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CONTROL OF THE BACTERIAL CONTAMINANTS ON THE BROILER CARCASS SURFACES

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A B S T R A C T

Eighty random swabs taken from the surfaces of chicken carcasses slaughtered at poultry slaughter shops in Benha city, Kalyobia governorate. The collected swabs were represented by 4 groups including control, potassium sorbate (0.1%), nisin (10 ppm) and acetic acid (1%) treated surfaces of the chicken carcasses (20 of each).The obtained results indicated that the mean values of different microbial counts in the swabs of control and treated surfaces of chicken carcasses with potassium sorbate , niacin and acetic acid were 2.12 $\times 10^6 \pm 0.35 \times 10^5$, $5.48 \times 10^5 \pm 1.04 \times 10^5$, $3.69 \times 10^5 \pm 0.58 \times 10^5$ and $8.92 \times 10^4 \pm 1.73 \times 10^4$ / cm^2 for APC , $7.46 \times 10^4 \pm 1.83 \times 10^4$, $1.93 \times 10^4 \pm 0.39 \times 10^4$, $6.61 \times 10^3 \pm 1.53 \times 10^3$ and $2.28 \times 10^3 \pm 0.65 \times 10^3$/ cm^2 for Enterobacteriaceae count , $4.37 \times 10^4 \pm 0.81 \times 10^4$, $1.10 \times 10^4 \pm 0.25 \times 10^4$, $3.56 \times 10^3 \pm 0.72 \times 10^3$, $2.03 \times 10^3 \pm 0.49 \times 10^3$/ cm^2 for staphylococcus count, respectively . *Citrobacter diversus, Citrobacter freundii, Enterobacter aerogenes, Enterobacter agglomerans , Enterobacter cloacae, Enterobacter hafniae, Klebriella ozaenae, Klebriella pneumonae, Proteus mirabilis, Proteus rettgeri, Proteus vulgaris* and *Serratia liquefaciens* were detected with different percentages . However, *S. typhimurium , S. enteritidis , S. muenster* and *S. haifa* were isolated from 10% , 5% , 5 % and 5 % of examined swabs of control treated surfaces of the chicken carcasses, respectively. However, *S. typhimurium* and *S.muenster* were detected from 5% and 5% of the examined swabs of potassium sorbate treated surfaces of chicken carcasses. While, *S. typhimurium, S. enteritidis* and *S. haifa* were isolated from 5% of each of the examined swabs of nisin treated surfaces of chicken carcasses.

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1. INTRODUCTION

Poultry is a highly nutritious food; it contains a highly digestible protein in addition to a low percent of fat and cholesterol. Potential causes of contamination of poultry during the slaughtering and processing procedures include contact of the carcass with body parts that contain a high microbial load (13, 22). The principal spoilage bacteria found on poultry include Pseudomonas, Staphylococcus, Micrococcus, Acinetobacter and Moraxella. In addition, poultry often supports the growth of certain pathogenic bacteria such as Salmonellae. Prevention of microbial contamination involves careful regulation and monitoring of the slaughtering and processing plants, proper handling and storage and adequate cooking of raw and processed poultry products (5). A vast array of chemical bactericide has been tested for their efficacy in reducing microbial loads on processed poultry carcasses. Among the chemicals commonly tested are hydrogen peroxide and more recently, organic acids, such as acetic acid (3). Therefore, the current study was performed to determine the effect of potassium sorbate, nisin and acetic acid on microbial contaminants on broiler carcass surface.

2. MATERIAL AND METHODS

80 swabs taken from the surfaces of chicken carcasses (10 cm^2) slaughtered at poultry slaughter shops in Benha city, Kalyobia governorate. The collected swabs were represented by 4 groups including control, potassium sorbate (0.1%), nisin (10 ppm) and acetic acid (1%) treated surfaces of the chicken carcasses (20 of each). Swabs from chicken surfaces were taken after use of sterile cotton swab and template. The sterilized template placed firmly against the surface to limit the examined area. The sterile cotton swab drawn from screw capped plastic tubes containing 10 ml buffered peptone water (1%) and rolled in the limited area of carcass (10 cm^2). All collected swabs were subjected to bacteriological examination for determination of APC, Enterobacteriaceae, Staphylococcus counts according to (12**).** Moreover, the isolation and identification of Enterobactereacea count were carried out according to (4). Furthermore, screening of salmonellae was applied by using Rappaport Vassiliadis broth as enrichment media (21), while XLD was used as plating media. The obtained results were statistically evaluated by application of Analysis of Variance (ANOVA) test.

