COMPARISON OF FATTY ACIDS AND CHOLESTEROL CONTENT IN THE MILK OF LATVIAN COWS

V.Šterna, A.Jemeļjanovs
Research Centre "Sigra" of Latvian University of Agriculture,Instituta street 1, Sigulda,LV-2150. Phone +371 797 6307, Fax:7976655, E.mail: Sigra@lis.lv, Latvia

Abstract. Milk fat is the most complex of natural fats and oils. Milk fat also contains a moderate amount of cholesterol. Concern about cholesterol in the diet arises because of a high serum cholesterol level, especially the low-density lipoproteins, which is only one of the risk factors associated with atherosclerosis. Other dietary factors are: the total fat intake, saturated fat intake and a lack of dietary fibres.

The investigations on cholesterol level in milk of different breeds of cows in our country are not conducted. Therefore, the tasks of the work were to determine the cholesterol level and fatty acid composition in different breeds of the Latvian cows milk and to analyse the influence of cows feed on the fatty acid and cholesterol content in milk.

Milk samples were obtained from *Latvian Brown,* and *Black and White* cows on a farms situated in Riga's region. Both breeds consumed the same feed.

Fatty acid composition and cholesterol content were analysed by gas chromatography at the National Veterinary Laboratory. Feed composition was detected in the Laboratory of Biochemistry of Research Centre "Sigra" of Latvian University of Agriculture. In this study, the difference between breeds associated in fatty acid composition, cholesterol and fat content was detected. The fat content in milk of *Black and White* breed cows was 4.25 ± 0.13 %, and cholesterol level – 16.25 ± 1.20 mg dl^{-1}. It was less, than in *Latvian Brown* breed cows milk, respectively, 4.88 ± 0.68 % and 18.63 ±3.58 mg dl^{-1}. As we know, milk of *Latvian Brown* has a significantly higher content of fat and protein, while *Black and White* cows have a higher milk yield. The content of saturated fatty acids was different between *Black and White* and *Latvian Brown* breeds. The amount of myristic acid, which most of all affects the cholesterol content in plasma, was the same in cows milk of both breeds – (0.37 g 100 g^{-1}).

Keywords: milk, cholesterol, fatty acids, breed

RIEBALŲ RŪGŠČIŲ IR CHOLESTEROLIO KIEKIŲ PALYGINIMAS LATVIJOS KARVIŲ PIENE

Santrauka. Pieno riebalai yra sudaryti iš natūralių riebalų ir aliejų. Pieno riebalai taip pat turi nedidelį cholesterolio kiekį. Domėjimasis cholesteroliu maiste atsirado todėl, kad aukštas cholesterolio kiekis kraujo serume, ypač žemas lipoproteinų tankumas, yra vienas iš rizikos faktorių, susijusių su ateroskleroze. Maiste esančio cholesterolio vartojimas gali būti vienas iš faktorių lemiančių cholesterolio kiekio padidėjimą serume. Kiti maistiniai faktoriai yra bendrų riebalų suvartojimas, sočiųjų riebalų suvartojimas ir ląstelienos trūkumas maiste. Mūsų šalyje nebuvo tyrinėtas cholesterolio lygis skirtingų veislių karvių piene. Todėl darbo tikslas buvo nustatyti cholesterolio kiekį ir riebalų rūgščių sudėtį skirtingų Latvijos veislių karvių piene ir išanalizuoti pašarų įtaką riebalų rūgščių ir cholesterolio kiekiui piene. Pieno mėginiai buvo paimti iš Latvijos žalųjų ir juodmargių veislės karvių, laikomų fermose Rygos rajone. Abiejų veislių karvės buvo šeriamos tokiu pačiu pašaru. Riebalų rūgščių sudėtis ir cholesterolio kiekis buvo analizuojami dujų chromatografijos metodu Nacionalinėje veterinarijos laboratorijoje. Pašarų sudėtis buvo nustatyta Latvijos žemės ūkio universiteto "Sigra" Tyrimų centro biochemijos laboratorijoje. Šiame darbe buvo nustatyti skirtumai abiejose veislėse tarp riebalų rūgščių sudėties, cholesterolio ir riebalų kiekio. Latvijos juodmargių veislės karvių piene riebalų kiekis – 4,25%, cholesterolio kiekis – 16,25mg dl^{-1}. Tai yra mažiau negu Latvijos žalųjų veislės karvių piene atitinkamai 4,88 % ir 18,63 mg dl^{-1} . Kaip žinoma, Latvijos žalųjų veislės karvių piene statistiškai patikimai didesnis riebalų ir baltymų kiekis, tuo tarpu Juodmargiai duoda didesnį pieno primilžį. Sočiųjų riebalų rūgščių kiekis skiriasi Juodmargių ir Latvijos žalųjų veislėse. *Miristic* rūgščių kiekis, kuris žymiai padidina cholesterolio kiekį plazmoje, buvo vienodas abiejų veislių karvių piene – 0,37 g 100 g^{-1}.

