INFLUENCE OF RECEIVING DIFFERENT LEVELS OF DIETARY FAT ON THE PERFORMANCE OF FINISHING STEERS

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ABSTRACT
Eighteen crossbred Holstein finishing steers of 200±25kg weight and 9.5 to 10 months of age were assigned randomly to one of the three groups having 6 animals in each those were supplied with different rations at different levels of calcium long chain of fatty acids (Ca-LCFA) for 120 days and the growth, feed conversion efficiency, dry matter intake and blood profile was studied. The control group received 0 % of Ca-LCFA, 1st group 3 % and the 2nd group 6 % of CLCFA. The average daily gains of control, 1st and 2nd groups were 1.083, 1.011 and 1.115kg, respectively and the fed conversion efficiency were 5.340, 5.688 and 5.898 which showed no significant difference treatment (P<0.05). Average daily dry matter intake of entire period in different groups were 7.433, 7.467 and 7.565 which was also not significant (p<0.05). The blood Hemoglobin, Glucose, PCV and total protein were also measured. The pcv of the 2nd group was significantly (P<0.05) lower than the other group, and also total protein of control groups was slightly lower than the other two groups.

INTRODUCTION
Satisfactory mechanistic explanation for the stimulatory effect of supplemental fat on milk production in midlactation cows already consuming adequate energy has been elusive. At least part of the effect seems to result from increased energy density and intake. Feeding higher-energy diets made isocaloric through addition of fat or concentrate increased yields of milk over lower-energy control diets in some but not all studies (Fluharty and Loerch, 1997, Drackley et al. 2003). The addition of fat decreases methane production (Chilliard, 1993), thereby increasing the proportion of metabolizable energy in the diet.

The use of supplemental fat to increase the energy density of ruminant is increasing rapidly. However, supplemental fat can affect ruminal digestion of carbohydrates negatively through an inhibitory effect for long-chain fatty acids (LCFA) on fiber digestion (Zinn, 1989) indicated that fat supplementation was associated with a decrease in carbohydrate fermentation, a reduction in ruminal fiber digestion, and a shift in the site of digestion from rumen to hindgut. Grummer, (2003) recommended that fat supplements must be relatively inert in the rumen to reduce the detrimental effects of fat on ruminal carbohydrate fermentation. Past research has indicated that dietary Ca levels should be increased when fat is fed to help alleviate effects on fiber digestion in high-forage diets (>40% forage). Available research data, however, indicate that production responses generally were similar between primiparous and multiparous cows (Canale et al. 1990).

Research on human health and wellbeing has, over recent decades, focused on the fat content and type of fat in food. The fats in food products derived from ruminants are generally highly saturated and the intake of such fats has been associated with a number of health concerns. It is possible to alter milk fat composition by adding fat to dairy cow diets, but fatty acids available for milk synthesis in ruminants do not directly reflect the fatty acid intake. Biohydrogenation of dietary unsaturated fatty acids in the mammary gland alters milk fat composition markedly (Agenas et al., 2002). CLA has been shown to possess health-promoting effects in animal models, for example, the capacity to inhibit tumour growth and reduce plasma cholesterol (Mac Donald, 2000). Some of these effects may translate into positive health
effects in humans, for example on breast cancer (Knekt et al., 1996; Aro et al., 2000).

The aim of this study was to examine the effects of fat source and calcium level on the performance and blood profile of finishing steers.

**MATERIAL AND METHODS**

This study, conducted at the Mary Rose private dairy farm in Gorgan city, Golestan province during the year 2003. Eighteen crossbred steers were blocked by weight and assigned randomly to a 2x3 factorial arrangement of treatments in a randomized complete block design with three pens of six steers each. Pen dimensions were 4.3 m x 7.4 m with automatic waterers located near the feed bunk and shared by animals of two pens. The animals group averaged 200 ± 25 kg body weight and 9.5 to 10 months of age. The treatments combined no supplemental fat, as control group, 3% fat as group 1 and 6% in group 2, respectively. The 5% (actual analysis .6%) level of Ca was chosen to fulfill the Ca requirement. All diets met or exceeded the minimum requirements for CP, Ca, ME (Mcal/kgDM), EE, NDF, ADF and P as described for medium-framed yearling steers (NRC. 1984). The fats were supplied by Kimiaroshd Company in Golestan province, Agh-Ghala Industrial Zone, Gorgan. Wheat-based diets were chosen to facilitate an optimally low ruminal pH. Steers after arrival were ear tagged; vaccinated against blackleg, malignant edema, infectious bovine rhinotracheitis, parainfluenza-3 and bovine viral diarrhea; implanted with anathematic and grubicide. Decoquinate at 180 mg/d vitamin A at 40,000 IU, and vitamin E at 200 IU was given in the daily ration for 10 days.

