THE EFFECT OF GROWTH RATE ON SOME BEEF PERFORMANCE CHARACTERISTICS OF CZECH FLECKVIEH HEIFERS

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Abstract


The objective of this study was to determine the effect of growth rate on some beef performance characteristics in Czech Fleckvieh heifers. Growth performance characteristics included age at slaughter (months) and daily weight gain (g). The observed beef performance characteristics were carcass weight, conformation class (SEUROP) and external fat deposition. The experimental group consisted of 480 heifers. The animals were assigned into three groups (A, B, C) based on age at slaughter. Group A consisted of 68 animals with the age at slaughter 15–21 months, group B 296 animals, age 22–28 months and group C 116 animals, age 29–35 months. A greater age at slaughter was significantly associated with a greater carcass weight which grew from 250.78 kg in group A to 317.69 kg in group C. The net weight gain decreased with age from 424.06 g in group A to 346.41 g in group C, the conformation improved from 4.46 in group A to 4.17 in group C and the external fat deposition increased from 2.5 in group A to 2.78 in group C. The dataset was again split into three groups differing in the daily weight gain (I, II, III). Group I consisted of 120 heifers with the daily gain up to 599 g, group II 303 animals with the daily gain of 600–799 g and group III only 57 animals with the gain of 800 g and more. A growing weight gain was significantly associated with a greater carcass weight (from 260.40 kg in group I to 338.66 in group III), a greater net weight gain (from 306.29 g in group I to 491.45 g in group III), improved conformation (from 4.75 in group I to 3.70 in group III) and the fat deposition was greater, too (from 2.35 in group I to 2.89 in group III).

Keywords: Czech Fleckvieh cattle, heifers, beef performance, growth rate

INTRODUCTION

Cattle farming is a major and essential part of the farming industry, closely connected to other areas of the agricultural production. Its development and growing milk and beef performance are closely related to the improved efficiency. The performance of Czech Fleckvieh cattle, as a dual purpose breed, is efficient in all production systems. Heifers play an important part in beef production although they are primarily intended for breeding and herd renewal. The heifers which have not served this purpose become slaughter animals. They are generally in good health and physical state but they greatly vary in age and live weight. This could affect carcass quality traits and fat deposition. The profitability of beef production largely depends on growth rate of slaughter animals. Number of scientists studied growing ability of various cattle breeds and categories (Aass, 1996; Depenbusch and Coleman, 2009; Chládek et al., 2005; Keane and Allen, 1998; Zahrádková et al. (2010), Bureš and Bartoň (2012), Bureš et al. (2004), Frickhem et al. (2002) and Filipčík and Šubrt (2005)) focused on beef performance of cattle. They pointed out that beef quality is an important criterion affecting customers’ decision-making. Therefore the research should focus on factors and mechanisms affecting the quality of beef, conformation and fat deposition in carcass of fattened animal.
The objective of this study was to determine the effect of age at slaughter on selected parameters of beef performance of heifers which were expressed by SEUROP classification and fat deposition. Then we determined also the effect of the average daily weight gain on beef performance of heifers and how these changes consequently assess variation in the market prices of animals across the classes and subclasses of SEUROP system.

MATERIAL AND METHODS

The experimental group included 480 heifers with 75% and more of Czech Fleckvieh cattle in genotype. The animals were slaughtered in a commercial abattoir and all the beef performance characteristics were determined: carcass weight (JUT – cold carcass weight), conformation class in SEUROP system (the letters were transferred into numbers for the purpose of the analysis S = 1, E = 2, U = 3, R = 4, O = 5, P = 6) and external fat content – subclasses 1–5. The animals were assigned to three groups according to their age at slaughter: age 15–21 months (group A, n = 68, average age 19.57 months), age 22–28 months (group B, n = 296, average age 25.69 months) and 29–35 months (group C, n = 116, average age 30.22 months).

The effect of daily live weight gain on beef performance was determined. The live weight of heifers at slaughter was calculated using the following formula:

$$\text{Average daily gain} = \frac{(\text{JUT} \times 1.85 - 32 \text{ kg})}{\text{age at slaughter in days}}.$$ 

The heifers were assigned into three groups according to their average daily gain: gain up to 599 g/day (group I, n = 120, average daily gain 528.34 g/day, net weight gain 306.29 g), 600 to 799 g/day (group II, n = 303, average daily gain 687.56 g/day, net weight gain 394.24 g) and 800 and more g/day (group III, n = 57, average daily gain 861.80 g/day, net weight gain 491.45 g).

The prices were calculated for each class and subclass of SEUROP classification of conformation and external fatness. The standard price underlaying this calculation was the average market price of beef (heifers) reported by State Agricultural Investment Fund in 2014 (TIS, 2014). Prices have been converted to the euro. Exchange rate from Czech National Bank was 1 EUR = 27.380 CZK (10.4.2015).

The observed parameters and characteristics were tested for inter-group differences by the analysis of variance using the programme STATISTICA 10.

