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# EFFICIENCY OF REARING REPAIR HEIFERS OF DAIRY BREEDS IN CORRELATION WITH MILK PRODUCTIVITY

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*The article presents analytical data on the assessment of Holstein, Ukrainian Black-and-White dairy and Ukrainian Red-and-White dairy heifers for the development of live weight in the dynamics of rearing from birth to 18 months of age. The study was conducted in the same conditions of the herd of LLC "Kamyshevatsky dairy complex" of the Kharkiv region. The assessment of heifers by absolute and relative indicators of live weight gain showed a high level of heifers rearing on the farm. In terms of live weight of heifers in the studied age periods of 6, 9, 12, 15 and 18 months, they exceeded the target standards of the Holstein breed by 7.8; 12.5; 42.7; 43.1 and 40.4 kg, respectively, the Ukrainian Black-and-White dairy – by 5.7; 11.2; 37.8; 39.3 and 37.1 kg, and the Ukrainian Red-and-White by 8.6; 13.4; 35.7; 37.9 and 35.9 kg. According to the indicators of absolute and relative growth of live weight of repair heifers of controlled breeds in the three-month dynamics of postnatal ontogenesis, interbreed differentiation was established with a significant advantage of Holstein heifers during the entire growing period. Holstein heifers in the three-month Age periods of 3-6, 6-9 and 9-12 with a high and statistically significant difference were better than the peers of Ukrainian Black-and-White and Red-and-White dairy in terms of average daily live weight gain by 32.9 and 47.5, respectively; 15.6 and 61.7 and 25.9 and 56.4 g ($p<0.001$). However, the greatest difference in average daily growth in Holstein heifers was found in the age period of 15-18 months and amounted to 69.1 and 115.7 g ($p<0.001$) in their favor. Holstein heifers took a priority position in terms of relative live weight gain during the entire rearing period. Thus, in the 0-3-month age period, at the highest growth rate (93.7%), Holstein heifers were dominated by the peers of the Ukrainian Black-and-White dairy by 1.7 % ($p<0.001$) and the Ukrainian Red-and-White by 2.1 % ($p<0.001$). A similar excess of Holstein heifers of the same age as Ukrainian Black-and-White and Red-and-White dairy breeds in relative development was observed during all three-month growing periods and in the last 15-18 month period it was 1.4 % ($p<0.001$) and 2.4 % ($p<0.001$), respectively. A direct correlation was established between the live weight of heifers and the average daily weight gain with signs of milk productivity of first calving cow for 305 days of lactation, regardless of breed.*

**Keywords:** Holstein, Ukrainian Black-and-White, Ukrainian Red-and-White, heifers, live weight, milk productivity, correlation.

# ЕФЕКТИВНІСТЬ ВИРОЩУВАННЯ РЕМОНТНИХ ТЕЛИЦЬ МОЛОЧНИХ ПОРІД У СПІВВІДНОСНІЙ МІНЛИВОСТІ З МОЛОЧНОЮ ПРОДУКТИВНІСТЮ

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*У статті наведено аналітичні дані з оцінки телиць голштинської, української чорно-рябої молочної та української червоно-рябої молочної порід за розвитком живої маси у динаміці вирощування від народження до 18-ти місячного віку. Дослідження проведено в однакових умовах стада ТОВ "Комишуватський Молочний Комплекс" Харківської області. Оцінка телиць за абсолютними та відносними показниками приросту живої маси засвідчила про високий рівень вирощування телиць у господарстві. За живою масою телиць у досліджувані вікові періоди 6, 9, 12, 15 і 18 місяців перевищували цільові стандарти голштинської породи відповідно на 7,8; 12,5; 42,7; 43,1 та 40,4 кг, української чорно-рябої молочної – на 5,7; 11,2; 37,8; 39,3 та 37,1 кг та української червоної молочної – на 8,6; 13,4; 35,7; 37,9 та 35,9 кг. За показниками абсолютного та відносного приросту живої маси ремонтних телиць підконтрольних порід у трьохмісячній динаміці постнатального онтогенезу встановлено міжпородну диференціацію з достовірною перевагою телиць голштинської породи упродовж усього періоду вирощування. Телиці голштинської породи у вікові тримісячні періоди 3-6, 6-9 та 9-12 з високою та статистично значущою різницею були кращими за одноліток українських чорно- та червоно-рябої молочних за середньодобовим приростом живої маси відповідно на 32,9 та 47,5; 15,6 та 61,7 і 25,9 та 56,4 г ($p<0,001$). Проте, найбільша різниця за середньодобовим приростом у голштинських телиць виявилася у віковий період 15-18 місяців і склала на їхню користь 69,1 та 115,7 г ($p<0,001$). За показником відносного приросту живої маси упродовж усього періоду вирощування пріоритетну позицію займали голштинські телиці. Так, у 0-3 місячний віковий період, за найвищої напруги росту (93,7 %) телиці голштинської породи переважали одноліток української чорно-рябої молочної на 1,7 % ($p<0,001$) та української червоно-рябої – на 2,1 % ($p<0,001$). Аналогічне перевищення голштинських телиць одноліток українських чорно-рябої та червоно-рябої молочних порід за відносним розвитком було упродовж усіх тримісячних періодів вирощування і в останній 15-18 місячний період воно склало відповідно 1,4 % ($p<0,001$) та 2,4 % ($p<0,001$). Встановлено пряму кореляцію між живою масою телиць і середньодобовими приростами з ознаками молочної продуктивності первісток за 305 днів лактації незалежно від породи.*

**Ключові слова:** голштинська, українська чорно-ряба, українська червоно-ряба, телиці, жива маса, молочна продуктивність, кореляція.

**Introduction.** Efficient, systematic and purposeful rearing of repair heifers is one of the main and important tasks of profitable development of the dairy cattle industry (Antonenko S. F., et al. 2022; Pankieiev, S. R. and Pylypenko Yu. G., 2021). A number of scientific studies have proven the positive correlation of live weight variability of heifers during their rearing period with indicators of economically useful characteristics of cows in adulthood, in particular with the level of milk productivity (Luhovyi S. I.,

2023; Polupan Yu. P. and Pryima S. V., 2024; Siriak V. A. et al. 2019), reproductive capacity (Tytarenko I. V. et al., 2016; Polupan Yu. P. et al., 2022) and the duration of lifelong use (Babik, N. P. et al., 2017). It is also proved that the growth and development of repair young animals is significantly affected by the cultivation technology (Vedmedenko, O. V. and Fursenko M. V., 2020), breed, genotype (Borshch O. O. and Ruban S. Yu., 2017; Radchenko et al., 2008), belonging to the line (Shkurko T. P., 2010; Petryshyn M. A. et al., 2024; Kuziv M. I. et al., 2024).

Authors of the study (Tytarenko I. V. et al., 2016; Tytarenko I. V. et al., 2016; Vedmedenko O. V., 2023) note that intensive rearing of heifers and the possibility of their early involvement in breeding use can significantly reduce the unproductive period and reduce the age of first fertilization. Conducted research (Shuliar A. L. et al., 2020; Shpetnyi M. B. et al., 2021; Kuziv M. I. and Fedorovych Ye. I., 2014) confirm that the key factors for determining the optimal insemination time are not so much age as live weight and the overall level of physical development of animals. Insemination of heifers with insufficient live weight, regardless of their age, negatively affects their productivity and overall economic value.

