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SOURCES OF CONTAMINATION DURING THE COMMERCIAL HANDLING OF FISH

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All probable sources of bacterial contamination during the commercial handling of fish such as ice used for chilling fish, the deck and hold of fishing vessel and the floor of the auction hall were examined for total bacterial counts and coliform and faecal coliforms Most Probable Numbers (MPN).

All the surfaces examined were found heavily contaminated with bacteria especially those of faecal original. Ice which is taken from the harbour for chilling the fish on board was found to contain lesser number of total bacteria and the organisms of faecal origin as compared to the ice brought back with the catch (old ice). Methods to prevent such contaminations are discussed.

INTRODUCTION

The sources of bacterial contamination of the fish are the environment in which fish is caught – the ice used for chilling and dirty surfaces with which fish comes into contact on the deck, in the holds of fishing vessels and in the auction market at the harbour.

In normal commercial practice in Pakistan, freshly caught fish undergoes the following events. For long fishing trips fishermen take ice from the harbour; block ice is crushed manually, filled in baskets and stored in the holds of the fishing vessels. After the catch, fish and shrimps are stored with ice in the holds. Fish may be from 7-10 days in ice before landing at the harbour. On landing, fish/shrimps are placed on the market floor for auction. This may take as much as six hours. During this period they are rarely protected by ice.

This primitive handling of fish/shrimps causes a lot of damage to their quality. Attempts have, therefore, been made to assess this damage in terms of the bacterial load and to trace the sources of contamination during the commercial handling of fish at Karachi Fish Harbour.

In order to determine the extent of bacterial load of the ice carried out in the fishing vessel to chill the catch, a bacteriological survey of the ice plant and storage rooms located at the fish harbour was also conducted in accordance with the plan shown in Fig. 1.

Flow sheet diagram of the handling events of the fish before processing is given in Fig.2. During the various sequences of handling events there is strong possibility for the addition of contamination on the surface of fish/shrimp from these sources. The present communication deals with this aspect of the study.

MATERIALS AND METHODS

All the studies detailed in this investigation have been carried out in the ice plant and premises at the fish harbour Karachi. Sampling has been done for determining the level of bacterial load on harbour surfaces, boats, baskets, and water and ice used in handling the fish. Ice and water samples were collected aseptically at random for their residual bacterial load. Bacterial samples from the premises were collected using sterile swabs and transferred to sterile peptone water.

Total plate count was determined with the spread plate method using 0.1 ml of appropriate dilutions on nutrient agar (Difco, Merck) plates. Plates in duplicate were incubated at 37°C and colonies counted after 48 hours. Coliform and faecal coliform MPN were determined according to the methods described by Thatcher and Clark [1].

RESULTS AND DISCUSSIONS

Table 1 shows the bacteriological results of samples collected at various stages of ice manufacture and its passage through the ice plant premises in accordance with the scheme shown in Fig.1. It may be seen that viable count at 37°, MPN coliforms and faecal coliforms in the water used for making ice and the ice samples from the storage room were at their minimum. The total count did not exceed (av. 9.14×10^3)/ml of water or melt water and

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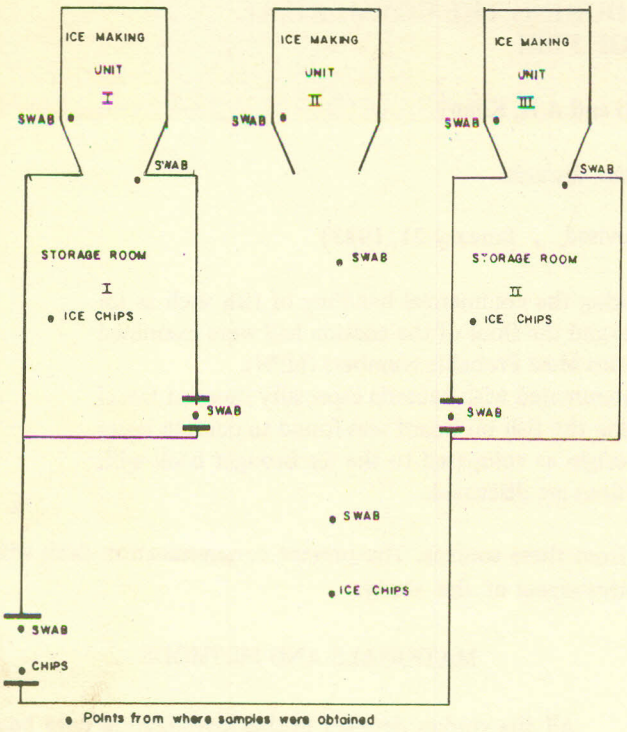

Fig. 1. Sketch of ice plant and storage rooms showing the sampling points.

