

Comparison of Round and Square Cores in the Determination of Beef Tenderness by Warner-Bratzler and Instron

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Summary

Seven rib-eye rolls, lip on (112A), were each cut into eight 2.54 centimeter thick steaks starting from the blade end. Steaks were randomly assigned to one of four treatment groups; 1) round versus square cores using Instron [inst1], 2) round versus square cores using Warner-Bratzler [inst2], 3) Instron versus Warner-Bratzler using round cores [rdsq1], and 4) Instron versus Warner-Bratzler using square cores [rdsq2]. Subsequently, steaks from each group were broiled in a General Electric industrial broiler grill to an internal temperature of 63 °C. Steaks were held overnight at 2 °C. Two steaks from each rib were placed into each instrument/core treatment group. Steaks were then divided into three sections identified as: a) lateral, b) medial, and c) central. Three 1.27 centimeter cores from each section were taken from each steak for a total of nine cores per steak and sheared once through the center. The results indicated that there was a significant difference ($p > .05$) between round and square cores for both Warner-Bratzler and Instron. In all mean groups tested, square cores had higher shear values than did round cores. There was no indication of differences between instruments, and no significant interactions between instruments and core types.

Introduction

The National Beef Quality Audit Strategy Workshop of 1992 indicated that in the top 15 concerns of the beef industry, both "low overall palatability" and "inadequate tenderness" were listed. Ranking sixth and seventh, respectively, indicates how important these textural qualities of beef are to the consumer. One way of measuring tenderness of beefsteaks has been the use of the Warner-Bratzler shear device, or the Instron Universal Testing Machine equipped with Warner-Bratzler attachments.

Warner-Bratzler shear force was proposed by the NCA as a method of identifying sires of progeny with tender beef. Although the Warner-Bratzler shear method of measuring tenderness has been used extensively, the methodology requires refinement to assure confidence in Warner-Bratzler shear values. To obtain a WB shear value, cores, usually 1.27 centimeters in diameter, are removed by using a hand or machine coring device. Being able to remove uniform-sized cores is a challenging part of obtaining WBS values.

Standardizing the way that cores are taken for tenderness, and removing the variation between individual cores would seemingly assist the industry in more adequately defining tenderness. Specifically, the variation in round cores raises a concern about their use as accurate measures of beef steak tenderness.

Recently the WB method was adapted to the Instron Universal Testing Machine to mechanically measure tenderness. Although the Instron is the accepted norm there is no definitive standard for taking meat samples to be tested. Because of this lack of standardization it is currently difficult to compare results of independent studies. Of the six factors Bratzler (1949) identified as critical to obtaining reliable results, there are four that have no standard in the academic community. They are: degree of doneness of the cooked meat, uniformity of sample size, direction of muscle fibers and temperature of sample.

Uniformity of sample size can be subdivided into number of cores and core uniformity. Of interest in this study are core size and the uniformity from end to end of each core. Recently the size of round cores taken was either 1.27 centimeters, Crouse (1989, 1991), or 2.54 centimeters, Bailey (1991), with 1.27 centimeter being the most common size of sampling, Wheeler (1991), Morgan (1991), Whipple (1990), Shackelford (1991), Gwartney (1996), and Huff-Lonegan (1996). Kastner (1969) determined that consistent core diameter had a definite effect on shear value. Machine cores with a more consistent diameter had greater shear force values than hand cores, which produced an hour glass configuration and lower shear force values.

This study was designed to observe the effect of core shape on WBS values of beefsteaks. Specifically the objective was to determine the results of using round versus square cores as measured by both the Warner-Bratzler shear and the Instron Universal Testing Machine equipped with Warner-Bratzler attachments.

Materials and Methods

Seven USDA select and low choice rib-eye rolls, lip on (112A), were each cut into eight 2.54 centimeter thick steaks starting from the blade end. Steaks were randomly assigned to one of four treatment groups: 1) round versus square cores using Instron [inst1], 2) round versus square cores using Warner-Bratzler [inst2], 3) Instron versus Warner-Bratzler using round cores [rdsq1], and 4) Instron versus Warner-Bratzler using square cores [rdsq2]. Subsequently, steaks were broiled in a General Electric (Chicago Heights, IL) Model CNO2 industrial broiler (288 °C). The surface of the steaks were 10.16 centimeters from the heat source. The steaks were tined when they reached an internal temperature of 24 °C and were removed when they reached an internal temperature

of 63 °C. Steaks were held overnight at 2 °C, and were allowed to equilibrate to room temperature (22 °C).

