# A QUALITY APPRAISAL OF TWO SHOULDER CUTS OF BEEF UNDER FOUR ROASTING CONDITIONS

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## ABSTRACT

Consumer size round bone shoulder and cross rib roasts of beef were cooked at each of two oven temperatures: 107°C and 163°C to each of two internal temperatures: 70°C and 80°C. For each roast type, two roasts were cut from both sides of each of four animals yielding a total of 16 round bone shoulder roasts and 16 cross rib roasts. A Latin Square design replicated four times was used to assess the effect of the four cooking conditions. Treatment arrangement permitted assessment of differences between animals, sides and roast cuts as well as cooking conditions. Quality assessment included edible yield, proximate analysis, force to shear the cooked sample and sensory panel judging. Shear force values obtained on all muscles occurring within the two roast types were combined into weighted means for each roast type. Costs per edible portion were considered.

Yields for the round bone shoulder roast were not different among cooking conditions. However for the cross rib, yields were significantly lower when cooking was done at the lower oven temperature and to the higher internal temperature due mainly to higher evaporation losses. In all cases, edible yield was higher for the cross rib roasts than for the round bone shoulder roasts due to the larger proportion of bone present in the latter. The cross rib roasts were still slightly more expensive per serving than the round bone

shoulder roasts when the retail price difference between the two was $0.20 per pound. For both roast types edible yield tended to be higher for the first cut than for the second cut, however this was only partially attributable to bone. Fat trimmed from the exterior of the roasts and intermuscular waste were also greater in the second cut of the round bone shoulder and cross rib, respectively. Proximate composition of the edible yield was not different between the two roast types. There were minimal differences in yield among animals and no differences in yield between right and left sides of animals.

Weighted means of shear values indicated that both roast types were most tender when cooked at the lower oven temperature of 107°C and to the higher internal temperature at this oven temperature; this was the condition which least favored edible yield. At the oven temperature of 163°C, cooking to the higher internal temperature increased the tenderness of the round bone shoulder roast only. Of all muscles studied, the tenderness of only four muscles differed appreciably among roasting conditions. The deltoideus, deep pectoral, triceps brachii (lateral head) and brachialis muscles in the round bone shoulder were significantly more tender when cooked at 107°C to 80°C than when cooked at 163°C to 70°C. Significant differences among animals were found in weighted means of muscle shear values. No differences in tenderness were found between right and left sides of animals.

The round bone shoulder roast was most well-liked by a 26 member untrained panel when cooked at 107°C to 80°C, however the cross rib roast was equally well-liked under all cooking conditions. Criticisms of tenderness were reflected in hedonic scores to a greater extent in the round bone shoulder roast than in the cross rib roast. As yields for the round bone shoulder were not appreciably different among roasting conditions, its tenderness response clearly defined its best roasting condition, 107°C to 80°C. With the cross rib however, as yields were affected appreciably by the roasting conditions and its tenderness response was less defined, 107°C to 70°C was considered the best roasting condition.

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# INTRODUCTION

Meat is the center of the menu and generally the most expensive item of the day's main meal. Of all meats, beef is the most popular in North America. For maximum palatability it is agreed that beef should be tender (Macdonald, 1963). However, steers are not all steaks and prime rib roasts; in fact, of the beef carcass only 26 to 28.5% is considered to be made up of tender cuts (Swift Canadian Co., Limited, 1961; Council of Canadian Beef Producers, 1964). A variable additional amount is made tender by grinding.

Most cookbooks recommend using moist heat to cook chuck or shoulder roasts. Meat that is pot-roasted or braised can be very acceptable, but it is quite a different product from a dry-heat cooked roast. In 1965, Nielsen and Hall showed that blade roasts cooked by dry heat were juicier than those cooked by braising. Several studies have shown that, other things being equal, most people prefer the flavor achieved by a cooking environment that permits surface evaporation, the flavor that has been associated with steaks, rib roasts and loin cuts (Cover, 1941a; Cover and Shrode, 1955; Griswold, 1955a; Hood, 1960).

Early research has shown that the triceps brachii (TB) from the chuck can be as tender as the longissimus dorsi (LD) of the rib when both are roasted at low temperatures (Cover, 1943).

However, slow cooking such as that used by Cover (1943) has been given very little consideration for use in the home as the long cooking time was considered inconvenient. However, with today's automatic ovens and more homemakers working outside the home, a long cooking time may be a convenience rather than a nuisance. Costs for fuel energy have been found negligible between heating at 107°C and 163°C (Nielsen and Hall, 1965).

