Effect of Exogenous Thyroxine Supplementation to Reduce the Incidence of Hypothermia in Dairy Calves

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ABSTRACT

Higher serum lipids concentration in blood is the major cause of hypothermia due to lesser utilization of lipids by the buffalo calves for generation of body heat (thermogenesis). A study of effect of exogenous thyroxine supplementation on hormonal status in murrah buffalo and crossbreed cow calves has been evaluated. The study was conducted on 12 healthy buffalo calves and 12 cow calves at Livestock Farm (calf unit), Adhartal, N.D.V.S.U., Jabalpur, Madhya Pradesh. Oral supplementation of thyroxine (0.167 mg/kg body weight), in powder form mixed along with 5 gram jaggery on 15 day interval starting from age of 16-days, 31-days and 46-days. The findings lead to these conclusions that thyroxine supplementation was found mobilisation of lipids and high density lipoprotein cholesterol for heat production to maintain homeostasis. The increased thyroxine level in buffalo calves helped to maintain their body temperature and increased basal metabolic rate, thus helped in their survival and reduced mortality.

Keywords: Thyroxine, buffalo and cow calves, cortisol
by uncoupling of oxidative phosphorylation process. Therefore, elevated body temperature will lead to sustenance of calves during initial two months of age. Hence, the present study was designed to explore the effect of exogenous thyroxine supplementation on \(T_3\), \(T_4\) cortisol concentrations in calves and to reduce the incidence of hypothermia in dairy calves.

**MATERIALS AND METHODS**

The study was conducted on a total of 12 apparently healthy buffalo calves and 12 cow calves at Livestock Farm (calf unit), Adhartal, N.D.V.S.U., Jabalpur (M.P.). The experiment was designed in total four groups of animals (I-IV), control group of buffalo calves and cow calves, thyroxine supplemented buffalo and cow calves, respectively (Table 1). Each group included six animals. The thyroxine was administered orally once a day @ 0.167 mg/kg body weight in powder form mixed along with 5 gram jaggery on 15th day, 30th day and 45th day (days from their birth) to the experimental calves. The blood samples were collected on 16th, 31st and 46th day in sterilized test tube without anticoagulant for separation and collection of serum. The concentration of thyroid hormone (\(T_3\) and \(T_4\)) and cortisol hormone were estimated by using commercially available standardized ELISA kits. The experimental data were analysed by analysis of variance using hierarchical design as per the method described by Snedecor and Cochran (1989).

**RESULTS AND DISCUSSION**

In the present investigation the higher rectal temperature as shown in Table 2, figure 1 of thyroxine treated calves is clearly related to the calorigenic effect of exogenously supplemented thyroxine, which maintains a critical role in the control of body temperature by stimulation of thermogenesis and regulation of cellular metabolism (Abdelatif and Saeed, 2009). The similar findings were also reported by Seitz *et al.* (1985). Some calorigenic effect of thyroxine (\(T_4\)) is also due to the metabolism of fatty acids as well as increase in the activity of the membrane bound Na\(^+\)-K\(^+\) ATPase in many tissues (Josef Fontana, 2014).

The \(T_4\) level also increased significantly (P<0.05) in both treatment groups of buffalo calves (9.12 ± 0.65) and cow calves (13.49 ± 0.98) as compared to control groups of buffalo calves (4.34 ± 0.18) and cow calves (5.48 ± 0.31), respectively. This significant (P<0.05) increase in the \(T_3\) and \(T_4\) concentration as depicted in Table 3 (figure 2) and Table 4 (figure 3), respectively in treatment groups may be due to increased thyroid stimulating hormone (TSH) or thyrotropin releasing hormone (TRH) as reported by Davicco *et al.* (1982) and Enright *et al.* (1993), respectively.
Table 1: Experimental design

<table>
<thead>
<tr>
<th>Groups</th>
<th>Experimentation</th>
<th>Class of animals</th>
<th>Number of animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Control</td>
<td>Buffalo calves</td>
<td>6</td>
</tr>
<tr>
<td>II</td>
<td>Control</td>
<td>Cow calves</td>
<td>6</td>
</tr>
<tr>
<td>III</td>
<td>Treatment with Thyroxine Sodium @ 0.167 mg/kg body weight</td>
<td>Buffalo calves</td>
<td>6</td>
</tr>
<tr>
<td>IV</td>
<td>Treatment with Thyroxine Sodium @ 0.167 mg/kg body weight</td>
<td>Cow calves</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 2: Rectal temperature (°F) at different intervals in different groups of calves

Mean values bearing different superscripts in rows and columns (lower case) and in last row (upper case), differ significantly (P < 0.05).

Table 3: T₃ (ng/ml) at different intervals in different groups of calves

Mean values bearing different superscripts in rows and columns (lower case) and in last row (upper case), differ significantly (P < 0.05).

Table 4: T₄ (µg/dl) at different intervals in different groups of calves

Mean values bearing different superscripts in rows and columns (lower case) and in last row (upper case), differ significantly (P < 0.05).

Table 5: Cortisol (µg/dl) at different intervals in different groups of calves

Mean values bearing different superscripts in rows and columns differ significantly (P < 0.05).
Supplementation of sodium-L-thyroxine showed no response to plasma cortisol concentration due to its weaker binding to plasma proteins and its higher fractional disappearance rate. Similar findings were also reported by Falconer and Jacks (1975).

**CONCLUSION**

The findings lead to these conclusions that thyroxine supplementation was found mobilisation of lipids and high density lipoprotein cholesterol of buffalo calves produced heat and reduces the incidence of hypothermia to maintain homeostasis in them. The increased thyroxine level in buffalo calves helped to maintain their body temperature and increased basal metabolic rate, thus helped in their survival and reduced mortality.

**REFERENCES**


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