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CHANGES IN AMINO ACIDS COMPOSITION OF COWS COLOSTRUM (DURING FIRST 72 HOURS AFTER PARTURITION)

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Abstract

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Changes in amino acid spectrum of colostrum within the period of 2 to 72 hours *post partum* were studied in dairy cows of the Czech Red Pied cattle with a genetic admixture of Black Pied Lowland breed (n = 10). Five of them were on the 1st lactation and 5 on the 2nd and/or higher lactations. Within the study period, the contents of non-essential amino acids (NEAA) and essential amino acids (EAA) decreased by 22.8–63.2% and 27.3–65.2%, resp., in dairy cows on the 1st lactation while in those on the 2nd and following lactations the corresponding values were 22.0–63.7% and 24.9–71.7%, respectively. The dependence of the course of changes in the AA spectrum of cow's colostrum on the time interval elapsing after the parturition could be characterised by a regression equation $y = b_0 + b_1/x + b_2/x^2$.

dairy cows, colostrum, amino acids, regression analysis

Milk is a complex biological system, in which its individual components occur in different ratios and in mutual relationships. Basing on results of long-term studies on milk composition of different animal species was possible to define average contents of individual milk components, their variability and (in the majority of cases) also their chemical composition. Crude protein is the most complicated component of both colostrum and milk. Regarding their nutritional and technological importance, these are the most studied milk components at all and it can be said that composition of milk protein is to a great degree dependent on the stage of lactation, season, breed, health condition of animals and method of milking.

In different animal species, production of colostrum and milk is determined by a number of physiological processes, which take place under completely concrete conditions and in dependence on mother's genotype. Proportions of individual colostrum and milk components are typical for each breed and each animal species. A good knowledge of milk and colostrum composition, variability in levels of their individual components and relationships existing among them enable us to estimate expected changes as induced by internal and external factors with a greater accuracy (Schablin, 1987; Khalil *et al.* 1992; Saito *et al.*, 1993).

The levels of selected biochemical parameters (i.e. proteins, fat, lactose, vitamins A and E, and immunoglobulins) in cow's colostrum at the moment of the first milking after parturition were studied by Jagoš *et al.* (1985) and Bouda *et al.* (1988); in goats and sheep a similar study was performed by Kráčmar *et al.* (2003, 2005).

The aim of this study was to obtain deeper and more exact data about the composition of cow's colostrum within the period of the first 72 hours *post partum* in dairy cows on the first as well as on the second and following lactations.

MATERIAL AND METHODS

Changes in the nutritive value of colostrum within the interval of 2–72 hours after the parturition were followed in dairy cows of the Czech Red Pied breed with an admixture of blood of Black Pied Lowland breed (n = 10). Five of them were on the first lactation and five on the second and following lactations. The average live body weights of primiparae females and of dams on the 2nd and following lactations were 500 kg and 550 kg, respectively. The study was carried out during the winter season from November to March.

The composition of feeding rations, their nutritive value as dependent on the rank of lactation, method of milk sampling, sample preparation and sample preservation were described in our earlier paper (Kráčmar & Zeman, 2003).

Experimental animals did not show any health problems during the whole study period.

Colostrum samples for amino acid determination were adjusted using acidic and oxidative acidic hydrolysis HCl (c = 6 mol/dm^3). The chromatographic analysis of sample hydrolysates was performed in the AAA 400 analyser (manufacturer INGOS Prague, CR) and using Na-citrate buffers and ninhydrin detection (Kráčmar *et al.*, 1998) as published in the Official Journal L 206 (Anonymus, 1978)

All results were evaluated using the ANOVA variation statistics programme. Correlation matrices and regression functions were calculated according to Snedecor and Cochran (1967) when using the statistical package Unistat, v. 5.1 and Office Excel®Microsoft.

RESULTS AND DISCUSSION

The obtained results were analysed separately for the group of primiparous dairy cows and for those on the 2nd and following lactations.

Average contents of essential and non-essential amino acids, sum of amino acids (ΣAA), sum of essential amino acids (ΣEAA), sum of non-essential amino acids (ΣNEAA) and sum of Met+Cys (ΣMet+Cys) in colostrum of primiparous females within the first 2 to 72 hours *post partum* are presented in Tabs I and II.

When comparing values recorded 12; 24; 36; 48 and 72 hours *post partum* with those found out 2 hours after parturition (= 100%), the following conclusions were drawn:

During the period of investigation, levels of NEAA and EAA decreased within ranges of 22.8–63.2% and 27.3–65.2%, respectively.

When comparing the decrease in contents of EAA within the period of 12 h with the initial 100% level (i.e. 2 hours *post partum*), the following results were obtained: Val >10%; His >25%; Phe, Arg, and Thr >30%; Met; Lys, Leu, and Ile >35%, and Cys 50%. The corresponding decreases within the interval of 24 h were as follows: Val >35%; His >40%; Phe, Arg, Ile, Thr, and Leu >50%; Met and Lys >55%, and Cys >65%. Within the interval of 36 h, the following decreases were observed: Val >45%; His >50%; Phe, Arg and Leu >55%; Met, Ile, Lys and Thr >60%, and Cys >80%. After 48 h, the decrease in EAA levels was as follows: His and Val >45%; Arg, Phe, Ile, Thr, Leu and Lys >55%; Met >65%, and Cys >80%. After 72 h, the following results were obtained: Val >60%; His, Leu and Lys >65%; Phe, Arg, Thr and Ile >70%; Met >75%, and Cys >85%.

