The Pharma Innovation Journal 2022; SP-11(6): 1259-1266

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(6): 1259-1266

www.thepharmajournal.com
Received: 18-04-2022
Accepted: 21-05-2022

Pallab Borah
M.V.Sc Scholar, Department of Animal Nutrition College of Veterinary Science, AAU, Khanapara, Assam, India

Gunaram Saikia
Professor, Department of Animal Nutrition, College of Veterinary Science, AAU, Khanapara, Assam, India

Ekramul Haque
Ph.D. Scholar, Department of Animal Nutrition, College of Veterinary Science, AAU, Khanapara, Assam, India

Jaredth BM Wankhar
M.V.Sc Scholar, Department of Veterinary and Animal Husbandry Extension Education, West Bengal University of Animal and Fishery Sciences, Kolkata, West Bengal, India

Corresponding Author
Pallab Borah
M.V.Sc Scholar, Department of Animal Nutrition College of Veterinary Science, AAU, Khanapara, Assam, India

Effect of high plan nutrition on the growth performance, feed conversion efficiency, nutrient utilization and feed cost per kg gain in Beetal goat kids in North Eastern region, India

Pallab Borah, Gunaram Saikia, Ekramul Haque and Jaredth BM Wankhar

Abstract
The present study was conducted to observe the growth performance of Beetal goat kids feeding on different plan of nutrition under stall fed condition. Three concentrate mixtures having 22, 24.2 and 26.4 percent crude protein and 71, 78.10 and 85.2 percent TDN were prepared with conventional ingredients available in Goat Research Station, AAU, Byrnihat. Twelve weaned male Beetal kids were divided randomly on the basis of live weight into three experimental groups (C, T_1 and T_2) of four animals in each group. Kids belongs to group C, T_1 and T_2 were fed a mixture of para and Napier grass (1:1 on DM basis) and respective concentrate mixture C, T_1 and T_2 in the ratio 40:60 on DM basis to meet the 100, 110 and 120 percent of nutrient (CP, DCP and TDN) requirement as per ICAR (2013) standard for growing male goats under tropical condition for a period of 84 days during which the change in body weight of kids were recorded fortnightly. In the last week of the feeding trial a digestion trial was conducted for duration of 5 days for evaluation of nutrient utilization by the kids of different groups. At the end efficiency of feed utilization, Feed conversion efficiency and economics of the feeding was calculated. The average daily gain found are 69.28^{a}±2.96, 74.76^{ab}±2.57 and 83.69^{b}±4.46 in group C, T_1 and T_2 respectively during entire feeding trial. The total DM intake (kg/animal) were 36.53±0.50, 38.48±0.89 and 44.78±0.79 in C, T_1 and T_2 groups, respectively. The feed conversion efficiency (on DM basis) in the experimental groups during entire feeding trial were 6.28±0.63, 6.13±0.39 and 6.36±0.58 in C, T_1 and T_2 groups, respectively. At last it was concluded that 100 percent recommendation of nutrient requirements (DCP & TDN) suggested by ICAR (2013) is appropriate for a satisfactory growth of Beetal goats under hot humid agro-ecological climatic condition of Assam and Other states of North East, India. However for better growth performance Beetal kids may be reared on higher protein and energy level up to 120 percent of ICAR (2013) recommendation.

Keywords: Average daily gain, total feed consumption, total gain in body weight, feed conversion ratio

Introduction
Goats are one of the oldest domesticated ruminant and probably the first animal after dog to be domesticated by man (zeuner, 1963) [21] and have been used for milk, meat, fur and skin across much of the world. In India goat constitutes 26.40 percent of the total livestock population and total number of goats is 148.88 million ranking 4th after cattle, buffalo and sheep according to 20th livestock census (2018). Small ruminants play an important role in the food and nutritional security of rural people providing meat, milk and skin although this sector is not organized like poultry sector in India. Productivity of a livestock farm is depends upon a number of factors. The first and the most important factor is the breed of animal maintained in the farm since genotype plays an important role in growth and productivity of ruminants. The degree to which diet influence the production efficiency may depend on an individual's genetic makeup. So selection of suitable breed for specific agro climatic condition of the region where the farm is located is most important to increase production of farms. The total goat population of Assam is 16.64 lakh and its production is characterized by rural small holder production which immensely contributes to poor man economy (19th Livestock census, 2012) [1]. In Assam as well as other parts of North East Region, goats are reared along with other livestock in a unit of 2 to 10 goats or more. Usual management system followed is either tethering on roadside, open waste lands or keeping them free for the whole day for grazing or browsing on indigenous grasses or bushes and therefore they receive low nutrients due to seasonal variation

