DOI 10.32900/2312-8402-2023-130-4-15
UDC 636.2.082.26

DYNAMICS OF MILK PRODUCTIVITY AND BODY WEIGHT OF COWS BY AGE AND PERIODS OF LACTATION

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The research was conducted on the farms of the Stepne State Enterprise and the Agroprogres Private Enterprise (stall housing) and on the dairy complex of the Kutuzivka State Enterprise (free housing).

It was established that the shape of the lactation curve of first-borns significantly differed from the classical one during untethered confinement. The average daily milk yield reached a maximum at 3-4 months and almost did not decrease until the 7th month of lactation. In older cows, fertility increased and reached a maximum at 2-3 months of lactation, and then gradually decreased. The relative increase in milk yield in comparison with the first month of lactation was 31% in first-born cows, 17% in second-calving cows, 7% in third-calving cows, and 18% in older animals, and in stall housing – 33%, 17%, 10 % and 2 %, respectively. The power of influence (η^2) of the month of lactation on the fat content in milk during untethered confinement was 8.5% in first-born cows, 14.5% in the second lactation, 13.1% in the third lactation, 12.2% in older cows, and for tethered confinement 14.8%, 36.9%, 33.6%, and 11.6%, respectively ($p<0.001$). Similar to the fat content in milk, the protein content of cows also changed during lactation. At the same time, the influence of the month of lactation on this indicator was much smaller than on the fat content, and in some cases it was improbable for stall housing.

The influence strength of the month of lactation on the daily yield of cows that were culled from the herd was 23.8% for free housing, 1.9% for body weight, and 8.0% for stall housing and 11.6 % ($p<0.001$). Correlation coefficients are 0.181, +0.411, and –0.223, +0.335, respectively ($p<0.01$).

Age-related changes in the body weight of animals depended on the technology of their husbandry. In free housing, it was higher both in the sample as a whole (6%) and in animals of different lactations (3-14%). The increase in body weight of cows with age in free housing was: 31 kg in the second lactation, 71 kg in the third lactation, and 100 kg in adult cows, while in stall housing these differences were only 6, 11, 35 kg, respectively.

Key words: husbandry technology, dairy cattle, age, month of lactation, daily yield, fat content, protein content, body weight.

ДИНАМІКА МОЛОЧНОЇ ПРОДУКТИВНОСТІ ТА ЖИВОЇ МАСИ КОРІВ ЗА ВІКОМ ТА ПЕРІОДАМИ ЛАКТАЦІЇ

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Дослідження проводили на фермах ДП ДГ «Степне» та ПП «Агропрогрес» (прив'язне утримання) та на молочному комплексі ДП ДГ «Кутузівка» (безприв'язне утримання).

Встановлено, що за безприв'язного утримання форма лактаційної кривої первісток значно відрізнялась від класичної. Середньодобові надої досягали максимуму на 3-4 місяці і майже не знижувались до 7 місяця лактації. У корів старшого віку надій зростав і досягав максимуму на 2-3 місяць лактації, а в подальшому поступово знижувався. Відносне збільшення надоїв у порівнянні з першим місяцем лактації у первісток складало 31 %, у корів другого отелення – 17 %, третього – 7 %, а у старших тварин – 18 %, а за прив'язного утримання – 33 %, 17 %, 10 %, та 2 %, відповідно. Сила впливу (η^2) місяця лактації на вміст жиру в молоці за безприв'язного утримання була у первісток – 8,5 %, на другій лактації 14,5 %, на третій лактації 13,1 %, у старших корів 12,2 %, а за прив'язного утримання 14,8 %, 36,9 %, 33,6 %, та 11,6 %, відповідно ($p<0,001$). Аналогічно вміст жиру в молоці на протязі лактацій змінювався і вміст білка у корів. При цьому сила впливу місяця лактації на цей показник була значно менша, ніж на вміст жиру, а за прив'язного утримання у ряді випадків невірогідною.

