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الحالة الصحية للماء والهواء بمجزر أسيوط

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لدراسة مايلعبه الماء والهواء في تلوث اللحوم بمجزر أسيوط تم أخذ ٢٥ عينة من كل منهما أثناء الذبح وتجهيز الذبائح وفحصها ميكروبيولوجيا لتحديد العدد الكلي للميكروبات ، عدد الميكروبات المعوية ، عدد الميكروبات المعوية السبحية ، الميكروب المكور العنقوى ، الذهبي ، العدد الكلي للخمائر والفطريات ، وقد وجد أن متوسط أعداد هذه الميكروبات في ١٠٠ سم ماء (١٠ × ٧١ ، ١٠ × ١٢ ، ١٠ × ٣٢ ، ١٠ × ٣٢٢ ، ١٠ × ٣٢٢) بالترتيب ، أما في الهواء فكان (١٢٤ × ١٠ ، صفر ، ٥ × ١٠ ، ٣٩ × ١٠) في المتر المكعب ، ولم يستدل على وجود الميكروبات اللاهوائية والسالمونيلا .

وقد تم تصنيف الميكروبات المعزولة - وقد ناقش البحث الأهمية الصحية لهذه الميكروبات .

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HYGIENIC STATUS OF AIR AND WATER IN SLAUGHTER-HALLS OF ASSIUT ABATTOIR

(With 5 Tables)

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SUMMARY

25 samples each of air and corresponding water were taken from slaughter halls in Assiut Abattoir and examined for total colony count, total coliforms, enterococci, staphylococcus aureus, salmonellae, as well as yeast and mould counts. Water in the slaughter halls was found to be contaminated with coliforms, faecal coliforms, enterococci, yeast and moulds. The aerobic plate count exceeds $2 \times 10^4/100$ ml water, while in air was $2 \times 10^4/m^3$. E.coli, Citrobacter spp. and Klebsiella spp. were the most frequently isolated total coliforms from water samples, whereas in airborne state. Strept faecalis, Klebsiella and Citrobacter spp. were the most common. It was concluded that strept faecalis is considered as indication of airborne state, while coliforms of water contamination. The hygienic significance of the isolated organisms was discussed.

INTRODUCTION

Detection and enumeration of microorganisms on environmental surfaces is of concern not only in the food industry but also in such areas as slaughter houses and the like (FAVERO, *et al.* 1968 and WALTER, 1955).

In general, the level and type of surface contamination is the desired information. The food industry puts such information to use in evaluating the efficiency of cleaning and sanitizing compounds and in assessing the overall sanitary condition of food processing areas.

Polluted water has long been known to be a potential source for microbial contamination of meat carcasses during their dressing and evisceration.

In the U.A.R., water in built up basins are used for washing carcasses, internal organs, knives, wiping clothes, as well as hands. Thus, the probability of water contamination with different microorganisms tend to be very great. Various attempts were performed to evaluate bacterial count and to detect different microorganisms from water used in slaughter houses (EL-MOSSALMI, *et al.* 1963; NASR and EL-SAWAH, 1964).

Air does not contain a natural flora of microorganism, but dust particles or moisture droplets present in air may pick up the microorganism. The kind of microorganism found in air in a given area depend on many factors; Droplets of moisture of persons talking, coughing and sneezing may contribute microorganisms to the air. Soil clinging to shoes and other clothing

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and soil adhering to material brought into this area are examples of the sources of microorganisms that may be transmitted through air. Therefore, air may serve as a reservoir of contaminant. If forced air is used on foods, contamination of food from air is greater than in still air. Air contamination may be induced unintentionally, when inflating carcasses by air to facilitate hide removal. The air is forced through by mouth which adds further to the hazards of contamination (WASSEF, 1969).

Coliform bacteria have served as indicator of fecal contamination of water and their densities have been utilized as criteria for the degree of pollution. Some investigators have suggested that these organism would serve equally well as indicators of airborne contamination by waste water (ADAMS, *et al.* 1970 and GROFF, *et al.* 1973). Other investigators emphasized the poor survival of coliform bacteria especially *E.coli* in the airborne state and suggested the possibility of using klebsiella (SORBER, *et al.* 1976), *Alcaligenes faecalis* (KING, *et al.* 1973), *Streptococcus faecalis* (CROWFORD, 1977) as indicator organisms for air pollution.

