Effect of feeding cotton seed cake (CSC) on growth performance and blood biochemical profile in Mehsana buffalo calves

Deepandita Barman1*, K.B. Prajapati1, M.M. Pawar2, Hemen Das3, C. Kotresh Prasad4 and Maneesh Ahirwar5

Department of Livestock Production and Management, College of Veterinary Sciences and Animal Husbandry, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Satsan-385 506, Gujarat, India.

ABSTRACT

The present study was conducted in 20 growing female Mehsana buffalo calves to study the effect of feeding cotton seed cake with the objective to increase growth and blood biochemical profile. Mehsana buffalo calves of 3-6 months of age were randomly divided in two groups on the basis of body weight and age. Group I was control (T1) fed Banasdan (concentrate mixture) whereas, group II (T2) was fed with cottonseed cake @ 700g, 850g and 960g for 1st, 2nd and 3rd month of treatment, respectively in addition to concentrate feed. Both the groups fed green fodder @ 3kg and dry fodder @ 1kg per day throughout the experiment. Body weights of individual calves were recorded at the commencement of the experiment and followed by monthly interval. Blood- biochemical constituents were recorded on day 1 and thereafter on day 90 of experiment period to analyze the changes in blood constituents in T1 and T2 groups. Average daily body weight gain of calves during the experimental period was higher (P<0.01) in T2 group as compared to T1 group. The serum glucose level was higher (P<0.05) in T2 group than T1 on day 90. The values of serum cholesterol, protein, globulin, ALP, SGOT and SGPT concentration were also significantly (P<0.01) higher in T2 group than T1 on day 90. However, the differences for serum albumin, A/G ratio, calcium and phosphorus on day 90 were found to be non-significant whereas metabolic hormone level T1 and T2 were significantly (P<0.01) higher in T2 than T1 on day 90. The results are indicative of supplementation of cotton seed cake in addition to Banasdan accelerated the growth, blood biochemical parameters and hormonal levels.

Key words: Buffalo, Blood biochemical profile, Cotton seed cake, Feeding, Growth.

INTRODUCTION

Cotton seed cake (CSC) is a high protein source for livestock in the cotton growing belt of India with high UDP (undegradable protein) value. It can be substituted up to 25% for groundnut cake and can be safely included up to 15% in cattle diets (NDB, 2012). Association with a source of degradable energy, it decreases the urinary nitrogen, as most of the energy comes from the fat content which is not adopted for the rumen microbe development at high level (Brown et al., 1997; Bonsi et al., 1997).

In calves, feeding strategies are important for body growth and body weight. Beyond three months of age, development of rumen is substantial and the microbial digestion becomes functional. As the rumen protozoa are varied, in vitro fiber digestion activity and gas production of rumen protozoa of water buffalo is higher as compared to cattle (Jabar et al., 1997) and also have higher capacity to digest dietary crude protein and crude fiber than cattle (Pradhan et al., 1991). Supplementation of cottonseed meal in the ration of ruminants decreases heat increment by lowering body temperature and reduces heat stress during summer (Moody, 1962) with superior values of fattening performance (Turki, 2011). It has also been reported that there is improved growth performance in buffalo calves through supplementing CSC (Yunus et al., 2004). Blood biochemical composition accurately reflects the metabolic status of the animal tissues and indirectly depict the utilization of the feed and the amount of nutrients absorbed into the circulation (Gonzalez and Scheffer, 2002). The nutritional status is depicted by the level of serum albumin and its synthesis is diminished during fasting, malnutrition and poor condition of liver, while the serum globulin level is related with immune status of the animal (Jain, 1986).

In cotton growing belt of India the CSC is an important and cost-effective option for feeding of ruminants as a source of protein. Realizing the potential and advantages
of CSC, the present study has been carried out to determine the
effect of feeding CSC on growth and blood biochemical profile
in Mehsana female calves from three to six months of age.