Studying the reports of scientists regarding the indicators that relate to the growth and development of repair heifers for live weight, it is possible to observe significant variability both within breeds and experimental farms in the dynamics of its growth from birth to mating age. Thus, according to studies of heifers of the Ukrainian Ukrainian Red-and-White dairy breed (n=1075), the average live weight in the periods from newborns, at 6, 12 and 18 months, was, respectively 30,4±0,07; 169,8±0,63; 294,4±0,73 and 395.9±1.07 kg (Ilnytska O. Yu. et al., 2014). Evaluation of heifers of three breeds raised in the same farm (Polupan Yu. P. and Pryima S. V. 2024b) - Holstein, Ukrainian Black-and-White and Red Dairy, in similar age periods (n=897) was 37,5±0,10; 161±0,7; 291±1,7 and 409±2.3 kg, which exceeded the standard of the Holstein breed at the age of 12 and 18 months, by 4 and 24 kg, respectively, the Ukrainian Black-and-White dairy – by 7 and 29 kg, the Ukrainian Red Dairy –by 29 and 54 kg. Dynamics of live weight growth of Ukrainian Black-and-White dairy heifers in comparison with the standard (n=151) according to research (Vedmedenko O. V. and Fursenko M. V., 2020) for the same age periods, respectively, was: 39.15±0.29; 176.19±0.96; 301.24±1.80 and 418.83±3.32 kg, which is also higher than the breed standard at the age of 6; 12 and 18 months by 3.64; 6.07 and 10.22 kg. The intensive development of heifers of the Ukrainian Red-and-White dairy breed within six lines is reported by (Dymchuk A. V. et al., 2022) with a live weight of newborns of 32.0 - 35.1 kg, in 6 – 166,1-189,5 kg; 12 – 300,4-325,5 and 15 months-361.1-387.4 kg.

So, the analysis of scientific studies showed a certain variability in the development of dairy heifers in Ukraine by live weight, which is the leading factor in the assessment and confirmed a sufficient level of intensity of their cultivation. Our research was aimed at evaluating repair heifers raised in the conditions of one farm, in a comparative analysis of their development with the determination of the prospects for further research on the study of the correlated variability of live weight with the economically useful characteristics of cows in adulthood.

**Materials and methods of research.** The material for the study was the breeding information of the enterprise for breeding Ukrainian Black-and-White, Red-and-White dairy and Holstein breeds of domestic breeding of the herd LLC “Kamyshevatsky dairy complex” of the Kharkiv region. Indicators for the development of repair heifers by live weight were obtained from the database of automated breeding accounting of the sums herd management program “Intesel Orsek”.

The absolute increase in live weight of heifers was determined by the formula:

$$A = W_t - W_0,$$

where: A is the absolute increase in live weight of the animal;

$W_0$ - live weight at the beginning of the period;

$W_t$ - live Mass at the end of the period.

The average daily increase in live weight was determined by the following formula:

$$X = \frac{W_t - W_0}{t_2 - t_1}$$ , where

X-average daily gain (g);

$t_1$-age at the beginning of the control period, days;

$t_2$-age at the end of the control period, days.

The relative growth rate was calculated by the formula (CIT. Basovskyi M. Z. et al., 2001) proposed by S. Brody:

$$K = \frac{(W_t - W_0) \times 100}{(W_t + W_0) \div 2}$$

Evaluation indicators were calculated using the formulas given in the textbook (Ladyka V. I., et al., 2023). The reliability of the obtained data was estimated by calculating statistical errors (S.E.) and student reliability criteria (td). The degree of reliability was classified in comparison with the values of standard criteria. The results of experimental studies were considered significant for the first $p<0.05$ (1), the second $p<0.01$ (2), and the third $p<0.001$ (3) probability threshold.

**Research results.** Quantitative characteristics of cattle are formed on the basis of hereditary characteristics and the influence of external conditions in the process of individual development. As scientific and practical experience in the field of zootechnics proves, optimal indicators of growth and development of repair heifers during postnatal ontogenesis are an important factor that ensures high milk productivity of cows throughout the entire period of their operation.

According to the results of experimental studies in identical conditions of the herd of LLC "Kamyshevatsky dairy complex", it was established that the highest live birth weight was characterized by the offspring of the Ukrainian Black-and-White dairy breed, which with an average live birth weight of 37.8 kg exceeded the Holstein and Ukrainian Red-and-White heifers with a significant difference of 1.0 ($p<0.001$; td=10.8) and 1.1 kg ($p<0.001$; td=11.9), table. 1.

*Table 1.*

**Development of repair heifers of Ukrainian dairy breeds for live weight in the dynamics of development from birth to 18 months, kg (x ± S.E.)**

| Age period | Breed | | | |
|---|---|---|---|---|
| | Holstein | Ukrainian Black-and-White dairy | Ukrainian Red-and-White dairy | on average by herd |
| n | 1636 | 1657 | 1387 | 4681 |
| new birth | 36,8±0,06 | 37,8±0,07 | 36,7±0,06 | 37,1±0,04 |
| 3 months | 102,7±0,17 | 103,3±0,20 | 100,9±0,24 | 102,5±0,12 |
| 6 months | 182,8±0,25 | 180,7±0,26 | 178,6±0,30 | 181,1±0,15 |
| 9 months | 246,5±0,26 | 245,2±0,26 | 242,4±0,29 | 244,8±0,16 |
| 12 months | 330,7±0,37 | 325,8±0,37 | 319,7±0,44 | 326,0±0,23 |
| 15 months | 381,1±0,46 | 377,3±0,36 | 371,9±0,42 | 376,7±0,24 |
| 18 months | 425,4±0,60 | 422,1±0,42 | 415,9±0,43 | 420,2±0,27 |

However, starting from the age of six months, the priority position was taken by Holstein heifers with a live weight of 182.8 kg in this age period, which became significantly higher compared to the peers of Ukrainian Black-and-White and Red-and-White dairy breeds, respectively, by 2.1 ($p<0.001$; td=5.82) and 4.2 kg ($p<0.001$; td=10.8). This situation did not change until the end of the rearing period, and at the age of 18 months, Holstein heifers with an average live weight of 425.4 kg outnumbered the peers of Ukrainian Black-and-White and Red-and-White dairy breeds with a significantly significant difference, respectively, by 2.1 ($p<0.001$; td=5.82) and 4.2 kg ($p<0.001$; td=10.8).

The average level of live weight of controlled heifers in the studied age periods exceeds the breed standards defined in the bonitation instructions (Lytovchenko A. M. et al., 2007). At the age of 6, 9, 12, 15 and 18 months, these indicators exceed the targets of the Holstein breed by 7.8; 12.5; 42.7; 43.1 and 40.4 kg, respectively, the Ukrainian Black-and-White dairy breed — by 5.7; 11.2; 37.8; 39.3 and 37.1 kg, and the Ukrainian Red-and-White breed – by 8.6; 13.4; 35.7; 37.9 and 35.9 kg. Such indicators indicate a fairly high level of Organization of cultivation of controlled repair heifers on the farm.

When studying the absolute increase in the live weight of repair heifers of controlled breeds in the three-month dynamics of postnatal ontogenesis, which is an indicator of the intensity of animal growth, interbreeding differentiation was also established with a significant advantage of Holstein heifers during the entire growing period, with the exception of the first 0-3 month period in comparison with the peers of the Ukrainian Black-and-White dairy breed (table. 2). While during this rearing period (0-3 months), Holstein heifers were better in terms of live weight gain than Ukrainian Red-and-White annuals by 2.0 kg with a significant significance ($p<0.001$; td=6.80).

