

PROTEIN CONTENT, ALD AND SDH ACTIVITIES IN THE SERUM OF LACTATING COWS

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Fructosediphosphate aldolase (ALD) and sorbitol dehydrogenase (SDH) are enzymes on two different metabolic pathways of sugars. Investigation of their activity can make possible characterization of the status of metabolism in different tissues and in the animal generally. Knowledge from investigation is as important for animal husbandry as for veterinary medicine. The objective of this research was to investigate metabolic processes in the Estonian Red breed and the Estonian Black and White breed cows (with different Holstein blood content) using the activity of two enzymes and serum protein content in lactation dynamics, during the calving period of cows. Ninety-eight first lactation cows were investigated. Animals with different HF blood content were selected using pedigree data. The cows were distributed over eight Central- and North-Estonian farms. The cows were clinically healthy. Health was checked and blood samples were collected monthly. Total protein content (biureth method Darbre, 1986), ALD activity (Sibley and Lehninger method) and SDH activity (UV-method). Were measures in serum statistical analysis was made, considering the cattle breed, calving period and age. Correlation data between biochemical character and milk productivity traits have been published previously (Karus, 1995). Statgraphics (1989) was used for the analysis.

Protein content, ALD and SDH activities and their dynamics in the first lactation are shown in Table 1. There was no correlation between serum protein contents of breeds. During the lactation there was a tendency of increases serum protein content. However, comparing serum protein content in two successive months, the increasing was significant only in the eighth month of lactation.

Table 1. Protein content, ALD and SDH activities in lactation dynamics / Vereseerumi ALD ja SDH aktiivsus

Month post partum Poegimisjärgne kuu	Protein content of serum (%) Vereseerumi valgusisaldus (%)	ALD activity ALD aktiivsus (pkat/ml)	SDH activity SDH aktiivsus (pkat/ml)
1	6.65 ± 0.09	270 ± 21	65.7 ± 5.6
2	6.76 ± 0.09	297 ± 28	61.5 ± 4.2
3	6.85 ± 0.09	277 ± 20	50.5 ± 4.5
4	6.99 ± 0.10	325 ± 29	45.0 ± 4.0
5	7.01 ± 0.09	346 ± 27	40.0 ± 4.5
6	7.12 ± 0.09	263 ± 21	40.4 ± 5.2
7	7.16 ± 0.08	194 ± 21	44.1 ± 4.9
8	7.08 ± 0.08	180 ± 20	46.5 ± 5.8
9	7.23 ± 0.08	201 ± 42	46.3 ± 5.3
10	7.21 ± 0.08	118 ± 28	49.7 ± 5.3
11	7.15 ± 0.08	104 ± 14	50.4 ± 4.9
12	7.07 ± 0.11	263 ± 48	52.6 ± 6.3

ALD activity had, during the lactation, no significant difference between breeds. Although Baigildin (1986) has been increasing ALD activity with age, we found no linear trend. The maximum ALD activity was found on the 5th month after calving (346 ± 27 pkat/ml), and the minimum one month before the second calving (104 ± 14 pkat/ml). There was no association between ALD activity and the portion of the Holstein breed in the data set.

Dynamics of SDH activity in Estonian Red and Estonian Black and White Cattle's serum is similar and differences in activity occurred only in two (the sixth and eighth) months. Also, Pyne and Maitra (1981) reported the absence of any difference between different cattle breed serum SDH activities. Minimum SDH activity occurred in the early stage of pregnancy (5th – 6th months of lactation), and maximum SDH activity was in the first month after calving (>60 pkat/ml).

For the investigation of the influence of calving period on the serum protein content, ALD and SDH activity, cattle were grouped into calving quarters (Table 2).

