

Original Research Article

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Influence of Feed Restriction on Plane of Nutrition and Carcass Parameters in Ram Lambs

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ABSTRACT

In a Completely Randomized Design, thirty two ram lambs (11.3 kg \pm 0.3) were tested with four feeding regimes to evaluate the effect of feed restriction followed by realimentation on plane of nutrition and carcass parameters. A 8 week restriction period was followed by a 4 week realimentation phase and the animals divided into 4 groups (T₁ to T₄) were subjected to feed restriction at 0, 10, 20, and 30 percent, respectively. After realimentation period, slaughtered animals were studied for carcass parameters. The weight of the skin, meat produced and meat to bone ratio were found to be higher ($P < 0.05$) for maximum restricted animals. No significant differences in DCP and TDN intake (kg/day) were observed among the treatments but tended to be higher in T₄ as compared to other treatments. The DE intake (M cal) and ME intake (M cal) were higher in T₄ and were non-significant. Similar trend was observed during realimentation phase also. The total cost of feed consumed per lamb was decreased with the level of restriction increased from T₁ to T₄. During restriction phase the feed cost / kg gain per lamb was increased with the level of restriction increased from T₁ to T₄. During re-alimentation phase, the feed cost / kg gain per lamb decreased from T₁ to T₄ with increased level of restriction while the feed cost / kg gain per lamb was lower in T₄ compared to T₁, T₂ and T₃. It was concluded that the increase in the feed restriction up to 30% in diet has improved the carcass yield and also has reduced the cost/kg gain in ram lambs.

Keywords

Feed restriction, Realimentation, Carcass parameters, cost/kg gain, Plane of nutrition

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Introduction

The effect of compensatory growth on body composition has been studied by various researchers and conflicting results have been obtained. Some reports have indicated increase in body fat content (Ledin, 1983; Notter *et al.*, 1983) and others have reported increase in the lean tissue of re-alimented animals (Dashtizadeh *et al.*, 2008; Al-selbood, 2009). Some contradictions could be due to

different phases of restrictions and re-alimentation, and different breeds with different maturity age. The existence of an interaction between the plane of nutrition and the physiological age would seem to explain some of the inconsistencies (Tatum *et al.*, 1988).

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 (Abegaz *et al.*, 1996). This strategy has very important implication 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 was reported (Shadnoush *et al.*, 2011; Sami *et al.*, 2013) that the weights of the body and some of the visceral organs decreased during feed shortage and delay in growth will be compensated with re-feeding phases. It was reported (Kamalzadeh and Aouladrabie, 2009) that sheep decrease their maintenance requirement as a result of feed restriction and further it was reported that the experimental conditions like length, severity of feed restriction, type of diet used and environmental conditions were more important than breed body size. The present study was planned to study the effect of feed restriction and re-feeding on the plane of nutrition and carcass parameters in ram lambs.

Results and Discussion

At the end of digestion trial, after the re-alimentation phase, four animals per each group were slaughtered by halal method and were compared parameters like body weight, skin, head, legs, viscera and meat to bone ratio were studied (Table 1). The weight of the skin, head, liver, kidney, spleen, meat produced and meat to bone ratio were found to be higher for maximum ($P < 0.05$) restricted animals. The remaining parameters were comparable among the animals of different treatments were statistically non-significant

No significant differences were found in DCP and TDN intakes (kg/day) among the

treatments (Table 2) and were higher in T₄ as compared to other treatments. The DE intake (M cal) and ME intake (M cal) were higher in T₄ as compared to other treatments. However, no significant differences were observed among the treatments during feed restriction. During refeeding process also the same trend was followed.