in quality, quantity of herbage leading to significant affect on their growth, reproduction, production. Although the local goats of Assam (Assam Hill and Assam local goat) produces good quality chevon but their potentiality is extremely poor in terms of growth rate with minimum ADG of 45.89g per day (Rahman and Rezazzi, 2014) [12] in stall fed condition and low mature body weight (Born *et al.*, 1980) [7]. However, cross breed (Beetal X Assam Local) goats showed better growth performance with maximum ADG of 68.33 g (Saikia *et al.*, 1995) [16] and 60.53 g (Bhuyan *et al.*, 1994) [6] which is less than that of pure Beetal goat i.e. 113 g/day (Ramzan *et al.*, 1988). Out of 20 defined breed of goat in India, Beetal goat, native of Punjab is large in size next to Jamunapari and is more prolific and more easily adaptable to different agro ecological and stall feeding condition. The effect of different level of protein and energy and their interaction on performance of crossbred (Beetal × Assam local) was studied by Bhuyan (1994) [6] and suggested that the high protein and high energy level (18% DCP and 85% TDN) in the concentrate mixture was found to be suitable for optimum performance of crossbred goat fed on concentrate and green Para grass at the ratio of 1:1 on DM basis. However, works on the effect of different plan of nutrition of growth performance of pure Beetal goat under stall fed condition in the agro-climatic condition of the states of North East Region is very scanty. Keeping the above fact in view, the present study was planned to find out the effect of higher level of protein and energy as compared to ICAR (2013) [9] requirement on growth performance of Beetal goat under fully stall fed condition to study the effect of high plan of nutrition on the growth performance, nutrient utilization, feed conversion efficiency and feed cost per kg gain of Beetal goat under stall fed condition in the hot humid climatic condition of Assam.

Materials and Methods

Feeding trial of the experiment was carried out in Goat Research Station, Assam Agricultural University, Byrnihat. Laboratory works were carried out in the Department of Animal Nutrition, College of Veterinary science, AAU, Khanapara. The experiment was conducted for a period of 3 months during September, October and November 2019. Twelve weaned male Beetal Kids obtained from Goat Research Station, AAU, Byrnihat were used in the present experiment. The kids were conditioned for a period of 2 weeks by providing a standard farm ration @100 g per day and ad-libitum green grass. During the conditioning period, kids were dewormed and vaccinated against Enterotoxaemia.

Preparation of concentrate mixture

Three concentrate mixtures having 22, 24.2 and 26.4 percent crude protein and 71, 78.10 and 85.2 percent TDN was prepared with conventional ingredients such as Maize, Wheat Bran, Rice Police, GNC, Soyabean meal, Mineral Mixture and Common salt available in Goat Research Station, AAU, Byrnihat for experiment animals.

Plan of experiment

After conditioning, the Kids were randomly divided into three groups on the basis of live weight (C, T_1 and $T_{2)}$ of four animals in each (Table 2). Kids belongs to group C, T_1 and T_2 were fed a mixture of Para and Napier grass (1:1 on DM basis) and concentrate mixture 1, 2 and 3 in the ratio of 40:60 on DM basis to meet the 100, 110 and 120 percent nutrient (CP, DCP and TDN) requirement as per ICAR (2013) [9] standard for growing male kid under tropical condition as per the following experimental plan (Table 3). Each animal was one replicate for its allotted group since they were fed individually. The fodder and concentrate were adjusted fortnightly along with the change in the live weight.

Feeding and digestion trail

The feeding trial was performed for a period of eighty four days during which the kids were fed individually with the mixture of harvested Para and Napier grass (at the ratio of 1:1 on DM) basis and concentrate mixture 1, 2 and 3 to group C, T1 and T2, respectively to meet the DM and other nutrients requirements as per ICAR (2013) [9] standard for growing kids. Concentrate was offered once at 7:30 A.M. followed by fodder. Clean and fresh drinking water was made available all the time to the kids. A digestion trial for a period of five-day duration was conducted in the last week of the feeding trial. The following observations were recorded during the feeding trial:

1. Fortnightly body weight change of kids.
2. Daily feed consumption.

Nutrient utilization

To study the nutrient utilization a digestion trial was conducted for a period of five days duration in the last week of the feeding trial. The kids were placed individually and tied far away from each other. Gunny bags were placed underneath each animal for collection of faeces for five days. Feed offered, residue left and faeces voided were recorded daily. Sample of feed offered, feed residues, faeces were collected and analyzed for proximate composition and fibre content. Body weight of the kids was recorded before and after digestion trial and average was considered as final weight.

Collection and sampling of faeces during digestion trial

The faeces voided in 24 hours by the individual kids were recorded daily morning at 7.00 A.M for 5 days. Faeces were weighed and representative sample of each animal was collected separately in a previously weighed polythene bag. The weighed amount of sample was kept for drying at 100°C in hot air oven and then the dried samples are grounded to pass through 1 mm sieve size and used for proximate and fibre fraction analysis.

Methods for analysis of biological samples

The chemical analysis of biological samples was done at Department of Animal Nutrition, College of Veterinary Science, Assam Agricultural University, Khanapara. Feed and faeces were analyzed by the method describe as per AOAC (2007) [4] and Van Soest *at el.*, (1991) [18].

Statistical analysis

The experimental data was statistically analyzed by using SPSS version 20. The means was compared as per Duncan multiple range test (Duncan, 1995) at 5 percent level of significance.

Experimental findings & Discussions

Chemical composition of concentrate mixture and green fodder used in the experiment

The chemical composition of concentrate mixtures and green fodder used to feed experimental kids of different groups during the experimental periods has been presented (Table 1).

