Effect of some microbial decontaminators on chicken carcass

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A B S T R A C T

This current study was carried out to evaluate the effect of trisodium phosphate 5%, 8% and 10%, chlorine 20 ppm,50ppm and 60ppm and hydrogen peroxide 1%, 2% and 3%, on total aerobic plate count, *Enterobactereacea* count, staphylococcus count and isolation percentages of *Salmonella spp*, *Staphylococcus aureus* and *L. monocytogens* of fresh slaughtered chicken. The results of count of control sample were 8.2±7.99, 4.41±3.89 and 4.30±3.76 log10cfu/g and the percentages of isolation were 60, 90 and 10%, respectively. While after dipping in trisodium phosphate 5%, 8% and 10%, the reduction percentage of aerobic plate count, *Enterobactereacea* count and *staphylococcus* count were 6.2%, 23%, 30.6%, 11.1%, 44%, 100% , 17.2%, 32.3% and 52%, after dipping in chlorine 20ppm, 50ppm and 60ppm,were 4%, 5%, 35.3%, 9.3%, 22.6%, 27.2%, 8.1%, 30.2% and 32.6%, after dipping in hydrogen peroxide 1%, 2% and 3%, were80.8%, 82.3% , 87.8%, 82.7%, 86.8%, 100%, 82.5%, 100% and 100%, respectively. Moreover, the reduction percentages of *Salmonella spp.*, *Staphylococcus aureus*, were 50%, 66.7%, 83.3%, 22.2%, 66.6% and 100%, after dipping in trisodium phosphate 5%, 8% and 10%. While after dipping in chlorine 20ppm,50ppm and 60ppm, were16.7%, 33.3%, 50%, 11.1%, 22.2% and 33.3% and after dipping in hydrogen peroxide 1%, 2% and 3%, were50%, 66.6%, 83.3%, 55.5%, 100% and 100%. *L. monocytogenes* failed to be detected (100% decontamination).

Key words: TSP, chlorine, hydrogen peroxide, chicken carcasses, decontamination.

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1. INTRODUCTION

Chicken meat is one of the most popular foods among developed and developing countries. It contains all essential amino acids, a lot of minerals as sodium, potassium, calcium, iron, phosphorous besides traces of vitamins such as vitamin B12 and niacin required for maintaining life and promoting growth (Food and Agriculture Oraganization (FAO), 2014). Chicken and other types of poultry, however, have higher pathogenic and spoilage bacterial counts than most other foods as *Salmonella*, *Staphylococcus aureus* and *Listeria monocytogenes. Salmonella* is an enteric microorganism associated with the intestinal tract of many animals and, thus, is potentially present in most raw meats; Illness is usually caused by the ingestion of a sufficient number of microorganisms which survive and reproduce in the human intestinal tract. *Staphylococcal* food poisoning is one of the most common types of food borne disease results from the ingestion of food containing toxin produced by *staph. aureus. Listeria monocytogenes* is a human pathogen that causes listeriosis, it is found in the environment and can be carried by humans and animals. It has been isolated at every level of the meat processing chain in slaughter and processing plant. Poultry meat and their products often get contamination from different sources starting from de-feathering, evisceration and subsequent handling during processing in plant. Numerous attempts have been made to find an appropriate means of eliminating or at least reducing such contamination by the use of an end-product treatment by some microbial decontaminators as tirsodium phosphate, chlorine (sodium hypochlorite) and hydrogen peroxide. Trisodium phosphate (TSP) has been used to treat raw poultry to reduce the numbers of pathogenic bacteria, thus extending shelf-life. TSP is generally recognized as safe by the US Food and Drug Administration and has been approved by the US Department of Agriculture-Food Safety and Inspection Service (USDA-FSIS) as an antimicrobial agent on raw chilled poultry carcasses (Federal Register, 1994). Chlorine (sodium hypochlorite) is the most common sanitizing agent because of its low cost and high efficiency (Seiberling, 1997). It has a wide range of antimicrobial action against gram positive and gram negative bacteria, bacterial spores and virus (Stanfield, 2003). Hydrogen peroxide used for chilling of chicken carcasses prior to its packaging as a powerful sanitizer to enhance its meat quality

and greatly reduce its bacterial load**.** H_2O_2 is highly unstable and breakdown into water and single oxygen molecule, oxygen is stable only when the molecules are pairs (O_2). A single oxygen molecule is a strong oxidizing and disinfecting agent (Black et al., 2008).