When comparing the decrease in contents of NEAA within the period of 12 h with the initial 100% level (i.e. 2 hours *post partum*), the following results decreases were observed: Glu >20%, Ser, Gly and Tyr >25%; Asp and Ala >30%, and Pro >35%. When comparing contents of NEAA after 24 with the initial values, the decreases were as follows: Gly >25%; Ala >30%; Ser and Tyr >35%; Asp >40%, and Glu and Pro >45%. After 36 h, contents of NEAA decreased as follows: Ala >45%; Asp, Ser and Tyr >50%; Glu and Pro >55%, and Gly >60%. After 48 h, the decrease in EAA levels was as follows: Gly and Ala >40%; Tyr >45%; Asp and Ser >50%, and Glu and Pro >55%. Contents of Asp, Glu, Ala and Pro decreased by >65%. Finally, the decrease in contents of Ser, Gly, and Tyr after 72 h was >70%.

Average contents of essential and non-essential amino acids, sum of amino acids (ΣAA), sum of essential amino acids (ΣEAA), sum of non-essential amino acids (ΣNEAA) and sum of Met+Cys (ΣMet+Cys) in colostrum of dairy cows on the 2nd and subsequent lactations are presented in Tabs III and IV.

When comparing values recorded 12; 24; 36; 48 and 72 hours *post partum* with those found out 2 hours after parturition (= 100%), the following conclusions were drawn:

During the period of investigation, levels of NEAA and EAA decreased within ranges of 22.0–63.7 % and 24.9–71.7%, respectively.

When comparing the decrease in contents of EAA within the period of 12 h with the initial 100% level (i.e. 2 hours *post partum*), the following results were obtained: Val >5%; His >25%; Phe, Arg, and Thr >30%; Met, Arg, Ile and Leu >30%; Leu >35% and Cys >45%. The corresponding decreases within the interval of 24 h were as follows: Val >45%; Tyr >50%; Phe, Met, His and Leu >55 %; Arg, Ile and Lys >60%, and Cys >70%. After 36 h, contents of EAA decreased as follows: Val >40%; His >50%; Met, Phe, Arg, Ile, Thr and Leu >55%, Lys >60% and Cys >70%. Ala >45%; Asp, Ser and Tyr >50%; Glu and Pro >55%, and Gly >60%. After 48 h, the decrease in EAA levels was as follows: Val >50%; His >55%; Phe, Arg, Leu and Lys >60%, Met, Ile and Thr >65%,

and Cys >70%. Gly and Ala >40%; Tyr >45%; Asp and Ser >50%, and Glu and Pro >55%. After 72 h, the following decreases in contents of NEAA were recorded: Val >65%, Lys >70%, Phe, Arg, Thr, Met, Leu and Ile >76%, and His and Cys >76%.

As compared with the reference value (i.e. that recorded 2 h *post partum*), the contents of NEAA observed in cow's colostrum after 12 h decreased in the following manner: Glu >20%, Ser, Gly, Ala and Tyr >25%, and Asp and Pro >30%. When comparing contents of NEAA after 24 h, the decreases were as follows: Gly, Tyr, Asp, Ser, Glu and Ala >48 %, and Pro >51%. Within the interval of 36 h, levels of NEAA decreased as follows: Ala, Gly, Asp and Tyr >46%; Ser >47%, and Glu and Pro >51%. After 48 h, the decrease in NEAA levels was as follows: Ala and Tyr >50%; Gly and Ala >40%; Tyr >45%; Asp and Ser >50%, and Glu and Pro >55%. After 72 h, the following decreases in contents of NEAA were found out: Asp >65%; Glu, Ala, Tyr, Ser and Pro >70% and Gly >72%.

Average contents of essential and non-essential amino acids, sum of amino acids (ΣAA), sum of essential amino acids (ΣEAA), sum of non-essential amino acids (ΣNEAA) and sum of Met+Cys (ΣMet+Cys) in colostrum of dairy cows within 2 to 72 h *post partum* are presented in Tabs V and VI and in Figs 1–4.

When comparing the decrease in contents of individual amino acids within the time interval of 12 h *post partum* with the initial value found 2 h after the parturition (100 %) it was concluded that in primiparous dairy cows this decrease in contents of EAA was always steeper than in dairy cows on the 2nd and subsequent lactations. With exception of Met and Lys, a similar tendency was found out also 72 h *post partum*. Essential amino acids His, Phe, Arg, Ile, Thr, and Val showed a similar trend 36 h *post partum*. As far as Leu was concerned, an identical tendency was found out in all dairy cows 12; 24; and 36 h *post partum*, while in Lys within the interval of 24 to 72 h and in Met 12, 24, and 72 h after the parturition. In case of Cys no agreement was found out in any time interval.

As compared with older dairy cows, in primiparae the decrease in contents of AA was always steeper: as compared with the contents recorded 2 h after parturition (100%), lower Cys levels were recorded 12; 36 and 72 h, in case of Met 36 and 48 h, and in case of His, Phe, Arg, Ile, Thr, Val, and Lys 12 h *post partum*. A lower decrease in the level of Cys was observed 24 and 48 h *post partum*, in levels of His, Phe, Arg, Ile, Thr and Val 24 to 72 h *post partum* and in that of Leu 48 and 72 h *post partum*.

As far as NEAA were concerned, a similar decrease in the level of Gly was found out after 12 h, in levels of Asp and Tyr after 12 and 72 h, in levels of Ser and Ala after 12; 36 a 72 h, in the level of Glu after 12; 48 and 72 h and in that of Pro 12 and 36 to 72 h *post partum*. In primiparous dairy cows a faster decrease was recorded in levels of Asp, Glu, Gly and Tyr 36 h *post partum* and a slower decrease in levels of Glu and Pro 24 h *post partum*, in those of Asp, Ala, Tyr and Ser 24 and 48 h *post partum* and in that of Gly 24; 48 and 72 h *post partum*.

Kráčmar *et al.* (1997) concluded that 12 h *post partum* the average content of amino acids decreases by approximately 25% as compared with values found out 2 h after the parturition; after 24; 36 and 48 hours, their contents decreased by ca 50%, 52%, and 54–60%, respectively. Similar results were obtained also in this experiment.

