The meat yield of holstein bulls fattened as baby beef

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Abstract

This work evaluated the fattening of Holstein bulls to 300 kg live weight (baby-beef). The trial included 27 Holstein bulls after finishing milk nutrition at an average live weight of 85.51 kg. The bulls were fed water and a granulated feed mixture *ad libitum* (crude protein – 197.92 $g.kg^{-1}$, fat – 26.10 $g.kg^{-1}$, ME – 13.12 $MJ.kg^{-1}$) and lucerne hay at a ratio of up to 25% of the total feeding dose to ensure a sufficiency of structural fibre. At the end of fattening at the age of 245 days, the animals achieved an average of 278.41 kg live weight with 4.49 kg average daily intake of mixture. An average daily gain of 1.124 kg was achieved during fattening. The feed conversion of granulated feed mixture was 3.39 kg. A detailed dissection of 6 animals was performed to obtain carcass value parameters. According to the SEUROP classification of carcasses according to conformation and fatness five carcasses were assigned to the R2 class and one to the U2 class. The cooling loss was 0.76%. The hot carcass weight was 154 kg, with a dressing percentage of 51.56%. The valuable cuts carcass was 38.88% and the proportion of fat in the carcass was 4.7%. The study confirmed that the prolongation of fattening increases the fat content in the meat (1.567 $g.100g^{-1}$) and consequently increases the energy value (448.015 $kJ.100g^{-1}$). We can say from the investigation of fatty acids in the intramuscular fat of *musculus longissimus thoracis et lumborum* that the largest proportion of monounsaturated fatty acids was accounted for by oleic acid (44.93%), followed by the saturated fatty acid palmitic acid (24.44%) and stearic acid (16.46%). The highest proportion of essential fatty acids was accounted for by linoleic acid (8.3%). "Baby-beef" fattening is a suitable alternative for the use of bulls of dairy breeds to achieve extremely good carcass parameters.

Calves, fatty acids, fattening baby-beef

Introduction

Slovak Republic has the lowest total meat consumption compared to all its neighbouring countries. Since 1990, when the downward trend began, it has decreased by 30.2% to the current per capita consumption of 58.6 kg, of which annual per capita consumption of beef is only 4.4 kg, and is decreasing every year. In Slovak Republic cattle rearing is oriented towards milk production, so most of the cattle for slaughter are dairy bulls. However, such bulls are less suitable for traditional fattening to high slaughter weights because of their rather poor slaughter parameters, such as fat content and kidney fat (Chládek and Ingr 2001). One possible option for dairy breed bulls is milk fattening, but this is currently economically inefficient (the milk components in milk replacers make it overly expensive). A solution to the problem may come in the form of intensive fattening based on total feed mixtures, known as fattening as baby beef, which exploits the high growth potential of dairy bulls until one year of age. Its prerequisite is high-quality nutrition that ensures average daily live weight gains of at least 1.1 kg.

Compared with adult beef cattle, fattened calves have a lower dressing percentage and significantly lower proportions of visceral fat. The same animals of a lower weight are equal in their slaughter value to other utility cattle breeds. For both producers and processors, carcass quality, i.e. the proportions of muscle, fat tissue and bone tissue, are of particular importance. For consumers, however, the most important things are the sensory qualities

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of meat, such as tenderness, juiciness, aroma and taste, and nutritional and physiological criteria (concentrations of proteins, amino acids and fat, the representation of fatty acids, cholesterol, vitamins, mineral substances), meat hygiene, toxicological aspects - residue levels (Krása et al. 1995).

Mojto and Zaujec (2001) listed fat as the most variable component of bovine meat, whose content is highest in cows and lowest in calves and slaughter bulls. Meat fat contains a high proportion of saturated fatty acids. Pork– and especially poultry – contains a higher proportion of unsaturated fatty acids. Significant sources of cholesterolemic saturated fatty acids also include milk fat and vegetable fats hardened by hydrogenation (Staruch et al. 2008).