Raktažodžiai: pienas, cholesterolis, riebiosios rūgštys, veislės

Introduction. Dietary intake of cholesterol may be one of the factors elevating serum cholesterol. Other dietary factors are: total fat intake, saturated fat intake and a lack of dietary fibres. The so-called lipid hypothesis postulates that saturated fatty acids may have a serum cholesterol raising effect, whilst polyunsaturated fatty acids may lead to reduced plasma cholesterol levels. Evaluation of effect of individual fatty acids on plasma cholesterol level is changed today. The short-chain fatty acids, such as butyric, caproic and caprylic acids, which are saturated fatty acids do not have any effect on the serum cholesterol level. Amongst the medium-chain saturated fatty acids, lauric and myristic acid, like a capric acid, may have a cholesterol-raising effect. In the mean time a cholesterol-lowering effect could be observed also for stearic, oleic and linoleic acids [Renner, 1995].

Although the role of dietary cholesterol on human health is discussed, it is important to determine

cholesterol level and composition of fatty acids in food of animal origin including milk and their products. Cholesterol is a major of sterols; amount of it in milk ranges from 10 to 20 mg100 ml $^{-1}$[Jensen, 1991] with the quantities related to the fat content.

As we know, milk of *Latvian Brown* has a significantly higher content of fat and protein, whereas *Black and White*s have higher milk yield. There are not investigations about cholesterol level in milk of different dairy breeds in our country.

Therefore, objectives of this study were to determine cholesterol level and fatty acid composition in cows milk of different breeds provided cows had access to the same feed intake.

Materials and methods. Milk samples were obtained from cows of *Latvian Brown, Black and White* cows from farms situated in Riga's region. Both breeds of cows had the same feed intake in one pasture and the same amount of concentrates intake.

Content of milk fat was analysed by Milkoscan 133.

Feed composition was detected in the Laboratory of Biochemistry of Research Centre "Sigra" of Latvian University of Agriculture.

The fatty acid composition and cholesterol content were analysed at the National Veterinary Laboratory by the gas chromatography method using GC/MS-006 (IDF 159:1992).

Research results. Composition of feed (grass and concentrates) is shown in Table 1.

Table 1. **The composition of feed**

Composition of feed	October
Dry matter, kg	15.94
protein, kg	2.44
Fibre, kg	4.19
Fat, kg	0.37
Calcium, g	120.61
Phosphorus, g	45.24
Feed units, kg	13.08
Digestible protein, g	1547.68
Palmitic acid, g 100g^{-1}	1.4
Linolenic acid, g 100g^{-1}	6.2
Linoleic acid, g 100g^{-1}	0.8
Oleic acid, g 100g^{-1}	0.8
Stearic acid, g 100g^{-1}	0.2

Milk samples are collected at the end of pasture season from cows of Latvian Brown, and Black and White breeds which had the same feed intake. Fat, protein and cholesterol contents in milk were analysed. Obtained results concerning cholesterol level in milk are shown in Figure 1. Cholesterol content depends on fat percentage. From Figure 1 we can establish linear relation, which can be described with equation Y=4.1301x-1.6126. Connection between fat content and cholesterol level in milk samples is close; the coefficient of correlation is R = 86%.

The comparison of cholesterol level in milk samples from *Latvian Brown*, and *Black and White* dairy breeds is reflected in Figure 2. We observe that the cholesterol level of *Black and Whites* (samples 1 to 4, in Figure 2), like the fat content, is more stable. Milk of *Latvian Brown* has a variable fat content and cholesterol level. Results of F–Test showed that the difference of variances is not significant (α=0.05). T–test was used for estimation of difference in cholesterol content of breads. Results of T–test showed that hypothesized Mean Difference =0. So, means of cholesterol content of both breeds are not significantly different (α=0.05). Obtained fat content and composition of fatty acids in milk of both breeds are shown in Table 2. In the table mean contents of eleven of most important fatty acids, except butyric and caproic acids, are shown.

