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EFFECTS OF STAGE OF GESTATION, PARTUS AND HOUSING SYSTEM ON SERUM ASPARTATE AMINOTRANSFERASE ACTIVITIES IN HOLSTEIN-FRIESIAN HEIFERS AND COWS

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The aim of the study was to establish the effects of stage of gestation, partus and housing system on the activity of serum aspartate aminotransferase (AST) in Holstein-Friesian heifers and cows. The examinations on AST were carried out on 24 heifers and 24 cows half of each category of animals from a system of loose housing and the other half were teltered from the mistals at days zero, 5, 20, 60, and 180 of pregnancy, 3 days before and the first day post partum. The activities of AST were almost constant during the period of pregnancy in heifers and cows (from 38,42 to 47,16 U/1). Also the results show that AST enzyme activity increased on the first day post partum in both categories of animals, except for the cows in the loose housing system (59,00; 55,00; 52,50 and 42,92 U/1).

Key words: cows, heifers, serum AST, pregnancy, partus, housing system.

INTRODUCTION

There is considerable interesent in physiological factors affecting serum aspartate aminotransferase (EC 2.6.1.1., AST formerly Glutamate Oxaloacetete Transaminase, GOT) in heifers and cows. Variations in the enzyme activity have been observed during the estrus cycle of dairy cattle, with peak activity occurring during estrus and proestrus (Davis et al., 1965) or only during estrus (Roussel and Stallcup, 1967). Roussel and Stallcup, (1966) also reported that serum AST levels were lower in bulls than in cows. Crist et al., (1966, 1967) showed that plasma transaminase activity increases as milk production increases and that a highly significant increase in transaminases occurs with advancing stage of lactation, while Stallcup et al., (1967) reported a highly significant negative correlation between AST activity and days of lactation. Crist et al., (1967) also observed that plasma transaminase activity decreases with advancing stage of gestation, but Stallcup et al., (1967) found no differences between open and pregnant cows in similar stages of lactation. Boots et al., (1968) showed that enzyme activity in breed heifers decreases with advancing stages of pregnancy.

Other workers have reported about the effects of age (e. g., Boots, 1968; Abrashev, 1976; Delev et al., 1985; Frerking et al., 1983), cold exposure (Olson et al., 1983), transport (Groth and Gränzer, 1975) feeding, age, lactation and pregnancy (Peterson and Waldern, 1981), stage of lactation and pregnancy (Stämpfli et al., 1981), stage of gestation and days before and after partum (e.g. Treude and Mülling, 1982; Lotthammer et al., 1988; Bostedt, 1974; Hambitzer et al., 1987) on plasma or serum AST activities in cattle.

The aim of this study was to determine if stage of gestation or partus affect the activity of serum aspartate aminotransferase values in Holstein-Friesian heifers and cows.

MATERIAL AND METHODS

Blood samples from 24 Holstein-Friesian heifers and 24 cows were taken by puncture of v. jugularis half of the animals were from a system of loose housing and the other half were tethered from mistals in each of these categories. Blood was taken at days O, 5, 20, 60 and 180 of pregnancy, 3 days before and the first day after partus, at 10^{00} am, After allowing the blood to clot serum was separated by centrifugation on 3000 r.p.m. and kept. at -20^{0}C. AST activity in serum was determined by the kinetic method proposed by the IFCC (International Federation of Clinical Chemistry; assay Gulford; Ciba Corning).

The following parameters were calculated mean value, standard deviation, coeficient of variation, standard error and interval of variation. Analysis of variance for three factors was applied. The significance of differences between two means was determined by the LSD test (least significance difference).

RESULTS

The results summarized in table 1 show that AST activity in the serum of pregnant heifers from the loose housing system varied from 42,92 ± 13,64 (5th day of pregnancy) to 45,50 ± 12,43 U/1 (20th day of pregnancy). No significant differences between mean values of AST activity in pregnant heifers were found. However, in calved heifers on the first day from partus the activity of serum AST was significantly higher (59,00 ± 24,75 U/1) than at each time in pregnant heifers ($P<0,01$).

AST activity in the serum of pregnant heifers from mistals varied from 38,42 ± 12,84 U/1 (zero day of pregnancy) to 44,17 ± 13,97 U/1 (three days before partus). Mean values af AST activity in these heifers were not significantly different. The activity of AST on the first day from partus (55,00 ± 22,66 U/1) was much higher ($P<0,01$) compared to each mean value during pregnancy, except the that found three days before partus (44,17 ± 13,97 U/1, $P<0,05$).

In the serum of cows from the loose housing system the lowest value of AST activity was observed on the 180th day of pregnancy (39,83 ± 11,87 U/1). The highest value (47,16 ± 12,19 U/1 was determined on the 60th day of pregnancy. No significant differences between mean values of AST enzyme activity in the

