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Groundnut cake was replaced with roasted guar (*Cyamopsis tetragonoloba*) to observe the effects on development and nutrient utilization in developing buffalo calves Korma

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Abstract
Determining the effects of feeding roasted guar korma at protein levels of 51% (E1) and 100% (E2) to female buffalo calves instead of groundnut cake (C) was the aim of this study. Pulled guar gum leaves are used to make roasted guar korma, a high-protein vegetable feed. Eighteen female buffalo calves were randomly assigned to each of the three treatments and placed in a 151-day growth study. All groups consumed comparable amounts of concentrate, wheat straw, and total DM. A digestibility trial was conducted at the end of the experiment, and it was shown that there was a statistically insignificant difference ($P<0.05$) between the nutritional value of the diet and the digestibility of near nutrients and cell wall elements between the four treatment groups. Over a 150-day period, the average daily rise and total live weight gain were significantly larger in E2 than in C, but similar to E1 in both groups. The calves in the three treatment groups' FCR and FCE did not differ noticeably from one another, yet since E2's FCR was lower than the other two groups', E2 had a higher FCE. E2 had lower dry matter and daily ration expenses per kilogramme of body weight growth than the other two groups. As a result, growing buffalo calves can add 50 or 100% of their diet to include roasted guar korma as a source of protein without affecting their diet's DM consumption, nutrient utilization, growth, or feeding costs.

Keywords: Roasted guar korma, Groundnut cake, Female buffalo calves, Growth performance, Nutrient utilization

Introduction

Raising cattle is one of the most important rural economic activities in the nation and has a significant economic impact on the whole economy. The majority of households that rely on agriculture do so to supplement their income, and for many families without access to land, the proceeds from livestock-related activities have been their primary source of income (DADH). In order to lower the cost of manufacturing animal products, it is now required to substitute traditional concentrates with some inexpensive but nutrient-rich agro industrial by-products because the price ratio of concentrate feeds to animal products has fallen.

Guar (*Cyamopsis tetragonoloba*) is a major crop for revenue in rain-fed areas, especially in semi-arid and desert regions of India. Primarily cultivated in Pakistan and India, this annual legume is drought-tolerant (Mishra *et al*., 2013) [14]. It is an essential legume for industry because of the high export value of the guar gum it extracts. The average annual production of guar seeds in India fluctuates greatly based on the pattern of rainfall, averaging 7-8 lakh tons (APEDA). The three components of guar seeds are the seed coat (14-17%), the endosperm (35-42%), and the germ (43-47%), according to Lee *et al*. (2004) [13]. As a byproduct of extracting guar gum, churi Korma (guar meal) is formed from the germ and hull of the seed and has a high protein content (Sharma & Gummagolmath, 2012) [17]. Three guar seed extracts are available: Guar Split/Gum (29%), Korma (30-35%), and Churi (35-40%) (APEDA, 2014) [2]. Processed guar korma is rich in carbohydrates and proteins, which makes it a great source of protein for ruminants and other animals. It is mostly fed to milking animals in order to increase the amount of milk and milk fat content, in addition to being a good feed for beef cattle (Etman *et al*., 2014a) [5]. The CP content of guar korma has been reported to vary from 56 to 58 percent, 55.8 percent by Soliman *et al*. (2014) [18], 52.7 percent by Nidhina and Muthukumar (2015) [15], 50 percent by Etman *et al*. (2014a) [5], and 46.9 percent by Grewal *et al*. (2014) [9]. The CP content of guar korma is influenced by the kind of germ fraction and heat treatment applied to the finished product. Since guar korma is usually a less expensive feed ingredient, animals are fed it instead of soyabean meal, dried distiller grains, cotton seed cake, and groundnut cake (Etman *et al*., 2014a) [5].

Trypsin inhibitor and beta-galactomannan gum residue are the two primary antinutritional ingredients in guar meal. Chicken growth is inhibited by residue made of beta-galactomannan gum; however, this effect can be mitigated by adding enzymes that can hydrolyze the galactomannan gum, such as pectinase and cellulase (Gheisari *et al*., 2011) [7]. While some researches believed that the primary antinutritional factor restricting the use of guar meal in feed was trypsin inhibitor (Couch *et al*., 1967) [3], Lee *et al*. (2003) [12] discovered that guar meal contains relatively little trypsin inhibitor. Fransis claim that saponins make feed less palatable and interfere with protein digestion and the gut's ability to absorb minerals and vitamins. The antinutritional components of industrial guar meal exhibited considerable reductions in trypsin inhibitor and phytate levels with application of various heat treatments (Nidhina & Muthukumar, 2015) [15]. More guar korma added to the experimental diets of growing buffalo calves increased their daily and overall growth, according to Etman *et al*. (2014a) [5]. When crossbred calves were given guar meal at 0, 50, and 100% levels in place of groundnut cake, their daily gains, feed efficiency, and DM digestibility all increased.

