Growth- and breed-related changes of marbling characteristics in cattle[1]

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ABSTRACT

The objective of this study was to investigate the growth- and breed-related changes of marbling characteristics in cattle. Four cattle breeds with different growth impetus and muscularity were reared and slaughtered under experimental conditions. German Angus as a typical beef cattle, Galloway as a smaller, environmentally resistant producer of beef, Holstein Friesian as a dairy type, and double-muscled Belgian Blue as an extreme type for muscle growth were used. These four breeds were expected to have differences in muscle development and i.m. fat deposition. Between five and 15 bulls of each breed were slaughtered at 2, 4, 6, 12, and 24 mo of age. Marbling characteristics were determined and classified in LM and semitendinosus muscle by computer image analysis (CIA). Between the breeds, differences appeared in the quantity, structure and distribution of the marbling flecks in both muscles. The deposition of fat in the double-muscled Belgian Blue remained substantially inferior than in the other breeds, up to the age of 24 mo. Marbling in German Angus showed larger ($P < 0.05$) marbling fleck areas particularly. Galloway cattle had the greatest ($P < 0.05$) number and the most regular ($P < 0.05$) distribution of the marbling flecks already in young animals. Furthermore, for marbling characteristics in Holstein Friesian a great number and a slightly finer structure were emphasized compared with the other investigated breeds. Postnatal growth-related changes of marbling in LM were characterized by an up to 40-fold increase in the number of marbling flecks from 2 to 24 mo of age but also by an up to 4-fold enlargement in the area of marbling flecks. The structure of marbling flecks was determined by two development trends. On the one hand, the marbling flecks became larger ($P < 0.05$) and the structure became coarser, reflected by an increasing ($P < 0.01$) proportion of long marbling flecks as well as by an increasing ($P < 0.01$) maximum skeleton line length. On the other hand, continually new small, round marbling flecks appeared. This caused a decrease ($P < 0.01$) of the proportion of the three largest marbling fleck areas. The distribution of the marbling flecks became more regular ($P < 0.05$) with increasing proportion and number of marbling flecks. The results suggest that hyperplasia of adipocytes plays an important role in marbling during growth.

Keywords: Adipogenesis, Breed differences, Cattle, Growth, Intramuscular fat, Marbling

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