

# THE EFFECT OF PINEAPPLE AND HONEY INJECTION ON PHYSICOCHEMICAL QUALITY OF LOW MARBLED BEEF WITHOUT COMPROMISING ITS FRESH APPEARANCE

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**Abstract** – The objective of this study was to investigate the effect of pineapple and honey injected into low marbled beef on enhancement of physicochemical and microbial qualities during storage. Beef loin was injected with a solution (6.0% pineapple concentrate, 2.5% honey, 0.5% monosodium L-glutamate, 0.5% phosphate, 0.3% salt, w/w), and the number of total aerobic bacteria, surface color, shear force, and reducing sugar were analyzed at day 0, 7, and 14. Injection process did not adversely affect microbial quality and surface color during storage compared to non-injected beef (control). Shear force was significantly lower in injected beef than in control ( $P<0.05$ ), whereas reducing sugar content was significantly higher in injected beef. In conclusion, the injection of pineapple and honey may improve the tenderness and flavor in low marbled beef during short storage periods without compromising microbial quality and fresh meat appearance.

**Key Words** – flavor, natural additives, tenderness

## I. INTRODUCTION

Injection process includes relatively rapid enhancement in tenderness and flavor of low marbled beef depending on the additives of injected solution. Meanwhile, there are constant demands for natural additives due to the concern about synthetic additives [1]. Pineapple is a natural tenderizer for meat owing to its high content of bromelain [2], and honey can provide sufficient amounts of reducing sugar, which is one of flavor precursors for the Maillard reaction [3]. Therefore, the objective of this study was to investigate the effect of pineapple and honey injected into low marbled beef on enhancement of physicochemical and microbial qualities during storage.

## II. MATERIALS AND METHODS

### *Sample preparation*

Beef loin (quality grade 2) and the additives were purchased from a local market in Korea. The solution (6.0% pineapple concentrate, 2.5% honey, 0.5% monosodium L-glutamate, 0.5% phosphate and 0.3% salt, w/w) was pumped to 120% of the initial weight of sample (sliced into  $7 \times 6 \times 2.7$  cm<sup>3</sup>; length  $\times$  width  $\times$  thickness), and the control was treated in a similar manner without injection process. All samples were sealed in impermeable polyethylene bags individually and stored at 4°C for 12 h for application time of the additives (0 day). Then, they were stored at 4°C for 14 days and analyzed at day 0, 7, and 14.

### *Microbial analysis*

The sample was serially diluted with sterile saline (0.85%, w/w), and each dilution (0.1 mL) was spread on plate count agar (Difco Laboratories, USA). The agar plates were incubated at 37°C for 48 h, and microbial counts were expressed as Log CFU/g meat sample.

### *Physicochemical quality analysis*

Surface color, shear force, and reducing sugar were analyzed. CIE L\*, a\*, and b\* values were measured using a spectrophotometer (CM-5, Konica Minolta Sensing Inc., Japan). Shear force was analyzed using a Warner-Bratzler shear attachment on a texture analyzer (TA1, Lloyd Instruments Ltd., UK) with a maximum cell load, 10 kg; target load, 10 g; target value, 25 mm; target speed, 2.0 mm/s. Reducing sugar was measured based on the method of Jayasena *et al.* [4].

### Statistical analysis

The general linear model was analyzed with the fixed (storage period and injection) and random effect (sliced sample) using SAS 9.4 software. Mean values with standard deviation were reported and significances were determined by the Student-Newman-Keuls multiple comparison test at  $P<0.05$ .

## III. RESULTS AND DISCUSSION

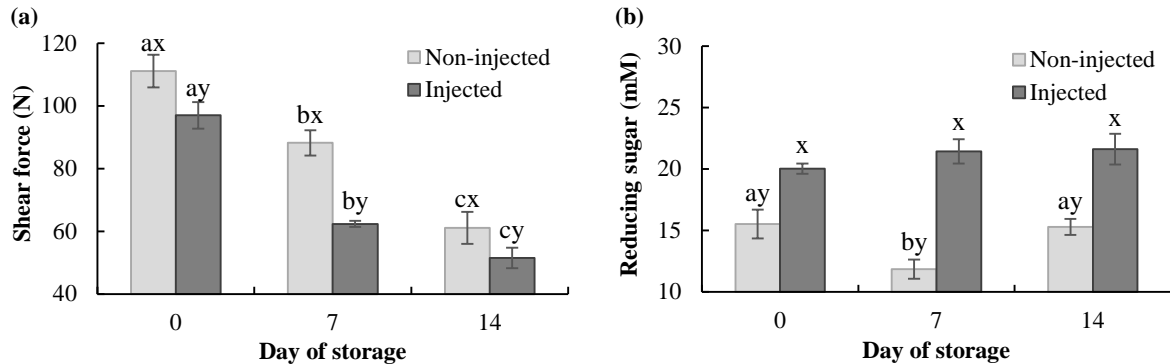


Figure 1. Effect of pineapple and honey injection on (a) shear force (N) and (b) reducing sugar content (mM) of low marbled beef. <sup>a-c</sup>Different letters within the same treatments differ significantly ( $P<0.05$ ); <sup>x,y</sup>Different letters within the same day of storage differ significantly ( $P<0.05$ ).

In this study, injected beef had significantly lower shear force than that in control due to the injection of pineapple (Fig. 1(a),  $P<0.0001$ , F-value = 74.91). Although aging had a strongly positive effect on shear force ( $P<0.0001$ , F-value = 211.39) over the storage period, the shear force values of injected beef at day 0 and 7 were similar to those of control at day 7 and 14, respectively. This result indicates that the injection of pineapple can shorten the aging period of beef by approximately a week. Injected beef showed significantly higher reducing sugar content by pineapple and honey (Fig. 1(b)). In terms of microbial counts and surface color, injection process did not aggravate microbial quality and appearance during storage compared to control (data not shown).

## IV. CONCLUSION

This study demonstrates that injection process with pineapple and honey could be used to enhance tenderness and flavor of low marbled beef without adverse effect on microbial quality and fresh meat appearance. Furthermore, the rapid tenderization effect of injection could shorten the aging period resulting in saving cost and efforts for aging process.

## ACKNOWLEDGEMENTS

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