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# Effects of rate of weight gain and weight loss on the relationship between carcass weight and GR measurements in cryptorchid lambs

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## ABSTRACT

This trial measured changes in the GR tissue depth and hot carcass weight (HCW) for 352 Border x Romney cryptorchid lambs which were subjected to various combinations of weight gain and weight loss treatments over the period from February to July 1987.

Growing lambs in the period February to May gained GR at about 1.4 mm/kg HCW regardless of rate of growth. A group of lambs that lost weight over April and May lost GR and HCW at similar rates to the rate of gain.

The final group of growing lambs in May to July gained GR at 0.9 mm/kg HCW and were significantly leaner than lambs killed in May. The group that lost weight over the May to July period lost GR at a faster rate (2.2-2.9 mm/kg HCW) than it was gained and were significantly leaner than lambs of similar HCW killed in the autumn. If the weight loss technique relies on this winter effect for accelerated fat loss it may be more efficient in terms of feed use to identify overfat lambs early in the autumn and grow them slowly into the winter to take advantage of this effect.

## INTRODUCTION

There is a move in lamb production in New Zealand towards higher carcass weights with reduced fat cover. Where a demand for heavy lean carcasses has been reflected in the payment schedule farmers have been quick to respond with supply. One of the difficulties farmers face is producing carcasses that are lean enough at the desired weight. Many sheep flocks in New Zealand produce unacceptably high numbers of T and F grade lambs at carcass weights over 20 kg.

While the long term solution to this problem lies in selection of appropriate animals with low fat cover, some interim measures have evolved from farmer practise. One solution advocated by producers of lean, heavy lambs has been to put overfat lambs on a sufficiently restricted feed intake to cause slow weight loss. Those using this system claim that lambs quickly lose excess fat, leading to carcasses which have lower GR tissue depth measurements at the same carcass weight when compared to lambs gaining weight. The success of this technique is supported by trial work which measured apparent rates of fat loss substantially greater than the fat accumulation rate expected during weight gain (G.H. Scales, pers. comm.).

Evidence from Mitchell and Jagusch (1972) who reported an increase in the protein:fat ratio in recently weaned lambs (18-21 kg live weight) with a negative energy balance also supports the suggestion that body fat levels can be altered by feeding level. Other evidence is not consistent with different experiments measuring loss of body tissue in varying proportions during weight loss. With heavier lambs (40 kg live weight) losing 1 kg live weight (LW) per

week Drew (1973) measured a predominant loss of protein and water over the first 5 weeks. Loss of fat only became an important factor over the second 5 weeks. Kirton *et al.* (1981) found no differences in the body composition of lambs (27 kg initial LW) which gained or lost weight once allowance was made for the differences in carcass weight produced by the treatments. Bray *et al.* (1985) measured weight loss with an apparent ratio of 1.4 mm GR/kg cold carcass weight (CCW) in 2 groups of mixed sex lambs which lost weight at a range of rates (0.25-1 kg CCW/week). Although a ratio of 1.4 mm GR/kg CCW is towards the high end of expected rates of gain, Bray commented that the lambs which lost weight were not leaner than those reaching a similar carcass weight through continuous growth. A combination of shearing and underfeeding was the only management strategy studied by Bray which led to reduced fat cover compared to continuously grown lambs at similar carcass weights. This strategy reduced GR by about 1mm at 12 to 16 kg CCW.

Being able to modify fat cover by small amounts of weight reduction would have benefits for producers of lean heavy lambs. Given the increased interest of animal welfare groups in farming practises a policy of deliberate weight loss may attract unfavourable comment.

The objective of this study was to examine the effect of weight loss on the ratio of GR to hot carcass weight in heavy lambs.