The dependence of changes in contents of amino acids in colostrum of primiparous and/or older dairy cows within different time intervals *post partum* can be expressed by the regression equation $y = b_0 + b_1/x + b_2/x^2$. Aggregate values are presented in Tabs VII–IX.

Contents of amino acids in milk protein show a high degree of variability. According to Polanský (1988), contents of amino acids in colostrum and milk can be influenced by quality of feeds (e.g. by silage of inferior quality) as well as by some other factors. Limit values observed in this study corresponded with data published by Šebela *et al.* (1976), Boroš (1988), Grieger *et al.* (1990) and Zeman *et al.* (1995) for the conditions of the Czech Republic and for Slovakia.

I: *Dynamics of changes in content of essential amino acids in colostrum of primiparous dairy cows within the first 2–72 h after parturition (mg/100 ml)*

hour	THR		VAL		ILE		LEU		PHE	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	761.1 ± 31.37	9.2	637.2 ± 35.82	16.0	668.0 ± 22.98	7.7	1146.0 ± 27.75	5.4	615.2 ± 24.60	8.9
12	564.7 ± 36.08	14.6	663.4 ± 23.94	8.1	448.3 ± 22.52	6.2	776.0 ± 24.03	6.9	440.4 ± 26.98	13.7
24	395.4 ± 23.91	13.5	477.5 ± 48.13	22.5	342.5 ± 35.83	23.4	569.6 ± 17.71	7.0	315.3 ± 29.86	13.5
36	363.8 ± 28.87	17.7	432.9 ± 29.83	15.4	309.0 ± 32.84	23.8	536.3 ± 35.06	14.6	277.6 ± 27.58	13.8
48	366.7 ± 28.47	14.2	414.3 ± 38.05	20.5	307.5 ± 31.14	22.6	542.7 ± 38.60	15.9	300.0 ± 22.68	16.9
72	238.1 ± 24.91	23.4	312.0 ± 33.20	23.8	204.1 ± 40.61	24.5	436.0 ± 25.05	12.8	198.3 ± 28.10	13.7

hour	HIS		LYS		ARG		CYS		MET	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	466.3 ± 37.27	17.9	1004.4 ± 35.95	8.0	639.8 ± 69.48	10.5	310.1 ± 16.40	11.8	237.4 ± 13.39	13.8
12	353.7 ± 38.03	24.0	691.8 ± 25.36	8.2	451.3 ± 44.54	12.2	161.0 ± 14.13	15.7	164.7 ± 14.19	15.7
24	277.6 ± 21.67	17.5	492.4 ± 21.62	9.8	329.5 ± 33.10	22.5	108.7 ± 11.43	12.9	116.7 ± 11.18	12.3
36	237.7 ± 22.16	20.8	445.2 ± 24.83	12.5	303.4 ± 16.86	12.4	73.9 ± 11.04	13.1	102.4 ± 10.74	16.0
48	254.8 ± 20.18	17.6	444.8 ± 39.74	20.0	303.7 ± 33.99	25.0	82.1 ± 11.93	13.3	86.2 ± 18.78	21.8
72	161.1 ± 13.38	14.7	369.6 ± 17.42	10.5	222.3 ± 24.67	24.8	50.9 ± 6.05	12.6	62.9 ± 24.56	18.7

hour	ΣCYS+MET		ΣEAK		ΣAK	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	547.5 ± 57.54	10.5	6485.4 ± 110.21	18.9	12448.2 ± 180.50	19.0
12	325.7 ± 14.81	13.3	4715.3 ± 32.08	16.8	9319.6 ± 115.80	13.8
24	225.4 ± 12.26	12.2	3425.1 ± 60.97	14.0	7132.4 ± 129.73	19.0
36	176.4 ± 7.65	9.7	3082.3 ± 92.90	16.7	6059.3 ± 121.16	18.0
48	168.2 ± 12.96	17.2	3102.7 ± 144.44	10.4	6155.7 ± 123.51	18.6
72	113.9 ± 12.78	15.5	2255.4 ± 68.10	16.3	4448.9 ± 63.38	14.2

II: *Dynamics of changes in content of non-essential amino acids in in colostrum of primiparous dairy cows within the first 2–72 h after parturition (mg/100 ml)*

hour	ASP		SER		GLU		PRO	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	802.9 ± 35.62	9.9	677.4 ± 15.11	5.0	2252.1 ± 311.62	30.9	991.0 ± 22.31	5.0
12	598.1 ± 50.77	18.9	534.5 ± 25.51	10.7	1860.9 ± 177.88	21.4	695.6 ± 45.82	14.7
24	427.8 ± 30.42	15.9	366.0 ± 20.52	12.5	1262.6 ± 171.40	30.4	488.5 ± 29.63	13.5
36	433.9 ± 44.71	23.1	363.4 ± 41.18	25.3	1183.8 ± 255.27	48.2	494.0 ± 42.78	19.3
48	395.7 ± 27.68	15.6	312.5 ± 29.17	20.8	1078.7 ± 199.65	41.4	470.1 ± 50.59	24.1
72	296.6 ± 30.44	22.9	231.5 ± 31.19	30.0	850.1 ± 32.10	8.4	387.4 ± 30.02	17.5

hour	GLY		ALA		TYR		ΣNEAK	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	284.8 ± 35.74	28.1	374.4 ± 22.43	13.4	552.6 ± 32.61	13.2	5935.2 ± 104.71	10.3
12	227.3 ± 22.63	22.3	281.7 ± 25.11	19.9	430.0 ± 51.68	26.8	4628.0 ± 83.25	8.5
24	154.4 ± 26.01	37.7	203.4 ± 36.33	40.5	288.3 ± 30.62	23.7	3191.0 ± 27.96	19.6
36	154.1 ± 18.63	27.1	219.9 ± 23.81	24.2	308.5 ± 26.38	19.1	3157.6 ± 30.65	12.7
48	138.0 ± 33.91	41.8	191.2 ± 8.03	9.7	279.3 ± 21.19	16.9	2865.5 ± 31.56	14.6
72	81.2 ± 13.25	10.3	130.6 ± 16.63	8.5	176.6 ± 11.52	6.0	2153.7 ± 10.98	11.4