For a practical judgment it is necessary to evaluate the hygienic status of slaughter halls by determining the total viable count as well as estimating the different types of microorganisms in one cubic meter of air and 100 ml of water used in the such halls.

MATERIAL and METHODS**Sample collection :**

25 air samples were collected at a level of 1.5 meter from different locations in Assiut abattoir, using liquid impinger at a flow rate of 10 liter per minute (COWN, *et al.* 1956). The samples were kept on ice during transport to the laboratory and microbiologically examined as soon as possible without any delay. 25 samples were also collected from the different sources of water used in different slaughter halls at Assiut abattoir including bucket, built up basins and water reserves as well as tap water. Each sample was obtained in a sterile one litre capacity sample bottle. The bottle were stored on ice during transport and examined as soon as possible after their arrival to the laboratory..

Standard plate count agar was used for estimation of aerobic plate count according to A.P.H.A. (1972). Total coliform levels in the sampler collecting fluid and water were estimated by M-endo broth with 15% agar and the colony forming units (CFU) per 100 ml of water or cubic meter of air were calculated according to TELTSCH, *et al.* (1980) which were adopted for estimating quantitatively the levels of salmonella in air and water samples. Coagulase positive staphylococci count was carried out by the methods described by (THATCHER and CLARK, 1968), while sodium chloride broth tubes used for isolation and identification of staphylococci was carried out according to (BAILEY and SCOTT, 1978). The method adopted for enterococci count was in accordance with (A.P.H.A., 1972; EFTHYMIU and JOSEPH, 1974). Enumeration of *C.perfringens* was carried out according to BEERNS *et al.* (1980) and was determined by referring the combination of positive tubes to MPN table consulted by DEMAN (1977). Members of isolated enterobacteriaceae strains were identified according to (COWAN and STEEL'S, 1974; BAILEY and SCOTT, 1978).

RESULTS

The obtained results were tabulated in Tables 1, 2, 3, 4 and 5.

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DISCUSSION

Results given in Table (1) revealed that the aerobic plate count (APC) of examined water samples ranged between 2×10^4 and 21×10^7 with a mean value of 7.1×10^6 per 100 ml of water, while the mean value of APC for cubic meter of air was 12.4×10^5 with a minimum of 2×10^4 and a maximum of 68×10^6 .

Concerning coliform organisms, the M.P.N per 100 ml of water varied between 15×10^4 and 3×10^7 with a mean value of 1.2×10^6 in (Table 1). It is clear from (Table 3) that the number and frequency percentage of the isolated and identified coliform organisms from water were: *E. coli* 11 (13.58 %), *Klebsiella* spp. 8 (9.88 %), *Citrobacter* spp. 6 (7.41 %) and *Enterobacter* spp. 3 (3.7 %).

As shown in (Table 4) that the identified coliform organism which could be detected in the air samples were *Klebsiella* spp. 11 (18.83 %) and *Eterobacter* spp. 10 (16.67 %).

It is clearly evident from our results that *E. coli* were detected from water samples representing 13.58%. The isolation of such organism is of great hazard. It indicates recent faecal contamination of such water. Besides, this organism may be opportunistically pathogenic (BAGLEY and SEIDLER, 1978; MARTIN & WASHINGTON, 1971) or capable of producing enterotoxin (KLIPSTEIN *et al.* 1973). *E. coli* can grow on meat in hot climate resulting in undesirable changes in meat constituting a public health hazard (JUNE *et al.* 1953). Moreover, *E. coli* has been implicated in cases of food poisoning. Pathogenic serotypes are also responsible for colienteritis, nephritis, cystitis in man as well as, enteritis and mastitis in cattle (MACKIE and MACCARTNEY, 1962).

Proteus species including *proteus morganii* (2.47%), *proteus rettgeri* (11.11%) were encountered in water samples examined. On the other hand *proteus morganii* (1.67%) is the only species detected in the air samples. However the isolation of such organisms constitutes a public health problem. *Proteus* species have been found to be involved in the spoilage of meat and sometimes give a putrifactive odour and cause food poisoning (FRAZIER, 1967).

Other species of enterobacteraceae including *Klebsiella* spp (9.88%), *Citrobacter* spp (7.41%) and *Serratia* spp. (2.47%) were recovered from air and water samples. These organisms are responsible for food-borne outbreaks of gastroenteritis especially children (BAILEY and SCOTT, 1978).