Сила впливу місяця лактації на добовий надій корів, яких було вибракувано зі стада, за безприв'язного утримання складала 23,8 %, на живу масу – 1,9 %, а за прив'язного утримання – 8,0 % та 11,6 % ($p<0,001$). Коефіцієнти кореляції відповідно –0,181, +0,411, та –0,223, +0,335 ($p<0,01$).

Вікові зміни живої маси тварин залежали від технології їх утримання. За безприв'язного утримання вона була вища як у цілому по виборці (6 %), так і у тварин різних лактацій (3-14 %). Зростання живої маси корів із віком за безприв'язного утримання складало: у другу лактацію 31 кг, у третю лактацію - 71 кг та у повновікових корів – 100 кг, а за прив'язного утримання ці відмінності були лише 6, 11, 35 кг, відповідно.

Ключові слова: технологія утримання, молочна худоба, вік, місяць лактації, добовий надій, вміст жиру, вміст білка, жива маса.

The milk productivity of cows is significantly related to a number of factors, in particular the genotype of the animals, the conditions of their cultivation and maintenance, as well as the characteristics of each individual animal. It is known about the presence of age variability of cows in terms of milk yield. The research of domestic scientists revealed that the milk productivity of cows of the Ukrainian black and white dairy breed increased on average up to 4 calvings, after which it decreased. By this age, more than 56% of animals died, which made it impossible to achieve maximum livestock productivity (Klymkovetskyi and Nosevych, 2020). Other scientists (Vedmedenko and Alimova, 2021) established that the achievement of the highest level of milk yield is typical for cows in the sixth lactation, which is 18.8% higher compared to first-born cows and 3.7-10.5% higher than other age periods. According to the results of Turkish researchers (Eşki and Kurt, 2021), milk production increased in the first three lactations,

remained stable in the 3rd and 4th lactations, and decreased in the 5th and 6th lactations. In the studies of Korean scientists, a reliable relationship between milk yield and lactation number was found, with the maximum yield of cows in the third lactation (Vijayakumar et al., 2021). However, domestic scientists indicate that Holstein cows achieved maximum milk yield in the first lactation, when gross milk production exceeded that of animals in the third lactation by 2,407.1 kg or by 15.40% ($P < 0.05$) (Kapshuk, 2020). In studies (Mazur et al., 2018), the age of achieving the best lactation performance in cows of the Holstein breed was 1.86 lactations, and in animals of the Ukrainian black-and Red-and-White dairy breeds it was 1.83 and 1.79 lactations, respectively. Nevertheless, according to the results of other studies (Hartanto et al., 2020), it was concluded that dairy cows of the Holstein-Friesian breed had the highest productivity in the 4th lactation period. It has been established that the earlier a cow reaches high milk yields and keeps them stable longer, the higher its productivity per lactation (Sharapa and Boiko, 2018; Calsamiglia S. et al., 2020). However, other domestic scientists outline that the fact that with intensive exploitation technology, the level of milk productivity in cows increases from the first to the fourth calving, after which it slightly decreases, indicates the physiological exhaustion of the organism (Hutsuliak, 2019).

Some researchers (Gorelik et al., 2021) note a low negative relationship between body weight and milk yield of cows, which increases with age up to 3 lactations. The greatest decrease in milk yield was observed in the fifth lactation. A moderate positive genetic correlation between lactation constancy and 305-day milk yield indicates that selection for increased milk yield may slightly improve lactation constancy (Shokri-Sangari et al., 2019). According to (Hoy et al., 2012), body weight of all cows decreased from an average of 581 kg after calving to an average of 576 kg in the first week. The smallest body weight (532 kg) was reached after 42 days of lactation. The greatest loss of body weight was observed in first-born cows (9.7%), and in cows of the 2nd and 3rd lactation – the least (6.9%). Cows with above-average body weight loss were found to have a longer service period and required more inseminations for insemination than cows with below-average body weight loss. Similar data were obtained by other researchers (Řehák et al., 2012), who indicated that the loss of live masiz 1 to 8 weeks after calving was probably negatively correlated with the length of the service period between calving and fertile insemination. Changes in body weight during the first 120 days of lactation in high-yielding cows have been studied in detail in studies (Straten et al., 2008; Hazel et al., 2017). However, the authors note the large individual variability in these characteristics in the groups and the need for further research to clarify the relationship between changes in body weight, milk yield and reproductive function.