MATERIALS AND METHODS
The study was conducted from 1st February to 31st
December, 2014 at Livestock Research Station,
Sardarkrushinagar Dantiwada Agricultural University,
Gujarat. Twenty clinically healthy growing Mehsana buffalo
female calves of three months age were selected for the
experiment. The calves were categorized randomly into two
groups of ten animals in each group. T1 (Control) was fed
with 1.360 kg/head/day Banasdan (Concentrate mix.)(n=10)
with 0.5 kg Banasdan and 0.700 kg/head/day cotton seed
cake, Guar chuni, Mineral mixture and Calcite) and T2 was
fed with 0.5 kg Banasdan and 0.700 kg/head/day cotton seed
cake (Table 1). Banasdan contains 20% CP and 63% TDN
with UDP 7.5 – 8%. Cotton seed cake contains 22-23% CP
and 13-14% UDP. They were fed with iso-nitrogenous diet
comprising Maize grain, DORB (Deoiled Rice bran), Rice
polish, Molasses, Rapeseed cake, Guar bhardo, Cotton seed
cake, Guar chuni, Mineral mixture and Calcite) and T2 was
fed with 0.5 kg Banasdan and 0.700 kg/head/day cotton seed
cake, Guar chuni, Mineral mixture and Calcite) and T2 was
fed with 0.5 kg Banasdan and 0.700 kg/head/day cotton seed
cake (Table 1). Banasdan contains 20% CP and 63% TDN
with UDP 7.5 – 8%. Cotton seed cake contains 22-23% CP
and 13-14% UDP. They were fed with iso-nitrogenous diet
to meet the nutrient requirement as per NRC (2001)
guidelines. The common feeding of both groups was three
kg green fodder (Oat) and one kg dry fodder (Jowar hay) /
head/day. All the calves were reared at farm under separate
shed with free access to fresh and clean drinking water and
all standard management practices were adopted during the
period of experiment.

The feeds were thoroughly analyzed for proximate
constituents (Table 2) by using the methods of analytical
procedures (AOAC, 1995).

Growth performance: Body weights of individual calves
were recorded at monthly interval and the average daily gain
was calculated by dividing the total weight gain by number
of days.

Collection of blood samples: Approximately 10 ml of blood
samples were collected aseptically from each animal
of all the groups via jugular vein puncture on initial (day 1)
and final day (day 90) of experiment for analysis of the
different parameters and transferred to VACUETTE® Z
Serum Clot Activator tubes (Greiner Bio-One GmbH,
Austria) and kept in slanting position for about 1 hour
followed by centrifugation at 700xg for 15 minutes to harvest
the serum. The separated serum samples were properly
labeled and stored at -20°C for further analysis.

Analysis of Blood biochemical constituents: The
biochemical parameters such as glucose, total protein,
albumin, globulin, total cholesterol, calcium (Ca), inorganic
phosphorus (Pi), alkaline phosphatase (ALP), serum
glutamic-oxaloacetate transaminase (SGOT) and serum
 glutamic-pyruvate transaminase (SGPT) were analyzed by
using Clinical Analyzer-635 (Systronics, India Ltd., India)
with the help of specific reagents. Hormones such as
triiodothyronine (T3) and thyroxine (T4) were estimated by
ELISA-LDN Labor Diagnostika Nord GmbH & Co. KG,
Nordhorn.

Statistical analysis: The data were expressed as arithmetic
mean(x) and standard error of mean (S.E) and the treatment
mean values analyzed statistically using Duncan’s new
multiple range test (DMRNT) (Sahu, 2010).

RESULTS AND DISCUSSION
The body growth and blood biochemical values of
Mehsana calves under two treatments has been presented in
Table 3, Table 4 and Table 5.

