THE EFFECTS OF PRE AND POST RIGOR MARINADE INJECTION ON SOME QUALITY PARAMETERS OF *LONGISSIMUS DORSI* MUSCLES

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ABSTRACT

This study was conducted to evaluate the effects of pre and post-rigor marinade injections on some quality parameters of *Longissimus dorsi* muscles. Three marinade formulations were prepared with 2% NaCl, 2% NaCl+0.5 M lactic acid or 2% NaCl+0.5 M sodium lactate. Injection time had significant effect on marinade uptake levels of samples. Injection of sodium lactate increased pH values of samples whereas lactic acid injection decreased pH. The highest cooking loss was found in samples marinated with 2% NaCl in both pre-rigor and post-rigor injection. On the 3. day of storage, highest amount of drip was observed in pre-rigor samples injected with sodium lactate.

Key words: injection, marination, pre-rigor, post-rigor, storage, meat quality

I. INTRODUCTION

Meat tenderness is one of the most important factors affecting palatability. Several factors influence meat tenderness such as ultimate pH, chilling temperature of carcasses, connective tissue content and enzymatic proteolysis [1]. Marination, a traditional technique, is used to improve tenderness, flavor and juiciness of meat to satisfy consumer demand [2]. Currently, marination is widely used by consumers to improve meat tenderness and flavour [3]. Marination is based on processing of meat with acidic or alkaline solutions and modification of physical and chemical properties of meat by altering the meat pH from isoelectric point. Critical point in marination procedure is the uniform dispersion of marinade ingredients into muscle.

Today in meat industry, various marination techniques are applied with different processing methods to improve the increase of tenderness, water holding capacity and flavor of the meat. In marination of beef, poultry, fish and other seafood, lemon juice, vinegar, wine, yogurt, and milk are used as a marination component as well as additives such as fat, sugar, spices, salt and phosphates [4, 5]. Marination time changes usually between 1 to 24 hours.

Therefore, the objective of this study was to verify the pre and post-rigor injection of various marinade solutions on some quality parameters of *Longissims dorsi* muscles.

II. MATERIALS AND METHODS

Five Holstein breed (17-18 months of age, 950-1000 kg body weight) were used as meat source. *Longissimus dorsi* muscles were removed form carcasses after 1 and 24 hour of slaughter. All muscles were trimmed of visible fat and connective tissues. Left sides were stored at +4°C for 24 hour for 24 h injection treatment. Right sides were used for pre-rigor injection. Three different marinade solutions were prepared (2% NaCl, 2% NaCl+0.5 M Lactic acid and 2% NaCL+0.5 M Sodium lactate) by using distilled water at 20°C. Marinade injection (11% v/W) was performed by using multi needle injector (Fomaco-Danimark). Muscles were stored at +4°C for 6 days and on 0., 3., 6. days of storage, pH [6], marinade uptake [7], free water, cooking loss [8] and drip loss [9].

III. RESULTS AND DISCUSSION

Marinade uptake levels were changed between 4.6 to 9.7 % (Table 1). The highest marinade uptake was obtained in samples pre-rigor injection of lactic acid marinade. Increasing lactic acid concentration from 1% to 2% resulted significant increment in marinade uptake [10]. Carcass part and meat type should have significant effect on marinade uptake of the meat samples [5]. Meat pH is an important factor affecting meat tenderness and the effect is greatly associated with water holding capacity. The effects of various marinade treatments on pH of samples are shown in Table 2. pH values of marinated meat were affected by marinade formulation, injection time (pre-rigor or post-

