

Original Research Article

<https://doi.org/10.20546/ijcmas.2018.705.111>

Study the Impact of Age on Enzyme and Hormone Profile of Crossbred Calves

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ABSTRACT

This study was conducted to evaluate the impact of age on serum enzymes and hormones in crossbred calves from birth to three months of age. The research was carried out on six apparently healthy crossbred calves (aged 0-3 months) with similar physiological status. Blood samples were collected from the experimental animals on 0, 3, 7, 10, 15, 30, 45, 60, 75 and up to 90 days age of calves. Five ml of whole blood from each animal was collected in clot activator vacutainer. Serum was separated and analyzed for serum enzymes and hormones. The concentration of Alanine Transaminase and Aspartate Transaminase were significantly ($P < 0.05$) highest on the day of birth while significantly ($P < 0.05$) lowest concentration was observed on 90th day of life. The serum Alkaline Phosphatase concentration was highest on the day of birth and decreased significantly ($P < 0.05$) on 3rd day. The serum Triiodothyronine (T_3) and Thyroxine (T_4) levels were significantly ($P < 0.05$) highest on the day of birth. While the lowest concentration of T_3 and T_4 were observed on 90th day of life. The level of T_3 and T_4 were decreasing significantly ($P < 0.05$) from the day of birth to 90th day of life. The non-significant difference was observed for serum cortisol from the day of birth to 90th day of life in crossbred calf. It could be concluded that among obtained among enzymes, ALT, AST and AKP having significant variation. Triiodothyronine and throxine levels differed significantly while level of cortisol was not affected significantly during pre-weaning period of crossbred calf.

Keywords

Enzymes,
Hormones,
Crossbred calves

Article Info

Accepted:
10 April 2018
Available Online:
10 May 2018

Introduction

The most vulnerable period in the life of any animal is the period after birth. In all species, the neonatal period represents a critical time during which all organ functions must adapt to the extra-uterine life; it is a transition phase

from the sheltered intra-uterine to the exposed extra-uterine environment (Piccione *et al.*, 2008). The increasing use of serum enzyme changes as aid to clinical diagnosis creates a need for understanding variations in serum enzymes in newborn animals. Marked temporary increase in serum activities of

aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in calves shortly after birth and reaching a maximum at 14 hours was observed (Maderova *et al.*, 1963). These changes were attributed to absorption of enzymes from colostrum.

The thyroid is an endocrine gland that secretes mainly thyroxine hormone. Thyroid hormones are involved in the regulation of metabolic events of different components in various body tissues, growth, reproductive performance, development and adaptation in ruminant and other farm animals (Latimer *et al.*, 2003; Todini, 2007). Many factors such as age, breed, nutrition, gender, season, climate and geographical traits of the region, the rearing technology, physiological conditions, method of measurement, drugs and disease affect the plasma concentrations of thyroid hormones (Todini, 2007; Stockham and Scott, 2002). These hormones circulate in blood bound to proteins, but small amounts of thyroid hormones are found in free form (fT₄ and fT₃). Only the free hormone is responsible for the biological activity of thyroid hormones and available to tissues (Todini, 2007). The effect of age on plasma thyroid hormone was investigated in some farm animals. In most studies, the highest levels of thyroid hormones were reported during the first period of life, an advancement in age results in decreases of these hormone levels (Todini, 2007; Eshratkhah *et al.*, 2010; Sharma *et al.*, 1985). In most species, the percentage of T₄ is higher than the other thyroid hormones in any period of life; with very little percentage of free forms of these hormones.

Pre-partum increase in fetal plasma Cortisol concentrations are also well documented for many mammalian species, including ruminants, and are related to adaptation of the neonate to extrauterine life (Hunter *et al.*, 1977). Hence, the present study was planned in crossbred calves from birth to three months

of age to find out the effect of age on enzymes and hormones.

Materials and Methods

The research was approved by the Institutional Animal Ethics Committee (IAEC, No.: 227/VPY/2016). The present study was conducted in the Department of Veterinary Physiology and Biochemistry, College of Veterinary Science & A. H., Anand Agricultural University, Anand on crossbred calves maintained at Instructional Livestock Farm Complex (ILFC) of Department of Livestock Production Management at College of Veterinary Science & A.H., Anand from birth to three months of age.

