

Literature Cited

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Muscle Fiber Growth of Cattle Differing in Mature Size

J.J. Guenther and J.R. Escoubas

Story in Brief

Changes in muscle fiber diameter of small and large scale beef calves were determined. Fiber diameters were measured, initially, when the calves were approximately 30 days of age and at 56 day intervals thereafter until the calves were about 14 months of age. Results showed the small scale calves to have wider muscle fibers than large scale calves and that the small scale calves matured earlier and at a faster rate in fiber diameter. In addition, most of the absolute increase in muscle fiber diameter occurred post-weaning. Finally, it was observed that at 30 days of age the test animals had already attained 46-47 percent of their respective 14 month muscle fiber diameter.

Introduction

In the cattle business, muscle is the ultimate product. Typically, beef carcasses consist of approximately fifty "principal" muscles. Perhaps the best known of these is the longissimus dorsi or "Ribeye". This muscle is also the single, largest "quality" muscle in the beef carcass. Hence it is often selected as the target for various muscle research studies.

A particular muscle is composed of a given number of sub-units called muscle fibers, which are actually the "cells" of the muscle. These cells or fibers are the functional units of the muscle and thus it might be assumed that as the individual fibers grow, so grows the entire muscle. An increase in muscle size, then, is brought about by an increase in the size of its sub-units, the fibers.

It is generally accepted that at birth the total number of muscle fibers is pretty much set in the bovine and that very few, if any, addition fibers are "laid down" post-natally. Consequently the subsequent increase in muscle size during pre- and post-weaning growth and development of the beef calf might be followed by studying various changes in individual muscle fiber parameters, such as fiber diameter. The objective of this study was to assess changes in muscle fiber diameter occurring during growth and development of cattle of differing size and weight.

Materials and Methods

Experimental units for the study were eight Angus and eight Charolais steer calves. These calves were selected to represent small and large scale cattle, respectively. At test period one, the calves averaged one month of age. At weaning, which was test period four, they averaged seven months and at the final test period, number eight, they averaged fourteen months. Test Period intervals were fifty-six days. At each period biopsy samples were obtained from the left and right longissimus dorsi muscles of each experimental calf. Muscle fiber diameter was determined on the biopsy samples following procedures developed in this laboratory and reported previously.

Results and Discussion

Experimental results are shown in Figures 1 and 2. In Figure 1 the data are presented on an absolute basis; whereas in Figure 2 they are given as a percentage of the final test period value. This is why the period 8 values in Figure 2 are shown as 100 percent. Each value shown in Figure 1 represents the average diameter of fifty muscle fibers.

The small scale Angus calves were greater in fiber diameter than the

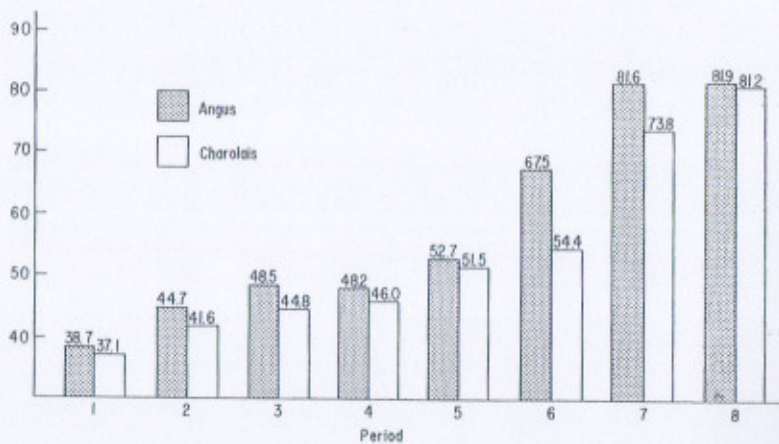


Figure 1. Fiber diameter - microns.

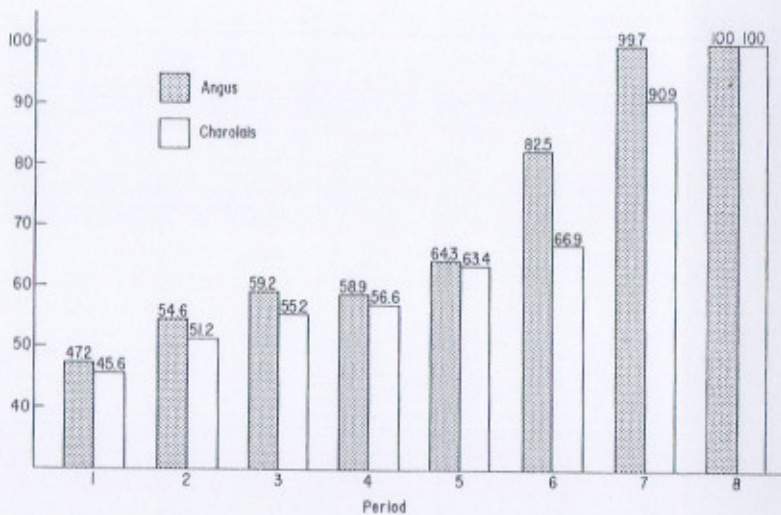


Figure 2. Fiber diameter - percent of final period.

large scale Charolais at all test periods, though this difference was only 0.7 microns at period 8 (Fig. 1). These results strongly suggest that small scale cattle mature earlier and at a faster rate in fiber diameter than large scale cattle. Also it may be noted that most of the increase in fiber diameter (both quantity and rate-wise) occurred post-weaning. This was between periods 5 and 7 for the Angus and between periods 6 and 8 for the Charolais. In general the Charolais followed the same trends in fiber diameter increase as did the Angus, but were 56 days or nearly two months slower.

On a percent net increase basis, the results showed that between periods 1 and 4 there was an approximate 11 percent increase in fiber diameter, while during periods 4 through 8 fiber diameter increased by 42 percent (Fig. 2). This rapid surge in fiber diameter occurred subsequent to the time when bone growth had attained a major portion of its potential development and possibly when the muscle fibers had completed a major portion of their metabolic adaptation. Finally it is pointed out that by 30 days of age the Angus and Charolais calves had already reached 47.2 percent and 45.6 percent of their respective period 8 fiber diameter.
