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RESEARCH ARTICLE

Improving the Weight Gain of Sinhal Goat in Winter Season by Feeding Different Types of Hay in Jumla District of Nepal

Hem Raj Dhakal[1]*, Mohan Prasad Yadav[1], Anu Duwal[2]

[1]Sheep and Goat Research Program (SGRP), Guthichaur, Jumla, Nepal, [2]Bangladesh Agricultural University, Mymensingh, Bangladesh

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ABSTRACT

An experiment was conducted on 18 growing female Sinhal goats at Sheep and Goat Research Program, Guthichaur, Jumla (2700 masl) for 90 days (from December 1, 2017, to February 30, 2017) with an aim of "improving the weight gain of goats in dry winter." Female goats of average 8 months of age having a body weight of 15.5 kg were allocated into three groups having six replications using complete randomized design. The animals were supplied with three different rations, namely, (T_1) *ad-libitum* cocksfoot hay + concentrate feed @1.5% of body weight (T_2) ad-libitum conventional hay + concentrate feed @1.5% of body weight, and (T_3) grazing in a moderate pasture with concentrate feed @1.5% of body weight. The nutrient composition of cocksfoot hay, conventional hay, and concentrate was 16.81 CP, 15.32 CP, and 6.91 CP, respectively. Data were recorded in MS excel and analyzed using r software. Animals were dewormed against internal parasites with fenbendazole @5 mg/kg body weight before the experimental trial. The experimental animals were placed in a house partitioned into individual pens that are equipped with feeding troughs and watering buckets. Results revealed that fortnightly mean weight gain in 15 days, 30 days, 45 days, 60 days, 75 days, and 90 days of experiment was found significantly different ($P < 0.05$) for all treatment groups. In 15 days, the highest value was observed in T1 (25.92 g) and the lowest in T3 (11.23 g). A similar result was also observed in 30, 45, 60, 75, and 90 days. The total average daily gain was also found significantly different ($P < 0.05$), in which, the highest data were recorded in T_1 (33.56 g) and lowest in T_3 (21.71 g). Likewise, total weight gain was also found significant ($P < 0.05$) among the diet groups where the highest data were recorded in T_1 (3.02 kg) and the lowest in T_3 (1.95 kg). Finally, the study concluded that the inclusion of cocksfoot hay in the goat diet in the dry harsh winter season could make a substantial improvement in body weight gain in the highlands of Nepal.

Key words: Average daily gain, cocksfoot, hay, Sinhal

INTRODUCTION

The economy of High Mountain is primarily dependent on animal husbandry. Livestock is more dominant in the hills and mountains than in Terai. Rugged topography, cold climate, and poor irrigation have limited agricultural production to single crop per year, sometimes even two crops in 3 years, and productivity is also low. Food deficit is, therefore, rampant in mountains. With very limited opportunity for crop production, livestock production thus can play a significant role in food security. The livestock sector contributes almost half of the total agriculture income, that is, 47% of the mountain livelihood.[1]

The goat is one of the most important ruminant animals for the livelihood of the hill and mountains of Nepal. The population of goats in the country is estimated to be 9.18 million with a distribution of 1.2 million (13.07%) in the mountain and 4.65 million (50.70%) in the hills.[2] During the past

Address for correspondence:
Hem Raj Dhakal
E-mail: dhakalhemraj44@gmail.com

10 years, among ruminants goat has the maximum annual growth rate of 2.80%.[3] Mountain goats are mostly Chyangra and Sinhal types grown up to 3000 m above sea level. Sinhal is grown for meat and manure. Of the four indigenous goat breeds, Sinhal is the heaviest and second most abundant goat (35%) with an average adult body weight of 42 kg for males and 34.8 kg for females.[4] Sinhal and Chyangra goats are declining in numbers and have not been fully utilized to exploit their potential. Mountain goats are good grazing instincts and are suitable for the migratory system. Goat meat (chevon) is an excellent protein source and provides important minerals such as iron and zinc.[5,6] It is generally known that raising young animals on high concentrate diets results in higher daily gains, dressing percentage, and carcass quality than on a forage system.[7] The productivity of goats can be improved by improving their nutrition either concentrate feeding or provision of additional forage. Feeding and management systems affect on productivity of animals. During the winter at high hills, there is very cold, and cannot be fed sufficiently under the traditional grazing management system.[6] Hay is the typical diet for ruminant animals during this time. Most of the farmers follow the grazing and fed a little amount of conventional hay to the goat. During the cold season, grazing animals survived from inadequate herbage, low temperature, and cold environment as a result, low growth rate and even death of grazing livestock.[8] If additional concentrate or quality forage is not provided, weight gain may be in minus during the winter season at the high hill. Feed efficiency and the off-take rate of livestock were quite low under traditional grazing management.[9] Therefore, the study was conducted to evaluate the effects of feeding different types of hay n the growth of Sinhal goats in the winter season for the better improvement of goat farming in Nepal.

