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Spin age-dependent correlation between live weight and milk yield of cows

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Abstract. For a long time the domestic black-and-white cattle was systematically improved by adding the blood of the world's best dairy breed – i.e. the Holstein breed. In 2002 a new Ural type of black-and-white breed was officially registered. In first heifers with live weight of less than 550 kg an average negative correlation of milk yield is observed, in the first heifers with live weight of 625 kg or more this correlation is low negative to an average positive. In cows a positive correlation between live weight and milk yield per lactation is noted, except for group of cows with a high live weight where this correlation is not established. It should be noted that along with an increase in live weight from 550 kg or less to a weight of 599 kg, the correlation between these signs decreased, but this correlation increased among the cows with a live weight of 600-624 kg. The correlation between live weight and milk quality parameters per lactations is also ambiguous and ranged from high positive (0.89, 1 lactation, weight up to 550 kg) to low negative (-0.19, 1 lactation, weight 625 kg or more) in terms of correlation between live weight and mass fraction of fat (MFF) in milk.

1. Introduction

To implement the Federal Scientific and Technical Program for Development of Agriculture in Russia for 2017-2025 it is necessary to develop the domestic production base, as well as to develop new types of products, new methods and safety assessment and a control system for agricultural raw materials of food products [1-7]. Special attention is paid to the development of dairy cattle breeding, since the main amount of milk (more than 97% of the total production) as a valuable food product and raw material for the processing industry is obtained from cattle. Milk provides a human with complete essential nutrients and is well digested by body. The milk yield increase among the cows is inseparably associated with improvement in milk quality, which has a significant impact on the quality of finished dairy products [8-18]. Nowadays for milk production in our country in recent years dairy cattle of domestic and foreign selection are used, which main livestock is represented by the black-and-white breed and Holstein breed. Since the end of the 70s of the last century the domestic black-and-white cattle has been systematically improved everywhere by adding the blood of the world's best dairy breed – i.e. the Holstein. As a result of such selection and breeding work in certain regions of the country, large groups of dairy cattle with



a high proportion of Holstein breed blood have been created. These cows feature biologically and economically useful traits depending on the breeding zone and breed resources used for cross-breeding [12-16]. In Sverdlovsk region the purebred bulls of Holstein breed with high productive qualities according to their maternal ancestors were used on the breeding stock of the black-and-white breed of Ural offspring. In 2002 a new Ural type of black-and-white breed was officially registered. Animals of this type are large-bodied and feature high milk productivity [17-27]. Evaluation of correlation of cows live weight with their milk yield depending on their age is relevant and has practical importance.

The aim of the research to study the correlation of productive and productive characteristics depending on the age of cows.

2. Materials and method

The research was implemented in one of breeding farms-multipliers engaged in breeding of black-and-white cattle of Ural type. The cows of the first and third lactation were divided into groups according to their live weight: cows less than 550 kg, 550-574 kg, 575-599 kg, 600-624 kg and more than 625 kg. Data and records of zootechnical and breeding information from *Seleks* database were used for analysis. Milk productivity was taken into account by control milking once a month, as well as by milk quality parameters: mass fraction of fat (MFF) and mass fraction of protein (MFP) in milk. These parameters per every cow were checked monthly in a dairy laboratory of OJSC “Uralplemcenter” of Sverdlovsk region. The coefficients of correlation between live weights and milk yield were calculated – upon the milk yield for 305 day per lactations, as well as coefficients of correlation between live weights - quality parameters of milk (MFF – MFP in milk) in milk per lactations.

3. Results

In order to increase the herd efficiency during selection and breeding work, it is important to use selection features and parameters in selection, and take into account their relation with each other. The farm uses Holstenized black-and-white cattle of Ural type with a high genetic potential for milk yield. In 2019 on average 8,215 kg of milk was received from each cows of 1,100; MFF and MFP in milk were 4.25 and 3.07%, respectively.

The milk yield of first heifers has been increasing for the last 3 years as well as the milk yield from the full-aged cows (figure 1).

