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Effect of feed additives supplementation alone and in combination on quantitative and qualitative wool attributes of growing Corriedale lambs

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Abstract
A trial of 90 days was conducted on 24 male Corriedale lambs divided in four groups of six lambs each, to study the effect of feeding probiotic mix and fibrolytic enzyme mix on gut health. A complete feed was prepared containing paddy straw 50 parts and concentrate mixture 50 parts on dry matter basis as per ICAR, 2013 with supplementation of probiotics mix (T_1) and exogenous fibrolytic enzyme mix (T_2) and Combination of probiotics mix and exogenous fibrolytic enzyme mix (T_3) while complete feed without supplementation served as control (T_0). Significantly ($P<0.01$) higher values of clean wool yield, skirting yield, fibre length, diameter and medullation in feed additive supplemented groups (T_1, T_2 and T_3) in comparison to control (T_0). Whereas the other qualitative wool traits like staple length, crimps, grease and scouring (%) were found to be non-significant in statistical terms between control and feed additive supplemented groups.

Keywords: Corriedale lambs, Feed additives, Wool parameters

1. Introduction
The use of feed additives in livestock ration has immense importance for improvement of nutrient utilization [1, 2] as well as growth and production [3, 4]. These additives modify rumen fermentation and optimize performance in animal production systems [5, 6]. Since the use of chemicals and antibiotics as a livestock feed additive is banned in many countries, natural feed such as "probiotics and enzymes" which have no residual effects are acceptable to consumers and showing potential for manipulation of rumen fermentation. Sheep have marked variation in growth and the quality of wool produced as there is a relationship between nutrient intake and product output in the farm animals [7, 8, 9]. As these feed additives improve the feed intake, nutrient digestibility and body weight gain metabolic efficiency of the individual animals [8] which are main components affecting efficiency of wool production [10, 8]. There have been reports superior wool quantitative parameters in sheep due to higher level of feeding [11]. Similarly, [12] reported that poor pasture growth or quality resulting in reduction in total growth per animal. Feeding of exogenous fiber-degrading enzymes tended to increase final fleece weight, wool production, and final staple length on wool characteristics [13]. Keeping these facts in view a study was carried to examine the effect of probiotic mix and fibrolytic enzymes mix on wool parameters in Corriedale lambs.

2. Material and Methods
A trial of 90 days was conducted on 24 male Corriedale lambs (3-4 months old, 9.25-11.00 kg) of uniform conformation divided in four groups of six lambs each, to study the effect of feeding probiotic mix and fibrolytic enzyme mix on gut health. A complete feed was prepared containing paddy straw 50 parts and concentrate mixture 50 parts on dry matter basis as per [14] with supplementation of probiotics mix (*Saccharomyces cerevisiae* + *Lactobaccilus acidophillus*) @ 3g/kg DM level and exogenous fibrolytic enzyme mix (cellulase, amylase, protease, pectinase, β-gluconase, lipase, phytase, mannase and xylanase) @ 9 g/kg, as per the invitro studies carried to arrive at optimum level of incorporation [15] while complete feed without supplementation served as control (Table 1).
At end of the experimental feeding, four representative animals of each group were machine shorn. Initially skirtings were removed and collected and then fleece from other parts of the body was removed. The entire fleece was removed in a single cut from each animal. The wool samples for laboratory analysis were taken from right middle region of the animals above the last pair of ribs. Each sample was taken as close to the skin as possible. The different wool parameters like Greasy fleece yield, Scouring yield, Staple length, Staple crimps, Grease

percentage, fibre diameter and modulation percentage were estimated as per *ISI specification No. IS−1349:1964* [16].
The data obtained from the experiment was processed and analyzed statistically using the Statistical Package for the Social Sciences, Base 14.0 (SPSS Software products, Marketing Department, SPSS Inc. Chicago, USA).

Table 1: Chemical composition of experimental feeds and feed ingredients

Item	Control diet	Probiotics supplemented	Enzyme mix supplemented	Combination (Probiotics+ Enzyme mix)
Ingredients proportion (%)				
Paddy straw	50.00	50.00	50.00	50.00
Maize	6.00	6.00	6.00	6.00
Wheat bran	7.60	7.60	7.60	7.60
Deoiled rice bran	9.00	9.00	9.00	9.00
Mustard oil cake	10.00	10.00	10.00	10.00
Soyabean	15.00	15.00	15.00	15.00
Molasses	0.80	0.80	0.80	0.80
Mineral mixture	0.80	0.80	0.80	0.80
Urea	0.40	0.40	0.40	0.40
Common salt	0.40	0.40	0.40	0.40
Probiotic mix	-	0.30	-	0.30
Enzyme mix	-	-	0.90	0.90
Chemical composition (% DM)				
CP	15.51	15.75	15.74	15.77
EE	3.15	3.18	3.16	3.16
CF	21.64	21.64	21.64	21.64
NFE	49.06	48.80	48.83	48.77
TA	8.64	8.66	8.64	8.66
AIA	3.31	3.33	3.31	3.32
NDF	68.03	67.79	68.03	68.03
ADF	42.15	42.11	42.15	42.15
HC	25.88	25.68	25.88	25.88
Cellulose	34.37	34.41	34.37	34.37
ADL	5.49	5.15	5.15	5.15
Ca	1.93	1.94	1.94	1.95
P	0.59	0.61	0.60	0.61