3. RESULTS

Table (1): Mean values results of different microbial counts in the swabs of control and treated surfaces of chicken carcasses (n=20).

Surface swab	Mean ± S.E* APC	Mean ± S.E* Enterobacteriacea	Mean ± S.E* Coliform	Mean ± S.E* Staphylococcus
Control	$2.12\times10^6\pm 0.35\times10^6$	$7.46\times10^4\pm 1.8310^4$	$3.01\times10^4\pm 0.75\times10^4$	$4.37\times10^4\pm 0.81\times10^4$
Pot. sorbate treated surface (0.1%)	$5.48\times10^5\pm 1.04\times10^5$	$1.93\times10^4\pm 0.39\times10^4$	$8.26\times10^3\pm 2.11\times10^3$	$1.10\times10^4\pm 0.25\times10^4$
Nisin treated surface (10 ppm)	$3.69\times10^5\pm 0.58\times10^5$	$6.61\times10^3\pm 1.52\times10^3$	$2.73\times10^3\pm 0.62\times10^3$	$3.56\times10^3\pm 0.72\times10^3$
Acetic acid treated surface (1%)	$8.92\times10^4\pm 1.73\times10^4$	$2.28\times10^3\pm 0.65\times10^3$	$9.18\times10^2\pm 2.34\times10^2$	$2.03\times10^3\pm 0.49\times10^3$

Table (2): Incidence of Enteric bacteria isolated from the swabs of control and treated surfaces of chicken carcasses (n=20).

Treatments / Enteric Bacteria	Control		Pot. Sorbate treatment (0.1%)		Nisin treatment (10 ppm)		Acetic acid treatment (1%)	
	No.	%	No.	%	No.	%	No.	%
Citrobacter diversus	5	25	5	25	4	20	1	5
Citrobacter freundii	7	35	6	30	4	20	3	15
Enterobacter aerogenes	4	20	3	15	3	15	1	5
Enterobacter agglomerans	1	5	-	-	-	-	-	-
Enterobacter cloacae	3	15	3	15	2	10	1	5
Enterobacter hafniae	2	10	1	5	1	5	-	-
Klebriella ozaenae	6	30	4	20	3	15	2	10
Klebriella pneumonae	2	10	2	10	2	10	-	-
Proteus mirabilis	10	50	7	35	5	25	4	20
Proteus rettgeri	8	40	5	25	3	15	2	10
Proteus vulgaris	13	65	8	40	7	35	5	25
Serratia liquefaciens	4	20	2	10	2	10	-	-

Table (3): Incidence of Gram positive cocci isolated from the of control and treated surfaces of chicken carcasses (n=20).

Treatments / Gram positive cocci	Control		Pot. Sorbate treatment (0.1%)		Nisin treatment (10 ppm)		Acetic acid treatment (1%)	
	No.	%	No.	%	No.	%	No.	%
Staphylococcus aureus	7	35	6	30	1	5	3	15
Staphylococcus epidermidis	9	45	6	30	2	10	5	25
Micrococci	14	70	10	50	4	20	6	30

Table (4) Incidence of *Salmonella* organisms isolated from the swabs of control and treated surfaces of chicken carcasses (n=20).

Treatments / *Salmonella* Strains	Control		Pot. Sorbate treatment (0.1%)		Nisin treatment (10 ppm)		Acetic acid treatment (1%)		Antigenic structure	
	No.	%	No.	%	No.	%	No.	%	O	H
S.typhimurium	2	10	1	5	1	5	1	5	1,4,5,12	i : 1,2
S.enteritidis	1	5	-	-	1	5	-	-	1,9,12	g,m : 1,7
S.muenster	1	5	1	5	-	-	-	-	3,10,15,34	e,h : 1,5
S.haifa	1	5	-	-	1	5	-	-	1,4,5,12	Z10: 1,2
Total	5	25	2	10	3	15	1	5		