The aim of the study was to evaluate the meat yield of Holstein bulls fattened as baby beef up to 300 kg live weight.

Materials and methods

The experiment with fattening baby-beef to 300 kg was conducted at the VKK Veľké Hoste farm of Company MVL Agro Ltd., Malé Chlievany, from September to February. The experimental group was made up of 27 Holstein bulls after finishing milk nutrition when the average daily intake of calf starter (HD-02) of the calves was 1.5 kg (at the age of 65.35 days and 87.41 kg average LW). The bulls were housed in straw-bedded stalls outside a building, with 4 to 5 (later 3) bulls per stall. In the winter months, because of extremely low temperatures and subsequent technical problems with water supply, they were moved to a single pen in a barn. The bulls were given *ad libitum* access to granulated feed mixture and water, and lucerne hay at up to 25% of the total feed ration to guarantee a sufficient content of structural fibre. The granulated feed mixture consisted of wheat, barley, maize, oats, extracted soybean meal, sugar refinery dry beet chips, a vitamin and mineral premix, and nutrients in dry matter: 197.92 $g.kg^{-1}$ CP, 26.10 $g.kg^{-1}$ fat and 13.12 $MJ.kg^{-1}$ ME.

At the end of the fattening period (at an age of 245 days and with an average live weight of 278.41 kg), we selected 6 bulls of equal live weight for slaughter and the analysis of carcass value parameters at the experimental abattoir of APRC Nitra in accordance with the cattle slaughter standard STN 46 6120. Under standard pre-slaughter conditions, we determined the slaughtered bulls' live weight immediately before the slaughter, and their hot carcass weight immediately after dressing. We also calculated the dressing percentage. The cold carcass weight was determined after 24 hours of cooling. The dissection of the right carcass halves was performed in accordance with the procedure used at the experimental abattoir. We determined the weight of individual meat cuts, the weight of separable fat and the bone weight. The weight of meat per whole carcass was calculated as twice the sum of the weight of all meat cuts plus the weight of the trim. The valuable cut was calculated as twice the sum of the weight of meat from the thigh, shoulder, loin and tanderloin. The proportions of individual basic tissues, proportions of different meat quality grades in the carcass and in meat weight were calculated from the parameters listed. The weight ratio between the forequarter and the hindquarter was also calculated.

We analyzed a spectrum of nutritional quality indicators of meat and intramuscular fat (*musculus longissimus thoracis et lumborum*) in slaughter calves. We determined the water content (in an ULTRA-X microwave analyzer), the content of fat, ash and proteins in accordance with STN 57 0185, muscle colour (by measuring the percentage of remission at 540 nm using Spekol 11 fitted with an R 45/0 remission extension), and the water holding content (employing the principles of the Grau-Hamm press method modified according to Hašek and Palanská 1976). We determined pH_{48} values using a piercing-tipped electrode by pH-meter Radelkis OP – 109. On day 7 post-slaughter, we measured the weight loss in cooked meat (Palanská 1986) and the shear force (toughness) of cooked meat using a Warner – Bratzler consistometer (G-R Manufacturing Co, Manhattan, USA).

We determined the content of fatty acids in intramuscular fat with a gas chromatographer Carlo Erba GC 8000 Top, J&W Scientific GC Column in the chemical laboratory of the Institute for Nutrition. From the composition ascertained, we calculated two indices, i.e. the fat unsaturation index (I_1), which is the ratio of unsaturated to saturated fatty acids ($\Sigma\ FA_{1,2,3}/\Sigma\ FAo$), and the index of nutritional value of fat (I_2), which is the ratio of essential to saturated fatty acids ($\Sigma\ FA_{1,2}/\Sigma\ FAo$) according to Zembayashi et al. (1995).

We calculated statistical characteristics for the results obtained in the fattening baby-beef: the average, standard deviation and the coefficient of variation.