MATERIALS AND METHODS

Location and Animals

This experiment was carried out at 2700 masl at Sheep and Goat Research Program, Guthichaur, Jumla, Nepal, for 90 days from December 1, 2019, to February 30, 2020, on 18 female Sinhal goats of 8 months of age. Female goats having an average weight of 15.5 kg were allocated into three groups having six animals in each group using a completely randomized design. Animals were dewormed against internal parasites with fenbendazole @5 mg/kg body weight before the experimental trial. The experimental animals were placed in a house partitioned into an individual pens that is equipped with a feeding trough and watering bucket. Animals were adapted to the experimental procedures and feeds for 7 days before the commencement of the trials.

Experimental Diets

Cocksfoot and conventional grasses were cut at 50% of flowering stage to make hay. The prepared cocksfoot hay and conventional hay were used for treatment Groups 1 and 2, respectively, and another group (Group 3) was allowed to graze. Grazing was usually done about 8 h a day. For all the animals, 1.5% on the basis of their body weight concentrate mixture was supplied.

Treatments details were:

- T_1: Feeding cocksfoot hay with concentrate 1.5% of the body weight
- T_2: Feeding conventional hay with concentrate 1.5% of the body weight
- T_3: Grazing with concentrate 1.5% of the body weight.

Data Measurement and Analysis

Initial live weight, monthly live weight, average daily gain (ADG), and total weight gain (TWG) were recorded. All the data obtained in the experiment were subjected to statistical analysis using r software for analysis of variance and Duncan's multiple range tests. The samples of feeds were sent to the Animal Nutrition Division, Khumaltar, Lalitpur for proximate analysis.

RESULTS AND DISCUSSION

Chemical Composition of Feeds

Table 1 indicates the chemical composition of feeds. It was found that among the dry roughages,

cocksfoot hay contained maximum crude protein (CP) as compared with conventional hay. Concentrate feed had 16% CP and 1% Ca. Low CP contained in conventional hay needed to support acceptable ruminal microbial activity and the production requirement of the host ruminant but there was no probability to supply additional CP on a fresh basis.

Growth Performance

Mean fortnight weight gain

The data on weight gain were presented in Tables 2 and 3.

The data revealed that the fortnightly mean weight gain of goats fed different types of hay was found statistically different ($P < 0.05$) in 15, 30, 45, 60, 75, and 90 days of the experiment. In 15 days, it was found the highest in T_1 ($25.92^{ab} \pm 2.6$) followed by T_2 ($19.87^{abc} \pm 1.3$) and the lowest in T_3 ($11.23^{bc} \pm 4.2$). A similar trend was found in 30 days, 45 days, 60 days, 75 days, and 90 days. In 30 days, the highest value (27.46 ± 3.01 g) was observed in goat-fed cocksfoot hay with concentrate @ 1.5% of BW (T_1) followed by T_2 (fed conventional hay with concentrate @ 1.5% of the BW) and the lowest (21.22 ± 8.91 g) was found in T_3 (conventional grazing with concentrate 1.5% of BW). In 45 days, the highest value was found in T_1 ($31.12^{ab} \pm 5.6$), followed by T_2 ($25.88^{bc} \pm 4.1$), and the lowest in T_3 ($23.61^{c} \pm 5.9$). In the same trend, in 60 days, the highest result was found in T_1 (35.42 ± 2.24 g) followed by T_2(28.01 ± 3.16 g) and the lowest in T_3 (25.88 ± 0.04 g). Likewise, in 75 days and 90 days, the highest value was in T_1 ($38.93^{a} \pm 9.1$ and 42.52 ± 9.12 g) followed by T_2 ($30.53^{b} \pm 8.3$ and 32.44 ± 3.42 g) and the lowest in T_3 ($24.12^{c} \pm 12.6$ and 24.25 ± 1.16 g), respectively.