III: *Dynamics of changes in content of essential amino acids in colostrum of dairy cows on the 2nd and subsequent lactations within the first 2–72 h after parturition (mg/100 ml)*

hour	THR		VAL		ILE		LEU		PHE	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	759.5 ± 34.47	10.1	725.1 ± 33.13	10.2	659.7 ± 39.60	13.4	1150.5 ± 26.52	5.2	608.2 ± 21.15	7.8
12	593.9 ± 29.31	11.2	689.6 ± 13.52	4.4	471.2 ± 22.65	10.7	795.0 ± 31.77	8.9	456.8 ± 20.16	9.9
24	366.1 ± 47.31	28.9	432.3 ± 23.84	12.3	288.6 ± 48.71	13.7	522.8 ± 26.36	11.3	273.9 ± 28.72	23.5
36	354.5 ± 32.80	20.7	435.4 ± 20.89	10.7	298.4 ± 38.08	26.5	525.8 ± 21.10	8.9	281.3 ± 37.76	18.4
48	303.0 ± 31.73	18.8	372.5 ± 31.40	18.8	260.8 ± 32.79	18.3	494.7 ± 31.14	14.1	258.4 ± 28.35	15.5
72	189.5 ± 30.25	13.6	264.9 ± 30.66	25.9	160.0 ± 31.25	43.7	338.7 ± 59.19	29.5	149.0 ± 10.14	15.2

hour	HIS		LYS		ARG		CYS		MET	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	459.4 ± 16.47	8.0	993.4 ± 44.43	10.0	631.7 ± 59.24	21.0	290.2 ± 34.86	26.9	229.3 ± 51.11	26.9
12	359.6 ± 36.59	22.8	724.6 ± 29.23	9.0	466.0 ± 23.18	11.1	166.9 ± 41.84	36.1	165.1 ± 64.02	18.7
24	218.5 ± 88.11	9.0	443.7 ± 60.39	30.4	284.0 ± 40.05	21.8	77.8 ± 17.45	3.8	114.1 ± 11.21	5.9
36	232.3 ± 45.47	21.5	438.3 ± 30.94	15.8	297.3 ± 26.09	19.6	75.8 ± 6.36	1.8	107.6 ± 8.69	1.8
48	207.3 ± 22.02	13.8	410.3 ± 32.60	17.8	268.1 ± 27.51	13.9	65.2 ± 8.08	2.8	91.4 ± 8.61	2.1
72	107.3 ± 17.82	7.3	322.9 ± 26.13	18.1	181.3 ± 25.42	11.1	67.7 ± 2.46	8.0	60.9 ± 9.96	3.7

hour	ΣCYS+MET		ΣEAK		ΣAK	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	519.5 ± 38.29	35.2	6507.0 ± 131.54	40.5	12442.2 ± 137.94	25.0
12	332.0 ± 10.55	7.1	4888.8 ± 153.32	28.1	9516.8 ± 113.24	27.0
24	191.9 ± 6.98	7.7	3021.7 ± 147.72	10.9	6212.7 ± 171.15	13.4
36	183.4 ± 7.48	9.1	3046.6 ± 137.59	10.1	6204.2 ± 115.38	15.0
48	156.6 ± 12.97	8.5	2731.8 ± 132.29	10.8	5597.4 ± 138.71	15.5
72	128.7 ± 12.99	10.5	1842.3 ± 55.22	6.7	3996.1 ± 54.74	13.6

IV: *Dynamics of changes in content of non-essential amino acids in colostrum of dairy cows on the 2nd and subsequent lactations within the first 2–72 h after parturition (mg/100 ml)*

hour	ASP		SER		GLU		PRO	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	802.9 ± 35.62	9.9	677.4 ± 15.11	5.0	2252.1 ± 311.62	30.9	991.0 ± 22.31	5.0
12	598.1 ± 50.77	18.9	534.5 ± 25.51	10.7	1860.9 ± 177.88	21.4	695.6 ± 45.82	14.7
24	427.8 ± 30.42	15.9	366.0 ± 20.52	12.5	1262.6 ± 171.40	30.4	488.5 ± 29.63	13.5
36	433.9 ± 44.71	23.1	363.4 ± 41.18	25.3	1183.8 ± 255.27	48.2	494.0 ± 42.78	19.3
48	395.7 ± 27.68	15.6	312.5 ± 29.17	20.8	1078.7 ± 199.65	41.4	470.1 ± 50.59	24.1
72	296.6 ± 30.44	22.9	231.5 ± 31.19	30.0	850.1 ± 32.10	8.4	387.4 ± 30.02	17.5

hour	GLY		ALA		TYR		ΣNEAK	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	284.8 ± 35.74	28.1	374.4 ± 22.43	13.4	552.6 ± 32.61	13.2	5935.2 ± 104.71	10.3
12	227.3 ± 22.63	22.3	281.7 ± 25.11	19.9	430.0 ± 51.68	26.8	4628.0 ± 83.25	8.5
24	154.4 ± 26.01	37.7	203.4 ± 36.33	40.5	288.3 ± 30.62	23.7	3191.0 ± 27.96	19.6
36	154.1 ± 18.63	27.1	219.9 ± 23.81	24.2	308.5 ± 26.38	19.1	3157.6 ± 30.65	12.7
48	138.0 ± 33.91	41.8	191.2 ± 8.03	9.7	279.3 ± 21.19	16.9	2865.5 ± 31.56	14.6
72	81.2 ± 13.25	10.3	130.6 ± 16.63	8.5	176.6 ± 11.52	6.0	2153.7 ± 10.98	11.4