So, the goal of this study is to evaluate the effect of some microbial decontaminators on chicken carcass.

2. MATERIALS AND METHODS

2.1. Collection of samples

Total number of ten random broiler chicken carcasses from an automatic poultry slaughtering plant in Ismailia city, Egypt were collected after complete preparation (slaughtering, scalding, de-feathering and evisceration), just after washing in the chiller. The collected samples were kept in separate plastic bags, transferred directly to the laboratory in an insulated ice box under complete aseptic conditions without any delay and subjected to the following examinations.

2.2. preparation of decontaminators:

2.2.1. Trisodium phosphate (TSP):

Trisodium orthophosphate 98% (Alpha chemika) was used to prepare 5%, 8% and 10% by dissolving 5.1 ml, 8.16 ml and10.2 ml in 100ml sterile distilled water.

2.2.2. Chlorine:

Sodium hypochlorite 4% (oxford laboratory) was used to prepare 20 ppm, 50 ppm and 60 ppm by dissolving 0.5ml, 1.25ml and 1.5ml in100ml sterile distilled water.

2.2.3. Hydrogen peroxide (H2O2):

H_2O_2 50% (Algohary) was used to prepare 1%, 2% and 3% by dissolving 2 ml, 4 ml and 6ml in 100ml sterile distilled water.

2.3. Preparation of chicken carcasses samples

Ten chicken breast samples were taken from each carcass (totally 100 samples) in laboratory and they divided into four groups. The first group [control group] 10 chicken breast samples were dipped separately in sterile water for 15 minutes at room temperature (25˚C). The second group were divided into three subgroups (each one have 10 chicken breast samples) the first subgroup was dipped in 5% Tsp solution, the second one was dipped in 8%Tsp solution and the third one was dipped in 10%Tsp solution. All groups were dipped for 15 minutes at room temperature (25˚C). The third group were also divided into three subgroups (each one have 10 chicken breast samples) the first subgroup was dipped in 20ppm chlorine solution and the second one was dipped in 50ppm chlorine solution and the third one was dipped in 60 ppm chlorine, all group dipped for 15 minutes at room temperature (25˚C). The fourth group divided into three subgroups (each one have10 chicken breast samples), the first subgroup was dipped in 1% hydrogen peroxide solution and the second one was dipped in 2% hydrogen peroxide solution and the third one was dipped in 3% hydrogen peroxide solution, all groups were dipped for 15 minutes at room temperature (25˚C). The samples were prepared according to the technique recommended by (International Commission on Microbiological Specification for Foods ICMSF, 1978), as follows: Twenty-five grams of the examined samples were taken by sterile scissors and forceps after surface sterilization by hot spatula, transferred to sterile polyethylene bags, to which 225 ml of 0.1% of sterile buffered peptone water were aseptically added to the content of the bag. Each sample was then homogenized for 2 minutes at 2500 r.p.m. using a sterile homogenizer to provide a homogenate of 1/10 dilution. The mixture was allowed to stand for 15 minutes at room temperature then one ml from such dilution was transferred to another sterile tube containing 9 ml sterile buffered peptone water and mixed well to make a next dilution, from which further decimal serial dilution were prepared. The preparing dilutions of all groups were subjected to the following examinations.

2.4. Bacteriological examination:

2.4.1. Determination of aerobic plate count (USDA, 2011): using standard plate count agar media.

2.4.2. Determination of Enterobacteriaceae count (ISO 21528-3, 2001) using violet red bile glucose agar media (VRBG).

2.4.3. Determination of total Staphylococci count (USDA, 2011) using Baird Parker agar media

2.4.4. Isolation of Salmonella spp. (Food and Drug administration (FDA), 2011a using Rappaport Vassilidis broth and Xylose Lysine Desoxycholate (XLD) agar. *2.4.5. Isolation of Staphylococcus aureus (USDA, 2011)* using Baird Parker agar media.