rigor) had no effect on pH. Lactic acid marinade has a low pH resulted a decrement in meat pH from 7.4 to 4.7. Previous studies have reported that the use of organic acids, including citric and lactic acids, within marinades leads to a decrease in the pH value of marinated meat [11, 5, 12]. Changes in free water content of samples are seen in Figure 1. Interaction between marinade treatment, and injection time made different effect on free water content at each evaluation period. At day 0, the highest free water (lowest WHC) was obtained in post-rigor samples injected with sodium lactate, on other storage days no differences were obtained in free water content of samples. Cooking losses changed between 37.8-34.4 on the first day of storage (Figure 2). Marinade treatment and storage period had significant effect on cooking loss of samples. The lowest cooking loss was obtained in pre-rigor samples injected with lactic acid. Similar to our results Omojola [13] presented that marinade injection time after slaughter has effect on cooking losses. Changes in drip loss of samples are seen in Figure 3. Drip loss changed between 1.6 to 7.9 %. It was observed that drip loss in all samples increased during the storage. On the 3. day of storage, highest amount of drip was observed in pre-rigor samples injected with sodium lactate. Lawrence et al., [14] investigated the effect of calcium chloride, calcium lactate in Longissimus muscle of cattle and they found that the amount of drip loss in samples marinated with calcium chloride and calcium lactate was higher than the control samples during 5 days of storage.

Table 1 Marinade uptake of muscles marinated after 1 and 24 hour postmortem time

Sample	Marinade Absorption Values (%)
T1	$6.0^{b} \pm 0.88$
TL1	$9.7^{c} \pm 0.30$
TSL1	$9,2^{c} \pm 0.26$
T24	$5.5^{ab} \pm 0.33$
TL24	$4.6^{a} \pm 0.07$
TSL24	$5.3^{ab} \pm 0.21$

a–c: With different letters in columns are significantly different ($P < 0.01$).

Table 2 pH values of marinade solutions and muscles before and after marination.

Sample	Marinade pH	pH-Before Marination	pH-After Marination
T1	$7.4^{c} \pm 0.04$	$6.7^{a} \pm 0.10$	$5.6^{b} \pm 0.02$
TL1	$2.0^{a} \pm 0.15$	$6.7^{a} \pm 0.08$	$4.7^{a} \pm 0.30$
TSL1	$6.9^{b} \pm 0.00$	$6.6^{a} \pm 0.07$	$5.4^{b} \pm 0.06$
T24	$7.3^{c} \pm 0.16$	$5.5^{b} \pm 0.03$	$5.4^{b} \pm 0.33$
TL24	$2.1^{a} \pm 0.14$	$5.3^{b} \pm 0.10$	$4.7^{a} \pm 0.35$
TSL24	$7.0^{b} \pm 0.42$	$5.5^{b} \pm 0.11$	$5.4^{b} \pm 0.16$

a–c: With different letters in columns are significantly different ($P < 0.01$).

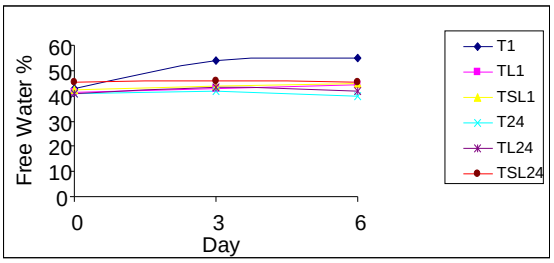

Figure 1. Free water changes during storage of marinated samples

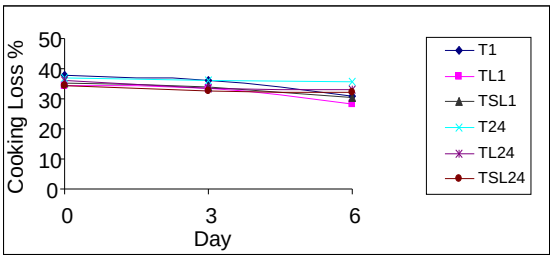

Figure 2. Cooking loss of marinated samples during storage

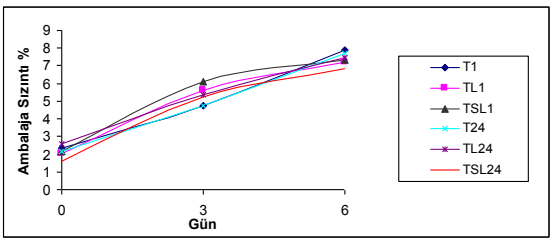

Figure 3. Drip loss of marinated samples during storage

IV. CONCLUSION

Pre-rigor marinade injection resulted higher marinade absorption and lower cooking losses and higher water holding capacity. Marination

with 11% injected sodium lactate or lactic acid solution can be used successfully to enhance water holding capacity of LD muscles.

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