MPN coliforms and faecal coliform were not more than av. 2.1 and 0.1 respectively. However, the ice from premises and the floor surfaces show a high count of both the total bacteria and the organisms of faecal origin. Since the floor was found to be highly contaminated and the ice blocks are moved through the premises by sliding on the floor, ice which comes incontact with dirty surfaces gets contaminated. The results of this limited survey indicate that the ice which leaves the ice plant and goes on fishing vessels with load of the order containing an average of 1.87×10^4 total viable bacteria, 17.84 and 12 MPN coliforms and faecal coliforms respectively per ml melt water. These counts have a chance of further increase during crushing of ice.

Table 2 shows the number of bacteria on ice from outside the old ice and the various surfaces with which fish comes in contact during handling events. It may be noted that trucks used to transport ice from the city were found to have considerable load of total bacteria but had comparatively fewer coliforms. Total count of truck swabs ranged between 1.2×10^6 –4×10^8 (av. 2.3×10^7) and had an average of 82.5 coliforms/cm^2. The samples of market ice collected from the landing place and from the bridge were found to contain both total bacteria and the organisms of faecal origin in excess as compared to ice prepared at the barbour. Ice coming from outside the harbour had an av. more than 10^6 total organisms, 54-140 coliforms and 22.3-35 faecal coliform/ml melt water. The corresponding figures for ice prepared at the fish harbour were 9.14×10^3 – 1.87×10^4, 211 – 17.8, 0.1 – 12 for total count, MPN coliforms and faecal coliforms respectively (Table 1).

It may be seen that all the surfaces of bridges, decks, holds, baskets which are used to deliver ice and fish, ice carrier etc., were found to contain excessive number of total bacteria and the organisms of faecal origin showing upto 5.9×10^{10} total bacteria, 11,000 coliform and faecal coliform MPNs per cm^2 of the surface, the presence of these is of great hygienic interest. Old ice was found to contain higher contamination than ice either from the plant or outside.

With regards to the containers used at the market, Spenser[2] has shown that the wooden boxes at Aberdeen carry loads from $10 - 20 \times 10^7/cm^2$ of the surface. Gianelli and Braccie[3] obtained similar figures for the landing boxes at Parma. Fisher[4] found similar loads on deck, hold floor and walls. Though in excess, these loads are not as high as found on fish baskets and other surfaces during the course of this study. No figures are available to compare the organisms of faecal origin from these articles.

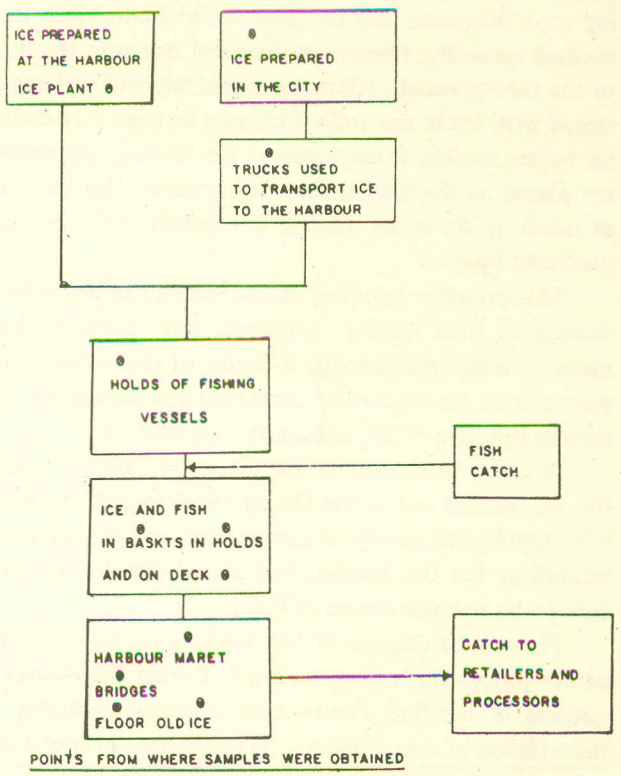

Fig. 2. Flow sheet diagram of the handling events.

Table 1. Bacteriological survey of ice manufacturing plant located at Karachi Fish Harbour.

