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EFFECT OF ^{137}Cs ON FATTY ACID COMPOSITION IN COW'S MILK<https://doi.org/10.15673/fst.v18i1.2789>

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Abstract. Lipid composition of raw milk is a key factor determining the nutritional value and technological suitability of the milk. Monitoring the level of contamination of cow's milk is often not available for farmers, living in the zone of radioactive contamination. ^{137}Cs activity concentration was higher than permissible level of 100 Bq/kg in all the studied milk samples from all the experimental groups of animals from the studied settlements. The highest value of the ^{137}Cs activity concentration of 600 Bq/kg in cow's milk was found in Stare Selo village of Rokytne district. According to our study, local animals have partially adapted to the seasonal increase in background radiation, and the milk of these cows, in accordance with existing quality standards, is conditionally suitable for consumption. The only factor prohibiting the consumption of this milk is the level of cesium-137 contamination. An increase in the ^{137}Cs activity concentration of more than 100 Bq/kg in cow's milk causes a sharp decrease in the relative content of polyunsaturated fatty acids (mostly of omega-6 fatty acids) and changes in the omega-3/omega-6 ratio downward omega-3 relative content. Relative adaptation of the lactating cows to the contamination was revealed; however, metabolism of lipids in the mammary gland and the level of lipids secretion are found to be sensitive to the level of ^{137}Cs contamination of milk. Thus, a violation of the secretory function of the mammary gland was revealed, in particular, metabolism of lipids with 18 carbon atoms in the chain. Relative content of linoleic acid immediately decreases by several times with the increasing the contamination level. Concentration of the stearic acid immediately exceeds the physiological limits at the value of ^{137}Cs activity concentration in milk about 110–130 Bq/kg. It gradually increases with the increasing the ^{137}Cs activity concentration up to 270–330 Bq/kg. And then it is being plateaued with the increasing the ^{137}Cs activity concentration up to 600 Bq/kg. On the base of the study of effect of ^{137}Cs on fatty acid ratio in cow's milk, the C18-coefficient is being proposed to be used as the parameter of damage to the mammary gland of cows in response to a high level of ^{137}Cs contamination, which is calculated as follows: $C18c = (C18:0 - C18:2)/100$. Determination of the C18-coefficient indicates the dose-dependent effect of the ^{137}Cs contamination on lipid metabolism in the mammary gland and catabolism of polyunsaturated fatty acids, particularly linoleic acid. Duration of the affecting contamination is obviously decisive factor of damage effect to the mammary gland, defining the level of biochemical transformations and initiating of peroxide processes.

Keywords: cows, milk, fatty acid composition, radioactive contamination.

Introduction. Formulation of the problem

The fatty acid composition is considered to be an important indicator of nutritional value of milk, which can be altered under the influence of various factors [1-2].

From a biological point of view, the percentage of fat and its composition in the milk of various species

of mammals is determined by the biological needs of newborns in metabolic energy, and the intensity of growth of organs and tissues at this stage of ontogenesis, as well as metabolism of biologically active substances. Thus, the lipid content in human (3.64%) and cow's milk (3.61%) is a bit higher in comparison to the mare's milk (1.21%) [3].

Human breast milk contains saturated and unsaturated fatty acids; and its composition fully meets biological needs of a newborn, including essential polyunsaturated fatty acids. However, if the mother's diet is unbalanced, the level of polyunsaturated fatty acids can decrease [4].

Newborns get a large amount of metabolic energy from milk. The reason of it is a high content of saturated and monounsaturated fatty acids in the milk, particularly, palmitic acid [5]. The percentage of saturated fatty acids in cow's milk is higher (65.6%) than in human milk (48.2%). At the same time, the percentage of mono- and polyunsaturated fatty acids is higher in human milk than in cow's milk (39.8% and 10.8% versus 30.3% and 4.5%). Despite the relatively similar percentage of lipids in cow's and human milk, fatty acid composition of each of them is adopted exactly for newborns needs of these species. Thus, cow's milk is poor for lipids, which are necessary for the development of the human brain, while amount of fat in this milk is absolutely sufficient for a rapid increase in body size of newborn calves [4,6].