## METHODS AND MATERIALS

The trial was run on the Wharenui Block of the Ngati Whakaue Tribal Lands Incorporation near Rotorua. Three hundred and fifty two Border x Romney cryptorchid lambs for the trial were selected

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on 14 January 1987 based on live weight. Average live weight was 28.5 kg with a range of 25.5 to 32.0 kg. There was no selection for body conformation or estimated fat cover. The lambs had been shorn on 14 December 1986. All lambs were grazed together until the trial commenced on 11 February when the lambs had reached an average 33.3 kg LW. Throughout the trial lambs were grazed on dominantly ryegrass (*Lolium spp.*) white clover (*Trifolium repens*) pastures. Lambs for slaughter and treatment groups were randomly selected from groups stratified on live weight.

### Growing Lambs

At the start of the trial 30 lambs (S group) were slaughtered at the Ruakura Abattoir and measurements were made of fasted live weight (24 h off pasture), hot carcass weight (HCW) and GR tissue depth. A further 70 lambs were allocated to the low growth rate group (L) with a weight gain target of 120 g LW/d or 60% of the growth rate of the high (H) group. The remaining 252 lambs were placed in the H group with a growth target of 200 g LW/d. Lambs were weighed every 10 to 14 d and feeding level adjusted to maintain target weight gains. Actual growth rates to 21 May were 190 g LW/d for the H group and 145 g LW/d for the L group. The L group grew at 160 g LW/d from 21 May to 9 July (Fig. 1).

Slaughter groups from the H and L treatments were killed on:

3 April	H1
23 April	H2, L1
21 May	H3, L2
9 July	L3

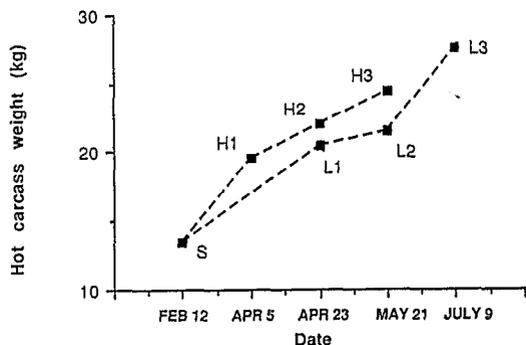


FIG. 1 Changes in hot carcass weight over time for sequential slaughter groups from high (H), and low (L) weight gain treatments. Slaughter groups in figure identified as in Table 1.

### Weight Loss Groups

On 23 April 40 lambs from the H group were allocated to the first weight loss treatment (A). Their feed intake was restricted and they lost weight at 140 g LW/d until slaughter on 21 May (Fig. 2).

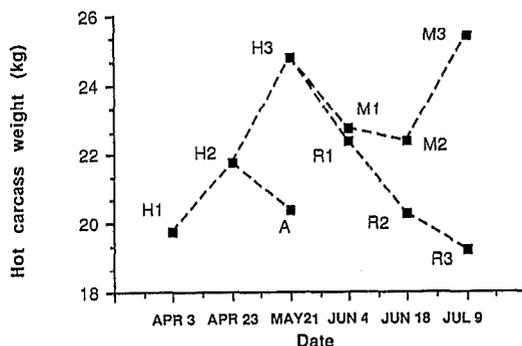


FIG. 2 Changes in hot carcass weight over time for sequential slaughter groups from high weight gain (H), weight loss, (A, R) and weight loss followed by weight gain (M) treatments. Slaughter groups in figure identified as in Table 1.

On 21 May the lambs remaining in the H group were allocated to 2 treatments. The second weight loss group (R) comprised 69 lambs and the maintenance group (M) 71 lambs. The R group lost weight (230 g LW/d) throughout the treatment period through to the final kill of 9 July. The maintenance group initially lost weight at a similar rate to the R group but when their feeding level was increased they rapidly regained weight and finished the trial about 2 kg LW heavier than at the start of the M treatment. Interim slaughter groups for both the R and M treatments occurred on 4 June and 18 June (Fig. 2).

### Management

To achieve weight loss, animals were restricted to a small area with access to water and limited grazing. The A group initially had access to 0.7 ha but this was further restricted to 0.15 ha when no weight loss occurred. The R group were restricted to 0.7 ha which produced the desired weight loss.