Research work, for consistent results, is most commonly conducted with individual muscles. However consumers have access to roasts that generally contain several muscles. Accordingly, in the present study, roasts were used as the primary experimental sample, while the behavior of individual muscles was examined on a sub-unit basis.

In 1965, Nielsen and Hall reported findings in favor of slow, dry heat cooking of blade roasts. The present work involved the study of two other common cuts from the chuck, the round bone shoulder (RBS) and cross rib (CR). These roasts were cooked to 70°C and 80°C at both 107°C and 163°C. The objective was to establish the best dry heat cooking method for both roasts and to establish their relative advantage to the consumer. Quality assessment included edible yield, force to shear the cooked sample, sensory panel judging and proximate analysis.

For the sake of brevity, the names of the two roast types being examined and the majority of the muscle names have been abbreviated. For quick reference see glossary in Appendix D.

# REVIEW OF LITERATURE

With meat that is consistent in breed, rearing practice, slaughter conditions and aging, the tenderness of the cooked product will be dependent on its location in the carcass and the cooking method. In this study the two types of meat being examined are both from the shoulder of the animal and within replicates, originated from the same animal. Hence, background features of the meat were common among all treatments studied.

## Retail Shoulder Cuts of Beef

The cutting of a carcass or wholesale cuts into retail cuts is not standardized throughout North America. However, essentially all the methods agree with the recommendation of Ramsbottom and Strandine (1948) that muscles of similar tenderness should be grouped so that the occurrence of tender and less tender portions within a roast or steak is minimized.

The Canadian methods of dividing the beef carcass into wholesale and retail cuts are similar to those described in the United States as Chicago or midwestern style (National Live Stock and Meat Board, 6th ed.), except that by the Canadian method, two ribs instead of one are left on the hindquarter (Council of Canadian Beef Producers, 1964).

Beef carcasses are sold to retailers in the form of wholesale cuts, that is, as sides, quarters and small units known as primal cuts. A small amount of fat and bone is trimmed away when a carcass is cut into wholesale cuts (Pecot et al., 1965).

From the forequarter come the primal cuts known as the rib, the square-cut chuck, the foreshank, the short plate, and the brisket.

In separating the forequarter into primal cuts, the first cut removes the short plate, the brisket and the foreshank (Lattin and Carson, 1934). Next, the rib is removed;

