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ROLE OF SOME DECONTRAMINATORS IN REDUCING THE BACTERIAL CONTAMINATION ON SLAUGHTERED SHEEP CARCASSES

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SUMMARY

Two hundred and fifty random samples were collected from 125 sheep carcasses from both surfaces of shoulder region at Sharkia traditional abattoir cover the whole day of work. The recorded counts of microorganisms were attributed to existence of proteolytic and lipolytic bacteria of the surfaces of tested carcasses, particularly such species have the ability to multiply rapidly at non refrigerating temperature. The efficacy of some decontaminators as water wash, acetic acid 2%, saponine 1% followed by water and combination between 1% saponine and 2% acetic acid were shown to be consistently effective methods for reducing total aerobic counts, total proteolytic counts, total lipolytic counts and *Staph. aureus* counts. The mean count of these microorganisms are significantly reduced by using acetic acid 2% from $3.5x10^6$ to $9.4x10^3$ on the external surface and from $2.3x10^6$ to $1.4x10^4$ on the internal surface, and from $2.3x10^5$ to $1.3x10^3$; $2.4x10^5$ to $1.8x10^3$ and from $8.9x10^4$ to $5.4x10^2$, $3.8x10^4$ to $1.1x10^3$ and from $1.6x10^4$ to $1.2x10^2$; $7.0x10^3$ to $2.1x10^2$ respectively.

While using saponine 1% show reduction in total bacterial count equal to that occur by water wash, but using a combination of 1% saponine and 2% acetic acid is non significant.

In conclusion, washing with water followed by an effective acetic acid 2% treatment provide the maximum possible reduction in bacterial count on sheep carcasses aiming to improve meat shelf life.

INTRODUCTION

In traditional abattoir, almost all the processes of slaughtering, preparation and postmortem inspection are carried out, different types of microorganisms can contaminate sheep carcasses, some are saprophytic and incriminated in meat spoilage, while others may be responsible for public health hazard.

In the abattoir itself, there are a large number of potential sources of contamination by microorganisms. These include the hide, soil, the contents of the gastrointestinal tract (if inadvertently released during dressing operations), air borne contamination, the instruments used in dressing (knives, saws, cleavers and hooks), various vessels and finally the personal. It is particularly important to avoid dirt from hides or settling on exposed meat surface (Lawrie, 1979). The main sources of bacterial contamination of carcasses were skin of animals (33%); population in abattoir atmosphere (5%); visceral content in normal condition (3%); transport and storage (50%); halving quartering and packaging (2%) and miscellaneous and personal (3%) (Scarfondi, 1975).

Murray (1969) recommended that the bacterial count on carcass of beef slaughtered under good hygienic conditions should not be more than $5x10^4$. Moreover, Reuter (1972) stated that the bacterial count on surface of slaughtered carcasses ranges normally from 10^5-$10^7/cm^2$. Cross contamination could be originated from butcher's hand and equipment used for meat preparation which may be soiled from slaughtered animal (Bryan, 1980).

The first microorganisms present in muscle may be introduced through vascular system during slaughtering and bleeding, proteolytic and lipolytic strains can grow and split protein and the fat causing unacceptable meat (Dainty, 1985 and Lowry and Gill, 1985). Several investigators debating such issue and named several microorganisms have the ability to produce an extracellular protease which alter the protein to produce a foul smell and off flavour as *Pseudomonas spp.* (Boethling, 1975); *Micrococcus spp.* (Akashi, 1977); *Bacilllus spp.* (Chopra and Mathur, 1983) and *Staphylococcus spp.* (Ciborowski and Jeljaszewiez, 1985).

Several decontamination intervention technologies were evaluated for their effectiveness in reducing levels of bacterial contamination on samples of beef meat by

immersion or spraying solutions of acetic acid 2% control aerobic plate counts, total coliform counts and *Escherichia coli* counts (Graves-Delmore et al., 1998 and Delmore et al., 2000).

The dipping of meat inoculated with *L. monocytogenes* into acid solutions (2% acetic acid or 2% lactic acid) reduced and then inhibited the growth of the pathogen during storage at 4°C (Samelis et al., 2001 and Ikeda et al., 2003).

Carcass fat undergoes changes during storage either by oxidation or by the action of bacterial lipase resulting in production of unpleasant taste and odour which commonly referred to as rancidity (Papon and Talon, 1988).

Many of the aerobic, actively proteolytic and lipolytic bacteria can reduce meat quality. Moreover, these microorganisms may constitute a public health hazard causing food poisoning (Ahmed et al., 1998 and Abd El-Rahman et al., 1998).

Researchers have demonstrated that, spray treatments with saponine alone or in combination with acetic acid washes are no more effective than combination with water washes for reducing aerobic and pathogenic populations associated with fecal contamination on beef tissue (Cutter, 1999).

