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Short communication

LOWER SERUM FREE AMINO ACIDS IN HOLSTEIN COWS WITH MILK FEVER IN FIELD CASE

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This study was conducted to investigate the relationship between serum free amino acids (FAA) and the onset of milk fever in dairy cows around the time of calving. The serum concentration of FAA was compared between multiparous cows with milk fever (MF group; n=7) and healthy multiparous cows (Control Group; N=16) kept on a Holstein dairy farm. Blood samples were obtained 3 to 4 weeks prepartum, on the day of calving, and 1 month post partum for analysis of serum amino acids and lipid parameters. The levels of all essential amino acids in the MF group were lower than those in the Control group. Significant differences between groups were observed in phenylalanine, valine, isoleucine, and leucine at 1 month post partum, and in tryptophan on the day of calving. Regarding the non essential amino acids, a significantly lower level of arginine was observed in the MF group compared to the Control group on the day of caving, as well as 1 month post partum. A significant positive correlation was detected between cholesterol and branched chain amino acids (BCAA) levels ($r=0.531$, $P<0.01$). These results showed that MF cows had lower levels in several FAA around the time of calving even before the onset of MF.

Keywords: calving, dairy cow, free amino acids, milk fever

INTRODUCTION

During late gestation, dry matter intake (DMI) of dairy cows is quite low whereas nutrient demand is extremely high [1]. Because nutritional requirements increase at the end of gestation to meet the demands of the fetus inside the uterus and growing mammary gland for the next lactation, pregnant cows need to mobilize energy from reserves [2]. However, serious reductions in DMI near parturition predispose animals to metabolic disorders such as displaced abomasum, milk fever, and ketosis. A decrease in nutritional levels, such as albumin, glucose, and cholesterol during the dry period was observed in the dairy herd with a high incidence of periparturient diseases [3,4].

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Thus, deficiency of nutrients around the time of calving may affect the onset of periparturient diseases.

Animals obtain essential amino acids (EAA) from feed and convert them to non essential amino acids (NEAA) that are used as energy sources or for protein synthesis inside the body. In dairy cows, maintaining a good balance of amino acids is important for achieving higher milk yields and good health [5].

A previous study reported higher serum total free amino acids in cows following higher DMI after calving [6]. On the other hand, lower levels of serum nutritive parameters such as cholesterol or beta hydroxybutyric acid in the preparturient period were often associated with negative effects on postparturient health conditions, underscoring the importance of nutritional improvement [7,8]. In particular, peripartum amino acids deficiency is known as a risk factor for metabolic diseases in the postpartum period [9,10]. A deficiency of protein energy is a form of malnutrition, leading to a shortage of amino acids in all cells in the body. The cows developed retained placenta after calving showed low circulating amino acids during the last 2 weeks of gestation [11]. The constituents of free amino acids in serum with the onset of milk fever in dairy cows around the time of calving have not been fully clarified. The objective of the present study was to investigate the changes in free amino acids and lipids in the cows which developed milk fever during the dry and early lactation periods in field conditions.

MATERIALS AND METHODS

Animals and protocol design

Twenty-three multiparous Holstein cows kept in one farm were used in this study. Seven cows had an onset of milk fever (MF group; mean parity 4.86 ± 0.95) and 16 cows remained clinically healthy throughout the experimental period (Control group; mean parity 3.00 ± 0.25), which showed a significant difference in parity ($P<0.05$). Mean milk yield per day 1 month after calving was 42.59 ± 1.58 kg in the MF group and 47.98 ± 0.95 kg in the Control group, without significant difference between groups. The MF group showed clinical signs such as lethargy, no appetite, low temperature of the body surface, weak heartbeat, muscular weakness, unable to stand, and relaxation of the anus. The level of serum calcium was under 5.5 mg/dl in all cows of the MF group before treatment. The response to intravenous calcium infusion in the cows in the MF group was rewarding, and the cows with MF recovered after treatment with calcium containing infusion. No cows had a complication of other diseases, such as calving paralysis, fractures of bones or pelvis, hip luxation, coliform mastitis, hypovolemic shock, and none were treated for other diseases during the experimental period. There were no instances of death or culling.