*Table 2.*

**Development of repair heifers of Ukrainian dairy breeds for live by weight in the dynamics of absolute increments, kg (x ± S.E.)**

| Age period in 3-month gradation | Breed | | | |
|---|---|---|---|---|
| | Holstein | Ukrainian Black-and-White dairy | Ukrainian Red-and-White dairy | on average by herd |
| n | 1182 | 1292 | 970 | 3446 |
| 0-3 months | 65,6±0,17 | 65,2±0,21 | 63,6±0,24 | 64,9±0,12 |
| 3-6 months | 81,6±0,25 | 78,7±0,27 | 77,4±0,39 | 79,6±0,17 |
| 6-9 months | 74,7±0,33 | 73,3±0,29 | 69,1±0,42 | 72,6±0,20 |
| 9-12 months | 79,6±0,39 | 77,3±0,38 | 74,5±0,50 | 77,4±0,24 |
| 12-15 months | 62,3±0,51 | 56,9±0,37 | 55,6±0,42 | 57,8±0,25 |
| 15-18 months | 54,2±0,46 | 48,0±0,24 | 43,8±0,33 | 47,6±0,20 |
| 0-18 months | 389,0±0,64 | 384,5±0,44 | 378,8±0,43 | 383,0±0,28 |
| 0-6 months | 146,0±0,25 | 142,7±0,26 | 141,3±0,31 | 143,7±0,16 |
| 6-12 months | 152,8±0,44 | 149,0±0,43 | 143,7±0,59 | 149,2±0,28 |
| 12-18 months | 109,2±0,85 | 101,8±0,48 | 99,2±0,54 | 102,1±0,34 |

Starting from the age of three months in all the evaluated age categories, Holstein heifers were better in absolute live weight gain with a difference in this age period compared to the peers of Ukrainian Black-and-White and Red-and-White dairy by 2.9 ($p<0.001$; td=7.88) and 4.2 kg ($p<0.001$; td=9.07). At the age of 15-18 months, the difference and reliability in favor of Holstein heifers increased to 6.2 ($p<0.001$; td=11.9)

and 10.4 kg (p<0.001; td=18.4), respectively. The absolute increase in live weight for the entire growing period, from birth to 18 months, was in favor of Holstein with a difference of 4.5 (p<0.001; td=5.79) and 10.2 kg (p<0.001; td=5.79), respectively.

There are effective studies to assess the development of heifers over six-month periods of live weight gain (Voitenko S. L. and Sydorenko O. V., 2021; Shuplyk V. V. and Pshybelska, A. R., 2020; Ivanov I. A., 2016), especially from six to twelve months of age, i.e. during puberty (Polupan Yu. P. and Pryima, S. V., 2024a). In the controlled herd, Holstein heifers increased their live weight by 3.3 (p<0.001; td= 0.1) and 4.7 kg (p<0.001; td=12.7), respectively, in half a year compared to the peers of Ukrainian Black-and-White and Red-and-White dairy dairy breeds. For 6-12 and 12-18 months, the difference in favor of Holstein heifers was 3.8 (p<0.001; td=6.18) and 9.1 kg (p<0.001; td=12.3) and 7.4 (p<0.001; td=7.58) and 10 kg (p<0.001; td=7.58), respectively.

Control of growth and growth is made possible by analyzing the average daily and relative growth rates, which show the energy and intensity of animal growth (Havrylenko M. S. and Kunovska N. V., 2005). Intensive development of calves during the milk period, covering the period from birth to the age of six months, plays a key role. At this time, it is important to take into account the biological features of individual development, in particular, increased growth energy during the first months of life, which is the basis for the formation of healthy and full-fledged young animals (Khmelnychyi L. M. and Bardash D. O., 2019). Yu. P. Polupan and S. V. Pryima (2024b) notes that due to the increased level of correlative variability of measurements of primiparous with the growth of heifers during puberty, special attention should also be paid to the cultivation of repair heifers during intensive puberty at the age of 6-12 months.

The level of average daily live weight gains of repair heifers of the controlled herd, regardless of breed, ensured their sufficient development during the mating age. At the same time, interbreeding variability was observed with higher indicators of average daily increments in Holstein heifers (Table 3).

*Table 3.*

**Development of repair heifers of Ukrainian dairy breeds for live by weight in the dynamics of average daily increments, G (x ± S.E.)**

| Age period in 3-month gradation | Breed | | | |
|---|---|---|---|---|
| | Holstein | Ukrainian Black-and-White dairy | Ukrainian Red-and-White dairy | on average by herd |
| n | 1182 | 1292 | 970 | 3446 |
| 0-3 months | 729,6±1,98 | 724,6±2,34 | 706,6±2,68 | 721,9±1,33 |
| 3-6 months | 907,5±2,77 | 874,6±3,04 | 860,0±4,43 | 885,1±1,90 |
| 6-9 months | 830,0±3,64 | 814,4±3,27 | 768,31±4,65 | 806,6±2,25 |
| 9-12 months | 884,9±4,35 | 859,0±4,27 | 828,5±5,59 | 859,6±2,72 |
| 12-15 months | 692,3±5,71 | 632,6±4,13 | 618,6±4,66 | 643,1±2,77 |
| 15-18 months | 602,8±5,09 | 533,7±2,72 | 487,1±3,67 | 529,4±2,22 |
| 0-18 months | 713,5±1,15 | 701,9±0,79 | 692,5±0,84 | 700,6±0,54 |
| 0-6 months | 802,4±1,38 | 784,5±1,47 | 776,2±1,70 | 789,8±0,88 |
| 6-12 months | 839,8±2,41 | 818,9±2,36 | 789,8±3,26 | 819,8±1,54 |
| 12-18 months | 600,0±4,68 | 559,6±2,66 | 545,1±2,95 | 561,1±1,87 |

Young animals of controlled breeds developed most intensively in the first four three-month periods, from birth to twelve months of age. The average daily weight gain of heifers was higher in representatives of the Holstein breed and amounted to a variability from 729.6 to 884.9 g, with higher results in the 3-6–month period – 907.5 g. heifers of the Holstein breed with almost the same average daily weight gain in the period 0-3 months compared to the peers of the Ukrainian Black-and-White dairy breed dominated heifers of the Ukrainian Red-and-White dairy by 23 g with a significant significance ($p<0.001$; td = 6,90).

Holstein heifers in the age three - month periods 3-6, 6-9 and 9-12 with a high and significant difference surpassed the peers of Ukrainian Black-and-White and Red-and-White dairy in terms of average daily live weight gain, respectively, by 32.9 ($p<0.001$; td=7.99) and 47.5 g ($p<0.001$; td=9.09), 15.6 ($p<0.001$; td=8.18) and 61.7 g ($p<0.001$; TD=10.4) and 25.9 ($p<0.001$; TD=4.25) and 56.4 g($p<0.001$; TD=7.96). However, the largest difference in average daily growth in Holstein heifers was found in the age period of 15-18 months and amounted to 69.1 ($p<0.001$; td=11.8) and 115.7 g ($p<0.001$; td= 8.4) in their favor.

