Biochemical and textural changes in beef from bulls and steers of different crossbreeds shortly after slaughter and during ageing

Julia Bogdanowicz, Monika Modzelewska-Kapituła, Wacław Mozolewski

Department of Meat Technology and Chemistry, Faculty of Food Sciences, University of Warmia and Mazury in Olsztyn, Poland

Introduction: Due to the prevailing quantity of dairy cattle in the Polish cattle population, crossbreeding is a common practice used to improve the bovine meat quality and the profitability of beef production. Crossbreeding of beef bulls with dairy dams offers a primary advantage such as obtaining a progeny with a higher carcass value and better eating quality of meat than pure dairy breeds (1,2). Previous researches which compared crossbreds of the Holstein-Friesian x purebred beef cattle, as well as bulls with steers (3-6) were mostly focused on the estimation of carcass characteristics, the value of beef cuts, and the quality of obtained meat (texture parameters, chemical composition, marbling etc.). Meanwhile, many authors have shown that genetic factors and castration might affect not only carcass features, but also release of hormones, neurotransmitters and enzymes responsible for crucial biochemical changes occurring in the muscle tissue after slaughter (1,7-8). The dynamics of post-mortem changes ultimately affects the beef quality (9), whereas the second most important factor influencing the beef flavour and tenderness, is the duration of ageing process (10,11). The aim of the study was to investigate the course of glycogenolysis in crossbred bulls and steers and to describe the dynamics of the above biochemical changes over time (from 45 min. to 48 h). Moreover the relationship of these attributes with beef texture was studied. The hypothesis that beef from bulls and steers of different crossbreeds required the same ageing time to achieve satisfactory tenderness was also tested.

Materials and Methods: The study was conducted using semitendinosus muscle of a progeny of Limousin × Holstein-Friesian (LMx, n=20) and Charolaise × Holstein-Friesian (CHx, n=19) (bulls and steers). Following attributes were determined: glycogen and lactic acid contents, pH value, ATP breakdown (metabolic rate of nucleotides R248, R250) and fragmentation of myofibrillar proteins (MFI) at 0.75, 3, 6, 12, 24, and 48h. Texture (Warner-Bratzler shear force, hardness, springiness, chewiness) was measured 2, 4, 7, and 14 days post-mortem.

Results: Cattle crossbreed did not affect the amount of muscle glycogen, and the castration did not differentiate it until the 3rd hour post mortem. The application of castration resulted in a beef texture improvement. The favourable interaction between crossbreeding and castration was found, and the highest Warner-Bratzler shear force values were observed in CHx bulls whereas the lowest, in CHx steers. Beef obtained from CHx turned out to be more predestined to short ageing, and from LMx required longer ageing to achieve good tenderness.

Conclusions: Practical application of the above tips may be helpful to reduce time and the overall costs of ageing process and provide satisfactory beef tenderness. The results obtained suggest that the progress of nucleotide metabolism expressed as R-value is a good (and better than pH) diagnostic indicator of beef tenderness.

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