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Effect of feeding different protein sources on growth and nutrient utilization of early weaned crossbred (Beetal X Assam hill goat) kids

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Abstract
The growth performance and nutrient utilization of eighteen preweaned crossbred (Beetal X Assam Hill Goat) kids was studied for two months, which were randomly divided into three groups (n=6) and offered *ad lib* diet containing Soybean meal (T_1), Ground nut cake (T_2) and Til oil cake (T_3). Body weight gain were significantly ($P<0.05$) higher in T_1 and T_2 as compared to T_3 group. Significant ($P<0.05$) difference was observed in feed conversion ratio between T_1 and T_3 group. No significant difference was found in dry matter intake (DMI) per 100 kg body weight and per kg metabolic body weight; however, highly significant ($P<0.0001$) difference was observed in total DMI and digestibility co-efficient between T_1 and T_2 and T_1 and T_3 group. The digestibility coefficient of CP was significantly ($P<0.0001$) differed among the groups except organic matter and nitrogen free extract. Hence, soybean meal can be incorporated in the diet of preweaned crossbred kids for better performance and economic advantage.

Keywords: Preweaned crossbred kids, protein source, growth performance

Introduction
Protein and energy are the two major components of feed that influence performance of any livestock especially during young growing stage. Different protein sources have varying effect on ruminant's performance (Jorgensen *et al*., 1984) [8]. Provision of the quality of protein in the kid's diet does not only improve the animal performance but also ensures profitable animal production. Different vegetable protein sources are used to formulate the rations for growing and fattening kids. These protein sources differ in amino acid profiles which result in varied responses of the animals (Bateman *et al*., 2005) [4]. This varied response in performance may be due to changes in rumen ecology and their different amino acid profile (Hall and Huntington, 2008) [6]. Inclusion of protein sources with amino acid profiles matching closely to the amino acid needs of the growing kids result in better growth performance and nitrogen utilization by the animal. Glucogenic amino acids present in some protein sources also improve the energy status of the animal by increasing gluconeogenesis. Presence of anti-nutritional factors may limit the inclusion of protein sources in the diet. So, a good protein source possessing better amino acid and micronutrient profiles with safe levels of anti-nutritional factors is always desirable in animal's diet, due to which, it has become necessary to explore the possibilities to achieve maximum goat production feeding on various vegetable protein sources at an early weaned age.
Hence, it was aimed to study the growth performance and nutrient utilization of early weaned crossbred kids based on three different protein sources i.e, Soybean meal, Ground nut cake and Sesame oil cake which differs in quality, amino acid profile and anti-nutritional factor contents.

Materials and Methods
The experiment was conducted on 18 crossbred (Beetal X Assam Hill Goat) kids of 30 days of age for two months, which were randomly divided into equal three different groups of six in each and offered *ad lib* diet containing SBM (T_1), GNC (T_2) and TOC (T_3) along with Napier grass respectively.

Table 1: Chemical Compositions of Experimental Diets (Concentreate Mixture and Napier Grass) for Crossbred (Beetal X Assam Hill Goat) Kids (On Per Cent Dm Basis)

Nutrients	Treatments			Napier
	T_1	T_2	T_3	
Dry matter	88.00	87.00	85.00	22.00
Crude protein	17.00	16.95	16.80	12.00
Crude fibre	13.28	12.13	12.48	27.00
Ether extract	1.75	1.63	1.48	1.20
Total ash	2.50	2.00	2.35	12.00
Organic matter	97.50	98.00	97.65	88.00
Nitrogen free extract	65.47	67.29	66.89	47.80

Three isonitrogenous and isocaloric concentrate diets were formulated and prepared with conventional ingredients and required supplements to meet the nutrient requirements of kids as per the recommendation of ICAR (2013) [7].

Table 2: The composition and nutritive values of the experimental diets

Ingredients	T1 (%)	T2 (%)	T3 (%)
Maize	50.85	53.56	50.43
Wheat bran	13	13	13
Soyabean meal	26.15	-	-
Ground nut cake	-	23.44	-
Sesame oil cake	-	-	27.57
Molasses	2	2	1
Fish meal	5	5	5
Mineral mixture	2	2	2
Common salt	1	1	1
DCP (%)	18.29	18.29	18.29
TDN (%)	77.38	75.69	77.26

Body weights of individual kids were recorded at the start of the feeding trial and thereafter in every week till the end of the feeding trial. The average feed intake of different experimental groups were calculated out daily from the difference of quantity of feed and fodder offered and residual feed were collected from the feeder in next day morning. The weekly and total feed intake during the whole experimental period was also calculated. A digestibility trial was conducted for five days using three animals from each group at the end of the feeding trial. The cost of production was also calculated. Proximate principles of feed, residue left and excreta were analyzed according to AOAC (2016) [1]. Statistical analysis was done as per the method of Duncans multiple range test at 5% level of significance.