During the dairy period of rearing, the average daily weight gain of Holstein heifers was higher compared to the peers of Ukrainian Black-and-White and Red-and-White breeds, respectively, by 17.9 ($p<0.001$; td=8.88) and 26.2 g ($p<0.001$; td=11.9). During a fairly responsible puberty period (6-12 months), a significantly significant difference in favor of Holstein heifers increased and, respectively, amounted to 20.9 ($p<0.001$; td=6.20) and 50 g ($p<0.001$; td=12.3). At the final stage of cultivation, which is an important mating period for reproduction, the priority position in terms of the intensity of the average daily increase in live weight was preserved for Holstein heifers with a predominance of the peers of Ukrainian Black-and-White and Red-and-White animals with a statistically significant difference of 40.4 ($p<0.001$; td=7.50) and 54.9 g ($p<0.001$; td=9.92), respectively.

Absolute indicators to a certain extent characterize the intensity of animal growth and are of great practical importance, since they allow you to compare actual results with planned ones, monitor compliance with the requirements of the standard or the desired type, and make calculations regarding the salary of farm employees.

Because young animals grow unevenly (Polupan Yu. P. and Pryima S. V., 2024a; 2024b; Cherniavska T. O. et al., 2017), therefore, the indicator of absolute growth does not reflect the actual intensity of growth processes, the degree of their intensity, that is, the relationship between the amount of increasing body weight and the intensity of growth. For this purpose, determine the relative increase, which is calculated as a percentage.

Based on the results of calculations of indicators of relative growth of live weight of repair heifers, its variability within the estimated breeds was established. In all age three-month periods, Holstein animals developed more intensively, table 4.

The fact that the intensive development of Holstein heifers is their biological feature is confirmed by a significant difference in the relative increase in live weight during the entire growing period. Thus, in the 0-3-month age period, at the highest growth rate (93.7%), they exceeded the peers of the Ukrainian Black-and-White dairy breed by 1.7 % ($p<0.001$; td=6.29), and the Ukrainian Red-and-White – by 2.1 % ($p<0.001$; td=7.34).

A similar excess of Holstein heifers of the same age as Ukrainian Black-and-White and Red-and-White dairy breeds in terms of relative development was observed during all three-month growing periods and in the last 15-18 month period it was 1.4 % ($p<0.001$; td=11.2) and 2.4 % ($p<0.001$; td=17.6), respectively.

*Table 4.*

**Relative increase in repair heifers of Ukrainian dairy products rocks by live weight in age dynamics, % (X ± S.E.)**

| Age period in 3-month gradation | Breed | | | |
|---|---|---|---|---|
| | Holstein | Ukrainian Black-and-White dairy | Ukrainian Red-and-White dairy | on average by herd |
| n | 1182 | 1292 | 970 | 3446 |
| 0-3 months | 93,7±0,17 | 92,0±0,21 | 91,6±0,23 | 92,6±0,12 |
| 3-6 months | 57,0±0,16 | 55,3±0,18 | 54,9±0,28 | 55,9±0,11 |
| 6-9 months | 35,2±0,16 | 34,6±0,14 | 32,8±0,19 | 34,3±0,09 |
| 9-12 months | 27,7±0,13 | 27,2±0,13 | 26,5±0,17 | 27,2±0,08 |
| 12-15 months | 17,7±0,15 | 16,3±0,11 | 16,1±0,12 | 16,6±0,07 |
| 15-18 months | 13,5±0,11 | 12,1±0,06 | 11,1±0,08 | 11,9±0,05 |

In the introductory part, it is noted that there is a correlation variability between the live weight in the cultivation of repair heifers and economically useful traits that are important for dairy cattle breeding. However, the most important indicators for dairy cattle are productivity in terms of milk yield, fat and protein.

According to the assessment of correlation variability between the live weight of Holstein heifers and the milk productivity of first calving cow in the age dynamics of rearing, from birth to 18 months, the existence of a positive relationship was established (table 5). With almost no association of live weight with milk yield, milk fat and protein and low reliability of newborn heifers, starting from the age of three months, the level of correlation coefficients gradually increases, reaching the maximum value and statistical significance at the age of 18 months ($r=0.282$; $p<0.001$; $td=5.42$).

There are effective studies to assess the development of heifers over six-month periods of live weight gain (Voitenko S. L. and Sydorenko O. V., 2021; Shuplyk V. V. and Pshybelska A. R., 2020; Ivanov I. A., 2016), especially from six to twelve months of age, i.e. during puberty (Polupan Yu. P. and Pryima S. V., 2024a).

Slightly higher correlation coefficients of average daily live weight gain with milk fat and protein yield for 305 days of the first lactation of Holstein animals were found in the period of three to six months ($r=0.228$; $r=0.211$; $r=0.193$). The assessment of the correlation variability of the average daily weight gain of heifers with similar signs of milk productivity of Holstein primiparous was highest at the age of 6-12 months ($r=0.262$; $r=0.251$; $r=0.242$) – this is just the period of puberty. The trend is similar to research conducted in this direction by employees of the Institute of animal breeding and genetics of the National Academy of Sciences (Polupan Yu. P. and Pryima S. V., 2024a).

*Table 5.*

**Correlation variability of Heifer growth intensity and milk productivity of Holstein first-born cows (r±S.E.)**

| Correlated sign | *n* | relationship with the sign of milk productivity | | |
|---|---|---|---|---|
| | | Milk yield | milk | |
| | | | fat | protein |
| Live weight in age, months | | | | |
| 0 | 1825 | 0,065±0,023[2] | 0,049±0,023[1] | 0,057±0,023[1] |
| 3 | 1472 | 0,129±0,026[3] | 0,117±0,026[3] | 0,122±0,026[3] |
| 6 | 1396 | 0,191±0,027[3] | 0,176±0,027[3] | 0,141±0,027[3] |
| 9 | 865 | 0,192±0,034[3] | 0,172±0,034[3] | 0,198±0,034[3] |
| 12 | 1190 | 0,201±0,029[3] | 0,155±0,029[3] | 0,142±0,029[3] |
| 15 | 528 | 0,230±0,043[3] | 0,183±0,043[3] | 0,173±0,044[2] |
| 18 | 344 | 0,282±0,052[3] | 0,245±0,053[3] | 0,238±0,054[3] |
| Average daily increase in live weight by age, months. | | | | |
| 0-3 | 1470 | 0,154±0,026[3] | 0,135±0,026[3] | 0,093±0,027[3] |
| 3-6 | 1184 | 0,228±0,029[3] | 0,211±0,029[3] | 0,193±0,029[3] |
| 6-9 | 618 | 0,214±0,037[3] | 0,207±0,040[3] | 0,191±0,040[2] |
| 9-12 | 738 | 0,121±0,037[2] | 0,158±0,037[3] | 0,147±0,037[3] |
| 12-15 | 466 | 0,125±0,046[2] | 0,121±0,046[3] | 0,129±0,046[2] |
| 15-18 | 313 | 0,158±0,056[2] | 0,142±0,052[2] | 0,141±0,051[2] |
| 0-6 | 1394 | 0,214±0,026[3] | 0,194±0,027[3] | 0,208±0,027[3] |
| 6-12 | 908 | 0,262±0,033[3] | 0,251±0,039[3] | 0,242±0,033[3] |
| 12-18 | 276 | 0,215±0,059[3] | 0,226±0,030[3] | 0,231±0,052[3] |

*Note. 1 - p≤0,05; 2 - p≤0,01; 3 - p≤0,001*

The level of indicators of correlated variability in the intensity of rearing repair heifers by live weight and signs of milk productivity of first-born cows of the Ukrainian Black-and-White dairy breed is shown in Table. 6.

