Influence of the duration of lactation and the season of the year on the manifestation of diseases that cause culling of animals

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Abstract. The article describes animal diseases as the reasons for their culling. The number of animals culled from the herd was analyzed depending on the duration of lactation. It was found that in most cases (20.1%) the culled animals had lactation duration close to standard. It was revealed that the largest number of dairy cows, both during the completed lactation and in the first 100 days of lactation, drop out of the herd due to obstetric and gynecological diseases (42.0-45.9%). Internal non-communicable diseases, as a factor in animal retirement, are in second place in terms of prevalence. In the studied population of animals, 30.7-33.4% of cases of culling of animals as a result of these diseases were found. Assessment of the structure of internal non-communicable diseases showed that diseases of the digestive system (40.0-43.1%) and diseases of the respiratory system (36.6-38.4%) prevail among them. Analysis of the seasonality of internal non-communicable diseases showed that most often diseases of the digestive system, respiratory system, metabolism and endocrine organs contribute to the culling of animals in the spring (26.7, 30.0 and 33.3% respectively), and diseases of the cardiovascular system cause the withdrawal of animals in winter (37.7%).

1. Introduction
In the last decade, the milk production of cows has increased significantly. Their morbidity has absolutely naturally increased, especially during the transit period [1-2]. A large proportion of all pathologies are metabolic disorders, mastitis, diseases of the distal extremities, etc. [3-4]. Retrospective assessment of the prevalence of clinical cases of diseases helps to understand the prevailing problems in different age and gender groups, the seasonal distribution of diseases, etc. [5]. The consequences of metabolic disorders in general are a change in the hormonal status of the cow’s body, which negatively affects the reproductive function, and also leads to a decrease in milk production. Analysis of reproductive qualities, assessment of the level of productivity in relation to the morbidity of animals is promising areas of research [6].

2. Materials and methods
Evaluation of 7,986 cases (including 1006 cases in the first 100 days of lactation) of culling dairy cows from herds of studied livestock enterprises of the Republic of Tatarstan in the period from 2013 to 2019, due to diseases was carried out on the basis of analysis of forms of veterinary and zootechnical registration, as well as databases of the "SELEX Dairy cattle". In the structure of the studied population of cows, 44.88% were cows of the Kholmogorsk breed, 31.86% - of the Tatarstan
type of the Kholmogorsk breed, 21.03% - of the Black-and-White Holstein breed and 2.23% - of the Black-and-White breed. The assessment of the duration of lactation in retired animals was carried out. All analyzed cases of culling of cows as a result of diseases were divided into 4 groups: obstetric and gynecological diseases, internal non-communicable diseases, and surgical diseases, infectious and invasive diseases. Internal non-communicable diseases were divided into the following groups: diseases of the digestive system, diseases of the respiratory system, diseases of metabolism and endocrine organs, diseases of the cardiovascular system. We assessed the incidence of these diseases by seasons: winter, spring, summer and autumn.

3. Results

It was found that the largest number of dairy cows (20.1%) leave the herd with lactation duration of 301-350 days. Animals whose lactation lasts 251-300 days drop out 2.4% less often. The proportion of retired cows whose lactation lasts 201-250 days is 14.0%, and 315-400 days - 12.3%. With other duration of lactation, the proportion of abandoned animals does not exceed 10.0% (figure 1).

![Figure 1. The proportion of animals retired depending on the duration of lactation.](image)

Evaluation of the studied cases of culling of cows showed that most often animals leave the herd due to obstetric and gynecological diseases (45.9%). 12.5% less often cows are culled due to internal non-communicable diseases (33.4%), in 20.1% of cases - due to surgical diseases, in isolated cases - due to infectious and invasive diseases. If we consider the reasons for the culling of animals in the first 100 days of lactation, then it should be noted that the share of obstetric and gynecological diseases is also predominant, although slightly lower - 42.05%. Also during this period, animals are less likely (30.7%) to drop out due to internal non-communicable diseases, while the share of surgical diseases increases to 26.64%. It should be noted that the share of infectious and invasive diseases in the structure of reasons for culling animals remains unchanged (table 1).

| Indicator                        | Completed lactation, % | including in the first 100 days of lactation, % |
|----------------------------------|------------------------|-----------------------------------------------|
| Obstetric and gynecological diseases | 45.9                   | 42.0                                           |
| Internal non-communicable diseases    | 33.4                   | 30.7                                           |
| Surgical diseases                  | 20.1                   | 26.6                                           |
| Infectious and invasive diseases     | 0.6                    | 0.6                                            |
The analysis of the structure of internal non-communicable diseases showed that in most cases, diseases of the digestive system (43.1%) are generally considered as the reason for the animal leaving the herd for complete lactation. Diseases of the respiratory system are 6.5% less likely to cause culling of animals. Metabolic and endocrine diseases occur 2.1 times less frequently than diseases of the respiratory system - in 17.8% of cases. The smallest share among internal non-communicable diseases is occupied by diseases of the cardiovascular system. It should be noted that in the first 100 days of lactation, their share is 0.3% lower than for complete lactation as a whole, as well as the share of diseases of the digestive system for the indicated period is 3.1% less, although the share of diseases of the respiratory system increases by 1.8%, and diseases of metabolism and endocrine organs - by 1.6% (table 2).

