# The Influence of Breed on the Fatty Acid Composition of Goat Milk and the Relationship between Breed and Seasonal Temperature with Milk Yield

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***Abstract.*** *In order to determine the influence of temperature on the productivity of goats and effect of their breed on the content of fatty acids in milk, an experiment was conducted with 30 goats of different breeds throughout the year. The first group included 10 goats of the Saanen breed, the second group included 10 goats of the Russian white breed, and the third group included 10 Ukrainian local breed goats. Productivity of goats as well as environmental temperature fluctuations were assessed daily, and the content of fatty acids in milk was determined twice a month during the year. Breed and external temperature influenced the milk yield of goats of all groups by 81.33% and 13.00%, respectively. It should also be noted that goats of the Saanen breed have a higher content of linolenic, isocaprylic, heptadecenoic, stearic, and erucic acids compared with goats of Russian white and Ukrainian local breed goats. In Ukrainian local breed goats, the content of capric, lauric, arachinic, myristoleic, pentadecanoic, pentadecenoic, isopalmitic, palmitoleic, hexadecadienoic, linoleic, and geneicosanoic acids was higher compared with goats of the Russian white breed and Saanen breeds. Russian white goats had a higher content of undecyl, behenic and docosahexaenoic acids compared with goats of Saanen breed and Ukrainian local breed goats.*

## Introduction

Today, the forecast for the growth of goat breeding in the world is positive (Liang and Paengkoum, 2019), but global climate changes associated with the variability of weather conditions and their impact on housing conditions will increasingly affect agricultural production in general and dairy cattle breeding in particular (Rojas-Downing et al., 2017; Tüfekci and Tozlu Çelik, 2021). Also, when climatic conditions change, further search for methods of adaptation of existing breeds of goats to new conditions, taking into account their characteristics, is relevant (Brahmi et al., 2012; Kyselov et al., 2022).

Previously published results indicate that seasonal factors in an extensive production system significantly influenced both the productivity of goats (Zazharska and Kostiuchenko, 2017) and the composition of goat milk in the majority of monounsaturated and branched fatty acids. However, saturated and polyun-saturated fatty acids showed only a few compositional changes in their content in goat milk under the influence of seasonal factors (Toyes-Vargas et al., 2013). Similar reports prove that there is a close dependence of the physicochemical parameters of milk of Saanen goats (Kljajevic et al., 2018) and other (Sejian et al., 2021) breeds on such a seasonal factor as heat stress. By studying the ability of goats to adapt to changes in housing conditions, scientists recommend use of local genetic resources and include them in their breeding programs. This will allow not only to improve their genetic characteristics, but also to increase the quality of milk in terms of fatty acid content (Dagong et al., 2019). At the same time, opposite reports are spreading, in which no influence of seasonal fluctuations on the differences between milk samples of six different breeds of Austrian goats in most physicochemical parameters and fatty acid composition was established (Mayer and Fiechter, 2012).

Other scientists point to a stronger influence of the genotypic factor both on milk quality indicators in contrast to other possible factors (Vacca et al., 2017; Shuvarikov et al., 2021) and on products made from it (Fresno et al., 2021). Other scientists claim that the physicochemical properties of milk samples differ significantly depending on the breed of goats, with some samples superior to others in one or more aspects (Alyaqoubi et al., 2015).

There are known repeated results emphasizing

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the more likely and stronger dependence of the quality and fatty acid composition of goat milk on the duration of lactation of goats associated with seasonal features (Ferro et al., 2017; El-Tarabany et al., 2018). Known works emphasize the significant influence on the amount of some fatty acids in milk by such factors as the age of females and the period of lactation. The effect of lactation stage on all traits was significant, except for protein percentage (Gharibi et al., 2020).

Investigating the dependence of the quality and composition of goat milk on various factors, a number of scientists found the most probable and strongest influence of the feeding method (Marcos et al., 2020) and directly of the composition of the rations (Tian at al., 2017). Moreover, there are reports of a higher influence of the goat feeding system itself than the lactation period or the age of the animals on the fatty acid composition of milk (Yakan et al., 2019). Feeding systems, especially goat grazing methods, have been shown to have a greater effect on essential fatty acid profiles than breed or a breeding method. A significantly high content of polyunsaturated fatty acids and a simultaneous low content of saturated fatty acids were found in the milk of grazing goats, compared with a higher content of saturated fatty acids and a lower content of polyunsaturated fatty acids in the milk of well-fed goats (Halyna et al., 2019; Bodnar et al., 2021).

Therefore, we can state that scientists show ambiguous views regarding the assessment of the dependence of indicators describing the influence of seasonal factors on the quality of milk in crossbred and purebred goats and the fatty acid composition of their milk. But the relevance of further research on this issue is increasing, since goat farming is in a state of positive dynamic changes in the increase of both the population and production volumes; however, the resources for further growth are quite limited (Röös et al., 2016), and the ecological situation is also gradually becoming more difficult (Jägermeyr et al., 2021; Peng and Guan, 2021).

The purpose of our experiment included a comparison of the content of fatty acids in the milk of goats of different breeds and an assessment of the dependence of their productivity on the influence of temperature.

## Materials and methods

To achieve the goals of the research, an experiment was conducted to determine the indicators of fatty acid content in milk obtained from goats of three breeds and to determine the productivity of goats paying attention to the change of weather conditions during the seasons of the year (seasonal temperatures).

For the experiment, lactating goats of Saanen, Russian white breed and Ukrainian local breed were selected with 10 heads in each group formed by a separate breed. Livestock taken for the experiment was kept in a special room (vivarium) on the territory of the Sumy National Agrarian University, Sumy region, Ukraine. This special room was designed according to the principles of humane goat handling. It allowed for watering, feeding, free movement in sufficient space, and proper lactation while maintaining a healthy microclimate.

The selection of goats for the experiment was based on the principle of pairs of analogues according to animal parameters such as age, live weight and the term of the goats. The goats were kept in identical conditions during the experiment.

The experimental goats had an average live weight of 60 kg and an average milk yield per lactation of 700 kg. All manipulations with the goats in the experiment strictly followed the provisions and policies of the humane treatment of animals set out in the Council Directive 86/609/EEC (1986).

In the special room of the vivarium, the goats were kept untethered on deep litter. The floor area per goat was 1.15 $m^2$. Fresh water was freely available for experimental goats. The rations of the goats kept in the vivarium were complete and balanced in terms of nutrients (Table 1).

Productivity of goats was determined by the method of daily milking with subsequent summation for each month during the year. Lactation of goats was 214 days. Milk samples for evaluation of fatty acid composition were taken from goats according to ISO 707:2008 (2008). Milk samples were collected in a volume of 50 mL during each of four consecutive milkings (morning and evening for two days). Combined proportionally with each delivery, the samples were filtered, cooled to +6 ± 2ºC and analyzed within 24 hours after the last collection. Milking of goats was carried out manually in compliance with

*Table 1.* Feed composition

| Indicator | Value |
|---|---|
| Fodder units | 1.7 |
| Exchange energy, MJ | 18.0 |
| Dry matter, kg | 2.0 |
| Crude protein, g | 280.0 |
| Digestive protein, g | 170.0 |
| Table salt, g | 16.0 |
| Calcium, g | 8.5 |
| Phosphorus, g | 6.0 |
| Magnesium, g | 0.9 |
| Iron, mg | 80.0 |
| Copper, mg | 15.0 |
| Zinc, mg | 88.0 |
| Cobalt, mg | 0.87 |
| Manganese, mg | 88.0 |
| Iodine, mg | 0.68 |
| Carotene, mg | 21.0 |
| Vitamin D, MO | 900.0 |

sanitary and hygienic standards. Samples of milk were taken exclusively from healthy goats twice a month.

