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Evaluation of ultrasonic cleaner and water resonance system apparatus for decontamination of *Campylobacter* and *Salmonella* on broiler carcasses in Thailand

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INTRODUCTION

Campylobacter and *Salmonella* are the leading causes of foodborne bacterial gastroenteritis in humans. Most diarrhea cases in Europe are caused by *Campylobacter* followed by *Salmonella* (1). Likewise, the majority of gastroenteritis cases in Japan are caused by *Campylobacter* (2). Since chicken meat consumption has been found to be associated with *Campylobacter* and/or *Salmonella* infection in humans, it is important to decontaminate these bacteria from chicken carcasses. Ultrasonic cleaner and water resonance system apparatus was developed to reduce *Campylobacter* and *Salmonella* residing in feather follicles of chicken carcass by using shock wave to remove microorganisms from follicles. It has been shown in Japan that this apparatus could be useful for decontamination of *Campylobacter* from chicken skin when it was used with chemical substances, such as sodium hypochlorite, cetylpi-ridinium chloride, etc. (3). However, it is unclear whether or not this apparatus can effectively reduce *Campylobacter* and *Salmonella* on chicken carcasses when it is used with potable water and/or other substances, such as organic acid. Therefore, the objective of this study is to evaluate the ability of ultrasonic cleaner and water resonance system apparatus in decontamination of *Campylobacter* and *Salmonella* on broiler chicken carcasses in Thailand.

MATERIALS AND METHODS

Thailand is one of the countries that export a lot of chicken meat and meat products to the European Union (EU). According to the EU regulation, chemical treatment of chicken carcasses is prohibited in processing plants. However, organic acid may be used for carcass washing in meat slaughtering process. Thus, this study focuses on the reduction of *Campylobacter* and *Salmonella* by using the ultrasonic cleaner and water resonance system apparatus with potable water and organic acid.

Study design: Our study comprises 2 experiments. In the first experiment, chicken carcasses were dipped into potable water and treated in the ultrasonic cleaner and water resonance system apparatus for 15, 30 and 45 minutes. During the treatment, each carcass was rotated at 30-40 rpm. In addition, chilled water (5-10°C) was tested using the same conditions as those of potable water. (The results of this experiment are shown in the abstract.) Regarding the second experiment, chicken carcasses will be dipped into various organic acids including acetic acid, lactic acid and propionic acid, and treated in the ultrasonic cleaner and water resonance system apparatus under different conditions. (The results of both experiments will be presented at the meeting.

Sample preparation: To enumerate *Campylobacter* and *Salmonella* on broiler carcasses, skin of each carcass was divided into breast and back parts. Skin sample from each part was further divided into six sections. Three sections of breast and back skin samples were separately enumerated for *Campylobacter* and *Salmonella* before and after carcass was treated in the ultrasonic cleaner and water resonance system apparatus.

Bacterial enumeration: Three-tube MPN method was used for *Campylobacter* and *Salmonella* enumeration. For *Campylobacter*, each broiler skin sample was enriched in 3 consecutive dilutions of Preston selective enrichment broth. Samples were incubated under microaerobic condition at 42°C for 24 hours. After the enrichment step, samples in Preston broth were subcultured onto mCCDA and incubated under microaerobic condition at 42°C for 48 hours. For *Salmonella*, each chicken skin sample was put in 3 consecutive dilutions of BPW and incubated at 37°C for 16-20 hours. After incubation, 100 µl of BPW were transferred to 10 ml of RVS broth and then incubated at 42°C for 24 hours. After that, samples in RVS broth were sub- cultured onto XLD agar and incubated at 37°C for 24 hours. Bacterial count before and after carcass was treated in the ultrasonic cleaner and water resonance system apparatus were compared using Pair t-test ($p<0.05$).

RESULTS AND DISCUSSION

Our preliminary results showed that *Campylo-bacter* (Table 1) and *Salmonella* (Table 2) count on chicken carcass skin before and after treatment with the ultrasonic cleaner and water resonance system apparatus were not statistically different *(p>0.05)*. Either a decrease or increase in *Campylo-bacter* and *Salmonella* load was found after the treatment. In addition, no effect of treatment time (15, 30 and 45 minutes) and water type (potable and chilled water) was observed. An average number of *Campylobacter* and *Salmonella* on broiler carcasses in the present study was 0.71 and 1.35 log MPN/gram, respectively. Although the ultrasonic cleaner and water resonance system apparatus might remove *Campylobacter* and *Salmonella* from the feather follicles, the microorganisms may still circulate in the water and re-contaminate chicken carcasses. This may be an explanation why an increase in *Campylo-bacter* and *Salmonella* load was observed after the treatment. It will be interesting to see whether *Campylobacter* and *Salmonella* will decrease after organic acid instead of water is used with the ultrasonic cleaner and water resonance system apparatus or not.

Table 1 *Campylobacter* count before and after treatment with the ultrasonic cleaner and water resonance system apparatus (log MPN/gram)

Treatment time	Skin part	Potable water		Chilled water	
		Before	After	Before	After
15 min	Breast	0.4±0.1	0.3±0	1.0±0.5	0.3±0
	Back	0.3±0	0.4±0.1	1.0±0.3	0.6±0.3
30 min	Breast	1.4±0.1	1.8±0.3	0.3±0	0.2±0.2
	Back	2.1±0.1	1.9±0.5	0.9±0.5	1.0±0.5
45 min	Breast	0.9±0	0.9±0.3	0.4±0.3	0.5±0.3
	Back	1.0±0.5	1.6±0.3	0.9±0.6	1.0±0.5

Note: Statistical difference was compared between before and after treatment.
All experiments were not statistically significant difference (*p>0.05*).

Table 2 *Salmonella* count before and after treatment with the ultrasonic cleaner and water resonance system apparatus (log MPN/gram)

Treatment time	Skin part	Potable water		Chilled water	
		Before	After	Before	After
15 min	Breast	0.9±0.4	1.1±0.2	2.1±0.3	2.1±0.4
	Back	0.8±1.0	0.9±0.8	1.4±0.1	2.2±0.1
30 min	Breast	0.7±1.3	0.8±1.2	2.2±0.1	2.3±0
	Back	1.6±0.8	0.9±0.9	2.3±0	2.2±0.1
45 min	Breast	0.2±0.2	0±0	2.2±0.1	1.8±0.5
	Back	0±0*	0±0	1.8±0.5	1.8±0.5

Note: Statistical difference was compared between before and after treatment.
All experiments were not statistically significant difference (p>0.05).
* means < 0.3 MPN/g

CONCLUSION

The results of the first experiment indicated that the ultrasonic cleaner and water resonance system apparatus had limited effect on *Campylobacter* and *Salmonella* decontamination from broiler carcasses when it was used with potable water or chilled water. With regard to the second experiment, organic acids (e.g. acetic acid, lactic acid and propionic acid) instead of water will be tested under various conditions. The results of the second experiment will be reported at the meeting.

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REFERENCES

[1] European Food Safety Authority. EFSA Journal 2017; 15(12):5077.

[2] Hatanaka et al., 2017. Jpn J Infect Dis. 70(4):455-457.

[3] Vetchapitak et al., 2017. Proceeding of The 1st JSPS Core-to-Core Program Joint Seminar and The 7th CADIC International Symposium. p. 24.