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Research Article

IMPACT OF FEED RESTRICTION AND COMPENSATORY GROWTH IN SHEEP

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ABSTRACT
Ninety-eight ewe lambs (14.9 kg ±0.63) divided into four groups at random were subjected to four feeding regimes to evaluate the effects of feed restriction on the body weight gain in a CRD model. The feed restriction was at four levels viz-0, 20, 30 and 40 percent for T1 (Control), T2, T3 and T4 for the four groups, respectively. The duration of the trial was for 105 days containing preliminary (up to 18 kg), restriction (5 weeks) and realimentation (5 weeks) periods. The decrease is significantly ($P<0.05$) different among groups and the increase in weight gain for the first group was 6.54, 17.7 and 23.8 percent higher as compared to groups 2, 3 and 4, respectively during feed restriction. The body weights recorded were significantly different ($P<0.05$) during realimentation phase. The increase in weight or compensatory growth for groups 2, 3 and 4 as compared to group 1 was in the order of 2>3>4 and it was 15. 6% and 13.4% higher for groups 4 and 3 as compared to group 2. It was concluded that the lambs can be feed restricted up to 40% and the loss in weight can be recouped with the phenomenon of compensatory growth.

Keywords: *Compensatory Growth, Realimentation Phase, Restricted Feeding, Growth Rate*

INTRODUCTION
One of the possible strategies to reduce the cost of lamb production includes the imposition of feed restriction followed by compensatory growth. Compensatory growth manifested is the ability of the animals previously restricted in the feed intake to outgain their better counter parts when given free access to good quality feed. Animals subjected to a period of under nutrition often exhibit a very high growth rate during subsequent re-alimentation (McManus *et al.*, 1972; Thornton *et al.*, 1979; Abegaz *et al.*, 1996). This phenomenon is called *compensatory growth*. Compensatory growth (catch-up) may be defined as a physiological process whereby an organism accelerates sometimes seen in animals following an extended period of slow growth or weight loss due to restricted nutrition. This strategy has very important implications in tropical areas where the animals largely depend on grazing natural pasture to support animal production coupled with feed restrictions which occur due to seasonal variations in nutrient quality and quantity of available pasture materials (Anya et al., 2008). It may not be a mandate with animals that compensatory growth should be complete or partial or no growth because this catch up growth is a complex metabolic function and a number of mechanisms are involved. There are reports saying that compensatory growth may be influenced by genetic factors, age of the animals at which restriction was imposed, severity and duration of restriction, the quality of re-alimentation diet and duration of re-feeding (Benschop, 2000; Lawrence and Fowler, 2002). Restricted animals often compensate within the same period as their fellow animals which are unrestricted (Dastizadeh *et al.*, 2008). In tropical countries like India scarcity of fodder resources occur in 6-7 months in a year resulting in standing hay and low quality feed that eventually culminates in the growth retardation of animals (Babayemi *et al*, 2003). The present experiment was conducted to quantify the effects of different restriction regimes on the growth performance of growing Vizianagaram local lambs.

MATERIAL AND METHODS
A total of 98 ewe lambs were selected, divided into 4 groups at random such that groups contain 25, 24, 25 and 24 animals for 1, 2, 3 and 4, respectively (T1 to T4) and were subjected to four feeding regimes to evaluate the effects of feed restriction levels on the body weight gain. All the animals were fed *adlibitum*

with concentrate mixture until they attained a body weight of about 18 kg. The feed restriction was at 4 levels viz- 0, 20, 30 and 40 percent for T1 (Control), T2, T3 and T4 for the four groups, respectively. The experiment was carried out for a period of 105 days. All the animals were dewormed before the start of the experiment. After they attained a body weight of about 18 kg (preliminary period), T2, T3 and T4 group of animals were subjected to **5** weeks feed restriction. Following feed restriction, all the animals were returned to *ad libitum* feeding for a period of 5 weeks (realimentation phase). Body weights and feed intake were recorded weekly. Group feeding was followed. Data was subjected to One-way analysis (Snedecor and Cochran, 1989).