The animals that were feed restricted to the maximum showed higher weights for visceral organs during re-alimentation phase. Many workers reported the catch-up weight of fat deposits, visceral organs etc. during re-alimentation after a period of feed restriction (Abouheif *et al.*, 2013; Sami *et al.*, 2013; Al-owaimer *et al.*, 2013; Al-selbood, 2009). In the present study the higher weight of the viscera especially liver for the maximum feed restricted group of animals could probably reflects hypertrophy of the liver tissue upon re-alimentation after a phase of feed restriction (Sami *et al.*, 2013). This compensatory growth was explained by Mora *et al.*, (1996) who found that during the first phase of re-alimentation, energy was diverted mainly to replenish protein and glycogen reserves in the liver tissues. In the present study, the growth performance or live weight gain was predominant and faster for the maximum feed restricted group of animals. Al-owaimer *et al.*, (2013) found that the late developing tissues such as internal fat and stomach compartments in goats and tail fat in sheep (Al-selbood, 2009) were proportionately more affected by the low plane of nutrition during feed restriction. However, it is understood that the early maturing tissues have a priority to take up the limited nutrients from the blood stream and lose less weight during feed restriction and as suggested by Abouheif *et al.*, (2015), the general trend of tissue accretion indicates a different partitioning priority of nutrient intake between carcass and non-carcass components of re-alimented lambs as indicated by an increase in weights and visceral fat.

Table.1 Carcass yield (kg) during re-alimentation phase among the treatments

Particulars	T ₁	T ₂	T ₃	T ₄
Body weight	19.08±0.4	19.5±0.6	20.3±0.8	20.1±1.0
Skin*	1.38 ^b ±0.04	1.41 ^{ab} ±0.06	1.49 ^a ±0.04	1.62 ^a ±0.02
Head*	1.46 ^a ±0.03	1.54 ^a ±0.03	1.48 ^a ±0.05	1.68 ^b ±0.02
Legs	0.57±0.06	0.61±0.02	0.69±0.03	0.66±0.02
Liver *	0.56 ^a ±0.03	0.72 ^a ±0.04	0.63 ^a ±0.04	0.9 ^b ±0.04
Heart+pericardium*	0.14 ^a ±0.008	0.15 ^a ±0.01	0.16 ^a ±0.006	0.19 ^b ±0.004
Kidney*	0.17 ^b ±0.06	0.2 ^{ab} ±0.01	0.19 ^b ±0.02	0.25 ^a ±0.01
Lung+ trachea	0.48±0.06	0.44±0.03	0.53±0.07	0.65±0.02
Spleen *	0.06 ^b ±0.005	0.07 ^{ab} ±0.004	0.09 ^a ±0.01	0.1 ^a ±0.008

^{ab} values in a row with different superscripts differ significantly *(P<0.05)

Continued...

Particulars	T ₁	T ₂	T ₃	T ₄
Oesophagus*	0.22 ^b ±0.008	0.26 ^a ±0.01	0.25 ^{ab} ±0.02	0.28 ^a ±0.01
Rumen+reticulum+* omasum+abomasums	0.66 ^b ±0.04	0.57 ^b ±0.03	0.69 ^a ±0.03	0.72 ^a ±0.03
Small intestine	0.64±0.04	0.59±0.03	0.58±0.06	0.6±0.1
Large intestine	0.3±0.02	0.28±0.02	0.27±0.03	0.31±0.02
Thoracic region	4.66±0.5	4.3±0.3	4.92±0.4	5.1±0.2
Abdomen region	3.8±0.1	4.3±0.5	4.5±0.2	3.8±0.4
Empty body weight	8.5±0.5	8.7±0.4	9.4±0.5	8.9±0.4
Meat *	4.8 ^b ±0.2	5.04 ^a ±0.2	5.6 ^a ±0.3	5.9 ^a ±0.3
Bone	3.67±0.3	3.63±0.3	3.8±0.5	2.9±0.3
Meat :Bone*	1.3 ^b ±0.08	1.4 ^a ±0.08	1.5 ^a ±0.2	2.0 ^a ±0.3

^{ab} values in a row not sharing common superscripts differ significantly *(P<0.05)