The possibility to manipulate the fatty acids composition in milk by different factors is being widely studied now [7-8]. Routine protocols of the analysis of the fatty acids content suppose the use of gas-liquid chromatography. Gas chromatography (GC) is considered to be a highly sensitive method used to identify and quantify the fatty acid content of lipids. Taking into account the importance of fatty acids presence in food products, the influence of various factors on the composition of fatty acids is in the scope of interest. Gamma-irradiation is one of these factors due to its widely use in the food industry for extended hygiene and safety purposes to reduce food allergenicity, effectively kill insects, molds, and bacteria and also to minimize the harmful substances such as biogenic amines and anti-nutritional factors presented in food [9].

Taking into account Ukrainian realities, regarded to the consequences of the Chernobyl accident and full-scale Russian military invasion, the study of the γ -irradiation effect on fatty acids composition in food products is also important from the point of view of the possible expansion of radioactive contamination [10].

Analysis of recent research and publications

With the expansion of the assortment of dairy products and their analogues in Ukraine and the world, the efficiency of the monitoring system of safety parameters of these products is increasing, and methods of the safety control are being improved [11-12].

The International Atomic Energy Agency (IAEA) has launched several programs with these goals. Among other things, target issues are testing and improvement of numerical models that simulate the transfer of radionuclides in the environment such as EMRAS, EMRAS-II, MODARIA and MODARIA-II [13].

The half-life of γ -emitter ^{137}Cs is about 30 years. It makes it present in the environment from 300 to 600 years [14].

The period of biological half-life of ^{137}Cs from the organism can differ significantly depending on the species. Thus, in humans it is approximately 110 days [15], in silver crucian carp it can fluctuate significantly (392 ± 206 days) [16], and in Japanese black cattle it reaches about 30 days [17]. The accumulation of radioactive cesium, both in muscles and in the bloodstream, depends on the intensity of consumption of radioactive cesium with feed by cattle [18].

In the organism of humans, animals and plants, the cesium ion (Cs^+) behaves like a potassium ion (K^+) and is localized mainly inside the cells. The pancreas and salivary glands secrete Cs into the intestines, excreting about 14% of ingested Cs in the feces in such a way, the rest 86% is excreted by the kidneys in the urine [15].

However, a significant part is also excreted with milk, which is considered one of the important sources of radionuclides entering the human organism [15].

Flowering plants can transfer radioactive cesium from the soil to honey bees; they can further concentrate the contaminant in honey [14].

Therefore, taking into account the current realities of hostilities with Moscow, there is a threat of uncontrolled spread of radioactive cesium in the milk of cattle on the territory of Ukraine, and not only from the Chernobyl Exclusion Zone. Taking into account the biological peculiarities of the effect of ^{137}Cs on the organism, it was assumed that a change in the intensity of lipid metabolism in the mammary gland can significantly affect the fatty acid composition of milk and the ratio of individual fatty acids. It was suggested that the content of unsaturated fatty acids is particularly vulnerable, however, this issue required additional study. It was extremely important for us to establish the dependence of this process on the content of ^{137}Cs in the secretion of the mammary gland and to identify possible patterns of this effect.

The purpose of the work was to develop a method for detecting changes in the secretory function of the mammary gland of cows under spontaneous contamination by γ -emitting ^{137}Cs .

The following **objectives** in the present study were intended to achieve the specified goal:

1. To reveal patterns of the effect of ^{137}Cs contamination on the content of individual fatty acids in the secret of the mammary gland.
2. To develop a coefficient for a rapid determining the extent of ^{137}Cs effect on milk parameters.