Table 2. Serum ALD and SDH activities depending on the calving session $X \pm s_x$ (pkat/ml) / Vereseerumi ALD ja SDH aktiivsus sõltuvalt poegimisajast

Month post partum Poegimisjärgne kuu	Calving session (quarter) / Poegimiskvartal					
	IV (n=34)		I (n=49)		II (n=15)	
	ALD	SDH	ALD	SDH	ALD	SDH
1	326 ± 29	65.8 ± 4.2	237 ± 33*	65.8 ± 4.6	248 ± 23	66.1 ± 4.6
2	336 ± 19	60.7 ± 5.1	250 ± 30*	61.6 ± 3.9	362 ± 46*	63.7 ± 4.7
3	261 ± 21	50.4 ± 4.6	273 ± 28	49.5 ± 5.4	328 ± 42	54.2 ± 4.9
4	207 ± 21	43.7 ± 4.5	399 ± 54*	45.3 ± 4.9	354 ± 47	47.1 ± 5.2
5	267 ± 23	39.9 ± 4.3	418 ± 43**	39.7 ± 4.8	290 ± 33*	41.1 ± 5.3
6	342 ± 27	40.2 ± 4.3	248 ± 38*	40.2 ± 4.4	130 ± 39**	39.6 ± 4.7
7	307 ± 34	43.5 ± 3.9	135 ± 37**	43.5 ± 4.1	128 ± 41	43.2 ± 4.2
8	253 ± 58	47.7 ± 4.4	155 ± 45	46.6 ± 4.8	92 ± 37	42.7 ± 5.0
9	303 ± 29	46.3 ± 4.7	160 ± 40*	46.5 ± 5.0	101 ± 37	45.6 ± 4.3
10	156 ± 49	47.5 ± 4.4	103 ± 42	51.2 ± 5.4	79 ± 36	49.9 ± 4.9
11	96 ± 34	47.7 ± 4.6	91 ± 37	52.1 ± 4.7	165 ± 36	51.0 ± 5.0
12	175 ± 25	51.9 ± 4.1	328 ± 59*	53.2 ± 4.9	250 ± 33	52.8 ± 5.1

* – P<0.05;

** – P<0.01.

The protein content of serum cows calving in the last and first quarters differed in six lactation months, and the difference was greater in the first period of the second pregnancy, i.e. from the fifth until the seventh month of lactation. High serum protein content usually characterizes a positive general physiological condition. Serum protein content first and second quarter calved cows differed in two lactation months (the third and the seventh). Considering the serum protein content we suggest, that the physiological condition of cows calving in the first and the second quarter is better than cows calving in the fourth quarter. Differences in ALD activities between the IV and I quarter calving cow groups occurred over eight months, but between the first and second quarter calving cow groups differences occurred over three months. Even in all groups the decrease of ALD activity in the 10th - 11th months of lactation occurred. The calving period has no influence on serum SDH activity.

The results of the investigation of serum biochemical characteristics in relation to cattle first calving age are shown in table 3. The protein content of serum was relatively low in all age groups. The greatest protein content in serum observed in cattle calved at 34-months at age (6.88 ± 0.10 %). Differences in serum protein content was significant only between the 35th and 36th month old first-calving cow groups (groups with one month age difference were compared).

ALD activity of serum from 34 - 35 month old first-calving cows were significantly lower than in all other cattle groups (224 ± 20 and 212 ± 21 pkat/ml). Total activities of sorbitol dehydrogenase were maximum in the serum of the 34 month old first-calving-cow group (70.2 ± 6.1 pkat/ml), but differences from other groups were not significant.