The content of fatty acids of goat milk was determined at the Institute of Animal Husbandry of the National Academy of Sciences of Ukraine, which has accreditation in accordance with the requirements of ISO/IEC 17025:2006 (2006) and the corresponding certificate No. 2T621 issued by the National Accreditation Agency of Ukraine. Homogeniser HF-0.5/25 (OHFU, China) was used for homogenization of milk samples heated to a temperature of +40°C. The homogenizer has been certified to include the requirements of ISO 9001:2008 (2008).

A modified Bligh and Dyer method was employed for the quantitative extraction of lipids (milk fat) from prepared milk samples. Milk samples (typically 1–5 mL) were accurately measured and transferred into centrifuge tubes or extraction flasks. The volumes were selected based on analytical needs and instrument sensitivity, ensuring sufficient lipid recovery for subsequent analysis. A mixture of solvents was added to each sample in specific ratios. First, methanol ($CH_3OH$) was added twice to the milk sample's volume (e.g., 20 mL methanol per 10 mL milk). Methanol acts as a polar solvent, facilitating protein denaturation and cell membrane disruption, thereby promoting lipid release into the solvent phase. The resulting mixture was thoroughly homogenized using a mechanical homogenizer (e.g., Polytron) or vigorously shaken for 1–2 minutes. This step ensured a uniform monophasic solution formed, maximizing contact between solvents and milk components and enhancing lipid extraction efficiency. After homogenization, an additional volume of chloroform (equal to the initially added volume, e.g., 10 mL) and distilled water (corresponding to the water content initially present in the milk) were added to the mixture. This induced the formation of a biphasic system, allowing clear separation of the organic (chloroform-rich, lipid-containing) and aqueous (methanol-water) layers upon centrifugation or gravity-assisted settling. The lower chloroform phase, containing the extracted lipids, was then collected for further analysis. . Fatty acids of milk were determined by the method of gas-liquid chromatography ISO 15885:2002 (2002). Gas chromatographic analysis of fatty acid composition was performed on a gas chromatograph with a flame ionization detector. FAME separation was performed on a capillary column (HP-5), 30 m × 0.25 mm × 0.25 μm in size with a stationary phase. Helium was used as the carrier gas with a flow rate of 1 mL/min. The injector temperature was 250°C, and the detector temperature was 280°C. Sample introduction was carried out in split mode with a separation ratio of 50:1. The volume of the introduced sample was 1 μL. The column temperature program was as follows: initial temperature of 70°C was maintained for 2 min, then heated at a rate of 10°C/min to a final temperature of 240°C with a holding time of 10 min. Identification of fatty acids was performed by comparing the retention times of the peaks with the retention times of the peaks of a standard mixture of fatty acid methyl esters. For quantitative determination, the peak area normalization method was used, using fatty acid standards at known concentrations.

The experimental data were analyzed using MS Excel 2016 and the statistical software package Statistica 12.0 (StatSoft Inc., USA). Initial data processing included the calculation of means (M), standard deviations (SD), and standard errors of the mean (SE) for each animal group, which allowed for a clear presentation of variability and reliability of the results in tabular form.

To evaluate the effect of various factors on goat milk yield, a one-way analysis of variance (ANOVA) was carried out in Statistica. This test made it possible to identify statistically significant differences between groups based on a single independent variable (e.g., breed, diet type, or season). When significant differences were observed, the Tukey's Honest Significant Difference (HSD) post hoc test was applied to determine which specific groups differed.

A two-way ANOVA with interaction effects was also performed in Statistica to analyze the combined effects of multiple factors, particularly the interaction between breed and seasonal temperature on milk yield. This allowed assessment not only of the individual influence of each factor but also of their interaction.

For a more precise evaluation of relationships and the influence of specific variables, mainly when milk yield depended on a continuous factor such as seasonal temperature, the least squares method was applied. This approach enabled the modeling of the data and estimating the effects of independent variables while controlling for potential confounding factors. Graphs and regression equations based on the least squares method were constructed using MS Excel 2016.

Differences were considered statistically significant at a probability level of $P \leqslant 0.05$. All mean values presented in the tables were calculated based on 14 independent replicates per experimental group, which ensured sufficient statistical power and robustness of the conclusions. This number of replicates helped to minimize the influence of random variation and improve the overall reliability of the experimental findings.

Experimental goats were treated with methods that allowed to alleviate their discomfort and prevent pain. The Bioethics Commission of the Sumy National Agrarian University on the care and use of animals in scientific (experimental) research (ethical approval number VT-22-0208-02) approved the methodology for conducting this experiment. Breeding and involvement of goats in the experiment in the university vivarium took place considering the requirements of the Law of Ukraine No. 3447-IV of 2006 "On the Protection of Animals from Cruelty".

**Results**

The analysis of the milk productivity of goats during lactation showed that it increases in spring and summer and decreases in autumn (Fig. 1).

As we can see, the absolute difference in milk yield between the Saanen breed and other breeds in July (0.50 and 0.44 L/day) is greater than in March (0.37 and 0.40 L/day). However, the relative difference between the Saanen and Russian White breeds is significantly higher in March (48.68%) compared with July (24.51%). A similar trend is observed when comparing the Saanen breed with the Ukrainian local breed (54.79% in March versus 20.95% in July). This indicates that although the Saanen breed maintains and even slightly increases its advantage in absolute terms during the peak lactation period (July), in relative terms, its superiority was more pronounced at the beginning of lactation (March), when overall milk yields were lower. In September, when the lactation period ended in most herds of the studied groups, the productivity advantage remained with the Saanen goats, and the local Ukrainian local breed goats gave the least milk. The highest average milk yield during lactation was observed in animals of all groups in July, when the temperature maximum reached 16.9–22.8°C, and the lowest milk yield was obtained in March with an average monthly temperature range of –4.8–4.4°C.

To determine the influence of breed and the average monthly temperature variation, a two-factorial analysis of variance was performed, which showed a probable influence of the breed factor on the milk productivity of goats during the year with a power of 81.33%. We can also conclude that milk yield also depended on temperature, which influenced it with a strength of 13.00% (Table 2).

The interaction of the goat breed factor and the temperature also had an effect on the milk productivity of the herd, but was only reliable at a level of 0.67%. Only 4.98% of the lactation depended on factors that were not taken into account.