Research materials and methods

Sampling and sample preparation for the laboratory measurements. For radiation control, average samples of whole milk in the amount of 1.0 l were collected in the private peasant farms of the most critical settlements of Ukraine. Sampling was performed in June 2022 in two settlements of Rokytniv district of Rivne region (Stare

Selo and Vezhitsia). These settlements belong to the third zone of radioactive contamination (Zone of Guaranteed Voluntary Resettlement). Within pastures near these settlements, the density of soil contamination by ^{137}Cs varies in the range of 30–60 kBq/m². The control group were milk samples from not contaminated experimental farms of the National University of Life and Environmental Sciences of Ukraine (Kyiv region). A total number of 28 milk samples were collected and analyzed.

Samples were collected in clean, hermetic polyethylene dishes, and then marked in a proper way for reliable identification during the laboratory studies. Sampling process and corresponding marks making were registered in the sampling act. To ensure reliable identification of the results of the laboratory studies, a unique number was assigned to each sample during the registration in the laboratory. Radioactive contamination of milk samples was expressed in the units of the activity concentration of the radionuclide (Bq/kg raw weight).

Measurement of radionuclide activity concentration. Activity concentration (content) of ^{137}Cs in the milk samples was measured in polyethylene Marinelli vessels with a volume of 1000 cm³, using a high-efficiency gamma spectrometer, equipped with a high-purity germanium semiconductor detector GEM-30185 (EG&G Ortec, USA) with the following parameters: energy resolution along the Co-60 line - 1.78 keV, registration efficiency relative to NaI - 30%. Alternatively, it was determined, using a gamma spectrometer with a SEG-001-63 scintillation detector (AKP, Ukraine). The spectrometer was calibrated using certified reference materials in accordance with the requirements of the standardized method [19].

Determination of the fatty acid composition of milk. Analysis of milk samples was performed in the Ukrainian Laboratory of Quality and Product Safety of Agricultural Products of the National University of Life and Environmental Sciences of Ukraine. The laboratory is accredited according to DSTU ISO/IEC 17025. Extraction of lipids from the studied milk samples was carried out according to the Folch method [20]. The next stage of sample preparation was hydrolysis and methylation of fatty acids of lipids, extracted from milk samples. For this, a standardized arbitration method was used according to DSTU ISO 5509-2002. The analysis of methyl esters of fatty acids was done by the gas chromatography system Trace GC Ultra (USA) with a flame ionization detector. Chromatography conditions: the column temperature was 140–240 °C, the detector temperature was 260 °C. The volume of the sample, introduced into the chromatograph, was 1 µl.

Identification of fatty acids was carried out using a standard sample of Supelco 37 Component FAME Mix. The quantitative assessment of the spectrum of fatty acids of milk lipids was performed by the method of internal normalization, and expressed in percent of their total content. Study of each sample was executed in 3 replicates.

Statistical processing of experimental data was carried out using generally accepted methods of variational statistics. The significance of a difference in the values of the studied parameters was assessed using the Student's t-test. Differences between the compared values were considered statically significant at the level of $P \leq 0.05$.

19 Fatty acids, starting from butyric (C4:0) and ending with behenic (C22:0), were detected and identified in cow's milk by the gas chromatography method.

Parameters of milk quality were also studied (dry skimmed residue of milk; mass fraction of fat, protein, lactose, minerals, water; freezing point; electrical conductivity; active acidity and density). According to the obtained values of these parameters, the studied milk met the norms of DSTU 3662:2018. Raw cow milk. Specifications. Physical and chemical parameters of raw milk were determined by the instrument EKOMILK M Milk Analyzer Milkana KAM98-2A.

Results of the research and their discussion

The analysis of the obtained experimental data on milk contamination and their comparison with the results of previous years indicates that the situation has practically not changed and is still difficult in the most critical settlements of the monitoring network in recent years, taking into account the variability of values due to natural and anthropogenic factors. In all these settlements, the activity concentration of ^{137}Cs in the studied milk samples is several times higher than the permissible level of 100 Bq/kg [21]. The highest values of ^{137}Cs activity concentration of 600 Bq/kg in cow's milk were found in the village Stare Selo of Rokytniv district.

