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Roasted guar (*Cyamopsis tetragonoloba*) was substituted for groundnut cake to see how it affected the growth performance and nutrient utilisation in growing buffalo calves. Korma

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Abstract
The goal of this study was to determine the effects of feeding roasted guar korma to female buffalo calves in place of groundnut cake (C) at levels of 51% (E1) and 100% (E2) on a protein basis. A by product of the production of guar gum, roasted guar korma is a high-protein feed made from vegetables. A 151-day growth trial was carried out on 18 female buffalo calves that were randomly assigned to each of the three treatments. Intakes of total DM, wheat straw, and concentrate were comparable across all groups. At the conclusion of the experiment, a digestibility trial was performed, and it was discovered that the difference in the digestibility of close nutrients and cell wall elements between different treatment groups and the nutritional value of the diet was statistically insignificant ($p<0.05$). Average daily increase and total live weight gain over 150 days were both considerably higher in E2 than C, but similar to E1 for both groups. FCR and FCE among the calves in the three treatment groups did not differ significantly from one another, although E2 had high FCE since E2's FCR was lower than the other two groups'. In comparison to the other two groups, E2 had reduced daily ration costs and dry matter costs per kilogramme of body weight gain. Therefore, roasted guar korma can be introduced to the diet of growing buffalo calves at levels of 50 or 100 percent as a source of protein without altering DM intake, nutrient utilisation, growth, or feeding expense.

Keywords: Roasted guar korma, groundnut cake, female buffalo calves, growth performance, nutrient utilization

Introduction
One of the most major economic activity in the country's rural areas, raising livestock has a big economic impact on the entire country. Most households who depend on agriculture receive additional income from it, and for many landless families, the income from activities related to livestock rearing has served as the major source of support (DADH). The price ratio of concentrate feeds to animal products has decreased, thus it is necessary to replace traditional concentrates with some affordable but nutrient-rich agro industrial by-products in order to reduce the cost of producing animal products.

A significant income crop in rain-fed areas, particularly in semi-arid and desert portions of India, is guar (*Cyamopsis tetragonoloba*). It is an annual legume that can withstand drought and is primarily planted in Pakistan and India (Mishra *et al*., 2013) [14]. Its extraction of guar gum, which has a high export value, makes it a crucial legume for industry. Guar seed production varies significantly depending on the pattern of rainfall in India, averaging 7-8 lakh tonnes per year (APEDA). According to Lee *et al*. (2004) [13], guar seeds are composed of three parts: the seed coat (14–17%), the endosperm (35–42%), and the germ (43–47%). Churi Korma (guar meal), which is made from the seed's germ and hull, is a byproduct of guar gum extraction and is high in protein (Sharma & Gummagolmath, 2012) [17]. Guar Split/Gum (29%), Korma (30-35%), and Churi (35-40%) are three extracts from guar seeds (APEDA, 2014) [2]. Guar korma that has been processed often has a lot of proteins and carbs, making it an excellent source of protein for ruminants and other animals. In addition to being a good feed for beef animals, it is mostly used to feed the milking animals in order to boost the milk and milk fat content (Etman *et al*., 2014a) [5]. According to Saeed *et al*. (2017), the CP content of guar korma ranges from 56 to 58 percent; Soliman *et al*. (2014) [18], 55.8 percent; Nidhina and Muthukumar (2015) [15], 52.7 percent; Etman *et al*. (2014a) [5], 50 percent; and Grewal *et* *al*. (2014) [9], 46.9 percent. The type of germ fraction and heat treatment used to create the final product affect the CP content of guar korma. Animals are fed guar korma in place of soyabean meal, dried distiller grains, cotton seed cake, and groundnut cake because it is typically a less expensive feed ingredient (Etman *et al*., 2014a) [5].

The main antinutritional components in guar meal are trypsin inhibitor and beta-galactomannan gum residue. Beta-galactomannan gum residue inhibits the growth of chickens, however this impact can be reduced by adding enzymes like pectinase and cellulase, which can hydrolyze the galactomannan gum (Gheisari *et al*., 2011) [7]. Although trypsin inhibitor was thought by some researchers to be the main antinutritional element limiting the use of guar meal in feed (Couch *et al*., 1967) [3], Lee *et al*. (2003) [12] found that guar meal contains very little trypsin inhibitor. According to Fransis *et al*. (2013), saponins reduce the feed's palatability and hinder the digestion of proteins as well as the absorption of minerals and vitamins in the gut. Trypsin inhibitor and phytate levels were significantly reduced when different heat treatments were applied to the antinutritional components of industrial guar meal (Nidhina & Muthukumar, 2015) [15]. Etman *et al*. (2014a) [5] came to the conclusion that adding more guar korma to the experimental diets of developing buffalo calves boosted both daily and total growth. Daily gains, feed efficiency, and DM digestibility all improved when guar meal level increased in ration when groundnut cake was replaced by it in crossbred calves at 0, 50, and 100% levels (Sagar and Pradhan, 1977).

Materials and Methods

Location of experiment

The experiment was conducted at the animal farm of Animal Nutrition & Feed Technology Division, Central Institute of Research on Buffaloes, Hisar. Hisar city is situated in semi – arid region and climatic conditions are subtropical in nature.