The regression analysis showed a direct dependence of the milk productivity of Saanen goats on temperature fluctuations during the lactation period from March to September. Milk production increased or decreased by 2 g for every 1°C increase or decrease in temperature. Such a direct relationship between the indicators for milk productivity was found in the temperature range from –4.8°C in spring to +22.8°C in summer. The interpretation of the value of the coefficient of determination $R^2$ showed that 79.57% of the variance of the dependent indicator of milk productivity with a change of +/–2 g with a simultaneous change in the monthly average temperature of +/–1°C was due to the response to these temperature fluctuations and the rest of the variance was formed by unaccounted factors, including the temperature factor (Fig. 2).

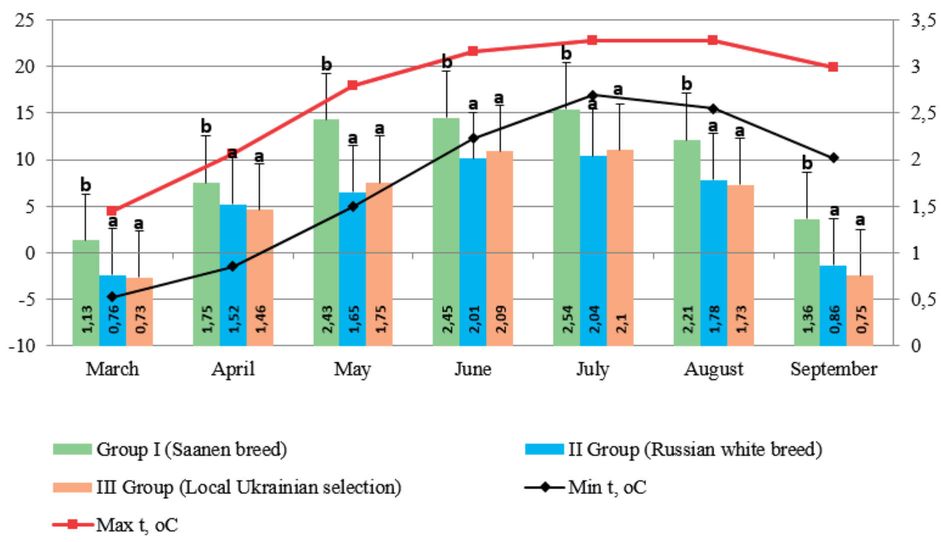


*Fig. 1.* Average daily productivity of goats (n = 30) during the lactation and monthly minimum and maximum outdor temperatures (different lowercase letters (a, b) indicate statistical differences between the groups at the level of $P < 0.05$)

*Table 2.* The influence of temperature and breed of goats on daily productivity

| Source of Variation | SS | df | MS | F | *P* value | F crit | Influence |
|---|---|---|---|---|---|---|---|
| Breed | 501.40 | 3.00 | 167.13 | 5805.04 | 0.00 | 2.61 | 81.33 |
| Temperature | 80.17 | 2.00 | 40.08 | 1392.29 | 2.9162E-298 | 3.00 | 13.00 |
| Interaction factors | 4.14 | 6.00 | 0.69 | 23.97 | 1.03854E-26 | 2.10 | 0.67 |
| Unaccounted factors | 30.74 | 1068 | 0.02 | | | | 4.98 |
| Total | 616.46 | 1079 | | | | | 100.00 |

Evaluation of the dependence of changes in milk productivity of Russian White breed goats on temperature fluctuations in the range of –4.8+22.8°C during the lactation period using the regression equation showed a direct regression relationship between the indicators. When the monthly average temperature fluctuated by ±1°C, milk productivity changed by ±3 g, 77.52% of which was due to the direct influence of temperature and 22.48% due to factors not taken into account (Fig. 3).

The regression analysis showed a direct positive effect of external temperature on milk productivity of local Ukrainian local breed goats with a strength of 73.26% and the effect of unaccounted factors at the level of 26.74%, which caused an increase in milk production by 2 g when the temperature index increased by 1°C and vice versa (Fig. 4).

The milk productivity of goats from three groups thus depended on the influence of the seasonal outdoor temperature. Russian white goats were the

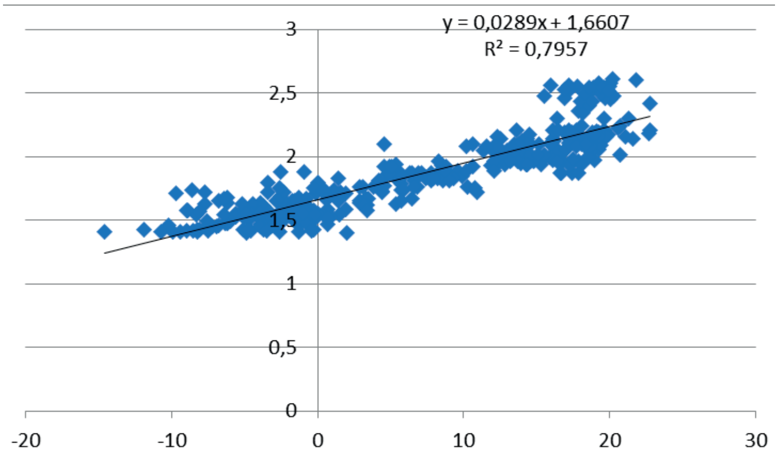


*Fig. 2.* Dependence of dairy productivity on changes in external temperatures during lactation in Saanen goats

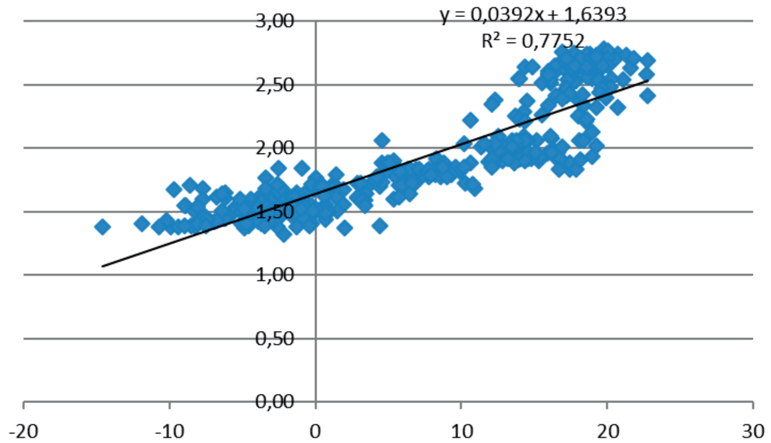


*Fig. 3.* Dependence of dairy productivity on changes in external temperatures during lactation in Russian white goats

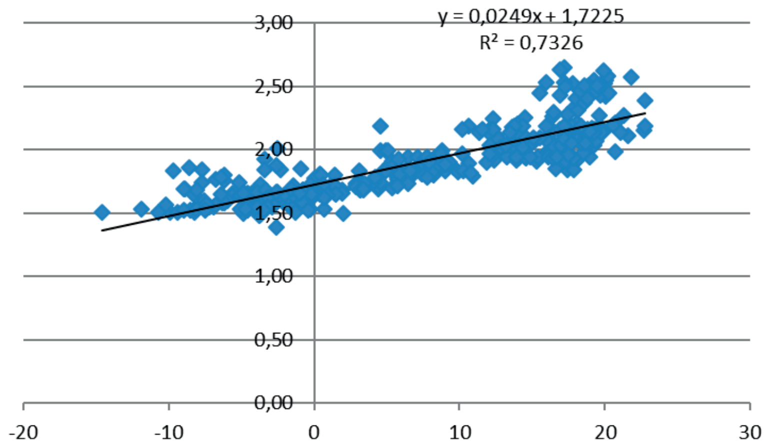


*Fig. 4.* Dependence of dairy productivity on changes in external temperatures during lactation in Ukrainian local breed goats

least resistant to this effect.