In the lactating organism, radioactive contamination significantly affects both biochemical and physiological processes and the intensity of radionuclide elimination from the body, including excretion through the mammary gland. We hypothesize that radionuclides can suppress the activity of certain metabolic pathways; and therefore, the intensity of synthesis and secretion of individual lipid components of milk can be changed. Thus, the percentage of saturated fatty acids can increase, while the secretion of polyunsaturated fatty acids decreases due to the activation of the peroxide oxidation processes. However, this issue requires additional study.

As shown in Table 1, the relative content of individual fatty acids in the milk of cows with the different ^{137}Cs activity concentration probably did not fluctuate in relation to the level of contamination (C4:0; C16:0; C17:1; C21:0; C22:0). It should be noted that changes in the relative content of the most of individual fatty acids in milk can be associated with the ^{137}Cs activity concentration in several cases only; while a clear pattern of it is impossible to reveal (C6:0; C8:0; C10:0; C12:0; C14:1; C15:0; C17:0; C18:1ω9c; C18:3ω3), although the trends could persist (C11:0; C14:0; C20:0). Any significant differences in the fatty acids content between the groups with the different levels of the ^{137}Cs contamination (101–200 Bq/kg and 201–300 Bq/kg) were also not found. In some cases, a certain

pattern of changes in the relative content of individual fatty acids in relation to the increasing level of contamination was found (C16:1; C18:0; C18:2 ω 6c). Thus, the relative content of palmitoleic acid (C16:1) in the milk samples with the ^{137}Cs activity concentration of 101–200 Bq/kg, 201–300 Bq/kg and 301–600 Bq/kg decreased by the factor of 1.62, 1.76 and 2.39, respectively ($p < 0.001$) in comparison to the cow's milk of the control group (< 100 Bq/kg ^{137}Cs). At the same time the relative content of stearic acid (C18:0) in these groups of samples gradually increased. In the samples with the ^{137}Cs activity concentration of 301–600 Bq/kg, it was higher by the factor of 1.8 ($p < 0.001$), than in the control samples. As for linoleic acid (C18:2 ω 6c), its relative content was lower by the factor of 4.65 ($p < 0.001$) in the samples with the highest ^{137}Cs level than in the control samples.

From the results it is clear that the ratio of the relative content of individual fatty acids can vary in relation to the level of the ^{137}Cs contamination affecting the lactating cows.

Changes in the fatty acid composition of milk, occurred under the conditions of lactating cows' exposure to ^{137}Cs , may indicate a violation of the mechanisms of the formation of lipid components of milk in the mammary gland. However, this issue requires further research. In the raw milk of cows, the fluctuation of the percentage of fatty acids can be quite significant. However, under pathological conditions, the relative amount of individual fatty acids may exceed physiological limits, in particular for C18:0 (max – 13.0; min – 9.0) and C18:2 ω 6c (max – 5.5; min – 3.5).

The present results provide evidence (Fig. 1) to a rapid decrease in the relative content of polyunsaturated

fatty acids (at the expense of omega-6 fatty acids) and the omega-3/omega-6 ratio under the ^{137}Cs activity concentration in cow's milk more than 100 Bq/kg.

It should be noted that the content of the saturated fatty acids in the milk samples ranged from 64.52% (for the group with the ^{137}Cs activity concentration in milk of 301–600 Bq/kg) to 67.45% (for the group of 201–300 Bq/kg of the ^{137}Cs content). Herewith, for the group of animals, where the ^{137}Cs activity concentration in milk is less than 100 Bq/kg, this parameter has intermediate values.