Table 1. Serum AST activities in heifers and cows, U/l

Housing system (A) Categories (B)	n	Statistical parametar	Pregnancy and partus, days (C) 0d	5d	20d	60d	180d	P-3d	P+1d	(A)	(B)
										X, SD, IVn	
Heifers (1)		X	43,25	42,92	45,50	43,58	44,33	43,08	59,00	44,92[a]	44,02[1]
loose (a)	12	SD	17,40	13,64	12,43	13,86	12,66	8,99	24,75	12,62	14,67
		IV	17–84	26–69	26–66	18–67	28–68	31–57	29–114	17–114	17–114
Heifers (1)		X	38,42	39,33	39,17	39,75	38,83	44,17	55,00	43,20[b]	44,02[2]
mistals (b)	12	SD	12,84	12,39	13,32	14,50	12,02	13,97	22,66	12,39	10,25
		IV	17–64	20–68	18–72	17–75	23–68	29–66	35–100	20–83	20–83
Cows (2)		X	43,75	47,08	43,25	47,16	39,83	43,25	42,92		
loose (a)	12	SD	13,47	11,37	9,09	12,19	11,87	7,72	7,21		
		IV	27–80	36–71	34–59	34–73	22–63	34–60	35–56		
Cows (2)		X	42,42	42,75	42,33	43,25	43,25	42,50	52,50		
mistals (b)	12	SD	10,72	10,99	11,09	7,06	9,27	9,11	13,60		
		IV	20–58	27–64	28–58	30–52	26–58	25–52	29–83		
		X	41,95	43,02	42,56	43,46	41,56	43,25	52,35	44,02	
(C)	48	SD	13,61	12,10	11,48	11,90	11,45	9,95	17,05	12,51	
		IV	17–84	20–71	18–72	17–75	22–68	25–66	29–114	17–114	

Treatments:	F:	$LSD_{A0,01}$	$LSD_{A0.05}$
A;	1,751NS	3.516	2.671
B:	0,000NS	3.516	2.671
C:	4,296**	6.578	4.997
AB:	2,270NS	4.972	3.777
AC:	0,505NS	9.303	7.067
BC:	1,526NS	9.303	7.067
ABC:	0,613NS	13.156	9.994

Legends:
d = day
P-3d = 3 days before partus
P+1d = 1 day post partum

serum of cows before and after calving were observed. In the serum of pregnant cows from mistals the activity of AST varied from 42,33 ± 11,09 U/1 to 43,25 ± 9,27 U/1. The mean value of the enzyme activity found on the first day after partus (52,50 U/1) was significantly higher ($P < 0,05$) than all values found in pregnancy.

Statistical analysis showed that the system of housing (factor A, A_A, LSD_A) and the category of animals (factor B, F_B, LSD_B) did not influence AST activity in the serum of heifers and cows. However, on the first day from partus, significant differences of AST activity ($P< 0,01$) were observed compared to the values during pregnancy (factor C, F_C, LSD_C).

Different combinations of the factors investigated, as well as their interactions (AB - system of housing x category of animals; AC - system of housing x time of blood collection; BC - category of animals x time of blood collection; ABC - system of housing x category of animals x time of blood collection) did not influence AST activity in the serum of heifers and cows, either.

DISCUSSION

The results for AST activity in the serum of heifers and cows obtained in our study during pregnancy, and on the first day after partus seem to be in agreement with the data reported by Stampfli et al., (1980), Lotthammer et al., (1988), Treude and Mulling, (1982), Bostedt, (1974) etc. Also, the results show that AST activity increased on the first day after partus in both categories of animals, except for the cows in the loose housing system. It is well known that stress can affect transaminase activity (Critchlow et al., 1963; Nichol and Rosen 1963; Pearl et al., 1966), so it follows that sudden or abrupt changes could upset an animal enough to cause changes in enzyme activity owing to increased stimulation by corticoids. However, changes in the transaminase activity are not consistent, indicating that other undetermined factors are involved. Enzymes are intimately related to metabolism, which in turn is easily and often influenced by the external environment. This environment includes feeding practices, weather, type of shelter, and all other aspects of herd managment. Also, it can be said that it is most probable that any factor which affects cells will affect transaminase activity. In hepatitis and other forms of liver disease associated with hepatic necrosis, serum AST is elevated even before the clinical signs and symptoms of disease appear. The levels may reach values as high as 100 times the upper reference limit, although 20 to 50-fold elevations are most frequently encountered.

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UTICAJ GRAVIDITETA, PARTUSA I SISTEMA DRŽANJA NA AKTIVNOST ASPARTAT AMINOTRANSFERAZE U KRVNOM SERUMU JUNICA I KRAVA HOLŠTAJN-FRIZIJSKE RASE

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SADRŽAJ

Cilj ovog rada je bio da se ustanove efekti graviditeta, partusa i sistema držanja na aktivnost enzima AST u krvnom serumu junica i krava holštajn-frizijske rase. Ispitivanja aktivnosti enzima AST u krvnom serumu su sprovedena na 24 junica i 24 krava (po 12 u slobodnom i vezanom sistemu držanja iz obe kategorije životinja) u toku graviditeta i to: 0., 5., 20., 60. i 180. dana graviditeta, tri dana graviditeta, tri dana pre i jedan dan posle partusa. Dobijeni rezultati ukazuju da se aktivnost enzima AST u krvnom serumu junica i krava u toku graviditeta kreće od 38,42 do 47,16 U/l i bila je relativno kostantna u naznačenom periodu. Prvog dana posle partusa ustanovljeno je značajno povećanje aktivnosti enzima AST u krvnom serumu junica kod oba sistema držanja (59,00 i 55,00 U/l) i krava u vezanom sistemu držanja (52,50 U/l). Kod krava u slobodnom sistemu držanja, prvog dana posle partusa, ustanovljena aktivnost enzima AST (42,92 U/l) nije bila statistički značajna u odnosu na utvrđene aktivnosti istog enzima u toku graviditeta.