The relationship between dry matter intake and the average daily gain

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Abstract. The productivity of animals is closely related to the quality of the diet and of dry matter intake. Dry matter intake (DMI) is a factor that needs to be assessed before an animal's diet can be calculated correctly. Purebred bulls of the Kazakh white-headed breed in the amount of 70 heads of 7-8 months of age were selected for the experiment. By the end of the test, the bulls were about 11-12 months old. The average weight of the bulls when put to the test was 248.47 ± 2.46 kg, at the end of the test their average weight was 319.7 ± 3.44 kg. It is worth noting that the largest average daily increase was 2.46 ± 0.05 kg, which was in a bull that consumed 6.2 6 kg of dry matter per day, while the lowest average daily increase was 0.36 ± 0.05 kg, which was in a bull that consumed 5.67 kg of dry matter.

Key words: bulls; beef, live weight; average daily gain, dry matter, dry matter intake

1 Introduction

In the Republic of Kazakhstan, there has always been enough grazing cattle on natural pastures. However, the growing demand for high-quality beef, unlike other types of meat, agriculture poses new challenges and priorities for increasing production for producers and improving the quality of the products obtained [1]. Ed Rayburn points out that over the years, scientists have worked on many aspects of feeding and rational use, which has led to achievements related to the efficiency and overall productivity of animals [2].

According to Michael L. Galyean et al. dry matter intake (DMI) is an important parameter in the compilation of quantitative indicators to meet nutritional needs, predict daily weight gain of animals and assess the profitability of the farm, mainly in feedlots. Thus, in order to reduce the cost of speed and use cheaper ingredients in diets, it is necessary to keep animals with high productivity [3].

Tadeu Silva De Oliveira write that the productivity of animals is closely related to the quality of the diet and the dry matter intake (DMI). Dry matter intake (DMI) is a factor that needs to be assessed before an animal's diet can be calculated correctly. Mertens believed that, for any successful nutrition or production program, it is important to understand and predict dry matter intake (DMI). DMI depends on the interaction of the animal, the diet, and the feeding environment [4].

Accurate estimates of feed intake are essential for predicting the extent to which diets meet requirements for maintenance and production of various classes of beef cattle. Nonetheless, because of the multifactorial nature of its control in ruminants, predicting intake accurately is a significant practical challenge. [4].

The formation of a new variable may not have a nonparametric distribution, and in this case it approximates the nonparametric Cauchy distribution (Ruzgas et al., 2021) [5]. According to Detmann et al. (2005) [6] and Lage et al. (2019) [7], the relationship between DMI and ADG does not take into account that a significant portion of raw materials can be used to meet maintenance needs. Thus, changes in the portion of feed used to maintain the basic metabolism will lead to deviations that may not be easy to detect if a conclusion about production is made based on this relationship [8].

The purpose of this study is to compare a single-factor analysis (the relationship between dry matter intake (DMI) and average daily gain (ADG).
2 Materials and methods

The object of the study is the bulls of the Kazakh white-headed breed. Purebred bulls of the Kazakh white-headed breed in the amount of 70 heads of 7-8 months of age were selected for the experiment. By the end of the experiment, the bulls were about 11-12 months old. The animals were selected considering the live weight and physiological condition of the bulls.

During the test period, the bulls were in the same feeding and maintenance conditions. In our study, the diet of experimental bulls consisted of feed produced on the farm. The main feed was hay, haylage, barley and premix. The feeding norms during the period of scientific research corresponded to the breed, live weight, and physiological condition of the bulls.

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To determine the live weight of bulls, the Brazilian Intergado system was used, which allows to obtain daily data on average daily gain, and control weightings of animals were carried out on the electronic scales of Novobratskoye LLP. Growth and development were monitored by weighing on the first day of evaluation, then every 28 days for 70 days in the morning before feeding. The bulls were divided into 3 groups according to the average daily gain. On average, the average daily gain in the first group was 0.75 kg, in the 2nd group 0.97 kg and in the 3rd group 1.2 kg. The data obtained served as the basis for establishing the average daily weight gain.

Chemical analysis of feed was carried out in the laboratory of "BKN Nova" LLP, and were also investigated in the laboratory of zootechnical analysis of feed and milk of S.Seifullin KATU on the FOSS NIRS DS2500 F analyzer. The SPSS 25.0 software was used to obtain descriptive statistics.

3 Results

To study the relationship, a chemical analysis of feed was carried out, the main indicators such as dry matter, metabolic energy, crude fiber, crude fat, crude protein, calcium, and phosphorus were calculated.

Table 1. Diet

<table>
<thead>
<tr>
<th>Feed</th>
<th>Giving, kg</th>
<th>DM %</th>
<th>ME MJ, MJ</th>
<th>AD F, %</th>
<th>ND F, %</th>
<th>CP %</th>
<th>CF %</th>
<th>Ca, g</th>
<th>P, g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haylage</td>
<td>15</td>
<td>38, 8</td>
<td>10, 27</td>
<td>43, 13</td>
<td>3, 8</td>
<td>18</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay</td>
<td>3</td>
<td>86, 4</td>
<td>8, 14, 2</td>
<td>63, 10</td>
<td>1, 9</td>
<td>9</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>4</td>
<td>87, 3</td>
<td>13, 70</td>
<td>19, 12</td>
<td>2, 2</td>
<td>20</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premix</td>
<td>0, 1</td>
<td>5</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>22, 1</td>
<td>54</td>
<td>104, 25</td>
<td>42, 12</td>
<td>3, 1</td>
<td>50</td>
<td>28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

According to Table 1, on average, bulls consumed 54% of dry matter, crude protein in the diet was 12.4%.