Materials and Methods

Location of experiment

The Central Institute of Research on Buffaloes, Hisar, Animal Nutrition & Feed Technology Division's animal farm served as the site of the experiment. The city of Hisar is located in a semi-arid region with subtropical weather.

Experimental diets

The several concentrate combinations and their chemical composition that were administered to the animals in the treatment and control groups are displayed in Tables 1 and 2. The concentrate combination for the control group (group C) consisted of groundnut cake, wheat, maize, barley, and wheat bran; in the E1 and E2 groups, roasted guar korma was substituted for 50% and 100%, respectively, of the groundnut cake protein in the C group. The concentrate mixture was mixed with 2% and 1% additions of mineral combination and normal salt, respectively. Using wheat bran as filler allowed the weight to be increased to 100 kg. Representative feed samples (concentrate mixture and wheat straw) were analyzed for proximate principles, such as dry matter, organic matter, crude protein, ether extract, crude fiber, and total ash, in accordance with the AOAC (2005) [1] methodologies.

Table 1: The concentration mixture's ingredient composition (kg/100 kg)

Ingredients	Interventions		
	C	T_1	T_2
Groundnut Cake	32.34	16.62	---
Roasted Guar Korma	---	12.62	24
Wheet	9.61	9.52	9
Maize	12.12	12.11	12.14
Barley	12.33	12.0	12.0
Wheat Bran	32.2	36.0	39.0
Mineral Mixture	2.0	2.51	2.0
Salt	1.0	1.31	1.0
Total	100	100	100

Table 2: Concentrate mixture's chemical makeup (percentage of DM base)

Attributes	Treatments		
	C	T_1	T_2
DM	90.32	90.36	90.63
OM	90.12	89.83	89.51
CP	22.96	23.57	23.87
EE	4.64	4.36	3.95
CF	12.32	12.06	11.52
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

A total of eighteen calves were selected based on their body weight, age, and average weight gain over the preceding thirty-four days. They were then split into three groups of six using a fully randomised block design. The growing buffalo calves received a ration that included wheat straw, which was fed ad libitum as a foundation diet. The animals had unrestricted access to water and wheat straw, although they were fed concentrate mixture on an individual basis. Each group received the same total amount of the concentrate combination. To meet the vitamin A needs, green fodder was also given once a week. ICAR (2012) reports that the animals were fed.

Digestion Trial

During the experimental phase, a seven-day digestion trial was carried out along with a six-day collecting period. During this time, the total amount of faeces that were void on a 24-hour basis was quantitatively collected in order to assess the digestibility of nutrients. For two days, the animals were weighed both before and after the trial in succession.

Results and Discussion

Dry matter and crude protein intake

The values of daily dry matter and crude protein intake for growing buffalo calves fed different diets are displayed in Table 3. All groups consumed comparable amounts of concentrate, wheat straw, and total DM. As with the variation in crude protein consumption, there was very little variation in the amount of dry matter consumed per 100 kg of body weight amongst treatments. Regarding growing male buffalo calves, these results were in agreement with those published by Goswami *et al*. (2012) [8], Sharif *et al*. (2014) [16], and Grewal as al. (2014) [9].

Table 3: The average daily intake of dry matter and crude protein (kg) in developing buffalo calves fed various diets

Parameters	Interventions		
	C	E1	E2
Intake			
Wheat straw	2.09±0.21	2.19±0.17	2.17±0.22
Concentrate	2.38±0.27	2.88±0.32	2.82±0.25
5Total DM	4.87±0.32	5.09±0.25	5.05±0.21
DM intake per 100 kg body weight	2.15±0.02	2.26±0.04	2.21±0.03
Crude protein intake	0.81 ±0.03	0.83±0.04	0.85±0.02

Digestibility coefficients and nutritive value of rations

The digestibility coefficients (%) and nutritional value of different feeds for growing buffalo calves under different feeding regimens are shown in Table 4. The digestibility of adjacent nutrients and cell wall components did not differ statistically significantly between treatment groups (P 0.05). The digestibility of dry matter, organic matter, and crude protein was similar between groups C and T_2, despite the T_1 group's results being lower. The digestibility of the nitrogen-free extract was similar for each of the three groups. While it was marginally lower in T_2, the digestibility of ether extract was similar in C and T_1. Crude fiber digestibility was highest in T_2 and lowest in T_1, whereas the digestibility of acid and neutral detergent fibers was best in T_2 and lowest in C. The statistical analysis's conclusions demonstrated that there was no appreciable difference in the nutritional content of different rations among different eating plans. The results of Goswami *et al*. (2012) [8], Grewal *et al*. (2014) [9], and Sharif *et al*. (2014) [16] were in agreement with these findings. Goswami *et al*. (2012) [8] discovered that nitrogen retention increased at a 50% guar meal supplementation level.

