EFFECT OF SEASONAL STRESS ON GROWTH RATE AND SERUM ENZYME LEVELS IN YOUNG CROSSBRED CALVES.

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ABSTRACT

A study was conducted on 16 crossbred calves during spring (Feb–Mar) and summer (July) on crossbred calves aged 15 days. Body weights were recorded at fortnightly intervals till 120 days of age. Approximately 10.0 ml blood was collected from each calf in the mid experimental period in chilled glass vials kept in ice-salt mixture. Blood sera were analyzed for glucose, serum glutamic pyruvic transaminase (SGPT), serum glutamic oxaloacetic transaminase (SGOT) and alkaline phosphatase. Growth rate was significantly (P<0.01) depressed in summer (362.12±17.42 gm./day) compared to spring (534.12±22.57 gm./day). Serum glucose was significantly (P<0.05) lower in summer (38.62±4.81 mg %) than spring (51.69±4.40 mg %). Similarly serum glutamic pyruvic transaminase (SGPT) activity was lower (P<0.05) in summer (10.68±0.96 U/ml) compared to spring (16.44±2.17 U/ml). Serum alkaline phosphatase was higher in summer (130.43±14.79 KA Units) compared to spring (119.44±10.81 KA Units), though the differences were non-significant at 5% level. It can be concluded that summer stress reduces growth rate and it may be due to lower energy generation and impaired metabolism. Lower SGPT activity indicates lower amino acid turnover while higher alkaline phosphatase activity is an indicator of bone resorption/alkalosis.

Key words : P.

INTRODUCTION

Calves are susceptible to heat stress, thus leading to lower growth rate in summer leading to economic losses (Marai et al. 1995; Broucek et al. 2007). Heat stress disturbs metabolism. SGOT and SGPT are involved in amino acid metabolism and hence, protein turnover. Alkaline phosphatase is involved in energy metabolism and is an indicator of alkalosis and stress while serum glucose is an indicator of energy turnover. Though, some reports (Cunningham, 2002; Koubkova et al. 2002) on depressed growth rate in calves by heat stress are available yet the underlying physiological mechanism is still not clear. The present investigation was undertaken to study the effect of heat stress on growth rate and serum enzymes activities and glucose concentration in crossbred dairy calves.

MATERIAL AND METHODS

The studies were conducted on young crossbred calves starting from 15 days till 120 days of age. Sixteen calves were taken in spring (Feb-March) and equal number in summer (July). Body weights were recorded every fortnightly and gain/day was calculated. Blood sera were analyzed for SGOT, SGPT, glucose and alkaline phosphatase. SGOT and SGPT were assayed as per Reitman and Frankel (1957) while glucose and alkaline phosphatase by the method of Varley (1975), respectively. The data were analyzed for analysis of variance and correlation coefficients by a statistical programme, SPSS.

RESULTS AND DISCUSSION

Values of various enzymes and weight gain have been depicted in Table 1. SGOT did not vary in different seasons while SGPT was significantly
Higher values of alkaline phosphatase were obtained in summer (8.42 per cent) though the differences were non significant at 5% level. Serum glucose was significantly (P<0.05) higher in summer (51.69±4.40 mg %) than spring (38.62±4.81 mg %). Body weight gain (gm. /day) was significantly decreased in summer than winter (47.49%). Growth rate was positively correlated with glucose (r=0.440) but negatively with SGPT (r=-0.328) though the differences were significant at 5% level).

Seasonal variations in growth rate in cattle have already been reported but the exact mechanism has still not been elucidated. Vysokos et al. (2005) reported that Holstein calves born in winter–spring had better adaptability than those born during summer-autumn. Broucek et al. (2007) reported significantly lower (P<0.01) body gain in calves born in summer. Similar results were reported by Marai et al. (1995) who reported lower gain and higher transaminases in calves during summer.

Reduced growth rate in summer may be due to lower nutrient intake, as reduction of heat increment of feeding by dietary manipulation may partially protect cattle from heat stress (Blackshaw and Blackshaw, 1994). Heat stress depressed feed intake from 10-35% in dairy cattle (West, 2003; Baumgard et al. 2006). The deleterious effects of heat stress may due to disturbed blood metabolite concentrations (Sasaki et al. 2002). Marai et al. (1997) reported that heat stress reduced weight gain and feed efficiency and had deleterious effects on thyroid, liver and kidney functions.

Daily gain and SGPT were significantly depressed during summer. This indicates decreased metabolic activity due to heat stress (Spurr, 1972). The values of transaminase are higher in the physiological state which demand higher energy turnover in cattle (Contreras et al. 1996). Lower intake during summer may lead to lower nutrient turnover in goats, which may be the reason of decreased SGPT activity in the present studies (Kaushik and Bugalia, 1999).

Increase in alkaline phosphatase activity due to heat stress is in agreement with Mehta et al (1985) and Bahga et al 2007). This may be due to alkalosis caused by increased alveolar ventilation and resultant alkalosis (Cunningham, 2002). Alkaline phosphatase is involved in maintaining homeostasis and energy generation in animal body (Swenson and Reece, 1993; Vashishth et al. (1998), which seems to be the reason of higher activity in the present investigation.

Lower level of glucose during heat stress may be due to increased glucose oxidation (Collier et al. 2008). Decreased gluconeogenesis and glycogenolysis were observed in cows during heat stress (Itoh et al. 1998). In heat-stress exposed cows (Koubkova et al. 2002), hemoconcentration led to increased blood glucose in initial stages followed by a quick decrease which also conform to the previous findings of Aboulnaga et al. (1989) and Ronchi et al. (1997). In beef cattle blood glucose concentrations were lower during restricted than normal growth (Ellenberger et al. 1989).

It can be concluded that heat stress depresses body gain in crossbred calves. The reason may be due to depressed gluconeogenesis, decreased activity of SGPT and alkalosis as indicated by higher alkaline phosphatase activity. Serum glucose concentration can be taken as an index of higher gain. Remedial measures like improved microclimatic modification and dietary nutrient balance are recommended.

**Table 1.** Average values + SE of various blood constituents and weight gain in different seasons.

<table>
<thead>
<tr>
<th>Blood constituent</th>
<th>Season</th>
<th>Variation over summer (%)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Summer</td>
<td>Spring</td>
</tr>
<tr>
<td>Serum glutamic oxaloacetic transaminase (Units/ml)</td>
<td>38.44±4.95</td>
<td>38.68±4.83</td>
</tr>
<tr>
<td>Serum glutamic pyruvic transaminase (Units/ml)</td>
<td>10.68±0.96</td>
<td>16.44±2.17*</td>
</tr>
<tr>
<td>Alkaline phosphatase (KA Units)</td>
<td>130.43±14.79</td>
<td>119.44±10.81</td>
</tr>
<tr>
<td>Glucose (mg/100 ml)</td>
<td>38.62±4.81</td>
<td>51.69±4.40*</td>
</tr>
<tr>
<td>Weight gain (gm./day)</td>
<td>362.12±17.42</td>
<td>534.12±22.57**</td>
</tr>
</tbody>
</table>

*P<0.05 **P<0.01
REFERENCES


