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Role of probiotics on growth and digestibility of nutrients in Kenguri lambs

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Abstract
An experiment was conducted for the duration of three months to assess the growth performance of Kenguri lambs. The animal trial was carried out with 10 Kenguri lambs of three months old randomly distributed to two treatments with average initial body weight of 12.94kg T-1 control group and 13.11 kg T-2 treatment group. The probiotic culture supplemented @ 500g per quintal concentrated feed and fed to treatment group whereas T-1 supplemented concentrate feed without probiotics. Tur bhusa fed as a sole roughage source for both the treatments. The average daily body gain was 83.9 and 89.2g in T-1 and T-2 respectively. The roughage dry matter intake varied from 321 to 487g and 330 to 508g in T-1 and T-2 respectively. Whereas the concentrate dry matter intake was varied from 368 to 460 in both treatments. The total dry matter intake was 745 to 937g and 785 to 965g in T-1 and T-2 respectively. Digestibility of nutrients was better in probiotic supplemented group then control group. This indicates probiotics have positive influence on growth performance of kenguri sheep. Hence recommended for supplementation of probiotic culture as feed additive in kenguri sheep ration and tur bhusa can be used as a sole dry roughage source for production of sheep under intensive system of rearing.

Keywords: lamb, growth, probiotics, Tur bhusa, Kenguri, digestibility

1. Introduction
Sheep farming is one of the common subsidiary activities adopted and promoting among farmers in our state for livelihood security and sustainable income generation. Lamb rearing are favourable due to low investment, easy to raise and manage, low feed requirements when compared to cattle, ability to thrive on various feed resources and superior market potential. Probiotics have been used in human and animal feed as feed additive from many years. Sheep can utilize both conventional and unconventional feed resources for their growth and production. The poor palatable unconventional feed resources like sugarcane trash (Jaishankar *et al*., 2017) [10] can be used in the form of total mixed ration to improve intake of roughage. Fuller (1989) [7] defined them as live microbial feed supplements, which beneficially affect the host animal by improving its intestinal microbial balance. Addition of microbial cultures in animal diets improved function in the digestive system to provide nutrients (Owings *et al*. 1990) [14]. Probitocis include viable microbial and microbial fermentation products which are beneficial to decrease the undesirable microflora population in the gastro- intestinal tract (Chiang, 1995) [5] and build-up resistance against diseases by stimulating the immune system (Cheeke, 1991) [4], (Patterson, 2003) [15]. Supplementation of probiotics improved carcass characteristics in broilers (Jaishankar *et al*., 2012) [11]. Hence, the present study was undertaken to evaluate the effect of dietary supplementation of probiotics cultures on growth performance and digestibility of nutrients in Kenguri lambs.

2. Materials and Methods
2.1 Animal, Experimental design and management
The Animal trial was carried out at Krishi Vigyan Kendra, Raddewadgi, Kalaburgi district, Karnataka. Ten three to four month old Lambs were selected with average body weight of approximately 13 kgs randomly separately in to two groups T-1 as control with out supplementation of probiotics and T-2 as Treatment group supplemented with probiotics culture as feed additive to study the effect of probiotics (*Saccharomyces cerevisiae*) procured from local market and supplemented as feed additive @500g/quintal on growth performance and digestibility of nutrients in Kenguri lambs. The lambs were rearing in intensive system by adopting common management practices like deworming, vaccination, with adequate floor space, light and ventilation, hygiene etc., All the experimental lambs were individually

dewormed with albendazole and vaccinated against Foot and Mouth Disease (FMD) and Enterotoxaemia (ET) before commencement of the experiment. Lambs were fed with identical ration for a period of one week so as to attain uniformity in pattern of nutrient intake. The experiment was conducted for the duration of three months (12 weeks). Tur bhusa is used as a sole dry roughage source in both the groups and supplied *ad libitum* and no green fodder supplied to lambs during the experiment period. Concentrate ration was formulated and supplied to meet the growth requirements as specified by ICAR (2013) [9]. Monthly body weights were recorded and average daily gain was calculated. Daily Feed offered and weekly feed leftover were recorded and average daily roughage and concentrate intake was calculated.

