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Effect of Heat Treated Soybean Cake Feeding on Growth Performnce of Growing Female Goats in Fodder based Basal Diet

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Abstract - Growth comparison of goats fed with treated and none treated soybean cake is not evaluated so far in Nepal. Therefore, an experiment was carried out on eighteen growing female goats (50% Jamunapari 6, 50% Barberi 6 and Kiko goats 6) at the Agriculture Research Station (Goat), Bandipur for 90 days after an adaptation period of 7 days. Female goats of average five months age having body weight 11.86 kg were allocated into three groups having six animals in each group by using Complete Randomized Design (CRD). For T_1 and T_2 concentrate mixture were composed by using procured feed ingredients with 16% crude protein level while T_3 was fed with commercial feed. Experimental animals of T_1 group was provided forest mixed fodder (adlib) + treated soybean cake included concentrate mixture @ 1.5% of body weight, T_2 group was provided forest mixed fodder (adlib) + untreated soybean cake included concentrate mixture @ 1.5% of body weight whereas T_3 was provided forest mixed fodder (adlib) + commercial concentrate mixture @ 1.5% of body weight. Experiment revealed that higher intake of concentrate feed was recorded for T_1 (207.6 g) followed by T_3 (199.58 g) and T_2 (193.87 g) which was highly significant ($P<0.001$) among diet groups.

Keywords : *goats, bypass protein feeding.*

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Keywords : goats, bypass protein feeding.

I. Introduction

Goats are important domestic animals in many parts of the world. In the developing countries, goats make a very valuable contribution, especially to the poor in the rural areas. The importance of this valuable genetic resource is underestimated and its extent of contribution to the livelihood of the poor is inadequately understood. Goats are efficient browsers and prefer eating brushy plants along with some other weedy plants found on the ranges. Nevertheless, goats are going to be more important source of livelihood for many more people in coming years and, thus, they deserve greater attention at both the micro and macro levels. Now, it is the time to consider and pay attention to the value and capacity of goats for producing food (Aziz 2010). Neopane and Pokharel (2008) reported that most of the farmers of western hills are rearing Khari goats, crossbred of Khari x Jamunapari and Khari and Barberi). Goat population of Nepal is estimated to be 9.19 million. Out of 9.19 million, goat population of western hills is 1.13 million which account 12.32% of total goat population that producing 5284 mt meat per annum (10% of total goat meat production) (MoAD 2012).

Oil seeds cakes and meals are the residues remaining after removal of the greater part of the oil from oil seeds. The residues are rich in protein and most are valuable feeds for farm animals. Most oil seeds are of tropical origin, they include groundnut, cottonseed, soya bean, mustard, til etc (Bajjlieh 2002). Soybean cake has an average protein content of 40% and oil content of 20% and 2500 to 2800 kcal of metabolizable energy per kilogram. It also has a superior amino acid profile. Soybean protein has great potential as a major source of dietary protein. A by-product from the oil production (soybean cake) is used as a high-protein animal feed in many countries. Moreover, soybean protein is rich in lysine, methionine, valine, and isoleucine. The protein content of soybean tend to be 75 to 80% degraded in the rumen (Broderick *et al*. 1988; Promkot and Wanapat 2003), which restricts its inclusion in diets for high-yielding ruminants.

The protein content in diets of ruminant animals is essential for growth and production requirements. Possibility that reasonable portions of high quality protein of feedstuffs may be degraded in the rumen is occurred, which negatively affect animal utilization of the feed. In this context, there are several methods for protection of dietary protein from degradation in the rumen (EL-Shabrawy 1996). The heat treatment is

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known one of the methods to increase the protection of the proteins. During the process of manufacturing oil seed meals, they are subjected to different degree of heating which partly explains differences in the degree of protection. Thorough heating of protein supplement causes denaturation of protein; it provides effective protection against microbial fermentation in the rumen. Heat treatment of protein meal at 125- 150^0 C for 2-4 hours improves the bypass protein. The main benefit of "*bypass*" protein is that the original amino acids in the protein meal are absorbed in the small intestine instead of converted into microbial protein in the rumen, thereby providing a different balance of essential amino acids for better animal nutrition hence, production (Schroeder 1997).

Growth comparison of goats fed with treated and none treated soybean cake is not evaluated so far in Nepal. Hence, a study was carried out to compare the growth performance of growing female goats fed with heat-treated and none treated soybean meal mixed concentrate mixture at Agriculture Research Station (Goat), Bandipur, Tanahun.

