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Blood Characteristics of Dairy Calves as Affected by Age, Breed and Types of Barn

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Abstract: Twenty one Holstein Friesian and Brown Swiss female calves, at 6-12 months of ages were used in this study. They were kept in open-shed barn at –10°C ambient temperature and 50 % relative humidity conditions during December. Then, in January the animals were kept in stall barn at 15°C ambient temperature and 75 % relative humidity. In each barn, blood samples were taken from the animals on three consecutive days at the end of both December and January and analyzed for serum sodium, potassium, PCV %, hemoglobin and erythrocyte values. Except for erythrocyte counts, all blood parameters are affected by types of barn, however breed factor was found significant for only erythrocyte count. Serum potassium levels were changed by the age of animals. Some interactions between factors were found to be significant.

Keywords: Dairy calve, Barn, Blood parameter

Introduction

Welfare and production of an animal are its state in regard to an attempt to cope with its environment. One of the major elements of the environment is the climate. Concurrently, climate is a component of the physical environment and consists of some factors, for example, temperature, solar radiation, relative humidity and wind. These factors have independent and/or compound effects on livestock physiology and production. Environmental factors also alter depending upon seasons, types of the barn as well as different day-times. The most effective ones among the environmental factors are ambient temperature and relative humidity.

Some blood characteristics may be used for determining the ability of an animal to withstand the rigors of climatic stress. Changes in these traits are objective criteria for the reaction to physiological or metabolic enforcement. These characteristics vary according to breed, genotype, age of the animal, season and also barn types (Chaudhry, *et al.,* 1988). The effects of the season and temperature on the blood parameters of lactating cows and heifers were already investigated by several researchers (Shijimaya, *et al.,* 1985, Saccon *et al.,* 1991 and Baruah *et al.,* 1998). However, there is very scarce research with regards to these traits in dairy calves subjected to different environmental conditions.

The objective of this study was to investigate effects of two different housing conditions (open shed and stall barn) on some blood characteristics of Holstein Friesian and Brown Swiss female calves at 6-8 and 10-12 months of ages.

Materials and Methods

A total of twenty one Holstein Friesian and Brown Swiss female calves with 130-162 kg live weights at 6-8 and 10-12 months of ages were used in this study. The calves were reared under the same feeding and management systems of the Research Farm of College of Agriculture at Atatürk University. The animals were kept in an open shed barn having average temperature of (- 10)ºC and average relative humidity of 50 % in December and fed dry hay and concentrates and they were supplied water *ad libitum*. The same ration was offered when they were moved into a stall barn whose average temperature and relative humidity values were 15 ºC and 75 % respectively during January. The ambient temperature and relative humidity values of these environments were measured and recorded by using a thermo hygrograph. In each barn, blood samples were taken from the animals on three consecutive days at the end of both December and January. Blood was taken from jugular vein at midday and the serum was separated immediately by a centrifuge and analyzed by a flame photometry for sodium and potassium levels (Kaneko, 1980). 5 ml of blood was taken from the same vein to determine other hematological parameters such as packed cell volume, hemoglobin and erythrocyte count as described by Imren (1994). The differences due to breed, types of barn and age groups for blood traits were analyzed statistically by three ways analysis of variance with repeated measures on environmental conditions factor. The statistical analysis was carried out by utilizing SPSS 10.0 statistics program (SPSS, 1994).

Results and Discussion

Least squares means with standard errors for blood parameters and results of the variance analysis are presented in Table 1. Barn types affected blood parameters significantly except for erythrocyte counts. The significant decline is occurred on the levels of hemoglobin and PCV % with increasing environmental temperature and relative humidity.

PCV % was not significantly affected by the breeds, however, the effect of the breed on the blood hemoglobin was significant at the level of $P<0.06$, and level of the hemoglobin of Holstein Friesian calves had higher than that of Brown Swiss calves.

The breed groups influenced significantly ($P<0.05$) erythrocyte count and Holstein Friesian calves exhibited higher average erythrocyte count than Brown Swiss calves. Age of the calves did not have significant influence on PCV % and erythrocyte count of the calves; however, interactions between the age of calves with the breed groups for both parameters were statistically significant. The PCV % and erythrocyte values of Holstein calves decreased with age, while the same parameters of Brown Swiss calves increased as the age of the calves advanced.