Since young animals were raised in the same farm under the influence of the same paratypical factors, the correlation coefficients between the calculated traits coincide in direction with Holstein heifers. Low correlation coefficients were obtained between live weight and milk yield, milk fat and protein in newborn heifers. With the increase in live weight with age, there is a similar increase in indicators of correlation variability with a higher correlation coefficient at the age of 18 months (r=0.229; p<0.001; td=7.16).

Between the average daily increase in live weight and milk yield in the three-month dynamics of cultivation, variability was observed from a minimum unreliable value at the age of 0-3 months (r=0.044), to a moderate and reliable level at the age of 3-6 months (r=0.260). For six-month growth periods, correlations for these traits were more significant with higher coefficients at 6-12 months of puberty (r=0.296).

*Table 6.*

**Correlation variability of the growth intensity of heifers and milk productivity of first-born Ukrainian Black-and-White cows dairy breed (r±S.E.)**

| Correlated sign | *n* | relationship with the sign of milk productivity | | |
|---|---|---|---|---|
| | | Milk yield | milk | |
| | | | fat | protein |
| Live weight in age, months | | | | |
| 0 | 1913 | 0,054±0,023[1] | 0,069±0,022[2] | 0,071±0,024[2] |
| 3 | 1477 | 0,119±0,026[3] | 0,107±0,024[3] | 0,105±0,024[3] |
| 6 | 1364 | 0,159±0,027[3] | 0,146±0,023[3] | 0,144±0,025[3] |
| 9 | 1102 | 0,162±0,031[3] | 0,158±0,029[3] | 0,148±0,032[3] |
| 12 | 1422 | 0,187±0,026[3] | 0,176±0,024[3] | 0,169±0,024[3] |
| 15 | 1083 | 0,205±0,033[3] | 0,198±0,031[3] | 0,194±0,031[3] |
| 18 | 918 | 0,229±0,032[3] | 0,222±0,033[3] | 0,208±0,030[3] |
| Average daily increase in live weight by age, months | | | | |
| 0-3 | 1469 | 0,044±0,026 | 0,038±0,024 | 0,047±0,028 |
| 3-6 | 1170 | 0,260±0,029[3] | 0,263±0,026[3] | 0,271±0,027[3] |
| 6-9 | 792 | 0,120±0,035[3] | 0,114±0,031[3] | 0,109±0,032[3] |
| 9-12 | 962 | 0,135±0,032[3] | 0,118±0,029[3] | 0,121±0,034[3] |
| 12-15 | 990 | 0,175±0,031[3] | 0,166±0,032[3] | 0,158±0,033[3] |
| 15-18 | 873 | 0,194±0,033[3] | 0,188±0,031[3] | 0,182±0,031[3] |
| 0-6 | 1356 | 0,281±0,027[3] | 0,269±0,025[3] | 0,271±0,029[3] |
| 6-12 | 1047 | 0,296±0,031[3] | 0,281±0,030[3] | 0,279±0,033[3] |
| 12-18 | 820 | 0,291±0,035[3] | 0,288±0,033[3] | 0,287±0,034[3] |

*Note. 1-p≤0.05; 2-p≤0.01; 3-p≤0.001*

The study of heifers of the Ukrainian Red-and-White dairy breed to study the correlated variability of their growth in the age dynamics of cultivation with signs of milk productivity according to the data of the first lactation revealed a similar trend similar to the results of studies of peers of Holstein and Ukrainian Black-and-White dairy breeds (Table 7).

The increase in live weight of heifers of this breed with age is directly related to an increase in positive correlations with the level of milk yield, the yield of milk fat and protein with the maximum values of coefficients at 18 months of age (r=0.288-0.295). According to the average daily weight gains, we pay attention to the obtained higher correlations with milk yield in the period of 3-6 (r=0.228) and 15-18 (r=0.239) months. During the six-month growth periods, the correlation variability of average daily weight gain with milk yield, milk fat, and protein was higher at 6-12 months of puberty (r=0.279; 0.274, and 0.272).

*Table 7.*

**Correlative variability of the growth intensity of heifers and milk productivity of cows-the firstborn of the Ukrainian Red-and-White dairy breed (r±S.E.)**

| Correlated sign | *n* | Relationship with the sign of milk productivity milk | | |
|---|---|---|---|---|
| | | Milk yield | milk | |
| | | | fat | protein |
| Live weight in age, months | | | | |
| 0 | 1874 | 0,057±0,023[1] | 0,044±0,021[1] | 0,042±0,025 |
| 3 | 1125 | 0,192±0,030[3] | 0,198±0,028[3] | 0,191±0,029[2] |
| 6 | 955 | 0,149±0,032[3] | 0,133±0,031[3] | 0,139±0,031[3] |
| 9 | 921 | 0,142±0,033[3] | 0,144±0,033[3] | 0,146±0,029[3] |
| 12 | 1019 | 0,202±0,031[3] | 0,192±0,028[3] | 0,189±0,031[3] |
| 15 | 916 | 0,240±0,032[3] | 0,233±0,033[3] | 0,235±0,030[3] |
| 18 | 900 | 0,295±0,032[3] | 0,288±0,034[3] | 0,291±0,033[3] |
| Average daily increase in live weight by age, months | | | | |
| 0-3 | 1122 | 0,066±0,030[1] | 0,054±0,033 | 0,069±0,027[1] |
| 3-6 | 736 | 0,228±0,036[3] | 0,209±0,034[2] | 0,214±0,032[3] |
| 6-9 | 611 | 0,152±0,035[3] | 0,148±0,031[3] | 0,146±0,035[3] |
| 9-12 | 690 | 0,170±0,038[3] | 0,155±0,033[3] | 0,149±0,034[3] |
| 12-15 | 748 | 0,217±0,036[3] | 0,197±0,032[3] | 0,186±0,033[3] |
| 15-18 | 738 | 0,239±0,036[3] | 0,212±0,034[3] | 0,196±0,031[3] |
| 0-6 | 952 | 0,237±0,032[2] | 0,214±0,031[2] | 0,219±0,030[3] |
| 6-12 | 685 | 0,279±0,038[3] | 0,274±0,032[3] | 0,272±0,032[3] |
| 12-18 | 680 | 0,241±0,038[3] | 0,233±0,034[3] | 0,229±0,034[3] |

*Note. 1-p≤0.05; 2-p≤0.01; 3-p≤0.001*

**Discussion.** The intensity of rearing repair heifers during ontogenesis has always aroused the increased interest of production practitioners and scientists, since the level of rearing depends on the indicators of reproductive capacity, productivity and longevity and, in general, the profitability of dairy cattle breeding (Bazeley K. J. et al., 2016; Bach A. and Ahedo J., 2008; Overton M. W. and Dhuyvetter K. C. 2020) ). It is reported that the intensity of cultivation of repair heifers of the Ukrainian Black-and-White dairy breed in age periods provided an increase in milk productivity (Antonenko S. F., 2020; Admin, O. Y., et al., 2024; Polupan Yu. P. and Pryima S. V., 2024a), which is consistent with the

results of our studies, which established a positive statistically significant correlation variability between live weight gains of heifers of all experimental breeds with milk yield, milk fat and protein yield.