RESULTS AND DISCUSSION

Tab. 1 presents beef performance characteristics of heifers and their relation to the age at slaughter. The heifers were mainly slaughtered at the age of 22–28 months – group B (296), with the average age of 25.7 months. Only 68 heifers were slaughtered at the age of 15–21 months (group A) with the average age of 19.6 months. Group C (29–35 months) was in between, with 116 animals and the average age of 30.2 months. The carcass weight was greatest in C (317.69 kg) and lowest in A (250.78 kg), group B was medium (302.69 kg). The intergroup differences were, as presumed, significant (P < 0.001). The average net weight gain was greatest in group A (424.06 g) and lowest in group C (346.41 g); in group B it was 389.20 g. The intergroup differences in the net weight gain were also highly significant (P < 0.01). The heifers in group C had the best conformation (4.17) and the animals from group A the worst (4.46), group B was on average classified with 4.18.

Group A was significantly different from groups C and B (P < 0.01). Groups B and C did not differ. External fatness was assessed (1 to 5) and the trend was contrary to the conformation class; group A had the lowest deposit of external fat (2.50), group B medium (2.69) and group C had the greatest external fat content (2.78). The difference was only significant between groups A and C (P < 0.01).

The average age of the heifers in group A was comparable to that presented by Filipčík and Šubrt (2005). Their experimental animals were on average 20 months old at slaughter and were mostly classified with U and R (3 and 4), which was better compared to our results (4.46). The fat classes (2 and 3) were similar to our results in the corresponding age group (2.50). The animals in the experiment of Studený et al. (2012) were on average 25 months old at slaughter, similarly to our group B (25.69). The conformation classification was again higher (3.87) and so was the fat class (3.15).

<table>
<thead>
<tr>
<th>Age at slaughter (months)</th>
<th>n</th>
<th>Average age at slaughter (months)</th>
<th>JUT (kg)</th>
<th>Average net gain</th>
<th>Conformation</th>
<th>Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>15–21</td>
<td>68</td>
<td>19.57 $^a$</td>
<td>250.78 $^a$</td>
<td>4.46 $^a$</td>
<td>2.50 $^a$</td>
</tr>
<tr>
<td>B</td>
<td>22–28</td>
<td>296</td>
<td>25.69 $^b$</td>
<td>302.87 $^b$</td>
<td>389.20 $^b$</td>
<td>4.18 $^b$</td>
</tr>
<tr>
<td>C</td>
<td>29–35</td>
<td>116</td>
<td>30.22 $^c$</td>
<td>317.69 $^c$</td>
<td>346.41 $^c$</td>
<td>4.17 $^b$</td>
</tr>
</tbody>
</table>

a, b, c – values in the same column marked with different letter differ (P < 0.05)
A, B, C – values in the same column marked with different letter differ (P < 0.01)
1) S = 1, E = 2, U = 3, R = 4, O = 5, P = 6
2) Fat class 1–5

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The external fat deposition was lower in our animals than in either of the above mentioned experiments. With growing age, the growth rate was decreasing. Frickhem et al. (2002) reported the net weight gain of 488 g, which was more than the net gain in all of our groups, including group A where the net gain was highest (424.06 g). However, our values were similar to those of Studený et al. (2012) who reported the net weight gain of 420 g. We found out a close positive association between the age at slaughter and carcass weight and conformation. Bureš et al. (2004) also reported that animals slaughtered at a greater live weight, with a greater carcass weight were classified higher for conformation.

Fig. 1 demonstrates how the age at slaughter affects the market price of animals, based on the conformation and fat class. There are two prices per kg of carcass weight. One is based on the conformation class with an average fat content and the other is based on the fat class with an average conformation. The “conformation” price was best in group C (the oldest heifers) but their price based on fat content was lowest. However, when the raising period is prolonged, the costs of raising are greater. Le Cozler et al. (2009) and Stevenson et al. (2008) recommend that heifers should be primarily raised with the aim to become replacement animals and make profit while the costs of their raising is kept to a minimum. Heikkila et al. (2008) suggested that in order to maximise profit, milking cows should be culled in later lactations if the costs of raising of replacement heifers are high. The costs of raising per day and animal range around 40 CZK (Chládek et al., 2013). The costs in group C (age at slaughter 30.22 months) are by 12 950.4 CZK greater than in group A (age at slaughter 19.57 months) whereas the difference in the market price of carcass (kg) is only 4 600 CZK.

The effect of growth rate on some beef performance characteristics is expressed in Tab. II. The heifers were assigned into three groups with different daily weight gains: Group I (400–599 g) with the average daily gain of 528.54 g, net weight gain 394.24 g; there were 120 animals which were slaughtered at 28 months of age on average. Group II (600–799 g) with the average daily weight gain of 687.56 g and the net weight gain of 394.24 g; there were 303 heifers which were slaughtered at the age of 25.68 months on average. Group III (800 g and more); there were only 57 heifers with the average daily weight gain of 861.80 g, net weight gain 491.45 g and average weight at slaughter 22.77 months.
The animals in group III had the greatest carcass weight (338.66 kg) and in group I the lowest (260.40 kg); the animals in group II weighed on average 306.94 kg.