All dry cows were kept in free stall housing. They were fed about 17 kg of total mixed ration (TMR), and had free access to hay and water. All cows in late gestation were moved from close up stalls to the maternity pen prior to the onset of labor, where they delivered. The lactating cows were kept in another free stall housing with free access to water. The feeding components of TMR during the dry and lactating periods are shown in Table 1.

Table 1. Composition of the diets fed to the cows during the dry and lactation period

	Diet(kg/day)	
Item	**Dry period**	**Lactating period**
Corn silage		24.9
First-cut grass silage		11.8
Second-cut grass silage	15.0	6.0
Dry ground corn		3.2
Soybean meal		1.4
Bypass protein	0.5	0.6
Compound feed	1.0	7.0
Beet pulp		2.0
Vitamin-mineral mix[1]		0.5
Vitamin-mineral mix[2]	0.2	

[1]Vitamin-mineral mix contained: 0.18g sodium chloride, 0.19g calcium carbonate, 0.01g magnesium oxide, 0.9g vitamins;
[2]Vitamin-mineral mix contained: 0.19g calcium carbonate, 0.05g vitamins

Blood sampling and analyses

Blood samples were collected from the tail vein into plain vacutainer tubes at 3 to 4 weeks before calving (Dry), on the day of calving, and at 1 month after calving. Blood samples were immediately centrifuged at 3,000 rpm for 10 min for isolating serum. The serum was kept at -30 °C until analysis.

The concentration of FAA in the serum was analyzed using an amino acid automatic analyzer (JIC-5/V, Nippon Electron, Co., Ltd., Tokyo, Japan). Serum samples were used to measure the serum total cholesterol (TC), beta hydroxy butyric acid (BHB), and non esterified fatty acids (NEFA) by enzyme assay. Body condition Score (BCS) was evaluated according to the method of Ferguson et al. [12].

Ethics

In this study, the procedures used were in accordance with the principles and guideline for animal use set by the Animal Experiment and Care Committee of Obihiro University of Agriculture and Veterinary Medicine Obihiro, Japan (No.24-4).

Statistical analysis

Analyzes were performed using the software-Excel TOKEI version 2.02 (SSRI Co., Ltd. Tokyo, Japan). All data are expressed as mean ± standard errors. All data were not normally distributed, and statistical analysis for each parameter was performed using Mann Whitney U test in order to determine the difference between two groups at the same sampling time. The difference was considered significant at P<0.05. Correlations of time course changes between biochemical parameters and FAA were analyzed using Spearman's rank correlation test, and significance was determined at P<0.01 or P<0.05.

RESULTS AND DISCUSSION

In this study, most amino acids in the MF group were lower at all sampling points, and significant differences were found in TAA, EAA, BCAA, and AAA during the Dry period (Table 2).

Table 2. Serum free amino acids concentration (μmol/L) in the tested groups

		MF Group	Control Group	
TAA	Dry	3210.2±470.2	6031.9±1104.0	*
	after calving	3097.2±554.8	5514.4±809.9	*
	1 Month	4266.2±842.5	6599.5±667.1	
EAA	Dry	1281.0±126.3	1898.3±170.4	*
	after calving	989.6±175.6	1429.1±166.0	
	1 Month	1396.5±239.6	2137.9±206.6	*
NEAA	Dry	1603.4±371.4	2416.0±552.7	
	after calving	1694.0±339.6	2291.9±351.4	
	1 Month	2448.7±634.4	2804.1±371.0	
AAA	Dry	120.1±12.0	165.5±14.5	*
	after calving	106.0±15.8	146.8±17.1	
	1 Month	120.7±14.8	169.4±17.6	
BCAA	Dry	681.2±70.2	987.2±99.9	*
	after calving	489.5±92.7	641.7±77.8	
	1 Month	815.9±159.1	1241.1±138.1	

Data are expressed as mean ± SE.
Astarisk indicate significant difference between the two tested groups (P < 0.05).
TAA=Total amino acid, **EAA**=Essential amino acid, **NEAA**=Non-essential amino acid, **AAA**=Aromatic amino acids, **BCAA**=Branched-chain amino acids.