Some studies have shown that heifers and cows that produced more milk at the beginning of lactation often had a greater decline in body condition during this same period (Manríquez et al., 2021; Tribout et al., 2023). This rapid mobilization of energy reserves can lead to debilitating metabolic disturbances in the short term and have long-term effects on fertility and immunity (Stevenson, et al., 2020). French researchers (Faverdin, et al., 2017) point out that we should not neglect the fact that the amount of feed consumed, which is minimal during calving and increases sharply during lactation, partly hides the weight loss of cows at the beginning of lactation and can lead to an underestimation of the body's mobilization. Cows with a high body fat index also tend to consume more feed, which is a favorable characteristic when trying to limit disturbance in early lactation (Lefebvre et al., 2023). In the studies of Turkish scientists (Kul et al., 2021) it was established that body weight and milk yield increased until the fourth lactation, then they decreased. The lowest body weight was observed in the first two months

of lactation, and increased linearly with the following period of lactation. Based on the results of this study, it is suggested that monitoring body weight changes at the beginning and in the middle of lactation can be used as a management tool to improve milk yields in dairy herds.

Although dairy cattle breeding has focused on improving performance in leading dairy countries, there are also opportunities to improve the shape of lactation curves and milk composition related to human health (Cole et al., 2023). The quality of cow's milk remains a key issue that determines the success of dairy farming as a whole. Research (De Vries and Marcondes, 2020) found that herds with the longest productive lifespan had the highest somatic cell count in milk, the highest age at first calving and the highest conception rate.

At the same time, the above-mentioned factors in the conditions of various technologies of maintenance in Ukraine have not been sufficiently studied.

The purpose of the work is to determine the dynamics of body weight, milk productivity and milk quality of cows by age and lactation periods in the conditions of different husbandry technologies.

Research materials and methods. The research used the data of control milking and weighing of cows of three farms over the past 10 years. On the farms of the Stepne State Enterprise and the Agroprogres Private Enterprise, stall housing was used, and at the dairy complex of the Kutuzivka State Enterprise, free housing was used. Cattle feeding was separated according to the husbandry technology by different types of fodder and full-rational fodder mixes, and cows were milked in stalls and milking halls.

When conducting the study, only the data of cows that had weighing records in the month of control milking were used. All data was divided into gradations. The first group includes animals that have not been eliminated during the current month, the second group includes culling animals in the current month. The average values of daily milk yield, fat and protein content in milk of cows of different ages and stages of lactation were determined. We conducted a comparative analysis of the data that were obtained using different retention technologies.

Data processing was carried out according to basic statistical methods using the SPSS-20 computer program. Average values and their errors, correlation coefficients were calculated. The forces of influence were determined based on the results of variance analysis, and the probability was determined using the Fisher test. The comparison of average values and the probability of correlations was carried out according to the Student's test.

Research results. At the first stage of research, age-related differences in milk productivity and body weight of cows under different technologies of their husbandry were studied (tables 1-2).

Cows that did not drop out in the control month of lactation had an average daily weight yield of 1.6 kg lower in stall housing compared to tethered animals. But according to the average content of fat and protein in milk, as well as according to body weight, cows that were kept free had an advantage by 0.15%, by 0.01% and 33 kg ($p<0.001$).

By comparing the age-related changes in milk productivity, it was established that with free housing, the daily yield increased with age from the first to the second lactation by 2 kg, and then decreased by 1.4 kg in the third lactation, and in cows of the fourth lactation and older by 4.5 kg. During stall housing, the maximum average daily yield was obtained from cows of the 3rd lactation, which was higher by 1.1 kg in comparison with the second lactation and 2.6 kg – with the third ($p<0.001$). Age differences in the content of fat and protein in milk have not been established.