Results and Discussion

The mean total body weight gain, total feed intake, feed conversion ratio, nutrient digestibility and cost of production of the experimental kids under different treatment groups has been presented in Table 3. Mean total body weight (Kg) of experimental kids in T_1 group were significantly ($P<0.05$) higher as compared to T_2 and T_3 groups which may be due to the high content of protein in soybean meal and high content of amino acid lysine and methionine. Fagbenro *et al.* (2010) [5] reported reduction in growth in *Clariasgari epinus* where sesame seed meal was incorporated at higher level. This reduction was not only due to amino acid profile, but also the presence of anti-nutritional factor. Karlsson and Martinsson (2011) [10] experimented with growth performance of lambs fed different protein sources *viz.* Peas, rapeseed cake or hampseed cake in barley based diet and reported that total gain was highest for diet containing peas followed by rapeseed cake. Higher growth rate in kids fed with lablab grain as protein source than GNC was reported by Singh *et al.* (2010) [12]. Significantly ($P<0.05$) higher final body weight gain of Afghani lambs fed diets with soybean meal as protein source than cotton seed meal and canola meal was reported by Khan *et al*. (1996) [11].

The significantly lower ($P<0.05$) feed conversion ratio in the group T_3 than T_1 may be attributed to the dietary amino acid profile and protein content in sesame seed meal which is better than soybean meal. The crude protein content of sesame seed meal is 75 per cent of soybean meal. Kumar *et al. (*2002) [9] reported that higher growth performance may be attributed to better utilization of feed ingredients, higher nitrogen retention and higher TDN intake. Khan *et al.* (1996) [11] reported that the feed efficiency of early weaned diet of lambs containing cotton seed, soybean and canola are 6.88, 5.41 and 6.17 respectively. They also reported the average daily weight gain (g) in Afghani lamb are more in pre-weaned diet containing soybean meal. Karlsson and Martinsson (2011) [10] experimented with lambs by feeding different protein supplements *viz.* peas, rapeseed cake or hempseed cake and reported that, the average gain was highest for diet containing peas followed by rapeseed cake. Abdalatif *et al.* (2011) [3] reported feed conversion ratio as 5.5, 7.6, 10.7 and 18.9 Sudanese desert kids when they were fed four rations having different concentrate roughage ratio.

Table 3: Total body weight gain, total feed intake, feed conversion ratio, nutrient digestibility and cost of production of the experimental kids under different treatment groups

Parameters	Dietary Treatment Groups		
	T1	T2	T3
Initial body weight(kg)	3.42±0.05	3.21±0.10	3.23±0.09
Final body weight(kg)	6.08^{a}±0.11	5.58^{b}±0.08	5.52^{b}±0.17
Total gain (kg)	2.66±0.08	2.38±0.10	2.29±0.17
Daily gain (g)	47.47±1.48	42.41±1.77	40.78±2.95
Total feed consumed (kg)	13.35±0.21	13.11±0.31	13.16±0.44
FCR	5.04^{b}±0.11	5.55^{ab}±0.19	5.81^{a}±0.26
Nutrient digestibility			
Dry matter	75.49^{a}±0.41	72.22^{b}±0.29	71.24^{b}±0.63
Organic matter	75.45±1.46	75.23±0.41	74.39±0.03
Crude protein	81.61^{a}±0.20	78.68^{b}±0.47	77.75^{b}±0.78
Ether extract	74.86^{a}±0.41	73.42^{b}±0.32	72.25^{c}±0.24
Crude fiber	79.86^{a}±0.66	78.80^{ab}±0.34	77.34^{b}±0.53
Nitrogen free extract	74.52±0.55	73.19±0.81	72.58±0.30
Cost of feeding/kg/weight gain (Rs)	92.06	95.26	93.43

Means bearing different superscripts within a parameter differ significantly ($P<0.05$).

Significant ($P<0.05$) differences were observed in digestibility of dry matter between T_1 and T_2 group and T_1 and T_3 group, Crude protein in group T_1, Crude fiber in T_1 and T_3 group, ether extract between T_1 and T_2group, $T_2$and T_3 group and T_1 andT_3 group. No significant differences was observed digestibility of organic matter and Nitrogen free extract among the different dietary groups. The cost of feeding per Kg gain in live weight was lowest in group T_1 (92.06) which contain SBM as major protein source than group T_2 (95.26) and T_3 (93.43).

Conclusion

Based on different parameters studied and cost of per kg live weight gain, It may be concluded that Soybean meal can be incorporated in the diet of preweaned crossbred kids for better performance and with a distinct economic advantage.

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