EFFECTS OF VARIOUS TREATMENTS ON THE TEXTURE SOFTENING OF POST-BREEDING MATURE COWS MEAT

A.M. Ahhmed*[1], N. Matsumoto[1], S. Kawahara[1], K. Ohta[1], R. Kuroda[2], T. Okayama[3], K. Nakade[4], M. Numata[4], T. Nakamura[5] and M. Muguruma[1]

[1] Faculty of Agriculture, University of Miyazaki, Miyazaki 889-2192, Japan, [2] Junwa Medical Center for Rehabilitations, Miyazaki 880-2112, Japan, [3] Faculty of Agriculture, Kobe University, Kobe 657-8501, Japan, [4] Central Research Institute, Ito Ham Food, Inc. Moriya 302-0104, Japan, [5] R&D Center, Unicafe Inc, Tokyo105-0003, Japan. Email: abdo772201@yahoo.co.uk

Keywords: beef, tenderisation, softening, vacuum packaging

Introduction

The processing of post-breeding mature cows meat has become a primary development theme in meat industries. The use of new materials sometimes can help to meet the challenges faced in meat manufacturing. In recent decades, many meat suppliers started to create some sort of soft meat, through the utilization of several techniques, such as mechanical tenderisation. The physical disruption of the muscle structure reduces the density of cooked meat fibres and therefore improves its tenderness (Hokins, 2004). The technologists need to pay particular attention to those variables that would directly impact the texture quality of meats that are tough, thereby difficult to chew, (e.g. mechanical processes, additives, heat treatments, packaging type). The use of new materials that originally come from leguminous and fruity sources has become increasingly used in meat tenderization. Products treated by organic, or plant-derived additives can contribute to promote the consumers to use those products as daily goods. This study was aimed to soften tough mature meat through the use mechanical tenderisations and the use of softening additives at two different heat treatments.

Materials and Methods

The meat used in this study was Top Loin Steak (Japanese Black Cows). The samples were designed as slices (4mm thick) and intentionally mechanically tenderised by tenderizer (OHMICHI, OMTR-270, Tokyo, Japan) to create clefts in the flesh. Additives, such as a fermented apple solution (FAS), fermented paste of beans (miso) and non-sterilized soy sauce were used to tenderise the meat. Samples used in the present study were divided to three groups. The first group was treated with 4% FAS, and set in a solution for 3 hours. The proportion of meat to the solution was 2:1. The second group was treated with miso. The miso was pasted on both sides of the sliced meat for one day. The proportion of the meat to miso was 5:1. The third sample set was treated with diluted (two times in distilled water before being used) non-sterilised soy sauce. Meat was set in the soy sauce for 3 hours; the proportion of meat to soy sauce was 2:1. The samples were subjected to two different heat treatments, the first of which involved being packaged and boiled at 75°C for 15 min, while the second condition involved meat that was grilled in an oven at 170°C for 5min, on each side of the sliced meat. The water-holding capacity was measured by checking the weight of the samples before and after the heat treatments. Another part of this research investigated the effect of vacuum packaging on the beef softening after adding FAS only. FAS was added to beef slices of the same thickness (4mm), and then packaged in clear plastic bags. The samples were subjected to the breaking strength, determination by using creep meter (Yamaden RE2-33005S, Tokyo, Japan).