Table 1

Milk productivity of cows and their body weight in the month of control milking under untethered conditions

Lactation number	Daily yield, kg		Fat percentage		Protein percentage		Body weight, kg	
	n	M±m	n	M±m	n	M±m	n	M±m
No culling animals in the current month								
1	11687	20.3±0.06	10002	3.69±0.003	10002	3.11±0.002	11687	561±0.7
2	5303	22.3±0.12	4613	3.71±0.005	4610	3.14±0.004	5303	592±0.9
3	3265	20.9±0.16	2858	3.69±0.007	2859	3.13±0.005	3265	632±1.2
4-12	5102	17.8±0.13	4522	3.69±0.006	4527	3.12±0.004	5102	661±1.0
Total	25357	20.3±0.04	21995	3.69±0.002	21998	3.12±0.002	25357	597±0.5
Culling animals in the current month								
1	180	14.4±0.72	98	3.68±0.043	98	3.08±0.025	180	484±6.4
2	217	14.4±0.74	129	3.69±0.040	130	3.07±0.025	217	518±6.4
3	157	14.0±0.85	82	3.84±0.056	84	3.04±0.026	157	544±9.0
4-12	239	10.5±0.62	107	3.73±0.045	108	3.05±0.025	239	604±7.6
Total	793	13.2±0.34	416	3.73±0.021	420	3.06±0.012	793	541±3.0

Table 2

Milk productivity of cows and their body weight in the month of control milking under stall housing

Lactation number	Daily yield, kg		Fat percentage		Protein percentage		Body weight, kg	
	n	M±m	n	M±m	n	M±m	n	M±m
No culling animals in the current month								
1	3539	20.9±0.11	3472	3.60±0.007	3489	3.09±0.003	3539	545±1.2
2	1549	22.0±0.23	1533	3.55±0.009	1536	3.12±0.004	1549	551±1.4
3	1569	23.5±0.20	1525	3.50±0.010	1532	3.11±0.005	1569	556±1.4
4-12	5794	22.1±0.10	5739	3.50±0.005	5751	3.11±0.003	5794	580±0.9
Total	12451	21.9±0.06	12269	3.54±0.004	12308	3.11±0.001	12451	564±0.6
Culling animals in the current month								
1	104	13.5±0.76	97	3.65±0.047	98	3.09±0.010	104	495±8.6
2	129	13.5±0.73	120	3.65±0.026	121	3.09±0.009	129	553±8.6
3	112	12.6±0.75	107	3.59±0.028	107	3.06±0.012	112	578±9.7
4-12	193	11.9±0.48	188	3.60±0.021	188	3.10±0.010	193	589±7.3
Total	538	12.7±0.33	512	3.62±0.021	514	3.09±0.004	538	560±3.8

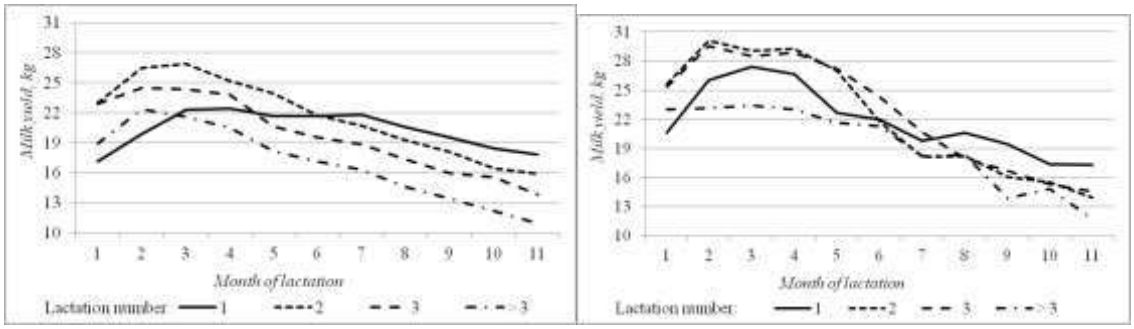
As for the body weight of cows of different ages, it depended on the technology of husbandry. During free housing, body weight was higher both in the sample as a whole (6%) and in animals of different lactations (3-14%). It is important to pay attention to the fact that the increase in the weight of cows with age was greater in free housing. Thus, the weight of animals increased with age for free housing by 31 kg in the

second lactation, by 71 kg in the third lactation, and by 100 kg in adult cows, while in stall housing these differences were only 6, 11, 35 kg, respectively ($p<0.001$).