Two steaks from each rib were placed into each instrument/core treatment group. Steaks were then divided into three sections identified as a) lateral, b) medial, and c) central. Three 1.27 centimeter cores from each section of each steak were removed parallel to the muscle fiber direction for a total of nine cores per steak. Round cores were removed by hand coring (Figure 1). Square cores were removed by taking one 1.27 centimeter strip from the lateral section, one from the medial section, and one from the central section. Each strip was then cut to obtain three cores, 1.27 centimeters² from each area designated in Figure 2. The cores were sheared once perpendicular to the long axis of the fibers using either the Warner-Bratzler (Manhattan, KS) or the Warner-Bratzler attachment of the Instron (Model 4502) controlled with a Model 4500 computer assisted module (Instron, Canton, MA). The Instron unit was calibrated to a full scale using a 1 kilonewton load cell, a crosshead speed of 250 millimeters/minute, and a sample rate of 10 points/second. The values were recorded in pounds for the WB and were then converted to kilograms for comparison with Instron data, which were recorded in kilograms.

Figure 1. Round cores.

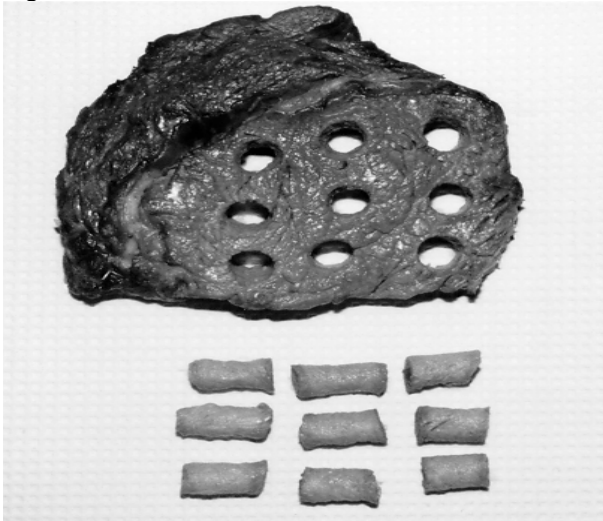


Figure 2. Square cores.



Results

The WBS and the Instron data (Figure 3 and Figure 4) both indicate a significant difference between round and square cores. Round cores required less shear force than did square cores and had smaller standard deviation between samples. On the other hand, the square cores were more consistent in dimension from end to end and showed no evidence of fiber separation. Indeed, fiber separation in round cores may account for the lower shear force measurement. The larger standard deviation for square cores versus round cores may be a more realistic measurement of actual differences in tenderness because of a more consistent sample size.

Core removal using the square coring method required less force and could be accomplished with even, uninterrupted motion. This ability to remove cores with little or no twisting most likely contributed to the lack of muscle fiber separation noted in the square cores. In addition, removal by using the square core method allowed easier recognition of muscle fiber orientation. This assured that samples were taken parallel to muscle fiber orientation.

Figure 3. The effects of round and square cores on mean values of Warner-Bratzler and Instron shear force values.

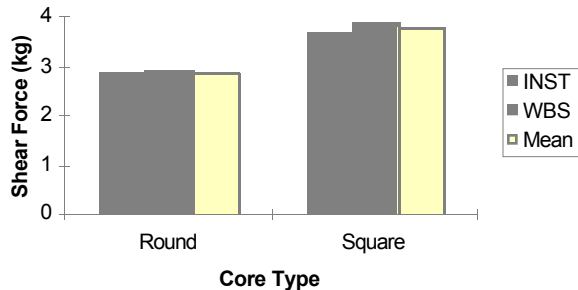
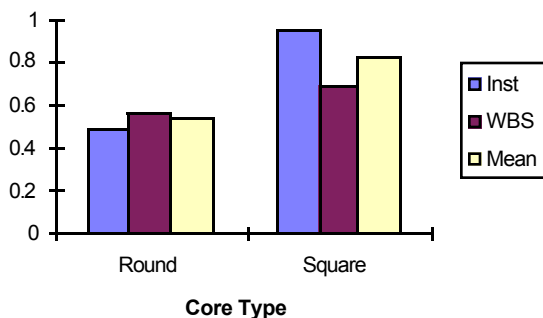


Figure 4. The effects of round and square cores on standard deviation of Warner-Bratzler and Instron shear force values.



Implications

Square cores were more consistent in dimension and did not display muscle fiber separation. Higher standard deviations for square cores may indicate more actual within steak variation than round cores. Both the Warner-Bratzler shear and the Instron may be used to achieve satisfactory results. More experimentation should be done to verify the potential for using square cores to standardize sampling for shear force measurements.

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