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CONTAMINATION OF DRESSED BROILERS WITH ENTEROTOXIGENIC STAPHYLOCOCCUS AUREUS DURING PROCESSING

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SUMMARY

Staphylococcus aureus count (log_{10} / g) in one hundered chicken samples after each of the different processing phases {defeathering, vent openers, removal of giblets, inside and outside washing, air chilling, wrapping and quick freezing} were 3.20, 3.85, 4.13, 3.24, 2.97, 3.43 and 2.26, respectively. Mean while the incidence of coagulase positive enterotoxigenic strains of Staphylococcus aureus in such samples were 0%, 11.11%, 23.08%, 9.09%, 0%, 21.43% and 11.11%, respectively. More over, the count of staphylococcus aureus (log_{10}/cm^2) of the examined slaughterhouse equipments (scalding tank, plucker, neck slitter, vent openers, eviscerator/spoon, cropping machine and inspector table were 2.09, 4.15, 4.19, 4.26, 4.63, 4.97, 4.99 and 5.14, respectively. Whereas, the incidence of the enterotoxigenic coagulase positive strain of Staphylococcus aureus in such equipment were 7.1%, 9.09%, 4.76%, 14.63%, 18.60%, 22.91%, 29.03% and 27.77%, respectively. The public health importance of the isolated organisms was discussed.

INTRODUCTION

Dressed poultry are subjected to contamination with pathogenic microorganisms from different sources during the period that elapses from time of slaughtering till consumption. Such contaminants may render the product unfit for consumption and constitute a public health hazard (Gibbs, et al., 1978, Raska et al., 1981, Harvey et al., 1982 and Evans et al., 1983). Abu-Ruwaida et al (1994), mentioned that the carcasses were heavily contaminated by different types of organisms, including indicator organisms (total aerobics, enterobacteriaceae, coliforms and Escherichia coli) and pathogenes, they also recorded that the microbial levels varied during processing, but the highest levels were detected after scaling and defeathering. No change in bacterial count was observed after the spray

washing following the evisceration, during the air chilling, packaging and in the cold storage. Many strains of these microorganisms are enterotoxigenic, Staphylococcus aureus organisms are usually implanted by hand or machinary, they produce sufficient toxins in the food and causing food poisoning (Wieneke, 1975 and Hobbes, 1975). The quantitative results of Notermans et al (1982), showed that the skin of broiler carcasses had more than 10^3/g of staphylococcus aureus. Hamdy et al. (1986) studied the influence of cold storage on Staphylococcus aureus contamination of dressed broiler and they stated that freezing at-18°C caused a continuous decrease in number of these microorganisms. Porto and Silva (1995) stated that the cleaning of equipments reduced but did not completely eliminate the bacterial population. They also mentioned that staphylococcus aureus was resistant to 50°C for 10 minutes but not for 60°C for 2 minutes.

MATERIAL AND METHODS

Part 1:

One hundred chicken swab samples were collected after each of the different processing points in a private slaughter house (defeathering, opening, removing giblets, inside and outside washing, air chiller, packing and after quick freezing).

Samples were transferred to the laboratory, where they were examined according to the technique of (ICMSF, 1978). Using the surface spread plate method and Baird-Parker medium. Inoculated plates together with control ones were incubated in a thermostatically controlled incubator at 37°C/24-48 hours. Suspected colonies (black and shiny with narrow white margins surrounded by a clear zone) were counted. The isolated Staphylococcus aureus were examined morphologically biochemically (API software) and coagulase production by slide method. Detection of serological types of enterotoxgenic coagulase positive *Staphylococcus aureus* was carried out using reverse passive Latex Agglutination Technique (RPLA) recommended by Shingaki et al., (1981) using Oxoid Set-Repla Kits.

Part II:

One hundred swab samples were collected from poultry Slaughterhouse equipments during processing (scalding tank, plucker, neck sliter, vent openner openning machine, eviscerator/spoon, cropping machine and inspector table). Sterile cotton swabs and template were used to delineate an area of 10 cm^2 collected swabs were immersed into a test tube containing 10 ml sterile peptone water as a diluent. Decimal serial dilutions were prepared according to technique of surface spread plate method using Baird-Parker medium. isolation of Staphylococcus aureus and detection of enterotoxins were carried out, as described before.

RESULTS AND DISCUSSION

Results given in Table (1) reveal that the mean Staphylococcus aureus count in log 10/g of

examined chicken samples after defeathering was 3.20. While after opening and removal of the giblets the counts was increased significantly to 3.85 and 4.13, respectively. From these results it is evident that during processing chicken carcasses after exposure and removal of the giblets became highly contaminated with staphylococci, which comes from live poultry carried staphylococci Tatcher and Clark (1975), Kusch (1977), Terayama et al. (1977), Gibbs et al. (1978), Raska et al. (1981), Harvey et al. (1982), Notermans et al. (1982), Adams and Mead (1983), Derriese et al. (1983), Evans et al. (1983) and Thompson and Patterson (1983) stated that live poultry carried staphylococci in bruised tissues, infected lesions, nasal sites, skin surface and arthritic joints.