It suggested that the main reason for decreased serum TAA was not NEAA but decreased EAA, since no significant difference in NEAA was found. Serum TAA of periparturient dairy cattle are influenced by EAA and NEAA as well as milk yield and feed intake [13]. Additionally, the placenta and the fetus in pregnant dairy cows are the major users of EAA. EAA seems to be used for the synthesis of NEAA rather than energy supply [14].

Zhang et al. [15] described that DMI and milk production were lower in MF affected cows close to calving. In this study, markedly lower serum FAA levels in the MF Group were observed in the Dry period. Free amino acids deficiency is caused by a lack of amino acids in the body. Bell [16] reported in ruminants that 35-40% of the energy supply to the placenta depends on glucose and lactate, and 55% on amino acids during the last third of pregnancy. In particular, proteins in the prepartum diet have a critical role in fetal protein synthesis from amino acids and as a source of a substantial amount of energy. It suggests that protein and amino acid intake might be insufficient before calving in the MF group to meet increased demands of amino acids for growing fetuses in late pregnancy.

Table 3 shows the concentration of essential amino acids in two groups. All values of EAA in the MF Group were also lower than those in the Control group. Significant differences were detected in tryptophan in the dry period and at 1 month, as well as in phenylalanine, valine, isoleucine, and leucine during the dry period. A similar result was reported previously in the dams with a restricted protein diet [17]. BCAAs are considered to be the critical amino acids for anabolism and energy homeostasis of the skeletal muscle serving as signaling molecules [18]. Since BCAAs are one of the key nutrients for muscle repair and development by synthesizing muscle proteins from plasma amino acids, deficiency of these amino acids might reduce the muscle function in the cows in the MF group around the time of calving. But in comparison to non essential amino acids, concentrations of arginine, glycine, aspartic acid, glutamic acid, and glutamine in the MF group were lower than those in the Control group. Significant differences were found in arginine at calving and 1 month post partum (Table 4).

Although the lowest level of serum TAA was observed in both groups on the day of calving, previous report indicated that decreased FAA was associated with a normal decrease in voluntary dry matter intake (DMI) prior to the day of calving [13]. In the present study, significantly positive correlations of cholesterol to BCAA ($r=0.531$, $P<0.01$), as well as to valine, leucine, and isoleucine levels ($r=0.563$, $r=0.563$, and $r=0.403$, respectively, $p<0.01$) were detected. This change is in accordance with previous reports [19-21], and may be due to the decreased dietary intake around the time of calving. Since Zhou [5] observed higher serum cholesterol and total amino acid including valine and isoleucine in the cows following their higher DMI after calving, DMI was suggested to be one of the factors to affect the changes to these nutrients.

Arginine is a conditionally essential amino acid that plays key roles in nitrogen metabolism, ureagenesis, cellular multiplication, and energy metabolism [22]. This amino acid protects muscle protein metabolism during stress induced hypercatabolism. In this study, a markedly low level of arginine was observed in the MF group after calving. Since arginine is involved in multiple metabolic processes in the body, this amino acid deficiency has the potential to depress many cellular and organ functions [23]. Previous studies have reported that injection of arginine via the jugular vein alleviated metabolic stress in Holstein cows during early lactation [24]. Thus, arginine deficiency could induce depressed function of muscles, mammary glands or other organs.

Table 3. Serum free essential amino acids concentration (μmol/L) in the tested groups