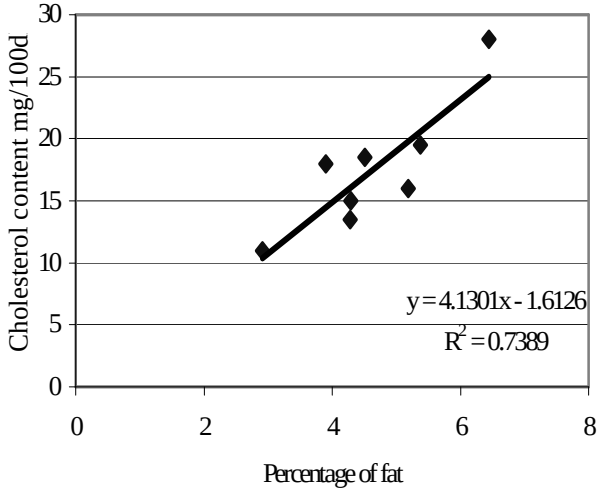


Figure 1. **Relationship between percentage of fat and cholesterol level in Latvian Brown and White cattle breeds.**

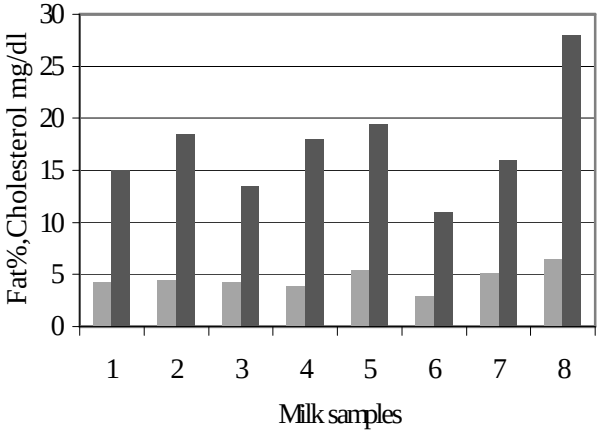


Figure 2. **Cholesterol and fat content in milk samples.**

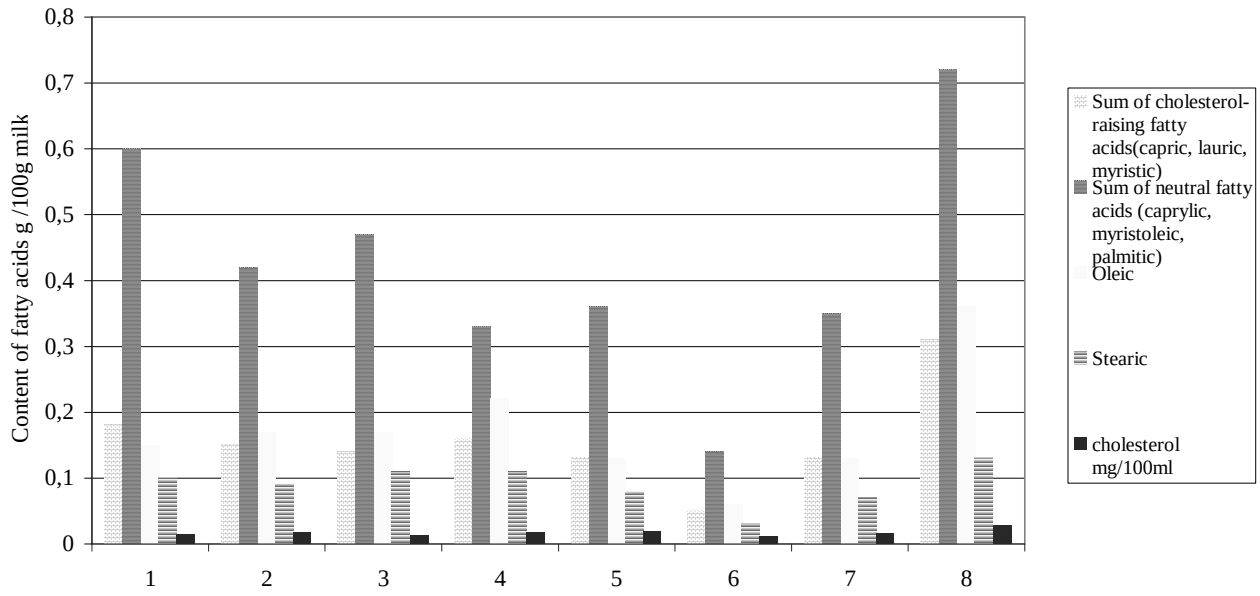
From Table 2 we can see the difference in breeds. *Black and Whites* had smaller difference between minimal and maximal content of fatty acids. In milk samples of *Latvian Brown* cows, amount of fatty acids varied in a wider range. For example, content of oleic acid in milk samples
of *Black and White* cows was in the range from 0.15 to 0.22 %, but in samples of *Latvian Brown* cows milk - in the range from 0.06 to 0.36 %.