Sample	Number of samples	TPC/ml or cm^2	Coliform MPN/ ml or cm^2	F. Coliform MPN/ml or cm^2
Water for making ice i.e. unfrozen ice from the frame	3	$1.5x10^2$–$3.94x10^5$ (1.9×10^3)	3-68 (.068)	<3
Ice from storage room	2	$1x10^3$–$1.82x10^4$ ($9.14x10^3$)	<3-4.2 (2.1)	<3
Ice from the premises of the ice factory	2	$2.34x10^2$–$1.4x10^6$ ($1.87x10^4$)	<3-35 (17.84)	3-24 (12)
Swab of ice plant	5	$2.5x10^4$–$2.7x10^6$ ($1.3x10^5$)	10-920 (526)	<3-920 (247.8)
Swab of storage room	2	$1.2x10^6$–$1.3x10^6$ ($1.35x10^6$)	150-250 (200)	100-150 (125)
Swab from the premises of ice factory	3	$1.2x10^7$–$1.4x10^7$ ($1.3x10^7$)	60-1600 (820)	20-1600 (736)

Table 2. Bacteriological counts of ice and various surfaces significant during handling of fish/shrimp.

Sample	Number of samples examined	TPC/ml or cm^2	Coliform/MPN/ or cm^2	F. Coliform MPN/ml or cm^2
Swab of trucks used from bringing ice from the city.	4	$1.2x10^6$–$4x10^8$ ($2.3x10^7$)	44-180 (82.5)	(*)
Melt water from trucks	5	4.10^3–$2.1x10^7$ ($5.1x10^6$)	34.112 (41)	7-22 (10.88)
Ice from landing place	8	$2.1x10^4$–$5.2x10^7$ ($7.53x10^6$)	86-430 (140)	11-43 (22.3)
Ice from the bridge	1	$5.4x10^6$	54	35
Swab of landing place		$2.1x10^6$–$3.2x10^8$ ($1.13x10^7$)	1,100-7,500 (1,800)	400-4,300 (820) (Av. of six)
Swab of deck	4	$4.2x10^6$–$5.1x10^9$ ($2.21x10^7$)	1.100-7,500 (1,550)	(1600) (av. of two)
Swab of baskets used to deliver ice.	2	$3.8x10^6$–$4.5x10^8$ ($4.3x10^7$)	1,100-2,800 (2,300)	(*)
Swab of ice carrier	1	$1.85x10^7$	920	180
Swab of boats 3 holds	11	$3.75x10^8$–$5.9x10^{10}$ ($2.7x10^9$)	2,800->11,00 (6,620)	1,400->11,000 (5,660)
Basket (for fish)	1	$2.3x10^9$	>11,000	>11,000
Ice from harbour	7	$1.2x10^5$–$2.8x10^7$	110-1,100	110-280

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Sample	Number of samples examined	TPC/ml or cm^2	Coliform/MPN/ or cm^2	F. Coliform MPN/ml or cm^2
Old ice	12	$(2.65x10^6)$ $5.2x10^7$–$3.1x10^9$ $(3.6x10^8)$	(815) 400-2,800 (1,100)	(260) 280-750 (640)

*Not determined.

It is interesting to note that ice leaving the factory and going on fishing vessels has slight loads of total bacteria/ faecal organisms (Table 1), the counts increase enormously during its stay at sea. The increase appears to be the result of contamination from the wall and surfaces of deck and holds. Similar results have been reported on the unused (old ice) in trawler holds on return from the fishing operation by Castell *et al.* [5].

Results of the present sutdy demonstrate that the surfaces coming in contact during commercial handling of fish at the Karachi harbour are generally heavily contaminated from bacteria and in particular with the organism of faecal origin. Contact of these heavily contaminated surfaces will certainly infect the fish catch even though the fish is carrying very little or no contamination from the environment. Thus, it is clear that handling of fish is unsatisfactory and there is need to improve it. What is required is simple hygiene during handling and for which we can take advantage of the current handling practices in developed countries.

Elimiantion of total and faecal organisms from these perishable food materials is necessary for controlling subsequent spoilage and from public health view point.

Following precautions have been recommended to avoid contamination during the commercial handling of fish. All surface that may come into contact with fish must be kept thoroughly clean to prevent contamination by spoilage or disease causing bacteria. Complete cleanliness involves the removal of the dirt with the help of a detergent so that the surface looks clean, by using a detergent, then killing any remaining bacteria by using disinfectants or sterilising agents.

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