Abstract

Effects of cattle breed, age and fattening intensity on the fatty acid profile and the content of selected minerals and vitamins in the *longissimus* muscle

Key words: beef, bulls, beef crosses, heifers, once-calved heifers, Virginia fanpetals

Beef is one of the most valuable types of meat. It is relatively low in calories, it contains protein of high biological value, and it is appreciated for its sensory attributes and high concentrations of bioactive compounds. Modern consumers pay attention not only to the aroma, palatability and juiciness of beef, but also to its health-promoting properties. The health benefits of beef are associated mainly with its intramuscular fat (IMF) content, fatty acid profile, and the concentrations of micronutrients, macronutrients and vitamins. Therefore, attempts have been made to increase the concentrations of bioactive compounds in beef by optimizing cattle fattening systems.

The aim of this study was to evaluate the effects of breed of beef bulls used for commercial crossing with dairy cows, slaughter age, sex category of animals, silage type and fattening intensity on the content of minerals and vitamins, and the fatty acid profile of beef.

The study comprised four experiments. The first experiment evaluated the influence of fattening intensity on the quality of the *longissimus thoracis* muscle (MLT) in 20 Polish Holstein-Friesian (PHF) bulls. From 11 to 19 months of age, bulls were fattened under semi-intensive (SI) and intensive (I) systems. The effect of cattle category on the quality of MLT obtained from heifers and once-calved heifers was determined in the second experiment. Heifers were slaughtered at 18 months of age, and once-calved heifers were slaughtered at 28 months of age, after calving and several months' lactation. The third experiment was performed to determine the impact of the breed of beef bulls: Hereford (HH), Limousin (LM) and Charolais (Ch), used for commercial crossing with dairy cows, on the quality of MLT in F_1 crosses (PHF x HH, PHF x LM and PHF x CH). The effect exerted by slaughter age was also evaluated: 72 bulls were slaughtered at 15, 18 or 21 months of age. The fourth experiment focused on the influence of silage type on the quality of *longissimus lumborum* (MLL) and *semimembranosus* (SM) muscles in 40 PHF bulls. During a 7-month fattening period, the animals were fed different types of silage supplemented with concentrate: group 1 received grass silage (GS), group 2 – Virginia fanpetals silage (VFS), group 3 – Virginia fanpetals silage and grass silage (VFS+GS), group 4 – Virginia fanpetals silage and maize silage (VFS+MS). Samples for analyses were collected after slaughter and 96-hour carcass chilling. The fatty acid

profile and the content of selected minerals (potassium – K, sodium – Na, magnesium – Mg, zinc – Zn, iron – Fe) in muscles were determined in experiments I-IV, and the concentrations of retinol and α-tocopherol were additionally determined in experiments II and IV.

The mineral content of MLT was not affected by the fattening intensity of PHF bulls. Intensive fattening had a beneficial influence on the proportion of monounsaturated fatty acids (MUFAs), whereas semi-intensive fattening contributed to an increase in the proportions of polyunsaturated fatty acids (PUFAs) and most functional fatty acids delivering health benefits. It was also found that the use of once-bred heifers in beef production offers the possibility of producing additional offspring with no negative effect on the content of functional components in meat. Fat extracted from the meat of heifers was more abundant in trans-vaccenic acid, arachidonic acid and docosahexaenoic acid (DHA), whereas fat extracted from the meat of once-calved heifers was characterized by higher concentrations of unsaturated fatty acids (UFAs), in particular oleic acid. Moreover, the MLT of once-calved heifers was a richer source of Zn, Fe, retinol and α-tocopherol. The best of the three beef sire breeds used for crossing with dairy cows could not be selected based on the present research findings. The LT muscle obtained from PHF x LM crosses contained less Fe, Mg and K, whereas fat extracted from this muscle had the lowest n-6/n-3 PUFA ratio, compared with the remaining crossbred bulls. Bulls slaughtered at 21 months of age were characterized by the optimal values of the analyzed traits and parameters, including higher Zn and Fe content and a more nutritionally desirable fatty acid profile of IMF. In comparison with GS, VFS can improve carcass and meat quality without compromising the fattening performance of bulls. In turn, GS had the most beneficial effect on the proportions of functional fatty acids in IMF. GS combined with VFS positively affected the fatty acid profile and α-tocopherol concentration. In comparison with MLL, the SM muscle contained less IMF with a more nutritionally desirable fatty acid profile. The SM muscle was also characterized by a more favorable mineral composition and higher α-tocopherol concentration.