		MF Group	Control Group	
Methionine	Dry	27.8±2.4	37.2±3.7	
	after calving	30.5±6.9	38.5±6.0	
	1 Month	20.9±3.4	31.0±5.1	
Lysine	Dry	118.4±13.5	163.1±19.2	
	after calving	73.7±10.7	114.9±14.6	*
	1 Month	106.3±17.9	154.3±15.1	
Threonine	Dry	99.2±9.7	123.9±12.3	
	after calving	68.9±13.0	99.5±12.6	
	1 Month	94.7±10.7	114.1±9.2	
Histidine	Dry	76.6±0.5	109.5±14.1	
	after calving	73.3±17.3	108.8±15.7	
	1 Month	67.7±7.3	81.7±7.8	
Tryptophan	Dry	36.1±6.7	63.3±9.8	*
	after calving	22.4±6.6	59.1±17.8	
	1 Month	36.1±7.9	125.6±33.3	*
Phenylalanine	Dry	60.5±6.6	87.5±9.6	*
	after calving	62.1±9.6	84.3±10.5	
	1 Month	59.7±6.5	87.7±12.6	
Valine	Dry	334.0±32.7	485.3±45.3	*
	after calving	216.2±42.3	281.2±33.8	
	1 Month	384.7±76.5	566.7±56.0	
Isoleucine	Dry	151.4±15.7	219.0±24.2	*
	after calving	119.8±27.9	150.3±19.5	
	1 Month	220.5±44.1	345.5±40.9	
Leucine	Dry	195.7±22.3	282.9±31.1	*
	after calving	153.5±26.6	210.2±26.4	
	1 Month	210.7±39.0	328.5±43.5	

Data are expressed as mean ± SE
Astarisk indicate significant difference between the two tested groups groups (P < 0.05).

Table 4. Serum free non-essential amino acid concentration (μmol/L) in the tested groups

		MF Group	Control Group	
Arginine	Dry	181.3±19.4	296.5±39.5	
	after calving	169.3±39.5	286.1±38.9	*
	1 Month	195.1±35.7	302.3±36.9	*
Glycine	Dry	248.2±38.0	303.6±30.8	
	after calving	427.0±68.0	664.6±78.4	
	1 Month	522.4±72.3	762.0±73.9	
Alanine	Dry	234.4±24.5	288.3±23.1	
	after calving	243.8±41.9	335.2±40.1	
	1 Month	287.8±33.6	313.4±27.8	
Asparagine	Dry	56.3±21.2	69.5±16.3	
	after calving	37.9±8.3	54.4±8.9	
	1 Month	128.8±52.6	100.1±25.3	
Aspartic acid	Dry	14.7±3.6	28.3±5.4	
	after calving	12.8±3.3	22.0±3.8	
	1 Month	14.3±2.4	17.7±1.8	
Glutamic acid	Dry	119.0±13.3	176.1±25.9	
	after calving	75.4±13.5	116.9±15.6	
	1 Month	92.8±11.5	130.7±13.9	
Glutamine	Dry	256.7±13.3	382.2±41.0	
	after calving	305.1±69.8	451.2±55.6	
	1 Month	263.4±27.2	294.2±25.3	
Serine	Dry	72.9±8.6	96.7±9.1	
	after calving	97.6±20.2	134.6±14.4	
	1 Month	105.5±11.3	112.0±8.4	
Proline	Dry	473.2±312.4	893.7±493.1	
	after calving	420.1±178.6	409.9±203.2	
	1 Month	924.3±513.3	942.7±258.4	
Tyrosine	Dry	59.6±6.1	78.0±6.1	
	after calving	43.9±7.4	62.5±7.2	
	1 Month	60.9±8.8	76.0±6.1	

Data are expressed as mean ± SE Astarisk indicate significant difference between the two tested groups ($P < 0.05$).

In the MF group, tryptophan was also markedly lower at 1 month after calving compared to the Control group. Ninomiya et al. [2] observed declined weights of body and skeletal muscle in mice fed a tryptophan deficient diet. BCS in both groups decreased gradually during the experimental period, and BCS in the MF group was significantly lower 1 month after calving compared to the Control group (Figure 1). Markedly reduced DMI and BCS were reported in dairy cows with milk fever after calving [26-28]. Therefore, decreased FAA including tryptophan in the MF Group may be associated with a more pronounced decrease in DMI in the MF cows.

