

ABSTRACT

Enhanced mitogenesis in stromal vascular cells derived from subcutaneous adipose tissue of Wagyu compared with those of Angus cattle

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Japanese Wagyu cattle are well known for their extremely high marbling and lower subcutaneous adipose tissue compared with Angus cattle. However, mechanisms for differences in adipose deposition are unknown. The objective of this paper was to evaluate breed differences in the structure of subcutaneous adipose tissue, adipogenesis, and mitogenesis of stromal vascular (SV) cells between Wagyu and Angus cattle. Subcutaneous biopsy samples were obtained from 5 Wagyu (BW = 302 ± 9 kg) and 5 Angus (BW = 398 ± 12 kg) heifers at 12 mo of age, and samples were divided into 3 pieces for histological examination, biochemical analysis, and harvest of SV cells. Adipogenesis of SV cells was assessed by the expression of adipogenic markers and Oil Red-O staining, while mitogenesis was evaluated by an MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) test, phosphorylation of extracellular signal-regulated kinase (ERK) and protein kinase B (PKB; AKT). Based on histological analysis, Wagyu had larger adipocytes compared with Angus. At the tissue level, protein expression of peroxisome proliferator-activated receptor γ (PPARG) in Wagyu was much lower compared with that of Angus. Similarly, a lower mRNA expression of PPARG was found in Wagyu SV cells. No significant difference was observed for the zinc finger protein 423 (ZNF423) expression between Wagyu and Angus. As assessed by Oil Red-O staining, Wagyu SV cells possessed a notable trend of lower adipogenic capability. Interestingly, higher mitogenic ability was discovered in Wagyu SV cells, which was associated with an elevated phosphorylation of ERK1/2. There was no difference in AKT phosphorylation of SV cells between Wagyu and Angus. Moreover, exogenous fibroblast growth factor 2 (FGF2) enhanced mitogenesis and ERK1/2 phosphorylation of SV cells to a greater degree in Angus compared with that in Wagyu. Expression of transforming growth factor β 3 (TGFB3) and bone morphogenetic protein 2 (BMP2) in Wagyu SV cells was lower than that of Angus, providing potential clues for breed differences on proliferation of SV cells in these two cattle breeds. The results of this study suggest that subcutaneous adipose-derived SV cells of Wagyu possess a lower trend of adipogenesis but higher mitogenesis compared with those of Angus.