4. DISCUSSION

Results achieved in table (1) revealed that the mean values of APC, Enterobacteriaceae, coliform and Staphylococcus counts in the swabs of control and treated surfaces of chicken carcasses were 2.12×106 ± 0.35×106 , 5.48×105 ± 1.04 ×105 , 3.69×105 ± 0.58 ×105 & 8.92×104 ± 1.73×104 for control, 7.46×104 ± 1.83×104 , 1.93×104 ± 0.39 ×104 , 6.61×103 ± 1.52×103 & 2.28×104 ± 0.65 ×104 for potassium sorbate, 3.01×104 ± 0.75×104 , 8.26×103 ± 2.11×103 , 2.73×103 ± 0.62×103 & 9.18×102 ± 2.34×102 for nisin and 4.37×104 ± 0.81×104 , 1.10×104 ± 0.25×104, 3.56×103 ± 0.72×103 & 2.03×102 ± 0.79×102 for acetic acid treatment, respectively. Differences associated with the swabs of control and treated surfaces of chicken carcasses were high significant (P<0.01) as a results of various bacterial group counts. The obtained results were nearly similar to those reported by 8, 18, 7, 25, 3 and 15. While, higher results were recorded by1, 10, 17, and 25. It is of great concern to mention that the application of acetic acid was greatly effective for the reduction of bacterial group counts followed by nisin and potassium sorbate. Thus, the highest bacterial counts were recorded for control group. Such findings could be attributed to the fact that organic acids such as acetic acid exert antibacterial activity. They have been traditionally used as food preservatives and are generally recognized as safe substances approved as food additives FAO/WHO and FDA (18). Also, sorbic acid and its salts have several advantages as food preservatives thought their antimicrobial activity, particularly aerobic catalase – positive organisms. Furthermore, their greater solubility and stability extend the use of sorbate to solutions appropriate for dipping

and spraying (6). The incidence of enteric bacteria isolated from the swabs of control and treated surfaces of chicken carcasses was recorded in table (2). In general, Citrobacter diversus, Citrobacter freundii, Enterobacter aerogenes, Enterobacter agglomerans, Enterobacter cloacae, Enterobacter hafniae, Klebriella ozaenae, Klebriella pneumonae, Proteus mirabilis, Proteus rettgeri, Proteus vulgaris and Serratia liquefaciens were isolated from the swabs of control and treated surfaces of chicken carcasses with different percentages. The improper handling of raw chicken meat in shops and food service establishment is one of the main reasons for food borne illness caused by Enterobacteria (16, 24). In addition, the presence of enteric bacteria in any food may be responsible for their inferior quality resulting in economic losses. Moreover, some strains of such organisms were incriminated in many cases of acute and chronic diarrhea (12, 19). Incidence of Gram positive cocci isolated from the swabs of control and treated surfaces of chicken carcasses is recorded in table (3). Accordingly, Staphylococcus aureus was isolated from 35%, 30%, 5%, 15% of the examined swabs of control, potassium sorbate ,nisin and acidic acid treated surfaces of chicken carcasses, respectively. While, Staphylococcus epidermidis and micrococci were isolated from (45% & 70%), (30% & 50%), (10% & 20%) and (25% & 30%) of the examined swabs of control, potassium sorbate, nisin and acetic acid treated surfaces of chicken carcasses, respectively. The highest reduction in the total staphylococci count was obtained in the group treated with acetic acid followed by nisin and potassium sorbate. Staphylococcus can be carried on hands, nasal passage or throats. Most food borne illness out breaks is result of contamination from food handlers and production of heat stable toxins in food (11). Sanitary food handling and proper cooking and refrigerating should prevent Staphylococcus food borne illness (6). Results achieved in table (4) declared that S. typhimurium, S. enteritidis , S. muenster and S. haifa were isolated from 10%, 5%, 5 % and 5 % of examined swabs of control treated surfaces of chicken carcasses, respectively. However, S. typhimurium and S.muenster were detected from 5% and 5% of the examined swabs of potassium sorbate treated surfaces of chicken carcasses. While, S. typhimurium, S. enteritidis and S. haifa were isolated from 5% of each of the examined swabs of nisin treated surfaces of chicken carcasses. Only S. typhimurium was detected from 5% of the examined swabs of acetic acid treated surfaces of chicken carcasses. Historically, Salmonella typhimurium has been the most frequently serotype and Salmonella enteritidis act as causative agents of human gastroenteritis throughout the world (2). An annual average of 186 cases was recorded during 1982 -1986 in Norway (26 and 23). Salmonellosis is a great problem and one of the most important food born disease. Mishandling in preparation of food of animal origin was the major reason for the out break of salmonellosis where 25 of 35 registered out breaks in 1986 were related to food of animal origin (20). The number of human cases of salmonellosis increased due to serious hygienic deficiency in food technology during processing, production and storage of food as will as due to poor hygiene of personal working (14). As conclusion, such results indicated that the application of acetic acid treatment on the chicken surfaces was very effective in reduction of most bacterial groups followed by potassium sorbate. In contrast, the application of nisin had little influence on different types of bacteria.

