

# Meat and Carcass Evaluation

## Estimates of Bone Maturity in Beef Cattle

J. J. Guenther

### Story in Brief

The progress of long bone maturation was followed in Hereford and Charolais crossbred steers, slaughtered at 500, 700, 900, and 1100 pounds by measuring the metacarpal epiphyseal cartilage thickness, and by determining the activity of serum alkaline phosphatase enzymes. Results showed a significant decrease in metacarpal epiphyseal cartilage thickness, and in serum alkaline phosphatase activity with increased weight and age of the test animals. Data suggest a positive relationship between the ossification of the metacarpal epiphyseal cartilage and the decline in serum alkaline phosphatase activity.

### Introduction

Apparently, muscle tissue in beef cattle does not attain its maximum growth rate, regardless of nutritional level, until bone approaches its physiologically mature state. Thus an estimate of the state of bone maturity could be useful to beef producers; for this would let producers identify the time at which it would be most beneficial to full-feed cattle for maximal rate of muscle growth.

Growing epiphyseal cartilage is one of the pre-requisites for long bone growth. When this cartilage becomes ossified the bone is "physiologically mature," increases in long bone length cease, and the stature or scale of the animal is fixed. The progress of bone maturation may be followed by measuring the width of the epiphyseal line, which narrows as the epiphyseal cartilage ossifies. In addition, it is thought that much of the alkaline phosphatase enzyme activity in serum is generated from osseous sources. Bone forming cells apparently secrete this enzyme which influences the deposition of calcium in bone tissue. Consequently, when bone growth nears its mature stage, a decline in the activity of serum alkaline phosphatase should occur.

The objectives of this experiment were to determine changes in metacarpal epiphyseal cartilage thickness and in serum alkaline phosphatase activity with increased weight in cattle.

## Materials and Methods

Sixteen Hereford and 16 Charolais crossbred steer calves were used in the text. Four calves from each breed were assigned to one of the following slaughter weight groups: 500, 700, 900, and 1100 pounds. All calves were fed, *ad libitum*, a standard feed-lot ration until attaining the desired slaughter weight.

### Epiphyseal cartilage measurements

The right metacarpal bones were removed from the carcass, freed of extraneous material, and six, one-fourth inch thick slices were obtained from the distal epiphysis of the bones. The bones were sliced to a point one inch dorsal to the epiphyseal line. Bone samples were prepared for epiphyseal cartilage measurement following a procedure modified from that of Evans, *et. al.* (Endocrinology, 32:13). Three measurements, evenly spaced (anterior-posterior), were obtained on each face (lateral and medial) of the bone slices using a light microscope fitted with an ocular micrometer.

### Serum alkaline phosphatase activity

Blood samples were obtained at slaughter. The samples were collected in 50 ml. centrifuge tubes, allowed to clot at room temperature for 24 hours, then centrifuged for 30 minutes at 5000XG. The serum fraction was decanted and serum alkaline phosphatase activity was determined via the procedure of Bessey, *et. al.* (J.B.C. 164:321).

## Results and Discussion

Test results are presented in Table 1. There was a decrease ( $P < 0.01$ ) in metacarpal epiphyseal cartilage thickness with increased weight and age of the

**Table 1. Effect of breed and weight on metacarpal epiphyseal cartilage thickness and serum alkaline phosphatase activity**

Breed	Weight group	Metacarpal epiphyseal cartilage thickness	Serum alkaline phosphatase activity <sup>2</sup>
Hereford	500 lbs	713	5.97
	700 lbs	589	5.78
	900 lbs	649	4.06
	1100 lbs	494	3.23
Charolais	500 lbs	657	5.78
Crossbred	700 lbs	632	7.33
	900 lbs	614	4.90
	1100 lbs	574	4.30

<sup>1</sup>Thickness measurements are in microns and each number represents the group average.

<sup>2</sup>Activity is presented in Sigma Units and each number represents the group average.

experimental animals. The overall decrease was greater for the Herefords, 219  $\mu$ , than for the Charolais crossbreds, 83  $\mu$ , suggesting that the Herefords were earlier maturing in long bone growth than the crossbreds.

Serum alkaline phosphatase activity data followed the same general trends as did the metacarpal epiphyseal cartilage measurements, showing a decrease ( $P < 0.01$ ) with animal weight and age. The overall drop in serum alkaline phosphatase activity from the 500 pound to the 1100 pound weight groups was 1.85 times greater, on the average, for the Hereford steers.

Results from this test suggest that with refined techniques for obtaining blood samples, serum alkaline phosphatase activity might be used as a non-destructive procedure on live cattle to estimate the state of physiological maturity of bone in beef cattle. Further testing, starting with younger cattle of known chronological age, and selected for this type of study seems warranted.

---

## The Effect of Electrical Stimulation on the Rate of Post-Mortem Glycolysis in Some Bovine Muscles

P.D. McCollum and R.L. Henrickson

### Story in Brief

Processing beef prior to the onset of rigor results in an unsatisfactory product. Electrical stimulation will hasten rigor by accelerating post-mortem metabolism. The purpose of this manuscript is to describe the effect of electrical stimulation on the rates of post-mortem glycolysis in the choice bovine carcass.

Sides from six choice carcasses weighing 310 - 367 Kg. were stimulated for 30 minutes beginning an hour after death. Sides from seven carcasses were stimulated for 15 minutes beginning 30 minutes post-mortem. In each instance the opposite side from the same carcass was held as an unstimulated control. All electrical parameters were held constant in all stimulated sides. Samples were taken from the longissimus dorsi (LD), psoas major (PM),