The trial began (d 0) with weighing the steers and increasing the diet to 50% concentrate for 7d, then to 72% concentrate (With 2% added fat in designated treatment diets) for 4 d, and finally to 85% concentrate. Steers were fed twice daily throughout the trail. Jugular blood was obtained by venipuncture from two steers group on day 0, 30, 60, and 120 of the trail and centrifuged at 2200 x g for 15 minutes to obtain serum. Blood was placed on ice immediately after sampling, then kept at 4°C and centrifuged within 48 hours. The same steers were sampled throughout the trial.

Starting and ending weights were the average of two consecutive early-morning weights. The steers were weighed at 28-d intervals until 120 days. Steers were weighed at 0700 and fed upon (six animals/treatment) at weighing on d 0, 30, 60, and 120 of the trial.

Data were analyzed as a randomized complete block design with a 2x3 factorial arrangement of treatments using pen as the experimental unit. The model included fat, Ca, and their interaction as treatment effects, with weight as a blocking factor (Cochran and Cox, 1957). When interactions were not significant (p > .10), the df associated with fat were further partitioned using orthogonal contrasts. When interactions were present, means were separated by least significant difference. Statistical analyses were performed using the GLM procedure (SAS, 1998) with p < .10 as the accepted level of significance.

**RESULTS AND DISCUSSION**

The overall (0 to 120d) effect of fat was to increase DMI (P < 0.05). The 6% Ca interacted with fat source to decrease gain (P < 0.05) and tended to increase gain in the no supplemental fat diet. In the group 2 diet, the 6% Ca had no effect on ADG, DMI or efficiency of gain.

In terms of overall performance, adding fat or supplemental Ca improved feed utilization compared with the 3% Ca no-fat diet (Table 1). These results are consistent with past research using > 80% concentrate diets (Zinn, 1989). Higher levels of Ca, supplied by limestone, have been shown to increase ruminal or small intestinal starch digestion (Brink and Steele 1985). Because wheat-based diets were used, a buffering effect
from Ca might have been the cause of the improved performance of the nonfat diet. Brink et al. 1984 reported results from five experiments with limestone added at .8 vs. 1.7% of the DM in high-corn diets (80 to 85%) that contained either various rations of dry corn (whole or rolled) or high-moisture corn. The 1.7% level of limestone did not affect gain, DMI, or efficiency in the three experiments using dry corn and in one of the experiments using high-moisture corn, however, in the other experiment using high-moisture corn (Brink et al., 1984), steers fed the 1.7% level of limestone were more efficient (\( P = .02 \)) than those fed the .8% level.

Improved gain and feed utilization when feeding fat have been related to its increased energy density. Feeding additional Ca increased ADG by 9.6%, whereas Ca improved ADG approximately 3% through improved feed utilization or intake of the no supplemental fat. This decreased ADG was due to the combined non-significant decreases in DMI. Fat increased DMI in this study. A reduction in feed intake when fat is fed has been the common result in past research (Cole and Hutcheson, 1987). The critical factor of the intake effect in this study is the type of grain fed (i.e., wheat). In several trials by Brethour et al. (1986), fat increased the feeding value of wheat (in 50 or 100% wheat diets) by consistently increasing DMI. Brandt (1988) found that adding fat increased ADG by an average of 11% (1.40 vs 1.25 kg/d) whether wheat was dry-rolled or steam-flaked. Steam-flaking wheat and adding fat produced additive increases in ADG compared with dry-rolled wheat. However, steam-flaking compared with dry-rolling often results in better performance when feeding wheat (Brandt et al. 1987) by altering ruminal fermentability, specifically by decreasing the rate of starch digestion (Kreikemeier et al. 1990).

Altering tissue Ca-LCFA composition by feeding fat is much more difficult in ruminants than in non-ruminants; however, significant but small changes have been shown by (Rule and Beitz, 1986).