2.2 Digestion trial and chemical analysis

At last week of the animal trial, Digestion trial was conducted, dung voided by lamb over 24 hours was weighed/measured every day at 9.00 AM. From each group, 1/5th of dung voided was used for DM estimation every day, 1/50th of dung voided was collected separately and preserved in freezer and the pooled samples used for nitrogen estimation. The dung samples collected for DM estimation over five days were pooled, ground and stored in air tight polyethylene containers for analysis of proximate constituents except for nitrogen. The pooled samples of feed, fodder and grounded dung were analyzed for proximate constituents according to AOAC (2005) [2]. The nitrogen content in the dung sample was determined by macro Kjeldhal method as per the procedure of AOAC (2005) [2]. The digestibility of nutrients was calculated as the difference in the nutrient intake and nutrient out go as a proportion of the intake and expressed as per cent using the following formula,

$$\text{Apparent digestibility coefficient (\%)} = \frac{\text{Nutrient intake (g/d)-Nutrient outgo in dung (g/d)x100}}{\text{Nutrient intake (g/d)}}$$

2.3 Statistical analysis

The Lamb growth and digestion trial was conducted to compare the means between two treatment groups for the duration of three months. The data of body weight, body weight gain, dry matter intake, intake of various nutrients and digestibility of nutrients were analyzed by comparing mean using unpaired t test and the results interpreted.

3. Results and Discussion

3.1 Chemical composition

The proximate composition of tur bhusa and concentrate feed mixture is presented in table 1, the organic matter, crude protein, ether extract, crude fibre, nitrogen free extractives and total ash content of tur bhusa on dry matter basis was 88, 6.3, 1.8, 36.5, 43.4 and 12 per cent respectively. The composition is on par with other conventional dry fodder like ragi straw, sorghum stover. The organic matter, crude protein, ether extract, crude fibre, nitrogen free extractives and total ash content of concentrate feed mixture is 91.3, 16.7, 3.0, 4.6, 66.9 and 8.7 respectively.

Table 1: Proximate composition of tur bhusa and concentrate feed mixture

Chemical composition	Tur bhusa	Concentrates
Dry matter	92.4	92.1
Organic matter	88.0	91.3
Crude protein	6.3	16.7
Ether extract	1.8	3.0
Crude fibre	36.5	4.6
Nitrogen free extractives	43.4	66.9
Total ash	12.0	8.7

3.2 Body weight gain and average daily gain

The initial and final body weight, live weight gain and average daily gain presented in table 2. The initial and final body weight varied non-significantly between the treatment groups. Whereas the live weight gain (kg) and Average daily gain (g) significantly varied between the groups. The diet supplemented with probiotics significantly improved body weight gain in Kenguri lambs. Improved body weights (ADG 89.2g) in probiotic supplementation may be due to augmented microbial protein synthesis leading to more amino acids supply to post ruminal level (Erasmus *et al.*, 1992) [6]. Similar results were observed as body weight gain improved by 1.90% and daily gain by 2.50% in lambs fed diets with probiotics compared to the control group. Better weight gain may also be related to higher consumption and better efficiency of feed utilization in the probiotics supplemented group. Probiotics do have beneficial effect in all other species as supplementation of lysine producing probiotics improved body weight gain and carcass characteristics in poultry (Jaishankar *et al.*, 2012) [11].

Table 2: Effect of probiotics on live weight gain and average daily gain in Kenguri lamb

Group	Initial weight (kg)	Final weight (kg)	Live weight gain (kg)	Average daily gain (g)
T-1 Control group	12.94±0.52	19.99±0.53	7.05^{a}±0.07	83.9^{a}±0.89
T-2 Probiotic group	13.11±0.84	20.60±0.92	7.49^{b}±0.10	89.2^{b}±1.19
P value	0.868	0.583	0.008	0.0077
Significance	NS	NS	S	S

3.3 Weekly Roughage, concentrate and total Dry matter intake

Roughage, concentrate and total dry matter intake is presented in Table 3. The average roughage intake in control group was 418g per day per animal whereas in probitoics supplemented group roughage intake was 439g per day per animal. The average concentrate intake in control and probiotic supplemented group was 428 and 430g respectively. As concentrate was completely consumed due to its good palatability. The total dry matter intake was 846 and 869g respectively. This might be due to improved cellulolytic bacterial activity, better digestibility and feed efficiency in the rumen of lambs fed probiotics as feed additive. Similar results reported by Wallace and Newbold (1993) [18]. Probiotics supplemented group has found to increase feed intake.