Analysis of medium-chain fatty acids (MCFA) in the milk of goats of different breeds revealed several statistically significant differences. In particular, it was found that goats of the Ukrainian local breed (Group 3) had a higher content of caprylic acid (C8:0) by 0.11% ($P < 0.05$) compared with the Saanen breed (Group 1), and by 0.10% ($P < 0.05$) compared with the Russian White breed (Group 2) (Table 3).

Similarly, the content of capric acid (C10:0) in the milk of Ukrainian local breed goats exceeded that of the Saanen breed by 1.01% ($P < 0.05$) and that of the Russian White breed by 0.92% ($P < 0.05$). Regarding lauric acid (C12:0), the Ukrainian local breed goats also demonstrated significantly higher levels, by 1.19% ($P < 0.05$) compared with the Saanen breed and by 1.41% ($P < 0.05$) compared with the Russian White breed. Additionally, the content of pelargonic acid (C9:0) was higher in the Ukrainian local breed by 0.01% ($P < 0.05$) compared with both the Saanen and Russian White breeds. The Ukrainian local goats also showed a higher concentration of lauroleic acid (C12:1) by 0.08% ($P < 0.05$) compared with the Russian White breed.

At the same time, the Saanen breed goats (Group 1) had a significantly higher content of isocaprylic acid (C8:0) by 0.02% ($P < 0.05$) than both the Russian White and Ukrainian local breeds. The content of lauroleic acid (C12:1) was also higher in Saanen goats by 0.05% ($P < 0.05$) compared with the Russian White breed.

On the other hand, goats of the Russian White breed (Group 2) were characterized by a significantly higher level of undecylic acid (C11:0) by 0.12% ($P < 0.05$) compared with the Saanen breed and by 0.11% ($P < 0.05$) compared with the Ukrainian local breed.

The total content of medium-chain fatty acids (MCFA) in the milk of Ukrainian local breed goats was 14.00%, exceeding that of the Saanen breed (12.25%) by 1.75 percentage points, which corresponds to a relative increase of 14.29%. Compared with the Russian White breed (12.20%), the milk of Ukrainian local goats demonstrated a higher MCFA content by 1.80 percentage points, equivalent to a relative difference of 14.75%. The difference between the Saanen and Russian White breeds was minimal, amounting to 0.05 percentage points, with the Saanen goats exhibiting a slightly higher value, representing approximately a 0.41% relative increase.

Analysis of the content of long-chain saturated fatty acids (LCFA-SFA) in the milk of goats of different breeds revealed that Saanen goats (Group 1) exhibited significantly higher levels of tridecanoic acid (C13:0) and isomyristic acid (C14:0) by 0.04% ($P < 0.05$) and 0.05% ($P < 0.05$), respectively, compared with Russian White goats (Group 2). Moreover, Saanen goats outperformed the Russian White breed in terms of stearic acid (C18:0) content by 0.72% ($P < 0.05$), and the Ukrainian local breed by 1.13% ($P < 0.05$). Their milk also contained significantly higher levels of myristic acid (C14:0) by 1.48% ($P < 0.05$) compared with the Ukrainian local breed. The concentration of pentadecanoic acid (C15:0) in the milk of Saanen goats was higher by 0.18% ($P < 0.05$) compared with the Russian White breed, while margaric acid (C17:0) was higher by 0.21% ($P < 0.05$). Regarding behenic acid (C22:0), Saanen goats showed a 0.11% ($P < 0.05$) higher content compared with the Ukrainian local goats (Table 4).

Russian White goats (Group 2) surpassed the Ukrainian local goats in stearic acid (C18:0) content by 0.41% ($P < 0.05$). The content of arachidic acid (C20:0) in the Russian White breed was higher by 0.09% ($P < 0.05$) compared with the Saanen breed. Furthermore, the behenic acid (C22:0) content in the milk of Russian White goats was higher by 0.14% ($P < 0.05$) than in the Saanen breed and by

*Table 3.* Medium-chain fatty acid (MCFA) content in milk of goats of different breeds (%)

| Fatty acid | Group 1 (Saanen breed) | Group 2 (Russian white breed) | Group 3 (Ukrainian local breed goats) |
|---|---|---|---|
| Caproic acid (C6:0) | $0.06 \pm 0.006^{a}$ | $0.06 \pm 0.003^{a}$ | $0.06 \pm 0.001^{a}$ |
| Caprylic acid (C8:0) | $1.09 \pm 0.006^{a}$ | $1.10 \pm 0.008^{a}$ | $1.20 \pm 0.009^{b}$ |
| Isocaprylic acid (C8:0) | $0.07 \pm 0.003^{b}$ | $0.05 \pm 0.004^{a}$ | $0.05 \pm 0.002^{a}$ |
| Capric acid (C10:0) | $4.49 \pm 0.262^{a}$ | $4.58 \pm 0.131^{a}$ | $5.50 \pm 0.241^{b}$ |
| Undecyl acid (C11:0) | $0.05 \pm 0.006^{a}$ | $0.17 \pm 0.002^{b}$ | $0.06 \pm 0.003^{a}$ |
| Isolauric acid (C12:0) | $0.06 \pm 0.007^{a}$ | $0.08 \pm 0.008^{a}$ | $0.07 \pm 0.008^{a}$ |
| Lauric acid (C12:0) | $5.96 \pm 0.281^{a}$ | $5.74 \pm 0.194^{a}$ | $7.15 \pm 0.321^{b}$ |
| Lauroleic acid (C12:1) | $0.45 \pm 0.003^{b}$ | $0.40 \pm 0.004^{a}$ | $0.48 \pm 0.025^{b}$ |
| Pelargonic acid (C9:0) | $0.02 \pm 0.006^{a}$ | $0.02 \pm 0.004^{a}$ | $0.03 \pm 0.002^{b}$ |
| SUM MCFA | 12.25 | 12.20 | 14.00 |

Note: different lowercase letters ($^{a, b, c}$) indicate statistical differences between the groups at the level of $P < 0.05$; the same letters indicate that there is no statistically significant difference between the groups.

0.25% ($P < 0.05$) than in the Ukrainian local breed. However, the level of isopalmitic acid (C16:0) was lower by 0.03% ($P < 0.05$) in the Russian White breed compared with the Saanen.

