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Enhancement of production of Pashmina goats by mineral and nutrient supplementation in Changthang region of Ladakh

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ABSTRACT

The present study was designed to determine the effect of mineral and nutrient supplementation on Pashmina production of *Changthangi* goats and birth weight of their kids in cold arid region of Changthang, Ladakh. Bucks (24) of same age and body weight were selected and divided randomly into four groups of 6 animals each to access pashmina production. Similarly, in 2nd experiment, pregnant does (24) were randomly selected and divided into four groups of 6 animals each to access the birth weight of their kids. The bucks and does were 2 to 3 years of age with average body weight of 40±2.87 kg. Experimental feeding was done for 60 days which was started in December month for both experiments. Each group in both experiments was assigned with four treatments namely T_0, T_1, T_2 and T_3. The goats in the control group (T_0) were fed with basal ration as per farmers practice, without nutrient and mineral supplementation. The goats of the treatment group (T_1) received only mineral supplement (agrimin forte supplement @ 10 g/day) without nutrient supplement in addition to basal ration. The T_2 and T_3 group received agrimin forte supplement @ 10 g/day with concentrated feed supplement in pellet and mashed form respectively @ 250 g/day. The pashmina production in T_0, T_1, T_2 and T_3 groups was recorded to be 221.33±3.33, 244.84±2.26, 247.66±5.58 and 246.0±5.46 g, respectively. In comparison to the control group, all the supplemented groups produced significantly higher pashmina. The birth weight of kids in T_0, T_1, T_2 and T_3 groups was 2.85±0.08, 3.08±0.07, 3.39±0.1 and 3.66±0.07 kg, respectively. T_3 group showed significantly higher birth weight of kids than the other groups. On the basis of these results, it can be concluded that the supplementation showed a positive effect on pashmina production of bucks as well as on birth weight of kids of supplemented does.

Key words: Changthang, Pashmina goats, Supplement

The Changthang region in the Indian Trans-Himalayan area of Ladakh represents the western extension of the Tibetan Plateau, an important highland grazing ecosystem. The livestock population is on the rise in all over Changthang. The increase is most dramatic in case of goats, preferred by Changpas (Ahmed 2004) presumably in response to the increasing demand for cashmere wool as the domestic goats of Changthang reportedly produce the finest cashmere wool or Pashmina in the world. Agricultural farming in cold arid region of Changthang is practiced on a limited scale due to scanty and uncertain rains and shortage of irrigation water leaving most of these regions to be used as rangeland grazing and plant productivity is also very low (Rawat and Adhikari 2005). Maintenance of pashmina flocks was possible only through a skillful organisation of the migration movements to avail pastures in certain niche or at certain times in the particular environment of the highest altitude cold desert of Changthang. Pashmina goats raised under these conditions generally graze on these degraded rangelands and are offered low quality fibrous feedstuffs like cereal straws and stubbles. Their feeding is facing serious difficulties related to quantitative and qualitative provision of nutrients in Changthang. Mineral nutrition of ruminant is a chronic problem since most forage plants contain varying levels of micro-minerals. Mineral requirement of goats are not fully understood or investigated and established requirements are extrapolated largely from information of cattle and sheep. In order to establish guidelines and to recommend the farmers of the area, the present study was carried out to determine the effect of mineral and nutrient supplementation on pashmina production of bucks and birth weight of the kids of pashmina goats.

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MATERIALS AND METHODS

The study was conducted in cold arid region of Changthang, Ladakh located 4,250 m mostly above sea level

where the highest altitude Krishi Vigyan Kendra of India, Nyoma exists. The area lies approximately between 36° 10' to 36° 60' N and 77° 55' to 78° 20' E with maximum dry season. The temperature in Changthang during summer (from April to September) varies from 6.1° to 23.2°C with the highest average of 17°C in July-August. During winter months, temperature decreases far below the freezing point around –35°C. The concentrated feed in pellet and mashed form was purchased from a recognised Mountain Livestock Research Institute Feed Plant Manasbal (SKUAST Kashmir Feed), Safapora district, Ganderbal, J&K along with mineral mixture, agrimin forte. The composition of supplements (% inclusion by weight) in our concentrated feed is presented in Table 1.