Table 3: Weekly Average roughage, concentrate and total dry matter intake

Week	Average daily roughage intake (g)		Average daily concentrate intake (g)		Total DMI	
	T-1	T-2	T-1	T-2	T-1	T-2
1	394	425	368	368	762	793
2	377	417	368	368	745	785
3	402	432	368	368	770	800
4	406	421	368	368	774	789
5	391	417	368	368	759	785
6	487	508	442	442	928	949
7	485	504	452	461	937	965
8	321	330	536	545	857	875
9	396	404	460	460	856	864
10	457	466	460	460	917	926
11	444	459	460	460	904	919
12	440	457	460	460	900	917
13	434	469	460	460	894	929
Mean	418±12.8	439±12.9	428±15.2	430±15.6	846±20.4	869±19.3
SD	46.07	46.53	54.71	56.31	73.39	69.75
P value	1.1648		0.9415		0.4301	
Significance	NS		NS		NS	

3.4 Roughage: Concentrate ratio and its proportion

The roughage: concentrate ratio and proportion of roughage and concentrate is presented in Table 4. The average roughage concentrate ratio in T-1 and T-2 was 0.99 and 1.04 respectively. The proportion of roughage in T-1 and T-2 was 0.5 and 0.51 respectively. Whereas the concentrate feed mixture proportion in T-1 and T-2 was 0.51 and 0.50 respectively. The roughage intake improved in probiotic supplemented group when compared to non supplemented control group. Increase feed intake in response to probiotics supplementation may be their positive effect on ruminal pH, leading to improved fiber degradation and dry matter intake (Umberger and Notter, 1989) [17]. On contrary Titi *et al.* (2008) [16] observed that supplementation of yeast culture in the diets of lambs and kids had no effect on DMI.

Table 4: Weekly Average roughage concentrate ratio and its proportion

Week	R:C ratio		Proportion of roughage and concentrate			
			Roughage		Concentrate	
	T-1	T-2	T-1	T-2	T-1	T-2
1	1.07	1.16	0.52	0.54	0.48	0.46
2	1.02	1.13	0.51	0.53	0.49	0.47
3	1.09	1.17	0.52	0.54	0.48	0.46
4	1.10	1.15	0.52	0.53	0.48	0.47
5	1.06	1.13	0.52	0.53	0.48	0.47
6	1.10	1.15	0.52	0.53	0.48	0.47
7	1.07	1.09	0.52	0.52	0.48	0.48
8	0.60	0.60	0.37	0.38	0.63	0.62
9	0.86	0.88	0.46	0.47	0.54	0.53
10	0.99	1.01	0.50	0.50	0.50	0.50
11	0.96	1.00	0.49	0.50	0.51	0.50
12	0.96	0.99	0.49	0.50	0.51	0.50
13	0.94	1.02	0.49	0.50	0.51	0.50
Mean	0.99±0.04	1.04±0.05	0.50±0.01	0.51±0.01	0.51±0.01	0.50±0.01
SD	0.137	0.158	0.042	0.043	0.042	0.043
P value	0.39		0.523		0.523	

3.5 Intake of various nutrients

Intake of various nutrients by Kenguri lambs is presented in Table 5. Higher dry matter intake observed in probiotics supplemented group therefore higher nutrient intake observed in probiotic supplemented group when compared to unsupplemented control group. The nutrient intake varied non significantly between the control and treatment group. Diet composition and probiotics supplementation are known to influence the performance of ruminants. Probiotics supplementation has been found to increase feed intake (Antunovic *et al.*, 2006) [1]. Therefore, supplementation of probiotics may influence dry matter intake by affecting ruminal pH and digestion of the nutrients. On contrary Hernandez *et al.* (2009) [8] noticed no change in intake of nutrient/dry matter intake of lambs fed grass diets which contain probiotics.