Next, the differences in performance indicators of cows that were culled from the herd were considered. When kept untethered, these animals had an average daily weight of 7.1 kg less ($p<0.001$), fat content 0.04% more ($p<0.05$), protein content 0.06% less ($p<0.001$) and body weight was 56 kg lower, compared to cows that remained in the herd ($p<0.001$). Similar trends were established for stall housing. The differences, respectively, were –9.2 kg ($p<0.001$), +0.06% ($p<0.01$), –0.02% ($p<0.01$) and –4 kg ($p>0.05$). It should be mentioned that the average daily milk yield of cows that were left out was probably higher when kept without tethering compared to stall housing. This indicates that a lower percentage of animals were eliminated due to low milk production in free housing than in stall housing. Average daily milk yield and body weight of older cows that died in the current month were lower compared to first-borns.

In contrast to free housing, in which the body weight of cows that left the herd, regardless of age, was lower in first-borns by 77 kg, cows of 2 lactations by 77 kg, cows of 3 lactations by 88 kg, 4 lactations and older by 57 kg ($p<0.001$) compared to animals that remained in the herd. In stall housing, only the weight of first-borns was lower by 50 kg ($p<0.001$), and the culled animals of older age had a body weight of 2-22 kg higher ($p>0.05$).

The second stage of research was aimed at studying the characteristics of changes in the productivity of cows and body weight during different lactations under different husbandry technologies. The dynamics of changes in the average daily milk yield of animals depending on the number of calving is shown in Figure 1.



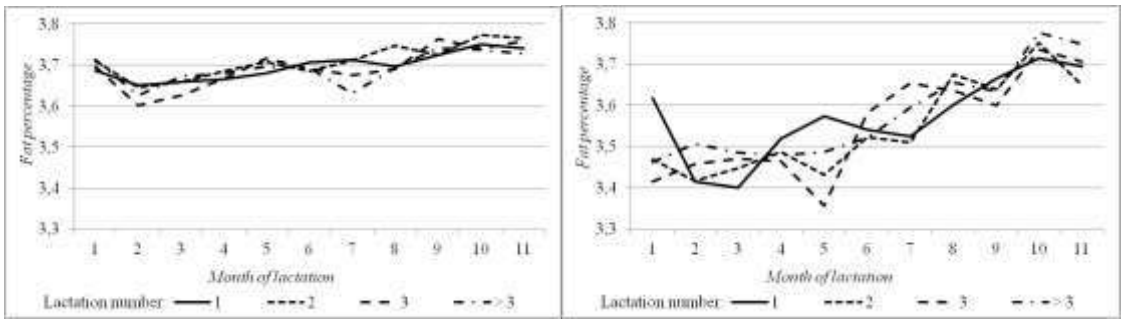
Free housing *Stall housing*

Fig. 1. **– Dynamics of daily milk yield of cows under different technologies of husbandry**

The lactation curve of first-borns significantly differed from the classical one during free housing. The average daily milk yield reached a maximum at 3-4 months of lactation and almost did not decrease until the 7th month. In older cows, the shape of the lactation curve was similar to the classical one. At the beginning of lactation, yield increased and reached a maximum at 2-3 months of lactation, and then gradually decreased. So, in cows of the second lactation, in the first month after calving, it was 23.0±0.38 kg, the maximum yield – 26.9±0.42 kg, and on the 11th month of lactation, it decreased to 15.9±0.48 kg. Accordingly, in the third lactation, milk yield was: 22.9±0.48, 24.5±0.67 and 13.8±0.63 kg, and in older animals: 18.9±0.41, 22.4±0.57 and 11.0±0.46 kg. The relative increase in milk yield compared to the first month of lactation was 31% in first-born cows, 17% in second-calving cows, 7% in third-calving cows, and 18% in older animals. The influence (η^2) of the month of lactation on daily fertility was: at the first calving – 8.5%, at the second lactation – 14.5%, at the third lactation – 13.1%, and in older cows – 12.2% ($p <0.001$).