On the basis of the results of the present study of the fatty acid composition of cow's milk in relation to the activity concentration of ^{137}Cs , it is proposed to determine the C18-coefficient of damage to the mammary gland of cows (Fig. 2) under the conditions of ^{137}Cs contamination ($\text{C18c} = (\text{C18:0} - \text{C18:2})/100$). It can be used to reveal the negative impact of this radionuclide on the quality and safety of milk and the physiological state of the mammary gland of lactating cows. The essence of the proposed method is that the relative content of fatty acids in cow's milk significantly depends on the level of the damage to the mammary gland by the ^{137}Cs contamination, which was determined in the amount of Bq/kg of mammary gland secretion.

A significant decrease of the relative content of linoleic acid (below the physiologically recognized minimum – 3.5%) and an increase in the level of stearic acid above the physiological maximum (13.0%) were revealed under the exceeding the permissible level of the ^{137}Cs activity concentration in cow's milk (Table 2).

Table 1 – Fatty acid composition of cow's milk with different levels of the ^{137}Cs activity concentration (M $\pm$ m)

Fatty acids, %	< 100 ^{137}Cs , Bq/kg (n=16)	101–200 ^{137}Cs , Bq/kg (n=4)	201–300 ^{137}Cs , Bq/kg (n=4)	301–600 ^{137}Cs , Bq/kg (n=4)
Butyric acid (C4:0)	3.30 $\pm$ 0.31	3.93 $\pm$ 0.26	3.91 $\pm$ 0.29	3.35 $\pm$ 0.02
Caproic acid (C6:0)	2.34 $\pm$ 0.22	2.26 $\pm$ 0.10 ^{oo}	2.38 $\pm$ 0.21 ^o	1.74 $\pm$ 0.03*
Caprylic acid (C8:0)	1.51 $\pm$ 0.11	1.18 $\pm$ 0.04 ^{*ooo}	1.26 $\pm$ 0.15 ^o	0.85 $\pm$ 0.03***
Capric acid (C10:0)	2.97 $\pm$ 0.22	2.63 $\pm$ 0.09 ^{ooo}	2.96 $\pm$ 0.24 ^{oo}	1.95 $\pm$ 0.07**
Undecanoic acid (C11:0)	–	0.36 $\pm$ 0.03 ^{ooo}	0.25 $\pm$ 0.04	0.17 $\pm$ 0.01
Lauric acid (C12:0)	3.29 $\pm$ 0.10	2.95 $\pm$ 0.06 ^{*ooo}	3.10 $\pm$ 0.35 ^o	2.12 $\pm$ 0.08***
Myristic acid (C14:0)	11.28 $\pm$ 0.64	10.49 $\pm$ 0.23 ^{oo}	10.11 $\pm$ 0.67	8.28 $\pm$ 0.41**
Myristoleic acid (C14:1)	1.19 $\pm$ 0.11	1.48 $\pm$ 0.14 ^{oo}	1.10 $\pm$ 0.15	0.57 $\pm$ 0.17*
Pentadecanoic acid (C15:0)	1.71 $\pm$ 0.18	1.39 $\pm$ 0.14	1.31 $\pm$ 0.02 ^o	1.51 $\pm$ 0.06
Palmitic acid (C16:0)	26.36 $\pm$ 1.57	22.79 $\pm$ 1.19	23.07 $\pm$ 1.01	22.26 $\pm$ 0.62
Palmitoleic acid (C16:1)	1.89 $\pm$ 0.02	1.16 $\pm$ 0.07***	1.07 $\pm$ 0.09***	0.79 $\pm$ 0.23***
Heptadecanoic acid (C17:0)	0.83 $\pm$ 0.02	0.78 $\pm$ 0.02	0.76 $\pm$ 0.02 ^{*o}	0.82 $\pm$ 0.01
cis-10-Heptadecenoic acid (C17:1)	–	0.42 $\pm$ 0.04	0.41 $\pm$ 0.03	0.43 $\pm$ 0.03
Stearic acid (C18:0)	11.19 $\pm$ 0.59	15.05 $\pm$ 0.92 ^{*oo}	17.18 $\pm$ 0.66 ^{***oo}	20.33 $\pm$ 0.13***
Oleic acid (C18:1 ω 9c)	27.38 $\pm$ 1.25	29.40 $\pm$ 1.32	27.51 $\pm$ 1.31 ^o	32.09 $\pm$ 0.92*
Linoleic acid (C18:2 ω 6c)	4.33 $\pm$ 0.24	1.48 $\pm$ 0.06 ^{***ooo}	1.47 $\pm$ 0.18 ^{***o}	0.93 $\pm$ 0.04***
Linolenic acid (C18:3 ω 3)	0.35 $\pm$ 0.05	0.92 $\pm$ 0.07 ^{***o}	0.97 $\pm$ 0.09 ^{***o}	0.64 $\pm$ 0.08***
Arachidic acid (C20:0)	0.14 $\pm$ 0.01	0.16 $\pm$ 0.02 ^{oo}	0.19 $\pm$ 0.09	0.27 $\pm$ 0.01***
Heneicosanoic acid (C21:0)	–	1.03 $\pm$ 0.22	0.89 $\pm$ 0.06	0.79 $\pm$ 0.21
Behenic acid (C22:0)	0.07 $\pm$ 0.01	0.06 $\pm$ 0.01	0.06 $\pm$ 0.01	0.08 $\pm$ 0.02

