

## EFFECT OF REPLACING COTTON SEED CAKE WITH GUAR MEAL ON GROWTH PERFORMANCE AND ECONOMICS IN SAHIWAL CALVES

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### ABSTRACT

The study was conducted to examine the effect of replacing cotton seed cake (CSC) with guar meal (GM), partially or completely, on nutrient intake, digestibility, growth performance and economics using Sahiwal calves. Twelve female Sahiwal calves of 8-10 months of age were used in a randomized complete block design. These calves were divided into 3 groups, 4 calves in each group. Three iso-nitrogenous and iso-caloric rations containing CSC (15%), GM (15%) and CSC and GM (7.5% each) were formulated. The study continued for 90 days. The first 25 days were adaptation period, while last five days of each month were taken as collection period. Chemical composition indicated that CSC contained 23.04% CP, 31.23% NDF and 18.49% ADF contents while GM contained 39.67% CP, 31.22% NDF and 17.77% ADF contents. Non-significant effects were observed on nutrient intake and digestibility in calves fed rations containing CSC, GM, CSC+GM. Concentrations of blood glucose, blood protein and blood urea nitrogen were also remained unaltered. Total weight gain by calves was unaffected due to replacing CSC with GM. Guar meal containing diets were cheaper than CSC based diet. The study revealed that replacing CSC with GM helped in economical ration formulation without any adverse effects on growth performance of the calves.

**Key words:** cotton seed cake, guar meal, calves, growth performance, economics

### INTRODUCTION

Nutrition plays a significant role to get optimum production from the animals. Provision of balanced ration not only increases the performance of the animals but it also ensures the availability of animal products comparatively at cheaper rates. Feed cost is an important concern in livestock farming (Goh and Rajion, 2007). Cost incurred on feed can be reduced through the use of indigenous feed resources.

Ruminant animals are fed forages and concentrate to meet their requirements. The low crude protein (CP) content of forage limits animal performance which is very critical nutrient especially for growing animals. The increased growth rate will help in attaining early sexual maturity (McDonald *et al.*, 1995). Proper provision of protein sources may help in improving the animal growth rate. Farmers have been using cotton seed cake (CSC) as a source of vegetable protein for livestock feeding in Pakistan. It is an excellent source of protein containing 23% CP (Jabbar, 2001). It has been observed that increasing the concentration of CSC in animal's diet results in increased weight gain (Wood *et al.*, 2004). However, the cost of CSC has gone very high due to its greater demand.

Guar is commonly grown in India and Pakistan where 90% of the world's production takes place. Guar meal (GM) contains 39% CP (NRC, 2001) with a high digestible value. It can replace costly conventional protein sources (Mahdavi *et al.*, 2010). Owing to its higher protein value, it may be used as a practical alternative of CSC. However, information regarding the use of GM to replace CSC and its effects on growth performance of calves yet needs to be explored. The study was planned to determine the effect of replacing cotton seed cake with guar meal on nutrient intake, digestibility, growth performance and economics in Sahiwal calves.

### MATERIALS AND METHODS

Sahiwal calves of 8-10 month of age having a body weight 70-90 Kg were used in a randomized complete block design to determine the effects of replacing CSC with GM on growth performance and economics. All calves were randomly divided into 3 groups, 4 calves in each group. Blocking was done on the basis of body weight of animals. The calves of each group were tagged for their identification. The calves were weighed initially before the start of experiment and thereafter at fortnightly intervals. The calves were housed on concrete floor in different pens. Before the start of the

trial, all calves were de-wormed against endo and ecto-parasites. Vaccination was done against hemorrhagic septicemia and foot and mouth disease.

Three iso-nitrogenous and iso-caloric rations containing CSC (15%), GM (15%) and CSC + GM (7.5% each) as protein source were formulated. Wheat straw and concentrate were mixed and offered as total mixed ration (Table 1). The experiment was continued up to 90 days. A period of one month was provided as adaptation period while last five days of each month were taken as collection period. Feeding was done twice a day (8:00 am, 8:00 pm) including 10% weigh back during collection period. During each collection period, ration offered, refused and faeces were recorded to determine feed intake and digestibility. Feed conversion ratio, feed efficiency and cost of unit live weight gain were calculated.

Digestibility trial was conducted using acid insoluble ash (McGeough *et al.*, 2010). Digestibility of dry matter (DM), crude protein (CP), acid detergent fiber (ADF) and neutral detergent fiber (NDF) were determined. During collection period, animals were shifted to separate metabolic pens to collect complete feces for determination of nutrients (DM, CP, ADF and NDF) digestibility.

