ACETIC ACID AS AN INTERVENTION STRATEGY TO DECONTAMINATE BEEF CARCASSES IN EGYPTIAN SLAUGHTERHOUSES

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ABSTRACT

Beef can be contaminated during the slaughter process, thus other methods, besides the traditional water washing, must be adopted to preserve meat safety. The objective of this study was to evaluate the effect of three concentrations of acetic acid interventions (0.5%, 1 and 1.5%) on the reduction of indicator bacteria on beef carcasses at a commercial slaughterhouse in Egypt without removing of debris and organic matters. Reduction was measured by total Aerobic Count (TAC), anaerobic count, *Staphylococcus aureus* count, coliform count, (log CFU/ cm^2) as well as isolation of *Salmonella* and *E-coli O157:H7*. Among the different interventions tested, treatments using 1% acetic acid concentration following three processing steps cattle receiving, carcass washing and final wash had reduced numbers of bacteria on carcasses but higher concentrations of acids required for effectiveness. Acetic acid solution sprayed after carcass washing can be successfully used to control indicator bacteria on beef carcasses under commercial conditions.

INTRODUCTION

Beef may be the vehicle of foodborne diseases as a result of deficient sanitary conditions during animal slaughter (**Loretz *et al.*, 2011**). The possibilities of eliminating pathogenic microorganisms from meat have received considerable attention in the last decades (**Sofos *et al.*, 1999**). Intervention strategies and their effects on microorganism levels have had an impact on industry economics and also on public health matters (**Bolder, 1997**). Bovine carcasses can be contaminated during the slaughter process through the contact with the animal's skin and hair, limbs, blood, stomach, gut contents, bile and other excretions,

facilities, equipment, and hands and worker's clothes **(Sofos, 2008)**. Carcass washing, chilling, storage and processing **(Koohmaraie *et al.,* 2007)** can also contribute to the reduction of the final microbial load on beef. Only a small fraction of the microbial flora is eliminated by the carcass washing procedure commonly practiced at slaughterhouses **(Bolton *et al.,* 2001),** thus the preservation of meat must be guaranteed by other methods to maintain its intrinsic quality and safety. Many chemical compounds have been shown to reduce bacteria populations. **Ransom *et al.* (2003)** reported that, chemical compounds are able to reduce the incidence of pathogens and other bacterial counts upon beef carcasses or their cuts by 1 to 3 logs. Organic acids such as acetic, citric, and lactic acid are widely used for carcass decontamination and are included among the different strategies for carcass and meat decontamination under controlled conditions at the laboratory **(Loretz *et al.,* 2011)**. The decontamination of meat can help to reduce human foodborne infections. However, process hygiene to prevent contamination should never be neglected **Dinçer and Baysal (2004)**. The objectives is of this work were to assess and select the best cost-effective concentrations (0.5%, 1% and 1.5%) of three different acids of food grade type to be applied under the current weak sanitary conditions with a little caution by visual monitoring to prevent the cross-contamination between the dirty and clean area. The means of controlling or even improving the safety of food products is to decontaminate the carcasses or products during or at the end of the production line.

MATERIALS AND METHODS

Microbiological analysis of carcasses at slaughterhouses is required for evaluating the hygienic performance of carcass production processes as required for effective hazard analysis critical control point implementation. For practical and economic reasons, the swab technique is the most extensively used carcass surface-sampling method. The main characteristics, advantages, and limitations of the common excision and swabbing methods were described by **Capita (2004)**. Microbiological testing are the only means of assuring the microbiological safety of beef involving the enumeration of indicator organisms rather than the detection of pathogens **(Brown, 2000)**. These indicators suggest the presence of conditions associated with increased risk of exposure to a pathogen **(Tortorello, 2003)**.

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Under normal circumstance without any intervention, a sterile metal with an area 10 cm^2 was placed firmly against the surface of the left side of the carcass behind forelimb to unify the area of sampling. Then by rolling sterile cotton swab over the surface of limited area, swabs were taken after each of the following processing steps which represent to one sample. For more accuracy in identifying the bacteriological counts and isolation of selected microorganism, fifteen samples were collected from each processing steps: 1) Cattle receiving 2) Slaughtering 3) Bleeding 4) Fore shank and head removal 5) Hind shank removal 6) Hide removal 7) Carcass Wash 8) Eviscerations 9) Splitting 10) Final wash and Weighting 11) Meat cutting and loading. Decontaminant using different concentrations of acetic acid (0.5%, 1 % and 1.5%) of food grade were applied. Surface was allowed to remain wet with disinfectant for 5 minutes. Personnel involved in these activities wore gloves, disposable waterproof and cleaned protective clothing. Three samples were collected from all processing steps. These samples were re-examined for the same microbiological examination without correction. All samples were directly transferred to the laboratory in a cooling box with a minimum of delay. In the laboratory, from each swab which immersed in sterile peptone water, one ml was transferred to test tube containing nine ml of sterile peptone water (0.1%) to provide the original dilution (10^{-1}). From which further ten-fold decimal dilutions were prepared up to (10^{-6}). Nine ml of Selenite-F-broth were added to the second swabs which collected in sterile tube. The following bacteriological examinations were done in this study:

