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Research Article

Dietary supplementation of extra concentrate with probiotics to does during periparturient period: Effect on performance of does and their kids

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Abstract

A study was conducted to evaluate the effect of supplementation of concentrates along with probiotics during the periparturient period to the does on the performance of their kids. Twenty-four pregnant healthy Boer x local cross does in the last month of gestation (day 120) were selected randomly and allotted to 4 groups (T1, T2, T3 and T4) of 6 animals in each group. The does were maintained under stall feeding conditions and offered a daily ration consisting of oats hay @ 1.2 kg/head/day and commercial pelleted feed @ 577.5 g/head/day during the periparturient period (one month pre-partum to one month post-partum). Kids were fed entirely by their does on milk. Does in treatment group T1 were offered a normal daily ration without supplementation. In T2 group does were offered normal ration and extra concentrates @ 150 g/head/day, T3 group were offered normal ration and extra concentrates @ 150 g/head/day with probiotics (*Saccharomyces cerevisiae* x10^{10} CFU/g) @ 2.5 g/head/day and T4 group were offered normal ration and extra concentrates @ 150 g/head/day + probiotic (*Saccharomyces cerevisiae* x10^{10} CFU/g) @ 4 g/head/day. Results indicated a significant ($p<0.05$) higher weekly body weight of periparturient does during the last week before kidding in supplemented groups as compared to the control group, but non-significant differences were observed between supplemented groups. The highest body weight was observed in T4 as 44.92±0.83 kg and the lowest in T1 as 40.74±0.59 kg. The average weaning weights of kids were highest (13.32±0.22 kg) in T3 group and lowest in T1 group (9.24±0.23 kg). Monthly average weight gains (MAVG) of kids were found to be significantly ($P<0.05$) higher in T2, T3, T4 than T1 (Control) group during the first, second and third month of age. However, there was a non-significant difference between T2, T3 and T4 treatment groups. The monthly AVG was highest (157.33±0.74 g/day) in T4 group and lowest in T1 group (108.33±1.78 g/day) during the first month. Net profit at weaning was highest in T3 group as Rs. 475/- followed by Rs. 380/- in T4 and Rs. 354/- in T2 group. It is thus concluded that supplementation of extra concentrates with a low level of probiotics in does during the periparturient period results in an improvement in the body weights of does and their kids, and this practice is feasible on economic lines.

Key words: Concentrate, Does, Kids, Performance, Periparturient period, Probiotics

Highlights

- Supplementation of extra concentrates with a low level of probiotics in does during the periparturient period results in an improvement in the performance of their kids.
- Supplementation of extra concentrates with a low level of probiotics in does during the periparturient period is feasible on economic lines.

INTRODUCTION

In recent years, the livestock sector has emerged as one of the key components of agricultural growth in developing countries. Indian livestock system is the endeavour of smallholders, and it is a centuries-old tradition.

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Over 70 percent of the rural households in India depend on livestock farming for supplementary income. From livelihood perspective, livestock farming is considered an important instrument to alleviate poverty (Baba *et al.*, 2011). The economy of Jammu and Kashmir is agriculture dependent, and livestock rearing occupies an important source of additional income for the rural people of the state. Due to abundant alpine pasture and the high demand for livestock products, sheep and goat rearing is the core activity of rural masses in Jammu and Kashmir state. Sheep and goat rearing play a vital role in the socio-economic upliftment of weaker sections of the society viz; Gujjars, Bakerwals, Chopans, Gaddies and Changpas. Goats are raised principally for their meat, milk, fibre and skin. It is also well suited to other livestock production, such as sheep and cattle on low-quality grazing land. Goats efficiently convert low quality grazing matter that is less desirable for other livestock into quality lean meat.

Furthermore, goats can be reared in a relatively small area of pasture and limited resources. It fulfils the high demand for proteins in human food products, thereby adding nutritional value to food products for its consumers. They also meet the specific needs of mankind, particularly by producing clothing through fibre and providing other by-products like pelts, skin etc. (Bruinsma, 2003).

During three weeks before and three weeks after kidding (periparturient period) there is a negative energy balance in does, which is considered as the primary cause for the development of the ketosis/ hyperketonemia in does, resulting in their decreased performance or even mortality (Van Saun, 2000). Further, during late gestation, there is reduction in the rumen capacity, especially in twin and triplet-bearing animals owing to the presence of foetus and the subsequent pressure of the gravid uterus on rumen resulting in decreased dry matter intake and hence, loss of performance (Andrews *et al.*, 1996). Nutrient restrictions during this period also result in foetal losses. This necessitates increasing nutrition density to meet the requirements. An increase in energy density in the ration will help does from relying on body fat reserves as an energy source and potentially becoming ketotic. Suppression of foetal growth in-uterus and a negative influence on the lactation performance has been attributed to nutrient restriction during late gestation (Tygesen *et al.*, 2008).