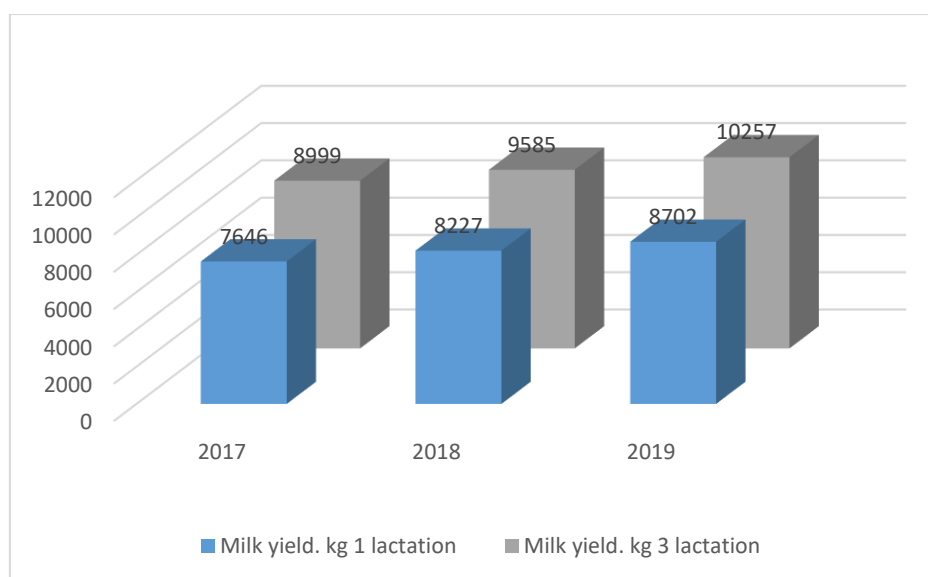


Figure 1. Milk yield of first heifers and cows for 3 lactation, kg.

The increase in milk yield for the first lactation is provided by a high level of breeding work on the farm, since animals with a higher potential for milk yield has been introduced into the herd every year, which led to increase of milk yield in first heifers for 3 years by 1,056 kg, or 13.8%. Milk yield increases with age, thus confirming the general regularity of milk yield, which is higher among the full-aged cows. Milk yield of full-aged cows increased by 1,258 kg or 14.0%.

It was found that the live weight of animals influences on the milk yield of first heifers and the cows (figure 2).

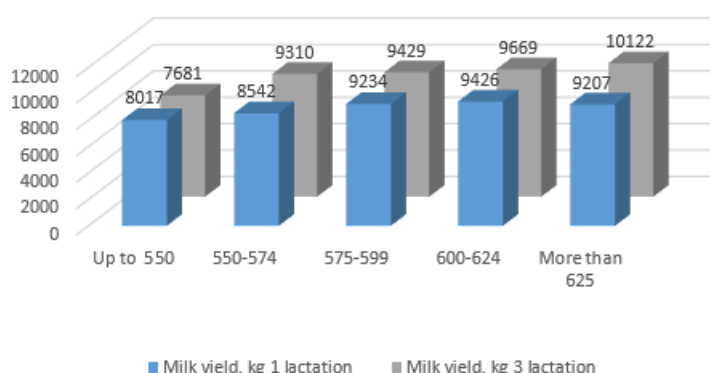


Figure 2. Milk yield of heifers and cows, depending on the live weight, kg.

It is obvious that full-age cows, except for the animals of live weight less than 550 kg, surpass the first heifers in milk yield per lactation. The group of cows with low live weight showed the lowest milk yield even in comparison with first heifers. This fact once again confirms the conclusion about the orientation of breeding work towards improving productive qualities. Milk yield of first heifers increases together with increase in live weight to 625 kg; and when it rises above 625 kg, the milk yield slightly decreases. However, the difference in this value between the groups with a live weight of 600-624 kg and 625 kg and more is insignificant, amounting to 229 kg or 2.5% ($P \geq 0.05$). In full-aged cows' milk yield per lactation increases along with an increase in live weight, reaching a maximum at the highest weight – 625 kg and more. The undoubted correlation of these parameters between each other, depending on a cow's age, arouses interest (figure 3).

