

## Non-Competitive Division\*

### The Fatty Acid Esterification Pathway in Bovine Liver and Adipose Tissue

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Fatty acid esterification resulting in glycerolipid formation was studied *in vitro* to assess breed differences (Angus vs Brahman) and relative activities in bovine liver and subcutaneous adipose tissue. Adipose tissue from both breeds incubated with [1-<sup>14</sup>C]palmitate in the presence and absence of glucose exhibited higher rates of glycerolipid production when glucose was added to incubation media. Angus adipose tissue had higher rates ( $P < 0.05$ ) of glycerolipid synthesis than Brahman both in the presence and absence of glucose. Both breeds exhibited a greater rate of lipid production in adipose tissue than in liver ( $P < 0.05$ ). The addition of glucose to liver tissue samples failed to elicit any change in glycerolipid synthesis within or between breeds. For all incubations, 83% of the final products were in the form of triacylglycerides. Homogenates used in the *sn*-glycerol 3-phosphate acyltransferase assay exhibited a greater glycerolipid biosynthetic rate (nmol lipid/mg protein/30 min) from adipose tissue when compared to liver ( $P < 0.05$ ). When compared between breeds, Angus adipose and liver homogenates displayed higher rates of glycerolipid production than Brahman tissue homogenates, with lysophosphatidic acid found in greater ( $P < 0.05$ ) amounts than all other glycerolipids. The activity of phosphatidic phosphohydrolase (PPH) in liver tissue homogenates displayed greater rates over their respective adipose homogenates in both breeds. Liver homogenates from Brahman had a much higher PPH rate than Angus liver homogenates, with 70% of the activity in the mitochondria. Angus adipose tissue homogenates exhibited better rates for PPH activity than from Brahman with 41% of the activity in the microsomes. Diacylglycerol acyltransferase activity was greater in adipose tissue homogenates compared to liver homogenates from Brahman steers. With the exception of Brahman liver PPH activity, Angus samples displayed a greater capacity for esterification of fatty acids for all enzymes and substrates.

### Fatty Acid Esterification Capacity of Bovine Intramuscular and Subcutaneous Adipose Tissues

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To determine the extent of exogenous unsaturated fatty acid uptake into beef tissues, 12 Angus cattle (6 steers and 6 heifers) of the same age group and finished with a standard finishing diet were divided randomly into two groups. One group (3 steers and 3 heifers) was subjected to a 72 h fasting period prior to slaughter while the other group was slaughtered 4 h after removal of feed. At slaughter, subcutaneous and intramuscular adipose tissue slices from the 8-13th rib region of the longissimus muscle were obtained *in vitro* incubations and cellularity determinations. After a 30 min incubation with radioisotopically-labeled fatty acids (palmitate, stearate, linoleate and linolenate) at concentrations ranging from 0.3 mM to 2.0 mM, lipids were extracted to determine rates of fatty acid esterification. The fatty acid esterification rate of adipose tissues increased with concentration. Of the five fatty acids studied, palmitate was shown to have the highest ( $P < 0.05$ ) incorporation rate (81.9 nmol/10<sup>5</sup> cells/30 min) into tissue lipids followed by oleate (43.4 nmol/10<sup>5</sup> cells/30 min) and linolenate (25.2 nmol/10<sup>5</sup> cells/30 min). As expected, subcutaneous adipose tissue, with larger mean cell diameter (166.2  $\mu\text{m}$ ) and volume ( $26.77 \times 10^5 \mu\text{m}^3$ ), had fewer cells per unit weight ( $3.18 \times 10^5$  cells/g tissue) than intramuscular adipose tissue (125.49  $\mu\text{m}$ ,  $12.39 \times 10^5 \mu\text{m}^3$ , and  $4.34 \times 10^5$  cells/g tissue, respectively). With the exception of palmitate, the esterification rates of fatty acids into tissue lipids were higher ( $P < 0.05$ ) in subcutaneous than in intramuscular adipose tissue. In general, tissue from fasted animals tended to have lower rates of fatty acid incorporation than those from the fed group. Heifers consistently had higher fatty acid esterification rates as compared to steers, but the differences were not significant ( $P > 0.05$ ). The data suggest that anatomical location of the tissue, feeding regimen and sex are important factors affecting the esterification capacity of exogenous unsaturated fatty acids into meat tissue lipids. Furthermore, beef lipids may be modified readily by elevating the level of unsaturated fatty acids *in vivo*.

\*Newly-formed division this year. For details, see Annual Report of the Graduate Student Research Poster Competition Award Committee (p 138).