At the same time, in this aspect, scientific studies have established that the level of correlations between the live weight of heifers in the rearing process, taking into account the age period and milk yield, is characterized by significant variability, which existed in the range: -0.237...+0.111 (Shuliar A. L. et al., 2020), -0,011…+0,331 (Vedmedenko O. V., 2023), +0,059…+0,947 (Voitenko S. L. and Sydorenko O. V., 2020), -0,58…+0,89 (Radchenko N. P. et al., 2008), -0,017…+0,260 (Fedorovych V. V. et al., 2023). These highly variable indicators of correlation variability between live weight of heifers and milk yield are not consistent with the results of our studies, according to which, regardless of breed, a positive statistically significant correlation was obtained between these traits. The significant variability in the correlation levels given in the literature can only be explained by the complex interaction of biological, genetic and environmental factors.

Therefore, according to the results of our research, the growth rate of young animals can be an effective breeding indicator that allows improving the genetic potential of the herd in terms of milk productivity. Special attention should be paid to the process of raising heifers during active puberty, which falls at the age of 6 to 12 months.

**Conclusions.**

1. The level of rearing repair heifers in the herd of LLC "Kamyshevatsky dairy complex" for breeding Holstein, Ukrainian Black-and-White and Red-and-White dairy breeds is quite high, with the best results in Holstein cattle, which ensures the production of milk yields at the level of 8-10 thousand kg.

2. The revealed direct correlation variability between the live weight of heifers and the average daily increments with signs of milk productivity of first calving cow indicates the breeding feasibility of selecting repair heifers in terms of growth intensity indicators. Special attention should be paid to the conditions for raising heifers during active puberty at the age of 6 to 12 months.

## References

Babik, N. P., Fedorovych, Ye. I., Fedorovych, V. V. (2017). Vplyv zhyvoi masy koriv holshtynskoi porody u period vyroshchuvannia na tryvalist ta efektyvnist yikh hospodarskoho vykorystannia [The influence of the live weight of Holstein cows during the growing period on the duration and efficiency of their economic use]. *Naukovyi visnyk Lvivskoho natsionalnoho universytetu veterynarnoi medytsyny ta biotekhnolohii imeni S. Z. Gzhytskoho - Scientific Bulletin of the S. Z. Gzhytskyi Lviv National University of Veterinary Medicine and Biotechnology.* 19(74), 71-75. https://doi.org/10.15421/nvlvet7416 (in Ukrainian).

Admin, O. Y., Admina, N. G., Paliy, A. P., Petrov, R. V., Nagorna, L. V., Kovalenko, L. M., Nazarenko, S. M., & Sevastianov, V. V. (2024). Influence of growth intensity of black and white dairy cattle on their reproduction and productivity under free housing. *Regu-latory Mechanisms in Biosystems,* 15(3), 469–476. https://doi.org/10.15421/022466 (in Ukrainian).

Antonenko, S. F. (2020). Vplyv intensyvnosti vyroshchuvannia telyts ukrainskoi chorno-riaboi molochnoi porody v rizni vikovi periody na maibutniu molochnu produktyvnist [The influence of the intensity of rearing heifers of the Ukrainian black-and-white dairy breed at different age periods on future milk productivity]. *Rozvedennia i henetyka tvaryn - Animal breeding and genetics.* 59, 17-25. https://doi.org/10.31073/abg.59.02 (in Ukrainian).

Antonenko, S. F., Piskun, V. I., Admina, N. H., Admin, O. Ye., Zolotarov, A. P., Trishyn, O. K. (2022). Formuvannia produktyvnykh oznak u telyts ta netelei pid vplyvom paratypovykh faktoriv [Formation of productive traits in heifers and heifers under the influence of paratypic factors]. *Naukovo-tekhnichnyi biuleten IT NAAN - Scientific and technical bulletin of IT NAAS*. 128, 72-79. https://doi.org/10.32900/2312-8402-2022-128-72-79 (in Ukrainian).

Bach A., Ahedo J. (2008). Record Keeping and Economics of Dairy Heifers, Veterinary Clinics of North America: Food Animal Practice, Vol. 24, Issue 1, P. 117-138. https://doi.org/10.1016/j.cvfa.2007.10.001.

Basovskyi, M. Z., Burkat, V. P., Vinnychuk, D. T., Kovalenko, V. P., Kiva, M. S., Ruban, Yu. D., Rudyk, I. A., Siratskyi, Y. Z. (2001). Rozvedennia silskohospodarskykh tvaryn [Breeding farm animals]. Bila Tserkva, 400 c. https://rep.btsau.edu.ua/bitstream/BNAU/4160/1/Rozvedennia_s.-h._tv.pdf (in Ukrainian).

Bazeley K. J., Barrett D. C., Williams P. D., Reyher, K.K. (2016). Measuring the growth rate of UK dairy heifers to improve future productivity, *The Veterinary Journal*, Vol. 212, P. 9-14. https://doi.org/10.1016/j.tvjl.2015.10.043.

Borshch, O. O., Ruban, S. Yu. (2017). Intensyvnist vyroshchuvannia krosbrednykh telyts za riznykh tekhnolohii utrymannia [Intensity of rearing crossbred heifers under different housing technologies]. *Visnyk Poltavskoi derzhavnoi ahrarnoi akademii - Bulletin of the Poltava State Agrarian Academy*. 4, 63-66. https://www.pdau.edu.ua/sites/default/files/visnyk/2017/04/14.pdf (in Ukrainian).

Cherniavska, T. O., Skliarenko, Yu. I., Ivankova, I. P. (2017). Vplyv tempiv rozvytku remontnykh telyts sumskoho vnutrishnoporodnoho typu ukrainskoi chorno-riaboi molochnoi porody na molochnu produktyvnist koriv-pervistok [The influence of the development rate of repair heifers of the Sumy intrabreed type of the Ukrainian black-and-white dairy breed on the milk productivity of primiparous cows]. *Visnyk Sumskoho natsionalnoho ahrarnoho universytetu. Seriia «Tvarynnytstvo» - Bulletin of Sumy National Agrarian University. Series "Animal Husbandry"*. 7 (33), 150-153. file:///C:/Users/Admin/Downloads/Vsna_tvar_2017_7_26%20(1).pdf (in Ukrainian).

Dymchuk, A. V., Ponko, L. P., Shutiak, O. V. (2022). Dynamika rostu zhyvoi masy telyts ukrainskoi chervono riaboi molochnoi porody riznykh linii [Dynamics of live weight growth of heifers of the Ukrainian red-mottled dairy breed of different lines]. *Naukovi dopovidi NUBiP Ukrainy - Scientific reports of NUBiP of Ukraine.* 3(97). SR_7_97(3)_Dymchuk (11).pdf (in Ukrainian).

Fedorovych, V. V., Shpyt, I. V., Fedorovych, Ye. I., Kuziv, M. I., Kuziv, N. M. (2023). Vplyv fenotypovykh oznak koriv na yikh molochnu produktyvnist [The influence of phenotypic traits of cows on their milk production]. *Naukovo-tekhnichnyi biuleten DNDKI veterynarnykh preparativ ta kormovykh dobavok i Instytutu biolohii tvaryn - Scientific and technical bulletin of the National Research Institute of Veterinary Medicine and Feed Additives and the Institute of Animal Biology.* 24 (2), 239-250. https://doi.org/10.36359/scivp.2023-24-2.26 (in Ukrainian).

Havrylenko, M. S., Kunovska, N. V. (2005). Rist telyts holshtynskoi porody zalezhno vid yikhnoi liniinoi nalezhnosti [Growth of Holstein heifers depending on their lineage]. *Rozvedennia i henetyka tvaryn - Animal breeding and genetics.* 38, 136-138. file:///C:/Users/Admin/Downloads/rgt_2005_38_20.pdf (in Ukrainian).