Table 3. Serum biochemical characteristics in the first month after calving / Vereseerumi valgusisaldus ja ALD ning SDH aktiivsus esimesel poegimisjärgsel kuul

Age of cows at first calving (months) Lehmade vanus esmakordsel poegimisel	Number of cows Lehmade arv	Serum protein % Valgu %	ALD activity ALD aktiivsus pkat/ml	SDH activity SDH aktiivsus pkat/ml
31	8	6,60 ± 0,12	274 ± 19	67,6 ± 5,0
32	14	6,61 ± 0,11	330 ± 23*	58,1 ± 6,2
33	22	6,81 ± 0,09	326 ± 22	65,1 ± 4,9
34	22	6,88 ± 0,10	224 ± 20*	70,2 ± 6,1
35	20	6,75 ± 0,10	212 ± 21	66,7 ± 5,6
36	8	6,55 ± 0,11*	270 ± 21*	64,3 ± 5,7
37	4	6,59 ± 0,09	287 ± 32	64,9 ± 7,2

* Significant difference between them and one month younger cows; P<0.05

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Piimalehmade vereseerumi valgusisaldus ning ALD ja SDH aktiivsus

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Kokkuvõte

Kuna biokeemiliste ja füsioloogiliste meetodite rakendamine põllumajandusloomade uurimisel võimaldab saada ulatuslikumat teavet looma organismis toimuvatest protsessidest, nende ainevahetuslike seaduspärasuste ja iseärasuste kohta, uuriti ALD ning SDH aktiivsust ja vereseerumi valgusisaldust eesti punast ja mustakirjut tõugu lehmadel esimese laktatsiooni jooksul, arvestades ka loomade vanust poegimisel ja poegimise sesoonsust. Kõik saadud arvanded töödeldi statistiliselt, kasutades programmi *Statgraphics* (1989).

Eesti mustakirjut ja eesti punast tõugu lehmade vereseerumi valgusisalduses usaldusväärseid tõugudevahelisi erinevusi ei olnud. Laktatsiooni vältel täheldati valgusisalduse kasvutendentsi, ent võttes aluseks üksteisele järgnevad kuud, oli see kasv usaldusväärne üksnes kaheksandal laktatsioonikuul. Uurides sesoonsuse mõju vereseerumi valgusisaldusele, ilmnes et aasta neljandas ja esimeses kvartalis poeginud lehmade vereseerumi valgusisaldus erines usaldusväärsest kuuel kuul, kusjuures erinevus oli olulisim laktatsiooni viiendast seitsmenda kuuni. Vereseerumi suurema

valgusisalduse järgi otsustades oli esimeses ja teises kvartalis poeginud lehmade üldine seisund parem kui neljandas kvartalis poeginutel. ALD aktiivsus saavutas maksimumi 5. kuul pärast poegimist ja oli minimaalne umbes kuu aega enne poegimist. Enam erinesid teineteisest neljandas ja esimeses kvartalis poeginud lehmade vereseerumi ALD aktiivsus, ent vaatamata toodud erinevustele täheldati kõikides rühmades laktatsiooni kümnendal-üheteistkümnendal kuul vereseerumi aldolaasse aktiivsuse mõningat vähenemist. Üldine SDH aktiivsuse dünaamika oli uuritud tõugudel sarnane. Sorbitooli dehüdrogenaasi aktiivsus vereseerumis oli minimaalne tiinuse varases faasis ja maksimaalne esimesel kuul pärast poegimist. Vereseerumi SDH üldine aktiivsus ei sõltunud poegimisajast. Vereseerumi valgusisaldus oli kõikides vanuserühmades suhteliselt madal. Suurim oli see nendel lehmadel, kes poegisid 34 kuu vanuselt (6.88 ± 0.10 %). Usaldusväärselt erines aga vaid 35 ja 36 kuu vanuste esmaspoegijate vereseerumi valgusisaldus (võrreldi ühekuulise vanuse erinevustega loomarühmi). ALD aktiivsus oli väiksem 34...35 kuu vanuste esmaspoegijate vereseerumis, olles usaldusväärselt väiksem kõigi teiste vanuserühmade omast (224 ± 20 ja 212 ± 21 pkat/ml). Vereseerumi üldine sorbitooli dehüdrogenaasi aktiivsus oli küll 34 kuu vanuste esmaspoegijate veres kõige suurem (70.2 ± 6.1 pkat/ml), ent selle erinevus teiste vanuserühmade vastavast väärtusest ei olnud usaldusväärne.