Saponins are naturally occurring compounds known as triterpenoid glycosides found in a variety of plant species including chickpeas, soy beans, peanuts, cereals and asparagus (Zablotowicz et al., 1996). These compounds are stable in basic solutions but hydrolyzed readily in acid solution. Saponins have demonstrated antibacterial activity against a wide variety of microbes including pseudomonas spp., *Streptococcus faecalis*, *staphylococcus aureus* (Abbasoglu and Turkoz, 1995), *E. coli*, Kelbsiella spp. and *Salmonella typhimurium* (Rodrick, 1997).

In general, saponins are water soluble colourless compounds commonly used as food additives, also could be used as an antimicrobial to reduce total plate counts and fecal coliforms by approximately 1 Log_{10} CFU/g when it was directly added to oyster meat (Rodrick, 1997).

Pretreated minced goat meat by immersion in 2% acetic acid was most effective for control of aerobic bacterial growth, yeast and mould growth and prolonged shelf life of pretreated samples (Chowdhury et al., 2005).

Effects of washing with organic acids (1.5% acetic acid) were investigated on bacterial contamination and shelf life of lamb and goat meat led to reduction in total viable counts of *Staph. aureus*, *L. monocytogenes*, *E. coli* and *S. typhinurium* and so prolonged the shelf life (Dubai et al., 2004).

Acetic acid solution (5%) diluted the bacteria and inhibited bacterial growth, this bacteriostatic solution was used in meat plant for rinsing clothes, hand and fingertip to prevent cross contamination (Snyder, 2004).

Decontamination treatments routinely applied during dressing of cattle carcasses. Effects were evaluated of washing with 2% acetic acid; to be consistently effective methods of reducing bacterial counts (Gill and Landers, 2003).

Spray washing is an efficacious method for removal of faecal and bacterial contamination from lamb carcass surfaces (Cabedo et al., 1996 and Kochevar et al., 1997).

The incidence of *L. monocytogenes*, *Salmonella spp.*, total aerobic bacteria, streptococcal counts and total coliforms from beef samples were low after direct spray with dilute acetic acid (Dickson, 1992; Siragusa and Dickson, 1993; Hardin et al., 1995 and Avens et al., 1996).

Therefore, the present study was undertaken to screen the attitude of total aerobic plate counts, total proteolytic counts, total lipolytic counts and total Staphylococcus counts on the external surface and the abdominal cavity of sheep carcasses and the efficacy of saponine and acetic acid as decontaminator agents aiming to improve meat shelf life.

MATERIAL AND METHODS

This study was conducted at Sharkia municipality abattoir, the number of samples were 250 swabs taken from (50 cm^2), distributed as 125 swab samples from each of external and internal carcass surfaces. The samples were collected from 125 sheep carcasses around the shoulder region (25 swabs after skinning and evisceration "traditional slaughtered method", 25 swabs after rinsing with water, 25 swabs after washing with 2% acetic acid, 25 swabs after washing with 1% saponine followed by water rinse, 25 swabs after washing with a combination of 1% saponine and acetic acid 2%.

The swab samples were taken at the same time intervals along the day of slaughter work and

constitute five groups. Each group was represented by 25 swab samples from each external and internal surfaces under every application. These swab samples were transferred to the laboratory on ice box without delay. Swabbing technique and microbial analysis were completed according to (APHA, 1992).

Saponin number 374 (technology management and funding, L.P., Princeton, N.J.) is produced by Quillaja Sabonara, or soapbark, an evergreen tree found in south America (Setten and Werken, 1996).

Moreover, statistical analysis for variance (ANOVA) followed by Dunn's multiple range test were carried out to indicate the significantly different groups from the control (Petrie and Walson, 1999).

The obtained data were statistically analyzed according to Tamhane and Dunlop (2000).

RESULTS AND DISCUSSION

The bacterial contamination on the surfaces of sheep carcasses slaughtered at traditional abattoir is start and become highest in the region below the initial incision through the skin, further more the contamination can occur from hide, knife and hands of butchers.

From the tabulated results, it can be seen that the aerobic plate counts (APC) were significantly increasing $P > 0.05$ through the day of work on the surface of control carcasses. The real increase in APC was noticed after evisceration where the mean values attained to $4.5x10^6$ (Table 1). Although the aerobic plate counts of any food article isn't a sure indicative of its safety for consumption, yet it is of great importance in judging the hygienic conditions under which it has been produced, handled and stored.

Hygienic quality of a fresh processing plant was assessed with respect to the numbers of viable microorganisms recovered from various surfaces coming into contact with meat. In this concern, Leel et al. (1997) pointed out that treatment with organic acids reduced the total bacterial count on the surface of the carcass, on the inner part of the meat and on the surface of deboned meat.

During removal of viscera, some leakage of rumen content occasionally occurs which contaminate the carcass and lead to additional massive contamination. The average number of aerobic bacteria on carcass during skinning and

evisceration aren't reduced by trimming. On the other hand, spray washing technique approximately halves the average number of those bacteria on the carcass surface (Gill et al., 1996). In traditional slaughtered method washing with water of no significant difference with control (Table 1), this may be attributed to water used in washing many act as a source of contamination. Therefore some trials were used to increase the effectiveness of washing in reducing the microbial population by applying some decontaminators such as saponine 1% and acetic acid 2%.