The experimental animals were reared in semi-open housing system which is made up of concrete floor under asbestos roofed housing system constructed east west direction and well covered with trees. These experimental calves were separated from other animals in pakka shed house. The experimental animals were maintained on ICAR feeding standards (1998).

Blood samples were collected from the experimental animals on 0, 3, 7, 10, 15, 30, 45, 60, 75 and up to 90 days age of calves. Five ml of whole blood from each animal was collected aseptically from jugular vein from birth to three months of age in clot activator vacutainer. Serum was separated by centrifugation at 3000 rpm for 15 minutes and stored at -20 °C in deep freeze until analyzed for serum enzymes like alanine transaminase, aspartate transaminase alkaline phosphatase and hormones like triiodothyronine, thyroxine and cortisol.

The serum enzymes *viz.* alanine transaminase, aspartate transaminase, alkaline phosphatase and hormones like triiodothyronine, thyroxine and cortisol were analyzed using Diagnostic

kits manufactured by Crest Biosystems, Coral Clinical Systems, Goa, by Spectrophotometer (model Visiscan 167). The serum hormonal parameters were analyzed at the Reproductive Biology Research Unit, College of Veterinary Science & A.H., AAU, Anand, by RIA (Radio Immuno Assay) method using the kits manufactured by Immunotech, Beckmen Coulter, Czech Republic.

The data was analyzed using completely randomized design (CRD) and significance was tested by Duncan’s New Multiple Range Test (DNMRT).

Results and Discussion

In the present experiment, the concentration of Alanine Transaminase and Aspartate Transaminase were significantly ($P < 0.05$) highest on the day of birth (39.32 ± 1.95 U/L and 40.46 ± 0.40 U/L, respectively), while significantly ($P < 0.05$) lowest concentration was observed on 90th day (12.98 ± 0.14 U/L and 31.45 ± 1.79 U/L, respectively) of life. Both ALT and AST decreased significantly (P

< 0.05) from the day of birth to 90th day of life with the mean value of 24.24 ± 1.55 U/L and 35.11 ± 1.64 U/L, respectively. The serum Alkaline Phosphatase concentration was highest on the day of birth (656.21 ± 53.20 U/L) and decreased significantly ($P < 0.05$) on 3rd day. The trend observed for the level of AKP was fluctuating up to 90th day of life with the mean value of 489.38 ± 25.01 U/L in crossbred calf. The data is depicted in Table 1.

The serum Triiodothyronine (T_3) and Thyroxine (T_4) levels were significantly ($P < 0.05$) highest on the day of birth (3.38 ± 0.39 ng/ml and 89.22 ± 2.77 ng/dl, respectively), while the lowest concentration of T_3 and T_4 were observed on 90th day of life (1.30 ± 0.27 ng/dl and 38.11 ± 0.33 ng/dl, respectively). The level of T_3 and T_4 were decreasing significantly ($P < 0.05$) from the day of birth to 90th day of life with the mean value of 2.01 ± 0.35 ng/dl and 58.89 ± 2.65 ng/dl, respectively. The non-significant difference was observed for serum cortisol from the day of birth to 90th day of life in crossbred calf. The data is depicted in Table 2.

Table.1 Mean (\pm SEM) values of enzymes in crossbred calves (n=6) from birth to 90 days