Table 4: Nutritive value and digestibility coefficients (%) of various diets given to developing buffalo calves under various dietary conditions

Digestibility (%)	Interventions		
	C	E_1	E_2
DM	55.27±0.35	52.24±1.14	53.2±0.62
OM	57.7±0.44	57±1.15	57.69±0.65
CP	63.58±0.36	63.08±1.34	63.12±1.55
EE	78±5.53	78.58±3.67	77.23±4.33
CF	43.44±0.84	43.65±2.57	45.37±0.62
NFE	61.37±1.02	62.1±0.92	58.76±0.83
NDF	42.49±0.42	44.69±1.88	46.03±0.65
ADF	33.61±2.36	33.86±2.58	36.24±1.56
TDN %	58.27±0.44	57.22±1.27	57.65±0.81
DCP %	11.73±0.13	11.27±0.22	11.74±0.42

Growth performance

The results for FCR, average gain (g/d), and total gain (kg) are shown in Table 5. The starting and final body weights of the three groups did not differ substantially from one another. Over a 150-day period, C's total live weight gain was 92.39 kg, while E1 and E2 saw weight gains of 92.98 kg and 103.33 kg, respectively. Even though E1's live weight growth values were higher than C's, there was no statistically significant difference between them. In a similar vein, E1 and E2 did not significantly differ from one another. The C and E2 groups, however, were very different. In the C, E1, and E2 groups, the average daily growth (g/d) was 609, 626, and 695 grams, while the average body weight gain per 100 kg of body weight (g/d) was 233.3, 236.85, and 253.68 grams. Although there was no appreciable difference ($p<0.05$), the values were found to be lower in the C group than the T_1 group and the E1 group than the E2 group. But there was a significant distinction between C and E2.

The results of Etman *et al*. (2014a) [5], who discovered that increasing the amount of guar korma in the experimental diets of growing buffalo calves led to higher daily and total growth, are consistent with our findings. In another study by Janampet *et al*. (2016) [11], children fed ration E2 (50% replacement of GNC with Toasted Guar Meal) had an average daily gain that was higher than children fed ration E3 (100% replacement of GNC with Toasted Guar Meal), but the values were comparable to those in the control group (which received GNC as the protein source). As stated by Goswami *et al*. (2012) [8] found that crossbred calves fed concentrate and groundnut cake substituted with guar meal at 50% and 75% did not significantly differ in weight gain. Furthermore, Sharif *et al*. (2014) [16] discovered no appreciable variations in weight gain between Sahiwal calves when guar meal was used in place of cottonseed cake in the concentrate combination at 7.5% and 15%, respectively. Goswami and Sharif *et al*.'s usage of raw guar meal may have contributed to their lack of finding any effect on the growth rates of the calves. Regarding FCR and FCE, there was no discernible difference between the calves in the three treatment groups. Group T_2 exhibited a high FCE, as seen by the calf FCR in group E2 being lower than in the other two groups.

Table 5: During the study period, growth performance, feed conversion efficiency, and feed conversion ratio were measured in growing buffalo calves under various nutritional regimens.

Parameters	Interventions		
	C	E1	E2
Initial weight (kg)	168.64±12.84	171.32±12.22	167.63±10.53
Final weight (kg)	262.03±14.71	263.3±13.88	274.97±11
Total Weight Gain (kg)	92.39^{a}±4.38	95.98^{ab}±3.72	103.33^{b}±3.47
Average body weight gain(g/d)	608^{a} ± 20.01	625^{ab} ± 22.13	694^{b} ± 19.07
Average body weight gain per 100 kg body weight (g/d)	234.30^{a} ±10.22	237.85^{ab}±12.26	252.68^{b}±10.16
DMI (kg in 150 days)	744.64±47.42	763.68±44.17	756.45±30.63
FCR	9.19±0.51	9.16±0.54	8.28±0.27
FCE (%)	11.43±0.73	13.51±0.77	12.85±0.56

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

Cost of growth

The cost of dry matter was Rs 114.88, 111.44, and 98.94 in treatment groups C, E1, and E2, respectively (Table 6). This showed that there was a daily net savings of Rs 3.67 and Rs 15.10 per kg of body weight rise for treatments T_1 and T_2, respectively. This gain can be attributed to RGK's higher CP content. Since guar is an annual crop, the season has an impact on the market price of RGK. Thus, by adding guar korma to ruminant diets, we can reduce production expenses.

Janampet *et al*. (2016) [11] showed similar outcomes in developing children, Walla in Egyptian buffalo milk yield, and Etman *et al*. (2014a) [5] in buffalo calves.

Table 6: Feeding costs for developing buffalo calves under various dietary regimens

Interventions	Average kilogram daily dose of DM		Ratio consumption cost (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	2.86	2.17	64.14	4.11	71.25	0.618	114.34	0
E_1	2.77	2.28	63.51	4.34	68.84	0.614	110.57	3.77
E_2	2.79	2.25	65.72	4.21	69.97	0.614	98.24	15.11

Conclusion

Based only on protein content, roasted guar korma can effectively substitute groundnut cake in CM, as demonstrated by growing buffalo calves' improved growth rate, FCR, FCE, and cost of growth.

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