Ukrainian local goats (Group 3) exhibited the highest content of pentadecanoic acid (C15:0), exceeding that of the Saanen breed by 0.32% ($P < 0.05$) and the Russian White breed by 0.50% ($P < 0.05$). This group also had the highest level of isopalmitic acid (C16:0), which was 0.05% ($P < 0.05$) and 0.08% ($P < 0.05$) higher than in the Saanen and Russian White breeds, respectively. Additionally, the Ukrainian local goats demonstrated the highest content of margaric acid (C17:0), surpassing that of the Russian White breed by 0.44% ($P < 0.05$) and the Saanen breed by 0.23% ($P < 0.05$). The arachidic acid (C20:0) content was also highest in this group, exceeding that of the Saanen by 0.38% ($P < 0.05$) and the Russian White breed by 0.29% ($P < 0.05$). At the same time, the levels of myristic, palmitic, stearic, and behenic acids in Ukrainian local goats' milk were lower than in the other groups.

The calculation of differences in the total sums of long-chain saturated fatty acids (SUM LCFA-SFA) among the breed groups showed that the Saanen breed (Group 1) had a sum higher by 0.92 than the Russian White breed (Group 2), and by 1.74 higher than the Ukrainian local breed (Group 3). The difference between the Russian White (Group 2) and Ukrainian local (Group 3) breeds was 0.82, in favor of the Russian White.

The analysis of monounsaturated fatty acid (MUFA) content in the milk of goats of different breeds revealed that goats of the Ukrainian local breed (Group 3) had the highest content of myristoleic acid (C14:1), exceeding that of the Saanen breed (Group 1) by 0.41% ($P < 0.05$) and the Russian White breed (Group 2) by 0.56% ($P < 0.05$). This group also demonstrated the highest levels of pentadecenoic acid (C15:1), surpassing the Saanen and Russian White breeds by 0.02% ($P < 0.05$). Similarly, palmitoleic acid (C16:1) was highest in the Ukrainian local breed, with levels 0.67% ($P < 0.05$) and 0.93% ($P < 0.05$) higher than those of the Saanen and Russian White breeds, respectively. Additionally, the content of gondoic acid (C20:1) in the Ukrainian local breed was 0.02% ($P < 0.05$) higher than in the Saanen breed and 0.04% ($P < 0.05$) higher than in the Russian White breed. Regarding erucic acid (C22:1), the Ukrainian local breed showed a 0.07% ($P < 0.05$) higher concentration compared with the Russian White breed (Table 5).

In Saanen goats (Group 1), the content of myristoleic acid (C14:1) was 0.15% ($P < 0.05$) higher than in the Russian White breed. Furthermore, the Saanen breed had a higher level of heptadecenoic acid (C17:1), by 0.07% ($P < 0.05$) compared with the Russian White breed and by 0.05% ($P < 0.05$) compared with the Ukrainian local breed. The content of erucic acid (C22:1) in the Saanen breed was also 0.11% ($P < 0.05$) higher than in the Russian White breed and 0.04% ($P < 0.05$) higher than in the Ukrainian local breed. In addition, the palmitoleic acid (C16:1) level in the Saanen breed was 0.26% ($P < 0.05$) higher than in the Russian White breed.

Goats of the Russian White breed (Group 2) exhibited the highest level of oleic acid (C18:1), exceeding that of the Ukrainian local breed by 2.59% ($P < 0.05$). The corresponding value in the Saanen breed was also higher than in the Ukrainian local breed by 2.05% ($P < 0.05$).

The total content of monounsaturated fatty acids (MUFA) was highest in the Saanen breed (26.65%). This value was 0.52% higher than in the Russian White breed (26.13%) and 1.47% higher than in the Ukrainian local breed (25.18%). The difference between the Russian White and Ukrainian local breeds was 0.95%, with a higher value in the Russian White breed.

*Table 4.* Content of long-chain saturated fatty acids (LCFA-SFA) in milk of goats of different breeds (%)

| Fatty acid | Group 1 (Saanen breed) | Group 2 (Russian white breed) | Group 3 (Ukrainian local breed goats) |
|---|---|---|---|
| Tridecanoic acid (C13:0) | $0.13 \pm 0.003^{b}$ | $0.09 \pm 0.004^{a}$ | $0.13 \pm 0.001^{b}$ |
| Isomyristic acid (C14:0) | $0.18 \pm 0.012^{b}$ | $0.13 \pm 0.011^{a}$ | $0.17 \pm 0.00^{b}$ |
| Myristic acid (C14:0) | $14.86 \pm 0.114^{b}$ | $14.94 \pm 0.211^{b}$ | $13.38 \pm 0.132^{a}$ |
| Pentadecanoic acid (C15:0) | $1.88 \pm 0.009^{b}$ | $1.70 \pm 0.018^{a}$ | $2.20 \pm 0.063^{c}$ |
| Isopalmitic acid (C16:0) | $0.31 \pm 0.005^{a}$ | $0.28 \pm 0.003^{b}$ | $0.36 \pm 0.002^{c}$ |
| Margaric acid (C17:0) | $1.30 \pm 0.100^{ab}$ | $1.09 \pm 0.092^{a}$ | $1.53 \pm 0.085^{b}$ |
| Stearic acid (C18:0) | $14.43 \pm 0.087^{b}$ | $13.71 \pm 0.099^{a}$ | $13.30 \pm 0.073^{c}$ |
| Arachidic acid (C20:0) | $0.75 \pm 0.015^{a}$ | $0.84 \pm 0.022^{b}$ | $1.13 \pm 0.093^{c}$ |
| Behenic acid (C22:0) | $0.45 \pm 0.011^{a}$ | $0.59 \pm 0.010^{b}$ | $0.34 \pm 0.007^{c}$ |
| SUM LCFA-SFA | 34.29 | 33.37 | 32.55 |

Note: different lowercase letters ($^{a, b, c}$) indicate statistical differences between the groups at the level of $P < 0.05$; the same letters indicate that there is no statistically significant difference between the groups.

*Table 5.* Content of monounsaturated fatty acids (MUFA) in milk of goats of different breeds (%)

| Fatty acid | Group 1 (Saanen breed) | Group 2 (Russian white breed) | Group 3 (Ukrainian local breed goats) |
|---|---|---|---|
| Myristoleic acid (C14:1) | $2.09 \pm 0.032^{b}$ | $1.94 \pm 0.018^{a}$ | $2.50 \pm 0.039^{c}$ |
| Pentadecenoic acid (C15:1) | $0.11 \pm 0.002^{a}$ | $0.11 \pm 0.001^{a}$ | $0.13 \pm 0.001^{b}$ |
| Palmitoleic acid (C16:1) | $3.46 \pm 0.052^{a}$ | $3.20 \pm 0.069^{b}$ | $4.13 \pm 0.021^{c}$ |
| Heptadecenic acid (C17:1) | $0.47 \pm 0.005^{b}$ | $0.40 \pm 0.007^{a}$ | $0.42 \pm 0.008^{a}$ |
| Oleic acid (C18:1) | $19.60 \pm 0.181^{b}$ | $20.14 \pm 0.162^{b}$ | $17.55 \pm 0.167^{a}$ |
| Heneicosanoic acid (C20:1) | $0.10 \pm 0.002^{a}$ | $0.080 \pm 0.001^{b}$ | $0.12 \pm 0.003^{c}$ |
| Erucic acid (C22:1) | $0.37 \pm 0.001^{a}$ | $0.26 \pm 0.001^{b}$ | $0.33 \pm 0.003^{c}$ |
| SUM MUFA | 26.65 | 26.13 | 25.18 |

Note: different lowercase letters ($^{a, b, c}$) indicate statistical differences between the groups at the level of $P < 0.05$; the same letters indicate that there is no statistically significant difference between the groups.