Table 1. Composition of supplements (% inclusion by weight) in our experimental feed in pellet and mash form

Ingredient	Concentrate mixture (pellet and mash)
Maize	17
Wheat bran	20
Deoiled Rice bran	20
Mustard oil cake	19
Rice bran	15
Molasses	5
Urea	2
Salt	1
Mineral mixture*	1

*Per kg of mineral mixture (Agrimine forte) provides Vitamin-D, 70,000 IU; Vitamin-A, 700,000 IU; Vitamin-E, 250 mg; Cobalt, 150 mg; Copper, 1,200 mg; Iodine, 325 mg; Iron, 1,250 mg; Magnesium, 6,000 mg; Potassium, 100 mg; Sodium, 5.9 mg; Manganese, 1,250 mg; Sulphur, 0.72%; Zinc, 9,600 mg; DL-Methionine, 1,000 mg; Calcium, 25.5% and Phosphorous 12.75%.

Bucks (24) of same age were selected and divided randomly into four groups of 6 animals each, to access their pashmina production. Similarly, in the 2nd experiment, pregnant does (24) were randomly selected and divided into four groups of 6 animals each to access the birth weight of their kids. The bucks and does were 2 to 3 years of age with average body weight of 40±2.87 kg. The age was determined by dentition, and the animals having 4 or more permanent incisors (adult) were included in the study. Experimental feeding was done for 60 days which was started in December month in both the experiments. Experimental animals met their nutrient requirements for maintenance and growth from grazing pasture lands as per their basal ration requirements. *Ad lib*. access to water was maintained throughout the study. Animals were maintained under uniform management conditions. The housing was well ventilated with adequate facilities for individual feeding. Each group in both experiments was assigned with four treatments namely T_0, T_1, T_2 and T_3. The goats in the control group (T_0) were fed with basal ration as per farmers practice, without nutrient and mineral supplementation. The goats of the treatment group (T_1) received only mineral supplement (agrimin forte supplement @ 10 g/day) in addition to basal ration without nutrient supplement. The T_2 and T_3 group received agrimin forte supplement @ 10 g/day with concentrated feed supplement in pellet and mashed form respectively @ 250 g/day as per NRC (1981) recommendations of feed standard. The experimental animals were supplemented in the morning at 6:00 hours once in a day. The kidding season of pashmina does is March month and birth weight of kids from each doe was recorded with weighing balance. Simultaneously, the harvesting season of pashmina from *changthangi* goats is June month in Changthang region of Ladakh and pashmina production from each buck was recorded. The birth weight of kids as well as pashmina production was subjected to analysis of variance to determine their significant variation of recorded data. One-way analysis of variance ANOVA (Snedecor and Cochran 1989) was applied for the data and values of $P<0.05$ were considered to be statistically significant. The analysis was executed by using SPSS 11.

RESULTS AND DISCUSSION

The average pashmina production of the 2nd treatment group (T_2) was recorded to be highest on mean basis (Table 2). Similarly, in T_1 and T_3 treatment groups, the production was 244.84±2.26 g and 246.0±5.46 g, respectively. The production in control group was least and found to be 221.33±3.33 g. The results showed that the mineral and nutrient supplementation had increased the production of pashmina in bucks by 20–25 g. Das *et al.* (2012) studied the effect of supplementation of concentrates and reported that provision of 150 g concentrate mixture significantly improved growth performance of Ganjam goats attributable to a more efficient utilization of the native pasture. The statistical analysis was done which revealed that all the supplemented groups showed significant ($P<0.05$) increase in pashmina production in comparison to the control group. It was also observed from the experiment that the pashmina production rise of all the treated groups respond equally for agrimin forte alone as well as mineral and feed supplement in combination. So, there were no interaction effects between the mineral and nutrient supplementation on the pashmina production of bucks. Farm made concentrates (FC) improve smallholder dairy cattle performance (Jingura and Sibanda 1998). However, farmers rarely supplement their cows with protein concentrates because of the high cost of supplements. Anderson (1978) reported that inclusion of supplementary energy in the form of essential nitrogen and other essential nutrient and protein in diet enhances the ability of poor quality roughages to provide adequate energy in beef cattle. Jadhav *et al*. (2011) conducted the study to assess the effect of feeding local unconventional feed ingredients on performance and blood biochemical profile of lambs at high altitude cold arid conditions of Ladakh. They found that feeding of local unconventional feed ingredients in complete feed of lambs had no adverse effect on performance and blood biochemical profile of lambs. On contrary, feeding of these ingredients in complete feed provided adequate nutrition

to support normal body growth of lambs indicating that these ingredients are futuristic potential feed resources for animals at high altitude cold arid regions of Ladakh. Das *et al.* (2012) studied the growth, nutrient utilization and rumen fermentation pattern in growing mithun (*Bos frontalis*) calves fed on different levels of dietary protein. They concluded that male growing mithun calves may be reared with the rice straw based diet containing minimum protein level of 80 g/kg dry matter.

