

Regulation of Differentiating Intramuscular Stromal Vascular Cells Isolated from Hanwoo Beef Cattle by Retinoic Acid and Calcium

Authors : Seong Gu Hwang, Young Kyooh Oh, Joseph F. dela Cruz

Abstract : Marbling, or intramuscular fat, has been consistently identified as one of the top beef quality problems. Intramuscular adipocytes distribute throughout the perimysial connective tissue of skeletal muscle and are the major site for the deposition of intramuscular fat, which is essential for the eating quality of meat. The stromal vascular fraction of the skeletal muscle contains progenitor cells that can be enhanced to differentiate to adipocytes and increase intramuscular fat. Primary cultures of bovine intramuscular stromal vascular cells were used in this study to elucidate the effects of extracellular calcium and retinoic acid concentration on adipocyte differentiation. Cell viability assay revealed that even at different concentrations of calcium and retinoic acid, there was no significant difference on cell viability. Monitoring of the adipocyte differentiation showed that bovine intramuscular stromal vascular cells cultured in a low concentration of extracellular calcium and retinoic acid had a better degree of fat accumulation. The mRNA and protein expressions of PPAR γ , C/EBP α , SREBP-1c and aP2 were analyzed and showed a significant upregulation upon the reduction in the level of extracellular calcium and retinoic acid. The upregulation of these adipogenic related genes means that the decreasing concentration of calcium and retinoic acid is able to stimulate the adipogenic differentiation of bovine intramuscular stromal vascular cells. To further elucidate the effect of calcium, the expression level of calreticulin was measured. Calreticulin which is known to be an inhibitor of PPAR γ was down regulated by the decreased level of calcium and retinoic acid in the culture media. The same tendency was observed on retinoic acid receptors RAR α and CRABP-II. These receptors are recognized as adipogenic inhibitors, and the downregulation of their expression allowed a better level of differentiation in bovine intramuscular stromal vascular cells. In conclusion, data show that decreasing the level of extracellular calcium and retinoic acid can significantly promote adipogenesis in intramuscular stromal vascular cells of Hanwoo beef cattle. These findings may provide new insights in enhancing intramuscular adipogenesis and marbling in beef cattle.

Keywords : calcium, calreticulin, hanwoo beef, retinoic acid

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