contra - lateral technique would require large numbers of animals to assess treatment effects.

The present results indicate that a more efficient design would be the Latin Square in which the treatment is assigned alternately to a particular side, and an even number of animals are added to the test. In this procedure the control side is also alternated between right and left. Moreover, the Latin Square design would require a minimum number of animals to assess animal, side and treatment effects.

The current data also suggest that if inferences are to be made to the effect of a particular treatment on beef tenderness in general, if would be wise to test an entire muscle such as the longissimus dorsi rather than a small portion of the muscle, such as the 9-10-11th rib, which has been the customary procedure in the past.

The Influence Of P-Chloromercuribenzoate On The Tenderness, pH, Adenosine Triphosphatase Activity And Protein Solubility Of Bovine Longissimus Muscle

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Story in Brief

This experiment was conducted to study the effect of a particular level of p-chloromercuribenzoate on the tenderness and certain biochemical attributes of beef muscle. Results showed that PCMB, as used in this test, had no statistically significant effect on the shear force, calcium or magnesium activated myofibrillar ATPase activity, pH or myofibrillar protein solubility of bovine longissimus dorsi muscle.

Introduction

Tenderness is the major quality attribute of beef and is supposedly influenced by the degree of post-mortem contracture of muscle and the subsequent formation of the actomyosin complex post-mortem. It follows, then, that inhibition of the above phenomena could lead to improved beef tenderness. Thus, the objective of this study was to determine the effect of a known sulfhydryl inhibitor, p-chloromercuribenzoate (PCMB), on the tenderness and on certain chemical attributes of bovine longissimus dorsi muscle.

Materials and Methods

Experimental material was obtained from the longissimus dorsi muscles of two, choice grade steers, weighing approximately 1100 lbs. alive. One side of each animal was designated for treatment, with the contra-lateral side serving as the untreated control. Treatment was alternated between right and left sides of experimental animals. The muscles were removed as whole blocks immediately post-mortem, trimmed of subcutaneous fat and weighed. The control muscles were wrapped and stored at 37° F. for 96 hours. The treatment muscles were injected with para-Chloromercuribenzoate (PCMB) to a final concentration of 5.0×10^{-4}m M in a volume of 15 percent of the original muscle weight. The solution was injected with a 50cc. hypodermic syringe fitted with a 6 inch needle. After injection the muscle was wrapped and stored identical to the control muscle.

At the appropriate time, each muscle was divided into 15 one inch steaks. Samples for chemical evaluation were also removed at this time, as shown in Figure 1. The steaks were fitted with individual thermometers and cooked to a center temperature of 160°F. in an oven which had been preheated to 300°F. Upon attaining the desired center temperature, the steaks were removed from the oven and five, ¾ inch diameter cores were removed, successively, along the dorsal-ventral midline of each steak, beginning at the medial side and terminating at the lateral side (Figure 1). Each core was sheared once, at its center, via the Warner-Bratzler device. Results were expressed as units of resistance to shear.

Samples for chemical evaluation were stored at 32°F. until required for analysis. At the appropriate time, the samples were removed from storage, thawed at 37°F. and analyzed for pH, myofibrillar adenosinetriphosphatase (ATPase) activity, and protein solubility. Samples were removed and analyzed at three time periods. Time "1" was immediately post-mortem before injection with PCMB, Time "2" was upon removal

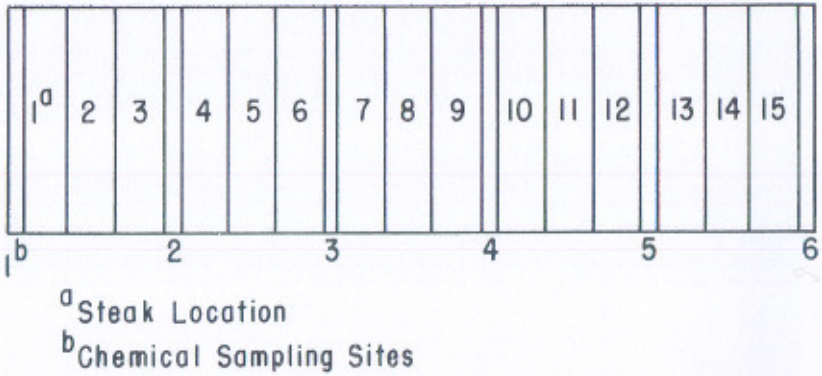

Figure 1. Schematic illustrating steak locations and sampling sites.

from storage, and Time "3" was after storage at 32°F. Samples analyzed for Time effect were from sites 1 & 6 only (Figure 1). Samples analyzed for location effect were from sites 1-6, and all were analyzed after freezer storage.