Table 5: Intake of organic matter, Crude protein, Ether extract, Crude fibre and Nitrogen free extractives

Week	OMI		CPI		EEI	
	C	T	C	T	C	T
1	682.7	710.0	86.3	88.2	18.1	18.7
2	667.7	702.9	85.2	87.7	17.8	18.5
3	689.7	716.1	86.8	88.7	18.3	18.8
4	693.3	706.5	87.0	88.0	18.3	18.6
5	680.1	702.9	86.1	87.7	18.1	18.5
6	832.1	850.6	104.5	105.8	22.0	22.4
7	839.5	864.4	106.0	108.7	22.3	22.9
8	771.8	788.0	109.7	111.8	21.9	22.3
9	768.5	775.5	101.8	102.3	20.9	21.1
10	822.1	830.1	105.6	106.2	22.0	22.2
11	810.7	823.9	104.8	105.7	21.8	22.1
12	807.2	822.1	104.5	105.6	21.7	22.0
13	801.9	832.7	104.2	106.4	21.6	22.2
Mean	759±18	779±17	97.9±2.7	99.5±2.7	20.4±0.5	20.8±0.5
SD	66.1	62.9	9.71	9.60	1.88	1.83
SEM	18.3	17.4	2.69	2.66	0.52	0.51
P value	0.44		0.68		0.57	

CFI		NFEI	
C	T	C	T
160.7	172.1	417.2	430.6
154.5	169.1	409.8	427.2
163.7	174.6	420.7	433.7
165.1	170.6	422.4	428.9
159.6	169.1	415.9	427.2
198.1	205.8	507.1	516.2
197.8	205.2	512.9	527.1
141.8	145.5	497.9	507.8
165.7	168.6	479.6	483.1
188.0	191.3	506.1	510.0
183.2	188.7	500.4	506.9
181.8	188.0	498.7	506.1
179.6	192.3	496.1	511.3
172±4.8	180±4.7	468±11.8	478±11.4
17.16	16.97	42.63	41.15
4.76	4.71	11.82	11.41
0.26		0.54	

3.6 Digestibility of Nutrients

The digestibility of various nutrients in control group and probiotics supplemented group is presented in Table 6. Improved digestibility was observed in diet supplemented with probiotics than control group. Since, probiotics may improve nutrient digestibility and degradation of fibre and ruminal digestion (Kamel *et al*., 2004) [12] and also by increasing the pH of the rumen (Mohamed *et al*., 2009) [13] and also enhancing growth and cellulolytic activity by rumen bacteria and preventing ruminal acidosis by balancing the Volatile fatty acid ratios in the rumen (Arcos-Garcia *et al*., 2000) [3]. Thus probiotics have positive effect of digestibility of nutrients.

Table 6: Nutrient digestibility per cent

Digestibility	Control	Treatment
Dry matter digestibility	64.11	65.67
Organic matter digestibility	68.41	69.87
Crude protein digestibility	75.63	77.94
Ether extract digestibility	73.42	75.04
Crude fibre digestibility	62.43	66.63
Nitrogen free extractives digestibility	71.72	73.13

4. Conclusion

The feeding trial on lamb growth with tur bhusa as a sole roughage source and concentrate feed mixture supplemented to meet the growth requirements as specified by Indian council of Agricuture Research and animal rearing in intensive system. No green fodder fed to animal during the experiment period. Improved body weight gain, feed efficiency, dry matter intake, digestibility of nutrients observed in probiotic supplemented group than control group. As probiotics have several beneficial properties in improvement of growth and health of animals. Hence it is recommend for supplementation of probiotic culture as feed additive in kenguri sheep ration and tur bhusa can be used as a sole dry roughage source for production of sheep under intensive system of rearing.

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