## Effects of Blade Tenderization, Vacuum Massage Time and Salt Level on Chemical, Textural and Sensory Characteristics of Precooked Beef Chuck Roasts

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The present study was conducted to determine the influence of blade tenderization (T), vacuum massage time (VMT) (2, 3 h), salt level (SL) (1.0, 1.25%) and muscle type (MT) on the chemical, textural and sensory characteristics of precooked roasts prepared from two whole beef chuck muscles. Triceps brachii (TRI) and Supraspinatus (SUP) muscles were either tenderized twice or not tenderized. All of the muscles were cut in half prior to vacuum massaging for either 2 or 3 h in a beef pump solution. The pump solution contained (by muscle weight) 10% water, 0.5% phosphate, 0.5% commercial beef flavor, 0.5% commercial beef pump and either 1.0 or 1.25% salt. Two halves of each muscle type were placed in vacuum bags, sealed and heat shrunk prior to being cooked in an agitating retort to an internal temperature of 68 C. The roasts were rubbed with a commercial beef rub prior to storage. Cooking losses were decreased ( $P < .05$ ) by higher SL, while T increased fat content ( $P < .05$ ). Protein content was higher ( $P < .05$ ) in the 1.0% SL treatment; however, salt concentration was higher ( $P < .05$ ) in the 1.25% salt level. T decreased ( $P < .05$ ) Warner-Bratzler shear values for the muscle bind site (junction between the two muscles) and muscle tissue. Instron values for hardness and chewiness of the muscle tissue were decreased ( $P < .05$ ) by blade tenderization. Higher VMT and higher SL each interacted with TRI to decrease ( $P < .05$ ) fat content while inversely effecting the fat content of Supraspinatus. T interacted with TRI to increase ( $P < .05$ ) cook loss, while inversely effecting cook loss of Supraspinatus. Sensory panel evaluation showed that TRI was more tender than SUP, while T increased first-impression tenderness. A lower percentage of panel members detected off flavors in SUP than Triceps brachii.

## Influence of Boning Time, Muscle Type and Salt Level on the Textural and Chemical Traits of Recombined Beef Roasts

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The present study was conducted to determine the influence of muscle type (MT), boning time (BT) and salt level

(SL) on various textural and chemical traits of precooked recombined beef roasts. The roasts were prepared from muscles taken from the chuck, including the Supraspinatus (SP), Infraspinatus (IF) and Triceps brachii (TB). Muscles were removed from 36 sides of Angus cow carcasses either immediately postmortem (prerigor) or after 24 h chill at 2 C. The whole muscles were defatted and as much connective tissue as possible was removed, vacuum massaged for two h and then like muscles were recombined to form a roast. Three different salt levels were used in the preparation of the roasts (0, 0.5, 1.0%). The roasts were then vacuum packaged, heat shrunk, cooked in an agitating retort to an internal temperature of 68 C and then chilled over night at 2 C prior to being frozen at  $-34$  C until further analyses. An Instron was used to test for the textural parameters of hardness, cohesiveness and chewiness. Instron values were determined in the bind site and in the muscle. BT significantly affected the protein level, caloric value and product yield. Roasts prepared with prerigor meats exhibited higher protein levels and product yield values and lower caloric values ( $P < .05$ ). SL was observed to affect several proximate parameters and product yield. As SL was increased, values for moisture and yield increased while values for fat, protein and calories decreased. Roasts prepared from IF muscles exhibited lower values for protein and moisture and had higher values for fat and calories ( $P < .05$ ). In general, Instron values indicated lower hardness values in the bind sites while values for cohesiveness were similar in both sites. SP muscles did exhibit higher Instron values. This study indicates the feasibility of binding large muscles together to form recombined beef roasts.

## Effects of Feeding Pigs Canola on Growth and the Palatability and Fat Characteristics of Pork

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Sixty-one pigs averaging 53 kg were equally allotted to one of three isonitrogenous dietary treatments. Diet 1 contained 20% intact whole canola seed, diet 2 contained 20% whole ground canola seed and diet 3 was a standard corn-soybean meal diet that served as a control. Canola is a low erucic acid rape seed and is high in protein (18%), total fat (over 40%) and oleate, a monounsaturated fatty acid. Pigs were stratified by weight and randomly assigned to one of nine pens (3 reps/diet). Pigs were weighed initially and every 2 weeks until they reached the endpoint of 102 kg. Feed consumption by pen was determined. No differences ( $P > .05$ ) for rate of gain or feed efficiency were observed among dietary treatments. Triangle difference tests comparing bacon from the control and canola-fed pigs were conducted after 0, 4 and 8 weeks of vacuum packaged storage at 1°-3° C. Panel members could detect differences ( $P < .001$ ) between bacon from control and the canola-fed pigs at all three storage intervals. However, panelists did not show a

preference ( $P > .05$ ) for one treatment over the other. Panel members judged the bacon from canola feeding to be softer than the control. Thiobarbituric acid values increased significantly during storage. Fatty acid composition of the bacon reflected differences in the diet. Canola has good potential

for supporting maximal gains and feed efficiency for growing pigs. Canola can replace a portion of the corn and soybean meal in swine finishing diet and the bacon is acceptable in organoleptic characteristics to the consumer.