The CP of the mix fodder grass (Para and Napier) was similar to the findings published in NDDB (2012) [11] and CF was a bit more may be due to variation in soil composition of different places. The DM and CP of the mix green fodder was similar reported by ICAR (2013) [9] where as the CF and NFE were comparable.

Table 1: Percent chemical composition of concentrate mixture and green fodder used in the experiment on dm basis

Nutrients	Concentrate Mixture			Green fodder
Particulars	C	T_1	T_2	
DM	91.11±0.50	93.17±0.59	94.12±0.64	15.67±0.77
OM	90.15±0.10	90.09±0.32	90.04±0.72	85.79±3.37
CP	21.11±0.30	23.79±0.45	25.63±0.33	8.80±0.38
EE	2.90±0.01	2.98±0.01	2.98±0.01	1.27±0.01
CF	4.93±0.03	4.97±0.03	4.99±0.03	31.41±1.11
NFE	61.21±3.24	58.35±1.35	56.44±2.25	44.31±1.45
T ash	9.85±0.03	9.91±0.02	9.96±0.04	14.21±0.45

Fortnightly changes in body weight (kg) of experimental kids during entire feeding trial

The fortnightly change in body weight of experimental kids during the entire feeding trial has been presented (Table 2) and the Graphical representation has been given in Fig.1. The body weight of experimental kids belongs to all groups was found to be increased along with age during the feeding trial. No significant difference was observed in change of body weight during 1st to 6th fortnight. The Initial body weight of kids of group C, T_1 and T_2 were 12.28±0.50, 12.20±0.35 and 12.20±0.36 kg, respectively and at the end of the experiment for group C, T_1 and T_2 were 18.04±0.63, 18.48±0.57 and 19.20±0.59 kg, respectively. Similar findings have been reported by Waheed (2011) [20] in Beetal goat.

Table 2: Fortnightly changes in body weight (kg) experimental kids during entire feeding trial

Fortnight	Group			Sem	p-value
	C	T_1	T_2		
Initial	12.28±0.50	12.20±0.35	12.20±0.36	0.02	0.989
1st	12.69±0.50	12.75±0.38	12.79±0.37	0.03	0.981
2nd	13.32±0.49	13.49±0.41	13.53±0.42	0.06	0.939
3rd	14.09±0.51	14.44±0.46	14.52±0.41	0.13	0.784
4th	15.18±0.57	15.56±0.50	15.76±0.43	0.17	0.711
5th	16.46±0.66	16.95±0.53	17.42±0.54	0.27	0.527
6th	18.04±0.63	18.48±0.57	19.20±0.59	0.33	0.421

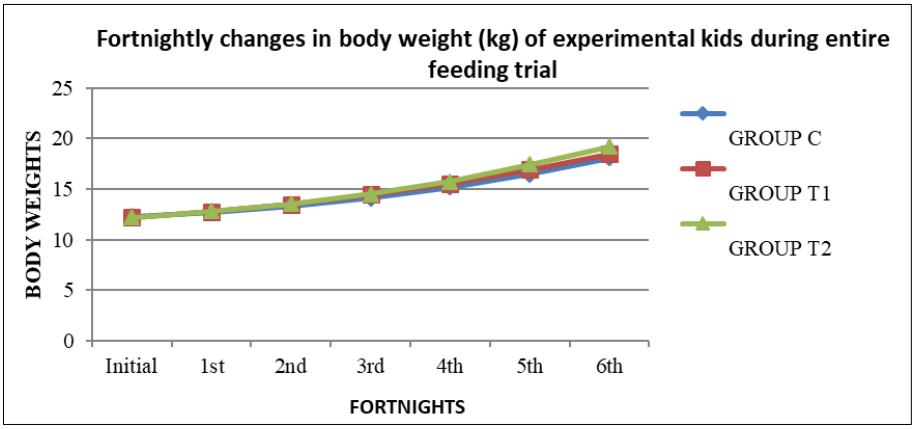

Fig 1: Graphical representation of forthnightly changes in body weight (kg) in experimental kids during entire feeding trial

Fortnightly gain in body weight (kg) of experimental kids during feeding trial

The fortnightly gain in body weight of experimental kids during the feeding trial has been presented (Table-3) and their graphical representation in Fig 2. The fortnightly gain in body weight did not significantly differ among the groups in the 1st, 2nd and 6th fortnight. However, significant difference was observed among the groups at 3rd, 4th and 5th fortnight. Significantly higher (p<0.05) gain in body weight was observed in kids of T_1 and T_2 groups as compared to the group C in 3rd , 4th and 5th fortnights. No, significant difference was observed between group T_1 and T_2. The higher growth in group T_1 and T_2 as compared to group C during 3rd, 4th and 5th fortnight might be due to better adjustment of kids to their respective rations and numerically higher digestibility of various nutrients.