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منع نمو وتكاثر الميكروبات على أسطح ذبائح الدواجن

الملخص العربي

تعتبر لحوم الدواجن من الأغذية ذات القيمة الغذائية العالية حيث أنها تمد الجسم بنسبة مرتفعة من البروتين الحيواني علاوة على احتوائها على بعض العناصر الأخرى مثل الدهون والأملاح المعدنية والفيتامينات. وتعد الدواجن من أكثر الأغذية عرضة للتلوث والفساد بالعديد من الميكروبات المسببة للفساد أثناء مراحل الإنتاج والتداول فى الأسواق والمحلات وهذه الميكروبات تشكل خطورة على صحة المستهلك. لذا أجريت هذه الدراسة على عدد ثمانين (80) مسحة من أسطح ذبائح الدواجن المذبوحة فى محلات مدينة بنها بمحافظة القليوبية. وقد أجريت الاختبارات على 4 مجموعات تشمل الكنترول والبوتاسيوم سوربات والنياسين والأسيتيك أسيد (20 من كل نوع). حيث أجريت الفحوص الميكروبيولوجية لدراسة تأثير هذه المعالجات على الناحية البكتريولوجية. وقد دلت هذه الدراسة على أن متوسط العدد الكلى للميكروبات الهوائية لأسطح ذبائح الدواجن للكنترول وأسطح ذبائح الدواجن المعالجة بالبوتاسيوم سوربات والنياسين والأسيتيك أسيد هي $2.12 \times 10^{6} \pm 0.35 \times 10^{5}$ و $5.48 \times 10^{5} \pm 1.04 \times 10^{5}$ و $3.69 \times 10^{5} \pm 0.58 \times 10^{5}$ و $8.92 \times 10^{4} \pm 1.73 \times 10^{4}$ / سم2، على التوالي. بينما كان متوسط العدد الكلى للميكروبات المعوية للكنترول والبوتاسيوم سوربات و النياسين والأسيتيك أسيد هو 7.46×10 و 1.93×10^{4} و 6.61×10^{3} و 2.28×10^{3} / سم2، على التوالى. على الجانب الأخر، كان متوسط العدد الكلى لميكروبات القولون هو 3.01×10^{4} للكنترول و 8.26×10^{3} للبوتاسيوم سوربات و 2.73×10^{3} للنياسين و 9.18 ؛ $\times 10^{2}$ / سم 2للأسيتك أسيد. وعلاوة على ذلك كان متوسط العدد الكلى لميكروب المكور العنقودى هو 4.37×10^{4} للكنترول و 1.10×10 للبوتاسيوم سوربت و 3.56×10^{3} للنياسين و 2.03×10^{3} / سم 2 للأسيتك أسيد. لقد تم عزل ميكروب المكور العنقودى الذهبى بنسب 35% و 30 % و 5% و15% من عينات الكنترول والبوتاسيوم سوربيت والنياسين والأسيتيك أسيد، على التوالي. وقد تم عزل الميكروبات المعوية سواء المسببة للفساد أو الممرضة من هذه المسحات بنسب متفاوتة. وتم عزل ميكروب *S.typhimurium, S. enteritidis, S. muenster* and *S.haifa* بنسب 10% و 5% و 5% و5 % من الكونترول، على التوالي ، وأيضا تم عزل *S.typhimurium and S.muenster*بنسبة 5% و5% من أسطح ذبائح الدواجن المعالجة بالبوتاسيوم سوربات. بينما *S. typhimurium, S. enteritidis* and *S. Haifa* قد تم عزلها بنسبة 5% لكل ميكروب من ذبائح الدواجن المعالجة بالنياسين. وقد تم دراسة ومناقشة الأهمية الصحية للميكروبات المعزولة ومصادر تلوث الدواجن التى تم فحصها بالإضافة إلى اقتراح التوصيات اللازمة لمنع نمو وتكاثر هذه الميكروب على أسطح ذبائح الدواجن.

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