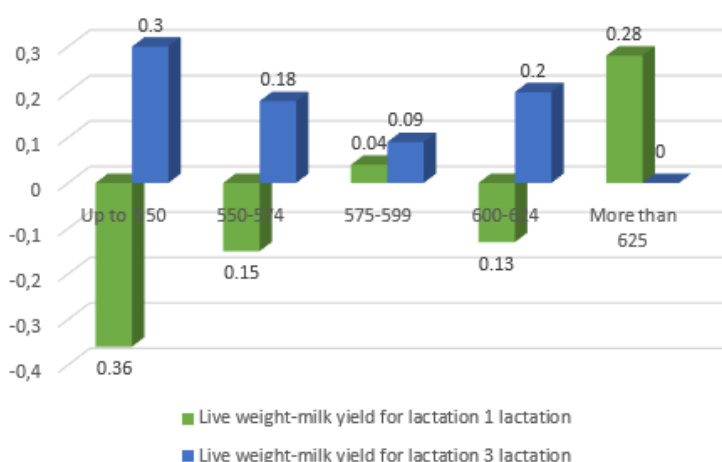


Figure 3. Correlation coefficients between live weight and milk yield for lactation.

Correlation between body weight and milk yield in heifers and cows varies. In first heifers with a live weight of less than 550 kg the medium negative correlation is observed, in first heifers with a live weight of 625 kg or more this correlation varies from a low negative to medium positive. In cows a positive correlation was noted between live weight and milk yield per lactation, except for cows with a

high weight, in which group this correlation was not established. It should be noted that with increase in live weight from 550 kg or less to a weight of 599 kg, there is a decrease in correlation between these signs, which increases with a live weight of 600-624 kg. Despite the absolute increase of milk yield in first heifers with their increase of live weight up to 624 kg, and in cows – 524 kg and more, the variability of the correlation coefficients does not allow predicting the milk yield of cows based on changes in their live weight.

The correlation between live weight and quality parameters per lactations was also ambiguous, and this correlation ranged from high positive value (0.89, 1 lactation, weight up to 550 kg) to low negative (-0.19, 1 lactation, weight 625 kg or more) in correlation between live weight and MJF in milk (figure 4).

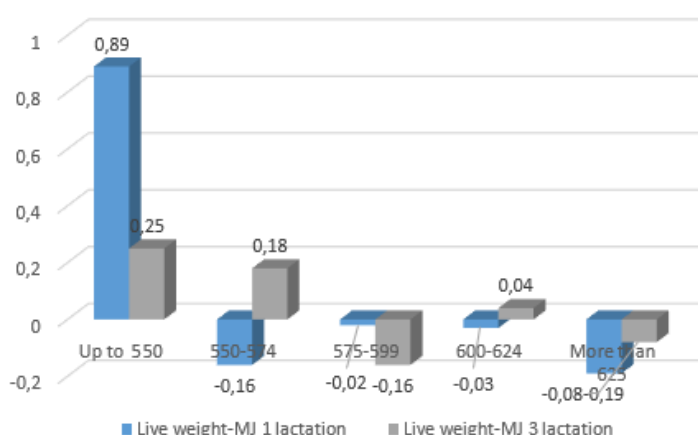


Figure 4. Correlation coefficients between live weight and MJF in milk.

It was found that smaller fluctuations in the coefficient of correlation between live weight and MJF in milk were recorded in the group of full-aged cows. In first heifers those fluctuations were more significant. Similar parameters were obtained when assessing the correlation between live weight and MFP in milk (figure 5).

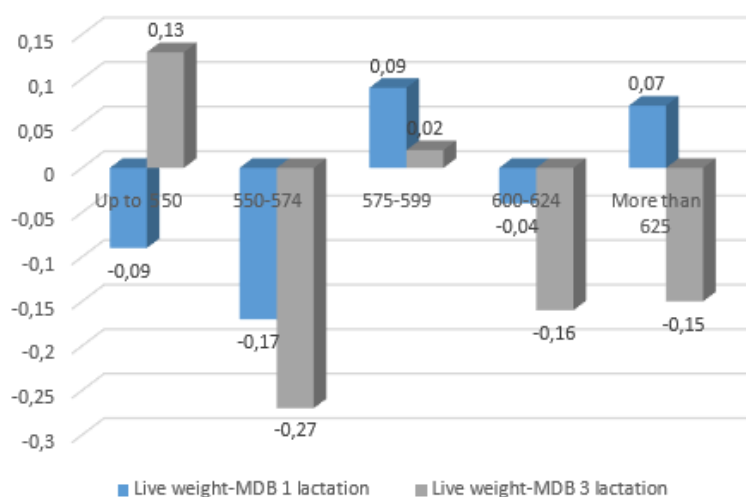


Figure 5. Correlation coefficients between live weight and MDB in milk.