Ilnytska, O. Yu., Fedorovych, Ye. I., Novak, I. V. (2014). Dynamika zhyvoi masy koriv riznykh linii prykarpatskoho vnutrishnoporodnoho typu ukrainskoi chervono-riaboi molochnoi porody u period yikh vyroshchuvannia [Dynamics of live weight of cows of different lines of the Carpathian intrabreed type of the Ukrainian red-motley dairy breed during their breeding period]. *Visnyk Sumskoho natsionalnoho ahrarnoho universytetu. Seriia «Tvarynnytstvo» - Bulletin of Sumy National Agrarian University. Series "Animal Husbandry"*. 2/1(24), 107-111. http://visnyk.snau.edu.ua/sample/files/snau_2014_2_1_24_tvar/JRN/27.pdf (in Ukrainian).

Ivanov, I. A. (2016). Otsinka fenotypovoi konsolidatsii pokaznykiv rozvytku molodniaku holshtynskoi ta ukrainskykh chorno-riaboi i chervono-riaboi molochnykh porid [Assessment of phenotypic consolidation of development indicators of young Holstein and Ukrainian black-and-white and red-and-white dairy breeds]. *Visnyk ZhNAEU - Bulletin of ZhNAEU.* 2 (56). 1, 281-286. http://ir.polissiauniver.edu.ua/bitstream/123456789/7626/1/VZNAU_2016_2_1_281-286.pdf (in Ukrainian).

Khmelnychyi, L. M., Bardash, D. O. (2019). Osoblyvosti rozvytku remontnykh telyts ukrainskykh chervono-riaboi ta chorno-riaboi molochnykh porid u hospodarstvakh sumskoho rehionu [Peculiarities of development of replacement heifers of Ukrainian red-pigmented and black-pigmented dairy breeds in farms of the Sumy region]. *Visnyk Sumskoho natsionalnoho ahrarnoho universytetu. Seriia «Tvarynnytstvo» - Bulletin of Sumy National Agrarian University. Series "Animal Husbandry"*. 1-2 (36-37), 1-9. http://repo.snau.edu.ua:8080/xmlui/handle/123456789/8514 (in Ukrainian).

Kuziv, M. I., Fedorovych, Ye. I. (2014). Zalezhnist molochnoi produktyvnosti koriv ukrainskoi chorno-riaboi molochnoi porody vid zhyvoi masy v period yikh vyroshchuvannia [Dependence of milk productivity of Ukrainian black-and-white dairy cows on live weight during their rearing period]. *Visnyk Sumskoho natsionalnoho ahrarnoho universytetu. Seriia «Tvarynnytstvo» - Bulletin of Sumy National Agrarian University. Series "Animal Husbandry"*. 2/2(25), 68-72. file:///C:/Users/Admin/Downloads/Vsna_tvar_2014_2(2)__17.pdf (in Ukrainian).

Kuziv, M. I., Fedorovych, Ye. I., Kuziv, N. M. (2024). Zalezhnist zhyvoi masy telyts ukrainskoi chorno-riaboi molochnoi porody vid metodu pidboru batkivskykh par [Dependence of live weight of heifers of the Ukrainian black-and-white dairy breed on the method of selection of parental pairs]. *Zbirnyk naukovykh prats «Tekhnolohiia vyrobnytstva i pererobky produktsii tvarynnytstva» - Collection of scientific papers "Technology of production and processing of livestock products"*. 2, 6-16. https://doi.org/10.33245/2310-9289-2024-190-2-6-16 (in Ukrainian).

Ladyka, V. I., Khmelnychyi, L. M., Povod, M. G., Bordunova, O. G., Opara, V. O., Pavlen-ko, Yu. M., Bula, L. V., Lykhach, V. Ya., Lykhach, A. V., Verbelchuk, T. V., Izhboldina, O. O., Smyslov, S. Yu., & Samokhina, E. A. (2023). Tekhnolohiia vyrobnytstva ta pererobky produk-tsii tvarynnytstva [Technology of production and processing of livestock products]. Oldi+. (In Ukrainian).

Liubynskyi, O. I. (2023). Osoblyvosti rostu telyts riznykh linii bukovynskoho zavodskoho typu ukrainskoi chervono-riaboi molochnoi porody [Peculiarities of growth of heifers of different lines of the Bukovyna factory type of the Ukrainian red-motley dairy breed]. *Rozvedennia i henetyka tvaryn - Animal breeding and genetics.* 66, 86-94. https://doi.org//10.31073/abg.66.09 (in Ukrainian).

Luhovyi, S. I. (2023). Vplyv oznak rostu ta rozvytku na molochnu produktyvnist koriv chervonoi stepovoi porody [The influence of growth and development traits on milk production of red steppe cows]. *Tavriiskyi naukovyi visnyk - Tavria Scientific Bulletin.* 131, 296-303. https://doi.org/10.32782/2226-0099.2023.131.36 (in Ukrainian).

Lytovchenko, A. M., Mykytiuk, D. M., Bilous, O. V. ta in. (2007). Instruktsiia z bonituvannia velykoi rohatoi khudoby molochnykh i molochno-miasnykh porid. Instruktsiia z vedennia pleminnoho obliku v molochnomu i molochno-miasnomu skotarstvi [Instructions for grading cattle of dairy and dairy-meat breeds. Instructions for keeping herd records in dairy and dairy-meat cattle breeding]. Kyiv: Aristei, 72. https://zakon.rada.gov.ua/laws/show/z0095-04#Text (in Ukrainian).

Overton M. W., Dhuyvetter K. C. (2020). Symposium review: An abundance of replacement heifers: What is the economic impact of raising more than are needed? J. Dairy Sci. 103:3828–3837. https://doi.org/10.3168/jds.2019-17143

Pankieiev, S. P., Pylypenko, Yu. P. (2021). Perspektyvna tekhnolohiia spriamovanoho vyroshchuvannia molodniaku v molochnomu skotarstvi [Promising technology for targeted rearing of young animals in dairy farming]. *Tavriiskyi naukovyi visnyk - Tavria Scientific Bulletin.* 118, 260-267. https://doi.org/10.32851/2226-0099.2021.118.33 (in Ukrainian).

Petryshyn, M. A., Kohut, M. I., Fedak, V. D., Polulikh, M. I., Shelevach, A. V., Stadnytska, O. I., Ilnytska, H. V. (2024). Dynamika rostu masy tila remontnykh telyts ukrainskoi chorno-riaboi molochnoi porody, otrymanykh vid riznykh variantiv pidboru [Dynamics of body weight growth of replacement heifers of the Ukrainian black-and-white dairy breed obtained from different selection options]. *Peredhirne ta hirske zemlerobstvo i tvarynnytstvo - Foothill and mountain agriculture and animal husbandry.* 75 (1), 157-166. https://doi.org/10.32636/01308521.2024-(75)-1-14 (in Ukrainian).

Polupan, Yu. P., Melnyk, Yu. F., Biriukova, O. D. Pryima, S. V., Mitiohlo, L. V. (2022). Rist, vidtvoriuvalna zdatnist i produktyvnist koriv riznykh porid, metodiv pidboru i pokhodzhennia za batkom [Growth, reproductive ability and productivity of cows of different breeds, selection methods and sire origin]. *Rozvedennia i henetyka tvaryn - Animal breeding and genetics.* 63, 91–119. https://doi.org/10.31073/abg.63.09 (in Ukrainian).