Determination of Total Aerobic Count (TAC):

Spread 0.1 ml of each dilution onto the surface of duplicated nutrient agar plates then incubated inverted at 37°C for 24 hours. The average number of colonies per countable plate was enumerated and the total aerobic count for each dilution was calculated and recorded as described by **ICMSF (1978)** as the following: The TAC = the arithmetic overage of the two counts × dilution factor.

Determination of anaerobic bacterial count:

Pipette aseptically 0.1 ml of each dilution of swabs collected onto duplicated plates with pre-poured, solidified and dried Reinforced Clostridial Medium agar. The inoculum was spread over the entire surface with a sterile bent glass rod by using a back and forth motion and let to dry for 5 - 10 minutes. After the agar has been dried, all plates were incubated

anaerobically by placing the plates in an upright position in mackintosh jar provided with anaerobic kits and incubated inverted at 37°C for 24 hours. Counting and calculation was adopted according to **(Gudkove and Sharpe, 1966).**

Determination of *Staphylococcus aureus* count:

Pipette aseptically 0.1 ml of each dilution of swabs collected onto the surfaces of separate Baird-Parkers plates. Count plates showing typical egg-yolk reaction on plates (black shiny colonies with white clear halo zone) and showing coagulase positive reaction. Calculate the number of *Staph. aureus* per gram of the original sample by using the arithmetic overage of the two counts multiplied by dilution factor.

Determination of Coliform (Most Probable Number "MPN"):

The three tubes fermentation method was applied. Pipette one ml of the decimal dilutions previously prepared to each three separate tubes of MacConkey broth supplemented with inverted Durham's tubes. Inoculated and control tubes were incubated at 37°C for 24 - 48 hours. Positive tubes which showing gas formation were recorded and confirmed by Eosin Methylene Blue agar (EMB) (see point 3.3.5). Then the Most Probable Number (MPN) of coliforms per cm^2 sample of each swap was estimated according to the tables recommended by **FAO (1991)**.

Isolation of Salmonella organisms:

Enrichment:

Nine ml of Selenite-F-broth was transferred aseptically to each swab which collected in sterile tube. Then inoculated enrichment broth was incubated at 43°C for 18 hours.

Selective plating:

A loopful of selective enrichment broth was streaked on Salmonella Shigellae (SS) medium in a manner to obtain isolated colonies. The inoculated plates were incubated at 37°C for 24 hours. Suspected colonies (non- lactose fermenters, red or pink in color with or without black centers) were picked up from plate for further identification.

Identification of suspected isolates:

Suspected colonies were purified on (SS) agar plates and incubated at 37°C for 24 hours. Then each purified suspected colony was streaked onto nutrient agar slope for further investigation. The obtained purified isolates were identified by biochemical examination.

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Biochemical identification:

Suspected isolates were identified by biochemical examination and applied as recommended by **ICMSF (1978)**.

Isolation E-coli O157:H7 micro-organisms:

Streak a loopful from each gas positive MacConkey broth tube which was previously incubated at 37°C for 48 hours on Eosin Methylene Blue agar (EMB) in a manner to obtain separate isolate. Incubate plates inverted at 37°C for 24 hours. The formation of nucleated colonies with or without bluish metallic shin confirms the presence of *E-coli* organism. The strains of Escherichia coli serotype O157:H7 were isolated by using selective agar media (Rainbow Agar O157) which has both selective and chromogenic properties that make it particularly useful for isolating pathogenic *E. coli* strains. Data before application were represented by mean (± standard deviation "SD") of 15 samples collected per each processing steps per each slaughterhouse under normal circumstances while after application were represented by the mean values of 3 samples collected from beef carcass for each concentration. The symmetrical data in all phases of the study were compiled in excel database, and organized for statistical analysis. The analysis was done using IBM SPSS version 21 **(Coakes, 2005),** a computer-based statistical software package. Different statistical approaches were used for comparing between means which include One Way ANOVA and Paired T test as well as linear logistic regression to estimate the coefficients of the linear equation.