Table 1: Least squares means with standard errors for blood charactaristics and results of the analysis of variance

		PCV (%)			Hemoglobin (g/100 ml)			Erythrocyte (10^6/mm^3)			Serum Sodium (mEq/l)			Serum potassium (mEq/l)		
	N	Mean	±	S.E.	Mean	±	S.E.	Mean	±	S.E.	Mean	±	S.E.	Mean	±	S.E.
Types of Barn (TB)																
Open Shed	21	27.81	±	0.57	9.26	±	0.19	4.78	±	012	133.4	±	0.37	4.52	±	0.03
Stall	21	25.47	±	0.48	8.63	±	0.21	4.75	±	0.13	140.0	±	0.29	4.88	±	0.07
Significance			**			*			NS			**			**	
Breed (B)																
Holstein Friesian	11	26.59	±	0.58	9.22	±	0.22	5.00	±	0.12	136.6	±	0.40	4.76	±	0.05
Brown Swiss	10	26.69	±	0.60	8.67	±	0.23	4.54	±	0.12	136.7	±	0.42	4.64	±	0.06
Significance			NS			a			*			NS			NS	
Age Groups (AG)																
6-8 Months	8	26.96	±	0.65	8.96	±	0.21	4.70	±	0.11	137.3	±	0.45	4.80	±	0.05
10-12 Months	13	26.32	±	0.52	8.93	±	0.26	4.84	±	0.14	136.1	±	0.36	4.60	±	0.06
Significance			NS			NS			NS			NS			*	
Interactions																
B x AG			**			NS			**			NS			NS	
TB x B			NS			NS			NS			NS			NS	
TB x AG			NS			NS			NS			NS			NS	

NS : Nonsignificant * : P<0.05, ** : P<0.01 a: Statistically significant at the level of P=0.06.

Concentrations of serum sodium and potassium were within the normal range values, and effects of the environmental conditions on the sodium and potassium were significant (Table 1). Serum sodium increased with increasing barn temperature.

It can be understood from Table I that, two different housing conditions yielded highly significant variation in all blood parameters except for erythrocyte counts. Hematological parameters were within normal ranges for calves but they were very close to the lower limits. These results might be due to insufficient feeding, discomposed concentrate ration as indicated by Imren (1994). The decline of hemoglobin and PCV % in stall barn with increasing the temperature and relative humidiy, supports findings of other studies (Shijimaya *et al.*, 1985 and Galip, 1995). Cold temperature levels cause an increasing trend on some hematological parameters as an adaptation function (Galip, 1995). Breed effect was not found to be significant on PCV % levels. As indicated by the Shaffer *et al.*, (1981), PCV value is lower for the larger breeds (Holstein and Brown Swiss) than for the smaller breeds (Jersey and Guernsey). Since both breeds investigated in the present study were considered as larger breeds, it was not unexpected to obtain insignificant difference of PCV % between the breed groups. The striking affect of the breed on the hemoglobin value was also observed by Shaffer *et al.* (1981) who reported that hemoglobin values of Holstein Friesian and Brown Swiss cows were respectively 10.35 and 9.70 g/100 ml, and the difference was statistically significat. Erythrocyte counts differed between breeds of the calves. Holstein Friesian calves had more erythrocyte than that of Brown Swiss's. The result was in accordance with findings of Noonan *et al.*, (1978) who reported differences among breeds in terms of erythrocyte values. The results were in agreement with findings of Noonan *et al.* (1978) who indicated that trends of the changes associated with age in the PCV % and erythrocyte count were different in various breeds. The decrease of PCV value in Holstein Friesian calves with age supports Shaffer et al. (1981) who found a significant negative relationship between day of age and PCV %. A drop in PCV % during the first years of age is also documented in the bovine by Lane and Chambell (1969) and Wingfield and Tumbleson (1973).

Barn types caused a significant variation for serum electrolytes. The result for serum sodium is in agreement with findings of studies conducted by Saksena *et al.* (1980) and Shebaita (1983) who suggested that serum sodium concentration increased with increasing of the temperature of the barn. On the other hand, some investigators (Wojcik *et al.*, 1980 and Broucek *et al.*, 1987) indicated a decline of the serum sodium and potassium levels in the warm housing conditions. The opposite results could be attributed to the different feeding and management systems, breeds, physiological differences and sensibility of serum electrolytes to monthly, weekly, even for daily changes (Galip, 1995). There are scarce and controversial results about the electrolyte status of calves according to some environmental conditions in scientific literatures. Future trials with greater between-animal variation imposed would allow more precise determination of the relationship between environmental factors and the physiology of animals.

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