Table 2. **Amounts of fatty acids cholesterol and fat in milk of Black and White and Latvian Brown breeds cows**

Fatty acids	Milk of Black and White g 100 g-1			Milk of Latvian Brown g 100 g-1		
	Min	Max	Mean	Min	Max	Mean
Caprilyc	0.026	0.046	0.036	0.01	0.05	0.028
Capric	0.039	0.059	0.051	0.02	0.09	0.048
Lauric	0.031	0.044	0.035	0.01	0.07	0.041
Myristoleic	0.020	0.790	0.680	0.29	1.22	0.685
Myristic	0.360	0.440	0.375	0.12	0.74	0.373
Palmitoleic	<0.020			<0.020		
Palmitic	0.62	0.96	0.650	0.12	0.80	0.460
Linolenic	<0.020			<0.020		
Linoleic	<0.020			<0.020		
Oleic	0.15	0.22	0.203	0.06	0.36	0.170
Stearic	0.09	0.110	0.110	0.03	0.13	0.077

As described before, stearic, oleic and linoleic acids have a cholesterol-lowering effect on human plasma cholesterol. The sum of cholesterol-raising fatty acids, oleic and stearic as cholesterol-lowering fatty acids and the sum of fatty acids with cholesterol-neutral effect on plasma cholesterol are reflected in Figure 3. From this figure we can establish that the sum of cholesterol-raising fatty acids is smaller than neutral or cholesterol-lowering fatty acids. From this point of view the differences in breeds do not exist.

The amount of all detected fatty acids and cholesterol content are shown in Figure 4. We can observe the difference in breeds, dependance on fat content. The amount of individual fatty acids and cholesterol level varied more in milk obtained from *Latvian Brown* cows (4 to 8 samples in Figure 4.)



1.-4. milk samples of Black and Whites, 5.-8.milk samples of Latvian Browns

Figure 3. **Contents of fatty acids and cholesterol in milk of Latvian cattle breeds.**

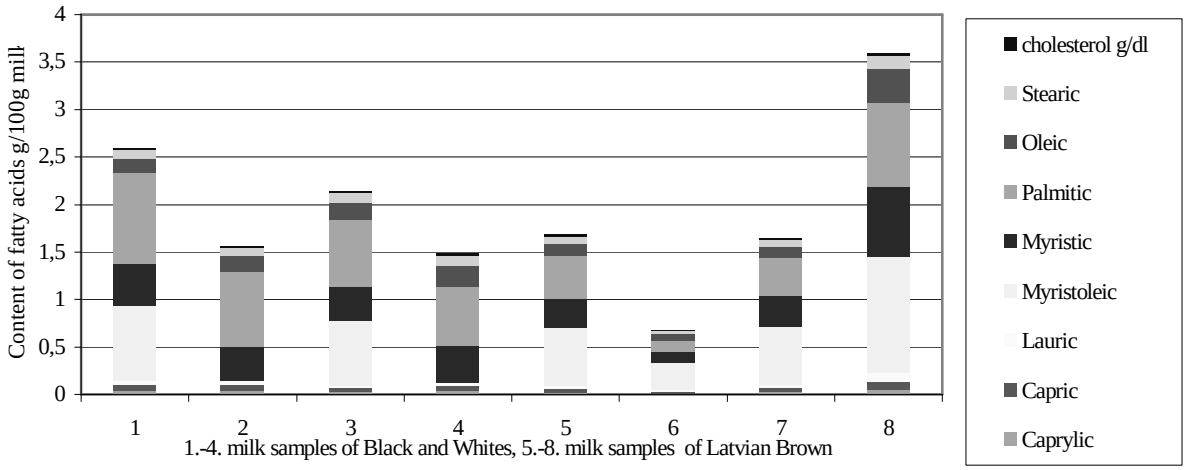


Figure 4. **All of detected fatty acids and cholesterol in milk of Latvian cattle breeds.**

Discussion and conclusions. As described above, amount of cholesterol in milk ranges from 10 to 20 mg100 ml $^{-1}$[Jensen, 1991]. Cholesterol level detected in our study was 16.25 ± 1.20 mg100 ml $^{-1}$in the milk of *Black and Whites;* 18.63 ± 3.58 mg100ml^{-1} in *Latvian Brown* breed cows milk, it depended on fat percentage.

From literature we can conclude that presence of myristic, lauric and capric acids in human diet more of all influenced cholesterol level in human blood [Renner, 1995]. In this study myristic, lauric, capric acids in milk of both breeds cows were in the same amounts. The mean amount of capric acid in milk of *Black and White* breed cows was 0.051 g 100g^{-1} in *Latvian Brown* breed cows milk 0.048 g 100g^{-1}mean amount of lauric acid 0.035 and 0.041 g 100g^{-1}miristic acid 0.0375 and 0.0373 g 100 g $^{-1}$ respectively.

From results of our research we concluded:

1.Increasing the fat content in milk, cholesterol content increased too.

2.Amount of fatty acids influencing cholesterol content in blood was the same in milk samples obtained from *Black and White* and *Latvian Brown* breeds cows.

3.Difference of cholesterol level in milk samples of both breeds was not significant (α=0.05) and associated with characteristic fat content of a breed.

4.In milk samples of *Latvian Brown* cows the amount of fatty acids varied in a wider range.

5. This study must be continued for more information.

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