The power of influence (η^2) of the month of lactation under stall housing on daily yield was higher and was equal to: at the first calving – 14.8%, at the second lactation – 36.9%, at the third lactation – 33.6%, and at more older cows – 11.6% ($p<0.001$). This indicates a smaller influence of other factors and more comfortable conditions of detention during tethered detention. The relative increase in milk yield compared to the first month of lactation was 33% in first-born cows, 17% in second-calving cows, 10% in third-calving cows, and 2% in older animals.

Figure 2 shows the changes in the fat content in the milk of cows according to the data of daily milk yield under different husbandry technologies.



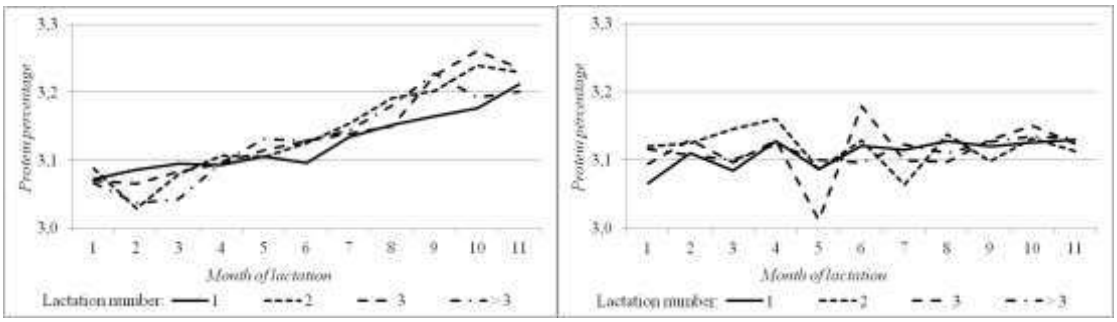
Free housing *Stall housing*

Fig. 2. **– Changes in the fat content in the milk of cows according to the data of daily milk yield under different technologies of husbandry**

During free housing, changes in milk fat content were small but plausible. The influence (η^2) of the month of lactation on this indicator was: at the first calving – 8.5%, at the second lactation 14.5%, at the third lactation 13.1%, and in older cows 12.2% ($p<0.001$). At the same time, the following clear trend was observed: in the first month of lactation, the fat content was at the level of 3.7%, in the second month of lactation, it decreased by 0.04-0.10%, then gradually increased and reached a maximum at 10-11 months of lactation (3.74-3.77%). This is due to changes in daily milk yield and the well-known relationship between milk yield and milk fat content.

Changes in the fat content in the milk of cows during husbandry were more significant. The influence (η^2) of the month of lactation on this indicator was: at the first calving – 14.8%, at the second lactation 36.9%, at the third lactation 33.6%, and in older cows 11.6% ($p<0.001$). Although the aforementioned trend was less clearly expressed in different lactations: in the first month of lactation, the fat content was at the level of 3.42-3.62%, in the second month it was equal to 3.42-3.51%, then it gradually increased and reached a maximum at 10-11 months of lactation (3.55-3.71%).

Similar to the content of fat in milk during lactation, the protein content of milk in cows kept without tethering also changed (Fig. 3). In the first month of lactation, it was equal to 3.06-3.09%, in the second month it slightly decreased and by the end of lactation it increased to 3.11-3.24%. At the same time, the influence (η^2) of the month of lactation on this indicator was much smaller than on the fat content and was: at the first calving – 2.4%, at the second lactation 5.1%, at the third lactation 4.8%, and at older cows 4.0% ($p<0.001$).



Free housing *Stall housing*

Fig. 3. **– Changes in the protein content in the milk of cows according to the data of daily milk yield under different technologies of husbandry**

During stall housing, the protein content practically did not depend on the month of lactation of the cow. The probable influence of the stage of lactation on the protein content of 3.1% and 2.5% ($p<0.001$) was established only in cows of the 1st and 3rd calving. The value of this indicator increased in cows of the above-mentioned lactations from 3.07-3.09% in the first month of lactation to 3.12-3.13% at the end of lactation.