The analysis of polyunsaturated fatty acid (PUFA) content in the milk of goats with different breeds showed that goats of the Ukrainian local breed (Group 3) had a significantly higher content of hexadecadienoic acid (C16:2), exceeding that of the Saanen breed (Group 1) by 0.08% ($P < 0.05$) and that of the Russian White breed (Group 2) by 0.25% ($P < 0.05$). The same group (Ukrainian local) also exhibited the highest concentration of linoleic acid (C18:2), which was 0.80% ($P < 0.05$) higher than in the Saanen breed and 1.08% ($P < 0.05$) higher than in the Russian White breed. Similarly, arachidonic acid (C20:4) was most abundant in the milk of Ukrainian Local goats, surpassing the Saanen breed by 0.05% ($P < 0.05$) and the Russian White breed by 0.10% ($P < 0.05$). The content of docosatrienoic acid (C22:3) was also higher in the Ukrainian local breed by 0.01% ($P < 0.05$) compared with both the Saanen and Russian White breeds (Table 6).

At the same time, the milk of Saanen goats (Group 1) contained a higher proportion of linolenic acid (C18:3) by 0.13% ($P < 0.05$) and docosadienoic acid (C22:2) by 0.06% ($P < 0.05$), both compared with the Russian White breed.

Goats of the Russian White breed (Group 2) were characterized by a significantly higher content of docosahexaenoic acid (C22:6), which exceeded that of the Saanen breed by 0.27% ($P < 0.05$) and the Ukrainian local breed by 0.18% ($P < 0.05$). However, the level of docosatetraenoic acid (C22:4) in the Russian White breed was lower by 0.01% ($P < 0.05$) compared with the Saanen breed.

The total amount of polyunsaturated fatty acids (SUM PUFA) was highest in the milk of Ukrainian local goats (7.79%), exceeding the values observed in the Saanen breed (6.20%) by 1.59% and in the Russian White breed (6.15%) by 1.64%. No statistically significant difference was observed in total PUFA content between the Saanen and Russian White breeds, amounting to only 0.05%.

The comparative analysis of total saturated (SFA) and unsaturated fatty acids (UFA) in the milk of goats from different genotypic groups (Table 5) did not reveal statistically significant differences ($P > 0.05$) among the examined breeds. Nevertheless, distinct tendencies were observed in both absolute and relative concentrations (Table 7).

Specifically, the milk of goats belonging to the Ukrainian local breed (Group 3) showed the highest proportion of total saturated fatty acids, reaching 69.61%. This value tended to exceed those observed in the Russian White breed (Group 2, 66.08%) and the Saanen breed (Group 1, 65.69%). In contrast, the total content of unsaturated fatty acids was slightly higher in the milk of Saanen goats (Group 1, 33.17%), showing a consistent trend toward elevated UFA levels compared with the Russian White (Group 2, 32.60%) and Ukrainian local breeds (Group 3, 32.52%).

While not statistically significant, these findings may reflect breed-specific differences in lipid metbolism and warrant further investigation with larger sample sizes and additional biochemical profiling.

## Discussion

It is known that the percentage of milk yield significantly depends on the season (Midau et al., 2010; Silva et al., 2021). According to reports, in dairy goats, climate change in the form of an increase in ambient temperature causes heat stress and negatively affects milk productivity (Yamani and Koluman, 2020; Sunagawa et al., 2015). However, according to the results of our research, milk productivity did not decrease during spring and summer temperature extremes, but was more sensitive to its decrease in the autumn, which did not quite coincide with the conclusions of other authors (Midau et al., 2010; Silva et al., 2021; Sunagawa et al., 2015; Yamani and Koluman, 2020).

Beyond seasonal influences on milk yield, evaluating the impact of breed on milk quality composition is crucially important for breeding programs and enhancing the nutritional value of dairy products. Modern research emphasizes the predominant influence of breed on milk quality parameters and

*Table 6.* Content of polyunsaturated fatty acids (PUFA) in milk of goats of different breeds (%)

| Fatty acid | Group 1 (Saanen breed) | Group 2 (Russian white breed) | Group 3 (Ukrainian local breed goats) |
|---|---|---|---|
| Tetradecadienoic acid (C14:2) | 0.82 ± 0.053[a] | 0.80 ± 0.067[a] | 0.97 ± 0.043[a] |
| Hexadecadienoic acid (C16:2) | 0.87 ± 0.014[a] | 0.70 ± 0.031[b] | 0.95 ± 0.026[c] |
| Linoleic acid (C18:2) | 3.07 ± 0.025[a] | 2.79 ± 0.038[b] | 3.87 ± 0.019[c] |
| Linolenic acid (C18:3) | 1.28 ± 0.010[b] | 1.15 ± 0.009[a] | 1.29 ± 0.011[b] |
| Arachidonic acid (C20:4) | 0.10 ± 0.006[b] | 0.05 ± 0.004[a] | 0.15 ± 0.028[c] |
| Docosadienoic acid (C22:2) | 0.15 ± 0.005[b] | 0.09 ± 0.003[a] | 0.14 ± 0.002[b] |
| Docosatrienoic acid (C22:3) | 0.09 ± 0.004[a] | 0.09 ± 0.006[a] | 0.10 ± 0.001[b] |
| Docosatetraenoic acid (C22:4) | 0.05 ± 0.002[a] | 0.04 ± 0.001[b] | 0.06 ± 0.005[a] |
| Docosahexaenoic acid (C22:6) | 0.17 ± 0.008[a] | 0.44 ± 0.015[b] | 0.26 ± 0.004[c] |
| SUM PUFA | 6.20 | 6.15 | 7.79 |

Note: different lowercase letters ([a, b, c]) indicate statistical differences between the groups at the level of $P < 0.05$; the same letters indicate that there is no statistically significant difference between the groups.

*Table 7.* Total amounts of saturated and unsaturated fatty acids in milk of goats of different breeds (%)

| Fatty acid category | Group 1 (Saanen breed) | Group 2 (Russian white breed) | Group 3 (Ukrainian local breed goats) |
|---|---|---|---|
| Sum of saturated fatty acids (SFA) | 65.69 ± 2.164[a] | 66.08 ± 2.008[a] | 69.61 ± 2.018[a] |
| Sum of unsaturated fatty acids (UFA) | 33.17 ± 0.987[a] | 32.60 ± 1.271[a] | 32.52 ± 1.215[a] |

Note: different lowercase letters ([a, b, c]) indicate statistical differences between the groups at the level of $P < 0.05$; the same letters indicate that there is no statistically significant difference between the groups.

derived products (Vacca et al., 2017; Shuvarikov et al., 2021; Fresno et al., 2021), as well as on the physicochemical properties of milk from various goat breeds (Alyaqoubi et al., 2015). Our results, based on a comparative analysis of fatty acid content in the milk of Saanen, Russian White, and Ukrainian local goat breeds, corroborate these findings, demonstrating significant breed-specific differences in fatty acid profiles. This supports the notion that the genetic factor is one of the strongest influences on milk quality (Vacca et al., 2017; Shuvarikov et al., 2021).