Polupan, Yu. P., Pryima, S. V. (2024a). Spivvidnosna minlyvist rostu telyts ta eksterieru pervistok z molochnoiu produktyvnistiu koriv [Correlation of heifer growth and conformation variability with cow milk productivity]. *Visnyk ahrarnoi nauky - Bulletin of Agricultural Science.* 5(854), 31-41. https://doi.org/10.31073/agrovisnyk202405-04 (in Ukrainian).

Polupan, Yu. P., Pryima, S. V. (2024b). Vplyv intensyvnosti rostu zhyvoi masy telyts na formuvannia eksterieru koriv molochnykh porid [The influence of the growth rate of heifers' live weight on the formation of the exterior of dairy cows]. *Visnyk Sumskoho natsionalnoho ahrarnoho universytetu. Seriia «Tvarynnytstvo» - Bulletin of Sumy National Agrarian University. Series "Animal Husbandry".* 3(58), 76-82. https://doi.org/10.32782/bsnau.lvst.2024.3.9 (in Ukrainian).

Radchenko, N. P., Skliarenko, Yu. I., Bratushka, R. V. (2008). Rist ta rozvytok molodniaku velykoi rohatoi khudoby riznykh henotypiv [Growth and development of young cattle of different genotypes]. *Naukovyi visnyk Lvivskoho natsionalnoho universytetu veterynarnoi medytsyny ta biotekhnolohii imeni S. Z. Gzhytskoho - Scientific Bulletin of the S. Z. Gzhytskyi Lviv National University of*

*Veterinary Medicine and Biotechnology.* 10 2(37). 3. 152-155. file:///C:/Users/Admin/Downloads/rist-ta-rozvitok-molodnyaku-velikoyi-rogatoyi-hudobi-riznih-genotipiv%20(1).pdf (in Ukrainian).

Shkurko, T. P. (2010). Rist, rozvytok ta produktyvnist koriv holshtynskoi porody riznoi liniinoi nalezhnosti [Growth, development and productivity of Holstein cows of different lineages]. *Visnyk Dnipropetrovskoho derzhavnoho ahrarnoho universytetu - Bulletin of the Dnipropetrovsk State Agrarian University.* 1, 120–127. https://dspace.dsau.dp.ua/bitstream/123456789/6115/1/366-Article%20Text-755-1-10-20141130.pdf (in Ukrainian).

Shpetnyi, M. B., Zabolotna, V. K., Hryshyn, S. Yu. (2021). Molochna produktyvnist ta vidtvoriuvalna zdatnist koriv zalezhno vid henetychnykh ta paratypovykh chynnykiv [Milk production and reproductive ability of cows depending on genetic and paratypic factors]. *Visnyk Sumskoho natsionalnoho ahrarnoho universytetu. Seriia «Tvarynnytstvo» - Bulletin of Sumy National Agrarian University. Series "Animal Husbandry".* 4(47), 33-42. https://doi.org/10.32845/bsnau.lvst.2021.4.6 (in Ukrainian).

Shuliar A. L., Shuliar A. L., Tkachuk V. P., Andriichuk V. F. (2020). Zalezhnist molochnoi produktyvnosti koriv ukrainskoi chorno-riaboi molochnoi porody vid zhyvoi masy u protsesi yikh vyroshchuvannia [Dependence of milk productivity of Ukrainian black-and-white dairy cows on live weight during their breeding]. *Tavriiskyi naukovyi visnyk - Tavria Scientific Bulletin.* 114, 224-230. https://doi.org/10.32851/2226-0099.2020.114.27 (in Ukrainian).

Shuplyk, V. V., Pshybelska, A. R. (2020). Rist i molochna produktyvnist koriv pervistok riznykh linii ukrainskoi chorno-riaboi molochnoi porody [Growth and milk production of first-calf cows of different lines of the Ukrainian black-and-white dairy breed]. *Podilskyi visnyk: silske hospodarstvo, tekhnika, ekonomika - Podolsk Herald: agriculture, technology, economy.* 35, 76-81. https://doi.org/10.37406/2706-9052-2021-2-9 (in Ukrainian).

Siriak, V. A., Polupan, Yu. P., Stavetska, R. V. (2019). Kharakterystyka za rostom ta molochnoiu produktyvnistiu koriv napivsester za batkom [Growth and milk yield characteristics of paternal half-sister cows]. *Tekhnolohiia vyrobnytstva i pererobky produktsii tvarynnytstva - Technology of production and processing of livestock products.* 2, 33–42. https://doi.org/10.33245/2310-9289-2019-150-2-33-42 (in Ukrainian).

Tytarenko, I. V., Bushtruk, M. V., Starostenko, I. S. (2016). Vplyv intensyvnosti vyroshchuvannia telyts na yikh vidtvornu zdatnist ta molochnu produktyvnist [The influence of heifer rearing intensity on their reproductive ability and milk production]. *Nauko vo-tekhnichnyi biuleten NDTs biobezpeky ta ekolohichnoho kontroliu resursiv APK - Scientific and technical bulletin of the Research Center for Biosafety and Environmental Control of Agricultural and Industrial Complex Resources.* 4 (1), 260–266. https://rep.btsau.edu.ua/bitstream/BNAU/1249/1/Vplyv_intensyvno.pdf (in Ukrainian).

Vedmedenko, O. V. (2023). Doslidzhennia molochnoi produktyvnosti koriv zalezhno vid klasiv rozpodilu za zhyvoiu masoiu molodniaku [Research on milk productivity of cows depending on the distribution classes by live weight of young animals]. *Podilskyi visnyk: silske hospodarstvo, tekhnika, ekonomika. Silskohospodarski nauky - Podolsk Bulletin: Agriculture, Technology, Economics. Agricultural Sciences.* 1(38), 15-19. https://doi.org/10.37406/2706-9052-2023-1.2 (in Ukrainian).

Vedmedenko, O. V., Fursenko, M. V. (2020). Doslidzhennia rostu telyts chorno-riaboi molochnoi porody zalezhno vid klasiv rozpodilu za zhyvoiu masoiu pry narodzhenni [Study of growth of black-and-white dairy heifers depending on the distribution classes by live weight at birth]. *Tavriiskyi naukovyi visnyk - Tavria Scientific Bulletin.* 116(1), 137-143. https://doi.org/10.32851/2226-0099.2020.116.1.18 (in Ukrainian).

Voitenko, S. L., Sydorenko, O. V. (2020). Vplyv pryrodno-klimatychnoi zony na produktyvnist khudoby ukrainskoi chorno-riaboi molochnoi porody [The influence of the natural and climatic zone on the productivity of Ukrainian black-and-white dairy cattle]. *Zbirnyk naukovykh prats «Tekhnolohiia vyrobnytstva i pererobky produktsii tvarynnytstva» - Collection of scientific papers "Technology of production and processing of livestock products".* 2, 58–65. https://doi.org/10.33245/2310-9270-2020-158-2-58-65 (in Ukrainian).

Voitenko, S. L., Sydorenko, O. V. (2021). Zberezhennia henofondu ta pidvyshchennia produktyvnosti khudoby biloholovoi ukrainskoi porody [Preservation of the gene pool and increase in productivity of Ukrainian white-headed cattle]. Visnyk ahrarnoi nauky - Bulletin of Agricultural Science. 2(815), 41-51. https://doi.org/10.31073/agrovisnyk202102-06 (in Ukrainian).