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Growth Comparison of Female Goats Fed with Treated Soybean Cake and Urea Incorporated Concentrate Mixture in Fodder based Basal Diet in Western Hills of (Nepal)

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Abstract - The domestic goat (Capra hircus) is significant throughout the world today, fulfilling a number of needs of various cultural groups. Feeding value of treated soybean cake and urea to goats is not evaluated so far. Therefore, a study was carried out on growing female Khari and Jamunapari and Barberi crosses at Agriculture Research Station (Goat), Bandipur, Tanahun. Twelve female kids (4 – Khari, 4 – Jamunapari cross and 4- Barberi cross) just after weaning of age five months with average body weight of 10.08 kg were selected for experiment (150 days) and were divided into two groups having six animals (2 animals of each breed) in each group by using Complete Randomized Design (CRD). Two types of concentrate mixture (urea and treated soybean cake incorporated) were formulated with 16% of crude protein content. Dry matter requirement was taken @ 4 kg per 100 kg body weight.

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Growth Comparison of Female Goats Fed with Treated Soybean Cake and Urea Incorporated Concentrate Mixture in Fodder based Basal Diet in Western Hills of (Nepal)

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Abstract - The domestic goat (Capra hircus) is significant throughout the world today, fulfilling a number of needs of various cultural groups. Feeding value of treated soybean cake and urea to goats is not evaluated so far. Therefore, a study was carried out on growing female Khari and Jamunapari and Barberi crosses at Agriculture Research Station (Goat), Bandipur, Tanahun. Twelve female kids (4 – Khari, 4 – Jamunapari cross and 4- Barberi cross) just after weaning of age five months with average body weight of 10.08 kg were selected for experiment (150 days) and were divided into two groups having six animals (2 animals of each breed) in each group by using Complete Randomized Design (CRD). Two types of concentrate mixture (urea and treated soybean cake incorporated) were formulated with 16% of crude protein content. Dry matter requirement was taken @ 4 kg per 100 kg body weight. All experimental animals were drenched with Fenbendazole @ 5 mg/kg body weight against internal parasites before assigning in experiment. Concentrate mixture was provided to the experimental animals individually @ 1.5% of body weight in plastic vassal once a day in the morning whereas adlib amount of fodder were provided twice a day in-group (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. Total feed intake by the goats was recorded daily for all experimental periods. The body weight gain of individual animals was measured fortnightly in the morning before feeding. Experiment revealed that average daily intake of concentrate mixture was higher (236.1g) in treated soybean cake incorporated concentrate mixture fed group (T1) than urea incorporated group (215.2 g) (T2) whereas fodder intake was higher in T2 (5.62 kg) than T1 (4.53 kg). Feed intake was no significant between groups and fodder intake differed significantly ($P<0.001$) between groups. Feed conversion ratio per kg body weight gain was observed higher for Treatment 2 (69.42:1) in comparison with T1 (49.34:1).Total body weight gain was recorded higher for T2 (9.07 kg) with average daily gain 51.33 g than Those of T1 (8.1 kg) with average daily gain 46 g. In case of breed, higher average daily gain was recorded for Khari, Barberi cross and Jamunapari cross (55; 45 and 35 g, respectively) in T1 whereas it was almost similar in T2, although, there was no significant effect of breed between groups.

Keywords : goats, bypass protein and urea feeding, Nepal.

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I. Introduction

The domestic goat (*Capra hircus*) is significant throughout the world today, fulfilling a number of needs of various cultural groups. The most important uses of goats comprise the use of their meat, fibre, hide and manure. Important characteristics of goats are their hardiness and adaptability, as they are able to survive under the extreme conditions. Goats are found all over the world, no matter whether the terrain is flat or mountainous and no matter whether the climate is hot, cold, wet or dry. Goats, thought to be one of the earliest domesticated ruminants in the race of human civilization have a multidimensional, economic, and socio-cultural significance for the Nepalese farmers. Goat is recognized as *poor man's cow* and comprises major small ruminants in most of marginal farmers' in the country and also major source of cash income for most poor peoples in Nepal. Most of the farmers of western hills are rearing Khari goats, crossbred of Khari x Jamunapari and Khari and Barberi (Neopane and Pokharel, 2008). 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 accounts 12.32% of total goat population that producing 5284 Mt meat per annum (10% of total goat meat production) (MoAC, 2012).