So, in the present study washing facilities include acetic acid 2% after water wash (Table 2) had high significant reduction in the microbial contamination of both external and internal surface of the carcass ($P<0.01$). The mean values of total aerobic count was reduced from $3.5x10^6$ to $9.4x10^3$ on external surface and from $2.3x10^6$ to $1.4x10^4$ on the internal surface. These results were agree with Siragusa (1995), Dubai et al. (2004), Snynder (2004) and Chowdhury et al. (2005).

Table (3) declares that experimentally washed carcass with 1% saponine followed by water wash show high significant reduction of APC at ($P<0.01$) in both external and internal surface were $2.4x10^6$ and $1.1x10^6$ respectively. While TPC was significantly ($P<0.05$) in both surfaces, the mean values were ($1.8x10^5$ and $1.5x10^5$) respectively, the mean value of TLC on the internal surface was non significant ($5.2x10^4$) while the external surface was significant ($2.7x10^4$). otherwise, the mean value of *Staph. aureus* on the external surface was non significant ($1.2x10^4$) and was significant on the internal surface ($4.4x10^3$). the same results were recorded by Rodrick (1997). While experimentally using of 1% saponine followed by 2% acetic acid of no significance in reduction of APC, TPC, TLC and *Staph. aureus* count. The same results were recorded by Cutter (1999). Because saponine is hydrolyzed under acetic condition. It was inactivated during the organic acid wash. This observation explain why higher populations were observed after this treatment.

Table (4) illustrates the statistical analytical results of some bacteriological counts on both external and internal surfaces of carcass after different treatments and declare that the mean values of APC was significant ($P<0.01$) after washing with acetic acid 2% and saponine 1% followed by water show significant ($P<0.05$) after combination wash with saponine 1% and acetic acid 2%. On the other hand, TPC mean value was significant ($P<0.01$) after washing

with acetic acid 2% but was significant ($P<0.05$) after washing with saponine 1% followed by water wash, while the mean value of TLC was significant ($P<0.01$) after washing with acetic acid 2% and saponine 1% followed by water was significant ($P<0.05$) after washing with water, otherwise the *Staph. aureus* mean value on external surface was non significant but was significant ($P<0.01$) on the internal surface after washing with acetic acid 2% and significant ($P<0.05$) after washing with saponine 1% followed by water wash.

In conclusion the results obtained during this study described that wash treatment with 2% acetic acid is more effective for reducing APC, TPC, TLC and *Staph. aureus* counts, than 1% saponine alone, while water wash and combination of 1% saponine with 2% acetic acid were non significant effect to reduce high microbial contamination.

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دور بعض مزيلات التلوث فى تقليل التلوث البكتيرى على أسطح ذبائح الأغنام

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أجريت هذه الدراسة بأحد مجازر الشرقية التقليدية على عدد 125 من ذبائح الأغنام وتم أخذ العينات من منطقة الكتف داخليا وخارجيا لعد الجراثيم الهوائية والميكروبات الحالة للبروتينات والدهون وكذلك الميكروب المكور العنقودى الذهبى من الأسطح الداخلية والخارجية لذبائح الأغنام ودراسة تأثير بعض مزيلات التلوث فى تقليل العد الكلى لتلك الميكروبات.

وتبين من هذه الدراسة أن استخدام حامض الخليك بتركيز 2٪ بعد عملية الغسيل بالماء قد أدى إلى تقليل ملحوظ فى العد الكلى للميكروبات الهوائية من 3.5×10^{6} إلى 9.4×10^{3} للسطح الخارجى للذبائح ومن 2.3×10^{6} إلى 1.4×10^{4} للسطح الداخلى وكذلك الميكروبات الحالة للبروتينات من 2.3×10^{5} إلى 1.3×10^{3} للسطح الخارجى ومن 2.4×10^{5} إلى 1.8×10^{3} للسطح الداخلى وأيضا الميكروبات الحالة للدهون من 8.9×10^{4} إلى 5.4×10^{2} للسطح الخارجى ومن 7.0×10^{3} إلى 2.1×10^{2} للسطح الداخلى على التوالى.

بيمنا كان هناك تغير غير ملحوظ فى العد الكلى لتلك الميكروبات بعد استخدام محلول السابونين 1٪ تم الغسيل بالماء ، بينما استخدام محلول من السابونين 1٪ وحامض الخليك 2٪ لتطهير أسطح الذبائح لم يعطى أى تغير فى العد الكلى لتلك الميكروبات.

هذا وقد تم مناقشة أهمية الاشتراطات الصحية الواجب توافرها لتقليل التلوث البكتيرى على أسطح ذبائح الأغنام بهدف إطالة فترة صلاحيتها وكذلك سلامة مستهلكى لحومها.