Results and Discussion

Fracturing the fibre of the flesh facilitated the absorption of the tissues and allowed for greater penetration with the additives. It was clear that the breaking strength of the samples treated with FAS, miso and soy sauce, respectively, were reduced. Moreover, the mechanically tenderised and boiled samples showed a decrease in the breaking strength, greater than that found in non-mechanical tenderised samples. Fig 1 shows the effects of mechanical tenderisation and all the additives on the breaking strength of boiled samples. These data indicate that the breaking strength was significantly reduced. Moreover, the breaking strength was decreased in the grilled samples and those processed by the same treatments (Fig 2). In a comparison between the untreated samples and samples processed by FAS and vacuum packaged, the breaking strength of the treated samples was drastically reduced (Fig 3 and 4). These data suggest that the vacuum packaging provides the opportunity for the additive solution to penetrate into the meat tissues. The total remaining weight examination was conducted to determine whether the various treatments had an effect on the water-holding capacity and total remaining weight of treated samples. Table 1 presents the values of the total remaining weight after the samples were treated at two different temperatures. The best recorded values were found in the samples treated by FAS and miso. Each of the samples was also subjected to sensory trait test. A total of 15 participants of different ages were engaged in this test. The taste of the samples treated with miso and soy sauce differed from the original quite a bit and the flavour of those samples was dominated by miso and soy sauce taste (data not shown). The taste of the samples treated by both the miso and the soy sauce were reportedly strongly influenced by those additions.

The meat in each case took on the flavour of the solution. However, the taste of samples treated with FAS was good. In addition, the vacuumed packaging with FAS contributed to the tenderization of post-breeding mature cow's meat. Data suggest that the use of mechanical tenderization and other additives had a positive affection the meat texture of mature beef.

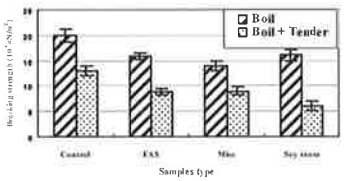

Figure 1: Breaking strength of tenderised and boiled samples.

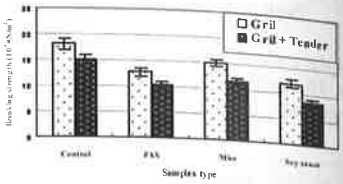

Figure 2: Breaking strength of tenderised and grilled samples.

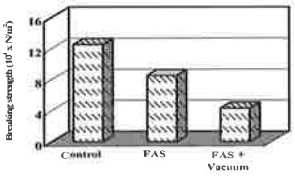

Figure 3: Breaking strength of samples boiled after treated with FAS and vacuum package for 3hours.

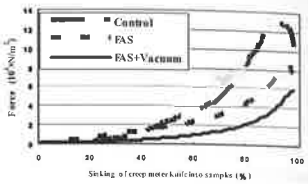

Figure 4: Force of a creep meter knife to samples treated by FAS and vacuum packaged.

Table 1: The total remaining weight of treated samples with plant-derived additives after subjected to two different heat treatments.

Grilled group		Boiled group	
Samples type	Samples weight (%)	Samples type	Samples weight (%)
Control	62.07	Control	70.81
FAS	68.03	FAS	75.32
Miso	66.17	Miso	76.27
Soy sauce	62.6	Soy sauce	69.72

Conclusions

The study was engaged using additives in order to soften the texture of mature beef. The feasibility of this study purposes to address a significant problem, in many countries, mature beef is considered to be an inconsumable meat. This study demonstrates that additives can play a role in solving such a problem. The use of FAS, miso and soy sauce, along with mechanical tenderization treatment can contribute to the softening of the meat of post-breeding mature cows. Furthermore, the breaking strength of the boiled samples was also significantly reduced. However, the taste of the samples treated with miso and soy sauce was largely influenced by the taste of those additives themselves, making them less palatable to the participants in this study. In conclusion, the samples treated with the combination of meat tenderizing and addition of FAS along with vacuum packaging proved to be effective in beef softening. The vacuum packaged samples gave the lowest value of breaking strength, which was found to be 60% less than the breaking strength in the control samples. This study provides evidence that may contribute to our understanding of the advantages of using plant-derived additives, along with meat tenderization, in order to present a consumable meat from mature beef that would otherwise be considered inedible by consumers.

Reference

Hokins, L. D. Tenderizing mechanisms/mechanical. In Jensen, W., Devine C. and Dikeman M. (2004) (Eds). *Encyclopedia of Meat Science.* (Vol. 3) (pp. 1355-1369) Oxford: Elsevier Ltd.