*2.4.6. Isolation of Listeria monocytogenes (USDAFSIS (United State Department of Agriculture, 1989)***:** using buffered *Listeria* enrichment broth and Palcam agar plates.

2.5. Statistical Analysis.

The bacterial population (cfu/g) was obtained from ten replications performed on separated days and their means were converted to log10cfu/g. Differences between log10cfu/g of untreated chicken samples and log10 cfu/g of treated chicken samples were calculated as log reduction of treatments were compared by Analysis of variance (ANOVA) test using the general liner models of SPSS 12.0 for windows. *P* value 0.05 was considered as significant.

3. RESULTS

3.1. Reduction by Tri sodium phosphate

Results in table (1) reported that aerobic plate count (APC) were 8.2±7.99 log cfu/g (control) and reduced to 7.69±6.64, 6.32±5.20 and 5.69±4.53 log cfu/g, with reduction percentages of 6.2%, 23% and 30.6%, when dipped in trisodium phosphate 5%,8% and10%, respectively. Also, table (2) reported that *Enterobacteriaceae* count were 4.41±3.89 log cfu/g (control) and reduced to 3.92±3.46, 2.47±2 and 0 log cfu/g, with reduction percentages of 11.1%, 44% and 100%, when dipped in trisodium phosphate 5%,8% and10%, respectively. On the other hand, *staphylococci* count was recorded in table (3) as 4.30±3.76 log cfu/g (control) and reduced to 3.56±2.67**,** 3.32±2.62 and 2.07±1.66, with reduction percentages of 17.2%, 32.3% and52%, when dipped in trisodium phosphate 5%, 8% and 10%, respectively. Table (4) showed that *Staphylococcus aureus* was isolated from 90% of the examined fresh chicken samples (control) and the reduction percentages were 22.2%, 66.6% and 100%, when dipped in trisodium phosphate 5%, 8% and10%, respectively. *Salmonella spp.* was isolated from 60% of the examined fresh chicken samples (control) and the reduction percentages were 50%, 66.7% and 83.3%, when dipped in trisodium phosphate 5%, 8% and10%, respectively (table 4). *Listeria monocytogenes* was isolated from 10% of the examined fresh chicken samples (control) while failed to be detected in the de-contaminated samples (100% de-contamination) as recorded in (table 4). All results were reduced significantly ($P<0.05$) when compared with corresponding control.

3.2. Reduction by chlorine

Moreover, the results showed in table (1) reported that aerobic plate count (APC) were 8.2±7.99 log cfu/g (control) and reduced to7.90±6.82, 7.81±6.76 and 5.32±4.96, with reduction percentage of 4%, 5% and 35.3%, when treated by chlorine 20ppm, 50ppm and 60ppm. As showed in Table (2), *Enterobacteriaceae* count were 4.41±3.89 log cfu/g (control) and reduced to 4±3.69, 3.44±2.92 and 3.21±2.82 with reduction percentages of 9.3%, 22.6% and 27.2% after dipping in chlorine 20ppm, 50ppm and 60ppm. On the other hand, staphylococci count was 4.30±3.76 log cfu/g (control) and reduced to 3.95±3.46, 3.04 ±2.34 and 2.91 ± 2, with reduction percentages of 8.1%, 30.2% and 32.6% (table 3) after treatment by chlorine 20ppm, 50ppm and 60ppm. Results in table (4) reported that *Staphylococcus aureus* was isolated from 90% of the examined fresh chicken samples (control) and the reduction percentages were 11.1%, 22.2% and 33.3%,*Salmonella spp* was isolated from 60% of the examined fresh chicken samples (control) and the reduction percentages were 16.7%, 33.3% and 50%, *Listeria monocytogenes* was isolated from10% of the examined fresh chicken samples (control) while failed to be detected in the decontaminated samples (100% decontamination). All results were reduced significantly ($P<0.05$) when compared with corresponding control.

