EFFICACY OF WATER AND LACTIC ACID AS WASH SOLUTION IN PREVENTING RECONTAMINATION IN REFRIGERATED CHICKEN CARCASS

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ABSTRACT
This experiment was conducted to study the efficacy of distilled water and lactic acid as wash solutions in preventing recontamination of some specific microbes on refrigerated chicken carcass. Chicken wings were purchased from an open market in Kuto, Abeokuta, Ogun State which were flayed (removing of the skin from the lean meat). The flayed skin (50 g) was initially observed for microbial load and was then agitated in the two wash solutions in a stomacher blender for 10 seconds, and then refrigerated for 9 days. Microbial load counts and identification were done at days 0, 3, 6 and 9 days of refrigeration. All measured parameters were significantly ($P<0.05$) different. Microbes such as *Salmonella and Shigella, Escherichia coli, Staphylococcus aureus* were observed on meat samples. Both treatments 1 and 2 showed the same trend of microbial load, in which all the bacteria were reduced as refrigeration days increased. The bacteria population of chicken wings washed in distilled water was not as effective as those washed in 0.4% lactic acid. There was total removal of *Staphylococcus aureus* from 190 log_{10} cfu/ml to 0 log_{10} cfu/ml after washing in 0.4% lactic acid solution.

INTRODUCTION
Food-borne diseases which are caused mostly by pathogenic bacteria such as *Salmonella spp, Shigella spp, Escherichia coli and Staphylococcus auerus* have a major health implication in industrialized countries (Bryne, 1980). In Nigeria, the incessant power supply has been a source of concern to the meat industrybecause it decreased the quality of frozen poultry meat.. In Nigeria, the poor unhygienic ways with which meat is being handled and the incessant power supply have been of serious concern. Research has shown that frozen poultry meats bought from a major market in Abeokuta. Ogun State have some levels of bacterial load, which could be detrimental to health (Sanwo *et al.*, 2009). To counter this threat the focus is currently on preventive system in accordance with the Hazard Analysis and Critical Control Point (HACCP) principles (Ropkins and Beek, 2009). Different methods have been studied in controlling contamination and decontamination using several chemicals such as organic acids like citric, acetic, lactic and benzoic acid as well their salts (Bolton *et al.*, 2001; Boston *et al.*, 2001; Jensen *et al.*, 2003, Jmenez-Villarreal *et al.*, 2003, Signorim *et al.*, 2006, Sanwo *et al.*, 2010). Ozone (Sheldon and Brown, 1986), and other compounds (Jimenez Villarreal *et al.*, 2003) have all been applied by dipping, spraying and washing. Hence, this study was aimed at evaluating the effect of distilled water and 0.4% lactic acid on preventing recontamination of a washed refrigerated chicken carcass.

MATERIALS AND METHODS

Experiment Procedures First phase, frozen chicken wings were purchased from an open commercial market in Kuto, Abeokuta, Ogun State, and prepared by removing the skin from the lean meat. Wash solutions which were distilled water (treatment 1) and 0.4% lactic acid (treatment II) were prepared by diluting the present solution in 100 ml distilled water. Each skin sample was repeated thrice, weighed and washed by agitation in a stomacher laboratory blender for 10 seconds, each using the prepared solutions. This was then sieved and the filtrate were put inside sample bottles and labeled for analysis at the microbiology laboratory of the University. Procedure was repeated on the 3rd, 6th and 9th day of refrigeration and replicated thrice for each treatment.

The Serial-dilution process: The plating of samples was done by using the 'pour plate' technique. the diluents (1 ml)from the test tubes was poured onto the diluents in the Petri dishes, and it was allowed to wet set before the plating was incubated. The media used Mannitol salt Agar (MSA), MacConkey Agar (MA), and Plate Count Agar (PCA), Deoxycholate citrate Agar (DCA), Potato Dextrose Agar (PDA), were poured into the Petri dishes in order to identify *Staphylococcus aureus, Escherichia coli, Salmonella Shigella spp,* and fungi such as *Aspergillus flavus, Candida spp, Rhodotorula spp*The PDA media wereused for the fungi and PCA were used for total plate count.

Total Bacteria count

The total bacteria count was determined with the pour plate technique using the PCA. The plates were incubated between 24 hours at 37 ^{0}C. All colonies appearing at the end of the incubation period were counted and the counts were expressed in colony forming unit per gram (cfu/g) of the sample. Colonies of bacteria developing on the plates were observed, isolated and re-isolated on a fresh media until pure culture was obtained. The bacteria isolated were then identified using both morphology culture characteristics, i.e. colour, consistency, shape, size, elevation, edge, opacity and biochemical test (such as oxidase, citrase, catalase). The specific microbes that were identified included: *Salmonella spp, Shigella spp. Staphypococcus aureus, Escherichia coli,* and total plate count was done.