Growth performance: The final body weight as well as
average daily gain in body weight was found significantly
higher (P < 0.01) in T2 group than T1. The results were in
consensus with Yunus et al., (2004) fed cottonseed meal and
Khan et al., (2002) where they supplemented CSC with lysine
and methionine in early weaned calves. This suggested that
the feeding of cotton seed meal in female calves has
significant effect on daily weight gain (Ali et al., 2008;
Shivakumar et al., 2005) due to higher UDP content (Yunus
et al., 2004).

Blood-biochemical parameters:
i) Glucose (mg/dl) and Cholesterol (mg/dl): The serum
glucose level was significantly (p < 0.05) higher in T2
whereas, the serum cholesterol level was found to be
significantly (p < 0.01) higher in T2 on day 90. The present
findings were in accordance with Rashid et al., (2013) where
they found its positive correlation with advancing age in early
weaned Nili-Ravi buffaloes calves. The results were also in
support with significantly (p < 0.01) higher cholesterol
concentration in Murrah buffaloes fed with non-transgenic
cottonseed meal (Singh et al., 2003). Serum cholesterol level
was found to be significantly (p < 0.01) higher in crossbred
calves fed on CSC diets as compared to GNC diets (Pattanaik
et al., 2003). The decreasing trend in blood glucose
concentration at 4 and 12 weeks of age in calves can be
attributed to reduced milk intake and higher starter intake,
higher ruminal fermentation and switching of energy reliance
on VFA as main source rather than milk (Hammon, 2002;
Khan et al., 2007).

Table 1: The feeding regimes of the experimental Mehsana female calves
<table>
<thead>
<tr>
<th>Age</th>
<th>Average Body weight(Pooled over last 3 years, LRS)(kg)</th>
<th>Feeding regimes(kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>56.90 ± 0.84(60)</td>
<td>Control group (T1)Banasdan</td>
</tr>
<tr>
<td>4 months</td>
<td>67.33 ± 0.32(60)</td>
<td>(Concentrate mix.)(n=10)</td>
</tr>
<tr>
<td>5 months</td>
<td>77.75 ± 0.25(60)</td>
<td>Treatment group (T2)Banasdan +</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cotton seed cake(n=10)</td>
</tr>
</tbody>
</table>
Table 2: Percent average composition of feed and fodder (on DM basis) fed to experimental Mehsana female calves

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Banasdan (Concentrate mix.)</th>
<th>Cotton seed cake</th>
<th>Green fodder (Oat)</th>
<th>Dry fodder (Jowar Hay)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>90.61</td>
<td>88.87</td>
<td>16.00</td>
<td>96.99</td>
</tr>
<tr>
<td>OM</td>
<td>90.21</td>
<td>91.95</td>
<td>90.61</td>
<td>91.99</td>
</tr>
<tr>
<td>CP</td>
<td>18.73</td>
<td>24.51</td>
<td>10.50</td>
<td>0.81</td>
</tr>
<tr>
<td>CF</td>
<td>05.94</td>
<td>11.39</td>
<td>24.40</td>
<td>39.35</td>
</tr>
<tr>
<td>EE</td>
<td>02.58</td>
<td>9.10</td>
<td>04.00</td>
<td>01.05</td>
</tr>
<tr>
<td>NFE</td>
<td>62.95</td>
<td>46.94</td>
<td>51.88</td>
<td>46.78</td>
</tr>
</tbody>
</table>

Table 3: Body weight and average daily gain in Mehsana buffalo calves under two different groups

<table>
<thead>
<tr>
<th>Parameter</th>
<th>T1(Mean ± S.E)</th>
<th>T2(Mean ± S.E)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial body weight (kg)</td>
<td>54.85 ± 1.03</td>
<td>55.46 ± 1.16</td>
<td>0.699</td>
</tr>
<tr>
<td>Final body weight (kg)</td>
<td>84.54 ± 2.44</td>
<td>91.86 ± 1.13</td>
<td>0.014*</td>
</tr>
<tr>
<td>Gain in weight (kg)</td>
<td>29.69 ± 1.73</td>
<td>36.40 ± 1.15</td>
<td>10.465**</td>
</tr>
<tr>
<td>Avg. daily gain (g)</td>
<td>329.89 ± 19.18</td>
<td>404.46 ± 12.79</td>
<td>0.005**</td>
</tr>
</tbody>
</table>

