Estimation of Muscle Fiber Area in Calf Muscles by Coulter Counter and Photo Micrographic Techniques

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Muscle fiber area or radial growth is an important parameter in assessing the influence of various genetic and treatment effects on muscle growth. Hence, procedures were developed to determine muscle fiber area by an automated Coulter Counter and a photomicrographic projection technique. These procedures were used to determine the fiber area of the Longissimus dorsi, Sartorius, Semitendinosus and Triceps brachii muscles taken from six, 15-day-old dairy calves.

Results are summarized in Table 1. No statistical significant differences between sides were noted in muscle fiber area by either technique. However, fiber area determined by the photomicrographic projection technique was significantly larger than that estimated by the Coulter Counter procedure. The average fiber area obtained by the Coulter Counter was 394 microns squared, while that by the photomicrographic procedure was 821 microns squared for the four test muscles.

Studies suggested that the unfixed muscle fibers possessed electrical conductivity which interfered with the resistance change in the apperture of the coulter cell. This would reduce the pulse height and result in a lower value for the fiber area measurements determined by the Coulter Counter method. Nevertheless, the standard error of the muscle fiber areas determined by the Coulter Counter was consistently smaller than that obtained with the photomicrographic projection technique.

Table 1. Estimation of muscle fiber area in four calf muscles by Coulter Counter and Photomicrographic techniques.

Estimation Technique	Muscle			
	Longissimus dorsi	Sartorius	Semitendinosus	Triceps brachii
Coulter Counter	284[1,2]	447	405	440
Photomicrographic	635	951	854	844

[1] Microns squared.
[2] Average of 216 values.

Count as a Predictor of Muscle Mass in Yearling Beef Bulls

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Earlier work at this station has shown the estimation of fat-free lean in yearling beef bulls by the ^{40}K whole-body counting techniques to be useful when used in conjunction with other performance data in selecting yearling bulls that have superior genotypes for rapid growth of muscle. The whole-body counter determines the quantity of electricity resulting from the emission of gamma rays from a radioactive isotope of potassium, ^{40}K. This isotope occurs naturally in the live animal and emits a weak and harmless gamma ray.

The basic principal of this evaluation technique is that a large part of total body potassium is found in the muscle and a constant proportion of this potassium is radioactive. It follows that differences in ^{40}K count among animals should estimate differences in the quantity of total lean among these animals.

The earlier research referred to was conducted using animals that were quite uniform in weight. Later research emphasized the need to identify sources of variation in the data where differences in the live weight of test animals occured because the counter was found to be less efficient in estimating whole-body potassium in heavier cattle.

Researchers using non-living masses of different materials have found that counter efficiency is reduced in larger masses by the phenomena called background depression and self-absorption. Through the creation of "phantoms" (non-living masses), approximating the dimensions and density of bulls weighing 900, 1000, 1100, 1200 and 1300 lb, and through subsequent research on the reduction of counter efficiency due to background depression by these weights, an adjustment system has been developed. This system is believed to enable one to compare the fat-free lean estimate by ^{40}K bulls of different weights with more confidence than has been possible in the past.

The purpose of this study was to evaluate net ^{40}K count when adjusted for background depression and self-absorption as a predictor of total lean in yearling beef bulls ranging in weight from 900 to 1300 lb.

Twenty-five Hereford and 22 Angus yearling bulls were fed under drylot conditions, not unlike many bull test stations, to randomly pre-assigned ^{40}K count weights. The Hereford bulls were obtained from the Animal Science Experimental Beef Herd and the Angus bulls were produced on a purebred ranch in Oklahoma. The younger Hereford calves averaged 460 lb going on feed while the older Angus calves averaged 686 lb.

Some bulls were slaughtered earlier than planned because of their inability to continue acceptable gains at heavier weights. The ration contained 27.8 percent steam rolled corn, 29.5 percent steam rolled oats, 4.3 percent dehydrated alfalfa pellets, 18.2 percent cottonseed hulls, 5.4 percent molasses and 14.8 percent soybean meal.

As the bulls reached the pre-determined count weight, they were trucked less than one mile to the O.S.U. Live Animal Evaluation Center and held off feed and water for

24 hr prior to the first of two counts. During this period, each bull was thoroughly washed using a low potassium soap in order to remove any foreign material that might alter the net ^{40}K count.

The bulls were individually counted in random order twice during the count day. A background count of the empty chamber was taken just prior to placing an animal in the chamber and again immediately after removal. The net ^{40}K count for the animal was the difference between the count with the animal in the counter and the average of two background counts.

Following the counting, the animals were trucked to the O.S.U. Meat Laboratory and slaughtered. After chilling in a 34°F cooler, the right half of each carcass was physically separated into very closely trimmed lean, fat and bone, and individual weights were recorded. The loin, rib, round and chuck were trimmed of all visible fat, the "thick" muscle systems were removed from the bone, and seam fat in excess of .1 inch was removed. Thinner muscle systems from these four cuts, with fat more difficult to remove, were later blended with similar "thin" lean from the minor wholesale cuts for chemical fat analysis.