3.3. Reduction by Hydrogen peroxide

Results in table (1) reported that aerobic plate count (APC) were 8.2±7.99 log cfu/g (control) and reduced to 1.57±1.21, 1.45±2.27 and 1±.54 log cfu/g with reduction percentages of 80.8 %, 82.3% and 87.8 %, respectively after dipping in hydrogen peroxide 1%, 2% and 3%. On the other hand, Enterobacteriaceae count were 4.41±3.89 log cfu/g (control) and reduced to 0.76±0.65, 0.58 ±0.45 and 0, log cfu/g, with reduction percentages of 82.7%, 86.8 % and 100 %, respectively (table 2) after dipping in hydrogen peroxide 1%, 2% and 3%. Moreover, the results showed in table (3) reported that *staphylococci* count were 4.30±3.76 log cfu/g (control) and reduced to 1.05±0.95, 0 and 0 log cfu/g with reduction percentages of 82.5%, 100% and100%, respectively after treatment by hydrogen peroxide 1%, 2% and 3%. As showed in table (4), *Staphylococcus aureus* was isolated from 90% of the examined fresh chicken samples (control) and the reduction percentages were 55.5%, 100% and 100%**,** *Salmonella spp* was isolated from 60% of the examined fresh chicken samples (control) and the reduction percentages were 50%, 66.6% and 83.3%**,** *Listeria monocytogenes* was isolated from10% of the examined fresh chicken carcasses samples (control) while failed to be detected in the decontaminated samples (100% decontamination). All results were reduced significantly ($P<0.05$) when compared with corresponding control.

Table (1) Statistical analytical results of aerobic plate count (log cfu/g) of examined fresh chicken samples before and after dipping in different concentrations of (Tsp, chlorine, H_2O_2). (n=10)

Treatment.	Min.	Max.	Mean ±S.D.	Reduction %.
Control (D.W)	4.53	8.90	8.20±7.99	-
Tsp 5%	4.32	8.65	7.69±6.64	6.2
Tsp 8%	3.44	7.23	6.32±5.20	23
Tsp 10%	3.04	6.54	5.69±4.53	30.6
Chlorine 20ppm	4.49	8.83	7.90±6.82	4
Chlorine 50ppm	3.93	8.77	7.81±6.76	5
Chlorine 60ppm	2.04	5.85	5.32±4.96	35.3
H_2O_2 1%	1.25	2.22	1.57±1.21	80.8
H_2O_2 2%	1.15	2.05	1.45±2.27	82.3
H_2O_2 3%	0.84	1.75	1±0.54	87.8

The values represent mean ± SD of ten experiments.

Table (2): Statistical analytical results of *Enterobacteriaceae* count (log cfu/g) of examined fresh chicken samples before and after dipping in different concentrations of (Tsp, chlorine, H_2O_2). (n=10)

Treatment.	Min.	Max.	Mean ±S.D.	Reduction %.
Control (D.W)	2.32	4.79	4.41±3.89	-
Tsp 5%	1.75	4.41	3.92±3.46	11.1
Tsp 8%	1.30	3.04	2.47±2	44
Tsp 10%	NG	NG	NG	100
Chlorine 20ppm	2.30	4.70	4 ±3.69	9.3
Chlorine 50ppm	1.67	3.85	3.44±2.92	22.6
Chlorine 60ppm	2.32	3.70	3.21±2.82	27.2
H_2O_2 1%	0.53	1.1	0.76±0.65	82.7
H_2O_2 2%	0.32	0.94	0.58 ±0.45	86.8
H_2O_2 3%	NG	NG	NG	100

The values represent mean ± SD of ten experiments. NG=No Growth. Mean results of decontamination are significantly different (p<0.05).

Table (3): Statistical analytical results of *staphylococci* count (log cfu/g) of examined fresh chicken samples before and after dipping in different concentrations of (Tsp, chlorine, H_2O_2). (n=10)

Treatment.	Min.	Max.	Mean ±S.D.	Reduction%.
Control (D.W)	3.04	4.67	4.30±3.76	-
Tsp 5%	3.14	3.72	3.56±2.67	17.2
Tsp 8%	2.34	3.55	3.32±2.62	32.3
Tsp 10%	1.32	2.36	2.07±1.66	52
Chlorine 20ppm	2.66	4.38	3.95±3.46	8.1
Chlorine 50ppm	2.17	3.47	3.04 ±2.34	30.2
Chlorine 60ppm	2.74	3.17	2.91 ± 2	32.6
H_2O_2 1%	0.85	1.21	1.05±0.95	82.5
H_2O_2 2%	NG	NG	NG	100
H_2O_2 3%	NG	NG	NG	100

The values represent mean ± SD of ten experiments. NG=No Growth. Mean results of decontamination are significantly different (p<0.05).