Table 4: Average blood-metabolites in Mehsana buffalo calves fed two levels of diet

<table>
<thead>
<tr>
<th>Blood metabolites</th>
<th>Days of trial</th>
<th>T1</th>
<th>T2</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose (mg/dl)</td>
<td>1</td>
<td>61.45 ± 0.63</td>
<td>59.21 ± 0.94</td>
<td>0.065</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>115.52 ± 4.63</td>
<td>116.79 ± 4.10</td>
<td>0.840</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>1</td>
<td>149.89 ± 5.72</td>
<td>171.05 ± 2.64</td>
<td>0.004**</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>5.86 ± 0.04</td>
<td>6.27 ± 0.07</td>
<td>0.001**</td>
</tr>
<tr>
<td>Albumin (g/dl)</td>
<td>1</td>
<td>3.25 ± 0.05</td>
<td>3.42 ± 0.03</td>
<td>0.061</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>3.08 ± 0.05</td>
<td>3.15 ± 0.06</td>
<td>0.371</td>
</tr>
<tr>
<td>Globulin (g/dl)</td>
<td>1</td>
<td>2.88 ± 0.08</td>
<td>2.59 ± 0.10</td>
<td>0.049*</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>3.16 ± 0.12b</td>
<td>1.33 ± 0.05</td>
<td>0.014**</td>
</tr>
<tr>
<td>A/G Ratio</td>
<td>1</td>
<td>1.13 ± 0.04</td>
<td>1.01 ± 0.05</td>
<td>0.200</td>
</tr>
</tbody>
</table>

Table 5: Average blood-biochemical constituents (minerals, enzymes and hormones) in Mehsana buffalo calves fed two levels of diet

<table>
<thead>
<tr>
<th>Blood biochemical constituents</th>
<th>Days of trial</th>
<th>T1</th>
<th>T2</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium (mg/dl)</td>
<td>1</td>
<td>9.22 ± 0.07</td>
<td>9.12 ± 0.03</td>
<td>0.185</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>9.44 ± 0.07</td>
<td>9.61 ± 0.07</td>
<td>0.111</td>
</tr>
<tr>
<td>Phosphorus (mg/dl)</td>
<td>1</td>
<td>6.14 ± 0.03</td>
<td>6.15 ± 0.04</td>
<td>0.741</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>6.27 ± 0.04</td>
<td>6.34 ± 0.02</td>
<td>0.160</td>
</tr>
<tr>
<td>ALP (IU/L)</td>
<td>1</td>
<td>134.60 ± 4.96</td>
<td>127.42 ± 4.10</td>
<td>0.285</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>199.00 ± 5.44</td>
<td>225.54 ± 2.92</td>
<td>0.001**</td>
</tr>
<tr>
<td>SGOT (U/L)</td>
<td>1</td>
<td>23.04 ± 1.58</td>
<td>21.82 ± 1.33</td>
<td>0.562</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>18.88 ± 1.50</td>
<td>25.49 ± 1.33</td>
<td>0.004**</td>
</tr>
<tr>
<td>SGPT (U/L)</td>
<td>1</td>
<td>26.01 ± 1.41</td>
<td>24.44 ± 1.07</td>
<td>0.388</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>22.17 ± 1.30</td>
<td>30.73 ± 0.83</td>
<td>0.001**</td>
</tr>
<tr>
<td>T3 (ng/ml)</td>
<td>1</td>
<td>0.62 ± 0.06</td>
<td>0.48 ± 0.04</td>
<td>0.109</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>1.59 ± 0.02</td>
<td>1.90 ± 0.07</td>
<td>0.001**</td>
</tr>
<tr>
<td>T4 (µg/dL)</td>
<td>1</td>
<td>7.25 ± 0.16</td>
<td>6.86 ± 0.15</td>
<td>0.090</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>7.54 ± 0.19</td>
<td>8.40 ± 0.24</td>
<td>0.009**</td>
</tr>
</tbody>
</table>