Table 2. Percentage of internal non-communicable diseases causing culling of animals.

| Indicator                                | Completed lactation, % | including in the first 100 days of lactation, % |
|------------------------------------------|------------------------|-------------------------------------------------|
| Digestive system diseases                | 43.1                   | 40.0                                            |
| Respiratory system diseases              | 36.6                   | 38.4                                            |
| Diseases of metabolism and endocrine organs | 17.8                  | 19.4                                            |
| Diseases of the cardiovascular system    | 2.5                    | 2.2                                             |

An assessment of the seasonality of internal non-communicable diseases, as a result of which the cows left the herd, showed that diseases of the digestive system were most often recorded in the spring, however, as in the winter, spring and summer periods in general, their share ranged from 25.7 to 26.7%, and in the autumn it was 5.3% lower than in the spring. Diseases of the respiratory system in most cases (30.0%) were the reason for the culling of animals also in the spring. For this reason, animals dropped out of the herd by 3.0% and 7.3% less often for this reason in summer and winter, respectively, and least of all in autumn. The peak of diseases of metabolism and endocrine organs also falls in the spring, when their share in the structure of the reasons for leaving was 33.3%. Slightly lower - in winter. In the summer and autumn periods, the frequency of their occurrence decreases significantly and averages 17.5%. It should be noted that the largest number of diseases of the cardiovascular system was detected in winter and amounted to 37.7%. Further, in the spring, summer and autumn periods, their gradual decline is observed with minimum values in the fall - 11.4% (table 3).

Table 3. Seasonality of internal non-communicable diseases that cause culling of animals.

| Index                                | Winter, % | Spring, % | Summer, % | Autumn, % |
|--------------------------------------|-----------|-----------|-----------|-----------|
| Digestive system diseases            | 26.1      | 26.7      | 25.7      | 21.4      |
| Respiratory system diseases          | 22.7      | 30.0      | 27.0      | 20.3      |
| Diseases of metabolism and endocrine organs | 31.8      | 33.3      | 19.7      | 15.2      |
| Diseases of the cardiovascular system| 37.7      | 34.3      | 16.6      | 11.4      |

4. Discussion
In his studies, E.V. Firsov and A.P. Kartashova (2019) [7] noted that lengthened lactation is observed in more than half of dairy cows. In our study, the proportion of rejected animals whose lactation exceeded 301-350 days was only 25.5%, which is significantly less. The patterns of culling animals established by us due to certain diseases generally correspond to the patterns obtained by P.T. Thomsen et al. (2004) [8], although N. Petkevich (2003) [9] noted that the main reasons for the withdrawal of cows from the herd are limb diseases, loss of reproductive abilities, abnormal calving and various injuries. Our results on the number of diseases of the digestive system are slightly higher than the data of A.I. Marenkova, O.A. Pronina, N.S. Borodulina (2011) [10], who identified them in
30.0% of cases, but they indicate a rather low (9.5%) spread of diseases of the respiratory system and
diseases of metabolism and endocrine organs (11.8%). It should be noted that the values for the level
of diseases of the respiratory system established in our studies are several times higher than those
indicated by A.I. Akmullin (2011) [11]. An increase in the loss of animals due to certain diseases in
the off-season during the transition from warm temperatures and vice versa was reported by C.D.
Dechow, and R.C. Goodling. (2008) [12], which is consistent with our results. In addition, G. L. Hahn,
et al. (2002) [13] noted that animals are especially sensitive to extreme weather conditions. The
studies of A. Vitali (2009) [14] also proved that in the spring and summer periods the culling of cows
occurs most intensively.

5. Conclusion
The key role of obstetric and gynecological diseases in the culling of dairy cows from the herd (42.0-
45.9%) is established; in second place among the reasons for leaving are internal non-communicable
diseases (30.7-33.4%). Among the latter, diseases of the digestive system prevail (40.0-43.1%). More
often, diseases of the digestive system, respiratory system, metabolism and endocrine organs cause the
departure of animals in the spring and diseases of the cardiovascular system - in the winter. The largest
number of retired cows has lactation duration close to standard.

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