Results and Discussion

The objective of this study was to establish the influence of a particular level of PCMB on tenderness and certain chemical attributes of bovine longissimus dorsi muscle.

The results of this study indicated no statistically significant effect of PCMB on tenderness. There was a statistically significant ($P<0.005$) effect on core position within the muscles, with the medial side being more tender than the lateral side. No statistically significant difference in tenderness due to steak location along the length of the muscle was noted.

ATPase activity was determined using both a Ca^{tt}-activated high ionic strength system, and a Mg^{tt}-activated low ionic strength system. Theoretically, it was believed that the Ca^{tt} system would stimulate free myosin ATPase activity, while the Mg^{tt} system would activate myofibrillar (actinmyosin complex) ATPase activity. Thus, if PCMB inhibited formation of actomyosin, the phenomenon could be detected by a low Mg^{tt} activation and no decreased Ca^{tt} stimulation. Results of this study indicated no significant effect on any parameter studied on the Ca^{tt} activated system. However, there was a significant time effect on the Mg^{tt} activated system in both treated and control muscles (Figures 2 and 3). This indicates that PCMB did not inhibit the formation of the

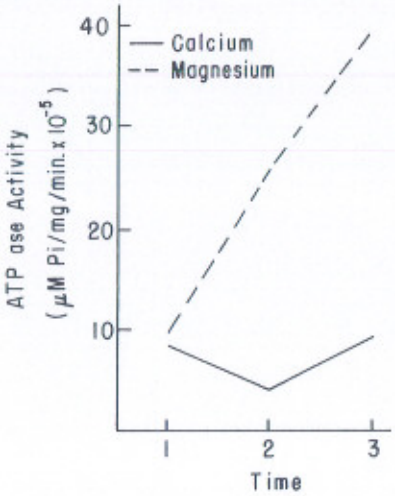

Figure 2. Influence of time on myofibrillar ATPase activity of PCMB treated muscles.

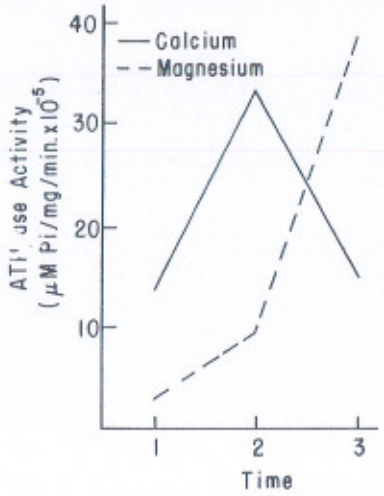

Figure 3. Influence of time on myofibrillar ATPase activity of control muscles.

actomyosin complex, as indicated by increased activity at time 2 and 3. Further study would be necessary to explain the large increase in activity between times 2 and 3, since the only difference between the two is freezing.

Results of analysis of the pH data indicated no significant variation in pH at the various sampling sites along the length of the muscle in either treated or control sides. However, there was a significant variation in pH with time with a drop in pH from approximately 6.4 at time "1" to a pH of 5.3 at times "2" and "3" (Figure 4). There was no significant treatment effect on muscle pH.

Analysis of the myofibrillar protein solubility data indicated no significant treatment effect on the solubility of the myofibrillar protein.

Summary

It is apparent from the results of this study that the level of PCMB used (5×10^{-4}mM) had no significant effect on tenderness or pH of bovine longissimus dorsi muscle or on myofibrillar protein ATPase activity or solubility. From a theoretical standpoint these results were somewhat unexpected, since PCMB is purportedly an efficient sulfhydryl group

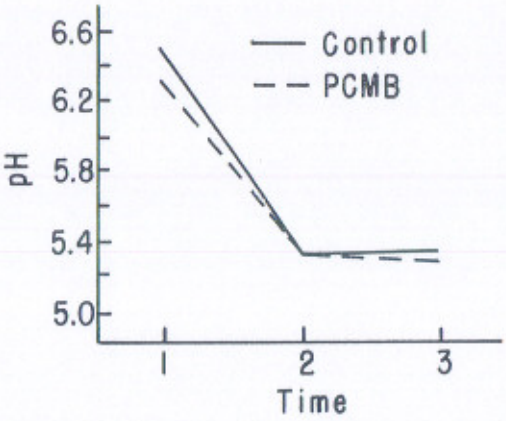

Figure 4. Influence of time on pH.

inhibitor. Perhaps the level of PCMB utilized was insufficient to effect significant mercaptide formation or the method of application of the test chemical or the handling of the treated samples did not allow sufficient reaction to occur.