Experimental diets

Tables 1 and 2 show the various concentrate combinations that were given to the animals in the control and treatment groups as well as their chemical make-up. Groundnut cake, wheat, maize, barley, and wheat bran were combined to create the concentrate mixture for the control group (group C); in the E1 and E2 groups, roasted guar korma was used in place of 50% and 100%, respectively, of the groundnut cake protein in the C group. A 2% and 1% addition of mineral combination and regular salt was made to the concentrate mixture. For the purpose of bringing the weight up to 100 kg, wheat bran was used as filler. According to the methodology of the AOAC (2005) [1] and the methodology of Van Soest *et al*. (1994), representative samples of feeds (concentrate mixture and wheat straw) were examined for proximate principles, including dry matter, organic matter, crude protein, ether extract, crude fibre, and total ash.

Table 1: Ingredient composition of concentrate mixture (kg /100kg)

Ingredients	Treatment		
	C	T_1	T_2
Groundnut Cake	32	16.6	---
Roasted Guar Korma	---	12.6	24
Wheat	9.6	9.5	9
Maize	12.1	12.1	12.1
Barley	12.3	12	12
Wheat Bran	32	36	39
Mineral Mixture	2	2.5	2
Salt	1	1.3	1
Total	100	100	100

Table 2: Chemical composition of concentrate mixture (% DM basis

Attributes	Treatments		
	C	T_1	T_2
DM	90.31	90.35	90.64
OM	90.16	89.82	89.50
CP	22.97	23.47	23.88
EE	4.65	4.35	3.94
CF	12.31	12.05	11.51
Total Ash	9.86	10.18	11.50
NFE	50.24	49.96	50.17
NDF	42.00	42.82	43.40
ADF	18.81	18.50	18.01

Distribution and feeding of animals

Based on their body weight, age, and average weight increase over the previous 34 days, 18 calves were chosen and divided into three groups of six using a completely randomised block design. Wheat straw was fed ad libitum as a base diet and was included in the ration given to the growing buffalo calves. Wheat straw and water were made freely available to the animals, while concentrate mixture was fed to each animal separately. The overall amount of the concentrate combination fed to each group was the same. Once a week, green fodder was also provided to fulfil the vitamin A requirements. According to ICAR (2012), the animals were fed.

Digestion Trial

A digestion trial of 7 days was conducted during experimental period with 6 days collection period, during which quantitative collection of total faeces voided on 24 hourly basis was made to determine the nutrients digestibility. Animals were weighed before and after trial consecutively for two days.

Results and Discussions

Dry matter and crude protein intake

Table 3 shows the values of daily dry matter and crude protein intake for developing buffalo calves on various feeds. Intakes of total DM, wheat straw, and concentrate were comparable across all groups. Similar to the difference in crude protein intake, the difference in dry matter intake calculated as per 100 kg of body weight across treatments was negligible. These findings concurred with those made public by Goswami *et al*. (2012) [8], Sharif *et al*. (2014) [16], and Grewal *et al*. (2014) [9] in relation to growing male buffalo calves.

Table 3: Mean values of daily dry matter and crude protein intake (kg) in growing buffalo calves under different dietary treatments

Parameters	Treatments		
	C	E1	E2
Intake			
Wheat straw	2.09±0.22	2.19±0.18	2.17±0.21
Concentrate	2.38±0.28	2.88±0.31	2.82±0.26
5Total DM	4.87±0.31	5.09±0.26	5.05±0.20
DM intake per 100 kg body weight	2.15±0.03	2.26±0.03	2.21±0.04
Crude protein intake	0.81 ±0.04	0.83±0.05	0.85±0.03

Digestibility coefficients and nutritive value of rations

Table 4 provides the digestibility coefficients (per cent) and nutritional value of various feeds for growing buffalo calves under various dietary regimens. Between different treatment groups, there was no statistically significant variation in the digestibility of nearby nutrients and cell wall components ($p<0.05$). Although the findings for the T1 group were lower, the digestibility of dry matter, organic matter, and crude protein were comparable across groups C and T2. For all three groups, the digestibility of the nitrogen-free extract was comparable. The digestibility of ether extract was comparable in C and T1, but somewhat lower in T2. While the digestibility of neutral detergent fibre and acid detergent fibre was best in T2 and lowest in C, the digestibility of crude fibre was highest in T2 and lowest in T1. The findings of the statistical analysis showed that there was no discernible variation in the nutritional value of various rations among various dietary regimens. These findings were consistent with those of Grewal *et al*. (2014) [9], Goswami *et al*. (2012) [8], and Sharif *et al*. (2014) [16], while Goswami *et al*. (2012) [8] found that nitrogen retention was higher at a 50% guar meal supplementation level.