Note: Mineral mixture consisted of Vitamin A-7,00,000 I.U, Vitamin D_3-70, 000 I.U, Vitamin E-250mg, Nicotinamide-1000mg, Co-200mg, Cu - 2000mg, I - 325mg, Fe - 1500mg, Mg - 6000mg, Mn - 1500mg, K - 100mg, Na - 5.9mg, S - 0.72%, Zn - 15gm, Ca - 25% and P - 12.75%.

3. Results and Discussion

The findings of present investigation (Table 2) indicated significantly ($P<0.01$) higher values of clean wool yield, skirting yield, fibre length, diameter and medullation in feed additive supplemented groups (T_1, T_2 and T_3) in comparison to control (T_0). Whereas the other qualitative wool traits like staple length, crimps, grease and scouring (%) were found to be non-significant in statistical terms between control and feed additive supplemented groups. The positive effect of feed additives on some quantitative wool parameters (clean wool yield, skirting yield) and qualitative wool parameter (medullation and fibre length) in present study can be because of higher feed intake, better digestibility of the diet, better nutrient utilization, higher body weight and better metabolic efficiency. The increase in fibre diameter is an undesirable character as reported in present study in the animals fed diet supplemented with feed additives. These results are in agreement to those of [17, 18] who reported higher level of feeding increased the fibre length and fibre diameter, the low plane of nutrition reduced the two wool quality attributes. [13] Reported that replacing 20 per cent and 30 per cent exogenous fibre digesting enzyme treated wheat straw for alfalfa hay caused numerical increase in mean fiber diameter with no effect on crimp per centimeter length of wool.

Table 2: Quantitative and qualitative wool parameters of lambs in different treatment groups

Attribute	Treatment groups			
	T_0	T_1	T_2	T_3
Clean wool yield (g) *	897.50 ±8.59^{a}	985.00 ±41.91^{ab}	1050.00±11.40^{b}	1042.00±21.55^{b}
Skirting yield (g) **	152.50 ±9.68^{a}	267.50 ±16.54^{c}	210.00±13.78^{b}	272.50 ±17.71^{c}
Staple length (cm)	5.71±0.01	5.72±0.02	5.72 ±0.01	5.71±0.01
Fibre length (cm) **	7.67±0.03^{a}	7.91 ±0.01^{b}	7.89±0.02^{b}	7.95 ±0.02^{b}
Crimps per cm	2.33 ±0.02	2.34±0.03	2.33±0.02	2.34 ±0.03
Medullation (%)**	5.66±1.88^{b}	0.88±0.68^{a}	0.90±0.25^{a}	0.16±0.12^{a}
Diameter (µm) *	16.49±0.59^{a}	18.54±0.51^{ab}	18.07±1.56^{ab}	19.75±0.43^{b}
Grease (%)	30.38±1.04	30.75±1.42	30.78±1.13	30.83±2.12
Scouring (%)	60.22±.49	59.85±1.22	60.62±1.05	58.50 ±2.76

^{abcd}Means superscripted with different letters in a row for a particular data differ significantly from each other *($P<0.05$), **($P<0.01$)

The lower medullation percentage in the wool of the animals fed diet supplemented with feed additives is encouraging result, might be attributed to better nutrient utilisation in the respective groups, as medullation is greatly influenced by nutrition as in earlier reports of [19] reported no medullation in the wool samples of Corriedale sheep as (being breed

character), but due to unfavorable environmental conditions, poor feeding and inbreeding can partly contribute to wool quality resulting in higher medullation. The findings of this investigation where fibrolytic enzymes supplementation numerically increased wool production are in agreement to the earlier reports of [20] who observed improvement in wool quantitative characteristics by replacing wheat straw treated with exogenous fibre digesting enzyme for alfalfa hay in Naieni breed replacement ewe lamb diets.

4. Conclusion

The feed additives has positive effect on quantitative and qualitative wool attributes as wool production and its quality is affected by combination of genetic, nutritional and environmental factors.

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