V: *Dynamics of changes in content of essential amino acids in cow's colostrum within the first 2–72 h after parturition (mg/100 ml)*

hour	THR		VAL		ILE		LEU		PHE	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	760.3 ± 22.14	19.2	681.1 ± 14.74	16.8	663.8 ± 25.62	12.2	1148.3 ± 19.61	15.4	611.7 ± 19.26	10.0
12	579.3 ± 53.45	29.2	676.5 ± 45.61	21.3	459.7 ± 42.52	29.3	785.5 ± 36.76	14.8	448.6 ± 31.61	22.3
24	380.7 ± 54.86	24.8	454.9 ± 79.35	25.9	315.5 ± 39.43	19.4	546.2 ± 79.46	46.0	294.6 ± 27.43	17.9
36	359.3 ± 81.39	22.7	434.1 ± 55.88	12.9	303.7 ± 53.74	29.6	531.0 ± 82.38	26.1	279.5 ± 29.28	33.1
48	334.9 ± 35.41	10.6	393.4 ± 73.41	15.9	284.2 ± 55.51	18.9	518.7 ± 83.22	27.8	279.2 ± 23.82	28.5
72	213.8 ± 26.26	12.3	288.4 ± 81.05	12.3	182.1 ± 24.47	13.4	387.4 ± 102.14	26.4	173.6 ± 26.35	15.2

hour	HIS		LYS		ARG		CYS		MET	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	462.9 ± 22.40	15.3	998.9 ± 32.53	10.3	635.7 ± 54.40	27.0	300.2 ± 37.67	39.7	233.3 ± 31.85	43.2
12	356.7 ± 26.77	23.7	708.2 ± 57.60	25.7	458.6 ± 31.14	23.5	163.9 ± 29.44	56.7	164.9 ± 36.09	40.1
24	248.1 ± 31.37	12.6	468.0 ± 46.55	28.8	306.7 ± 37.96	28.2	93.2 ± 16.46	25.6	115.4 ± 27.84	24.0
36	235.0 ± 25.53	23.4	441.8 ± 21.97	15.7	300.3 ± 27.81	18.8	74.9 ± 20.06	27.5	105.0 ± 32.72	10.2
48	231.0 ± 25.43	21.1	427.5 ± 19.73	16.3	285.9 ± 20.68	17.2	73.6 ± 28.96	12.4	88.8 ± 33.01	10.4
72	134.2 ± 28.88	21.5	346.3 ± 25.09	17.3	201.8 ± 22.23	11.0	59.3 ± 28.89	15.0	61.9 ± 38.12	6.2

hour	ΣCYS+MET		ΣEAK		ΣAK	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	533.5 ± 61.67	36.6	6496.2 ± 88.52	43.0	12445.2 ± 83.33	21.0
12	328.9 ± 55.67	53.5	4802.0 ± 95.42	20.1	9418.2 ± 134.12	19.5
24	208.6 ± 56.96	28.6	3223.4 ± 67.66	16.6	6672.5 ± 154.29	17.3
36	179.9 ± 40.39	22.5	3064.5 ± 58.29	10.1	6131.8 ± 103.45	16.9
48	162.4 ± 67.11	21.2	2917.2 ± 62.49	6.8	5876.5 ± 95.48	15.1
72	121.3 ± 78.22	17.3	2048.8 ± 43.66	11.4	4222.5 ± 80.88	16.1

VI: *Dynamics of changes in content of non-essential amino acids in cow's colostrum within the first 2–72 h after parturition (mg/100 ml)*

hour	ASP		SER		GLU		PRO	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	806.3 ± 44.39	17.4	679.7 ± 24.04	11.2	2255.2 ± 292.08	14.1	997.6 ± 42.06	13.3
12	598.5 ± 30.85	16.3	534.8 ± 19.58	11.6	1852.2 ± 93.28	15.9	694.7 ± 26.79	12.2
24	465.0 ± 86.56	18.5	408.1 ± 17.06	13.2	1301.0 ± 129.74	31.5	522.0 ± 41.34	16.8
36	421.7 ± 48.94	16.7	361.3 ± 22.83	20.0	1143.1 ± 186.70	51.6	487.4 ± 34.29	22.2
48	409.3 ± 49.15	13.8	330.9 ± 20.65	16.2	1073.9 ± 120.02	35.3	483.6 ± 55.76	26.5
72	290.4 ± 49.80	13.4	225.9 ± 25.99	13.6	875.8 ± 134.74	38.2	381.5 ± 27.01	22.4

hour	GLY		ALA		TYR		ΣNEAK	
	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)	mean±S.D.	CV(%)
2	290.2 ± 26.58	29.0	368.4 ± 26.51	22.8	551.7 ± 20.83	11.9	5949.0 ± 82.04	14.4
12	228.3 ± 18.22	25.2	276.6 ± 23.67	27.1	431.0 ± 16.86	19.7	4616.2 ± 108.70	17.4
24	193.7 ± 13.22	21.6	234.9 ± 25.16	14.6	324.4 ± 22.16	11.8	3449.1 ± 87.12	17.9
36	142.6 ± 13.43	19.4	211.8 ± 10.54	14.9	299.3 ± 35.05	27.1	3067.3 ± 107.93	25.2
48	157.8 ± 22.48	14.3	208.6 ± 18.81	19.0	295.2 ± 54.35	28.2	2959.3 ± 114.32	26.9
72	88.3 ± 32.02	11.5	132.5 ± 16.22	13.9	179.3 ± 25.86	24.6	2173.7 ± 142.62	20.7