Table 1: Chemical composition of feed

Content	DM	CP	NDF	ADF	Ca
Conventional hay	87.29	6.91	75.23	46.80	0.45
Cocksfoot hay	86.40	16.81	72.87	44.45	0.52
Concentrate	91.76	15.32	53.56	39.70	0.95

ADG (g) and TWG (Kg)

The data elucidated that ADG and TWG in different groups have significant differences ($P < 0.05$). The highest ADG (33.56 ± 4.68 g/day/goat) was obtained from feeding cocksfoot hay with concentrate @ 1.5% of BW (T_1) followed by (T_2) feeding conventional hay with concentrate @ 1.5% of BW (26.67 ± 2.76 g/day/goat) and the lowest (21.71 ± 4.99 g/day/goat)wasobtainedbyconventional grazing system (T_3). The highest TWG between groups (3.02 ± 0.12 kg/goat) was observed from the T_1 diet followed by the T_2 diet (2.40 ± 2.76 kg/goat) and the lowest (1.95 ± 6.22 kg/goat) by the T_3 diet.

The result was supported by many authors. Under the transhumance system in high hill, the body weight gain of Baruwal sheep of age at 12 months was 47.0 ± 0.6 g/day to 49.2 ± 0.09 g/day.[10] When only grazing on forages is provided, it may not be sufficient for optimum live weight gain.[11] When kids and lambs are raised on pasture, the available forage mass can influence intake, performance, and body weight.[12] Management options (feeding strategies and mating systems) including alternative breeding programs enhanced sheep and goat productivity.[13] An adequate amount of

Table 2: Fortnightly means weight gain of goat fed different types of ration

Treatments (three feeding regimes)	Fortnightly mean weight gain (g/day)					
	15 days	30 days	45 days	60 days	75 days	90 days
T_1	25.92^{ab}±2.6	27.46^{a}±3.01	31.12^{ab}±5.6	35.42^{a}±2.24	38.93^{a}±9.1	42.52^{a}±9.12
T_2	19.87^{abc}±1.3	23.26^{ab}±0.02	25.88^{bc}±4.1	28.01^{b}±3.16	30.53^{b}±8.3	32.44^{b}±3.42
T_3	11.23^{bc}±4.2	21.22^{b}±8.91	23.61^{c}±5.9	25.88^{c}±0.04	24.12^{c}±12.6	24.25^{c}±1.16
Grand mean	19.01±5.4	23.98±5.42	26.87±2.7	29.77±3.91	31.19±8.5	33.07±6.34
P value	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CV%	3.54	5.12	3.12	7.88	9.76	11.09
LSD (0.05)	6.67	8.86	12.81	8.7	8.97	3.24
SEM±	0.92	1.12	0.56	1.11	3.43	1.90

T_1: Cocksfoot hay + Concentrate @1.5% of BW, T_2: CONVENTIONAL hay + Concentrate @1.5% of BW, T_3: Grazing + Concentrate @1.5% of BW, CV: Coefficient of variation, LSD: Least significant difference, SEM: Standard error of the mean and NS: Non-significant. Superscripts a, b, and c means significant values within the rows.

Table 3: ADG and TWG of goat fed different types of ration

Treatments (three feeding regimes)	ADG (g)	TWG (kg)
T_1: cocksfoot hay+Concentrate @ 1.5% of BW	33.56^{a}±4.68	3.02^{a}±0.12
T_2: Conventional hay+Concentrate @ 1.5% of BW	26.67^{b}±2.76	2.40^{b}±2.76
T_3: Grazing+Concentrate @ 1.5% of BW	21.71^{c}±4.99	1.95^{bc}±6.22
Grand mean	27.31±3.65	2.45±1.98
P value	<0.05	<0.05
CV%	4.45	9.45
LSD (0.05)	6.87	0.68
SEM±	2.01	0.23

ADG: Average daily gain, TWG: Total weight gain, CV: Coefficient of variation, LSD: Least significant difference, SEM: Standard error of the mean, and NS: Non-significant. Superscripts a, b, and c means significant values within the rows

roughage is necessary in total mixed ration for proper structural and functional development of the rumen.[14] A higher dressing percentage (42.2 vs. 36.8%) was found from housed than extensively reared goats.[15] Average dressing percentages were 42.18, 39.0, 36.79, and 34.0 for stall feeding, tethering, restricted grazing, and grazing groups, respectively.[15] Concentrate feeding to small ruminants (goats and sheep) improved their body weight and maintained condition in the migratory system.[16] Stall feeding had a better growth rate of kids than the open grazing system of rearing. Under stall-fed conditions, average weight gain ranged from 8.67 g/day to 11.33 g/day whereas in the open grazing system, weight gain was 4.87 g/day to 8.33 g/day in different belts.[17]

CONCLUSION

The result revealed that feeding cocksfoot hay was more profitable as compared with the conventional system of grazing and feeding conventional hay. The inclusion of cocksfoot hay in the goat diet in the dry harsh winter season could make a substantial improvement in the body weight gain of the goat in the high altitude.

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