Table 3: Fortnightly gain in body weight (kg) of experimental kids during feeding trial

Fortnight	Group			Sem	p-value
	C	T_1	T_2		
1st	0.49±0.11	0.55±0.12	0.59±0.10	0.038	0.738
2nd	0.64±0.02	0.74±0.05	0.74±0.10	0.033	0.506
3rd	0.77^{a}±0.02	0.95^{b}±0.09	0.99^{b}±0.01	0.067	0.032
4th	1.07^{a}±0.05	1.12^{b}±0.04	1.28^{b}±0.05	0.063	0.031
5th	1.30^{a}±0.12	1.39^{ab}±0.07	1.65^{b}±0.10	0.104	0.052
6th	1.58±0.09	1.54±0.08	1.78±0.11	0.074	0.198

†abc Mean with different superscripts within the same row differ significantly (P<0.05)

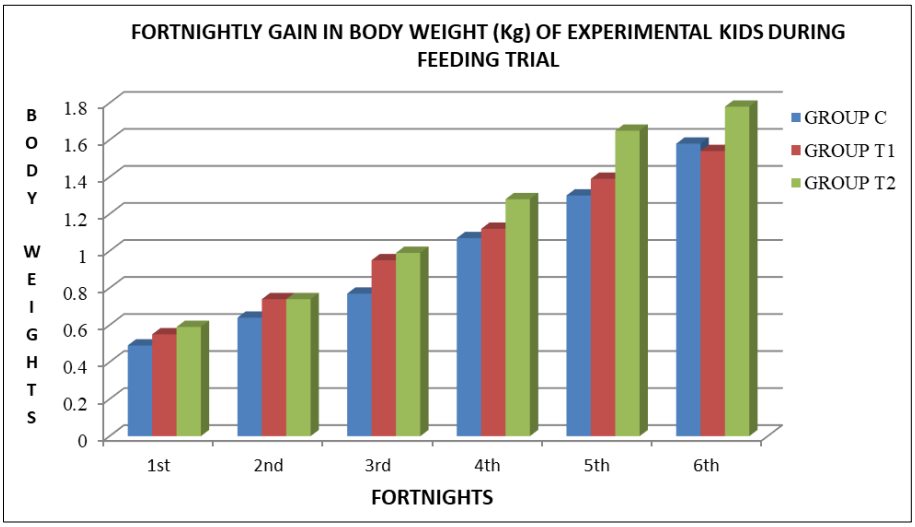

Fig 2: Graphical Representation of Frotnightly Gain in Body Weight (Kg) Of Experimental Kids during Feeding Trial

Total and average daily gain in body weight of experimental kids during entire feeding trial

The Total and average daily gain during entire feeding trial have been represented in Table 4, the graphical represented in Fig.3 and Fig.4.The total gain in body weight in kids during entire feeding trial in C, T_1 and T_2 group were 5.82±0.22, 6.28±0.43 and 7.03±0.36 kg respectively. Statistically no significant difference was observed among the groups in respect of total gain in body weight of the experimental kids during entire feeding trial. Significantly higher ADG in group T_2 may be due to higher protein and energy content in the concentrate mixture indicating that protein component was efficiently utilised in kids of group T_2. Similar results of higher ADG in diets providing higher TDN and protein have been reported (Rekhate *et al*., 2008) [14]. Average daily gain increased as dietary protein and energy level increase from group C to group T_2 which was reflected from the increase dry matter intake from group C to group T_2. Because DMI related positively to dietary protein and energy level, the increase ADG could be explained as a response to increase protein and energy intake.

Table 4: Total gain in body weight (kg) and average daily gain (g/d) of experimental kids during entire feeding trial

Particulars	Group			Sem	p-value
	C	T_1	T_2		
Average initial body weight (kg)	12.28±0.50	12.20±0.35	12.20±0.36	0.02	0.989
Average final body weight (kg)	18.04±0.63	18.48±0.57	19.20±0.59	0.33	0.421
Experimental Period (days)	84	84	84		
Total gain in body weight (kg)	5.82±0.22	6.28±0.43	7.03±0.36	0.35	0.094
Average daily gain in body weight (g/day)	69.28^{a}±2.96	74.76^{ab}±2.57	83.69^{b}±4.46	2.96	<0.001

†abc Mean with different superscripts within the same row differ significantly (P<0.05)

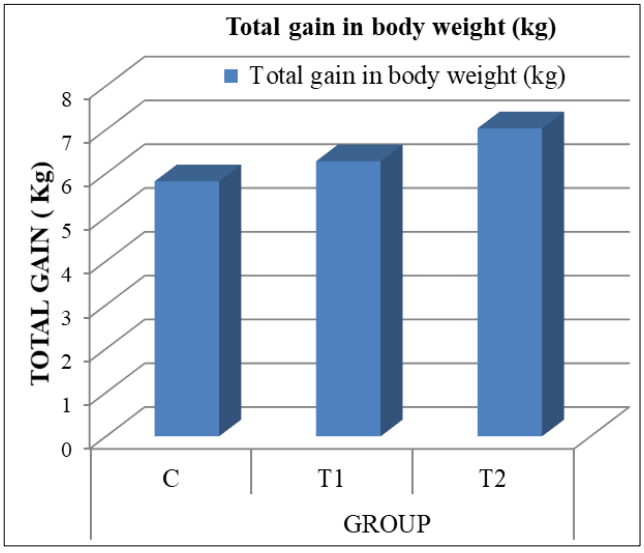

Fig 3: Graphical representation of total gain (kg) in body weight of experimental kids during entire feeding trial