The nature of changes in the body weight of cows during lactation depended on the number of calving (Fig. 4). Unfortunately, body weight data were incomplete for a number of months of lactation during stall housing, so they were not analyzed.

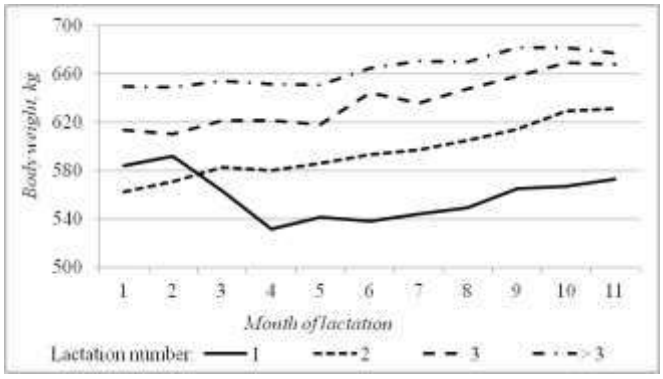
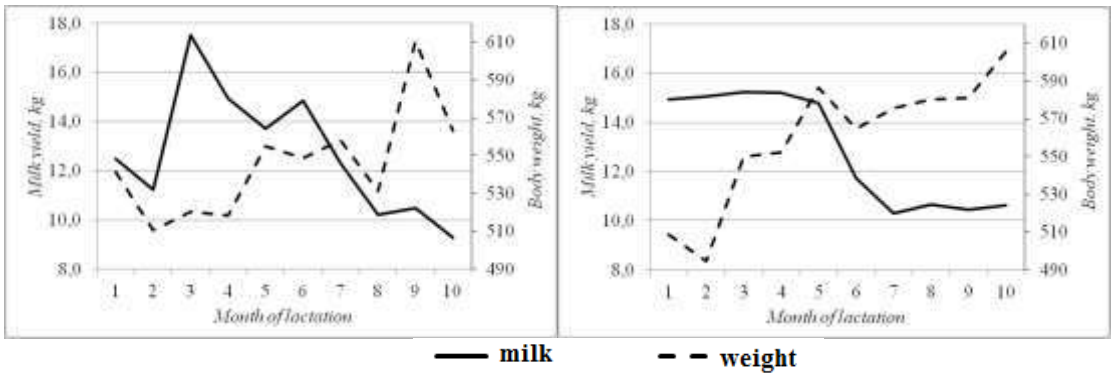


Fig. 4. **– Dynamics of body weight of cows during lactations under free housing technology**

During the period of lactation, the body weight of the first-borns changed as follows when they were kept untethered. In the first two months of lactation, it almost did not change (584±1.7 and 592±1.9 kg). In the third-fourth month after calving, their weight decreased by 29-61 kg, and starting from the fifth month, it gradually increased. At the same time, at the 11th month of lactation, it did not reach the value of the second month and was 19 kg lower. This indicates a negative energy balance at the beginning of lactation in first-borns. Nevertheless, this phenomenon was not observed in older lactating cows. The body weight of cows of the second calving gradually increased by 68 kg during 11 months of lactation, of the third – by 55 kg, and of the fourth – by 27 kg.

The influence (η^2) of the month of lactation on body weight was: at the first calving – 9.7%, in the second lactation – 10.1%, in the third lactation – 7.0%, and in older cows – 3.0% ($p<0.001$).

Figure 5 shows the dynamics of daily milk yield and body weight of cows at weaning in different months of lactation.



Free housing *Stall housing*

Fig. 5. **–Daily milk yield and body weight of cows at culling in different months of lactation under different technologies of husbandry**

As the graphs show, during the first two months of lactation, the average daily weight yield of cows that were left was at the level of 12.5±0.64 -11.2±1.3 kg, then in the 3rd month it probably increased to 17 .5 ± 1.25 kg and was at the level of 13.7 ± 1.41 - 14.9 ± 0.95 kg at 4-6 months of lactation. In the future, it gradually decreased to 9.3±1.57 kg. Changes in the body weight of cows were as follows: in the first month of lactation, cows with a body weight of 541±7.4 kg were eliminated; in 2-4 months of lactation, the animals that dropped out had a weight of 21-30 kg lower; in the following months of lactation, their body weight increased. The power of influence (η2) of the month of lactation on daily yield was 23.8%, and on body weight – 1.9% ($p<0.001$), correlation coefficients were -0.181 and +0.411 ($p<0.01$), respectively.