Note: significance of differences * $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$ – relatively to the control group (less than 100 Bq/kg of ^{137}Cs), Bq/kg; ^o $P \leq 0.05$, ^{oo} $P \leq 0.01$, ^{ooo} $P \leq 0.001$ – relatively to the group with ^{137}Cs level of 301–600 Bq/kg, Bq/kg

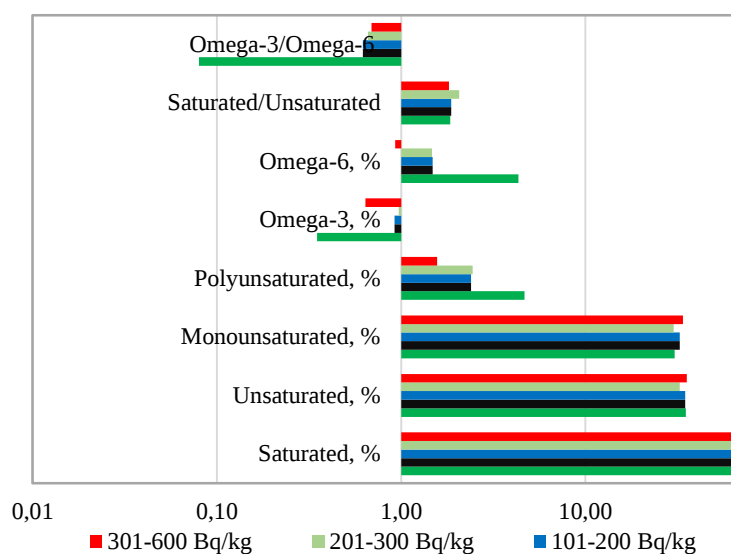


Fig. 1. Relative content of the fatty acids groups in relation to the ^{137}Cs activity concentration in cow's milk

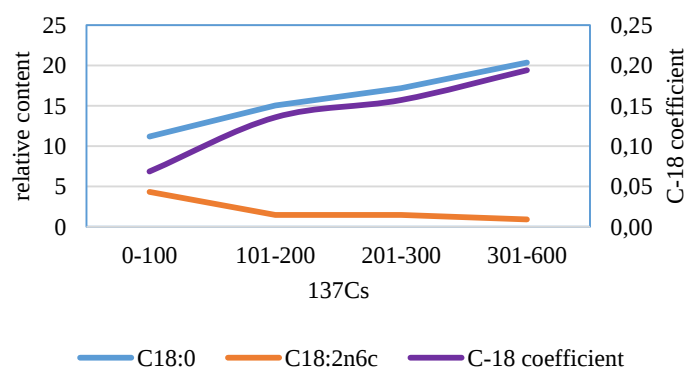


Fig. 2. Relative content of the C18:0, C18:2 fatty acids and C-18-coefficient in relation to the ^{137}Cs activity concentration in cow's milk