To assess the physiological status of the experimental animals as well as to see whether their nutritional status is reflected in their blood profile, a study of the levels of certain constituents of blood was carried out. In present research the Hb and Glucose of different groups of animals were not significant among themselves, \( P < 0.05 \) (Table 1). The Hb level has got a crucial role in transport of oxygen and its level is influenced by variation in dietary iron as well as protein. Hb level of blood tended to increase with age. Yazdani and Gupta, (1996a), Soly and Singh, (2003). The red cell size in a new born calf was smaller than cows and decreased in size gradually until adult size was reached. Holman, (1956). In our findings only group 2 animals had significant difference compared to the other groups \( P < 0.05 \) (Table 1). Hence, the low level of pcv in blood indicates the anemic condition of the animal. Indirectly the pcv is the index of health status of the individual. The pcv content observed

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>G 1</th>
<th>G 2</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth (g)</td>
<td>1.083a</td>
<td>1.111a</td>
<td>1.115</td>
<td>0.048</td>
</tr>
<tr>
<td>Feed conversion efficiency (kg)</td>
<td>5.340a</td>
<td>5.688a</td>
<td>5.898a</td>
<td>0.566</td>
</tr>
<tr>
<td>DMI (kg)</td>
<td>7.433a</td>
<td>7.467a</td>
<td>7.565a</td>
<td>0.137</td>
</tr>
<tr>
<td>Hemoglobin (mg/100ml)</td>
<td>10.603a</td>
<td>10.628a</td>
<td>10.696a</td>
<td>0.121</td>
</tr>
<tr>
<td>Glucose (mg/100ml)</td>
<td>43.413a</td>
<td>43.480a</td>
<td>43.575a</td>
<td>0.172</td>
</tr>
<tr>
<td>Packed cell volume( % )</td>
<td>39.708a</td>
<td>39.675a</td>
<td>39.453b</td>
<td>0.126</td>
</tr>
<tr>
<td>Total protein (g/100ml)</td>
<td>6.650b</td>
<td>6.770a</td>
<td>6.814a</td>
<td>0.151</td>
</tr>
</tbody>
</table>

Means with the same letter are not significantly different.
in the present study was similar to the results values of earlier workers Yazdani and Gupta, (1996b), Soly and Singh, (2003).

The level of glucose in the blood is an important factor in determining the glucose concentration in the interstitial fluid, which has an influence on the rate of transport of this sugar into individual cells. It is one of the most important energy yielding constituents. Small increase may be found in hyperactivity of pituitary and adrenal glands. Moderate rise of glucose level is associated with the infectious diseases. Bidarkar (1985) observed that the blood glucose level decreased with increase in age of the calves. They also observed that levels of protein in that diet had significant effect on blood glucose, which was similar with the result of present investigation. Abdelhafez et al. (1983) reported that the rate of glucose utilization in ruminant is positively related with digestible energy intake. Since one of the reason for variation in glucose in the ruminant species is nutritional status of animal.

The chief physio-chemical functions of the plasma protein are the maintenance of normal blood volume and normal water content in the tissue fluids. They provide nutrition for the body and contribute to the solubility and transport of lipids, fat-soluble vitamins, bile salts, hormones and various drugs in the blood. The gamma globulin fraction provides antibodies for the defense against infection. It also reflects nutritional status of animals specially the nitrogen balance. In present research only control group animals had significant effect compared to group1 and group 2 (P<0.05) (Table1) Payne et al. (1974). Katharia and Avasathi (1985) reported that a normal value of total proteins to be 7.5 to10gm/100ml. Levels of plasma protein increase with the aging in all species (Shaffer et al 1981). In buffalo, Bidarkar (1985) observed that the higher plane of nutrition did not have significant effect on total plasma protein.

CONCLUSIONS

Increasing dietary Ca levels to 6% in wheat-based finishing diets did not seem to improve the feeding value of added fat. However, it did improve gain/feed ratios when fat was not included in the 85% wheat diets. Fat source interacted differently with Ca level and seemed to do so in the rumen, primarily through decreased Ca-LCFA synthesis. Increasing dietary Ca levels from .3 to .6% in wheat-based finishing diets did not increase the feeding value of added fat; in fact, it caused a decrease in weight gains of steers. Adding 3% fat or Ca to .6% (dry matter basis) or both to an 85% steam-rolled wheat finishing diet increased gain/feed ratios by 9.8%. Average daily gain and dry matter intake were also increased by adding fat to 85% wheat finishing diets.

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REFERENCES