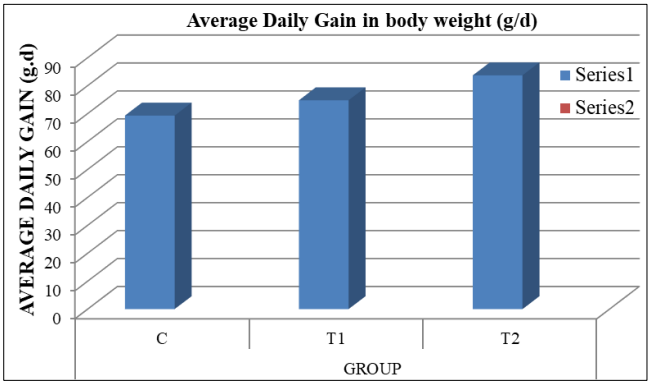

Fig 4: Graphical representation of average daily gain (G/D) in experimental kids during entire feeding trial

Total feed consumption (dm basis) by the experimental kids during entire feeding trial

The total feed consumption on dry matter basis by experimental kids during entire feeding trial (84 days) has been presented in Table 5. No significant difference was

observed among the groups in respect of intake from concentrate, roughage and the total of them. However, Intake increased numerically from group C to group T_2 along with the increase level of protein and energy level in the rations. This might be due to increase concentration of available nutrients from the ration of group C to group T2. It might be also due to increase palatability of the ration from group C to group T_2. Similar results were found in some studies, high input feeding system has been found to be more efficient in enhancing the growth performance of Beetal by improving the nutrient availability (Mukhtar *et al*., 2013 and Sarwar *et al*., 2010) [17].

Table 5: Total Feed Consumption (Dm Basis) By the Experimental Kids During Entire Feeding Trial

Particulars	Group			Sem	p-value
	C	T_1	T_2		
Concentrate (kg/animal)	21.92±0.36	23.69±0.33	27.47±0.21	0.85	0.197
Green fodder (Kg/ animal)	14.61±0.24	14.79±0.60	17.31±0.42	0.68	0.803
Total (kg/animal)	36.53±0.50	38.48±0.89	44.78±0.79	1.91	0.294

Feed conversion efficiency (on dm basis) during entire feeding trial

The feed conversion efficiency (on DM basis) in the experimental kids during entire feeding trial been presented (Table-6) and their graphical representation in Fig 5. No significant difference among the groups in respect of feed conversion efficiency in the present experiment might be due to non significant difference observed in respect of total feed intake and total gain in body weight in kids of different groups.

Table 6: Feed conversion efficiency (on dm basis) in the experimental kids during entire feeding trial

Particulars	Group			Sem	p-value
	C	T_1	T_2		
Initial body weight (kg)	12.275±0.50	12.200±0.35	12.200±0.36	0.02	0.989
Final body weight (kg)	18.043±0.63	18.480±0.57	19.198±0.59	0.33	0.421
Total body weight gain (kg)	5.82±0.22	6.28±0.43	7.03±0.36	0.35	0.094
Total feed consumed during entire feeding trial on DM basis (kg)	36.530±0.50	38.482±0.89	44.780±0.79	1.91	0.294
Feed Conversion efficiency (kg DM/kg gain)	6.28±0.63	6.13±0.39	6.36±0.58	0.38	0.063

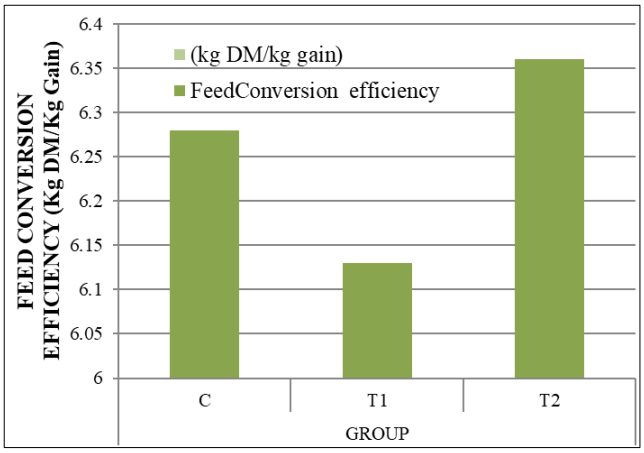

Fig 5: Graphical Representation of Feed Conversion Efficiency (Kg Dm/Kg Gain) Of Experimental Kids during Entire Feeding Trial

Utilisation of nutrients by the experimental kids dry matter intake by the experimental kids during digestion trial

The dry matter intake by experimental kids during digestion trial has been presented (Table 7). The DM intake per 100kg body weight observed in the kids of present experiment were similar with the observation reported for crossbred (Beetal × Assam local) kids (Baruah *et al*., 1988; Angami, 1990; Bhuyan, 1994[6] and Saikia *et al*., 1995) [5, 3, 6, 16] fed on concentrate mixture and para grass with different level of protein and energy which was ranges between 3.08 to 3.73 kg per 100kg body weight. No significant difference observed in respect of DM intake per 100 kg body weight among the kids of different groups indicated the similar palatability of the concentrate mixtures used for feeding kids in the present experiment and values were within the standard range (ICAR, 2013) [9]. The DM intake per kg metabolic body size observed in the present experiment were in good agreement with those reported in Marwari goats fed adlibitum diets comprising concentrate and roughage at 50:50 ratio (Wadhwani and Patel, 1991) [19]. The significantly (p<0.05) higher DM intake per kg metabolic body size was observed in kids belongs to group T_1 and T_2 in the present experiment compared to the control group might be due to higher body weight of the kids of group T_1 and T_2 during the period of conducting digestion trial.