Soybean cake is the most extensively used as a protein source for all classes of animals. It has become the standard to which all other protein sources are compared, and its quality, acceptance, and reputation are widely known. The soybean meal contains from 44 to 50% crude protein and from 2500 to 2800 kcal of metabolizable energy per kilogram. Heat treatment increases the amount of soy protein escaping microbial degradation in the rumen. Heat treatment first reduces the solubility of protein and then, if prolonged or

excessive, reduces the availability of its amino acids to the animal (Smith, 1998). Furthermore, 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.

Protein supplementation costs can be reduced if a portion of the protein comes from non-protein nitrogen (NPN) sources such as urea. Rumen microbial growth is dependent on the availability of nitrogen in the form of peptides, amino acids and NH_3. Fibrolytic bacteria use ammonia as a chief nitrogen source to meet the nitrogen demands of rumen microbes (Russell *et al*., 1992). Urea is a non-protein nitrogen source, 100% soluble, degradable and therefore very rapidly provides ammonia for microbial protein production. Urea is a cheaper non-protein source of nitrogen commonly used for ruminants feeding due to convenience and availability. Urea has a protein equivalent of 287% protein equivalents on a dry matter basis (NRC, 1989). The microorganisms in the rumen to produce microbial protein use it. It should not make up more than one percent of the complete ration or three percent of a concentrate feed (Solaiman, 2004). Growth comparison of goats fed with urea / 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 soybean meal and urea mixed concentrate mixture at Agriculture Research Station (Goat), Bandipur, Tanahun.

II. Methodology

a) Experimental Animals

This experiment was carried out on twelve growing female goats (50% Jamunapari - 4, 50% Barberi –4) and female Khari goats (4) at Agriculture Research Station (Goat), Bandipur, Tanahun from 5 May 2012 to 11 September 2012 (069/1/23 to 069/5/26). Female goats of average five months old with average body weight of 10.08 kg were divided into two 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 such as maize, soybean cake, rice bran, minerals and salt were procured in Khowpa Feed Industry, Bhaktapur and urea from agro vet. Two types of concentrate mixture were composed for experimental animals having 16% crude protein level that are given in Table 1.

Table 1 : Composition of Concentrate mixture

S/n	Ingredients	T1		T2	
		Part	Crude Protein, %	Part	Crude Protein, %
1	Maize	50	3.95	75	5.92
2	Soybean cake	28	10.7	0	0
3	Urea	0	0	3	8.6
4	Rice bran	20	1.78	20	1.78
5	Mineral mixture	1	0	1	0
6	Salt	1	0	1	0
Total		100	16.43	100	16.3

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 4 kg per 100 kg body weight. Following diets were formulated to the experimental animals (Table 2).

Table 2 : Experimental diets of the animais

Treatment	Experimental Diet
1	Forest mixed fodder (adlib) + soybean cake included concentrate mixture @ 1.5% of body weight
2	Forest mixed fodder (adlib) + urea included concentrate mixture @ 1.5% of body weight

e) Feeding Regime

Concentrate mixture was provided to the experimental animals individually in plastic vassal once a day in the morning whereas *adlib* amount of fodder were provided twice a day in group (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.

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 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) Measurement Recording

The trial period consisted 150 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 **"t"** 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 is given in Table 3 and crude protein content of prepared concentrate mixture was verified in laboratory that is given in Table 4.

Table 3 : Chemical composition of different feed ingredients (% 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	36.17	81.72	18.28	5.81	20.24	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
Soybean cake included concentrate mixture	88	91.2	8.8	16.6
Urea included concentrate mixture	89	89.7	10.3	16.8

DM- dry matter, OM- organic matter, TA- total ash, CP- crude protein, CF- crude fibre.

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 (236.1g) than that of T2 (215.2 g) per day which was no significant between groups whereas fodder intake was significantly higher ($P<0.001$) in T2 (5.62 kg) than that of T1 (4.53 kg) which resulted higher dry matter intake for T2 (236.05 kg) followed by T1 (195.9 kg). In addition, feed conversion ratio per kg body weight gain was observed higher for T2 (69.42:1) in comparison with T1 (49.34:1). Furthermore, there was no significant effect of breed in concentrate and fodder intake, however, intake of concentrate and fodder was higher in Khari goat than crossbred.

