Microbial decontamination by dipping lactic acid solution of pork stored at room temperature

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Introduction

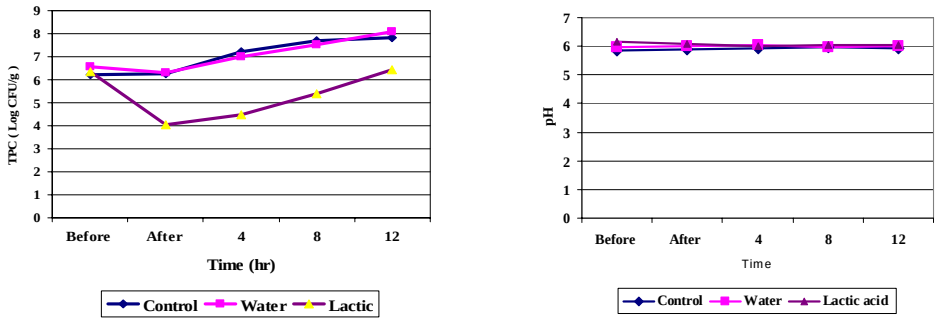
In the past decade, there has been demonstrated a growing concern over the safety and quality of red meat products (Eisel *et al*., 1997). In Thailand, animals are slaughtered at night during 11 pm-3 am. After that meat is transported to market and sold from early morning until afternoon. Meat is sold at open-air markets. All shops displayed meat both on the counters and some were hung. Therefore, meat is exposed to the environment, including ambient temperature (30-38 ^{o}C). This condition encourages microbial contamination leading to health problem (Ockerman *et al*., 2001; Pilasombut *et al*., 2007). Concern about contamination of meat, there have been investigated in treatments for reduction the number of bacteria on meat. Lactic acid is often used for surface decontamination (Pipek *et al*., 2004; Podolak *et al*., 1996). Concentration of acid in the range of 1-2% is generally accepted (Pipek *et al*., 2004). Therefore, the objective of this study was reduction of microbial population by dipping lactic acid solution onto the surface of pork during storage at room temperature.

Materials and Methods

Fresh pork shoulders (1.5 kg) were randomly taken from open-air market in early morning. Twelve pieces of pork were assigned according to 3 x 5 factorial arrangements in CRD. The treatments were 2 factors, factor A was 3 types of solution as control (no dipping), lactic acid and sterile distilled water whereas factor B was sampling time as before dipping and after dipping at 15 min, 4, 8 and 12 hr. Piece of meat was dipped in solution for 2 min before stored at room temperature (30-38 ^{o}C). For microbiological analysis, total plate count (TPC) was determined according to AOAC (2000) and expressed as log $_{10}$ colony forming unit (cfu). For meat quality studies, pH, and meat color were performed. Color was determined by Minolta chromameter (CR-300, Japan). Values of pH were measured by pH meter (WTW, D812 Weilheim; Electrode-WTW pH-Sentix^{sp}). The 2 % lactic acid was prepared by diluted L(+) Lactic acid (PURAC 80, 80% , PURAC biochem, Gorinchem Netherlands) with distilled water. All data was analyzed by using GLM procedure in SAS program.

Results and Discussion

The results of experiments showed that application of lactic acid on pork had affected on microbial reduction. Total bacterial count of pork stored at room temperature was significantly decreased ($p<0.05$) after dipped in lactic acid 15 min, 4 , 8 and 12 hr compared to control and distilled water groups as shown in Figure 1 (a). It has been reported that lactic acid reduced the initial bacterial count and causes a delay of the start of logarithmic phase of their growth (Pipek *et al*., 2004; Podolak *et al*., 1996). In addition, it was found that after 4 hr of storage, total bacterial count of control and dipping in water increased more than 7 log cfu/g which García-López *et al.* (1998) reported when numbers of microorganisms exceed 7 log cfu, the first spoilage sign was detected as off odour . However, total bacterial count of lactic acid group was lowerd than 7 log cfu/g after storage at room temperature for 12 hr.



(a) (b)

Figure 1 Effect of decontamination using lactic acid dip on total bacterial counts (a) and pH (b) on pork

For meat quality studies, the results found that there was not significantly different in pH value (Figure 1b). Lactic acid group had L* value higher but a* value lower than control and distilled water groups (Table 1 and 2). Therefore, lactic acid caused pale of pork surface. These results were similar to Pipek *et al.* (2004) that meat color changed to lighter or brownish after treated with lactic acid.

Table 1 Meat color L* value (lightness) of pork treated with water and lactic acid solution

Sampling time	Meat color (L*)			
	Control	Water	Lactic acid	Average
Before dipping	40.25 ^{cd}	38.23 ^{abcd}	39.87 ^{bcd}	39.45^{fg}
After dipping 15 min	38.36^{abcd}	39.39 ^{abcd}	46.43 ^{e}	41.39 ^{f}
After dipping 4 hr	36.92 ^{abc}	38.16 ^{abcd}	46.62 ^{e}	40.57 ^{fg}
After dipping 8 hr	34.42 ^{a}	34.97 ^{ab}	42.96 ^{de}	37.45 ^{gh}
After dipping 12 hr	35.19 ^{abc}	34.69 ^{a}	40.34 ^{abcd}	36.74 ^{h}
Average	37.03 ^{I}	37.09 ^{I}	43.25 ^{k}	

a,b,c,d means with different superscripts are significant difference ($p<0.05$)
f,g means with different superscripts are significant difference ($p<0.05$)
I,k means with different superscripts are significant difference ($p<0.05$)

Table 2 Meat color a* value (redness) of pork treated with water and lactic acid solution

Sampling time	Meat color (a*)			
	Control	Water	Lactic acid	Average
Before dipping	14.85 ^{a}	13.96 ^{a}	14.45 ^{a}	14.42
After dipping 15 min	15.89 ^{a}	12.59 ^{a}	13.05 ^{a}	13.84
After dipping 4 hr	15.10 ^{a}	12.86 ^{a}	9.47 ^{b}	12.47
After dipping 8 hr	14.80 ^{a}	13.60 ^{a}	10.19 ^{a}	12.86
After dipping 12 hr	13.15 ^{a}	13.85 ^{a}	10.33 ^{a}	12.44
Average	14.76^{c}	13.37^{cd}	11.50^{d}	

a,b means with different superscripts are significant difference ($p<0.05$)
c,d means with different superscripts are significant difference ($p<0.05$)

Conclusions

Lactic acid solution (2% v/v) can be used for decontamination of fresh pork resulted in prolonging shelf-life of pork up to 12 hr stored at room temperature. However, color of pork surface was lighter and less red after treated by lactic acid solution.

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