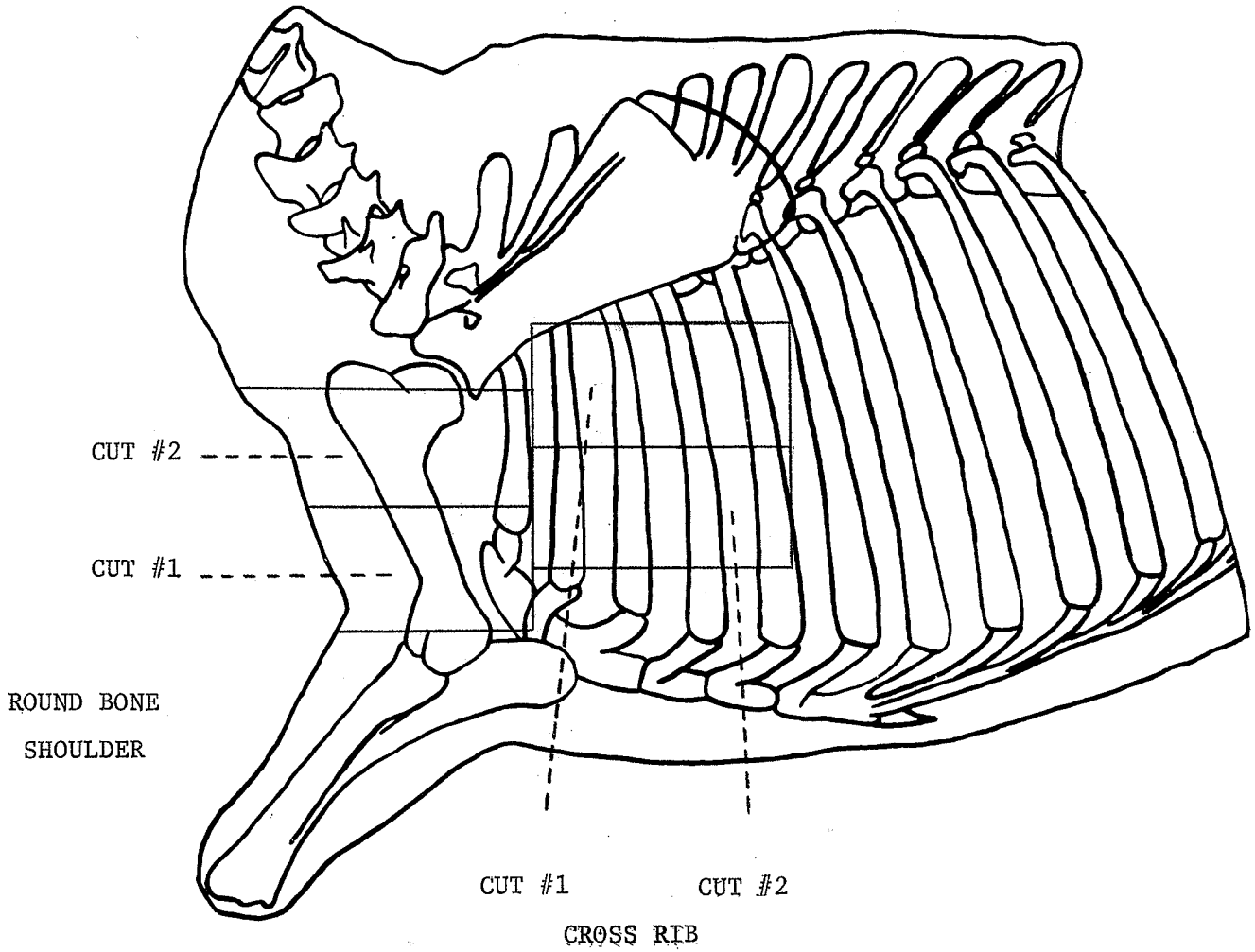



FIGURE 1. Location of the roasts in the forequarter.

it is cut between the fifth and sixth ribs counting from the neck end of the forequarter. The remainder is called the chuck and the neck, or combining the two, the square-cut chuck. The trimming of retail cuts may be slight or extensive depending on such factors as the finish of the carcass, the price of the meat and the demands of consumers (Pecot et al., 1965).

The square-cut chuck accounts for 25 to 26% of the beef carcass and yields retail cuts such as blade roasts and steaks, arm roasts and steaks, boneless chuck roasts, CR roasts, ground beef and stewing beef (Council of Canadian Beef Producers, 1964).

Blade roasts and steaks are taken from the upper part of the square-cut chuck, next to the prime rib side. They are cut above the CR roasts, approximately perpendicular to them (Figure 1). The roasts are also called blade pot-roasts (National Live Stock and Meat Board, 6th ed.).

The CR roast is taken from the lower side of the square-cut chuck, next to the prime rib (Figure 1). It contains about four ribs and can be called the short-rib or the Boston cut or the English cut. The ribs can vary in length from two to six inches and the cut is often described as rectangular (National Live Stock and Meat Board, 6th ed.).

Arm roasts and steaks contain the knuckle bone and may or may not contain cross sections of the ribs depending on the method of cutting. These cuts are also known as the

RBS, the round shoulder and the shoulder (Figure 1). Frequently the term pot-roast is included in the roast labels, for example, arm pot-roast, shoulder pot-roast etc.

Any part of the square-cut chuck may be deboned, rolled and labelled as a boneless chuck or shoulder roast, however it is usually taken from the forward side of the chuck. If it is mainly from the neck it is labelled as boneless neck (Lattin and Carson, 1934).