Blood samples were collected for serum chemistry during each collection period. For this purpose, about 8-10 ml of blood was taken without anti-coagulant and allowed it to clot at room temperature then was kept in the refrigerator at 4°C for half an hour. Serum was removed through centrifugation at 1500 rpm for 15 minutes. The serum was stored at -20°C till further serological analysis.

Samples of feed offered and the collected fecal samples were analyzed for DM (Method 930. 15; AOAC, 1990), CP (Kjeldhal method 955. 04; AOAC, 1990), NDF and ADF (Van Soest *et al.*, 1991). The blood urea nitrogen (BUN) concentration was determined through the method described by Bull *et al.* (1991).

## RESULTS

**Chemical composition:** Cotton seed cake contained 92.85% DM, 23.04% CP, 31.23% NDF and 18.49% ADF contents. The Metabolizable energy was 2.29 Mcal/kg for CSC whereas, GM contained 93.16% DM. The CP, NDF and ADF contents of GM were 39.67, 31.22 and 17.77%, respectively. The metabolizable energy of GM was 2.20 Mcal/kg (Table 2).

**Nutrients intake and digestibility:** The DM intake and digestibility were remained unaffected ( $P > 0.05$ ) by feeding CSC, GM, CSC+GM diets to the calves. Similarly, a non-significant ( $P > 0.05$ ) effect was observed on NDF, ADF, Ca and P intakes and digestibility by feeding CSC, GM, CSC+GM diets to the calves (Table 3).

**Blood Parameters:** The average concentrations of blood glucose were 58.90, 58.99 and 59.15 mg/dL, total blood protein were 33.3, 33.6 and 33.9 g/dL while BUN were 12.19, 12.01 and 13.37 mg/dL in calves fed CSC, GM and CSC+GM based diets, respectively (Table 4). The result indicated that CSC, GM and CSC+GM diets had non-significant ( $P > 0.05$ ) effects on blood glucose, total blood protein and blood BUN in calves.

**Growth Performance:** There was non-significant ( $P > 0.05$ ) effect of replacing cotton seed cake with guar meal on weight gain in calves. The average daily gain was 622.78 g/day for calves fed CSC based diet and 610.22 and 615.89 g/d for calves fed GM and CSC+GM based diets, respectively (Table 5).

**Economics of Experimental Rations:** The cost of one Kg feed for group fed CSC based diet was Rs. 19.86 while it was Rs. 14.48 and 16.70 for groups fed GM and CSC+GM diets, respectively. Feed costs/ kg weight gain were 165.82, 125.76 and 138.29 in calves fed diets containing CSC, GM and CSC+GM, respectively (Table 6).

## DISCUSSION

**Chemical composition:** Findings of the present study were supported by Jabbar *et al.* (2006) who reported that CSC is an excellent source of protein containing 92.5% DM and 21.1% CP. Babikar (2012) also recorded 24.79% CP and 2.22 Mcal/kg DM ME contents of CSC. Gadberry *et al.* (2009) noticed that CSC contained 27.7% CP while higher in NDF (52.1%) and ADF (44.0%) contents.

**Nutrients intake and digestibility:** A non-significant ( $P > 0.05$ ) effect was observed on nutrients intake in calves fed rations containing CSC, GM and CSC+GM. Jabbar *et al.* (2006) also reported that nutrients intake remained unaltered in fattening calves by replacing CSC with sunflower meal. Lack of differences on feed intake indicated that palatability of sunflower meal is as good as CSC. Milis *et al.* (2005) also reported non-significant effect on DM digestibility through soybean meal or corn gluten meal supplementation. This is attributed to equal rate of bacterial CP flow when corn gluten meal and extruded soybean meal based diets were fed at 2.7% of body weight (Santos-Silva *et al.*, 2003).

**Blood Parameters:** Our findings were in consistent with Lohakare *et al.* (2006) who reported that blood glucose levels were not influenced by different dietary protein treatments in crossbred cows. They also reported non-significant effect on serum levels of total protein fed different protein treatments. The non-significant effect of different protein sources on BUN concentration was supported by Sarwar *et al.* (2011) in lambs. Similarly, Davies *et al.* (2007) found that BUN concentration remained unaffected through feeding different protein sources.

**Growth performance:** The non-significant effect on growth performance across different protein sources was also supported by Bangani *et al.* (2000). Khan *et al.* (1997) found that growing lambs fed soybean meal and canola meal had better weight gain than lambs fed cotton seed meal which pointed out that soybean meal and canola meal were better protein supplements compared to cotton seed meal. This is attributed to the fact that canola meal is rich in vitamins and minerals and also is excellent in methionine and cysteine which are sulphur containing amino acids that resulted in better growth rate (Khan *et al.*, 1997).