Means in a row with different superscripts differ significantly (* p < 0.05; **p < 0.01)
were further supported by non-significant difference in serum albumin level between calves fed on CSC diet and GNC diet (Pattanaik et al., 2003). The present findings were in accordance with Saijpaul et al. (2006) where they found significantly higher (P < 0.05) level of globulin in treatment group fed with whole linted cottonseed in crossbred cows. The serum globulin level is related with the immune status of the animal (Jain, 1986) and hence, it was concluded that the animals in T1 (CSC) have higher immune status as compared to T0 (control) group with values within normal range.

iv) A/G ratio: The treatment difference for albumin:globulin ratio was non-significant on day 90 and corroborate with non-significant difference between buffaloes fed on transgenic cottonseed group (Singh et al., 2003). The result was further supported with non-significant difference in A/G ratio between calves fed on CSC diet and GNC diet (Pattanaik et al., 2003).

v) Calcium (mg/dl) and phosphorus (mg/dl): The serum calcium and phosphorus concentration were non-significant between T1 and T2 on day 90 which was supported with Lohakare et al. (2006) where they didn’t find any significant difference in serum calcium and phosphorus level between dietary protein treatments in crossbred calves and between treatment groups fed with whole linted cottonseed in crossbred cows (Saijpaul et al., 2006).

vi) Alkaline phosphatase (IU/L), Serum glutamic-oxaloacetate transaminase (U/L) and serum glutamic-pyruvate transaminase (U/L): The values of serum alkaline phosphatase (ALP), glutamic-oxaloacetate transaminase (SGOT) and glutamic-pyruvate transaminase (SGPT) were significantly (p < 0.05) higher in T1 than T2 on day 90 which were in agreement with significantly higher ALP in goats consuming 15.7% ECS (EasiFlo® cottonseed) (Solaaiman et al., 2009). There is an increased secretion of ALP from the liver to the blood when the animals are in active stage of bone growth (Singh and Swarup, 1994). Therefore, the significant variation in serum ALP in T1 in the current study is the reflection of increased growth rate observed in calves. The study was also in line with statistically non-significant but numerically higher SGOT and SGPT level in buffalo fed transgenic cottonseed and higher concentration of serum SGPT activity due to high UDP ration in ruminants (Singh et al., 2003). Feeding of CS resulted in increase in SGPT/ALT activity at 4 months in comparison to calves fed on GN (Pattanaik et al., 2003). There was a linear increase in serum SGPT/ALT activity in heifers with increasing levels of whole cottonseed inclusion in the diets (Colin-Negrate, 1996).

CONCLUSION

Based on the results, it may be concluded that the feeding of cotton seed cake in concentrate mixture of Mehsana buffalo calf improved average daily body weight gain and increased the levels of serum cholesterol, total protein and globulin by enhancing the peripheral circulation and immunity in the body. The enzymes serum ALP, SGOT and SGPT increased significantly with the diet fed with high protein (CSC) which reflects the increase growth rate in Mehsana calves. Effect of feeding CSC significantly increased the circulating thyroid hormone levels (T3 and T4), thereby, improved the body growth towards active growing stage.

ACKNOWLEDGEMENT

Authors would like to thank Dr. K.B. Prajapati, Research Scientist, Livestock Research Station, SDAU, Dr. M.M. Pawar, Department of Animal Nutrition, Dr. H. Das, Asst. Professor, Animal Biochemistry and Physiology, Veterinary College, SDAU to provide all kind support and facilities to conduct this experiment and M/s C. Kotresh Prasad and Girish Panchbhai for analysis and support during the study period.

REFERENCES