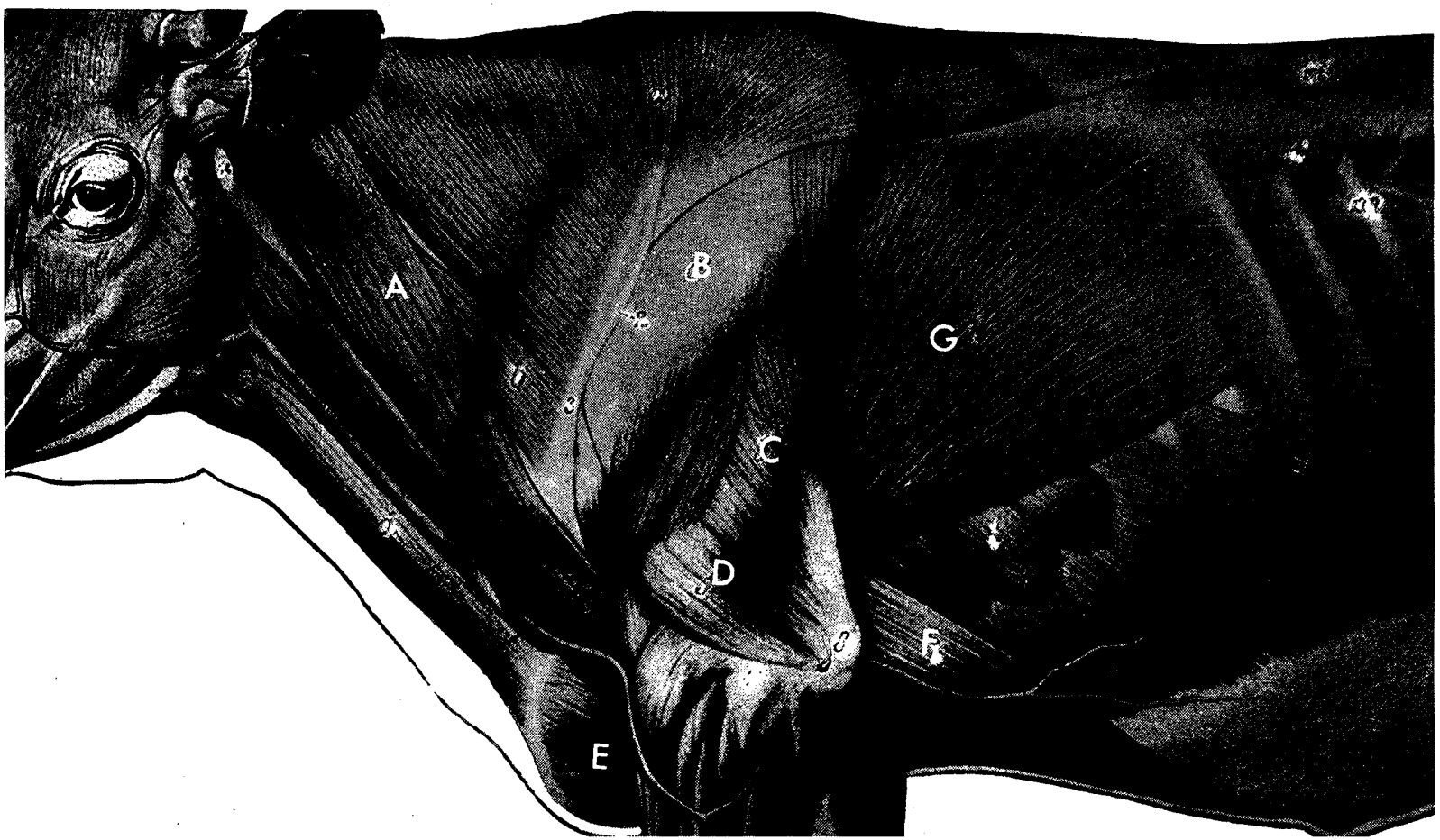
Stewing beef and hamburger are made from trimmings from the neck, shank and flank.

## Description of the Muscles present in the Round Bone Shoulder and Cross Rib Roasts

This section will deal with a brief description of the location and action of each of the muscles that the author was able to identify in the two roast types used in the study, the RBS and CR. Figure 1 shows the exact location of the roasts in the forequarter of the carcass and Figure 2 shows the location of several of the identified superficial muscles in the animal. The muscles of both roast types are the muscles of the thoracic limb with the exception of two muscles of the CR roast; the scalenus dorsalis which occurs in the neck and the external and internal intercostals which occur in the thorax. Figures 3 - 6 show the location of the muscles within the cuts before trimming and/or boning; they also show in progression the change in proportion of the muscles and bones from the first cut through to the second cut. The figures are divided into two sections; the CR is the upper section and the RBS, the lower.