Statistical Analysis: Data collected were subjected to two way analysis of variance (ANOVA) in a randomized complete block design (2 by 4 factorial arrangement) using SAS (1999).

RESULTS AND DISCUSSION

Tables 1 and 2 show the main and interactive effects of treatment on refrigeration days of chicken carcass. Significance differences ($P<0.05$) were observed in all parameters measured. In Table 2, there was good reduction of microbes as refrigeration days increased from day 0 (before refrigeration) to day 6 (of refrigeration). Salmonella and Shigella reduced from 267.5 $\log_{10}$ cfu/ml to 105 $\log_{10}$ cfu/ml, *E. coli* from 267.3 $\log_{10}$ cfu/ml to 258 $\log_{10}$ cfu/ml, *Staphylococcus aureus* from 190 $\log_{10}$ cfu/ml to 119 $\log_{10}$ cfu/ml and TPC from 292 $\log_{10}$ cfu/ml to 280 $\log_{10}$ cfu/ml, when washed in distilled water. However, chicken wings washed in 0.4% lactic acid solution gave a better result of *Salmonella amd Shigella*, reduced from 267.5 $\log_{10}$ cfu/ml to 48 $\log_{10}$ cfu/ml, *E. coli* from 256 $\log_{10}$ cfu/ml to 62.5 $\log_{10}$ cfu/ml, *Staphylococcus aureus* and TPC were totally eradicated. This result agrees with the report of Sanwo *et al.* (2009), who observed better microbial reduction when 0.4% lactic acid at first washing of chicken wings for 10 seconds was used; to a minimal reduction of chicken wings at 5th frequency of wash, when washed in distlled water. Marcel *et al.* (1988), Mossel and Drake, (1990) also reported that undissociated lactic acids inhibit the growth of microorganisms. Also, lactic acid is a natural constituent of meat and generally recognized as safe substances (Anderson and Marshall, 1990).

However, at day 9 of refrigeration in both solutions, microbial load was observed to increase which was more in chicken wings washed in distilled water. This could be attributed to the power outage for about five hours, which occurred between the 8th and 9th day of refrigeration.

In conclusion, 0.4% lactic acid is a better wash solution than distilled water.

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Table 1: Showing Main Effect of wash solutions and days of refrigeration.

Microbes	Wash solutions (log_{10}cfu/ml)		Refrigeration days			
	Distilledwater	Lacticacid	0	3	6	9
Salmonella and Shigella	194.29±82.35^{a}	170.89±107.43^{a}	267.50±5.69^{a}	114.75±50.42^{b}	76.75±33.02^{c}	65.5±39.91^{c}
Escherichia coli	248.57±115.85^{a}	137.89±119.16^{b}	146.25±140.11^{b}	138.75±159.71^{b}	165.25±118.75	95±6.63^{c}
Staphylococcus aureus	180.43±56.83^{a}	30.89±9.17^{d}	96±108.55^{c}	89.25±103.12^{c}	59.5±68.75^{d}	140.5±6.35^{b}
Aspergillus flavus	9.28±10.42^{a}	2.44±2.69^{b}	5±1.63^{ab}	0.00	13.25±12.39^{a}	3.5±2.65^{b}
Total plate count	206.43±141.23^{a}	204.11±100.86^{a}	183.75±125.60^{ab}	69.25±80.51^{b}	278.75±18.71^{a}	300±0.00^{a}

^{a,b,c,} Means along the same row with different superscripts are significant (P<0.05)

Table 2: Showing Interactive effect of wash solutions and refrigeration days.

		Microbes				
		Salmonella and Shigella	*E. coli*	*Staphylococcus aureus*	*Aspergillus flavus*	*Total plate count*
Distilled water (log_{10}cfu/ml)						
	0	267.5±9.19^{a}	267.3±.19^{ab}	190±2.85^{b}	6.00±14.14^{b}	292.5±2.12^{a}
	6	157.5±6.36^{c}	184.5±60.92^{b}	178.5±6.36^{c}	0	288±4.43^{a}
	3	105±4.24^{d}	168±5.66^{b}	119±4.24^{d}	23.5±6.36^{a}	280±5.66^{a}
	9	300±0.00^{a}	300±0.00^{a}	281±9.89^{a}	5.5±0.71b	300±0.00^{a}
Lactic acid (log_{10} cfu/ml)						
	0	267.5±3.54^{a}	256±1.41^{ab}	0	5.5±0.71^{b}	75±4.24^{c}
	6	72±12.73^{c}	93±8.49^{c}	0	4.00±1.41^{b}	138.5±6.26^{b}
	3	48.5±7.78^{c}	62.5±6.36^{c}	0	0	0
	9	231±4.24^{b}	290±5.65^{a}	0	3.00^{c}±0.00	277.5±1.82^{a}

^{a,b,c,} Means along the same column with different