Table 2 – The C18-coefficient in the groups of the milk samples with different levels of the ^{137}Cs content

The ^{137}Cs activity concentration, Bq/kg	C18-coefficient
Less than 100 (permissible level)	0.04–0.10
101–200	0.11–0.14
201–300	0.15–1.16
301–600	0.17–0.19

It is absolutely clear that the C18 coefficient can fluctuate within very wide limits (0.04–0.10), depending on the physiological characteristics of animals, diet composition and season. However, under conditions of the radioactive contamination, this parameter rises above 0.10 and indirectly reflects the intensity of the ionizing radiation effect on the physiological state of the mammary gland, fatty acid composition of milk, and its nutritional and technological suitability.

As shown in Figure 3, the value of the C18-coefficient significantly depends on the ^{137}Cs content in the milk of cows. If a lactating cow is being affected by the radioactive contamination of the environment, the ^{137}Cs activity concentration in cow's milk increases in a dose-dependent manner. And it causes a violation of lipid metabolism in the mammary gland.

A violation of the secretory function of the mammary gland was found, in particular, in metabolism of lipids with 18 carbon atoms in the chain. Moreover, the relative content of linoleic acid decreased by several times immediately under the exceeding the permissible level of the ^{137}Cs activity concentration in cow's milk; while the concentration of stearic acid, immediately exceeding the physiological limits at the ^{137}Cs activity concentration of about 110–130 Bq/kg, gradually increased up to the ^{137}Cs activity concentration of 270–330 Bq/kg, and plateaued up to 600 Bq/kg.

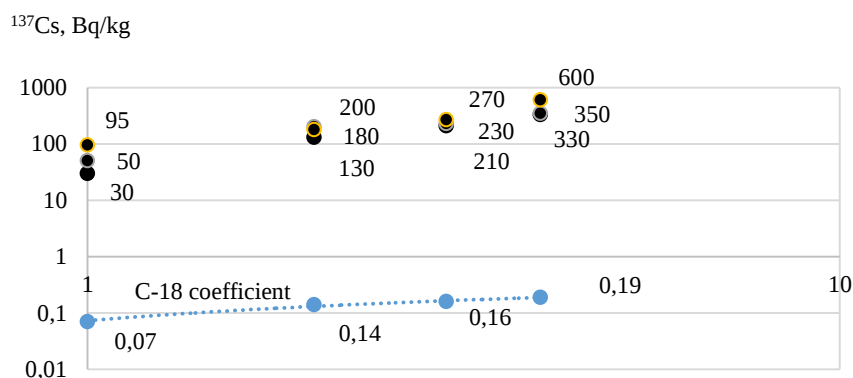


Fig. 3. Relationship between the C18-coefficient and ^{137}Cs content in the studied samples of cow's milk

The determination of the C18-coefficient indicates the dose-dependent effect of the ^{137}Cs contamination on the organism of cows from the point of view of the lipid metabolism in the mammary gland and catabolism of polyunsaturated fatty acids, particularly linoleic. The factor of the duration of the radioactive contamination effect on the physiological state of the mammary gland is obviously decisive and is responsible for the extent of biochemical transformations and initiation of peroxide processes.

Conclusion

Therefore, the exceeding the permissible level of the ^{137}Cs activity concentration of 100 Bq/kg in the milk of cows causes a decrease in the relative content of polyunsaturated fatty acids (at the expense of omega-6 fatty acids) and the omega-3/omega-6 ratio. Despite the relative adaptation of lactating cows to radionuclide exposure, it was found that the metabolism of lipids in the mammary gland is quite sensitive to the ^{137}Cs content in milk. Thus, a violation of the secretory function of the mammary gland was found, in particular, in metabolism of lipids with 18 carbon atoms in the chain. Moreover, the relative content of linoleic acid decreased by several times immediately under the exceeding the permissible level of the ^{137}Cs activity concentration in cow's milk; while

the concentration of stearic acid, immediately exceeding the physiological limits at the ^{137}Cs activity concentration of about 110–130 Bq/kg, gradually increased up to the ^{137}Cs activity concentration of 270–330 Bq/kg, and plateaued up to 600 Bq/kg.