VII: *Parameters of the regression function* $y = b_0 + b_1/x + b_2/x^2$ *expressing changes in levels of amino acids in colostrum of primiparous cows within the first 2–72 h after parturition*

	b_0	b_1	b_2	r	F
Asp	284.08	4640.33	–7179.47	0.976**	30.07*
Ser	223.75	4573.89	–6116.30	0.988*	61.19**
Glu	711.13	15764.60	–25341.19	0.999**	647.16**
Pro	356.38	4751.20	–6912.16	0.991**	84.56**
Gly	104.75	2004.55	–3247.11	0.881	5.21
Ala	156.85	1850.87	–2881.04	0.909*	7.16
Tyr	192.92	3567.39	–5704.34	0.956*	16.08*
ΣNEAA	2027.27	37300.72	–58866.27	0.986**	51.25**
Thr	221.43	4779.97	–7401.62	0.985**	48.91**
Val	271.53	5544.27	–9626.16	0.987**	54.26**
Ile	201.38	3500.87	–5135.89	0.986*	53.11**
Leu	394.95	5112.49	–7220.65	0.995**	142.68**
Phe	184.49	3536.64	–5350.64	0.985*	50.42**
His	162.54	2749.38	–4284.26	0.972*	26.46*
Lys	312.56	5097.63	–7427.64	0.997**	290.69**
Arg	204.65	3402.87	–5065.35	0.992**	87.64**
Cys	35.12	1732.73	–2366.05	0.997*	230.49**
Met	51.30	1607.20	–2470.21	0.995**	149.18**
ΣCys+Met	86.42	3339.20	–4834.58	0.998**	298.00**
ΣEAA	2039.99	37063.13	–56346.76	0.992**	89.86**
ΣAA	4067.21	74364.84	–115214.80	0.990**	76.32**

* P<0.05 ** P<0.01

VIII: *Parameters of the regression function* $y = b_0 + b_1/x + b_2/x^2$ *expressing changes in levels of amino acids in colostrum of dairy cows on the 2nd and following lactations within the first 2–72 h after parturition*

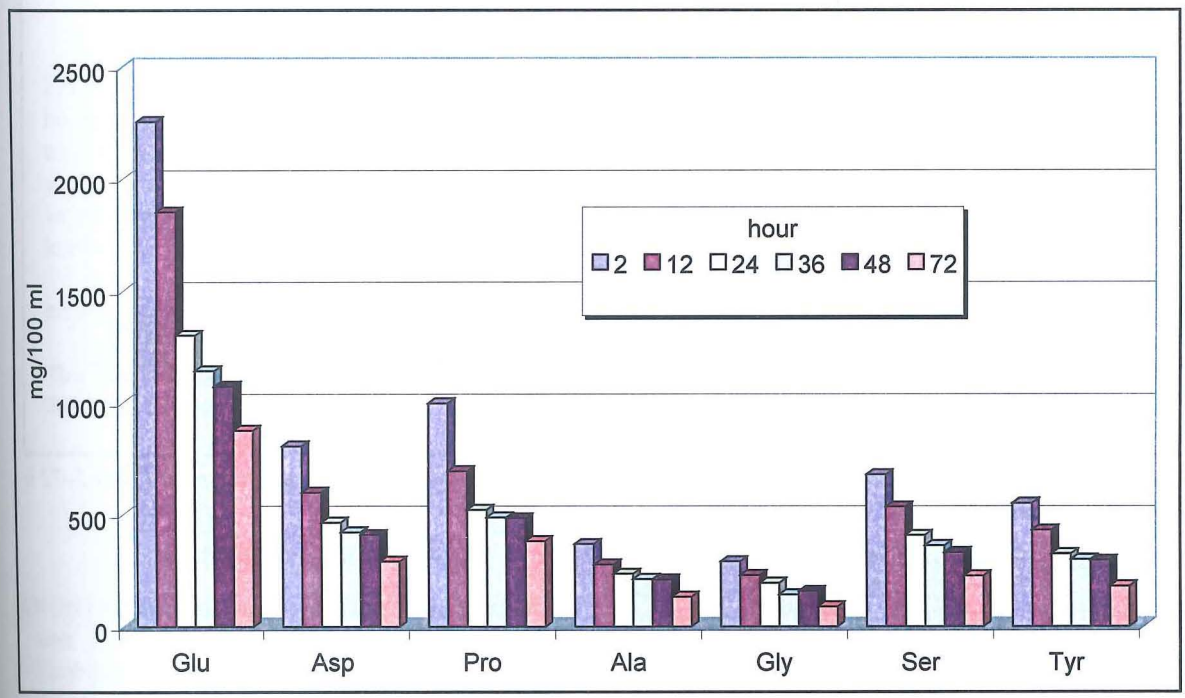
	b_0	b_1	b_2	r	F
Asp	278.19	4422.61	–6746.66	0.986**	52.55**
Ser	202.86	4628.52	–7359.22	0.988**	61.46**
Glu	697.39	16053.85	–25888.94	0.995**	141.54**
Pro	346.50	4643.55	–6708.78	0.993**	101.14**
Gly	78.89	2105.46	–3387.57	0.973*	26.21*
Ala	133.37	2092.93	–3222.07	0.967*	21.49*
Tyr	174.50	3555.89	–5599.69	0.969*	22.72*
ΣNEAA	1911.63	37502.96	–58912.99	0.989**	67.62**
Thr	149.46	6186.10	–9932.36	0.988*	64.03**
Val	213.63	6608.89	–11171.98	0.983*	41.83**
Ile	138.27	4581.48	–7077.44	0.983*	48.54**
Leu	305.38	6669.28	–9958.22	0.988**	62.03**
Phe	129.60	4494.51	–7074.75	0.981*	37.98**
His	102.01	3589.13	–5748.99	0.962	23.04*
Lys	250.96	6303.88	–9637.36	0.993**	101.77**
Arg	153.82	4232.64	–6553.70	0.985*	49.95**
Cys	31.16	1715.09	–2393.54	0.991	86.43**
Met	53.58	1578.62	–2454.57	0.989*	67.88**
ΣCys+Met	84.80	3292.71	–4846.34	0.997**	250.15**
ΣEAA	1527.90	45959.89	–72003.51	0.988*	60.83**
ΣAA	3439.62	83461.19	–130913.56	0.989**	64.05**