The amount of crude fiber was 44.9%, the diet contained 3.1% of crude fat. The diet also had 25.2% and 42.5% ADF and NDF. Also, the amount of calcium and phosphorus in the diet was 50 and 28 grams, respectively.

Table 2 shows the average indicators for the dry matter intake and for the average daily weight gain of the three groups that were formed by the average daily weight gain. To verify the assumption of the ANOVA test based on dry matter intake data, the normality of the data was checked using the Kolmogorov-Smirnov test (P =0.200). The observed data value coincides with the expected value, that is, the degree of deviation of the data from the theoretical distribution is minimal, which indicates the normality of the distribution (P>0.05). Using the Livin test, it was found that the deviations were homogeneous P = 0.302. The results of the statistical analysis are shown in Table 2.

Table 2. Indicators for dry matter intake and average daily gain

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Average</th>
<th>δ</th>
<th>Min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>21</td>
<td>5,3±0,37</td>
<td>1,7</td>
<td>1,73</td>
<td>9,48</td>
</tr>
<tr>
<td>Group 2</td>
<td>25</td>
<td>6,5±0,29</td>
<td>1,1</td>
<td>3,81</td>
<td>9,50</td>
</tr>
<tr>
<td>Group 3</td>
<td>24</td>
<td>6,9±0,37</td>
<td>1,8</td>
<td>3,83</td>
<td>9,32</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>6,32±0,2</td>
<td>1,78</td>
<td>1,73</td>
<td>9,50</td>
</tr>
</tbody>
</table>

On average, the bulls consumed 6.32±0.21 kg of dry matter and the average daily gain was 0.10±0.03 kg. Group 1 consumed 5.3 ±0.37 kg of dry matter and the average daily increase of this group was 0.75±0.02 kg, while group 2 consumed 6.5±0.29 kg of dry matter and the average daily gain was 0.97±0.01 kg, which is 22% more than group 1. Group 3 consumed an average of 6.9±0.37 kg of dry matter and the average daily gain was 1.2±0.05 kg. Compared with group 1 and 2, the average daily gain of group 3 is 37.5% and 19.1% more, respectively. It is worth noting that the largest average daily gain was 2.46±0.05 kg, which was in a bull that consumed 6.26 kg of dry matter per day, which is a descendant of the Cactus line, while the lowest average daily increase was 0.36± 0.02 kg, which was in a bull...
that consumed 5.67 kg of dry matter and is a descendant Veteran lines.

To test the assumptions of the ANOVA test according to the average daily gain, the normality of the data was checked using the Kolmogorov-Smirnov test (P=0.08). The observed data value coincides with the expected value, that is, the degree of deviation of the data from the theoretical distribution is minimal, which indicates the normality of the distribution (P=0.05). Using the Livin test, it was found that the deviations were homogeneous P=0.229.

Table 3. Relationship between dry matter intake and average daily weight gain

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Average DM</th>
<th>ADG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>21</td>
<td>5.3±0.37</td>
<td>0.75±0.02</td>
</tr>
<tr>
<td>Group 2</td>
<td>25</td>
<td>6.5±0.29</td>
<td>0.97±0.01</td>
</tr>
<tr>
<td>Group 3</td>
<td>24</td>
<td>6.9±0.37</td>
<td>1.2±0.05</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>6.32±0.21</td>
<td>1.01±0.03</td>
</tr>
<tr>
<td>Correlation</td>
<td>R=0.95</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These studies were conducted to study the relationship between the average daily gain and the dry matter intake. In the course of the study, it was revealed that there is a positive correlation between dry matter intake and the average daily gain (R= 0.95). It follows that the more bulls consume dry matter, the more they gain weight.

4 Discussion

During the study, it was revealed that the bull of group 3, the Cactus line consumed 6.26 kg of dry matter per day and the average daily gain was 2.46± 0.05 kg, which is the largest gain, while the lowest average daily gain was 0.36± 0.02 kg, which was in the goby that consumed 5.67 kg of dry matter and is a descendant Veteran line.

Vickers M. in his research indicates that the low level of average daily growth is probably due to the nutritional properties of feed, as well as the genetics of beef cattle. When studying the possibilities of providing feed, it is important to take into account the content of DM in each potential source to assess the efficiency of feed production for beef cattle; this is closely related to the average daily increase of group 3 is 37.5% and 19.1% more, respectively.

It is also worth noting that the goby of group 3, the Cactus line consumed 6.26 kg of dry matter per day and the average daily gain was 2.46± 0.05kg, which is the largest gain, while the lowest average daily gain was 0.36± 0.02 kg, which was in the goby that consumed 5.67 kg of dry matter and is a descendant Veteran lines.

The results of these studies show that there is a positive correlation (R=0.95) between the consumption of dry matter and the average daily increase.

5 CONCLUSIONS

In the course of the analysis, it was revealed that group 3 consumed an average of 6.9 ±0.37 kg of dry matter and the average daily increase was 1.2 ± 0.05 kg. Compared with group 1 and 2, the average daily increase of group 3 is 37.5% and 19.1% more, respectively.

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References