Results and discussion

Before comparing our results from baby beef fattening with the results of other authors, we should bear in mind that only exceptionally can we find papers in scientific journals that deal with this issue, or, for that matter, investigate the carcass value of Holstein bulls aged eight months. At the end of the fattening period was the live weight of calves at the age of 245 days averaged 278.41 kg. Their mean daily weight gain over the entire period of fattening was 1.124 kg, and the mean daily feed mixture consumption was 4.49 kg. Feed consumption per one kg weight gain was 3.99 kg of granulated feed mixture. Mean daily gains in bull fattening achieved by Pinďák and Vrchlabský (2000) were 7.4% higher. We believe that this difference can be explained by the fact that we fattened twice as many bulls, and by the significantly negative effect of climatic conditions, as there were also some bulls in our group whose mean daily weight gain was up to 2.0 kg. Extremely low temperatures in the winter period and consequent technical problems with the water supply required that the bulls be moved to a common stall, which had an extremely significant effect on the overall efficiency of fattening baby-beef.

Six bulls of comparable weight were selected from the group for the analysis of slaughter value parameters (Tab. 1). When evaluating the slaughter value of hot dressed carcasses using the SEUROP standard, we graded 5 of them as R 2 grade carcasses and one as a U 2 grade carcass. The cooling loss was 0.76%. The mean hot weight after slaughter was 154.00 kg, which represents a slaughter yield of 51.56 %. The portion of valuable cut and fat was 38.88 % and 4.7 % from half carcass, respectively. The valuable cut of total meat was 55.48 %. In their carcass evaluation, Pinďák and Jeřábek (2001) identified a trend of slaughter yield increases with increasing weight (275 - 386 kg). The slaughter yield in our study with a mean weight of 298.67 kg was lower by 6%, and by 4% compared with the results of Pinďák and Vrchlabský (2000). The quality grade was the same; the fat class in their case was 1, while in our case it was 2, which was most probably because our bulls were older and heavier at slaughter. The kidney fat content, on the other hand, was lower by up to 48.83%. The ratio of forequarters to hindquarters was similar. Kica et al. (2002) achieved a similar final live weight, though after a longer period of fattening because the mean daily weight gains of their bulls were lower. Their slaughter yield was also lower. Compared to Blanco (2004), our bulls were 25 kg heavier at the end of the experiment, but the bulls in his study were reared and fattened using traditional methods. Similarly, slaughter yield was 6% higher and hot carcass weight 22 kg higher compared to values reported by the above author. Čuboň et al. (2009) reported a similar pre-slaughter live weight of calves at the age of 8 months to that ascertained in our study, though they found a lower slaughter yield and a higher proportion of kidney fat.

When evaluating the basic chemical composition of nutritional indicators of bull beef quality (Table 2), we determined total fat content at a level 1.567 $g \cdot 100g^{-1}$. This content fulfils the requirements for high-quality dietary meat. We found that extending the fattening period increases the fat content in the meat, which consequently also increases

Table 1. Slaughter parameters of bulls from fattening baby-beef

Parameter	SI units	mean n = 6	s_x	v
Pre-slaughter live weight	kg	298.67	5.35	1.79
Forequarter weight	kg	70.17	2.86	4.07
Hindquarter weight	kg	84.83	3.76	4.44
Hot carcass weight	kg	154.00	4.52	2.93
Chilled carcass weight	kg	152.83	6.43	4.21
Slaughter yield	%	51.56	0.93	1.80
Kidney fat	kg	1.53	0.31	20.49
Hide	kg	20.00	1.67	8.37
Quality grade		R 2		
Valuable cut	kg	29.17	1.70	5.83
Portion of valuable cut from half carcass	%	38.88	0.82	2.11
Portion of valuable cut from total meat	%	55.48	0.56	1.00

Table 2. Basic chemical composition of nutritional, physical and technological indicators of bull's meat from fattening baby-beef