* P<0.05 ** P<0.01

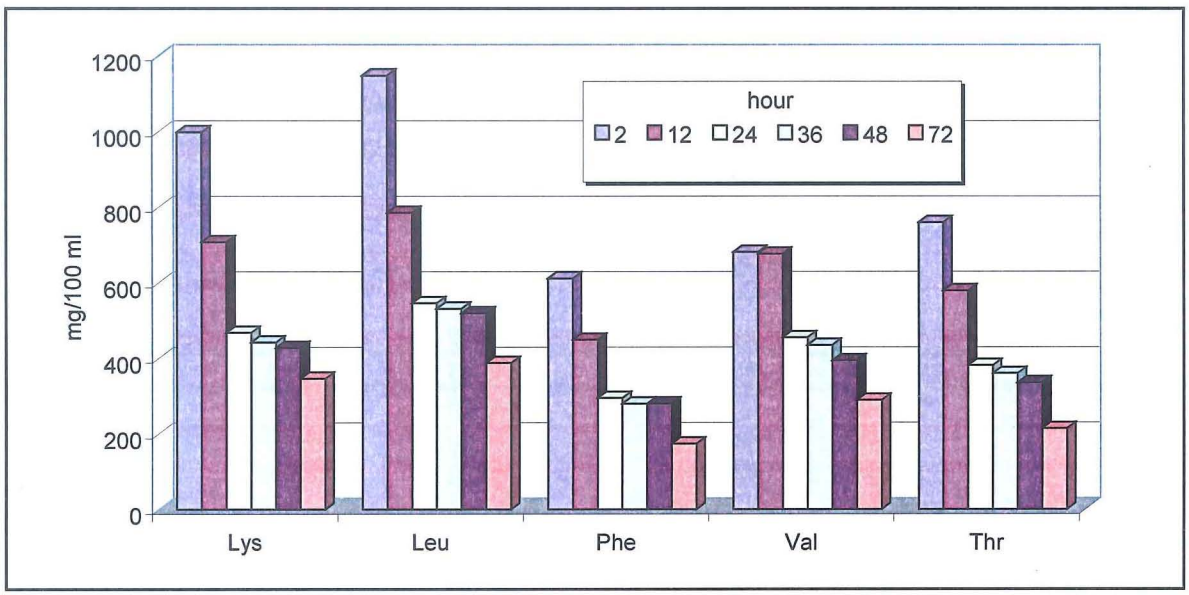
IX: *Parameters of the regression function* $y = b_0 + b_1/x + b_2/x^2$ *expressing changes in levels of amino acids in colostrum of dairy cows within the first 2–72 h after parturition*

	b_0	b_1	b_2	r	F
Asp	281.09	4532.44	–6964.89	0.986*	50.68**
Ser	212.02	4674.74	–7479.69	0.984*	45.61**
Glu	704.26	15908.92	–25614.25	0.998**	402.99**
Pro	351.45	4696.76	–6809.08	0.994**	129.43**
Gly	91.82	2054.25	–3315.64	0.954*	15.25*
Ala	145.13	1971.54	–3050.72	0.957	16.33*
Tyr	183.71	3561.64	–5652.02	0.970*	23.68*
ΣNEAA	1969.47	37401.80	–58889.63	0.991**	83.36**
Thr	185.51	5482.04	–8665.26	0.988*	59.41**
Val	242.54	6077.28	–10400.50	0.985**	50.41**
Ile	169.89	4039.34	–6103.43	0.987*	56.11**
Leu	350.18	5890.54	–8588.60	0.992**	91.82**
Phe	157.04	4015.89	–6213.29	0.984*	47.45**
His	132.24	3170.60	–5018.98	0.974**	28.22*
Lys	281.78	5700.29	–8531.64	0.996**	170.18**
Arg	179.24	3816.93	–5808.06	0.989*	69.59**
Cys	33.15	1722.98	–2377.58	0.998**	497.66**
Met	52.44	1592.93	–2462.64	0.993**	99.89**
ΣCys+Met	85.60	3316.75	–4841.94	0.999**	658.97**
ΣEAA	1783.93	41511.25	–64174.57	0.991**	79.41**
ΣAA	3753.40	78918.05	–123064.20	0.991**	86.17**