Days	Alanine Transaminase (U/L)	Aspartate Transaminase (U/L)	Alkaline Phosphatase (U/L)
0	39.32 ^a \pm 1.95	40.46 ^a \pm 0.40	656.21 ^a \pm 53.20
3	34.84 ^{ab} \pm 2.21	38.23 ^{ab} \pm 1.42	405.14 ^{bc} \pm 62.53
7	30.25 ^{bc} \pm 2.18	37.01 ^{abc} \pm 1.73	487.46 ^{abc} \pm 46.10
10	28.14 ^c \pm 2.17	36.05 ^{abcd} \pm 1.73	457.32 ^{bc} \pm 72.37
15	25.16 ^{cd} \pm 1.78	35.08 ^{abcd} \pm 1.73	522.65 ^{abc} \pm 39.81
30	22.24 ^{de} \pm 1.37	34.32 ^{bcd} \pm 1.81	483.33 ^{abc} \pm 29.35
45	18.10 ^{ef} \pm 0.45	33.65 ^{bcd} \pm 1.85	565.49 ^{ab} \pm 10.35
60	16.35 ^{fg} \pm 0.51	32.85 ^{bcd} \pm 1.70	447.98 ^{bc} \pm 64.53
75	15.02 ^{fg} \pm 0.55	31.96 ^{cd} \pm 1.71	487.15 ^{abc} \pm 58.10
90	12.98 ^g \pm 0.14	31.45 ^d \pm 1.79	381.12 ^c \pm 50.54
GM	24.24\pm1.55	35.11\pm1.64	489.38\pm25.01
CV%	15.69	11.46	25.88
CD _{0.05}	4.415	4.672	146.95

Values having different superscripts differed significantly ($P < 0.05$) within column

Table.2 Mean (\pm SEM) values of hormones in crossbred calves (n=6) from birth to 90 days

Days	Triiodothyronine (ng/ml)	Thyroxine (ng/ml)	Cortisol (ng/ml)
0	3.38 ^a \pm 0.39	89.22 ^a \pm 2.77	42.18 ^{ab} \pm 10.89
3	2.04 ^b \pm 0.43	83.85 ^{ab} \pm 1.69	40.36 ^{ab} \pm 9.77
7	1.61 ^b \pm 0.32	76.23 ^b \pm 1.27	40.63 ^{ab} \pm 7.97
10	1.79 ^b \pm 0.33	66.61 ^c \pm 4.50	45.06 ^{ab} \pm 8.94
15	2.13 ^b \pm 0.25	58.99 ^{cd} \pm 3.11	37.47 ^{ab} \pm 6.95
30	2.23 ^{ab} \pm 0.13	51.96 ^d \pm 3.09	33.49 ^b \pm 7.01
45	1.86 ^b \pm 0.55	42.45 ^e \pm 2.74	42.35 ^{ab} \pm 7.83
60	2.31 ^{ab} \pm 0.44	41.28 ^e \pm 1.27	44.44 ^{ab} \pm 7.75
75	1.45 ^b \pm 0.23	40.24 ^e \pm 2.34	53.09 ^{ab} \pm 8.92
90	1.30 ^b \pm 0.27	38.11 ^e \pm 0.33	64.12 ^a \pm 7.65
GM	2.01\pm0.35	58.89\pm2.65	44.32\pm8.45
CV%	43.44	11.05	46.74
CD_{0.05}	1.015	7.554	

Values having different superscripts differed significantly ($P < 0.05$) within column

Elevations in serum ALT is associated with reversible or irreversible damage to the hepatocyte plasma membrane.

Increased serum ALT activity has the highest sensitivity for inflammation, necrosis, vacuolar hepatopathy, and primary neoplasia.

Enzyme activity of AST transiently increased after colostrum intake but there was no association with time of first colostrum feeding, indicating that the rise of plasma AST activity was the consequence of enhanced endogenous production and was independent of colostrum intake (Zanker *et al.*, 2001).

The higher level of AKP in serum of calf on the day of birth was most likely due to absorption of colostrum which causes activation of enzymes in the calf's intestine.

Thus, serum alkaline phosphatase appeared to be from intestinal sources and/or colostrum could be stimulating the intestinal alkaline phosphatase activity.

Based on these findings, it could be concluded that, enzymes *viz.* ALT, AST, AKP and hormones like triiodothyronine and throxine levels differed significantly while level of cortisol was not affected significantly during pre-weaning period of crossbred calf.

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How to cite this article:

Milap G. Sedhiya, M.M. Pathan, A.M. Pande, S.P. Madhira, R.J. Modi and Sarvaiya, N.P. 2018. Study the Impact of Age on Enzyme and Hormone Profile of Crossbred Calves. *Int.J.Curr.Microbiol.App.Sci*. 7(05): 912-916. doi: <https://doi.org/10.20546/ijemas.2018.705.111>