COMPARSION OF SKELETAL MUSCLE SATELLITE CELLS BETWEEN CALVES AND CATTLE: DIFFERENCES IN PROLIFERATION AND DIFFERENTIATION CHARACTERISTICS

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I. INTRODUCTION

Skeletal muscle satellite cells (SMSCs) play a vital role in the growth and development of muscle tissue [1]. SMSCs possess the ability to differentiate into multinucleated myotubes through muscle formation and self-renewal [2]. However, the growth and development of SMSCs can vary depending on the biological characteristics, tissue, and environment of the cells [3]. Previous studies have reported differences in growth between young and adult cells using C_2C_{12} mouse myoblasts [4]. Based on this, the current study presents a hypothesis of differences in growth between young and adult cells in cattle. Cells were isolated from bovine muscle tissue, and significant differences between young and adult cells were confirmed in cell proliferation rate, differentiation ability, and gene analysis. This study may contribute to a better understanding of the growth and development of SMSCs.

II. MATERIALS AND METHODS

Cells were extracted from 6 bovine muscle tissues (3 calves, 3 cattle) of the biceps femoris, and were used in experiments to study cell proliferation and differentiation. Once the cells reached confluence, the expression levels of various genes, including Pax7, MyoD, MyoG, MyHC, PLAG1, and FASN, were analyzed using RT-PCR.

III. RESULTS AND DISCUSSION

As shown in Figure 1A, the SMSC from calves demonstrated significantly faster proliferation rates compared to the cattle, with a doubling time of 2.43 days ($P<0.01$). Moreover, the calf SMSC exhibited a higher cell fusion index, indicative of faster myotube formation, compared to the cattle, as demonstrated in Figure 1B ($P<0.01$). Gene expression analysis, as illustrated in Figure 2, indicated that the calves SMSC exhibited higher expression levels of MyoD and Pax7, which are critical regulators of cell growth and development, compared to the cattle ($P<0.01$). Furthermore, during differentiation, the calf SMSC showed higher expression levels of MyHC, a myogenic differentiation marker, compared to the cattle ($P<0.01$). Conversely, the cattle demonstrated higher expression levels of FASN and PLAG1, which are associated with growth rate, meat quality, and meat texture, during both proliferation and differentiation ($P<0.01$).

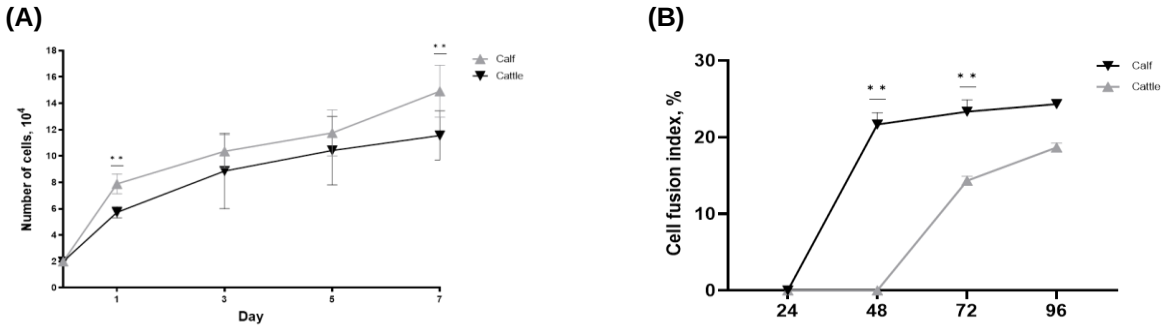

Figure 1. (A) Cell proliferation between calf and cattle (B) Cell fusion rate after differentiation in calf and cattle. Results were expressed as Mean±SD, **P-value<0.05.

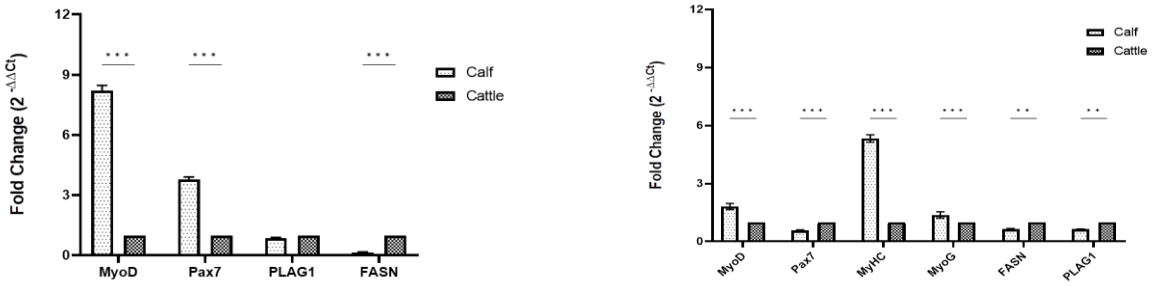

Figure 2. Relative gene expression of calf and cattle was analyzed by RT-PCR. Results were expressed as Mean±SD, **P-value<0.05.

IV. CONCLUSION

This study compared SMSC from calves and cattle and confirmed the hypothesis that cells from younger animals exhibit greater rate of proliferation as well as differentiation. Gene expression patterns, however, were somewhat controversial, showing that those associated with meat quality and texture were expressed higher in cells from cattle. Our results warrant further investigation to optimize the 3D cell culture condition using these cell pools.

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