II. Methodology

a) Experimental Animals

This experiment was carried out on eighteen growing female goats (50% Jamunapari 6, 50% Barberi 6 and Kiko goats 6) at Agriculture Research Station (Goat), Bandipur, Tanahun from 29 November 2012 to 25 March 2013 (069/8/14 to 069/11/14). Female goats of average five months old with average body weight of 11.86 kg were allocated into three groups having six animals in each group by using Complete Randomized Design (CRD). They were drenched with Fenbendazole @ 5 mg/kg body weight against internal parasites before assigning in experiment.

b) Concentrate Mixture Composition

Feed ingredients maize, soybean cake, rice bran, minerals and salt were procured from Khowpa Feed Industry, Bhaktapur. For T1 and T2 concentrate mixture were composed by using procured feed ingredients with 16% crude protein level that has been presented in Table 1 while for T3 commercial compound feed was used made by Pancharatna Feed Industry, Narayangadh, Chitwan.

Table 1 : Composition of concentrate mixture

S/n	Ingredients	T 1		T2	
		Part	Crude Protein (%)	Part	Crude Protein (%)
1	Maize	50	3.94	50	3.94
2	Soybean cake	28	10.7	28	10.7
3	Rice bran	20	1.77	20	1.77
4	Mineral mixture	1	0	1	0
5	Salt	1	0	1	0
Total		**100**	**16.41**	**100**	**16.41**

c) Heat treatment of soybean cake

The drying of forage is known to increase the protection of the proteins. Thorough heating of protein supplement causes denaturation of protein; it provides effective protection against microbial fermentation in the rumen. Heat treatment was done by using hot air oven at temperature 125- 150^0 C for 2-4 hours as suggested by Suresh, *et al* (2009).

d) Experimental diet of the animal

The dry matter requirement of goats was calculated based on 5 kg per 100 kg body weight. Following diets were formulated to the experimental animals (Table 2).

Table 2 : Experimental diets of the animals

Treatment	Experimental diet
1	Forest mixed fodder (adlib) + treated soybean cake included concentrate mixture @ 1.5% of body weight
2	Forest mixed fodder (adlib) + untreated soybean cake included concentrate mixture @ 1.5% of body weight
3	Forest mixed fodder (adlib) + commercial concentrate mixture @ 1.5% of body weight

e) Feeding Regime

Concentrate mixture and *adlib* amount of fodder was provided to the experimental animals individually in plastic vessel. Concentrate mixture was provided once a day in the morning whereas fodder twice a day (morning and evening). Quantity of concentrate mixture and fodder given daily to the animals was weighed daily and refusal was weighed in next morning. Experimental animal had free access to drinking water.

f) Chemical Analysis

The samples of feed ingredients, prepared concentrate mixture and forest mixed fodder were sent to the Animal Nutrition Division, Khumaltar, Lalitpur for proximate analysis. Representative samples were analyzed for dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE) and total ash contents (TA). The DM was determined by oven drying at 100°C for 24 hrs. Crude protein of the samples was determined using the Kjeldahl method. Ether extract was determined using Soxhlet apparatus. Ash content was determined by ashing at 550°C in a muffle furnace for 16 hrs (AOAC 1980). Crude fibre of the samples was determined using the Van Soest method (Goering, H.K. and Van Soest 1970).

g) Results Recording

The trial period consisted 90 days after an adaptation period of 7 days. Total feed intake by the goats was recorded daily for all experimental period. The body weight gain of individual animals was measured fortnightly in the morning before feeding.

h) Data Analysis

Data of feed intake and body weight gain were analyzed by "*One Way Annova*" test for every measurement using computer statistical package Minitab 2003, versions 13.20.

III. Results and Discussion

a) Chemical composition of feedstuffs

The result of chemical analysis has been given in Table 3 and crude protein content of prepared concentrate mixture was verified in laboratory that is presented in Table 4.

Table 3 : Chemical composition of different feed ingredients (percentage DM basis)

Ingredient	DM	OM	TA	CP	CF	EE
Maize	87.69	97.97	2.03	8.92	2.34	4.48
Rice bran	87.85	89.5	10.5	11.52	4.83	5.1
Soybean cake	86.87	92.63	7.37	44.29	9.38	0.7
Mixed forest fodder	39.94	90.01	9.99	11.16	NA	NA

The calculated value of crude protein was verified with laboratory analysis, which is presented in Table 4.