Table 7: Dry matter intake by experimental kids during digestion trial

Particulars		GROUP			Sem	p-value
		C	T_1	T_2		
Avg. Bwt.(Kg)		18.04±0.63	18.48±0.57	19.20±0.59	0.33	0.421
Avg. $BW^{0.75}$ (Kg)		8.75±0.56	8.91±0.72	9.17±0.41	0.36	0.365
DM Intake (kg/day)	From Concentrate	0.342±0.06	0.382±0.03	0.415±0.01	0.85	0.192
	From Roughage	0.228±0.04	0.254±0.06	0.276±0.02	0.68	0.803
	Total	0.570±0.05	0.636±0.09	0.691±0.09	1.91	0.294
DM intake/100 kg B.wt. (kg)		3.16±0.25	3.44±0.17	3.60±0.10	0.10	0.136
DM intake/ $kgW^{0.75}$(g)		65.14^{a}±2.53	71.38^{b}±1.46	75.35^{b}±3.15	2.09	0.054

†abc Mean with different superscripts within the same row differ significantly (P<0.05)

Digestibility coefficient during digestion trial.

The digestibility coefficient of DM, OM, CP, EE, CF, NFE, NDF and ADF in group C, T_1 and T_2 presented (Table 8). Significantly higher digestibility of DM in higher energy and protein groups (T_1 and T_2) compared to the control group (C) might be due to increase palatability of the rations as intake of DM also increased from control group (C) to group T_2. This also might be creation of better environment in the rumen for better growth of microbial population leading to higher digestibility in kids of group T_1 and T_2. Similar trend in which increase digestibility of DM along with increase energy level were reported in crossbred (Beetal×Assam local) kids. (Saikia *et al.*, 1995) [16]. Higher digestibility (p<0.001) of OM in kids on high plan of nutrition (T_1 and T_2) as compared that in control group (C) might be due to higher digestibility of DM in these groups. Significantly higher digestibility of crude protein in the kids belong to higher plan of nutrition (T_1 and T_2 group) might be due to appropriate rumen environment which facilitate the more digestion of protein. Similar observations were reported by Russel *et al.* (1992) [15], which stated that the digestibility increased along with the increase crude protein content of the diet. No significant difference was observed in respect of Ether extract intake, digested and digestibility coefficient however the results are comparable in respect of T_1 and T_2 group. This might be due to the similar content of Ether extract in the three rations provided to the groups C, T_1 and T_2 and also the roughage provided to them were of same kind. The digestibility of EE observed in the present experiment was comparable to the findings of Reddy and Raghavan (1987) [13] in Desi kids of Andhra Pradesh, Gebremedhin (2015) [8] in growing kids fed with hydroponically sprouted maize and barley fodder with Finger millet straw. Statistically no significant (P>0.05) difference was observed among the groups in respect digestibility of crude fibre. The values were similar in all the groups (C, T_1 and T_2) as the roughage offered to them was similar in kind and quantity. Significantly (p<0.05) higher NFE digestibility observed in the kids of higher plan of nutrition groups (T_1 and T_2) might be due to higher digestibility observed in DM, OM, and CP in the present experiment. No significance difference was observed among the groups in respect of digestibility coefficient of NDF & ADF. However, significant (p<0.05) difference was observed among the groups in respect of NDF and ADF intake and digested during digestion trial.

Table 8: Digestibility coefficient of DM, OM, CP, EE, CF, NFE, ADF and NDF of the three Rations C, T1 and T2 during digestion trial

Digestibility Coefficient			
	C	**T_1**	**T_2**
DM	57.54±1.91	63.99±2.77	67.00 ±1.50
OM	63.70 ±3.78	76.55 ±3.48	77.90 ±4.40
CP	73.00±3.62	81.03±4.02	84.94±2.57
EE	74.65±1.80	77.31±1.55	78.41±3.00
CF	53.43±2.35	56.41±2.79	55.46±1.74
NFE	73.78±1.79	79.52±3.01	86.58±1.75
NDF	58.65±4.38	64.11±2.58	64.65±1.89
ADF	46.41±1.92	52.00±3.28	50.94±1.70

Plan of nutrition

Plan of Nutrition during digestion trial in the three groups (C, T_1 and T_2) is presented (Table 9). All the experimental kids belongs to different groups in the present experiment received DM, CP, DCP and TDN in 100 percent of the requirement suggested by ICAR (2013) [9] standard which indicated that all the experimental composite ration (C, T_1 and T_2) used in the experiment could satisfied the requirement of nutrients to the growing kids of all groups.