Pseudomonas species were isolated from water samples representing (6.17%). The hygienic significance of the isolated *Pseudomonas* species lies in the fact that they affect the keeping quality of meat. Moreover, they considered as potential food poisoning organisms.

It can be seen that the most common coliform in water was *E. coli*, whereas in air is uncommon. Concentrations of coliform bacteria in airborne state are very rare where the reason is their low resistance in the air (MULLER *et al.* 1980).

Staphylococci were present in 11 (13.58 %) out of 81 total isolates from examined water samples, from which 6 (7.41 %) were coagulase-positive and 5 were coagulase-negative (Table 3). On the other hand, out of 60 bacterial isolates from air, sthylococci were detected in 21 (34.99 %) samples. Coagulase-positive and coagulase-negative *Staph. aureus* were equally present in 6 (13.33 %) samples, while *Micrococcus* species were found in 5 (8.33 %) samples (Table 4). This organism is mainly emitted from the skin, manure, upper respiratory tract of animals, dust and moisture droplets (WILLIAMS, 1963; SCOTT *et al.*, 1955). These types of organisms have been implicated as aetiological significant agents of food-borne illness. It also encountered in variety of skin abscesses, pustules and less frequently, septicemia, enterocolitis,

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osteomyelitis and pneumonitis (IVLER, 1974).

Staphylococcus aureus is one of the most common agents of food poisoning. *Staph aureus* in drinking water may also serve a source of colonizing residents exposed to contaminated water.

Salmonellae, as well as, clostridial organisms could not be detected during enumeration of such organisms.

The summarized results given in Tables (1 & 2) reported that the mean value of enterococci count per 100 ml of water was 3.2×10^5 , while that of air was 5×10^5 per cubic meter. The most predominant enterococcal isolates was strept faecalis which constituted 19 (23.64 %) and 17 (28.33 %) out of 81 and 60 bacterial isolates from water and air samples respectively as presented in Tables (3 & 4).

Enterococci is indicative of sanitary neglected measures during slaughtering and preparation of carcasses besides constitutes a public health hazards.

The average yeast and mould count per 100 ml of water varied from 4×10^2 to 121×10^5 with a mean value of 2.7×10^5 , while it varied from 1×10^4 to 114×10^5 with a mean value of 3.9×10^5 per cubic meter of air samples examined Table (1 & 2).

The identified yeast and mould from air samples were *Candida albicans* 4 (80 %) and *Aspergillus fumigatus* 1 (20 %) as presented in Table (5). Whereas, *C. albicans*, *Terulopsis glabrata*, *Aspergillus fumigatus*, *Aspergillus niger* and *Pencillium* species were the most prevalent yeast and mould isolated from water.

Spoilage yeasts are those which find their way into foods because of their wide distribution in nature resulting in undesirable changes in physical appearance of food they also responsible for mouldy taste or odour (WALKER, 1976). *C. albicans* is frequently responsible for a severe type of intestinal disturbance inspite of their habituation as saprophyte on the skin, mouth and intestinal tract of man (BAILEY and SCOTT, 1974).

It has been pointed out that the number of microorganisms in air may be reduced under natural condition by sedimentation, sun rays and washing, also removal of microorganisms from air by artificial means. Frequent cleaning of built up basins, flushing of storage tanks and in case of severe contamination intermittent chlorination of water supplies would help to eliminate various contaminants from the water and therefore lower the probability of food contamination.

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Table (4)

Incidence of isolated microorganisms from air samples in slaughter halls

Bacterial species	No of isolates	% of total
Staphylococci coagulase + ve	8	13.33
Coagulase - ve micrococcus spp.	8	13.33
Strept. faecalis	5	8.33
Proteus monganii	17	28.33
Klebsiella spp.	1	1.67
Enterobacter spp.	11	18.33
	10	16.67
Total	60	

Table (5): Frequency distribution of isolated yeast and mould from air and water samples

Total isolates	ISOLATES				
	C.albican	Aspergillus		Torulopsis glabra	Pencillium spp.
		A. fumigatus	A. niger		
Air	5	4 (80%)	1 (20%)	-	-
Water	22	6(27.27%)	5 (22.73%)	4(18.18%)	2 (9.07%)
				2 (9.07%)	5 (22.73%)