During stall housing, the average daily weight yield of cows that died during the first five months of lactation was 14.8±1.34 - 15.2±1.06 kg, and subsequently decreased to 10.3±1.03 - 10.6±0.77 kg. The body weight of cows that died in the first month of lactation was 509±13.4 kg, in the second month of lactation animals with a slightly lower weight (495±12 kg) were died, and later their body weight increased to 605±11.9 kg. The power of influence (η^2) of the month of lactation on daily yield was 8.0%, and on body weight – 11.6% ($p<0.001$), correlation coefficients were -0.223 and +0.335 ($p<0.01$), respectively.

Discussion. According to our data, it was established that the daily yield of cows under free housing increased with age from the first to the second lactation, and then decreased, while the maximum average daily yield was obtained from cows in the third lactation during stall housing. At the same time, according to Ukrainian scientists (Klymkovetskyi A. A. and D. K. Nosevych, 2020; Hutsuliak, 2019), animals with 4 calvings had the highest yield, and according to (Vedmedenko and Alimova, 2021), the achievement of the highest level of yield is characteristic of cows in the sixth lactation. However, our results are consistent with Eşki and Kurt, 2021; Vijayakumar et al., 2021; Gorelik et al., 2021. Nevertheless, some researchers (Kapshuk, 2020) indicate the highest yield for the1st lactation, and others for the second (Mazur et al., 2018). Daily milk yield of cows depends significantly on paratypic and genetic factors. Under different conditions of their maintenance and the level of annual genetic improvement of dairy cattle, age-related changes in milk productivity differ.

As for the dynamics of the body weight of cows during lactation, we have established that in the third-fourth month after calving, the weight of the first-borns decreased by 29-61 kg during free housing. Other researchers point to the loss of body weight of cows in a third of lactation (Hoy et al., 2012). They also indicate that the greatest loss of body weight was observed in first-born cows, and the least in cows of

the 2nd and 3rd lactation. Similar data were obtained by other researchers (Řehák et al., 2012; Stevenson, et al., 2020; Manríquez et al., 2021; Tribout et al., 2023). It should be noted that the phenomenon of negative energy balance is primarily related to the inconsistency of the feeding level with the genetic potential of the animal's milk productivity.

Conclusions:

1. The technology of husbandry, feeding and milking dairy cattle affects the nature of changes in milk productivity and body weight of cows with age and during lactation.

2. The daily yield of cows increased with age from the first to the second lactation under free housing, and during tethered husbandry the maximum average daily yield was obtained from cows of 3 lactations.

3. The increase in body weight of cows under free housing was 31 kg in cows of the second lactation, 71 kg in cows of the third lactation, and 100 kg in older cows, while in tethered husbandry these differences were only 6, 11, 35 kg, respectively.

4. Cows, which were culled from the herd, under untethered conditions had an average daily yield of 7.1 kg less, a fat content of 0.04% more, a protein content of 0.06% lower, and a body weight lower by 56 kg. than the cows that remained in the herd, the differences were – 9.2 kg, +0.06%, –0.02% and –4 kg, respectively.

5. In free housing, the body weight of cows that left the herd was lower by 77 kg in first-born cows, by 77 kg in the 2nd lactation cows, by 88 kg in the 3rd lactations, and by 57 kg in the 4^{th} lactation and older cows compared to animals that remained in the herd. Only the weight of the first-borns was lower by 50 kg during tethered husbandry.

6. The decrease in the body weight of the first-borns was established for the 3-4th month of lactation under free housing, which indicates a negative energy balance at the beginning of lactation. In older cows, fertility increased and reached a maximum at 2-3 months of lactation, and then gradually decreased.

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