RESULTS

Table (1): Total Aerobic Count (log cfu/cm^2) at different steps of cattle slaughtering before and after correction**.**

Processing steps	Normal Mean* SD)	Acetic acid 0.5 % Mean** (SD)	Acetic acid 1 % Mean** (SD)	Acetic acid 1.5 % Mean** (SD)
Cattle receiving	5.31 (.25) [a q]	5.21 (.14) [a q]	4.45(.11) [b q]	4.27(.25) [b q]
Slaughtering	5.23 (.26) [a r]	5.00 (.32) [a q]	4.14(.07) [b q]	4.27(.27) [b q]
Bleeding	5.12 (.34) [a s]	4.96 (.21) [a q]	4.16(.05) [b q]	4.31(.29) [b q]
Fore shank and head removal	5.08 (.45) [a s]	4.96(.21) [a q]	4.25(.11) [b q]	4.25(.31) [b q]
Hind shank removal	5.14 (.45) [a s]	4.98(.25) [a q]	4.26(.16) [b q]	4.29(.30) [b q]
Hide removal	5.44 (.27) [a t]	5.08(.48) [a q]	4.10(.18) [b q]	3.99(.39) [b r]
Carcass Wash	5.32 (.34) [a t]	5.01(.39) [a q]	4.10(.17) [b q]	3.99(.45) [b r]
Eviscerations	5.43 (.24) [a u]	5.07(.43) [a q]	4.14(.25) [b q]	4.07(.59) [b r]
Splitting	5.27 (.22) [a v]	5.03(.39) [a q]	4.11(.18) [b q]	3.99(.52) [b r]
Final wash & Weighting	5.31 (.17) [a v]	5.03(.41) [a q]	4.09 (.17) [b q]	3.93(.49) [b r]
Meat cutting & loading	5.45 (.14) [a w]	5.04(.44) [b q]	4.06(.09) [c q]	3.97(.50) [c r]

[*] Data represented by mean (standard deviation "SD") of 15 samples collected per each processing steps per each slaughterhouse under normal circumstance. [**] Data represented by mean (standard deviation "SD") of 3 samples collected per each processing steps per each slaughterhouse after correction. For comparing counts of different concentration of each used acid including counts at normal circumstances for each processing step: [a-b-c-d] data with different superscripts are significantly difference at P value<0.05 (using One Way ANOVA). For comparing counts between successive processing step within each concentration: [q-to-z] data with different superscripts were significantly difference at P value<0.05 (using paired samples T test).

Table (2): Total Anaerobic Count (log cfu/cm^2) at different steps of cattle slaughtering before and after correction

Processing steps	Normal Mean* (SD)	Acetic acid 0.5 % Mean** (SD)	Acetic acid 1 % Mean** (SD)	Acetic acid 1.5 % Mean** (SD)
Cattle receiving	3.19 (.13) [a q]	3.25 (.11) [a q]	2.70 (.13) [b q]	2.54 (.04) [b q]
Slaughtering	3.17 (.16) [a q]	3.08 (.29) [a q]	2.46 (.32) [b q]	2.46 (.13) [b q]
Bleeding	3.06 (.18) [a r]	3.15 (.16) [a q]	2.56 (.36) [b q]	2.43 (.10) [b q]
Fore shank and head removal	3.18 (.14) [a s]	2.93 (.24) [a q]	2.78 (.07) [b q]	2.36 (.27) [c q]
Hind shank removal	3.34 (.12) [a t]	3.04 (.07) [b q]	2.77 (.13) [b q]	2.44 (.22) [c q]
Hide removal	3.29 (.13) [a u]	3.02 (.07) [a r]	2.69 (.28) [b q]	2.53 (.23) [b r]
Carcass Wash	3.09 (.15) [a v]	2.57 (.28) [b r]	2.53 (.31) [b r]	2.31 (.06) [b r]
Eviscerations	3.50 (.14) [a w]	2.77 (.11) [b r]	2.66 (.07) [b r]	2.29 (.34) [b r]
Splitting	3.41 (.13) [a x]	2.64 (.21) [b r]	2.61(.21) [b r]	2.38 (.06) [b r]
Final wash & Weighting	3.37 (.12) [a x]	2.51 (.12) [b r]	2.58 (.18) [b r]	2.33 (.10) [b r]
Meat cutting & loading	3.51 (.31) [a x]	2.65 (.22) [b r]	2.77 (.14) [b r]	2.33 (.17) [b r]