The figure above shows that there are fluctuations in the coefficients of correlation between live weight and MFP in milk and the correlation of these parameters to each other, does not allow taking into account their interrelation while running selection and breeding work with the herd. The animals must be selected separately per each of the feature.

4. Discussion

Correlation of economically useful traits between each other is important during breeding activities on the farm in order to increase the breeding value of the cows. It has been defined in this farm that it's necessary to select animals in order to improve valuable breeding qualities per each individual trait - live weight and milk yield, taking into account the absolute increase of each trait together with an increase in live weight, MFF and MFP in milk. Similar studies were carried out N. V. Bogolyubova, V. P. Korotky, A. S. Zenkin, V. A. Ryzhov, N. P. Buryakov [23,24], Mymrin V. and Loretts O. [21], O. V. Gorelik, O. E. Lihodeevskaya, N. N. Zezin, M. Ya. Sevostyanov and O. I. Leshonok [25-27].

5. Conclusion

The increase of live weight in the first heifers and cows leads to absolute increase of milk yield in cows, but the live weight does not have a natural correlation of these parameters between each other. It is different for cows of different ages. No logical relation has been established between the live weight and quality parameters of milk. The variability of this relation between these features does not allow taking it into account during selection and breeding work on a herd. The animals must be selected separately per each of this feature.

References

- [1] Gorelik O, Rebezov M, Gorelik A, Harlap S, Dolmatova I, Zaitseva T, Maksimuk N, Fedoseeva N and Novikova N 2019 Effect of bio-preparation on physiological status of dry cows *International Journal of Innovative Technology and Exploring Engineering* **8(7)** 559-62
- [2] Gorelik O et al. 2019 The state of nonspecific resistance of calves during the preweaning period *International Journal of Pharmaceutical Research* DOI: 10.31838/ijpr/2019.11.01.133
- [3] Gorelik O et al. 2017 Study of chemical and mineral composition of new sour milk bio-product with sapropel powder *Annual Research & Review in Biology* **18(4)** 1-5 DOI: 10.9734/ARRB/2017/36937
- [4] Gorelik O et al. 2020 Studying the biochemical composition of the blood of cows fed with immune corrector biopreparation *AIP Conference Proceedings* **2207** 020012 DOI: 10.1063/5.0000317
- [5] Belookov A, Belookova O, Zhuravel V, Gritsenko S, Bobyleva I, Ermolova E, Ermolov S, Matrosova Y, Rebezov M and Ponomarev E 2019 Using of EM-technology (effective microorganism) for increasing the productivity of calves *International Journal of Engineering and Advanced Technology* **8(4)** 1058-61
- [6] Khaziakhmetov F et al. 2018 Effect Of Probiotics On Calves, Weaned Pigs And Lamb Growth *Research Journal of Pharmaceutical, Biological and Chemical Sciences* **9(3)** 866-70 WOS:000438847100113
- [7] Khaziakhmetov F, Khabirov A, Rebezov M, Basharov A, Ziangulov I and Okuskhanova E 2018 Influence of probiotics "Stimix Zoostim" on the microflora of faeces, hematological indicators and intensivity of growth of calves of the dairy period *International Journal of Veterinary Science* **7(4)** 178-81
- [8] Gorelik A et al. 2016 Lactation performance of cows, quality of colostrum milk and calves' livability when applying "Albit-bio" *Advances in Agricultural and Biological Sciences* **2(1)** 5-12
- [9] Gorelik O V et al. 2016 The effectiveness of dietary supplements Ferrourtikavit usage for the dairy cows *Advances in Agricultural and Biological Sciences* **2(1)** 27-33
- [10] Smolnikova F, Moldabayeva Z, Klychkova M, Gorelik O, Khaybrakhmanov R, Mironova I, Kalimullin A and Latypova G 2019 Sour milk production technology and its nutritive value *International Journal of Innovative Technology and Exploring Engineering* **8(7)** 670-2
- [11] Chernopolskaya N, Gavrilova N, Rebezov M, Harlap S, Nigmatyanov A, Peshcherov G, Bychkova T, Vlasova K and Karapetyan I 2019 Biotechnology of specialized fermented

