Dept. of Food Control.
Faculty of Vet. Med., Alex. Univ.
Head of Department: Prof. Dr. A.A. Ahmed

BACTERIOLOGICAL EVALUATION OF MEAT PROCESSING ESTABLISHMENT AND THEIR CONTROL

(With 3 Tables)

By

I.A. SAMAHA* AND A.A. DRAZ

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التقييم البكتريولوجى لمنشآت تصنيع اللحوم وكيفية وقايتها

إبراهيم سماحة ، عبد الماجد دراز

تم جمع عدد مسحات من سطح مناضد التقطيع عدد (٢٥) ، الأوعية عدد (٢٥) ، المفارم عدد (٢٥) من مصانع اللحوم فى محافظة الأسكندرية. وتم فحص هذه العينات بكتريولوجيا (العدد الكلى للبكتريا ، عدد البكتريا القولونية، عدد البكتريا السبحية وعدد البكتريا العنقودية) بالاضافة الى ذلك تم تصنيف البكتريا التى تم عزلها. وقد أسفرت النتائج على زيادة عدد البكتريافى العينات وخاصة من المفارم. كما تم دراسة تأثير بعض المطهرات مثل نوجيرم ٥٠ ، ناسكوسييت ومسيروجيرم على العدد الكلى للبكتريا من الناحية العملية.

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*: Dept. of Microbiology and Animal Hygiene.

SUMMARY

A total of 75 swabs was collected from the surface of cutting tables (25), containers (25) and mincing machines (25) of meat processors located at Alexandria Governorate. The swabs were examined bacteriologically including total bacterial count, coliform count (MPN), Enterococci count (MPN) and Staphylococcus aureus count. The results indicate high bacterial counts and the machines were found to be highly contaminated in relation to cutting tables and containers. Identification of the isolated bacteria from the examined equipments was carried out. In addition the effect of the sanitizers such as No germ 50, Nascosept and Misrogerm on the bacterial count in practice were investigated and determined.

INTRODUCTION

The hygienic status of the meat processing equipments had been of interst to a number of investigators and resulted in the publication of several papers *(GILBRET and MAURER, 1962; WYATT and GUY, 1980 and WILLIAMS* et al., *1983).* Meat processing establishments are one of the most important source through which meat products may be contaminated.

The bacterial residue on processing equipments has a cumulative effect in contaminating processed meat products with bacteria. The cumulative contamination of meat products caused by poor cleaning and sanitizing of equipments could have a significant effect on product shelf life and safty *(WILLIAMS* et al., *1983).*

Microbiological quality of meat ptoducts depends mainly upon the sanitary conditions of the meat processing equipments. *DOUGLAS and DOROTHY (1963)* adviced the use of quaternary ammonium compounds in concentrations ranged between 1:2000 and 1:5000 in food industry, dairy equipments and utensils.

This work was done to determine the degree of contamination of the surfaces of meat processing equipments and to evaluate the effectiveness of some quaternary ammonium compounds (QAC) on some of the contaminated objects.

MATERIAL and METHODS

A total of 75 swabs were collected from the surfaces of the different equipments used in meat processing establishments including cutting tables (25), containers (25) and mincing machines (25). The swab technique was used. Swabs previously moistend in a sterile 0.1% peptone water were streaked firmly and uniformaly with the equipments 12-15 times in one direction in a path of 10 cm^2 *(WILLIAMS ET AL., 1983).*

From the original test tube containing the swab 10-fold serial dilutions were done. Then, the samples were subjected to the following bacteriological examinations according to *A.P.H.A. (1984):*

a- Total bacterial count b- Coliform count (MPN).
c- Enterococci count (MPN) d- Staphylococcus aureus count

Identification of the isolated bacteria were carried out according to *CRUICKSHANK et al. (1978).* Quaternary ammonium compounds including No germ 50, Nascosept and Misrogerm were applied on the surface contact of cutting tables at a concentraion of 1:2000, 1:450 and 1:100. Ten swabs were taken from each sanitizer after the elapse of 15 and 30 minutes and subjected to total bacterial count according to *A.P.H.A. (1984).*

RESULTS

Are tabulated in Tables 1, 2 and 3.

DISCUSSION

The figures listed in Table 1 revealed that the mean value of total bacterial count per 10 cm^2 of cutting tables, containers and mincing machines was $1.01 \times 10^7 \pm 2.38 \times 10^6$, $2.4 \times 10^7 \pm 4.5 \times 10^6$ and $2.7 \times 10^7 \pm 2.03 \times 10^6$ respectively, coliform count (MPN) was $1.09 \times 10^5 \pm 6.1 \times 10^4$, $7.6 \times 10^5 \pm 2.4 \times 10^5$ and $2.6 \times 10^6 \pm 8.6 \times 10^5$ respectively. Concerning with Enterococci (MPN) was $1.1 \times 10^5 \pm 4.01 \times 10^4$, $1.1 \times 10^5 \pm 1.5 \times 10^4$ and $3.6 \times 10^6 \pm 1.03 \times 10^6$ respectively. In addition, the mean value of Staph. aureus count was found to be $5.3 \times 10^4 \pm 1.4 \times 10^4$, $6.6 \times 10^5 \pm 1.4 \times 10^5$ and $1.2 \times 10^6 \pm 2.8 \times 10^5$ respectively. These results are nearly similar to that reported by *WILLIAMS et al. (1983); GILBERT and MAURER (1968).* However, the high bacterial counts of the examined swabs reflect the bad hygienic measures of the tested meat processer equipments.