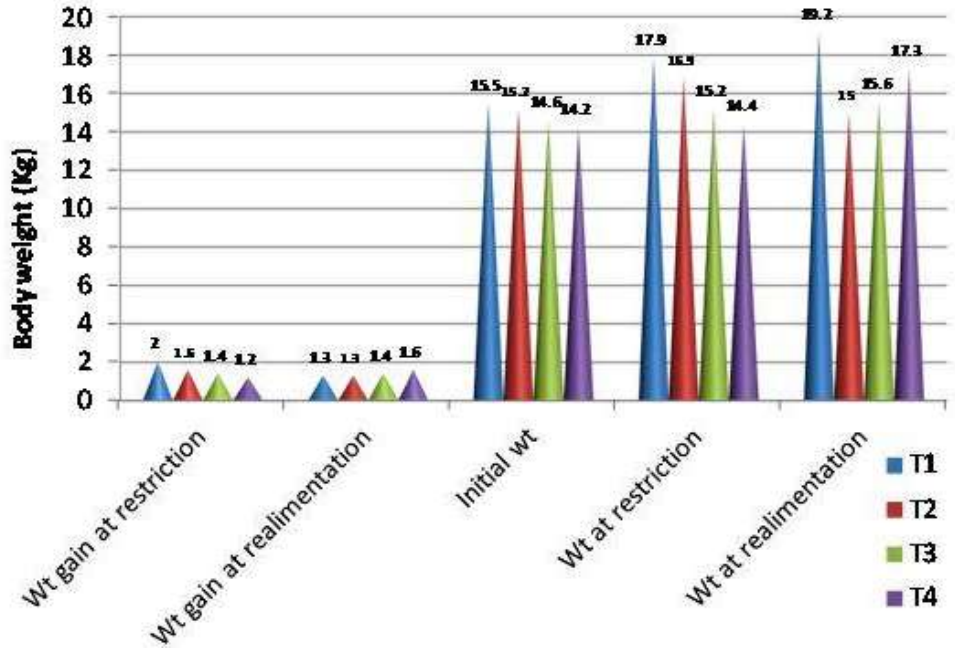

Figure 1: Cone chart showing the weight gains at preliminary, restriction and realimentation phases

RESULTS AND DISCUSSION

The composition (%) of Concentrate mixture fed was 50,20, 27,2 and 1 for maize, deoiled ground nut cake, deoiled rice bran, mineral mixture and salt, respectively. The average initial weights (kg) for the four groups were 15.5±0.23, 15.2± 0.17, 14.6±0.31 and 14.2 ±0.67. Though all the animals were distributed at random, non-significant differences were found. A feed restriction was followed for five weeks at 0, 20, 30 and 40 percent respectively for groups 1, 2, 3 and 4. During feed restriction there appeared a decreased trend in gaining body weight from groups 2 to 4.The average weights recorded for groups 1, 2, 3 and 4 were 17.9 ± 0.75, 16.9 ± 0.71, 15.2 ± 1.01 and 14.4 ± 1.12, respectively (Table 1) during feed restriction. The decrease is significantly ($P<0.05$) different among groups. The increase in weight gain for the first group was 6.54, 17.7 and 23.8 percent higher as compared to groups 2, 3 and 4, respectively.

The average feed consumed (g) was (Table 1) 138.7, 141.7, 136.9 and 139.3 (for each animal) for groups 1, 2, 3 and 4, respectively during the growth period up to about 18 kg. However, during restricted feeding for 5 weeks the daily average feed consumed (g) per animal was 142.4, 115.6, 100.3 and 87.4 for groups 1, 2, 3 and 4, respectively.

During the 5 week realimentation phase, the body weights recorded were significantly different ($P<0.05$) from each other. The group 4 which was fed with 40% reduction gained maximum weight ($P<0.05$) during the period of realimentation phase. The values were (Table 1) 19.2 ± 0.82, 15.0±1.15, 15.6±0.96 and 17.3± 0.73 kg for groups 1, 2, 3 and 4, respectively. The increase in weight or compensatory growth for groups 2, 3 and 4 as compared to group 1 was in the order of 2>3>4 and it was 15. 6% and 13.4%

higher for groups 4 and 3 as compared to group 2. The weight gain (kg) during realimentation phase were (P<0.05) 1.3±0.08, 1.3±0.05, 1.4±0.04 and 1.6±0.04 for groups 1, 2, 3 and 4

Table 1: Showing the weight gains, feed intake during preliminary, restricted and realimentation periods among the treatments

S.N.	Parameter	T1	T2	T3	T4
1	Initial weight (Kg)	15.5±0.23	15.2±0.17	14.6±0.31	14.2±0.67
2	Body weight during feed restriction (Kg) *	17.9±0.75[a]	16.9±0.71[ab]	15.2±1.01[ab]	14.4±1.12[b]
3	Body weight during realimentation phase (Kg) *	19.2±0.82[a]	15.0±1.15 [ab]	15.6±0.96[b]	17.3±0.73[b]
4	Ave. weight gain (loss) during restriction period (Kg) *	2.0±0.06[a]	1.6±0.05 [b]	1.4±0.04[c]	1.2±0.04[d]
5	Ave. weight gain during realimentation phase (Kg) *	1.3±0.08[a]	1.3±0.05 [b]	1.4±0.04[ab]	1.6±0.04[ab]
6	Ave. weight gain during preliminary phase (Kg) *	4.8±0.40	4.6±0.23	4.71±0.44	4.5±0.43
7	No. of weeks under preliminary period	8.13±0.59	8.04±0.47	8.25±0.58	8.08±0.39
8	Ave. feed consumed/animal/day during preliminary period (g)	138.7	141.7	136.9	139.3
9	Ave. feed consumed/animal/day during restriction period (g)	142.4	115.6	100.3	87.4
10	Total feed consumed/animal/day during preliminary period (Kg)	197.3	199.4	197.6	196.9
11	Total feed consumed/animal/day during restriction period (Kg)	208.3	159.3	141.7	118.1