Table (4): Incidence and reduction % of *Salmonella, Staphylococcus, Listeria monocytogenes* in examined sample before and after dipping in different concentrations of (Tsp, chlorine, H_2O_2)**.**

Treatment.	*Staphylococcus aureus.*		*Salmonella.*		*Listeria monocytogens.*	
Control (D.W)	9	90	6	60	1	10
Tsp 5%	7	22.2	3	50	0	100
Tsp 8%	3	66.6	2	66.7	0	100
Tsp 10%	0	100	1	83	0	100
Chlorine 20ppm	8	11.1	5	16.7	0	100
Chlorine 50ppm	7	22.2	4	33.3	0	100
Chlorine 60ppm	|6	33.3	3	50	0	100
H_2O_2 1%	4	55.5	3	50	0	100
H_2O_2 2%	0	100	2	66.7	0	100
H_2O_2 3%	0	100	1	83.3	0	100

N.B.: % was calculated according to the positive number of samples.

4. DISCUSSION

TSP at a high pH (pH 12) helps to remove fat films and exerts surfactant or detergent effect, loss of cell viability, membrane integrity and disruption of cytoplasmic and outer membranes of the microorganisms (Capita et al. (2002). Similar results of APC reduction were reported by Morshedy and sallam (2009) by dipping of chicken carcasses in TSP solution resulted in reduction of APC by 0.9 log cfu/g. On the other hand higher reduction of APC was obtained by Bautista et al. (1995) when used TSP caused reduction of APC by 4.4 log cfu/g. Comparatively lower reduction of APC was reported by Yang Z and Slavik (1998) who reported an initial decrease of 0.74 log10 cfu/chicken carcass when used TSP10%, (Sallam and Samejima, 2004) where dipping of chicken breasts in aqueous solution of 10% TSP for 10 min resulted in initial reduction of 0.48 and 0.91 log10 cfu/g in aerobic plate counts, (Okolocha and Ellerbroek, 2005) where dipping treatment using 10% TSP and the result revealed that TSP reduced APC by 0.3 log cfu/ml. Similar results of *Enterobacteriaceae* counts reduction were reported by Salvat et al. (1996) where *Enterobacteriaceae* counts reduced more than 2 logs when concentrations are between 10 and 12%, (Kanellos and Burriel, 2005) where treatment of poultry carcasses by dipping in 12% TSP causes reduction of *Enterobacteriaceae* by 3.43 log cycles. On the other hand lower reduction of *Enterobacteriaceae* reported by Whyte et al. (2001) where application of 10%TSP for 15 seconds reduce *Enterobacteriaceae* by 1.86 log10 cfu/g, (Sallam and Samejima, 2004) where dipping of chicken breasts in aqueous solution of 10% TSP for 10 min resulted in initial reduction of 0.91 log10 cfu/g in *Enterobacteriaceae* count respectively, (Okolocha and Ellerbroek, 2005) where dipping treatment using 10% TSP revealed that TSP reduced *Enterobacteriaceae* by1.6 log cfu/ml. Nearly similar results of *Staph* count reduction were reported by (Aksoy, 2003) where dipping of chicken carcass in 10%Tsp causes reduction in *staphylococci* count from 5.67 to 2.58 log cfu/g. The same results of *Staph aureus* reduction were reported by Rodriguez de ledesma et al. (1996) where dipping of chicken carcass in 10% trisodium phosphate for 10 seconds caused reductions of *Staph aureus* by 84 to 97%. Comparatively lower reduction of *Saph aureus* were reported by Saad et al. (2015) where the reduction percentages of *Staph aureus* was 8.11%, 10.58 % and 27.69%, when dipping of chicken carcass in trisodium phosphate 3%, 5% and 8%, respectively. Nearly similar results of *Salmonella spp* reduction were reported by Li et al. (1994) where used TSP (10%)that causes the reduction ranged from 34% to 76% of *Salmonella spp*, (Rodriguez de ledesma et al., 1996) where dipping chicken carcass in 10% trisodium phosphate for 10 seconds caused reductions of *Salmonella spp.* by 84.3%. Moreover, higher reduction of *Salmonella spp.* reported by Whyte et al. (2001) where dipping of chicken carcass in 10% trisodium phosphate cause complete decontamination of *salmonella* (100%) which failed to be detected. On contrary, lower reduction of *Salmonella spp.* reported by (Saad et al., 2015) where treatment of poultry carcasses by dipping in 3%,5% and 8% TSP solution causes reduction of *Salmonella spp* by 34.88%, 36.78% and 38.01%, respectively. Nearly similar results of *L. monocytogenes* reduction were reported by Rodriguez de ledesma et al. (1996) where the effect of dipping chicken carcass in 10% trisodium phosphate for 10 seconds caused reductions of 79% to 95% of *L. monocytogenes*.