On the basis of the results of the present study of the fatty acid composition of cow's milk in relation to the content of ^{137}Cs , it is proposed to determine the C18-coefficient of damage to the mammary gland of cows under the conditions of ^{137}Cs contamination ($\text{C18c} = (\text{C18:0} - \text{C18:2})/100$). The determination of the C18-coefficient indicates the dose-dependent effect of the ^{137}Cs contamination on the organism of cows from the point of view of the lipid metabolism in the mammary gland and catabolism of polyunsaturated fatty acids, particularly linoleic. The factor of the duration of the radioactive contamination effect on the physiological state of the mammary gland is obviously decisive and is responsible for the extent of biochemical transformations and initiation of peroxide processes.

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ВПЛИВ ^{137}Cs НА СКЛАД ЖИРНИХ КИСЛОТ У КОРОВ'ЯЧОМУ МОЛОЦІ

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Анотація. Ліпідний склад молока-сировини є одним з важливих факторів визначення поживної цінності та технологічної придатності молока. Проживаючи в зоні радіоактивного забруднення фермери не завжди мають змогу перевірити рівень секреції радіонуклідів з молоком корови. У всіх населених пунктах дослідних груп тварин вміст ^{137}Cs у відібраних пробах молока перевищував допустиму норму, яка становить 100 Бк/кг. Найвищі значення вмісту ^{137}Cs у молоці корів зафіксовано у с. Старе Село Рокитнівського району (600 Бк/кг). Згідно наших досліджень, місцеві тварини частково адаптувалися до сезонних підвищень радіоактивного фону й їх молочна залоза, відповідно до існуючих стандартів якості, виділяє умовно придатне до споживання молоко. Єдиним фактором, що забороняє споживання такого продукту є рівень цезію-137. Зростання вмісту більше 100 Бк/кг ^{137}Cs у молоці корів викликає зниження відносного вмісту поліненасичених жирних кислот (за рахунок омега-6 жирних кислот) та зміни у співвідношенні омега-3/омега-6 у бік зменшення омега-3 жирних кислот. Не дивлячись на відносну адаптацію лактуючих корів до навантаження радіонуклідами, виявилося, що метаболізм ліпідів у молочній залозі та рівень їх секреції є досить чутливим до рівня ^{137}Cs у молоці. Так, встановлено порушення секреторної функції молочної залози, а саме – обміну ліпідів з 18 атомами Карбону в ланцюзі. При чому, якщо відносний вміст лінолевої кислоти одразу при перевищенні радіоактивного забруднення знижувався в декілька разів, то концентрація стеаринової кислоти вийшовши одразу за фізіологічні межі на рівні біля 110–130 Бк/кг, поступово наростала до рівня 270–330 Бк/кг, після чого виходила на плато до 600 Бк/кг. Виходячи з аналізу особливостей жирнокислотного складу молока корів залежно від вмісту ^{137}Cs , пропонується визначати С18-коефіцієнт ураження молочної залози корів за інтенсивністю ^{137}Cs навантаження їх організму ($\text{C18c} = (\text{C18:0} - \text{C18:2})/100$). Визначення С18-коефіцієнту висвітлює дозозалежний вплив навантаження організму корови ^{137}Cs на обмін ліпідів у молочній залозі та катаболізм поліненасичених жирних кислот, зокрема лінолевої. Фактор тривалості впливу навантаження організму радіонуклідами на фізіологічний стан молочної залози, очевидно, є визначальний і відповідає за глибину біохімічних перетворень та ініціацію пероксидних процесів.

Ключові слова: корови, молоко, жирнокислотний склад, радіоактивне забруднення.