The shank, brisket, plate and flank were also very closely trimmed of fat, the lean was removed from the bone and all fat in excess of .1 inch was removed. This boneless, closely trimmed lean from these cuts were blended with similar lean from the four major wholesale cuts, ground and sampled for chemical fat analysis. Total carcass lean was determined to be total "thick" closely trimmed boneless lean + (total "thin" trimmed lean - chemical fat) x 2. Chemical fat was determined by the modified Babcock fat test.

Since the analysis of the data has not been completed, only preliminary observations are presented. Count weight for the bulls ranged from 970 to 1264 lb with a mean count weight of 1114 lb and a standard deviation of 88 pounds. Table 1 presents a grouping of the cattle into four uniform weight groups along with average values for some preliminary observations.

The lean content in Group I and II bulls was quite similar as was the increase in amount of lean between Groups I and II (19.8 lb) and Groups II and III (22.8 lb). Percentage lean of count weights was also quite similar for Groups I, II and III with 34.6, 34.0 and 34.1 percent, respectively. However, from a body composition standpoint there appeared to be a reduction in lean production relative to other body components in the Group IV bulls. This is expected since generally, among cattle of this weight fed in the drylot, as body weight increases, so does the proportion of fat as a component of the gain.

Table 1. Population description and some preliminary observations.

Weight Groups	I	II	III	IV
Observations Count Wt. Range (lb)	970-1043	1044-1117	1118-1191	1192-1264
Number of bulls	13	10	12	12
Ave. Total Carcasses Lean (lb)	348.4	368.2	391.0	402.4
Ave. Total Carcass Lean (lb) (as % Count Wt)	34.6	34.0	34.1	31.6
Correlation Coefficient (^{40}K predicted vs actual carcass lean)	.88	.87	.70	.88

One means of evaluating the usefulness of adjusted ^{40}K count as a predictor of total carcass lean is to determine correlation coefficients between that amount of lean predicted from adjusted net ^{40}K count and the amount of carcass lean as determined from slaughter, physical separation and chemical analysis methods. The higher the correlation between these two variables, the more effective adjusted net ^{40}K count will be in detecting differences in the lean content of animals across weight groups.

Correlation coefficients of .88, .87, .70 and .88 for Groups I, II, III and IV, respectively, indicate a fairly strong correlation between the predicted and actual lb of carcass lean within each weight group. The pooled within weight group correlation was .83 which means that, on the average, 68.7 percent (correlation coefficient squared) of the variation in the weight of carcass lean is accounted for by the adjusted net ^{40}K count. These correlations indicate that ^{40}K count adjusted for "background depression" and "self-absorption" may well prove useful as a predictor of carcass lean in yearling beef bulls over a range of live weights. It should be pointed out that considerable variation in correlation coefficients is normally expected when as few as 10 to 13 observations are available. A complete analysis of the data will be accomplished in the near future.

Chemical Test for Detection of Wheat Pasture Flavor Component in Raw Milk

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An undesirable flavor characterized as "fishy" which occurs in milk from cows which have grazed on wheat pasture has been a problem in wheat growing areas. Even though the component that causes fishy flavor in milk was identified as trimethylamine, detection of low concentration of trimethylamine in field conditions remains a problem in dairy industry.

A rapid and easy chemical test for detection of trimethylamine in raw milk has been established by adding formaldehyde and sodium hydroxide to a sample of milk to release volatile amines. The formaldehyde serves as a complexing agent to retain ammonia, primary and secondary amines so that they will not appear in the volatile fraction. The volatile components which contains any trimethylamine are then checked with a pH indicator.

Twenty ml of a raw milk sample was placed into a 2.5 x 15 cm test tube. One ml of formaldehyde (37 percent formaldehyde in 10 percent methanol) and one ml of 5 percent aqueous sodium hydroxide were added to the milk. The tube was then stoppered with a rubber stopper fitted with two glass tubes (0.2 cm ID). One tube (5 cm long) contained a piece of white yarn (100% Virgin Orlon Acrylic fiber) saturated with bromocresol green (BCG). This was accomplished by dipping the yarn in the indicator (0.1 percent BCG) and drying it prior to placing it in the glass tube. This tube was inserted so that it extended above the stopper. The other tube was inserted through the stopper so that it reached the bottom of the test tube. The other end of the second glass tube was connected to an aquarium air pump via a rubber tube. Air was bubbled through the milk sample (6 ml/min). The height of color change (from orange to green) on the yarn was measured at one minute intervals during a six minute time period. The test tube was submersed in a 28 C waterbath during the test.

By this chemical test, the intensity of fishiness in milk from cows which had consumed wheat pasture was easily shown by the height of green color. Raw milk samples which exhibited more than a 1.0 cm height of green color change by this test were identified by a trained sensory test panel as having a very slight fishy flavor. Using a standard curve prepared with TMA standards in raw milk, such samples were found to contain approximately 2 ppm TMA. This concentration of TMA in raw milk could be estimated within three minutes by using the chemical test. Thus, the chemical test described herein could be used as a rapid detection method for TMA at the farm bulk milk pick up area.

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