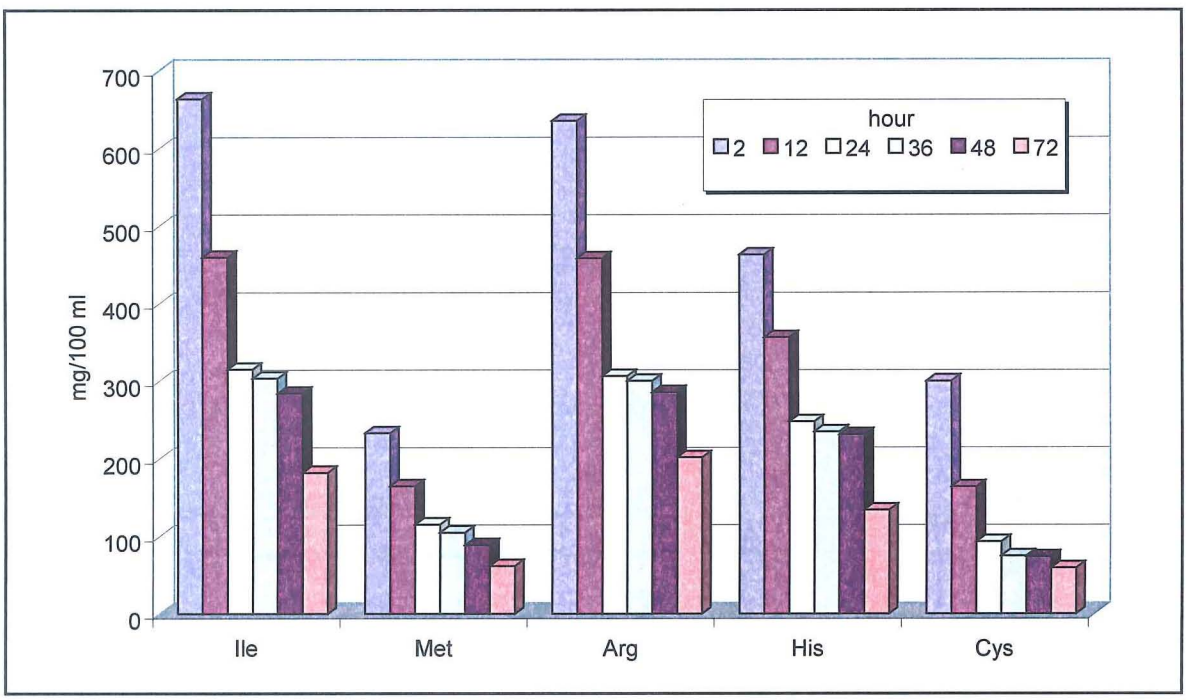
* P<0.05 ** P<0.01



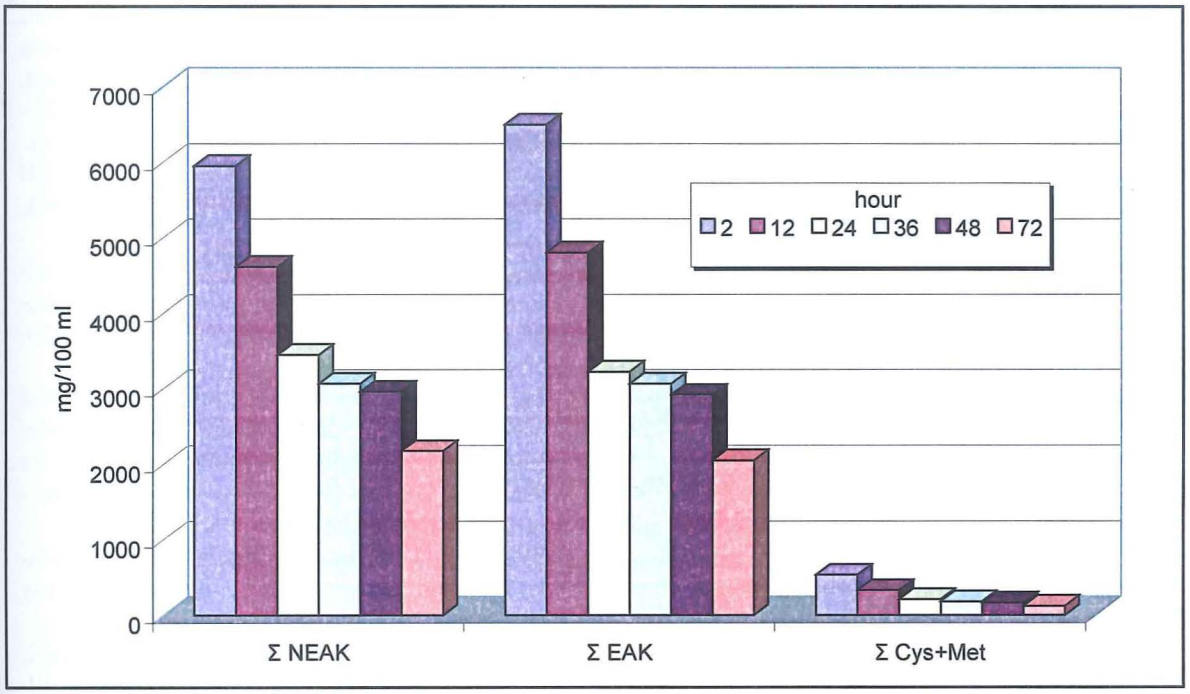
1: *Dynamics of changes in content of non-essential amino acids in cows colostrum during the first 2–72 h after parturition*



2: *Dynamics of changes in content of choice essential amino acids in cows colostrum during the first 2–72 h after parturition*



3: *Dynamics of changes in content of choice essential amino acids in cows colostrum during the first 2–72 h after parturition*



4: *Dynamics of changes in content of essential, non-essential amino acids and Σ Cys+Met in cows colostrum during the first 2–72 h after parturition*

SOUHRN

Změny aminokyselinového spektra kravského mleziva v průběhu prvních 72 hodin po porodu

Změny aminokyselinového spektra mleziva v průběhu 2 až 72 hod. po porodu byly sledovány u krav českého strakatého skotu s genetickým podílem černostrakatého nížinného skotu ($n = 10$), z nichž bylo 5 krav na 1. laktaci (prvotelky) a 5 krav na 2. a vyšší laktaci. Obsah NEAA u krav na 1. laktaci se během sledovaného období poklesl v rozpětí 22,8–63,2 %, u EAK v rozpětí 27,3–65,2 % u krav na 2. a vyšší laktaci ve stejném pořadí o 22,0–63,7 %, resp. 24,9–71,7 %. Průběh změn aminokyselinového složení mleziva krav v závislosti na době od porodu byl vyjádřen lomenou regresní rovnicí $y = b_0 + b_1/x + b_2/x^2$.

mléčné krávy, mlezivo, aminokyseliny, regresní analýza

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