[*] Data represented by mean (standard deviation "SD") of 15 samples collected per each processing steps per each slaughterhouse under normal circumstance. [**] Data represented by mean (standard deviation "SD") of 3 samples collected per each processing steps per each slaughterhouse after correction. For comparing counts of different concentration of each used acid including counts at normal circumstances for each processing step: [a-b-c-d] data with different superscripts were significantly difference at P value<0.05 (using One Way ANOVA). For comparing counts between successive processing step within each concentration: [q-to-z] data with different superscripts are significantly difference at P value<0.05 (using paired samples T test).

Table (3): Total Staph Count (log cfu/cm^2) at different steps of cattle slaughtering before and after correction.

Processing steps	Normal Mean* (SD)	Acetic acid 0.5 % Mean** (SD)	Acetic acid 1 % Mean** (SD)	Acetic acid 1.5 % Mean** (SD)
Cattle receiving	3.00 (.26) [a q]	2.81 (.31) [a q]	1.81(.65) [b q]	2.09(.22) [b q]
Slaughtering	2.91 (.40) [a q]	2.54 (.44) [a q]	1.75(.66) [b q]	1.95(.18) [b q]
Bleeding	2.83 (.36) [a r]	2.70 (.35) [a q]	1.68(.59) [b q]	1.96(.13) [b q]
Fore shank and head removal	2.86 (.36) [a r]	2.41(.56) [a q]	1.54(.22) [b q]	1.90(.12) [b q]
Hind shank removal	2.91 (.29) [a r]	2.46(.42) [b q]	1.76(.10) [c q]	1.82(.08) [c q]
Hide removal	3.32 (.35) [a s]	2.51(.32) [b q]	2.05(.09) [c q]	1.82(.35) [c q]
Carcass Wash	3.05 (.23) [a t]	2.20(.19) [b q]	1.55(.26) [c r]	1.46(.14) [c q]
Eviscerations	3.36 (.30) [a u]	2.45(.57) [b q]	1.85(.30) [c r]	1.37(.30) [d q]
Splitting	3.34 (.17) [a u]	2.49(.47) [b q]	1.72(.26) [c s]	1.57(.18) [c q]
Final wash & Weighting	3.31 (.18) [a u]	2.19(.41) [b q]	1.83(.13) [c s]	1.36(.22) [d q]
Meat cutting & loading	3.33 (.24) [a u]	2.10(.50) [b q]	1.84(.19) [c s]	1.38(.34) [d q]

[*] Data represented by mean (standard deviation "SD") of 15 samples collected per each processing steps per each slaughterhouse under normal circumstance. [**] Data represented by mean (standard deviation "SD") of 3 samples collected per each processing steps per each slaughterhouse after correction. For comparing counts of different concentration of each used acid including counts at normal circumstances for each processing step: [a-b-c-d] data with different superscripts are significantly difference at P value<0.05 (using One Way ANOVA). For comparing counts between successive processing step within each concentration: [q-to-z] data

with different superscripts are significantly difference at P value<0.05 (using paired samples
T test).

Table (4): Total Coliform Count (log cfu/cm^2) at different steps of cattle slaughtering before
and after correction

Processing steps	Normal	Acetic acid 0.5 %	Acetic acid 1 %	Acetic acid 1.5 %
	Mean* (SD)	Mean** (SD)	Mean** (SD)	Mean** (SD)
Cattle receiving	2.22 (.75)$^{a\,q}$	2.57(.49)$^{a\,q}$	1.53(.12)$^{a\,q}$	1.20(.17)$^{b\,q}$
Slaughtering	2.23 (.75)$^{a\,q}$	1.83(.87)$^{a\,q}$	1.40(.26)$^{a\,q}$	1.10(.00)$^{b\,q}$
Bleeding	2.28 (.43)$^{a\,q}$	1.73(.23)$^{a\,q}$	1.60(.00)$^{b\,q}$	1.10(.00)$^{b\,q}$
Fore shank and head removal	2.45 (.74)$^{a\,q}$	2.00(.00)$^{a\,q}$	1.80(.35)$^{a\,q}$	1.35(.57)$^{b\,q}$
Hind shank removal	2.16 (.35)$^{a\,q}$	2.17(.67)$^{a\,q}$	1.87(.23)$^{a\,q}$	1.83(.95)$^{a\,q}$
Hide removal	2.85 (.44)$^{a\,r}$	2.63(.96)$^{a\,q}$	2.00(.69)$^{a\,q}$	2.23(1.10)$^{a\,r}$
Carcass Wash	2.96 (.30)$^{a\,r}$	2.00(.90)$^{b\,r}$	1.40(.52)$^{b\,q}$	1.58(1.16)$^{b\,r}$
Eviscerations	5.42 (2.35)$^{a\,s}$	3.53(.75)$^{a\,s}$	2.27(.46)$^{b\,q}$	2.37(1.67)$^{b\,r}$
Splitting	5.43 (3.09)$^{a\,s}$	3.07(.46)$^{a\,s}$	2.80(.00)$^{a\,q}$	2.10(1.32)$^{b\,r}$
Final wash & Weighting	5.25 (3.12)$^{a\,s}$	2.60(.95)$^{a\,s}$	1.97(.64)$^{b\,q}$	1.23(.68)$^{c\,r}$
Meat cutting & loading	5.37 (3.14)$^{a\,s}$	2.57(1.37)$^{b\,s}$	1.67(.98)$^{b\,q}$	1.28(.65)$^{c\,r}$