While after inside and outside washing and air chilling (O°C) the count was reduced to 3.24 and 2.97, respectively. from these results it is evident that inside and outside washing with chlorinated water (100ppm) caused great reduction in staphylococcus aureus count, (Ranken et al., 1965). Nearly similar findings were reported by Gunderson et al. (1954), Zeigler and Stadelman (1955), Mercer and Somers (1957), Allen (1961), Dixon and Pooley (1961), Barnes (1965), Barnes and Impey (1968), Patterson (1968), Elliot (1969), Surkiewieze et al. (1969), Mead and Impey (1970), Ella and Mead (1971), Katula (1974), Mulder and Bolder (1981) and notermans et al. (1982). The cooling effect on the chicken carcasses leaving the air chiller led to reduction

Table: 1 Staphyloccus aureus count (log 10/g) of chicken samples at different processing point inside slaughtrehouse.

Processing point	Staphylococcus aureus count (1og10/g)				
	Minium	Maximum	Mean	S.D	S.E
After defeathering	2.70	3.4	3.20	0.2258	0.4752
After opening	2.88	3.95	2.80	0.3331	0.5771
After removal the inside organs (giblet)	3.23	4.47	4.13	0.3286	0.5732
After inside and outside washing	2.33	3.95	3.24	0.5019	0.7084
After Air chilling (oC)	2.12	2.97	2.97	0.7259	0.8519
After packing	2.56	3.99	3.43	0.4943	0.7030
After blast freezing (-40c)	2.00	2.90	2.26	0.3551	0.5959

S. D.> Standar Deviation
S. E.> Standar Error

Table 2.A: API Software identification of isolated Staphylococcus aureus isolated from examined chicken samples at different processing points

Processing points	Staph aureus				
	No	%	Software		
After defeathering	23	23	6 6 6	726 736 736	151 143 150
After opening	27	27	6 6 6	726 737 737	151 153 151
After removal inside organs (giblet)	38	38	6 6	726 737	151 153
After inside and outside washing	14	14	6 6 6	726 326 332	151 153 153
After Air chilling (-40C)	9	9	6 6	726 736	151 150
After packing	23	23	6 6	726 734	151 153
After blast freezing	12	12	6 6	726 736	151 153
Total No	146				

Table 2B: API Software identification of isolated Staphylococcus aureus isolated from examined Slaughterhouse equipments

Equipment	Staph aureus				
	No	%	Software		
Scaling tank	33	33	6 6	726 737	143 151
Plucker	41	41	6 6	726 736	150 150
Neck sliter	29	29	6 6	726 736	151 153
Vent opening	51	51	6 6 6	726 326 332	151 153 153
Opening machine	58	58	6 6	726 736	151 143
Eviscerator/spoon	67	67	6 6 6	736 326 332	153 153 153
Cropping machine	35	35	6 6	726 737	151 153
Inspector table	23	23	6 6	726 736	151 153
Total No	337				

Table 3: Distribution of single and multiple enterotoxins produced by Staphylococcai coagulase + ve isolated from chickens at different processing points. (Set-Repla Kits).

Processing Points	No. of isolates Coagulase+ve		Entrotoxigenic Strain		Entroxin Production													
					Single Produce Strain								Multiple Produce strain					
					A		B		C		D		A+B		A+B		C+D	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
After defeathering	10	10.98	-	0	-	0	-	0	-	0	-	0	-	0	-	0	0	0
After opening	18	19.78	2	11.11	2	100	-	0	-	0	-	0	-	0	-	0	0	0
After removal inside organs (giblet)	26	28.57	6	23.08	5	83.33	-	0	-	0	1	16.7	-	0	-	0	0	0
After inside and out-side washing	11	12.08	1	9.09	1	100	-	0	-	0	-	0	-	0	-	0	0	0
After air chiller (0C)	3	3.29	-	0	-	0	-	0	-	0	-	0	-	0	-	0	0	0
After packing	14	15.38	3	21.43	2	66.67	-	0	-	0	1	33.3	-	0	-	0	0	0
After blast Freezing (-40C)	9	9.89	1	11.11	1	100	-	0	-	0	-	0	-	0	-	0	0	0
Total strain	91	100%																

Table: 4 Staphyloccus aureus count (log 10/cm-2) from Poultry Slaughter house equipments

S.H. Equipments	Staphylococcus aureus count (log 10/cm-2)				
	Minium	Maximum	Mean	S.D	S.E
Scalding tank	2.21	3.23	2.99	0.3147	0.5609
Plucker	3.95	4.25	4.15	0.1058	0.3252
Neck sliter	3.83	4.40	4.19	0.2348	0.4845
Vent opening	3.97	4.63	4.26	0.2539	0.5038
OpeningMachine	4.00	5.23	4.63	0.3087	0.5556
Eviscerator/spoon	4.33	5.83.	4.97	0.6060	0.7784
Cropping machine	4.21	5.83	4.99	0.4903	0.7002
Inspector table	4.43	5.87	5.14	0.5386	0.7338

. S. D.> Standar Deviation
S. E.> Standar Error

Table 5: Distribution of single and multiple enterotoxins produced by Staphylococcai coagulase + ve isolated from slaughter house equipments. (Set-Repla Kits).