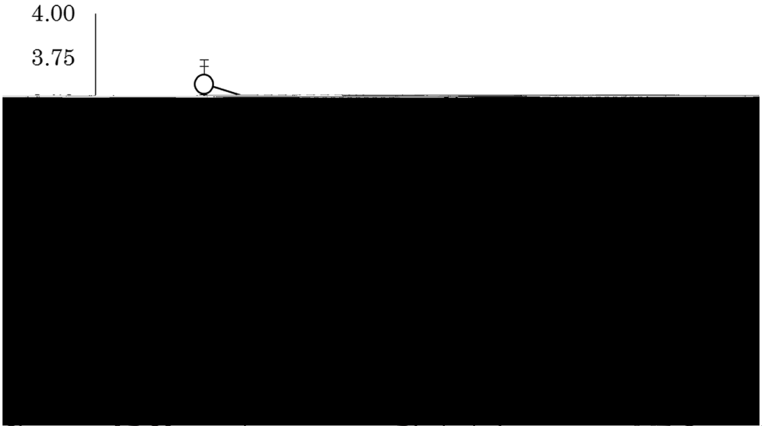

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Figure 1. Changes of BCS score in two groups. Black circle represents MF Group (N=7), and white circle represents Control Group (N=16). Results are expressed as the mean (±SE). Asterisks indicate significant differences between the two groups (P<0.05).

Serum cholesterol levels in both groups decreased on the day of calving and recovered after that. Conversely, serum NEFA levels increased in two groups on the day of calving. There was no significant difference in these parameters. BHB levels in both groups continued to increase during this observation period and a significantly lower level in the MF group than the Control group was observed at 1 month (Table 5).

The lactating cow with above 1.2 mmol/l of serum BHB level is diagnosed as subclinical ketosis [29], and strong correlations among blood NEFA and BHB levels and energy balance in early lactation dairy cows have been reported [30]. Hyperketonemia was suggested as one of the most frequent findings in high producing dairy cows.

In conclusion, MF cows showed lower levels in several FAA around the time of calving. Proteins stored in the maternal muscles are released to augment the supply of amino acids for fetal growth and development during the later pregnancy. Zhang et al [31] described that maternal nutrition during gestation has a marked effect on the muscle, bone and the other organs development of cattle fetuses. The cows with undernutrition, such as FAA and cholesterol, might be at risk of decreased muscle function due to demands of amino acids for the fetus before calving. This study did not clarify the effect of low serum FAA and cholesterol during the dry period on the onset of milk fever, or whether low FAA directly affected calcium metabolism. Further research is required to determine the specific reasons for the various differences in serum FAA and lipids in the MF cows around the time of calving.

Table 5. Serum free non-essential amino acid concentration in the tested groups

		MF Group	Control Group	
TC	Dry	131.57±11.64	121.50±5.10	
(mg/dL)	after calving	71.86±6.09	68.6875±3.79	
	1 Month	165.43±7.91	181.38±7.36	
NEFA	Dry	0.13±0.03	0.10±0.01	
(μEq/L)	after calving	0.90±0.19	0.71±0.05	
	1 Month	0.29±0.05	0.39±0.05	
BHB	Dry	622.14±29.41	672.00±36.15	
(μmol/L)	after calving	1023.29±129.36	798.94±49.51	
	1 Month	1348.00±167.98	2433.50±249.54	*

Data are expressed as mean ± SE. Astarisk indicate significant difference between the two tested groups ($P < 0.05$). **TC**=Total cholesterol, **NEFA**=Non-esterified Fatty Acid, **BHB**=β-hydroxybutyric acid.

Authors' contributions

KK participated in the design of the study, carried out the sampling of blood, performed the statistical analysis, and drafted the manuscript. HO carried out the assays of amino acid in the serum, conceived of the study, and participated in its design and coordination and helped to draft the manuscript. All authors read and approved the final manuscript.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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REFERENCES

1. Janovick NA, Drackley JK: Prepartum dietary management of energy intake affects postpartum intake and lactation performance by primiparous and multiparous Holstein cows. J Dairy Sci 2010, 93 (7), 3086-3102.