* Data represented by mean (standard deviation "SD") of 15 samples collected per each
processing steps per each slaughterhouse under normal circumstance. ** Data represented by
mean (standard deviation "SD") of 3 samples collected per each processing steps per each
slaughterhouse after correction. For comparing counts of different concentration of each used
acid including counts at normal circumstances for each processing step: [a-b-c-d] data with
different superscripts were significantly difference at P value<0.05 (using One Way ANOVA).
For comparing counts between successive processing step within each concentration: [q-to-z] data
with different superscripts are significantly difference at P value<0.05 (using paired samples
T test).

DISCUSSION

Appropriate and safe antibacterial agents able to decontaminate meat surfaces have long been high concern of meat industry. In an attempt to manage beef carcass contamination, spray wash treatments utilizing three concentrations (0.5, 1 and 1.5 %) of acetic acid, were performed in slaughterhouse in Egypt to evaluate their efficacy in reducing numbers of aerobic, anaerobic, *Staph aureus, coliform counts*. Organic acids may affect the integrity of microbial cell membrane or cell macromolecules or interfere with nutrient transport and energy metabolism, causing bactericidal effect **(Ricke, 2003)**. Statistical analysis were done using One Way ANOVA at P value<0.05to compare the counts of different concentration of each acid used considering the counts at normal circumstances as a reference for each processing step aiming to select the best concentration. Statistical analysis were done using paired samples T test at P value<0.05 for comparing counts between successive processing steps within each concentration aiming to overview the effect of acid after application on the other steps. By using the acetic acid, there is no significant reduction in TAC at 0.5% in all processing steps except at the meat cutting and loading step. While at 1% and 1.5%, there is significant reduction in all processing steps even than using acetic acid 0.5 %. Despite that washing carcasses and/or dressed sides can reduce the numbers of aerobes and Escherichia coli by about one log unit **(Gill, 2009)** and may reduce the numbers of enteric bacteria transferred from the hide to meat but in the present study reduction was observed without removing of debris (Table 1). This is comply with **Hamby *et al.* (1987)** who reported that, intermittent sprays of sides with acetic acid resulted in significant (1.8 - 4.3 $\log/cm^2$) reductions in aerobic plate count on meat cuts**.** By comparing between acetic acid 1% and 1.5%, there is no significant deference between them. Knowing that, application of decontaminant was at cattle receiving, carcass wash and final wash, so there is a need to identify the application effect of each acid on the successive processing steps. The statistical analysis revealed that, there is no any significant different on TAC between the processing steps in case of acetic acid 0.5% and 1% while at acetic acid 1.5%, significant effect of acid application were at hide removal, carcass wash, slaughtering, final wash, cattle receiving and final steps, respectively which mean that this concentration reducing the TAC when applied and its effect continue for the successive steps. It was obviously that, washing with