In the 2nd experiment, the results showed that average birth weight of kids in the T_3 group was highest than the other groups (Table 2). Mude *et al.* (2010) also observed that the supplementation of mineral mixture @ 15 g/day orally for 60 days during advance stage of pregnancy in does increased survival per cent of kids and reduced post-parturient complications during kidding than non-supplemented group. From 4 week before parturition until weaning, the doe or ewe will consume 60% of the nutrients required in a year, therefore, it is important to provide as much nutrition as possible during this time from grazed forages as was done in our experiment, the supplement was given in advanced pregnancy. The birth weight of kids in control group (T_0) differ non-significantly from T_1. However, the results of T_0 and T_1 vary significantly ($P<0.05$) from T_2 and T_3 as shown in Table 2. These observations revealed that the increase in birth weight of kids of treated pregnant does depends more upon the inclusion of supplementary energy in the form of essential nitrogen and other essential nutrient and protein in diet of nutrient supplement of feed which was given in our experiment in the form of pellet and mash as compared to mineral supplementation. Varriko *et al*. (1992) found that supplementation of a basal natural grass hay with Leuceana, cowpea and tagasaste resulted in increased weight gains for young friasian and zebu crossbred steers. It was observed that the results between T_2 and T_3 treatment groups showed a non-significant difference (Table 2) but recorded to be highest in (T_3) mashed form group (3.66±0.07 kg). Thus mashed form of feed remain most suitable for the pregnant does to be fed in Changthang area along with mineral supplement so that that the birth weight of kids will increase significantly. It was observed from our experiment that the birth weight of kids of pregnant does among all the treated groups responded unequally for agrimin forte treatment alone and mineral and feed supplement treatments in combination, as there was observed significant increase of birth weight of kids in nutrient and mineral treated groups (T_2 and T_3) as compared to (T_1) mineral treated group. The proximate analysis of feed fed to goats was calculated according to method of McDonald *et al.* (2011) and was recorded as 11% moisture, 17% crude protein, 12% crude fibre, 3% ether extract, 4% acid insoluble ash and 2,600 Kcal/kg metabolic energy which indicated that timely provision of supplements such as minerals and/or protein can increase intake and digestibility of available forage, mitigating need for additional supplementation which in turn positively affected the pashmina production and birth weight of kids. Several studies have suggested that organic trace minerals improve various indices of reproduction in cows, including an increase in pregnancy percentage (Nocek *et al*. 2006), a reduction in open days and services per conception (Kellogg *et al.* 2003). Kachue *et al.* (2013) while supplementing the diet of goats in the last stage of pregnancy with Selinium in the form of L-selenomethionine (Se-Met) or sodium seleniate, obtained a slightly higher content of this element in colostrum in case of supplementing the diet with Se in the form of Se-Met. It is worth emphasizing that supplementation of cow diet with Se contributes to proper development of foetuses and increased activity of the immune system, which results in the increase in immunity of new born calves to infectious diseases and thus in the increased effectiveness of their rearing.

Table 2. Average pashmina production of bucks in grams (g) and average birth weight of kids of does in kilograms (kg) fed with mineral and nutrient supplements.

Treatment group	Average pashmina production	Average birth weight of kids
T_0	221.33^{a}±3.33	2.85^{a}±0.08
T_1	244.84^{b}±2.26	3.08^{a}±0.07
T_2	247.66^{b}±5.58	3.39^{b}±0.1
T_3	246.00^{b}±5.46	3.66^{b}±0.07

Values (Mean±SE) bearing different superscripts in column differ significantly from each other.

Increased resource use of Changthang region is necessary and there is a need to target ruminant production systems and the opportunities to improve productivity by per animal performance. The principle aim should therefore be to intensify the use and efficiency of the feed resources, in which the benefits should be identified. Farmer should also not underestimate the availability of minerals among the available nutrients in the grazing areas of Changthang plateau, although the needs of the animals are in small amount. The Changthang is a fodder scarce area and our recommended policy is to manage rangeland grazing areas although they are of poor quality but our mineral and nutrient supplementation will gain the benefits and economics upto the limit that Changpas (nomadic pastoralists) will go for it.

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