Table 4 : Chemical composition of prepared concentrate mixture (% DM basis)

Particular	DM	OM	TA	CP	CF
Treated soybean cake included concentrate mixture	91.92	92.54	7.46	16.83	5.95
Untreated soybean cake included concentrate mixture	91.58	92.10	7.90	16.92	5.64
Commercial feed	90.74	89.85	10.15	15.94	6.45

b) Feed Intake

Average daily intake of concentrate mixture and fodder by goats during experimental periods is given in Table 5. Higher intake of concentrate feed was recorded for T1 (207.6 g) followed by T3 (199.58 g) and T2 (193.87 g) which was highly significant ($P<0.001$) among diet groups. Similarly, fodder intake was also noted significantly higher ($P<0.001$) among diet groups (1969.5 g , 1967.6 g and 1942 g for T2, T3 and T1, respectively), however, dry matter intake was observed almost similar for all treatment group (89.53 kg, 89.33 kg and 89.28 kg for T3, T1 and T2, respectively). Feed and fodder intake of different genotypes of goats was found to be non-significant among goat breeds. In addition, feed conversion ratio per kg body weight gain was observed higher for T3 (22.49:1) followed by T2 (17.57:1) and T1 (16.24:1).

Table 5 : Feed intake of experimental animals/day/animal

Feedstuffs	Mean ± SD		
	T1	T2	T3
Feed intake (g)	207.6±57.96	193.87±45.70	199.58±35.15
Fodder intake (g)	1942.3±439.1	1969.5±440.4	1967.6±443.1
Total dry matter intake (DMI) (k)g	89.33	89.28	89.53
Feed conversion ratio (FCR)	16.24:1	17.57:1	22.49:1

c) *Growth Performance*

Growth is a complex; highly integrated process involving numerous interactions among nutrients, environment, genotype, and many different hormones and receptors of these hormones in various tissues (Spencer 1985).The growth performance of experimental goats is given in Table 6 and Figure 1. Initial body weight of T1, T2 and T3 was 12.15 kg, 11.25 kg and 12.18 kg, respectively that reached 17.66 kg, 16.33 kg and 16.40 kg during 90 days of experiment for T1, T2 and T3, respectively. Both initial and final body weight was non-significant among diet groups. Similarly, there was also non-significant effect of goat breed on body weight gain. Total body weight gain was recorded higher for T1 (5.50 kg) followed by T2 (5.08 kg) and T3 (3.98 kg) which was significant ($P<0.05$) among diet groups. Similarly, average daily gain was also noted higher in T1 (61.2g) followed by T2 (56.48 g) and T3 (44.22 g) which also significant ($P<0.05$) among diet groups.

Table 6 : Growth performance of goats

Parameter	Mean ± SD		
	T1	T2	T3
Initial Body weight (kg)	12.15±4.43	11.25±3.11	12.18±2.27
Initial metabolic weight (kg)	6.5	6.14	6.51
Final Body weight (kg)	17.66±4.48	16.33±3.03	16.40±2.56
Final Metabolic weight (kg)	8.61	8.12	8.14
Total weight gain (kg)	5.50±0.36	5.08±1.06	3.98±0.40
Average daily gain (g)	61.20±4.01	56.48±11.87	44.22±4.48