Table 9: Plan of nutrition in different groups of experimental kids during digestion trial

Particulars	**Group**		
	C	**T_1**	**T_2**
Average body weight(kg)	18.04±0.63	18.48±0.57	19.19±0.59
Average metabolic body weight (kg)	8.75±0.56	8.91±0.72	9.17±0.41
Average daily body weight gain(g)	69.28±2.96	74.76±2.57	83.69±4.46
DM intake (kg/d)	0.570±0.05	0.636±0.09	0.691±0.09
DMI per 100 kg body weight(Kg)	3.16±0.25	3.44±0.17	3.60±0.10
DMI per Kg $W^{0.75}$(g)	65.14±2.53	71.36±1.46	75.35±4.51
DM requirement as per ICAR (2013) [9] (Kg/d)	0.554 ±0.03	0.569±0.04	0.565±0.05
DM received as percent of ICAR requirement (2013) [9]	102.88±3.12	111.77±7.50	122.30±2.41
CP intake (g/d)	43.60±1.99	52.03±5.58	57.23±11.98
CP intake/100kg body weight (g)	399.57±21.2	469.29±23.45	492.34±19.50
CP intake/kg $W^{0.75}$(g)	14.26±3.1	18.92±2.54	22.94±2.86
CP requirement as per ICAR (2013) [9] (g/d)	40.32±3.47	47.33±7.12	54.98±8.20
CP received as percent of ICAR requirement (2013) [9]	103.22±2.31	113.89±4.31	123.76±6.83
DCP intake(g/d)	39.14±1.32	47.38±3.54	53.82±11.23
DCP intake/100kg body weight (g/d)	368.72±17.32	378.32±20.54	412.67±23.66
DCP intake/kg $W^{0.75}$(g/d)	6.92±0.13	7.13±0.16	7.84±0.14
DCP requirement as per ICAR (2013) [9] (g/d)	32.14±2.43	38.33±5.02	42.16±5.89
DCP received as percent of ICAR requirement (2013) [9]	102.11±1.93	111.63±6.03	122.24±7.12
TDN Intake (kg/d)	0.24±0.003	0.27±0.04	0.31±0.09
TDN Intake/100kg bwt (kg/d)	2.16±0.19	3.27±0.21	3.94±0.17
TDN intake / kg $W^{0.75}$ (g)	41.36±1.22	53.32±0.97	55.32±0.62
TDN requirement as per ICAR (2013) [9] (kg/d)	0.23±0.02	0.24±0.03	0.26±0.03
TDN received as percent of ICAR requirement (2013) [9]	104.34±3.54	112.50±6.85	119.23±6.03

Feed cost per unit gain (Rs/ kg body weight gain)

For calculation of the expenditure incurred on various feedstuffs and for cost of growth production have been taken into consideration. The housing and management practices were similar for all the groups and expenditure incurred on these have been excluded. The rate of purchase (Rs/100 kg) of concentrate mixtures and fodder used for feeding of experimental kids in different groups has been presented in Table 10. The rate was in increasing trend from control (C) ration to treatment rations due to increase inclusion level of protein supplements in the concentrate feed. The feed cost per kg gain of experimental kids during the experiment has been presented in Table 11. On comparing with the gain in body weight, the cost of feed per kg live weight gain were Rs.135.80±3.77, 139.00±3.79 and 146.37±2.50 in group C, T_1 and T_2, respectively. The cost per kg live weight gain numerically increases from group C to group T_2. Although the total gain in body weight in kids belongs to the treatment groups (T_1 and T_2) were numerically higher compared than the control group (C), the total feed consumption also increased from control (C) group to treatment groups (T_1 and T_2). Therefore, the feed cost per unit gain in body weight increased along with the increase in protein and energy in the diets.

Table 10: Rate of purchase (Rs/100 kg) of concentrate mixtures and fodder used for feeding experimental kids of different groups

		Value per 100 kg concentrate mixtures (Rs)			
Feed/ Fodder	**Rate of purchase per 100 kg (Rs)**	**C (Rs)**	**T_1 (Rs)**	**T_2 (Rs)**	**Green Fodder (Rs)**
Maize	2230.00	1119.00	1007.10	895.20	
Wheat bran	2489.00	124.45	124.45	124.45	
Rice polish	1885.00	131.95	94.25	94.25	
GNC	4800.00	820.00	902.00	1107.00	
Soyabean Meal	3339.00	500.85	667.80	667.80	
Mineral Mixture	7990.00	7.00	7.00	7.00	
Common Salt	700.00	159.8	159.80	159.00	
Total cost per 100 kg		2862.00	2962.40	3054.21	100
Cost/ kg		28.62	29.62	30.54	1.00

Table 11: Feed cost per kg gain of experimental kids during the experiment

Particulars		**Group**			**Sem**	**p-value**
		C	**T_1**	**T_2**		
Feed cost	Concentrate (Rs)	697.14	779.00	932.60		
	Roughage (Rs)	93.23	94.38	96.40		
	Total (Rs)	790.37	873.38	1029.00		
Total gain in body weight (kg)		5.82±0.22	6.28±0.43	7.03±0.36		
Feed Cost/kg gain		135.80±3.77	139.00±3.79	146.37±2.50	0.22	0.835

Conclusion

Based on the results obtained in the present experiment, it could be concluded that 100% of ICAR (2013) [9] recommendation of DCP and TDN for growing kids were appropriate for satisfactory growth performance of Beetal kids under stall fed condition. However, for more growth performance, Beetal kids may be reared on higher protein and energy level up to 120% of ICAR (2013) [9] recommendation under stall fed condition in the Agro-climatic condition of Assam and NE region. More elaborative feeding trial with large number of animal is required for a certain accurate results.