2. Lindsay DB: Relationships between amino acid catabolism and protein anabolism in the ruminant. Fed Proc 1982, 41 (9), 2550-2554.
3. Kida K: The metabolic profile test: its practicability in assessing feeding management and periparturient diseases in high yielding commercial dairy herds. J Vet Med Sci 2002, 64 (7), 557-563.
4. Takahashi T, Mori A, Oda H, Murayama I, Kouno M, Sako T: Comparison of cholesterol levels among lipoprotein fractions separated by anion-exchange high-performance liquid chromatography in periparturient Holstein-Friesian dairy cows. J Vet Med Sci 2021, 83 (2), 260-266.
5. Schwab CG, Broderick GA A: 100-Year Review: Protein and amino acid nutrition in dairy cows. J Dairy Sci 2017, 100 (12), 10094-10112.
6. Zhou Z, Loor JJ, Piccioli-Cappelli F, Librandi F, Lobley GE, Trevisi E: Circulating amino acids in blood plasma during the peripartal period in dairy cows with different liver functionality index. J Dairy Sci 2016, 99 (3), 2257-2267.
7. Dann HM, Morin DE, Bollero GA, Murphy MR, Drackley JK: Prepartum intake, postpartum induction of ketosis, and Periparturient disorders affect the metabolic status of dairy cows. J Dairy Sci 2005, 88 (9), 3249-3264.
8. Dann HMM, Litherland NBB, Underwood JPP, Bionaz M, D'Angelo A, McFadden JWW, Drackley JK: Diets during far off and close up dry periods affect Periparturient metabolism and lactation in multiparous Cows. J Dairy Sci 2006, 89 (9), 3563-3577.
9. Janovick NA, Boisclair YR, Drackley JK: Prepartum dietary energy intake affects metabolism and health during the periparturient period in primiparous and multiparous Holstein cows. J Dairy Sci 2011, 94 (3), 1385-1400.
10. Ji P, Osorio JS, Drackley JK, Loor JJ: Overfeeding a moderate energy diet prepartum does not impair bovine subcutaneous adipose tissue insulin signal transduction and induces marked changes in peripartal gene network expression. J Dairy Sci 2012, 95 (8), 4333-4351.
11. Chassagne M, Chacornac JP: Markers of nutritional risk for placental retention: use of blood analysis at the end of gestation. Vet Res 1994, 25 (2-3), 191-195.
12. Ferguson JD, Azzaro G, Licitra G: Body condition assessment using digital images. J Dairy Sci 2006, 89 () 3833-3841.
13. Shibano K, Kawamura S, Hakamada R, Kawamura Y: The relationship between changes in serum glycine and alanine concentrations in non-essential amino acid and milk production in the transition period in dairy cows. J Vet Med Sci 2005, 67 (2), 191-193.
14. Lapierre H, Lobley GE, Doepel L, Raggio G, Rulquin H, Lemosquet S: Triennial Lactation Symposium: Mammary metabolism of amino acids in dairy cows. J Anim Sci 2012, 90 (5), 1708-1721.
15. Zhang G, Dervishi E, Ametaj BN: Milk fever in dairy cows is preceded by activation of innate immunity and alterations in carbohydrate metabolism prior to disease occurrence. Res Vet Sci 2018, 117, 167-177.
16. Bell AW: Regulation of organic nutrient metabolism during transition from late pregnancy to early lactation. J Anim Sci 1995, 73 (9), 2804-2819.
17. Bhasin KK, van Nas A, Martin LJ, Davis RC, Devaskar SU, Lusis AJ: Maternal low-protein diet or hypercholesterolemia reduces circulating essential amino acids and leads to intrauterine growth restriction. Diabetes. 2009, 58 (3), 559-566.
18. Kamei Y, Hatazawa Y, Uchitomi R, Yoshimura R, Miura S: Regulation of Skeletal Muscle Function by Amino Acids. Nutrients 2020, 12 (1), 261.

19. Doepel L, Lapierre H, Kennelly JJ: Peripartum performance and metabolism of dairy cows in response to prepartum energy and protein intake. J Dairy Sci 85 (9), 2315-2334.

20. Meijer GA, Van der Meulen J, Bakker JG, Van der Koelen CJ, Van Vuuren AM: Free amino acids in plasma and muscle of high yielding dairy cows in early lactation. J Dairy Sci 1995, 78 (5), 1131-1141.

21. Verbeke R, Roets E, Peeters G: Variations in the concentrations of free amino acids in the plasma of the dairy cow at parturition. J Dairy Res 1972, 39 (3), 355–364.

22. Kirk SJ, Barbul A: Role of arginine in trauma, sepsis, and immunity. J Parenter Enteral Nutr 1990, 14 (5), 226S-229S.