Indicator	SI units	mean n = 6	s_x	v
Total water content	$g \cdot 100g^{-1}$	75.583	0.567	0.750
Total protein content	$g \cdot 100g^{-1}$	23.183	0.436	1.879
Total fat content	$g \cdot 100g^{-1}$	1.567	0.234	14.924
Energy value	$kJ \cdot 100g^{-1}$	448.015	12.910	2.882
pH 48 h		5.333	0.234	4.384
Meat colour 540 nm	% remission	10.300	2.325	22.569
Water holding content	$g \cdot 100g^{-1}$	31.672	2.117	6.685
Cooking loss	$g \cdot 100g^{-1}$	33.353	3.450	10.344
Cooked meat toughness	j.W-B	4.917	0.801	16.282

its energy value (448.015 $kJ \cdot 100g^{-1}$). In her milk-feeding experiment, Rydlová (2003) reported a total fat content in a group of bulls fed a ration with a higher proportion of vegetable fat in the milk replacer of 1.02 $g \cdot 100g^{-1}$, and an energy value of 389.65 $kJ \cdot 100g^{-1}$. The meat of another group of bulls whose ration contained a higher proportion of animal fat had 1.30 $g \cdot 100g^{-1}$ total fat content and its energy value was 404.42 $kJ \cdot 100g^{-1}$. The pH value of the meat was within the normal range, and had no DFD symptoms ($pH_{48} \geq 6.2$). The technological division of carcasses showed a lower proportion of fat and a higher proportion of meat in our experiment than those reported by Čuboň et al. (2009). In terms of nutritional indicators, we found a lower level of proteins (20.96%) and a higher content of fat (3.23%) and thus also a higher energy value (472.70 $kJ \cdot 100g^{-1}$). The fat and protein contents ascertained in our study in bull beef were the same as the results of Štercová et al. (2008), although the animals in their study were slaughtered at 570 kg live weight, which was, however, influenced by the utility cattle breed used.

We monitored 10 fatty acids in the range from $C_{12:0}$ to $C_{20:4}$ in the *musculus longissimus thoracis et lumborum* (Table 3). The most abundant saturated fatty acids were palmitic and stearic acid (24.44% and 16.46%, respectively). Of the fatty acids monitored, the largest percentage was made up of monounsaturated oleic acid (44.93%). Of essential fatty acids, the most heavily represented was linoleic acid (8.3%), while linolenic and arachidonic acids were found in minimal quantities in the meat, which corresponds with the results of Mojto

Table 3. Representation of fatty acids in *m. longissimus thoracis et lumborum* in fattened bulls

Fatty acids		mean n = 6	s_x	v
lauric acid	$C_{12:0}$	0.06	0.01	12.35
myristic acid	$C_{14:0}$	2.27	0.20	9.02
palmitic acid	$C_{16:0}$	24.44	0.71	2.92
palmitoleic acid	$C_{16:1}$	2.67	0.24	8.81
stearic acid	$C_{18:0}$	16.46	2.07	12.57
oleic acid	$C_{18:1}$	44.93	1.73	3.86
linoleic acid	$C_{18:2}$	8.30	2.14	25.83
linolenic acid	$C_{18:3}$	0.70	0.10	14.27
arachic acid	$C_{20:0}$	0.04	0.02	43.61
arachidonic acid	$C_{20:4}$	0.10	0.04	43.74
Fat unsaturation index		1.32	0.13	9.94
Index of fat nutritional value		0.21	0.06	29.14

et al. (1999). The representation of individual fatty acids explains the low unsaturation index (1.32) and index of nutritional value of fat (0.21), which were, however, higher than those reported by the above authors.

Conclusions

We may conclude that fattening baby-beef is a good alternative use of dairy bulls in which very good slaughter parameters can be achieved, although the nutritional value index fell short of nutritional recommendations with their minimum value of 0.4. If we disregard technical problems in winter months, the utilization of foodstuffs was effective. We achieved the meat with a higher content of total fat and saturated fatty acids, all the time fulfils the requirements for high-quality dietary meat.

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