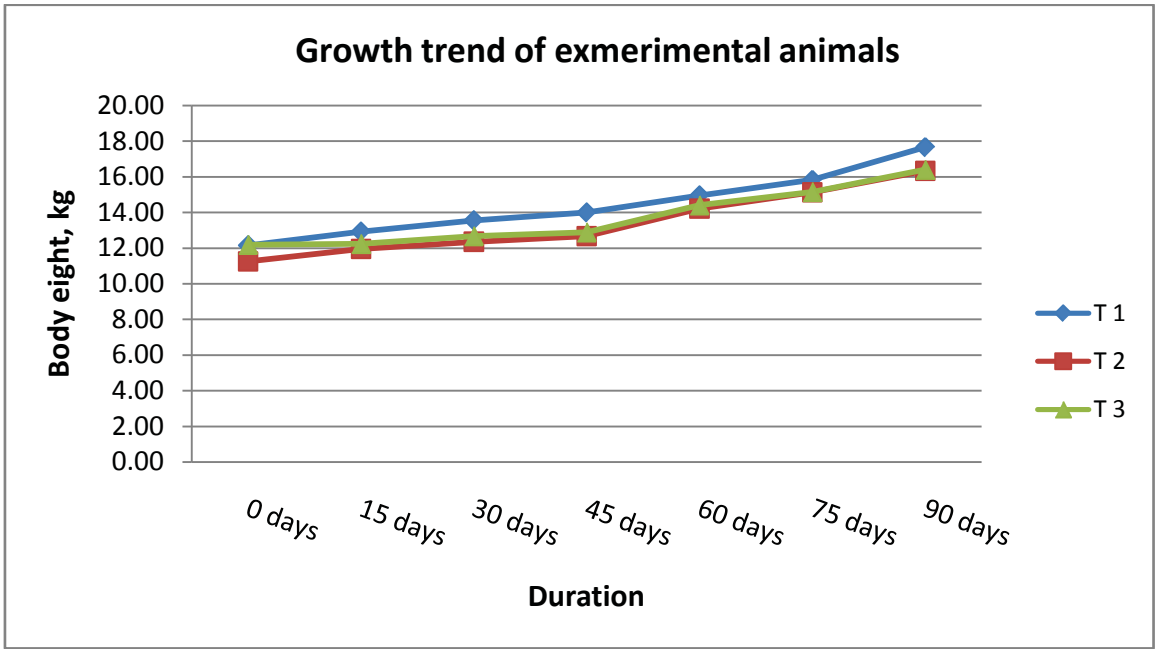

Figure 1 : Body weight gain trend of goats during experiment period

IV. Discussion

This study was initiated with objective to compare the growth performance of female goats of different breeds fed with treated, none treated soybean cake incorporated concentrate mixture, and commercial compound feed on fodder based basal diet. Result revealed that concentrate feed and fodder intake was highly significant ($P<0.001$) among diet groups. Both initial and final body weight was not significant among groups, however, total weight gain and average daily gain of experimental animals significantly ($P<0.05$) differed among diet groups. Similarly, result proved that there was not significant effect of breed in feed intake and body weight gain. This experiment revealed that heat treatment of soybean cake significantly improves the feed intake and body weight gain in comparison to without heat treatment.

Limea *et al.* (2011) tested the effects of a treated soybean cake incorporated concentrate diet on 32 Creole goats for growth, carcass fat, and fatty acid composition of muscle (supraspinatus), perirenal and intramuscular adipose tissues. Goats were fed a tropical green forage *Digitaria decumbens* ad libitum with no concentrate (G0) or 1 of 3 levels of concentrate: 140, 240 and 340 g/day, respectively. Goats were

slaughtered according to the standard procedure at the commercial body weight (22 to 24 kg). Goats fed the concentrate diets had greater average daily gain ($P < 0.001$), cold carcass weights ($P < 0.001$), perirenal ($P < 0.01$) and intramuscular ($P < 0.01$) adipose tissues weights. Feeding increased concentrate did not increase the content of any cholesterol-increasing saturated fatty acid in meat.

Sahlu *et al*. (2012) conducted an experiment on growing female angora goats with four treatment groups. Experimental animals were fed with low protein high degradability, 12% CP with conventional, solvent-extracted soybean meal; Low protein low degradability, 12% CP with expelled, heat-treated soybean meal; high protein high degradability, 19% CP with conventional, solvent-extracted soy- bean meal; and high protein low degradability, 19% CP with expelled, heat- treated soybean meal. They reported that average initial body weight of the goats was 22.1 kg and the final body weight was 26.2 kg with no differences ($P > 0.05$) in body weight gain between treatments. Mean DMI increased significantly ($P < 0.01$) as dietary CP level increased but was not affected significantly ($P < 0.05$) by heat treatment of the dietary protein. Their observations were in agreement with those of Roffler *et al*. (1978), Barney *et al*. (1981) and Blauwiekel and Kincaid (1986). Others have reported a decrease in DMI when dietary CP was increased (Foldager and Huber 1979; Edwards *et al*. 1980; Grieve *et al*. 1980). A recent study indicated that DMI increased linearly in young growing goats as dietary CP level increased (Lu and Potchoiba 1990)

V. Conclusion

Our experiment revealed that there is a significant effect of heat-treated soybean cake on feed and fodder intake, and total body weight gain of goats; however, it could not be seen as mentioned in different literatures. Perhaps it might be due to winter season of experiment conduction when most of the protein and energy were spent for body maintenance. Therefore, it is suggested that this type of experiments should be continued in future also considering winter loss of weight gain of animals.

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