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

Feedstuffs	Mean ± SE	
	T1	T2
Feed intake, g	236.1±46	215.2±37.9
Fodder intake, kg	4.53±0.01	5.62±0.02
Total dry matter intake (DMI), kg	195.9	236.05
Feed conversion ratio (FCR)	49.34 : 1 kg	69.42 : 1 kg

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 was 10.92 kg and for T2 were 9.25kg that reached 19.02 and 18.32 kg during 150 days of experiment for T1 and T2, respectively. Both initial and final body weight was not significant between groups. Total body weight gain was recorded higher for T2 (9.07 kg) with average daily gain 51.33 g than those of T1 (8.1 kg) with average daily gain 46 g. In case of breed, higher average daily gain was recorded for Khari, Barberi cross and Jamunapari cross (55; 45 and 35 g, respectively) in T1 whereas it was almost similar in T2, although, there was no significant effect of breed between groups.

Table 6 : Growth performance of goats

Parameter	Mean ± SE	
	T1	T2
Initial Body weight, kg	10.92 ± 0.89	9.25 ± 1.8
Initial metabolic weight, Kg	6.0	5.3
Final Body weight, Kg	19.02 ± 1.5	18.32 ± 1.3
Final Metabolic weight, kg	9.10	8.85
Total weight gain, kg	8.1	9.07
Average daily gain, g	46	51.33

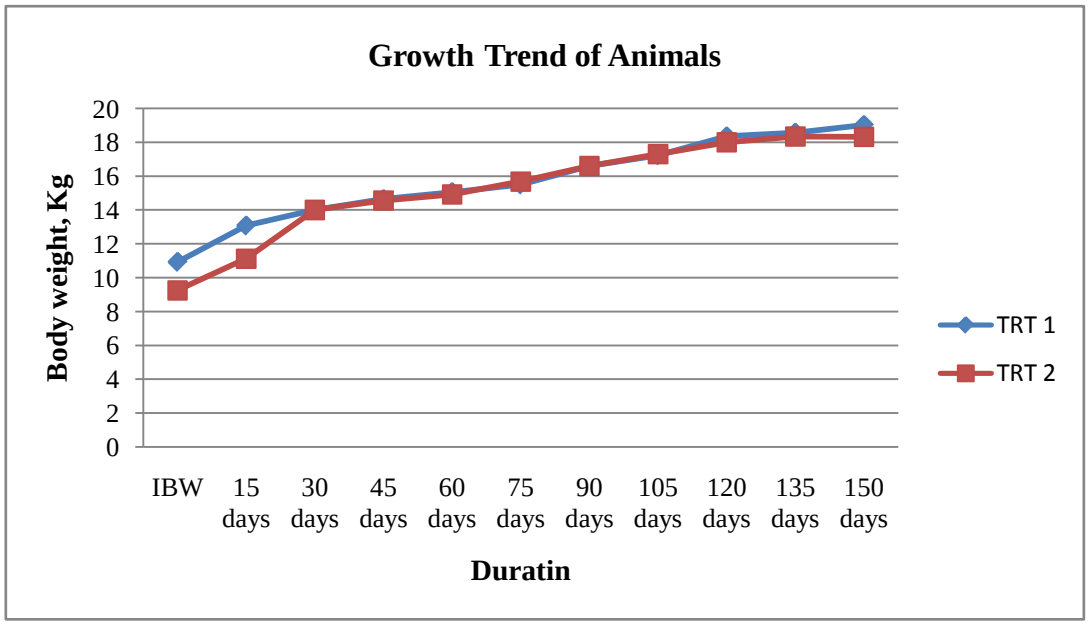

Figure 1 : Body weight gain trend of goats during experiment period

IV. Discussion

This study was initiated with objective to compare the growth performance of female goats of different breeds fed with urea and treated soybean cake incorporated concentrate mixture on fodder based basal diet. Experiment revealed that concentrate feed intake was not significant between diet groups whereas fodder intake was significantly different ($P<0.001$) between groups which resulted more total dry matter intake of T2 (urea fed group) subsequently higher FCR than treated soybean cake fed group (T1). Initial body weight of T1 was 10.92 kg and it was 9.25kg for T2 that reached 19.02 and 18.32 kg during 150 days of experiment for T1 and T2, respectively. Both initial and final body weight was not significant between groups. Our experiment proved that 3% inclusion of urea in concentrate mixture is safe and no adverse effect in animal health. Furthermore, incorporation of urea in concentrate mixture contributes in low cost of compound feed than that with inclusion of soybean cake which cost is higher than urea.