Comparatively lower reduction of *Listeria monocytogenes* reported by Capita et al. (2001) where using 8%,10% and 12% TSP solution for treatment chicken carcasses samples which inoculated with *L. monocytogenes* and dipping for 15 min and the result revealed that the reduction percentage were 12%, 14% and 18%, respectively, Saad et al.(2015) where treatment of poultry carcasses by dipping in 3%,5% and 8% TSP solution causes reduction of *L. monocytogenes* by 21.74 %, 21.74 %, 25.14 %, respectively.

The active agent of chlorine (sodium hypochlorite) is hypochlorous acid, which forms upon the hydrolysis of the hypochlorite ion. Antimicrobial action of hypochlorous acid is the following: its molecules penetrate the bacterial cell wall and react with key enzymes to prevent normal respiration and carbohydrate metabolism (Chmielewski and Frank, 2003). Similar results of APC reduction were reported by Whyte et al. (2001) where dipping by 25 ppm chlorine solution reduce total viable count (TVCs) from 4.98±0.38 to 4.52±0.24 log10 cfu/g, reduced APC by 0.4 log cfu/g, (Gelis and Kabul, 2006) where chlorine reduced APC by 0.3 log cfu/g. Moreover, lower reduction of APC reported by EL dosoky and Sherins (2012) where treatment by 25ppm and 50ppm chlorine solution caused reduction by 0.02 and 0.11 log cfu/g, respectively, (Oh et al., 2014) where the APC were reduced by 0.03, 0.06, and 0.22 log cfu/g after treatments of 50 ppm, 100 ppm, and 200 ppm chlorine solution. Comparatively higher reduction of APC obtained by Bautista et al. (1995) when used 50ppm chlorine solution caused reduction of APC by 2.4 log cfu/g. Nearly similar results of *Enterobacterieacea* reduction were reported by Whyte et al. (2001) where dipping by 25 ppm chlorine solution reduced *Enterobacterieacea* count from 3.37±0.31 to 3.16±0.16 log10 cfu/g by 0.2 log10 cfu/g reduction. The results of *Staph* count reduction were similar to that reported by Aksoy (2003) where dipping of chicken carcass in 70 ppm chlorine solution causes reduction in *Staph*. count from 5.67±0.38 to 4.56±0.21 log cfu/g with reduction count 1.1 log cfu/g, Nearly similar results of *Staph. aureus* reduction was reported by Saad et al. (2015) where treatment by 25ppm,50ppm and 70 ppm chlorine solution caused reduction percentages of *Staph aureus* by14.29 %, 15.70 %, 19.58%, respectively. On the other hand, higher reduction of *Staph aureus* was reported, where dipping of chicken carcasses in 30ppm of chlorine solution for 7 min and the results revealed that 28.57% reduction of *Staph. aureus* on chicken carcasses. Moreover, lower reduction of *staph. aureus* reported by Gelis and Kabul (2006) where commercial chlorine chiller on poultry carcasses during processing reduce *Staph aureus* from and $1.4x10^4$ to $6x10^3$cfu/g with reduction percentage 9.7%, (EL dosoky and Sherins, 2012) where treatment by 25 ppm, 50 ppm chlorine solution caused reduction of *Staph. aureus* counts from 3.62±1.59 to 3.6±1.17 and 3.58 ±1.1 log 10 cfu/g, respectively with reduction count 0.02 log cfu/g and 0.04 log cfu/g and reduction percentage 0.5% and 1.1% log cfu/g. Similar results of *Salmonella* reduction were reported by Saad et al. (2015) where the efficacy of chlorine (30 ppm, 50ppm and 70ppm) reduced *Salmonella* by 26.02 %, 26.57 % and 29.16%, respectively. On contrary lower reduction of *salmonella spp.* reported by Nassar et al. (1997) where the carcasses subjected to chlorine 20 ppm and 50 ppm, there was no reduction in the number of carcasses which gave positive results for the presence of *Salmonella* but the carcasses subjected to 100 ppm chlorine gave 30% reduction of the number of carcasses which gave positive for *Salmonella* and 70% reduction of the number of carcasses which gave positive for *Salmonella* when subjected to 200 ppm chlorine. Similar results of *L. monocytogenes* reduction were reported by Russell and Axtell (2005) where using of 50 ppm of chlorine cause elimination of all *Listeria monocytogenes*. Moreover, lower reduction of *Listeria monocytogenes* reported by Tsai et al. (1992) where chlorinating chiller water at 40 mg/l of chlorine reduced *L. monocytogenes* in poultry by only 37–50% log cfu/g in3–5 min (Saad et al. (2015). Where treatment by 30 ppm, 50 ppm, and 70ppm chlorine solution caused reduction of the of *Listeria monocytogenes* by 16.64 %, 20.60% and 30.43% log cfu/g, respectively.