Acknowledgement

The authors are highly thankful to the University, AAU, (Assam Agricultural University) along with College of Veterinary science, AAU, Khanapara, Guwahati-781022 and Goat Research Station, Byrnihut, India for providing all the facilities and support for this study.

Reference

1. 19th Livestock Census. BHAS (Basic Animal Husbandry Survey). Govt. of India, 2012. (http://www.indiaenvironmentportal.org.in/content/399839/19th-livestock-census-2012-all-india-report/)
2. 20th Livestock Census. Department of Animal Husbandry and Dairying, Govt. of India, 2019. (https://vikaspedia.in/agriculture/agri-directory/reports-and-policy-briefs/20th-livestock-census)
3. Angami M. Feed intake, nutrient utilization and growth in female crossbred (Beetal X Assam local) goats fed different levels of energy. M. V. Sc. Thesis, Assam Agricultural University, Khanapara, Guwahati, 1990.
4. AOAC. Official Methods of Analysis. 18th Edition. AOAC, International Gaithersburg. MD, USA, 2007. (http://www.worldcat.org/oclc/237912350)
5. Baruah DK, Saikia S, Bora NN, Sarkar AB. Growth performance of Assam local crossbred kids under different feeding regimes. Indian Journal of Animal Production and Management. 1988;4(2):98-99.
6. Bhuyan R. Growth Response, Nutrient utilization and Carcass characteristics of Crossbred (Beetal × Assam local) Goats fed different plan of Nutrition, Ph.D. Thesis submitted to AAU, Khanapara, Guwahati, Assam, 1994.
7. Born TA, PJS Boone and EM Pintor. The effect of feeding frequency and feeding periods on the performance of goats. AGRIS record, 1980.
8. Gebremedhin WK. Nutritional benefit and economic value of feeding hydroponically grown maize and barley fodder for Konkan Kanyal goats. Journal of Agricultural and Veterinary Science. 2015;8:24-30.
9. ICAR- NIANP. Nutrient Requirements of Sheep Goat and Rabbit. Indian council of Agriculture Research, New Delhi, 2013. (https://issuu.com/kisanadmin/docs/nutrient_requirements_of_sheep__goa)
10. Muktar N, Sarwar M, Nisa MU, Sheikh MA. Growth response of growing lambs fed on concentrate with or

without ionopohores and probiotics. International Journal of Agricultural Biolological. 2013;12(5):734-738.
11. NDDB. Nutritive value of commonly available feeds and fodder in India. National Dairy Development Board, Anand, 2012, 36-56.
12. Rahman A, Rezazzi AJ. Growth and mature weight of Swedish Fine wool Landrace ewes. I. Growth curves and estimation of individual mature weight. Acta Agricultural Scan. 2014;40:441-443.
13. Reddy TJ, Raghavan GV. Effect of feeding different roughage to concentrate ratio diets on growth, feed efficiency and cost of economics of production in goats. Indian Veterinary Journal. 1987;64(7):584-86.
14. Rekhate DH, Patil JM, Dhoke AP. Nutrient Utilisation and growth performance of goats on pelleted complete diets prepared from gram straw and arhar stalks. Indian Journal of Animal Science. 2008;78:1400-1403.
15. Russel JR, Irlbeck NA, Hallauer AR, Buxton DR. Nutritive value and ensiling characteristics of maize herbage as influenced by agronomic factors. Animal Feed Science and Technology. 1992;38:11-24.
16. Saikia G, Baruah KK, Buragohain SC, Saikia BN, Pathak, NN. Feed intake, utilization of nutrients and growth of Assamese x Beetal goats fed three levels of energy. Small Ruminant Research. 1995;15(3):279-282.
17. Sarwar M, Mukhtar N, Shahzad MA, Nisa MU. Traditional versus high input feeding system; impact on nutrients intake, blood dynamics, hormonal profile, weight gain and economics in growing lambs. Egyptian Journal of Sheep and Goat Science. 2010;51:127-145.
18. Van Soest, PJ, Robertson JB, Lew BA. Method for dietary fiber, neutral detergent fiber and non-starch polysaccharides in relation to animal nutrition. Journal of Dairy Science. 1991;74:3583-3597.
19. Wadhwani KN, Patel AM. Effect of feeding diets of different roughages to concentrate ratio in feed efficiency and feed economics of chevon production in marwari goats. Indian Journal of Animal Science. 1991;61(11):1249-1250.
20. Waheed A, Khan MS, Ali S, Sarwar M. Estimation of growth curve parameters in Beetal goats. Archives Animal Breeding. 2011;54(3):287-296.
21. Zeuner. Effect of feeding frequency on the growth performance of Beetal goat kids during winter season. Journal of Animal and Plant Science. 1963;24(1):11-15.