Table.2 Plane of nutrition

Restriction phase				
Particulars	T₁	T₂	T₃	T₄
DCP (%)	14.53 ± 0.3	14.72 ± 0.5	15.12 ± 0.3	14.8 ± 0.4
TDN(kg/day)	75.99 ± 0.5	77.11 ± 0.7	77.69 ± 0.9	78.94 ± 1.2
ME(M cal)	27.4 ± 0.9	27.8 ± 0.4	28.07 ± 0.8	28.5 ± 0.7
DE(M cal)	33.4 ± 1.1	33.99 ± 2.1	34.42 ± 1.3	34.7 ± 1.5
Realimentation phase				
TDN(kg/day)	77.7 ± 0.6	78.47 ± 1.2	79.07 ± 0.4	80.5 ± 1.3
ME(Mcal)	28.1 ± 1.8	28.3 ± 1.5	28.59 ± 0.8	29.1 ± 1.1
DE(Mcal)	34.2 ± 0.9	34.4 ± 0.7	34.8 ± 0.5	35.4 ± 0.7

The results showed that the lowered maintenance requirement continues during re-alimentation phase until protein is fully replenished in these organs. In general, early maturing parts (head, feet and visceral organs) have higher priority in usage of available nutrients in blood and are less affected than late maturing parts. These observations are supported by several reports including those of Hornick *et al.*, (2000) and Kamalzadeh *et al.*, (1998) which have shown that growth rate is reduced with a coordinated decrease in tissue turnover but some tissues react more than others. In re-alimentation phase, the reactions were mostly due to the restriction responses of animals and the most affected organs with the greatest retardation, responded faster than those of less affected. These findings are supported by other reports (Hornick *et al.*, 2000; Kamalzadeh *et al.*, 1998; Dashtizadeh, 2008).

Plane of nutrition

Data on plane of nutrition revealed that the DCP content expressed as % in the diet consumed or kg/day was non-significantly higher in T₄ as compared to other treatments. This may be attributed to higher CP digestibility in T₄ as compared to other treatments. The present study also indicated that the DCP content expressed as % in the diet consumed or kg/d was higher in ram

lambs fed 30% restriction group compared to control. Further, the DCP intakes in all the treatment groups were higher than the recommended levels of ICAR (2013).

The TDN content expressed as % in the diet consumed or kg/day was non-significantly higher in T₄. The numerically higher nutrient digestibilities recorded in ram lambs fed 30% restricted group as compared to others might have resulted in higher TDN content when compared with others. The DE and ME intakes (Mcal) reported in the present study followed similar trends as observed with TDN intakes.

The DCP, TDN and ME intakes per Wkg^{0.75} as well as calorie protein ratio was higher in ram lambs fed 30% restricted group as compared to others treatments. This indicated that the ram lambs fed on different dietary treatments were maintained at increasing plane of nutrition. Further, the DCP intakes per W kg^{0.75} as well as calorie protein ratio reported in the present study were higher than the values recommended by ICAR (1998) standards.

The total feed cost in restricted phase showed a decreasing trend from T₁ to T₄ and reverse trend was observed during re-alimentation phase. The feed cost per Kg gain per lamb was maximum for 30 % feed restricted

animals. The phenomenon restated that animals subjected to a phase of under nutrition often exhibit a very high growth rate during subsequent re-alimentation. Though not much variation was observed regarding the average subabul cost per lamb in re-alimentation phase, during restriction phase the cost showed more and was non-significant.

The expenditure incurred for feed during restriction phase showed a decreased trend with a corresponding decrease in the feed intake. However, reverse trend was observed during re-alimentation phase as the feed intake increased. The maximum restricted group recouped faster with higher feed intake with a corresponding increase in the cost of feed.

It was concluded that the increase in the feed restriction up to 30% in diet has improved the carcass yield and reduces the cost of production per kg gain. The cost of feed per kg gain was 63, 35 and 18 percent less for T₄, T₃ and T₂ as compared to T₁ during realimentation phase.

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