

ABSTRACT

Pulsatile growth hormone secretion, circulating insulin-like growth factor-1 concentration and cellular density of somatotrophs differ between Wagyu and Holstein steers

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Japanese Black cattle (Wagyu), deposit much higher amounts of intramuscular fat, known as marbling, than other breeds of cattle. To determine whether this unique fat deposition is attributable to the somatotropic axis, we compared pulsatile growth hormone (GH) secretion, plasma levels of insulin-like growth factor-1 (IGF-1) and cellular density of somatotrophs (GH-expressing cells) in the anterior pituitary glands of Japanese Black and Holstein steers. Blood samples were withdrawn every 15 min for 6 h from 14 Japanese Black and 12 Holstein steers at about 17 months of age, and GH and IGF-1 concentrations were determined. The distribution and proportion of GH-expressing cells were analysed by immunohistochemistry combined with point-count morphometry in pituitaries from six steers from each breed aged about 18 to 21 months. Overall mean and baseline plasma GH concentrations were lower ($P < 0.001$) in Japanese Black than Holstein steers. In addition, Japanese Black had smaller ($P < 0.05$) amplitudes of GH secretory pulses than Holstein steers, whereas the GH pulse frequency did not differ between the breeds. Japanese Black steers also had lower ($P < 0.001$) plasma levels of IGF-1 than Holstein steers. The marbling score of Japanese Black steers was higher ($P < 0.001$) than that of Holsteins at the same carcass weight. The proportion of GH-expressing cells was smaller ($P < 0.05$) in Japanese Black than Holstein steers at the hind dorsal and hind ventral regions of the adenohypophysis. Thus, in Japanese Black and Holstein steers, the breed difference in the relative density of GH-expressing cells corresponded to that in profiles of pulsatile GH secretion. These results suggest that the features of the somatotropic axis intrinsically differ between Japanese Black and Holstein cattle and that these features may be partly responsible for the genetic ability of the former to deposit greater amounts of marbling fat and for the smaller frame of Wagyu cattle.