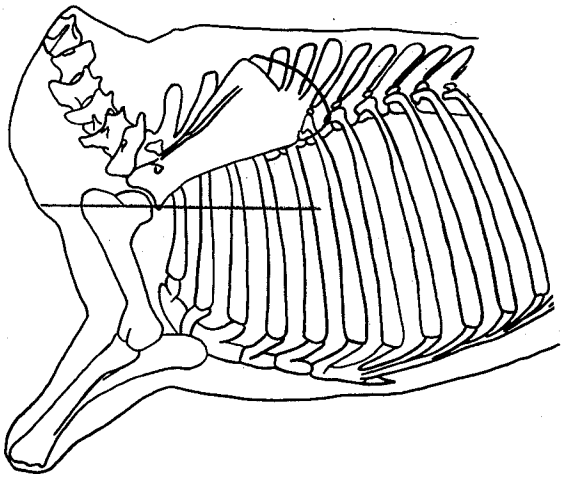
The reader is referred to "The Anatomy of the Domestic Animals" by Sisson and Grossman (1947) for more detailed descriptions than are given in the following discussion.

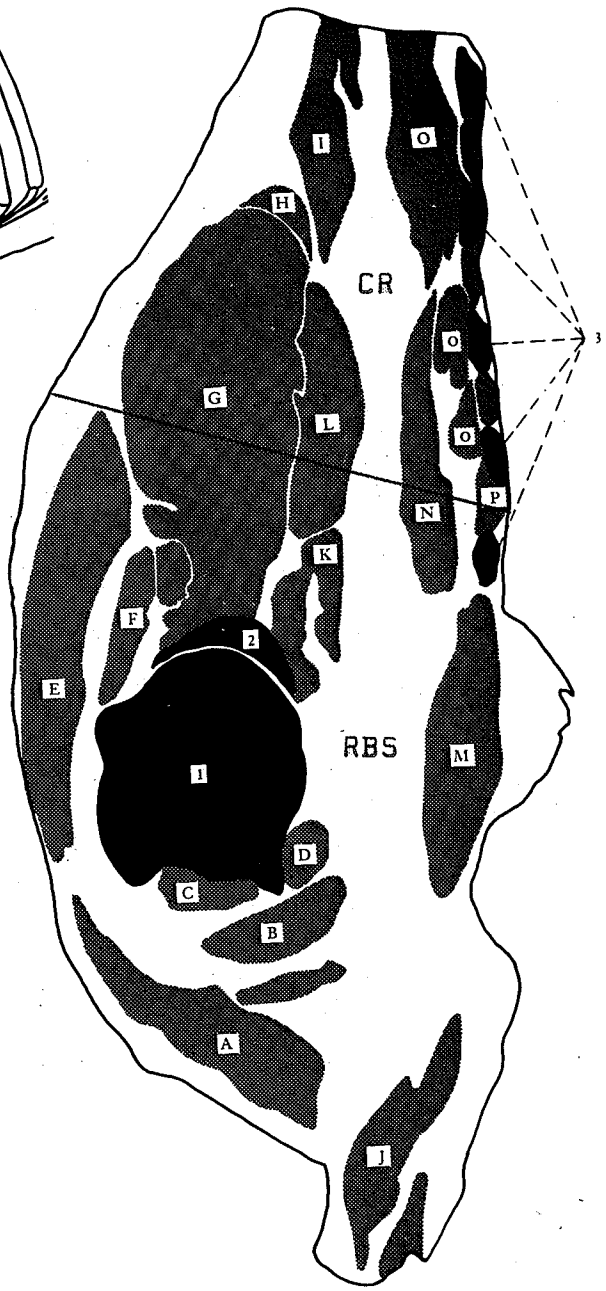
The muscles identified, in order of decreasing proportion, in the RBS and CR roasts, were as follows:




A, Brachiocephalicus; B, Deltoideus; C, Triceps brachii (long head); D, Triceps brachii (lateral head); E, Superficial pectoral; F, Deep pectoral; G, Latissimus dorsi.

FIGURE 2. Superficial muscles of the neck, shoulder and thorax present in the two roasts. (From Sisson and Grossman, 1947)






Muscles

- A Brachiocephalicus
- B Deep pectoral
- C Tendon of biceps brachii
- D Coracobrachialis
- E Deltoideus
- F Teres minor*
- G Triceps brachii (long head)
- H Tensor fasciae antibrachii
- I Latissimus dorsi
- J Sternocephalicus*
- K Subscapularis*
- L Teres major
- M Scalenus ventralis*
- N Scalenus dorsalis
- O Serratus ventralis*
- P Intercostal muscles

Bones

- 1 Humerus
- 2 Scapula
- 3 Ribs

Rib Fingers - muscle P

*Not visible in the roasts used.

FIGURE 3. Size and shape of the muscles and bones of the square-cut chuck at the position indicated on the skeletal diagram of the carcass. (From Tucker et al., 1952)