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 *Digit aria 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), Huber and Kung (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).

Onwuka *et.al.* (1989) recommended urea could be incorporated in concentrate mixture of goats at levels between 1 - 5% which defines a save utilization level, however, some other studies recommended higher levels (up to 10%). Chanjula *et.al* (2007) conducted an experiment on growing goats to assess effect of levels of urea and cassava chip (CC) on feed intake, rumen ecology, blood metabolites and microbial populations. Four, Thai native X anglo nubian crossbred growing male goats with average body weight (19 kg) were randomly assigned according to a 4x4 Latin square design. The experimental were provided one of four diets: T1 - urea at 0% (CC=30%), T2 - urea at 1% (CC=40%), T3 - urea at 2% (CC = 50%) and T4 - urea at 3% (CC=60%), of DM basis, respectively. Elephant grass (*Pennisetum purpureum*) was offered on an ad-lib basis. The results revealed that total DM intake and Body weight change were similar among treatments ($P>0.05$). Likewise, rumen pH, BUN, blood glucose, PCV and microbial populations were similar among treatments ($P>0.05$), while NH3 -N increased as the urea level increased and were found highest ($P<0.05$) in T4 at 12.8 mg/dL. Based on this experiment, it can be concluded that a higher level of urea (3%) could be used with a high level of CC in concentrate and it was good approach in exploiting the use of local feed resources for goat production.

Sophea *et.al* (2010) evaluated the effect of nitrate-nitrogen diet on the growth performance and rumen gases change in goats fed high in rumen undegradable protein. Twelve young goats were randomly allocated into four treatments with three replications. Urea were subsequently dropped and replaced by nitrate without changing exogenous nitrogen content to have four levels of nitrate (0, 2, 4 and 6%) based on dry matter intake. There was a very good improvement in feed intake as percentage of body weight ($P<0.000$) when nitrate levels increased. Growth performance was insignificant different ($P>0.05$) with urea as a sole fermentable nitrogen supplement and/ or after being completed replaced by nitrate. However, there was a tendency for goats fed nitrate to have a slightly higher weight gain than urea. The growth curve of all animals is linear when percentage of supplementary nitrate increased respectively although there were was some inconsistency in animal performance within early stage of adaptation of 21 days. Rumen ammonia content was high with 34 mg/ 100 ml for 2 and 4% of supplementary nitrate and 42.5mg/100 ml for urea level equivalent to 6% nitrate based on dry matter basis. The results indicate that nitrate can be safely used as rumen supplementary nitrogen source as well as urea to improve animal feed intake and animal performance with another tremendous advantage of reduction of rumen methane emission.

Barth *et. al.* (1962) reported gains and feed efficiency of lambs fed urea to be 65% of that of lambs fed isolated soy protein. A combination of 30% wood pulp and 6.5% of an alkaline mineral mixture promoted the highest gains of lambs fed the urea purified diet in which 30, 40 and 50% wood pulp and 3.5, 5.0 and 6.5% minerals were compared. McDonald (1966) reported that a purified diet containing 25% cellulose was optimal for urea nitrogen utilization, and that gains and feed efficiency of lambs was 73% as good with urea as with isolated soy protein. Briiggemann (1967) reported that gains of rams fed a urea containing purified diet were 57% as good as that of rams fed a purified diet containing isolated soy protein. Clifford and Tillman (1968) reported growth of sheep fed the urea purified diet to be 70% as good as growth of sheep fed an isolated soy protein purified diet. Bunn *et al.* (1964) reported that gains and feed efficiency were about 50% as good when urea was compared to casein in purified diets for sheep. Goodrich and Tillman (1968) reported that growth of lambs fed urea was about 80% of those fed isolated soy protein in a 60-day purified diet study. The results from these studies indicate that when NPN completely replaces the protein in purified diets, growth rate and feed efficiency are about 65% as good on the NPN diet as on the protein containing diets. Furthermore, there appears to be a trend for a further reduction in animal performance in extended growth trials.

V. Conclusion

Our experiment revealed that perhaps amount of bypass protein of soybean cake and production of

microbial protein by rumen microbes is almost same. Therefore, there was not significant differences in body weight gain between diet groups. Incorporation of 3% urea in concentrate mixture of goats is safe and no adverse effect on animal health.

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