Lambs were drenched every 28 d with Ivermectin®. Several deaths in March prompted vaccination against pulpy kidney on 26 March. Scald was a problem with some lambs in the H treatment and about 50 were treated at some time. Total deaths were 7 (2%) of which 1 may have been related to stress caused by underfeeding.

**Analysis**

Differences between slaughter groups were tested using the ratio of GR tissue depth to HCW (GR:HCW). Significant differences in the ratio GR:HCW at a similar carcass weight were taken to indicate a significant effect on GR.

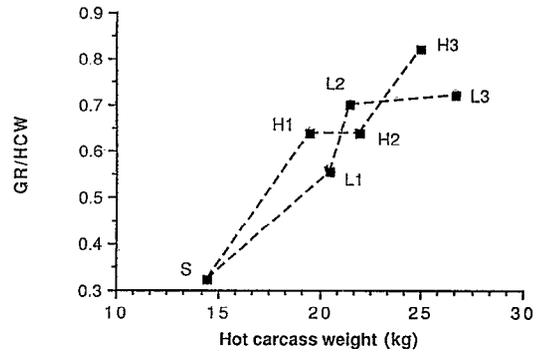
**RESULTS**

**Growing Lambs**

Overall the GR:HCW ratio increased as HCW increased reflecting the increasing proportion of fat in lamb carcasses as weight increased (Fig. 3). There were no significant differences in GR:HCW between the H and L groups killed on or before 21 May. Over the last period of growth of the L group there was a slower rate of increase in the GR:HCW ratio and the L3 group had a significantly lower GR:HCW ratio than the H3 group.

**Weight Loss Groups**

The A group lost 3.9 kg LW over a 28 d period and was 1.2 kg HCW lighter than the H2 slaughter group with an average GR 1.6mm lower (Table 1). There was no significant difference between the GR:HCW ratio of the A group and the H1 and L1 groups which had similar HCW.



**FIG. 3** The relationship between GR tissue depth/hot carcass weight and hot carcass weight for sequential slaughter groups from weight gain treatments. Slaughter groups in figure identified as in Table 1.

The R group lost a total of 11 kg LW over a 50 d period. The final slaughter group (R3) was 5.6 kg HCW lighter than the H3 group with an average GR 12.1 mm lower. There was a trend for all R slaughter groups to have a lower GR:HCW than H or L slaughter groups with similar HCW (Fig. 4). However only for the R3 group was the difference between it and the H1 and L1 groups of similar HCW statistically significant.

**TABLE 1** Details of slaughter groups.

Group	Date	No. of lambs	Fasted live weight (kg)	Hot carcass weight (kg)	GR (mm)	GR:HCW
S	12 February	30	30.1	13.9	4.9	0.35
H1	3 April	20	40.1	19.6	13.4	0.68
H2	23 April	20	43.2	21.6	14.9	0.68
H3	21 May	30	48.4	24.9	21.1	0.84
A	21 May	38	40.9	20.4	13.3	0.65
R1	4 June	20	42.3	22.3	15.1	0.66
R2	18 June	20	40.7	20.2	11.9	0.58
R3	9 July	28	39.4	19.3	9.0	0.46
M1	4 June	20	43.3	22.8	15.3	0.66
M2	18 June	20	44.6	22.4	13.8	0.61
M3	9 July	31	51.7	25.4	18.4	0.72
L1	23 April	20	40.5	20.3	12.2	0.59
L2	21 May	20	40.9	21.3	15.1	0.70
L3	9 July	28	53.8	26.7	20.0	0.74

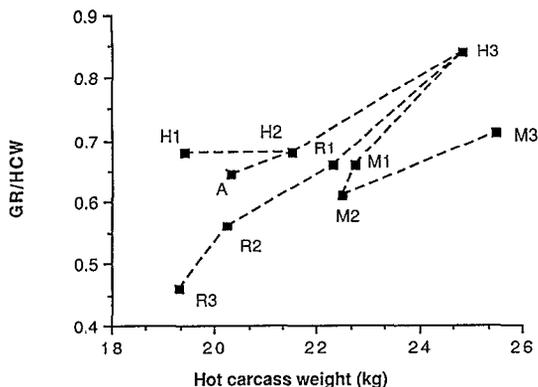


FIG. 4 The relationship between GR tissue depth/hot carcass weight and hot carcass weight for sequential slaughter groups from high weight gain, (H) weight loss (A, R) and weight loss followed by weight gain (M) treatments. Slaughter groups in figure identified as in Table 1.