- product for elderly nutrition *International Journal of Pharmaceutical Research* **11(1)** 545-50 DOI: 10.35940/ijrte.B3158.078219
- [12] Chernopolskaya N, Gavrilova N, Rebezov M, Dolmatova I, Zaitseva T, Somova Y, Babaeva M, Ponomarev E and Voskanyan O 2019 Biotechnology of specialized product for sports nutrition *International Journal of Engineering and Advanced Technology* **8(4)** 40-5 DOI: 10.35940/ijrte.B3158.078219
- [13] Gavrilova N, Chernopolskaya N, Rebezov M, Moisejkina D, Dolmatova I, Mironova I, Peshcherov G, Gorelik O and Derkho M 2019 Advanced Biotechnology of Specialized Fermented Milk Products *International Journal of Recent Technology and Engineering* **8(2)** 2718-22 DOI: 10.35940/ijrte.B3158.078219
- [14] Gavrilova N, Chernopolskaya N, Rebezov M, Shchetinina E, Suyazova I, Safronov S, Ivanova V and Sultanova E 2020 Development of specialized food products for nutrition of sportsmen *Journal of Critical Reviews* **7(4)** 233-6 DOI: 10.31838/jcr.07.04.43
- [15] Temerbayeva M *et al.* 2018 Development of Yoghurt from Combination of Goat and Cow Milk *Annual Research & Review in Biology* **23(6)** 1-7 DOI: 10.9734/arrb/2018/38800
- [16] Temerbayeva M *et al.* 2018 Technology of Sour Milk Product For Elderly Nutrition *Research journal of pharmaceutical biological and chemical sciences* **9(1)** 291-5
- [17] Serikova A, Smolnikova F, Rebezov M, Okuskhanova E, Temerbayeva M, Gorelik O, Kharlap S, Baitukenova Sh, Baitukenova S and Tumbasova Y 2018 Development Of Technology Of Fermented Milk Drink With Immune Stimulating Properties *Research Journal of Pharmaceutical, Biological and Chemical Sciences* **9(4)** 495-500 WOS:000438848100062
- [18] Smolnikova F, Toleubekova S, Temerbayeva M, Cherkasova E, Gorelik O, Kharlap S, Derkho M, Rebezov M and Penkova I 2018 Nutritive Value Of Curd Product Enriched With Wheat Germ Research *Journal of Pharmaceutical, Biological and Chemical Sciences* **9(3)** 1003-8 WOS:000438847100131
- [19] Rebezov M B *et al.* 2021 Control of the stability of the results of studies of cadmium content using the method of additions in cow's milk samples *IOP Conf. Ser.: Earth Environ. Sci.* **677** 052051 doi:10.1088/1755-1315/677/5/052051
- [20] Skvortsov E, Bykova O, Mymrin V, Skvortsova E, Neverova O, Nabokov V and Kosilov V 2018 Determination of the applicability of robotics in animal husbandry *The Turkish Online Journal of Design Art and Communication* **8(S-MRCHSPCL)** 291-9
- [21] Mymrin V and Loretts O 2019 Contemporary trends in the formation of economically-beneficial qualities in productive animals. Digital agriculture - development strategy *Proceedings of the International Scientific and Practical Conference (ISPC 2019) Advances in Intelligent Systems Research* 511-4
- [22] Gridina S, Gridin V and Leshonok O 2018 Characterization of high-producing cows by their immunogenetic status *Advances in Engineering Research* 253-6
- [23] Bogolyubova N, Korotky V, Zenkin A, Ryzhov V and Buryakov N 2017 Digestion and metabolism indices of sheep when using activated charcoal supplement *OnLine Journal of Biological Sciences* **17(2)** 121-7
- [24] Bogolyubova N, Romanov V, Korotky V, Ryzhov V and Zenkin A 2017 Assessing efficiency of the coniferous energy supplement in the diet of dairy cows for maintaining productive health *Asian Journal of Pharmaceutical and Clinical Research* **10(10)** 117-20
- [25] Gorelik O V *et al.* 2020 Assessment of the effect of inbreeding on the productive longevity of dairy cattle *IOP Conf. Ser.: Earth Environ. Sci.* **548** 082009 doi:10.1088/1755-1315/548/8/082009
- [26] Gorelik O V *et al.* 2020 The use of inbreeding in dairy cattle *breeding IOP Conf. Ser.: Earth Environ. Sci.* DOI: 10.1088/1755-1315/548/8/082013
- [27] Gorelik O *et al.* 2020 Studying the biochemical composition of the blood of cows fed with immune corrector biopreparation *AIP Conference Proceedings* **2207** 020012 DOI: 10.1063/5.0000317