Analysis of medium-chain fatty acid (MCFA) content revealed substantial breed differences, underscoring the influence of breed on the milk fat profile. Our study showed that the Ukrainian local goat breed had statistically significantly higher levels of several important MCFA compared with the the Russian White breed. These findings, demonstrating notable excesses (ranging from 0.01% to 1.41% in absolute terms for individual acids), may indicate unique metabolic peculiarities of the Ukrainian local breed. For instance, the higher content of caprylic and capric acids, known for their antimicrobial properties (Žan et al., 2016), could enhance the functional attributes of milk from this breed. These data partially concur with studies by Halyna et al. (2019) and Bodnar et al. (2021), who also noted variations in the content of caprylic, capric, and lauric acids among breeds, although their specific values for Alpine goats differed from our findings for the Saanen breed.

Concurrently, Saanen goats exhibited statistically significantly higher levels of isocaprylic acid (C8:0) and lauroleic acid (C12:1) compared with the Russian White breed, which may reflect breed-specific characteristics in the metabolism of branched and unsaturated fatty acids. Russian White goats (Group 2), in turn, displayed a substantially higher level of undecylic acid (C11:0). The total sum of MCFA was highest in the milk of Ukrainian local goats (14.00%), surpassing the Saanen and Russian White breeds by 1.75% and 1.80%, respectively. We believe this is linked to the adaptation of local breeds to specific husbandry and feeding conditions, influencing the synthetic activity of the mammary gland, or to a genetic predisposition for more efficient de novo synthesis of fatty acids from precursors. Such significant differences in the MCFA profile highlight the potential of local breeds for selection and production of milk with improved characteristics, which is important in the context of the growing role of goat farming and environmental challenges, as noted by Röös et al. (2016).

In the profile of long-chain saturated fatty acids (LCFA-SFA), significant breed differences were observed, indicating distinct lipid metabolic pathways in the studied goat groups. Analyzing the obtained data, we see that the highest content of unsaturated fatty acids was in goats of the Saanen breed compared with goats of other breeds (Salari et al., 2016). Saanen goats (Group 1) demonstrated statistically significantly higher levels of several LCFA-SFA compared with the Russian White breed. Importantly, the content of myristic (C14:0) acid in Saanen goats was also substantially higher than in the Ukrainian local breed. Such data coincide with the data of other researchers (Žan et al., 2016), who proved that goats of the Saanen breed that grazed in highland conditions had a large amount of similar fatty acids, C16:0, C18:1, C14:0 in their milk, and C10:0. Under the conditions of our experiment, the highest content of saturated fatty acids in Saanen goats was stearic acid (C18:0). These data align with some previous studies indicating specific characteristics of the saturated fatty acid profile in Saanen goats. However, some of our results contradict the general assertion by Kyselov et al. (2022) that Saanen goats were "inferior to other breeds" in saturated acid content, as we observed higher levels of specific SFA in Saanen goats. This study also confirms with data (Kyselov et al., 2022) in terms of the amount of saturated acids in the milk of Saanen goats, which were inferior to other breeds. Other publications (Galina et al., 2019; Bodnár et al., 2021) have noted a similar trend, namely that only three saturated fatty acids – caprylic (C8:0), capric (C10:0) and lauric (C12:0) – were present in significantly higher amounts in Alpine goat milk than in goats of the Saanen breed, while the average content of saturated fatty acids in milk was 74.52 and 73.05%. These parameters may indicate particular adaptive mechanisms or genetic characteristics influencing lipid metabolism.

In contrast to the Saanen and Russian White breeds, Ukrainian local goats exhibited the highest content of specific LCFA-SFA, despite having the lowest total sum of LCFA-SFA (50.31%). This indicates a unique fatty acid profile characteristic of the locally adapted breed. For instance, the increased content of branched-chain fatty acids (isopalmitic) is believed to be associated with the peculiarities of the rumen microbiome and its influence on fatty acid synthesis. The difference in the total LCFA-SFA content between breeds (Saanen and Russian White having higher values) may be attributed to genetic factors affecting the efficiency of de novo fatty acid synthesis in the mammary gland or the utilization of circulating fatty acids. These differences hold significant implications for the nutritional value of milk, as various saturated fatty acids affect human health differently, and understanding their concentrations in milk from different breeds can aid in developing dietary recommendations and breeding strategies.

Analysis of the monounsaturated fatty acid (MUFA) profile in the milk of different goat breeds revealed significant breed-specific characteristics, which may indicate varying efficiency in MUFA synthesis or their incorporation into milk fat. Ukrainian local breed goats demonstrated statistically significantly higher levels of several valuable MUFA, compared with both Saanen and Russian White breeds. This suggests a potentially higher dietary value of milk from local breeds, as MUFA are known for their role in reducing the risk of cardiovascular diseases and improving blood lipid profiles. Concurrently, Saanen goats also had higher levels of some key MUFA acids compared with the Russian White breed, and palmitoleic (C16:1) acid compared with the Russian White. These data are consistent with numerous studies that consistently indicate a higher content of unsaturated fatty acids in Saanen goat milk (Salari et al., 2016; Yurchenko et al., 2018; Mykhalko et al., 2022). This may be attributed to the genetic characteristics of the Saanen breed that promote more active synthesis or accumulation of unsaturated fatty acids. Other researchers (Yangilar, 2013) found indicators of the content of stearic (C18:0) and oleic acid (C18:1) in the milk of Saanen goats to be identical to our results. Russian White goats (Group 2) distinguished themselves with the highest level of oleic acid (C18:1), surpassing the Ukrainian local breed. This parameter was also high in Saanen goats. A high content of oleic acid is nutritionally important as it is the main monounsaturated acid in milk, positively impacting health. Our data regarding the significant content of oleic acid aligns with the results of Yangilar (2013), who also reported substantial levels of this acid in Saanen goat milk. The total sum of MUFA was highest in the Saanen breed (26.65%), which is consistent with previous observations regarding their propensity for synthesizing a larger quantity of unsaturated fatty acids. Such inter-breed differences in the MUFA profile may be attributed to the complex interplay of genetic factors influencing the activity of desaturases, which are responsible for the formation of unsaturated bonds in fatty acids, as well as differences in lipid metabolism characteristic of each breed. Understanding these breed-specific features is crucial for optimizing selection and producing dairy products with desired nutritional characteristics.

In the context of polyunsaturated fatty acids (PUFA), significant inter-breed differences were observed, emphasizing the varying contribution of breed to the formation of this important class of fatty acids. Ukrainian local goats stood out with significantly higher levels of several PUFA compared with both Saanen and Russian White breeds. This has important nutritional implications, as linoleic and arachidonic acids are essential fatty acids that play a key role in preventing cardiovascular diseases, possess anti-inflammatory properties, and influence brain development. The observed advantage of local goats in the content of these acids indicates their potential as a source of milk with a high biological value. The total sum of PUFA was also highest in the milk of Ukrainian local goats (7.79%), significantly (by 1.59%

and 1.64%, respectively) exceeding the values for Saanen and Russian White breeds.