Feeding a high level of concentrate increases the energy status of does during gestation, and the kid born from these does have higher body weight. Kids born from highly nourished does were heavier at birth. Maternal nutrition resulted in improved colostrum and/ or milk availability for offspring, therefore increases the survival rate at weaning. Supplementation of concentrate in does during periparturient periods showed a positive impact on the performance of does and their kids. An increase in the nutrient density by increasing the concentrate ratio may lead to a major change in rumen microbial populations due to rapid growth of lactic acid-producing bacteria. High concentrations of lactic acid accumulation cause rumen pH to drop to less than 5.0. The body systems are most susceptible to such stressful conditions. Probiotics like yeasts may stimulate the growth and enzymatic activity of cellulolytic bacteria, improve microbial protein synthesis, increase fibre digestibility, and change microbial protein and amino acids in the large intestine.

The present study was conducted to explore the possibility of improvement in the performance of periparturient does through extra concentrate with or without probiotics supplementation. The experiment was conducted at Mountain Research Centre for Sheep and Goat (MRCSG), Shuhama, SKUAST-K from November 2017 to January 2018.

MATERIALS AND METHODS

Twenty four pregnant healthy Boer x local cross does in the last month of gestation (day 120) were selected randomly and allotted to 4 groups (T1, T2, T3 and T4) of 6 animals each.

Table 1. Feeding schedule of experimental animals during the study period

Different treatment	Normal ration		Extra conc. (g)	Probiotics (g)	DCP (g/head/day)	TDN (g/head/day)
	Roughage oats hay (kg)	Conc (g)				
T1	1.2	577.5	-	-	105	918.6
T2	1.2	577.5	150	-	126	1015.8
T3	1.2	577.5	150	2.5	126	1015.8
T4	1.2	577.5	150	4	126	1015.8

Boer goat has its origin in South Africa and is a popular meat breed. The does were maintained under stall feeding conditions and offered a daily ration consisting of oats hay @ 1.2 kg/head/day and commercial concentrate feed @ 577.5 g/head/day during the periparturient period (one month pre-partum to one month post-partum). Does in treatment group T1 (Control) were offered a normal daily ration without supplementation. In T2 group were offered normal ration and extra concentrate @ 150 g/head/day, T3 group were offered normal ratio and extra concentrate @ 150 g/head/day with probiotic (*Saccharomyces cerevisiae* x10^{10} (colony forming units) CFU/g) @ 2.5 g/head/day and in T4 groups were offered normal ration and extra concentrate 150 g/head/day + probiotic (*Saccharomyces cerevisiae* x10^{10} CFU/g) @ 4 g/head/day. The feeding schedule of experimental animals during the study period has been summarized in Table 1. Kids were fed entirely on milk by their does.

The body weights of does (at prepartum period, before kidding, after kidding and post-partum period) and birth weights of kids were recorded using a digital spring balance. The bodyweight of the kids was recorded every 7 days during the first month and every 15 days in subsequent months till weaning (90 days). All the recordings were taken in the morning (8.30 AM to 9.30 AM) using a digital spring balance with a maximum measurement of up to 100 kg. Monthly average weight gain (g/day) was calculated at the end of the month by dividing the total weight achieved by the kid during the month by the number of days in that particular month up to weaning (90 days). Economics of supplementation in treatment groups (T2, T3 and T4) was calculated on a comparative basis with respect to the control. The cost incurred on feeding the control group has been kept constant as the latter was the same in all the four groups, which differed only in terms of additional concentrate and probiotics offered to them. Additional weights achieved by the kids at birth and weaning in treatment groups have been calculated by subtracting the average weights of kids in these groups with corresponding average values in the control group. The cost of concentrate (pelleted feed) offered to the does during the study period was Rs. 18/kg and probiotic of Rs. 500/kg, while the market value of chevon (live weight basis) was Rs. 200/kg.

Data obtained were subjected to statistical analysis by one-way ANOVA using the General Linear Model procedure of Statistical Package SPSS 21.0 version as per Snedecor and Cochran (1994).

