

THYROXINE AND TRIIODOTHYRONINE LEVELS IN PREMATURE CALVES

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Summary: The aim of this study was to determine serum total T₄ and total T₃ concentrations in premature calves. For this purpose, 20 premature calves and 10 healthy newborn calves were used as material. Premature calves had higher serum T₄ levels (10.4±0.6 µg/dl) (p<0.001) and lower serum T₃ levels (1.2±0.02 ng/ml) (p<0.001) than did newborn calves. Serum triglyceride, cholesterol and glucose concentrations were lower (p<0.001) in premature calves than in newborn calves. The importance of thyroid hormones in premature calves requires further studies.

Keywords: Premature calves, serum T₃ and T₄.

Prematür Buzağlarda Troksin ve Triiodotronin Düzeyleri

Özet: Çalışmada prematür buzağlarda serum total T₄ and total T₃ konsantrasyonlarını tespit etmek amaçlandı. Bu çalışmada, 20 adet prematür ve 10 adet yeni doğmuş sağlıklı buzağı materyal olarak kullanıldı. Prematür buzağlarda serum T₄ düzeyi yeni doğmuş sağlıklı buzağlara göre yüksek (10.4±0.6 µg/dl) (p<0.001), T₃ düzeyi ise düşüktü (1.2±0.02 ng/ml) (p<0.001). Prematür buzağlarda serum trigliserit, kolesterol ve glikoz konsantrasyonları yeni doğmuş sağlıklı buzağlara göre düşük (p<0.001) olarak tespit edildi. Prematür buzağlarda, troid hormonlarının önemini ortaya koyan ilave çalışmaların yapılması gereklidir.

Anahtar sözcükler: Prematür buzağı, Serum T₃ ve T₄.

INTRODUCTION

Low birth weight and a short silky hair coat, general weakness or floppiness are diagnostic criteria of premature calves^{1,2}. Foetuses discharged from day 42 until approximately 260 days of pregnancy are generally considered aborted, and from day 260 until birth as premature deliveries². Foetal endocrine changes that occur in late pregnancy not only initiate parturition, but also stimulate a variety of maturational changes that enable the newborn to survive. In the absence of these changes neonatal death may occur because of malfunctioning of immature organs³. If the premature induction with the exogenous hormones modifies endocrine changes that normally occur, the newborn may be insufficient for neonatal life. Recent experiments have underlined the importance of thyroid function for health of the newborn calf³. For instance, lowered plasma thyroid hormone concentrations have been implicated in respiratory distress syndrome and disturbances of thyroid function have been associated with the occurrence of disease in the newborn calf⁴. The importance of the thyroid and its diseases are well studied in companion animals but less so in farm animals⁵. The purpose of the study was to determine serum total thyroxin (T₄) and 3,5,3'-triiodothyroxine (T₃) levels in the premature calves.

MATERIAL and METHODS

In this study, twenty spontaneous premature calves (Premature group), which were referred to the Clinic of Internal Medicine, Faculty of Veterinary Medicine, and ten clinically healthy newborn calves (Control group) belonging to the farm of Veterinary Faculty, University of Selçuk were used as material. All premature and control calves were Holstein of both sexes.

Spontaneous premature calves could not receive colostrum because of general weakness, inability to stand, no suckling reflex, respiratory distress. Blood samples were collected from all spontaneous premature calves at admission. They were 2 to 12 hours old.

Blood samples were collected at 2nd to 6th hour after birth in newborn calves (control group). Ease colostrum intake may be able to affect the serum concentrations of total T₄ and T₃, newborn calves did not receive colostrum in this study.

All blood samples were centrifuged at 1500 g for 15 min, and serum was separated and stored at -20°C until analysis. Concentrations of total T₄ and T₃ were determined by solid phase radioimmunoassay, originally designed for human use. The suitability of

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the kits for measuring bovine plasma was previously described⁵. In addition glucose, cholesterol and triglyceride concentrations were also determined on a Tecnicon RA-XT auto analyser using commercial kits.

Statistical analysis: The data were analysed using the Minitab program. Data are presented as values \pm standard deviation (SD). P-values <0.05 were considered significant. Two-sample student's t test has been used for analyses.

RESULTS

The spontaneous premature calves had gestational ages ranging from 259 to 265 days, body weight between 32 to 40 kg, general weakness, soft claw, inability to stand, no suckling reflex, respiratory distress and short silky hair coat. Four of the premature calves with respiratory distress syndrome died in spite of extensive therapy. The rest of the calves (n:16) were treated. Dead premature calves had lower serum T_3 levels compared to the other premature calves.