Equipment	No. of isolates Coagulase+ve		Entrotoxigenic Strain		Entroxin Production													
					Single Produce Strain								Multiple Produce strain					
					A		B		C		D		A+B		A+B		C+D	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Scalding tank	14	9.62	1	7.1	1	100	-	0	-	0	-	0	-	0	-	0	-	0
Plucker	33	13..25	3	9.09	2	66.67	-	0	-	0	1	33.3	-	0	-	0	-	0
Neck sliter	21	8.43	1	4.76	1	100	-	0	-	0	-	0	-	0	-	0	-	0
Vent opening	41	16.46	6	14.63	5	83.33	-	0	-	0	1	16.7	-	0	-	0	-	0
Opening machine	43	17.26	8	18.60	6	75.00	-	0	-	0	2	25	-	0	-	0	-	0
Eviscerator / spoon	48	19.27	11	22.91	6	54.55	-	0	-	0	5	45.5	-	0	-	0	-	0
Cropping machine	31	12.44	9	29.03	5	55.56	-	0	-	0	4	44.4	-	0	-	0	-	0
Inspector table	18	7.22	5	27.77	5	100	-	0	-	0	-	0	-	0	-	0	-	0
Total strain	249	100%																

of Staphylococcus aureus count than those entering it. This due to increased sensitivity of Staphylococcus aureus to temperature in the range of 0-1°C. Nearly similar findings were reported by Hartsell (1951), Ingram (1951), Gerorgala and Hurst (1963), Jackson (1974), Patterson and Jackson (1979a and 1979b), Karim and Yu (1980), Kraft et al. (1981), El mossalami et al. (1986) and Hamdy et al. (1986) while after packing the count was increased to 3.43, Kusch, 1977. Notermans et al. (1982), Adams and Mead, 1983 and Thompson and putterson, 1983 stated that staphylococcus aureus strain which contaminate poultry carcasses following processing, have their origin from either contaminated equipment or carrier persons in the processing plant or from hand lesion of workers in the plant. While after blast freezing (-40°C) the count was reduced to 2.26. Hartsell, 1951; Ingram; 1951; Gerorgala and Hurst, 1963; Jackson, 1974; Patterson and Jackson, 1979a and 1979b; Karim and Yu, 1980 Kraft et al. 1981, Notermans et al; 1982; Sedik 1982; El-mossalmi et al; 1 986 and Hamdy et al., 1986 stated that freezing killed high proportion of microorganisms especially immediately after freezing and die gradually on storage in frozen state. Results given in table (3) reveal that the incidence of staphylococcus aureus coagulase positive proved to be 10.98% of examined chicken after defeathering, 19.78% after opening, 28.57% after removal the giblets 12.08% after inside and outside washing, 30.29% after air chilling (0°C), 15.38% after packing and 9.89% after blast freezing (-4°C) respectively. While with concerning the enterotoxigenicity of isolated staphylococcus aureus strains proved to be 0% after defeathering, 11.11% after opening, 23.08% after removal of giblets, 9.09% after inside and outside washing, 0% after air chilling

(0°C), 21.43 % after packing and 11.11% after blast freezing (-40°C). Nearly similar results finding were reported by Thompson and Patterson (1983).

Results given in table (4) reveal that the staphylococcus aureus count in log / cm2 of examined scalding tank, plucker, neck sliter, vent opener, opening machine, eviscerator / spoon, cropping machine and inspector table were 2.99, 4.15, 4.26, 4.63, 4.97, 4.99 and 5.14, respectively. This indicate that slaughterhouse equipment plays an important vechicle for transmission of pathogenic bacteria to poultry carcasses during processing. Nearly similar finding were reported by Kusch (1977), Notermans et al (1982), Adams and Mead (1983) and thompson and Patterson (1983). Results given in table (5) reveal that the incidence of staphylococcus aureus coagulase positive proved to be 9.62% of examined scalding tank, 13.25% of plucker, 8.43% of Neck sliter, 16.46% of vent opener, 17.26% of opening machine, 19.27% of eviscerator / spoon 12.44 % of cropping machine and 7.22% of inspector table respectively. While with concerning the enterotoxigenicity of isolated staphylococcus aureus strains proved to be 7.1%, 9.09, 4.76, 14.63, 18.60, 22.91, 29.03 and 27.77 of examined scalding tank, plucker, neck sliter, vent opener, opening machine, eviscerator/spoon, cropping machine and inspector table, respectively. While As for enterotoxigenic staphylococcus aureus types, it is evident that the isolates were able to produce enterotoxin type A and D. Nearly similar findings were reported by Public Health Laboratory (1969), Public Health Laboratory (1970), Sim kovicova and Gilber (1979), Hobbes (1971) and Sedik (1982).

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