RESULTS

The results regarding bodyweight of does have been summarized in Table 2. There was a significantly ($p<0.05$) higher weekly body weight of periparturient does in T4, T3 and T2 (supplemented group) as compared to T1 (Control) treatment group during the last week before kidding, but non-significant differences were observed between T2, T3 and T4 treatment groups. During the last week before kidding highest body weight was observed in T4 as 50.60±1.01 kg, followed by T3 as 49.00±1.18 kg and T2 as 49.00±0.30 kg and the lowest in T1 treatment group as 46.24±0.71 kg. However non-significant difference was observed in all the treatment groups up to last week before kidding. After kidding, there was a significantly

Table 2. Mean (±SE) weekly body weight (kg) of periparturient does supplemented with extra concentrate with or without probiotics

Stage	Days	Different treatment			
		T1 (Control)	T2	T3	T4
Pre-partum period	-28	45.10±0.71	44.56±0.51	44.70±0.27	45.98±1.13
	-21	45.24±0.13	44.84±0.49	45.00±1.25	46.26±1.11
	-14	45.44±0.74	45.66±0.43	45.88±1.30	47.12±1.06
	-7	45.66±0.73	46.62±0.42	47.02±1.26	48.26±1.10
Before kidding	0	46.24±0.71[a]	49.00±0.30[b]	49.00±1.18[b]	50.60±1.01[b]
After kidding	0	40.30±0.58[a]	42.38±0.50[ab]	42.32±0.99[ab]	44.20±0.86[b]
Post-partum period	7	40.54±0.59[a]	42.72±0.48[ab]	42.62±0.98[ab]	44.52±0.85[b]
	14	40.64±0.59[a]	42.92±0.49[ab]	42.82±0.97[ab]	44.76±0.84[b]
	21	40.70±0.59[a]	43.00±0.50[ab]	42.90±0.98[ab]	44.88±0.83[b]
	28	40.74±0.59[a]	43.03±0.50[ab]	42.94±1.00[ab]	44.92±0.83[b]

Mean with a different superscript in a row differ significantly ($p<0.05$)

higher ($p<0.05$) weekly body weight in T4 group as compared to T1 treatment group but a non-significant difference between T2, T3 and T4 treatment groups up to the end of the trial. The highest body weight at the end of the trial was observed in T4 as 44.92±0.83 kg, followed by T3 as 42.94±1.00 kg, T2 as 43.03±0.50 kg and T1 as 40.74±0.59 kg respectively.

The mean body weights (kg) of kids whose does were supplemented with extra concentrates with or without probiotics have been summarized in Table 3. The average birth weight of T2, T3 and T4 was significantly higher than T1 group (Control). Average birth weights of kids were 2.66±0.923, 3.16±0.073, 3.18±0.11 and 3.31±0.69 kg for T1, T2, T3 and T4 respectively. Average weekly and fortnightly body weight of T2, T3 and T4 was significantly ($p<0.05$) higher as compared to T1 treatment group (Control). However, no significant difference was observed between T2, T3, and T4 treatment groups. The average weaning weights of different treatment groups were 9.24±0.23, 12.32±0.54, 13.32±0.22 and 13.20±0.16 kg for T1, T2, T3 and T4 respectively.

Table 3. Mean (±SE) body weight (kg) of kids of the does supplemented with extra concentrates with or without probiotics

Age in days	Treatment groups			
	T1	T2	T3	T4
0	2.66±0.92[a]	3.16±0.07[b]	3.18±0.11 [b]	3.31±0.69 [b]
7	3.50±005[a]	4.18±0.08 [b]	4.50±0.13 [b]	4.48±0.10 [b]
14	4.66±0.31 [a]	5.66±0.29 [b]	6.02±0.21 [b]	5.66±0.11 [b]
21	5.26±0.38[a]	6.32±0.19[b]	6.74±0.14[b]	6.80±0.18 [b]
28	5.92±0.42 [a]	7.32±0.29 [b]	7.90±0.18 [b]	7.94±0.17[b]
45	6.50±0.29[a]	8.32±0.32[b]	8.74±0.25[b]	9.10±0.26[b]
60	7.72±0.24[a]	10.04±0.33[b]	10.70±0.54[b]	10.72±0.15[b]
75	8.18±0.26[a]	11.16±0.44[b]	11.30±0.34[b]	11.84±0.24[b]
90	9.24±0.23[a]	12.32±0.54[b]	13.32±0.22[b]	13.20±0.16[b]

Mean with a different superscript in a row differ significantly ($p<0.05$)

Table 4. Mean (±SE) monthly average weight gain (g/day) of kids of the does supplemented with extra concentrates with or without probiotics

Treatment	0-30 days	30-60 days	60-90 days
T1(Control)	108.33±1.78[a]	60.00±0.98[a]	50.66±1.20[a]
T2	138.66±1.34[b]	90.66±0.76[b]	76.00±0.39[b]
T3	154.13±1.98[b]	92.66±0.73[b]	87.33±1.39[b]
T4	157.33±0.74[b]	93.33±0.44[b]	82.66±0.03[b]

Mean with a different superscript in a column differ significantly

Table 5. Economics of kids of the does supplemented with extra concentrates during periparturient period with or without probiotics