Our results demonstrate that the PUFA profile is breed-specific. While previous discussions might have suggested a superiority of Saanen goats in linoleic acid, our study clearly indicates the dominance of the Ukrainian local breed for linoleic acid (C18:2). According to our results, linolenic acid (C18:2) was the highest content of unsaturated fatty acids in Saanen goats compared with goats of other breeds. Concurrently, Saanen goats had a higher content of linolenic acid (C18:3) and docosadienoic acid (C22:2) compared with the Russian White breed. This confirms that different breeds may have varying propensities for synthesizing or incorporating specific PUFA into milk fat, which could be related to unique enzymatic systems (e.g., desaturases) or genetic markers controlling the metabolism of these acids. Russian White goats distinguished themselves with a significantly higher content of docosahexaenoic acid (C22:6), surpassing both other breeds. This is a valuable indicator, as C22:6 is an important omega-3 fatty acid associated with numerous health benefits. Such significant variations in PUFA content among breeds can be explained by the complex influence of breed on fatty acid metabolism, and potentially by breed-environment interaction. Although this study did not detail feeding specifics, it is known that diet (especially grazing) has a significant impact on the PUFA profile, often even greater than breed (Halyna et al., 2019; Bodnar et al., 2021). However, the observed differences likely reflect inherent breed-specific genetic characteristics since all animals were kept under the same conditions. Understanding these differences allows for a more targeted use of genetic resources from various breeds to produce milk with an optimal PUFA profile.

Our results regarding the higher content of unsaturated fatty acids in the milk of Saanen goats compared with goats from local selection and goats of other breeds are consistent with our previous data (Mykhalko et al., 2022). Similar to the claims of Tur et al. (2015), in our study, the content of certain unsaturated fatty acids in the milk of Saanen goats was higher compared with saturated fatty acids. A comparative analysis of the total sums of saturated (SFA) and unsaturated fatty acids (UFA) in the milk of goats from different genotypic groups did not reveal statistically significant differences. But the total amount of saturated and unsaturated fatty acids did not differ. Nevertheless, clear tendencies were observed in both absolute and relative concentrations. This aligns with our previous data (Mykhalko et al., 2022) and other studies (Tur et al., 2015), which also found no significant differences in the total quantity of SFA and UFA but noted breed-specific characteristics in their ratio. The consistency of our results with previous studies (Mykhalko et al., 2022; Tur et al., 2015) demonstrating a higher UFA content in Saanen goat milk across various management conditions confirms the stability of this breed-specific characteristic. The observation that the total amounts of SFAs and UFAs did not differ suggests that genetic and environmental factors primarily influence the ratio between these fatty acid groups rather than their overall concentration.

Discrepancies with some previous studies concerning genetic correlations (Maroteau et al., 2014) may be explained by complex genetic architecture and gene-environment interactions. Also, our assumptions are confirmed by research (Yurchenko et al., 2018), which in its conclusions states that goats of the Saanen breed have high levels of unsaturated fatty acids such as C16:0, C16:1 and C18:1 in their profile. However, our studies are somewhat inconsistent with the findings of other scientists who claim that in Saanen goats no significant genetic correlation was found between fat content and the presence of C16:0 fatty acids, while correlations between fat content and specific fatty acids of goats (C6:0–C10:0) were positive (0.17–0.59). In addition, the genetic correlation between fat content and C14:0 was negative (–0.17 to –0.35) (Maroteau et al., 2014). Such indicators of the content of fatty acids, in our opinion, are undoubtedly related not only to the breed factor and the peculiarities of feeding, but also to the significant influence of external factors of a natural nature. The influence of natural factors, such as seasonality and diet, on the fatty acid profile must be undeniable (Marcos et al., 2020; Tian et al., 2017; Yakan et al., 2019), and this can modify the expression of genetic characteristics. For example, studies show that feeding systems, especially grazing, have a greater influence on the essential fatty acid profile than breed, which may explain some differences compared with the literature, where housing conditions might have varied (Halyna et al., 2019; Bodnar et al., 2021). The variation in mammary gland absorptive and synthetic capacities, driven by breed, constitutes a fundamental cause of inter-breed differences in milk fatty acid composition. Distinct breeds exhibit varying efficiencies in the uptake of fatty acids from the bloodstream and possess differential activities of enzymes involved in de novo fatty acid synthesis within the mammary gland. This ultimately leads to the formation of a characteristic fatty acid profile for each breed.

The consistently higher content of unsaturated fatty acids in the milk of Saanen goats, corroborated by our findings and prior research (Salari et al., 2016; Žan et al., 2016; Yurchenko et al., 2018), holds significant implications for the nutritional value of dairy products. Milk with an elevated UFA content is considered more beneficial for human health, as these acids play a crucial role in the prevention of cardiovascular diseases, exhibit anti-inflammatory properties, and influence brain development. The genetic predisposition of the Saanen breed towards the synthesis of a greater quantity of UFAs represents a valuable trait that can be considered in goat selection and breeding programs. The detection of specific fatty acids – oleic acid (C18:1), myristic acid (C14:0), stearic acid (C18:0), and linoleic acid (C18:2) – at elevated concentrations in Saanen goat milk underscores the unique biochemical profile of this breed. These individual fatty acids exert diverse effects on milk flavor, texture, and health-promoting attributes. For instance, oleic acid is a monounsaturated fatty acid known for its positive impact on the cardiovascular system. Linoleic acid is a polyunsaturated omega-6 fatty acid essential for numerous physiological processes. Our results indicate that local goat breeds, such as the Ukrainian local, can be a valuable resource for producing milk with an elevated content of specific beneficial fatty acids, opening new opportunities for selection and improving the nutritional value of dairy products. Further research with larger sample sizes and additional biochemical profiling can provide a deeper understanding of these interrelationships.

## Conclusions

During the lactation period from March to September, goats of the Saanen breed have a higher milk productivity than their Russian white counterparts and Ukrainian local breed goats. The milk productivity of the experimental goat depended 13.00% on the external temperature and 81.33% on the breed. During lactation, at an average monthly variation of outdoor temperatures in the range of –4.4°C to 22.8°C, the milk volume of Saanen breed goats and Ukrainian local breed goats increased by 2 g and that of Russian White goats by 3 g when the temperature increased by 1°C.

The study revealed statistically significant differences in the content of medium-chain (MCFA), long-chain saturated (LCFA-SFA), monounsaturated (MUFA), and polyunsaturated fatty acids (PUFA) among goats of the Saanen, Russian White, and Ukrainian local breeds. This underscores the predominant influence of the genetic factor on milk quality.

The milk from Ukrainian local and Saanen breeds demonstrated high nutritional potential. Goats of the Ukrainian local breed showed a statistically higher content of a number of important MCFA (e.g., caprylic, capric, lauric acids) and PUFA (particularly, linoleic and arachidonic acids), indicating their potential as a source of milk with improved functional and biologically valuable characteristics. The Saanen breed, in turn, stands out with a higher content of certain unsaturated fatty acids, including the total sum of MUFA, which has positive implications for human health.

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## Conflict of Interest

The authors have not declared any conflict of interests.

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