[abcd] *Values in a row not bearing common superscripts differ significantly * (P<0.05)*

The total weight gain during preliminary period was 4.8±0.40, 4.6± 0.23, 4.7± 0.44 and 4.5 ± 0.43 for groups 1, 2, 3 and 4, respectively. The weight gain (loss) during feed restriction was 2.0± 0.06, 1.6±0.05, 1.4±0.04 and 1.2±0.04 for groups 1, 2, 3 and 4, respectively and was found non-significant.

No. of days taken

The number of weeks taken to reach the target initial weight of about 18 kg was 8.13 ± 0.59, 8.04 ± 0.47, 8.25 ± 0.58 and 8.08 ± 0.39 for groups 1, 2, 3 and 4, respectively.

Total feed consumed

The four groups of animals containing 25, 24, 25 and 24 animals each consumed a total feed (kg) of 197.3, 199.4, 197.6 and 196.9 on an average for groups 1, 2, 3 and 4, respectively and it was 208.3, 159.3, 141.7 and 118.1 for groups 1, 2, 3 and 4 respectively, during the periods of preliminary and restriction.

It was observed from the results that the group of animals which were feed restricted for a long time recouped faster as compared to other groups which could be due to a physiological impulse called compensatory gain (Ford and Park, 2001). They reported that during compensatory growth, the metabolism of the animal continues to adjust to low feed ingestion while the animals are not restricted. The base energy metabolism continues to be low and increases slowly adjusting to the new feeding regime and so the utilization of energy and protein remains to be more efficient while the energy requirements for growth remains the same resulting in compensatory growth and weight gain the feed restricted animals.

The restricted energy intake during restriction phase resulted in lower weight gains as compared to the animals that were non-restricted. Realimentation permitted a return to normal weight gain (Neto *et al.*, 2011). Greater energy intake than necessary for maintenance caused a greater proportion of ingested energy to be available for growth and caused compensatory growth. In the present findings it was shown that the animals restricted with 40% recorded the maximum compensatory growth and these results tally with the results of Neto *et al.*, (2011) where in they reported that the animals subjected to 40% feed restriction presented better feed conversion (P<0.05) compared to the group without restriction. They reported that food conversion was much better during the realimentation phase indicating the possibility of manipulating the intake for a period to reduce the ration between weight gain and DM intake in the following period, resulting in more economic intake without affecting the body weight.

In the present experiment, there was partial compensation for two restrictions (30 and 40 percent) but only the 40% restriction group presented greater weight gain compared to unrestricted and 20% restricted groups. These results are in agreement with that of Neto *et al.*, (2011) who reported that 40% restricted

group of animals showed greater weight gain as compared to 20% and unrestricted group. It was also reported by Dastizadeh *et al.,* (2008) that limited feeding of sheep will cause to improve the food conversion index during refeeding process.

The present results contradict with those of Yagoub and Babiker (2009) who reported lower weight gains with compensated female goats while Toukourou and Peters (1999) found no difference in weight gains and FCE among the compensated and control goat groups in their studies. This discrepancy might be related to age, breed, type of animals, length of recovery (compensated period), severity and duration of restriction period and the type of realimentation diet as the animals are known to respond differently based on the diversified mechanisms involved in the compensatory growth system (Benschop, 2000; Hornick *et al.,* 2000; Sanz-sampelayo *et al.,* 2003; Joemat *et al.,* 2004 and Yagoub and Babiker, 2009).

Conclusion

In most of the sheep production systems, lambs survive on their body reserves during the periods of feed shortage and replenish them when adequate nutrition is restored. With the present findings, it can be concluded that the lambs can be feed restricted upto 40% and the loss in weight can be recouped with the phenomenon of compensatory growth. The feed restricted animals caught up with live weights of continuously fed animal group. This phenomenon of compensatory growth can be practiced during the periods of feed scarcity by the way of feed restriction at different stages as reported in the present study.

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