minus Southdown*	*Ram minus Ewe*	*Weaned minus Unweaned*
M. longissimus area (cm^2)	12.1	0.1	0.5	−0.1
M. longissimus area/carcass wt (cm^2/kg)	0.76	−0.10***	−0.08***	0.02
Rib-cut muscle/bone	3.00	−0.24*	−0.06	0.08
3 leg muscles[1]/femur	5.19	−0.56***	−0.34**	−0.04

[1]*M. semimembranosus, M. biceps femoris, M. semitendinosus*

favour of the ewe lambs, and that weaning treatment had no clear effect. The absence of significant breed or sex effects on *M. longissimus* area, despite the differences in carcass weights (Table 1), gives rise to the highly significant effects when the area of *M. longissimus* is expressed as a ratio with carcass weight. Other measures of muscling also indicated that carcasses from the Southdown-sired lambs were significantly better muscled. This is in general agreement with reports in the literature of comparisons between the Southdown and other breeds (Boccard and Radomska, 1963; Fourie *et al.*, 1970; Fahmy *et al.*, 1972; Kempster and Cuthbertson, 1977; Kirton *et al.*, 1978).

The sex effect was less clear, as its influence on the ratio of *M. longissimus* area to carcass weight may have been partly due to the higher carcass weight of the ram lambs (Purchas, 1978). However, it is consistent with the significantly higher ratio of the weight of three leg muscles to the femur weight for the carcasses from ewe lambs. Other reports have generally shown small differences between the muscling of ewe and ram lambs, with ewes often being slightly superior at the same carcass weight (Everitt and Jury, 1966; Fourie *et al.*, 1970; Fahmy *et al.*, 1972; Makarechian *et al.*, 1978).

TABLE 4: THE EFFECT OF BREED, SEX AND WEANING TREATMENT ON SOME MEASURES OF MEAT QUALITY

	Overall Mean	*Hampshire minus Southdown*	*Ram minus Ewe*	*Weaned minus Unweaned*
Warner-Bratzler shear forces (kg):				
M. biceps femoris (60°C)	2.25	0.18	0.32**	0.14
M. semimembranosus (70°C)	3.63	−0.20	0.16	0.00
Sarcomere length (μ):				
M. longissimus (0°C)	1.20	0.00	−0.02	0.04
M. longissimus (18–20°C)	1.59	−0.02	−0.02	0.12*

Warner-Bratzler shear values shown in Table 4 did not differ between the two breed groups for either muscle. The sex effect on shear force as a measure of meat tenderness was significant for *M. biceps femoris* cooked to 60°C, with the ram lamb samples being slightly tougher, but was not significant for *M. semimembranosus* cooked to 70°C. These results suggest that connective tissue may be involved in sex difference, as *M. biceps femoris* contains a higher concentration of collagen than *M. semimembranosus* (Cross *et al.*, 1972) and the lower cooking temperature used would have

increased the contribution of connective tissue to tenderness (Dransfield, 1977). Measurements of sarcomere length were made on small (2 to 3 g) samples of *M. longissimus* which were taken within 1 h of slaughter and stored for at least 24 h at the temperatures indicated. Slightly longer sarcomeres were found in samples taken from weaned lambs and kept at 18 to 20°c, but this difference was not reflected in any weaning effect on shear force.

These results suggest that there is little scope for decreasing lamb fatness by weaning lambs at a weight 20% below their proposed weight at slaughter or about 4 to 6 weeks prior to slaughter.

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