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decontaminant reduced numbers of bacteria on carcasses when numbers were relatively high but not when they were relatively low which was the same finding with **Gill and Landers (2003)** when comparing between four beef plants. There is significant reduction in anaerobic count in case of using the acetic acid 0.5% in hind shank removal step and carcass wash up to meat cutting step. By using the acetic acid 1% and 1.5 %, there is significant reduction in all processing steps. By comparing between acetic acid 1% and 1.5%, there was no significant different except in fore-and-hind shank removal steps only. For all concentration significant effect of acid application were increased at hide removal, carcass wash, hide removal, evisceration, carcass wash and final wash steps respectively. By comparing between the counts in the successive steps, statistical analysis revealed that, there is significant reduction in acetic acid 0.5%, 1%, and 1.5% increased at carcass wash till to the end mean that those acids with mentioned concentrations reducing anaerobic count effectively when reapplied and its effect continue for the successive steps (Table 2). Significant reduction was observed in Staph. Aureus count in case of using the acetic acid 0.5% starting from hind shank removal. By using the acetic acid 1%, there is significant reduction in all processing steps even than using acetic acid 0.5% starting from also hind shank removal. In case of using acetic acid 1.5% there was significant reduction not only than normal circumstances but also than using acetic acid 0.5% in all processing steps and reducing more than using acetic acid 1% in evisceration, final wash and meat cutting steps (Table 3). It was found that, increasing the concentration of the used organic acids increased the bacterial lethality proportionally. This finding is similar to those reported by **Raftari *et al.* (2011)** which found that, the reduction rate of Staph. Aureus was proportional to the type and the concentration of each treatment. ANOVA for log reduction of Staph. Aureus showed that, there was a significant difference between 1, 1.5 and 2% concentrations of each organic acid (acetic, lactic). The statistical analysis revealed that, there is no any significant different on Staph. Aureus count between the processing steps in case of acetic acid 0.5% and acetic acid 1.5%. Regarding acetic acid 1%, a significant effect of acid application in reducing Staph. Aureus count was in all concentrations at carcass wash and increased more at splitting at 1%, which mean that acid with mentioned concentrations reducing the Staph. Aureus when applied and its effect continue for the successive steps. These findings are similar to that of another

study by **Raftari** *et al.* **(2009)** that reported that, Staph. Aureus decreased after being exposed to all treatments. The reduction rate of the selected bacteria was proportional to the type and the concentration of each organic acid. Log reductions analysis showed that, increase in the concentration of organic acids resulted in increasing the antibacterial effect of organic acids. There is no significant reduction in coliform count in hind shank and hide removal steps either by using the acetic acid 0.5% or 1% or 1.5%. Reduction in coliform counts was significantly by using the acetic acid 0.5% at meat cutting, and by using acetic acid 1% at bleeding, carcass wash, evisceration, final wash and meat cutting and by using acetic acid 1.5% at all processing steps except as mentioned at hind shank and hide removal (Table 4). The reduction was increased more at final wash and meat cutting by using acetic acid 1.5%. Statistical analysis was revealed that there is no significant different in case of acetic 1%. For acetic 0.5% and 1.5%, significant effect of acid application were increased at carcass wash, hide removal, fore shank removal, hind shank removal, evisceration, and hind shank removal, respectively. Then the coliform count reduced more by using acetic 0.5% at evisceration step. Statistical analysis revealed that, there is no significant different in case of acetic 1%. For acetic acid 0.5 % and 1.5% significant effect of acid application were increased at carcass wash and hide removal, respectively. Then the coliform count reduced more by using acetic 0.5% at evisceration step which means that those acids with mentioned concentration reducing the coliform count and its effect continue for the successive steps. These findings were similar to that of another study **(Anderson and Marshall, 1990)** which investigated the reduction in the microbial population to 1, 2 and 3% concentrations of lactic acid. They found that, population reduction of *E. coli* was more evident by increasing the concentration of lactic acid. Another study also observed that 4% concentration of acetic and lactic acids caused stronger reduction effect on population of bacteria than 2% concentration **(Conner** *et al.,* **1997**). However, another study did not find significant correlation between concentration of organic acid and bacterial reduction, but they found that, the fine adjustment of certain organic acids with certain other acids might lead to more striking reductions in bacteria than changing concentration of any given organic acid **(Cheung** *et al.,* **2010)**. Log reductions were reported in APC, coliform, and E. coli counts when combination between hot water (55°C) and lactic acid 4% **(Castillo,** *et al.,* **2001).**

CONCLUSION

Organic acids and their salts are widely used as chemical antimicrobial agents because their efficacy is generally well understood and cost effective. After using of decontaminants at 1% concentration of acetic acid without removing of debris and organic matters, the TAC, anaerobic, staph, coliform counts were significantly reduced in slaughterhouses. Applications of acids at critical points throughout the slaughtering process improve their effectiveness to produce meat more safe for human consumption. Using of decontaminant has reduced numbers of bacteria on carcasses when numbers were relatively higher more than relatively lower but higher concentrations of acids required for effectiveness without affecting the organoleptic properties of meat.

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