Group	A.C /day (g)	A.P/ day (g)	T.C.C (Rs.)	T.C.P (Rs.)	I.P.C (Rs.)	W.G (kg)	O.P.C (Rs.)	N.P.W (Rs.)
T1	-	-	-	-	-	-	-	-
T2	150	-	162	-	162	2.58	516	354
T3	150	2.50	162	75	237	3.56	712	475
T4	150	4	162	120	282	3.31	662	380

A.C= Additional concentrates; A.P= Additional probiotics; T.C.C= Total cost of concentrates; T.C.P= Total cost of probiotics; I.P.C= Input cost of supplementation; WG= Weight gain; O.P.C= Output cost in terms of additional weight at weaning; N.P.W= Net profit at weaning

Mean monthly average weight gain (MAVG) (g/day) of kids whose doses were supplemented extra concentrates with or without probiotics have been summarized in Table 4. Monthly AVG of the kids were found to be significantly (P<0.05) higher in T2, T3, T4 than T1 (Control) treatment group during 30, 60 and 90 days. However there was no significant difference between T2, T3 and T4 treatment groups. Monthly AVG at 60-90 days was highest for T3 87.33±1.39g/day and lowest in T1 (Control) group as 50.66±1.20 g/day.

The economics of kids whose does were supplemented with extra concentrates with or without probiotics have been summarized in Table 5. Net profit at weaning was highest in T3 as Rs. 475.00 followed by T4 (Rs. 380.00) and T2 (Rs. 354.00).

DISCUSSION

The results regarding bodyweight of does are in agreement with other workers. Kerketta *et al*. (2017) reported higher body weight of periparturient does supplemented with concentrate in field conditions. Pathan *et al*. (2017) reported that growth rate of stall feeding with concentrate supplementation group and browsing with concentrate supplementation group was significantly (P<0.05) higher than (Control) browsing group goats. The results regarding the bodyweight of kids as found in the present study are well supported by the findings of Kerketta *et al*. (2017), who found that the average bodyweight of kids was significantly (P<0.05) higher in steamed up group compared to non-steamed group under field conditions. Murniati *et al.* (2015) also reported that birth weight was higher in higher concentrate supplemented groups as compared to control. Ocak *et al*. (2005) reported that the lambs born from ewes fed a high level of crude protein (1.4 times maintenance) in their diet during late gestation had higher birth weights (4.9±0.1 kg versus 4.3±0.1 kg; P≤0.05) than those from ewes fed the normal maintenance level of crude protein. The results of the present study can be explained on the basis of extra nutritional requirements of the does during the periparturient period which may be sufficed through supplementation, resulting in higher birth weights of kids. Further, during the immediate post-partum period, the kid is more dependent on the doe in terms of its nutrition. Thus kid can be expected to perform better if the milking performance of its doe is adequate.

The monthly AVG at 60-90 was highest for T3 87.33±1.39 g/day and lowest in T1 (Control) group as 50.66±1.20 g/day. The results of the present study are well supported by the findings of Chaturvedi *et al*., 2009 who reported a higher value of average daily gain of lambs in the nutrient supplementation group than the non-supplemented group. Kerketta *et al*. (2017) found that kids suckled from higher concentrate supplemented goats attained higher average daily gain up to three months of age. Ocak *et al*. (2005) reported that their average daily weight gain was significantly ($p<0.05$) higher in higher concentrate supplemented groups than the control. In contrast to the present study Dabiri *et al*. (2016) found that the average daily gain of suckling lamb was higher in the high level probiotic (*Saccharomyces cerevisiae*) supplemented group than control and low level probiotic groups.

The cost of extra concentrate and probiotic fed to the does during the study period (one month pre-partum to one month post-partum) was equated against the additional weight achieved by kids at weaning. The cost of concentrate (pelleted feed) offered to the does during the study period was Rs. 18/kg and probiotic of Rs. 500/kg, while the market value of chevon (live weight basis) was Rs. 200/kg. Net profit at weaning was highest in T3 as Rs. 475.00 followed by T4 (Rs. 380.00) and T2 (Rs. 354.00). Similar findings were reported by Guru *et al.* (2004), Haddad *et al.* (2005) and Rastogi *et al.* (2006) who reported that supplementation of extra concentrate in ewes during the peri-parturient period (late gestation and early lactation) increased the profitability in terms of the additional weight achieved by the lambs at the time of weaning.

The supplementation of extra concentrates with a low level of probiotics in does during the periparturient period results in an improvement in body weights of does and their kids, and this practice is feasible on economic lines.

Conflict of interest: Authors have no conflict of interest in this study.

Author's contribution: AF: Carried out the research work; RAP and MTB: Conceptualized the idea; SA, HMK, GGS and MA: Helped during the trial; SR: Helped in the collection of data.

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