In addition, surface of equipments may contain films of food deposits that provide microenvironment acceptable for survival and growth of microorganisms. So, the potential for microbial build up on equipment is improperly cleaned and sanitized *(BANWRT, 1979 and FRAZIER & WESTHOFF, 1983).*

Swabbing may be considered as an effective tool for monitoring and measuring equipment sanitation, the total bacterial count can be used as a measure of the effectiveness of sanitation procedures used on processing equipment which include cleaning of equipment and application of sanitizer as well as Food and Drug adminstration (1967). However, properly cleaned and sanitized processing equipment should have total bacterial count for not more than 100 colonies per 8 in cm^2 *(WILLIAMS, et al., 1983).*

Coliforms, a broad group of bacterial species can be isolated from soil, water, vegetation, faeces and skin or hide of animals during processing. The presence of coliforms on processing equipments may indicate either direct or indirect contamination of the equipment with faecal material. However, processing equipment can be contaminated with animal or human faeces by cross contamination from a prior contaminated sources such as beef carcases or human hand *(CHORDASH and INSULATA, 1978 and NEWTON et al., 1977).*

Isolation of Staph. aureus from processing equipments surfaces may indicate inadequate cleaning and sanitizing of processing equipments *(MINOR and MARTH, 1976).* Staph. aureus naturally inhabits the skin, mouth and nose of humans as well as animal hides and skin. However, Coliforms and Staph. aureus are sensitive to sanitizers and should not be isolated from properly cleaned and sanitized equipment surfaces *(WILLIAMS et al., 1983).*

Mincing machines were found to be highly contaminated in relation to cutting tables and containers and this may be due to the improper cleaning and sanitization.

In addition, the isolation of pathogenic and potentially pathogenic bacteria from the examined equipments (Table 2) at various percentages indicated that, the meat processers may act as a dangerous source of meat contamination.

It is evident from table 3 that the bacterial counts were found to be significantly decreased after the application of quaternary ammonium compounds at a proper concentration and suitable time. In addition. No germ 50 was found to be the most efficient sanitizers used in

sanitization of meat processor equipments at a concentration of 1 : 2000 after 30 minutes. However, Quaternary amonium compounds are more wide spreaded than the phenolic compounds for they have the advantage of being odourless, colourless, tastless, non-irritating to that they have not toxic residues. So, many workers prefer the use of such compounds *(DOUGLAS & DOROTHY, 1963; CLAUSEN, 1966; EL-BAHAY et al., 1968; ALI, 1969 and HUSSIN, 1977).*

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Table (1) : Statistical analysis of data obtained from the bacteriological examination of meat processor equipments (per 10 cm^2) .

Variable counts	Cutting tables (25 samples)			Containers (25 samples)			Mincing machines (25 samples)		
	Min.	Max.	Mean ±S.E.M.	Min.	Max.	Mean ±S.E.M.	Min.	Max.	Mean ±S.E.M.
T.B.C.	$2.6x10^4$	$3.5x10^7$	$1.01x10^7 \pm 2.38x10^6$	$7.2x10^5$	$3.1x10^8$	$2.4x10^7 \pm 4.5x10^6$	$1.1x10^6$	$3.5x10^8$	$2.7x10^7 \pm 2.03x10^6$
Coliform count(MPN)	$3x10^3$	$1.1x10^6$	$1.09x10^5 \pm 6.1x10^4$	$3x10^4$	$5x10^6$	$7.6x10^5 \pm 2.4x10^5$	$3x10^4$	$1.1x10^7$	$2.6x10^6 \pm 8.6x10^5$
Enterococci count(MPN)	$3x10^3$	$5x10^5$	$1.1x10^5 \pm 4.01x10^4$	$3x10^4$	$2.3x10^5$	$1.1x10^5 \pm 1.5x10^4$	$7x10^4$	$1.1x10^7$	$3.6x10^6 \pm 1.03x10^6$
Staph.aureus count	$1.4x10^3$	$4.2x10^5$	$5.3x10^4 \pm 1.4x10^4$	$3.2x10^4$	$2.3x10^6$	$6.6x10^5 \pm 1.4x10^5$	$3.9x10^4$	$4.5x10^6$	$1.2x10^6 \pm 2.8x10^5$

Table (2) : Percentage of pathogenic and potentially pathogenic bacteria isolated fron meat processors .

Isolates	Site of examination								
	Tables			Containers			Machins		
	No.	Freq.	%	No.	Freq.	%	No.	Freq.	%
E.coli	25	14	56	25	14	56	25	19	76
Klebsiella spp.	25	6	24	25	7	28	25	8	32
Shigella flexneri	25	4	16	25	5	20	25	5	20
Pseudomonas spp.	25	13	52	25	12	48	25	16	64
Proteus morgamii	25	7	28	25	8	32	25	9	36
Proteus rettgeri	25	6	24	25	7	28	25	8	32
Proteus mirabils	25	3	12	25	4	16	25	6	24
Proteus vulgaris	25	5	20	25	8	32	25	5	20
Arizona spp	25	1	4	25	2	8	25	3	12
Enterobacter	25	8	32	25	10	40	25	12	48
Providencia	25	2	8	25	3	12	25	5	20
Strept. faecium	25	25	100	25	25	100	25	25	100
Strept. faecalis	25	25	100	25	25	100	25	25	100

Table (3) : The bactericidal effect of some sanitizers used for food industry equipments .

Sanitizer	Concentration	Total bacterial count	
		15 min.	30 min.
No germ 50	1 : 2000	$1.2\ 10^2 \pm 1.09\ 10$	$1.05\ 10^2 \pm 0.8\ 10$
Nascosept	1 : 450	$3.9\ 10^2 \pm 4.02\ 10$	$3.0\ 10^2 \pm 2.5\ 10$
Misrogerm	1 : 100	$5.3\ 10^2 \pm 3.7\ 10$	$4.5\ 10^2 \pm 3.6\ 10$