Premature calves had higher serum T_4 levels ($p<0.001$) and lower serum T_3 levels ($p<0.001$) than did newborn calves (Table 1). Serum triglyceride, cholesterol and glucose concentrations were significantly ($p<0.001$) lower in premature calves than in the newborn calves (Table 1).

Table 1. The mean (\pm SD) values of serum T_3 , T_4 , glucose, cholesterol and triglyceride concentrations in premature and control group calves and their statistical significance.

Table 1. Prematür ve kontrol grubu buzağılarda ortalama serum T_3 , T_4 , glikoz, kolesterol ve trigliserid konsantrasyonları ile bunların istatistiksel önemlilikleri.

PARAMETERS	Premature group (n:20)	Control group (n:10)	P
Total T_3 (ng/dl)	1.2 \pm 0.02	1.6 \pm 0.06	< 0.001
Total T_4 (μ /dl)	10.4 \pm 0.6	6.2 \pm 0.3	< 0.001
Glucose (mg/dl)	42.0 \pm 1.9	72.4 \pm 6.4	< 0.001
Total cholesterol (mg/dl)	56.9 \pm 1.7	107.5 \pm 6.4	< 0.001
Total triglyceride (mg/dl)	36.0 \pm 1.7	54.2 \pm 3.2	< 0.001

DISCUSSION

Clinical signs of premature calves were similar to those described by Korteba and Madigan¹ and Ok et al². Thyroid hormones stimulate the metabolic rate and enhance of carbohydrate, lipid and protein turnover rates⁶. Pregnancy increases maternal metabolic rate and energy consumption. Melnik et al⁷, suggested that

enhanced thyroid hormone secretion in the pregnant cow could explain the plasma concentrations of T_4 in late pregnancy. It has been hypothesised⁸ that maternal T_4 plays a vital role in foetal neurogenesis. Maternal T_4 has limited access to the foetal circulation⁹, but seems to ensure an adequate placental supply during the last trimester of foetal life. In this study, serum T_4 levels in the premature calves were higher than those of in the newborn calves. Thyroid hormones are essential for normal growth, mental development and sexual maturation. Many of these actions are mediated by T_3 ^{10,11}. Dietary iodine deficiency is associated with stillbirth, abortion, weakness and goiter¹⁰. In the present study, although serum T_4 levels were higher in premature calves than in newborn calves, serum T_3 concentrations were lower in premature calves than in newborn calves. Based on these findings it is likely that the conversion of T_4 to T_3 may be impaired. The conversion of T_4 to T_3 may be reduced by the most important systemic illness or prolonged fasting. According to Cabello and Levicuk¹² low concentrations of T_3 and cortisol may contribute to reduced synthesis of pulmonary surfactants. In the present study, four of the premature calves with respiratory distress syndrome died. Dead premature calves had lower serum T_3 levels compared to the other premature calves. This explains at least in parts, the high mortality rate observed in the premature calves. Schönberger et al¹⁴, have shown that thyroid hormone injections lower mortality rate in premature calves.

Serum glucose concentrations were significantly lower in premature calves than in newborn calves. Newborn calves and foals are able to resist starvation hypoglycaemia for more than a week^{1,5}. The maintenance of glucose homeostasis immediately after birth, when the newborn loses its placental source of glucose, is dependent on adequate stores of liver glycogen. In this study, finding of low serum glucose concentration in the premature calves may be related to inadequate stores of liver glycogen in the intrauterine life. In the premature and/or growth retarded foetus, glycogen stores may be low as a result of starvation in the uterus or insufficient time to accumulate glycogen. Thus newborn may be dependent on infusions of dextrose to maintain glucose levels^{1,3,5}.

Content of cholesterol in relation to thyroid hormones have shown that the level of total and free cholesterol is directly proportional and the level of

esterified cholesterol negatively related to the content of total and free T₄ in blood serum of calves during early fattening¹³. O'Kelly and Wallace¹⁴ informed that plasma cholesterol levels were low at birth and increased daily to highest values on day 6. In our study, serum total cholesterol and triglyceride concentrations were significantly lower in the premature calves than in newborn calves.

It can be concluded that serum T₃ concentrations were lower in the premature than newborn calves, whereas total T₄ concentrations were higher in premature than newborn calves, indicating impairment of thyroidal the conversion of T₄ to T₃. In addition serum glucose and triglyceride concentrations were low in premature calves. Revealing the importance of thyroid hormones in premature calves requires further studies.

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