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FACTORS AFFECTING THE LEVEL OF CONJUGATED LINOLEIC ACID (CLA) IN MILK FROM DIFFERENT COW'S BREEDS[1]

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Abstract: The investigations were carried out on the milk samples obtained from the cows of different breeds i.e.: Black and White (BW), Red and White (RW), Polish Red (PR) and Simental (100 cows of each breed) during a whole year. It was revealed that the cow's breed and nutritional season had a substantial influence on the level of CLA in milk. The percentage of the CLA in the total fatty acids content was the highest in milk of PR cows - 0,92% and Simental - 0,69% when compared to the BW- 0,39 and RW cows-0,31%. The level of CLA in milk of each cow's breed increased with increasing percentage of green forages in the diet starting from May to June (0,74 ± 0,16%) and then it decreased in July and August (0,65 ± 0,17%). Its lowest level for each cow's breed was noticed during the period from December to January (0,38 ± 0,06%).

Keywords: conjugated linoleic acid (CLA), cow's breed, nutrition

Introduction and Literature Review

Conjugated linoleic acid (9-cis; 11-trans) is considered as a bioactive milk fat component and in its natural state it occurs mainly in the milk of ruminants. Therefore milk and its products are considered as functional food. Preventive effect of CLA was proved against the wide range of the civilization diseases, such as: cancers, heart diseases, osteoporosis and obesity (*Pisulewski et al. 2002*). Fat level and its composition including CLA content are affected by many factors (genetic, physiological and environmental).

Many authors reported that the most influencing effect on CLA level in milk has feeding. *Parodi (1999)* in his investigations noted the highest value of polyunstarated fatty acids and CLA content during pasture period in opposite to winter period. The similar tendency showed *Pisulewski et al. (2002).* A reason of this fact authors connected with high contents of unsaturated fatty acids in oils of grass seeds. Milk fat is the richest natural source of CLA with reported values ranging from 2,4 to 28,1 mg/g (*Parodi 1999).* Seasonal variations are very substantial with values during the summer period often up to 2 or 3 times higher than in the winter (*Fogerty et al. 1988).* Reported CLA values for Australian and New Zeland milk, are often somewhat 2 to 3 times higher than values reported for equivalent US products. This phenomenon presumably reflects the greater access to lush pasture, rich in polyunstarated fatty acids, throughout the year by Australasian cattle and sheep (*Parodi 1997).*

Kelly et al. (1998) reported that feeding high amounts of linoleic acid oil (sunflower) increased CLA concentration to 24,4 mg/g of milk fat compared with lower values obtained for cows fed diet of lower amounts of that fatty acid. *Dhiman et al. (1996)* found that cows grazing on pasture could attain a CLA concentration of 22,7 mg/g of fat, which is much more higher than values for cows fed conserved forages.

Grześkiewicz et al. (2000) showed strict correlation between kind of forage and the level of CLA as well as trans-isomer of linoleic acid (particularly during the pasture period).

Another factor affecting CLA level in cows' milk is breed. According to data citated by *Lowless et al. (1998)* CLA level in milk of Holstein-Friesian, Mountbeliard and Normand cows was ranged between 14,5-18,3 mg/g of fat, respectively. *Reklewska and Bernatowicz (2002),* CLA content in milk of Black and White, Polish Red and Simental cows evaluated as (mg/g of fat): 7,1 – 11,7; 7,0-10,8; 7,0-9,4, respectively.

The level of CLA in milk is also affected by the animal species. *Reklewska and Bernatowicz (2002)* its level evaluated at (%): 0,1-0,7 (horses); 0,3-1,4 (cattle); 0,5-2,0 (sheeps); 0,3-1,0 (goats); 0,1-0,3 (pigs).

Grega et al. (1999) estimated that composition of cows' milk showed higher value of polyunsaturated fatty acids at the end of lactation (3,01-3,92%) in relation to it onset (2,02-3,81%). It was propably affected by milk yield.

A positive relation between CLA levels in milk fat and increasing age of the animals has been reported by *Lal and Narayanan (1984).* In this study cows in 4-6 lactation showed a reduction in milk fat

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CLA compared to cows in 1-3 lactation and older cows (above 7 lactation) which yielded higher milk fat CLA levels than younger cows.

Kelly et al. (1998) found substantial individual variations (9,9-51,7 mg CLA/g of fat) in cows at the same stage of lactation that consumed the same diet and were subjected to the same management regiment.

The aim of the study was an evaluation of relationship between the level of CLA in milk and such factors as: cow's breed, feeding period and lactation stage.

Material and Methods

Investigations were carried out on the milk fat from 100 cows being in second lactation. The milk samples from whole udder have been collected during the summer and winter feeding period. Milk fat was extracted according to *Anderson and Kjaergaardas (1962).* In extracted fat the polyunstauratyed fatty acids and CLA levels were estimated according to *Chaluard et al. (1991)* by chromatographic method.