23. Morris SM Jr: Arginases and arginine deficiency syndromes. Curr Opin Clin Nutr Metab Care 2012, 15 (1), 64-70.

24. Ding LY, Wang YF, Shen YZ, Zhou G, Wu TY, Zhang X, Wang MZ, Loor JJ, Zhang J: Effects of intravenous arginine infusion on inflammation and metabolic indices of dairy cows in early lactation. Animal 2020, 14 (2), 346-352.

25. Ninomiya S, Nakamura N, Nakamura H, Mizutani T, Kaneda Y, Yamaguchi K, Matsumoto K, Kitagawa J, Kanemura N, Shiraki M, Hara T, Shimizu M, Tsurumi H: Low levels of serum tryptophan underlie skeletal muscle atrophy. Nutrients 2020, 12 (4), 978.

26. Charbonneau E, Pellerin D, Oetzel GR: Impact of lowering dietary cation-anion difference in nonlactating dairy cows: a meta-analysis. J Dairy Sci 2006, 89 () 537-548.

27. Goff JP, Hohman A, Timms LL: Effect of subclinical and clinical hypocalcemia and dietary cation-anion difference on rumination activity in periparturient dairy cows. J Dairy Sci 2020, 103 (3), 2591-2601

28. Rodrigues R, Cooke RF, Ferreira HAO, Florido RR, Camargo V, de Godoy HO, Bruni GA, Vasconcelos JLM: Impacts of subclinical hypocalcemia on physiological, metabolic, and productive responses of Holstein Gir dairy cows. Transl Anim Sci 2020, 4 (2), txaa016.

29. Duffield T: Subclinical ketosis in lactating dairy cattle. Veterinary Clinics of North America: Food Animal Practice 2000, 16 (2), 231-253.

30. Reist M, Erdin D, von Euw D, Tschuemperlin K. Leuenberger H, Delavaud C, hilliard Y, Hammon HM, Morel C, Philipona C, Zbinden Y, Kuenzi N, Blum JW: Estimation of energy balance at the individual and herd level using blood and milk traits in high-yielding dairy cows. J Dairy Sci 2002, 85 (12), 3314-3327.

31. Zhang Y, Otomaru K, Oshima K, Goto Y, Oshima I, Muroya S, Sano M, Saneshima R, Nagao Y, Kinoshita A, Okamura Y, Roh S, Ohtsuka A, Gotoh T. Effects of low and high levels of maternal nutrition consumed for the entirety of gestation on the development of muscle, adipose tissue, bone, and the organs of Wagyu cattle fetuses. Anim Sci J. 2021 92 (1), e13600.

NIŽI NIVO SLOBODNIH AMINOKISELINA U SERUMU KOD HOLŠTAJN KRAVA SA MLEČNOM GROZNICOM – SLUČAJ SA TERENA

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Ova studija je sprovedena radi ispitivanja veze između slobodnih aminokiselina (FAA) u serumu i pojave mlečne groznice kod mlečnih krava u vreme teljenja. Serumska koncentracija FAA je upoređena kod multiparnih krava sa mlečnom groznicom (MF grupa; n=7) i zdravih multipara (kontrolna grupa; N=16) koje se drže na farmi mlečnih Holštajn krava. Uzorci krvi su uzeti 3 do 4 nedelje pre teljenja, na dan teljenja i 1 mesec nakon teljenja radi analize aminokiselina u serumu i parametara lipida. Nivoi svih esencijalnih aminokiselina u MF grupi bili su niži nego u kontrolnoj grupi. Značajne razlike između grupa primećene su u fenilalaninu, valinu, izoleucinu i leucinu 1 mesec nakon teljenja, i u triptofanu na dan teljenja. Što se tiče neesencijalnih aminokiselina, značajno niži nivo arginina primećen je u MF grupi u poređenju sa kontrolnom grupom na dan teljenja, kao i 1 mesec nakon teljenja. Značajna pozitivna korelacija je otkrivena između nivoa holesterola i nivoa aminokiselina razgranatog lanca (BCAA) ($r=0{,}531$, $P<0{,}01$). Ovi rezultati su pokazali da su MF krave imale niže nivoe nekoliko FAA oko vremena teljenja, čak i pre početka MF.