

Marbling in beef: Turning muscle into fat?

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Aims:

Marbling or intramuscular fat in beef is highly prized in some export markets, such as Japan and Korea. Since a premium is paid for intensely marbled meat in these markets, producers seek to control intramuscular fat deposition in cattle through nutrition. Long term grain feeding on diets low in beta-carotene will increase marbling in some cattle breeds. However, in other cattle breeds long term grain feeding merely increases the amount of subcutaneous fat.

Thus, it is clear that there are breed differences in terms of intramuscular fat deposition and one possible mechanism is differing abilities to convert muscle cells into fat cells. Therefore, the aim of this project is to study the ability of different cattle breeds to convert muscle cells to fat cells.

Background:

There is a genetic component to marbling or intramuscular fat deposition in cattle, but the underlying genes have not been discovered. One of the issues is that the process of marbling is not well understood. There is much debate about whether the process involves increasing the amount of lipid filling in mature adipocyte fat cells (hypertrophy) OR whether the process involves increasing the actual number of mature adipocyte fat cells (hyperplasia). Increasing the amount of lipid filling implies that some cattle breeds specifically accumulate more fat in intramuscular adipocytes than in other types of adipocytes. Increasing the number of mature adipocytes implies that some cattle breeds have more fat precursor cells (pre-adipocytes) in their muscles. There is evidence supporting both of these hypotheses and the debate is ongoing with no further progress towards determining the specific genes controlling marbling.

Recently though, it has been observed in humans, rodents and even pigs that it is possible to convert mature muscle cells into adipocytes. Previously, it had been assumed that only pre-adipocytes could develop into mature adipocytes. This observation opens an entirely new area of investigation as it is quite possible that some cattle breeds under certain circumstances (eg long term grain feeding) may convert their muscle cells to fat cells and thus, increase the amount of intramuscular fat.

To investigate this possibility, muscle biopsy samples from cattle breeds that differ in their ability to marble (eg Angus, Hereford) will be tested using cell culture. The number and size of the fat cells converted from muscle cells will be monitored using differential staining and microscopy. PCR of specific gene markers for the various cell types will be used to verify the results.

Key words: cattle, marbling, intramuscular fat, cell conversion, genetics

Other information: An honours scholarship may be available for this project.

References:

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