Results and Discussion

The obtained results are shown in tables 1-3. Data presented in table 1 show on statistically significant differences in the level of polyunstaurated and CLA fatty acids in milk of different cow's breeds. They highest level was found in milk of Polish Red and Simental cows. The similar data were described by *Farot (2001)* who showed more beneficial profile of different kind of fatty acids groups and cholesterol in milk of Polish Red and Simental cows in comparison to milk of Black and White cows.

Table 1. Polyunsaturated acids and CLA levels in milk of different cow's breeds.

Fatty acids (%)	Cow's breed			
	Black and White	Red and White	Polish Red	Simental
Polyunsaturated	2,15 ± 0,31 A	2,28 ± 0,28 b	2,78 ± 0,17 A, b	2,77 ± 0,15 A, b
CLA	0,31 ± 0,04 A	0,39 ± 0,08 b	0,92 ± 0,07 A, b	0,69 ± 0,05 A, b

A – $p<0,01$ b – $p<0,05$

The highest influence on CLA level was expressed by feeding period (table 2). The highest its level was noted during the pasture period (April-June) in opposite to lowest level of CLA during the winter period (January-March). These differences were statistically significant. *Stanton et al. (1997)* reported that CLA level in milk arises in relation to grass share in a diet dose and amounts to: 16kg - 3,91; 20 kg – 5,92; 24 kg – 5,52; CLA mg/g of fat, respectively.

Table 2. Milk polyunsaturated acids and CLA levels in milk in relation to feeding period

Fatty acids (%)	Month of feeding			
	January-March	April-June	July-September	Octob-Decem.
Polyunsaturated	1,28 ±0,12 A	3,27 ± 0,17 A, B	2,89 ± 0,15 A, B	1,42 ± 0,10 B
CLA	0,38 ± 0,06 A	0,74 ± 0,10 A, B	0,65 ± 0,11 A, B	0,40 ± 0,08 B

A, B- $p<0,01$

No effect of lactation stage was shown on the level of polyunsaturated and CLA fatty acids (table 3). These data are in good agreement with results obtained by *Stanton et al. (1997).*

Table 3. Milk polyunsaturated fatty acids and CLA levels in relation to lactation stage

Fatty acids (%)	Month of lactation	
	January-May	June-October
Polyunsaturated	2,52 ± 0,21	2,63 ± 0,19 NS
CLA	0,58 ± 0,10	0,67 ± 0,12 NS

NS – not significant

Data obtained from presented experiment show the same view as *Murphy et al. (1995),* who concluded that the main factor of variation in milk fatty acids profile is affected by indoor and outdoor feeding.

Conclusions

1. The level of CLA in cow's milk is affected by breed and feeding period.
2. These environmental and genetic factors can improve a bioactive character of milk.

FAKTORI KOJI UTIČU NA NIVO KONJUGOVANE LINOLNE KISELINE (CLA) U MLEKU KRAVA RAZLIČITIH RASA

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Rezime

Konjugovana linolna kiselina (9-cis; 11-trans) se smatra bioaktivnom komponentom mlečne mast ii u svom prirodnom stanju se javlja uglavnom kod mleka preživara. Zbog toga se mleko i mlečni proizvodi smatraju funkcionalnom hranom. Preventivno dejstvo CLA je dokazano protive velikog broja bolesti ljudske populacije kao šti su: rak, srčana obolenja, osteoporoza i gojaznost.

Cilj ovog istraživanja je bio ispitivanje uticaja genetskog faktora (rasa), faktora sredine (ishrana), fizioloških faktora (stanje i broja laktacija) na nivo CLA u kravljem mleku. Ispitivanje je izvedeno na uzorcima mleka dobijenim od krava različitih rasa: crno-bela (BW), crveno-bela (RW), poljska crvena (PR) i simentalska (100 krava od svake rase) tokom cele godine. Utvrđeno je da su rasa i sezona u pogledu ishrane imali značajan uticaj na nivo CLA u mleku. Procenat CLA u ukupnim masnim kiselinama je bio najveći u mleku PR krava– 0,92% i kod simentalskih krava – 0,69% u poređenju sa BW– 0,39 kao i RW kravama – 0,31%. Nivo CLA u mleku krava svake ispitivane rase se povećavao sa povećanjem učešća zelenog krmiva u obroku od maja do juna (0,74 ± 0,16%) da bi se smanjivao u julu i avgustu (0,65 ± 0,17%). Najniži nivo CLA za sve rase je utvrđen u periodu decembar – januar (0,38 ± 0,06%).Uticaj broja i stanja laktacije nje bio statistički signifikantan za nivo CLA bez obzira na rasu. Rezultati pokazuju da bilo rasa ili ishrana mogu da utiču na porat nivoa bioaktivnih komponenata mleka odn. CLA u kravljem mleku.

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