All the intergroup differences were statistically significant (P < 0.001). The heifers in group III received the highest conformation grades (3.70) and in group I the lowest (4.75), group II was in the middle (4.10).

All the differences between groups were significant (P < 0.01). External fat grades (1–5) were quite the opposite. Group I had the least amount of fat (2.35), group II greater (2.78) and group III the greatest (2.89). Grades in group I were different from groups II and III.

Group III had the greatest carcass weight with daily weight gain of 861.80 g and the lowest age at slaughter. Some other authors (Sami et al., 2004; Šubrt et al., 2006; Tесlіk and Bureš, 2001) also reported that increasing growth rate and live weight before slaughter significantly improved conformation but at the same time enhanced fat deposition. Zahrádková et al. (2010) found similar results in other breeds – Limousine heifers were classified with grade 3.42 for conformation and 3.30 for fat deposition. Classification of Charolais heifers was similar – 3.54 for conformation and 2.87 for fat. Stolc et al. (1999) found a positive association between the weight and beef quality; a greater weight at slaughter implied a greater carcass weight, a greater weight and percentage of lean beef and a smaller proportion of bones. Temisan and Augustini (1989) pointed out that sensory evaluation (affected by a greater intramuscular fat content) was much more favourable in heifers and steers than in bulls with a lower intramuscular fat content. Therkildsen et al. (1998) found similar results in bulls – internal fat can affect beef composition and its sensory characteristics. Greater live weight gains are closely associated with greater proportions of lean beef.

Fig. 2 demonstrates the effect of daily weight gain on the price of dressed carcass based on the conformation and fat class. The price based on conformation was greatest in group III on average 72.80 CZK/kg (2.66 EUR/kg) of dressed carcass and worst in group I 67.13 CZK/kg (2.45 EUR/kg). The price in group II was 71.48 CZK/kg (2.61 EUR/kg). The prices based on a fat sub-class were as follows: group I 73.34 CZK/kg (2.68 EUR/kg), group II 72.35 CZK/kg (2.64 EUR/kg) and group III 72.05 CZK/kg (2.63 EUR/kg). The graph suggests that the price of carcass of faster growing heifers (group III) was lower because of a greater fat content rather than poor conformation.

The heifers in group III would make the most profitable slaughter animals, with the best price for conformation and an acceptable price for fatness. A positive aspect of using heifers as slaughter animals for beef production is the low costs of raising, about 15–20% (Shamay et al., 2005; Mourits et al., 1999). However, according to some scientists, too intensive growth during the raising period (especially a pre-pubescent stage) may negatively affect development of the mammary gland parenchyma and subsequently milk production of primiparous cows (Daniels, 2010; Ettema and Santos, 2004; Silva et al., 2002; Sejrsen and Purup, 1997; and Capuco et al., 1995).

CONCLUSION

The aim of this work was to determine the effect of growth rate on some beef performance characteristics, including carcass weight, conformation (SEUROP) and external carcass fat content in Czech Fleckvieh heifers. The experimental group of 480 heifers was divided into three age sub-groups and the effect of age at slaughter on beef performance characteristics was monitored. The heifers in group A (n = 68) were slaughtered at the age of 15–21 months, with the average of 19.37 months, in group B (n = 296) at the age of 22–28 months, on average 25.69 months; in group C (n = 116) at
29–35 months, on average 30.22 months. Heifers slaughtered at different ages significantly varied in the carcass weight and net weight gain (P < 0.01). The average conformation class in group A was different compared to groups C and B (P < 0.01). The dataset was again divided into three groups with different daily weight gains: 400–599 g/day (group I – 120 animals with the average daily gain of 528.54 g/day and net weight gain 306.29 g/day); 600–799 g/day (group II – 303 animals with the average daily weight gain of 687.56 g/day and 394.24 g/day net weight gain) and 800 g/day and more (group III – 57 animals, the average gain 861.80 g/day and net weight gain 491.45 g/day). There was a significant relation between the growth rate and carcass weight and conformation class (P < 0.001). The relation between the weight gain and fat deposition was not that strong. The only significant differences in the fat class were found between group I and groups II and III.

In conclusion, heifers slaughtered at the age of 29–35 months had the greatest carcass weight and the best conformation class in SEUROP system but also the greatest external fatness. But the producers have to consider growing costs per extra days of finishing (compared to the heifers which had conceived or were sold earlier).

Therefore it is sensible to monitor the growth rate (daily weight gain) of the animals. Our results imply that the heifers gaining 861.80 g per day were slaughtered earlier (22.77 months) compared to the other groups; their carcass weight was greatest and the conformation class best of all groups; the fat deposition was only mild.

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REFERENCES


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