**Economics of Experimental Rations:** Guar meal based diet was more economical than diets containing CSC and CSC+GM. Mahdavi *et al.* (2010) pointed out that replacing protein sources with cheaper guar meal resulted in better economic efficiency. Guar meal can be used to substitute other protein sources without any side effects (Turki *et al.*, 2011).

**Table 1: Percentage of ingredients and chemical composition of experimental rations**

Ingredients (%)	CSC	GM	CSC+GM
Cotton seed cake	15	0	7.5
Guar Meal	0	15	7.5
Wheat bran	10.01	10.5	10.02
Wheat straw	40	40	40
Sunflower meal	4.8	5.62	5.43
Rice polish	16.4	16.2	16.1
Molasses	9.43	9.8	9.6
DCP	2	2	2
Salt	0.5	0.3	0.5
Urea	1.04	0.08	0.55
Vegetable oil	0.82	0.5	0.80
Total	100	100	100
Feed cost/kg	19.86	14.48	16.70
<b>Chemical composition (%)</b>			
Dry matter	90.04	89.34	89.72
Crude Protein	14.04	14.06	14.03
*Total digestible nutrients	61.86	61.45	61.68
*Metabolizable energy(Mcal/kg)	2.22	2.21	2.22
Neutral detergent fiber	43.39	43.94	43.63
Acid detergent fiber	29.17	29.39	29.29
Calcium	0.7	0.8	0.7
Phosphorus	0.9	0.9	0.9

CSC= Cotton Seed Cake, GM= Guar Meal

\* Calculated according to NRC (1984)

**Table 2: Chemical composition of cotton seed cake and guar meal.**

Nutrients	Cotton seed cake	Guar meal
Dry matter (%)	92.85	93.16
Crude protein (%)	23.04	39.67
Neutral detergent fiber (%)	31.23	31.22
Acid detergent fiber (%)	18.49	17.77
Metabolizable energy (Mcal/kg)	2.29	2.20

**Table 3: Effect of replacing cotton seed cake with guar meal on nutrients intake and digestibility in calves fed experimental diets**

Nutrients Intake	Diets			
	CSC	GM	CSC+GM	SE
Dry matter intake (kg/d)	5.2	5.3	5.1	2.63
Digestibility (%)	64.5	63.3	64.7	0.468
Crude protein intake (kg/d)	0.73	0.75	0.72	0.27
Digestibility (%)	69.7	68.8	70.7	1.06
Neutral detergent fiber intake (kg/d)	2.26	2.33	2.22	0.14
Digestibility (%)	52.4	53.1	51.3	1.072
Acid detergent fiber intake (kg/d)	1.52	1.56	1.50	0.15
Digestibility (%)	41.6	42.8	40.0	0.66
Calcium intake (g/day)	36.4	42.4	35.7	0.82
Digestibility (%)	68.8	67.1	69.5	2.07
Phosphorus intake (g/day)	46.8	47.7	45.9	0.13
Digestibility (%)	77.8	76.1	78.7	1.18

CSC= Cotton Seed Cake, GM= Guar Meal (P 0.05)

**Table 4: Effect of replacing cotton seed cake with guar meal on blood metabolites in calves**

Parameters	Diets			
	CSC	GM	CSC+GM	SE
Blood glucose, mg/dL	58.90	58.99	59.15	0.97
Total blood protein, g/dL	33.3	33.6	33.9	0.01
Blood urea nitrogen, mg/dL	12.19	12.01	13.37	0.43

CSC= Cotton Seed Cake, GM= Guar Meal (P 0.05)

**Table 5: Effect of replacing cotton seed cake with guar meal on body weight gain and gain to feed ratio in calves**

Parameter	Diets			SE
	CSC	GM	CSC+GM	
Initial weight, kg	83.08	82.16	84.69	2.91
Final weight kg	139.13	137.08	140.12	3.17
Average daily gain, g/d	622.78	610.22	615.89	0.04
Feed conversion ratio	8.35	8.69	8.28	0.45

CSC= Cotton Seed Cake, GM= Guar Meal (P 0.05)

**Table 6: Economics of Experimental Rations**

No	Items	CSC	GM	CSC+GM
1	Total no. of Animals	4	4	4
2	Total no. of days	90	90	90
3	Feed consumed on DM basis	468	477	459
4	Cost of feed/ kg (Rs)	19.86	14.48	16.7
5	Total cost feed (Rs)	9294.48	6906.96	7665.3
6	Feed cost/ kg, weight gain (Rs)	165.82	125.76	138.29

CSC= Cotton Seed Cake, GM= Guar Meal

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