Table 4: Digestibility coefficients (percent) and nutritive value of different rations in growing buffalo calves under different dietary treatments

Digestibility (%)	Treatments		
	C	E_1	E_2
DM	55.27±0.37	52.24±1.16	53.2±0.63
OM	57.7±0.48	57±1.14	57.69±0.66
CP	63.58±0.32	63.08±1.35	63.12±1.54
EE	78±5.56	78.58±3.68	77.23±4.32
CF	43.44±0.85	43.65±2.58	45.37±0.6
NFE	61.37±1.03	62.1±0.91	58.76±0.82
NDF	42.49±0.41	44.69±1.87	46.03±0.64
ADF	33.61±2.37	33.86±2.57	36.24±1.57
TDN %	58.27±0.45	57.22±1.28	57.65±0.8
DCP%	11.73±0.14	11.27±0.21	11.74±0.41

Growth performance

Table 5 displays the results for total gain (kg), average gain (g/d), and FCR. The three groups' beginning and ultimate body weights did not significantly differ from one another. In C, total live weight gain over 150 days was 92.39 kg, compared to 92.98 kg and 103.33 kg in E1 and E2, respectively. Although E1 had greater live weight growth values than C did, the difference was not statistically significant. Similar to this, there was no significant difference between E1 and E2. However, the C and E2 groups differed significantly. The overall average daily gain (g/d) and average body weight gain per 100 kg of body weight (g/d) in the C, E1, and E2 groups, respectively, were 609, 626, and 695 grammes and 233.3, 236.85, and 253.68 grammes. The values were noted to be lower in the C group than the T1 group and the E1 group than the E2 group, although there was no discernible difference ($p<0.05$). However, there was a big difference between C and E2.

These findings concur with those of Etman *et al*. (2014a) [5], who found that adding more guar korma to the experimental diets of developing buffalo calves resulted in greater daily and overall growth. In a different study by Janampet *et al*. (2016) [11], the average daily gain was higher in children fed ration E2 (50% replacement of GNC with Toasted Guar Meal) than in children fed ration E3 (100% replacement of GNC with Toasted Guar Meal), but the values were similar to those in the control group (GNC as the protein source). According to Goswami *et al*. (2012) [8], there was no discernible difference in weight gain between crossbred calves fed concentrate and groundnut cake replaced with guar meal at levels of 50% and 75%. In addition, Sharif *et al*. (2014) [16] found no discernible differences in weight gain between Sahiwal calves when cottonseed cake was substituted with guar meal at 7.5% and 15% levels, respectively, in the concentrate combination. The fact that Goswami and Sharif *et al*. found no impact on calves' growth rates may be related to the fact that they used uncooked guar meal.

The calves in the three treatment groups did not significantly differ in terms of FCR or FCE. FCR of the calves in group E2 was lower than that of the other two groups, indicating that group T2 had a high FCE.

Table 5: Growth performance, feed conversion ratio and feed conversion efficiency in growing buffalo calves under different dietary treatments during experimental period

Parameters	Treatments		
	C	E1	E2
Initial body weight (kg)	168.64±12.83	171.32±12.23	167.63±10.54
Final body weight (kg)	262.03±14.7	263.3±13.89	274.97±12
Total Weight Gain (kg)	92.39^{a}±4.37	95.98^{ab}±3.71	103.33^{b}±3.48
Average body weight gain(g/d)	608^{a} ± 20.02	625^{ab} ± 22.14	694^{b} ± 19.08
Average body weight gain per 100 kg body weight (g/d)	234.30^{a} ±10.23	237.85 ^{ab}±12.27	252.68^{b}±10.17
DMI (kg in 150 days)	744.64±47.41	763.68±44.18	756.45±30.64
FCR	9.19±0.52	9.16±0.53	8.28±0.28
FCE (%)	11.43±0.73	13.51±0.78	12.85±0.57

*Mean values in a row with different superscript differ significantly ($p<0.05$)

Cost of growth

In treatment groups C, E1, and E2, the cost of dry matter was Rs 114.88, 111.44, and 98.94, respectively (Table 6). This indicated that for treatments T1 and T2, respectively, there was a daily net saving of Rs 3.67 and Rs 15.10 per kg of body weight gain. The greater CP content of RGK is responsible for this gain. Due to guar being an annual crop, the market price of RGK varies according to the season. Thus, we can lower production costs by including guar korma in ruminant feeds.

Similar results were reported by Janampet *et al*. (2016) [11] in developing children, Walla *et al*. (2016) in the milk output of Egyptian buffaloes, and Etman *et al*. (2014a) [5] in buffalo calves.

Table 6: Cost of feeding in growing buffalo calves under different dietary treatments

Treatments	Average daily DM intake in kg		Cost of ration consumed (Rs/d)			Live gain (kg/d)	Cost/kg Live wt gain (Rs)	Net savings per kg weight gain (Rs)
	Concentrate	straw	Concentrate	Wheat straw	Total			
C	2.87	2.18	64.15	4.12	71.26	0.619	114.35	0
E_1	2.78	2.29	63.52	4.35	68.85	0.616	110.58	3.78
E_2	2.78	2.26	65.71	4.2	69.98	0.615	98.25	15.10

Conclusions
Roasted guar korma can successfully replace (on 100% protein basis) groundnut cake in CM as evident from better growth rate, FCR, FCE and cost of growth in growing buffalo calves.

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