A similar trend was seen in the M group over the period in which it lost weight although the differences were not significant (Fig. 4). When the M group regained weight the final slaughter group (M3) had a significantly lower GR:HCW ratio than the H3 slaughter group of similar HCW.

#### Apparent Changes in GR per kg HCW

In experiments of this kind it is possible to compare the weight and fat cover of sequentially killed groups of animals and derive an apparent rate of GR gain or loss per kg HCW. While this will not be the true pathway for any individual animal it does allow some assessment of the practical benefits of the management techniques used in this experiment.

The average apparent rate of increase of GR for the H group lambs was 1.5 mm GR/kg HCW from 12 February to 21 May. This is at the high end of expected values for increase in fat cover in cryptorchid lambs. The apparent rate of gain for the L group through to 21 May was similar at 1.4 mm GR/kg HCW. From May to 9 July the rate of gain was lower at 0.9 mm GR/kg HCW. The apparent rate of loss for the A group at 1.3 mm GR/kg HCW was similar to the rate of gain of the H and L groups. The R and M groups had higher apparent rates of loss at 2.2 mm GR/kg HCW for R and 2.9 mm GR/kg HCW for the weight loss period of the M treatment. When the M group regained lost weight the apparent rate of gain was 1.5 mm GR/kg HCW.

#### DISCUSSION

The results obtained in this experiment indicate that weight loss can lead to a reduction in the GR:HCW ratio of lambs at similar carcass weights. Two

important points emerge from the data which affect the usefulness of this technique.

Firstly the time of the year at which the weight loss occurred seemed to affect the results in this trial. The A group in April and May lost GR and HCW at a rate similar to the apparent rate of gain. However the R and M groups in May to July lost GR at a faster rate per kg HCW than they had gained it. The higher rate of loss in the R and M treatments coincided with the slower apparent rate of gain in the L group. Several authors have shown that lambs deposit fat more slowly over winter and may even be leaner at the end of winter than in late autumn despite having grown (Rattray *et al.*, 1976; Kirton *et al.*, 1982; Bray and Taylor, 1987). The lower rate of apparent GR increase in the L group from May to July is likely to represent the start of this winter effect. Evidence from this trial and others suggests that the difference in GR produced by the winter effect is generally consistent at around 2.0 to 2.5 mm GR for a 18 to 21 kg HCW lamb. It may be that the physiological change which leads to the winter effect in growing lambs causes more rapid fat mobilisation in lambs which are losing weight.

This may explain the different results obtained in this trial compared to similar trials by Kirton *et al.* (1981) and Bray *et al.* (1985) which were done in the summer and found no effect of weight loss on GR:HCW relationships.

Secondly, using reconditioning to obtain a GR 2 mm lower than from a growing animal would take a weight increase and then loss of 1.5 to 3 kg HCW. While the extra value of a WX lamb can justify the loss of HCW the extra feed needed to give the prior weight gain and the degree of weight loss required suggest that this technique should only be applied to marginally overfat animals. Those animals that regained weight after weight loss (M3) ended with lower GR:HCW carcasses. This result is in line with those of Drew (1973) and indicate that the fat component of loss is the last to be replaced. While this offers an opportunity to produce leaner carcasses the M3 lambs were no leaner than the L3 lambs which reached similar weights by slower continuous growth.

Given these inefficiencies in weight loss techniques a better approach may be to identify marginally overfat lambs at an earlier stage, grow them more slowly through the autumn and use the winter effect to give satisfactory fat cover at the desired carcass weight without having to resort to any weight loss.

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