The bactericidal and inhibitory activity of hydrogen peroxide (H2O2) result from its properties as an oxidant and its ability to generate other cytotoxic oxidizing species such as hydroxyl radicals, hydroxyl radicals are a type of reactive oxygen species (ROS). ROS are physiological reactants some act as signaling molecules, but their overproduction can lead to biological damage. The results of APC reduction were similar to that reported by Mostafa (2010) where treatment of chicken carcasses by hydrogen peroxide 0.1% in chiller reduces APC by 97.3% log cfu/g. on the other hand lower reduction of APC reported by EL-Dosoky and sherin (2012) who shows that the mean log cfu value of APCs were 5.73±`3.23, 5.34±2, and 5.20±2.47 log10 cfu/g in control samples and after decontamination with hydrogen peroxide 1% and 2% , respectively with reduction count 0.39 log cfu/g and 0.53 log cfu/g and reduction percentage 6.8% and 9.2% log cfu/g

.Moreover, lower reduction of total *Enterobactericeae* count were reported by Mostafa (2010)who investigated the effect of hydrogen peroxide on reduction of the *Enterobactericeae* count and founded that *Enterobactericeae* count reduced by 1.61 log cfu/g. Nearly similar results of *Staphylococcus aureus* reduction were reported by Neighbor et al. (1994) where he investigated the effect of 5% H_2O_2 on *Staphylococcus aureus*, there was complete inactivation following exposure to H_2O_2, Mostafa (2010) where treatment of chicken carcasses by hydrogen peroxide 0.1% in chiller reduces *Staph. aureus* counts by 94.9% log cfu/g. On contrary lower reduction of *Staph aureus* reported by EL-Dosoky and sherin (2012) who shows that the mean log cfu value of the counts of *Staph aureus* were 3.62±1.59, 3.44±1 and 3.30±1.07 log10 cfu/g in control samples and after decontamination with hydrogen peroxide 1% and 2% , respectively ,the reduction count were 0.18 log cfu/g and 0.32 log cfu/g with reduction percentage of 5% and 8.83% log cfu/g. Similar results of *Salmonella* reduction were reported by Nassar et al. (1997) where he detected that at a concentration of 2% hydrogen peroxide compound gave 30% reduction for *Salmonella,* while 3% hydrogen peroxide gave 70% reduction for *Salmonella* .Similar results of *L. monocytogenes reduction* were reported by Robbins Justin et al. (2005) where he detected that 3% H_2O_2 solution reduced the initial concentration of *L. monocytogenes* by 6.0 log cfu/ml after 10 min of exposure at 20°C, and 3.5% H_2O_2 solution reduced the population by 5.4 and 8.7 log cfu/ml (complete elimination) after 5 and 10 min of exposure at 20°C, respectively.

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