TECHNICAL ASSISTANCE TO BUILD FOOD SAFETY CAPACITY

FOR THE FISHERIES SECTOR

Hygiene in Fish Processing

Train-the-Trainer Course for Ocean Delight, Suriname

Prepared by: Megapesca Lda Portugal

Outline

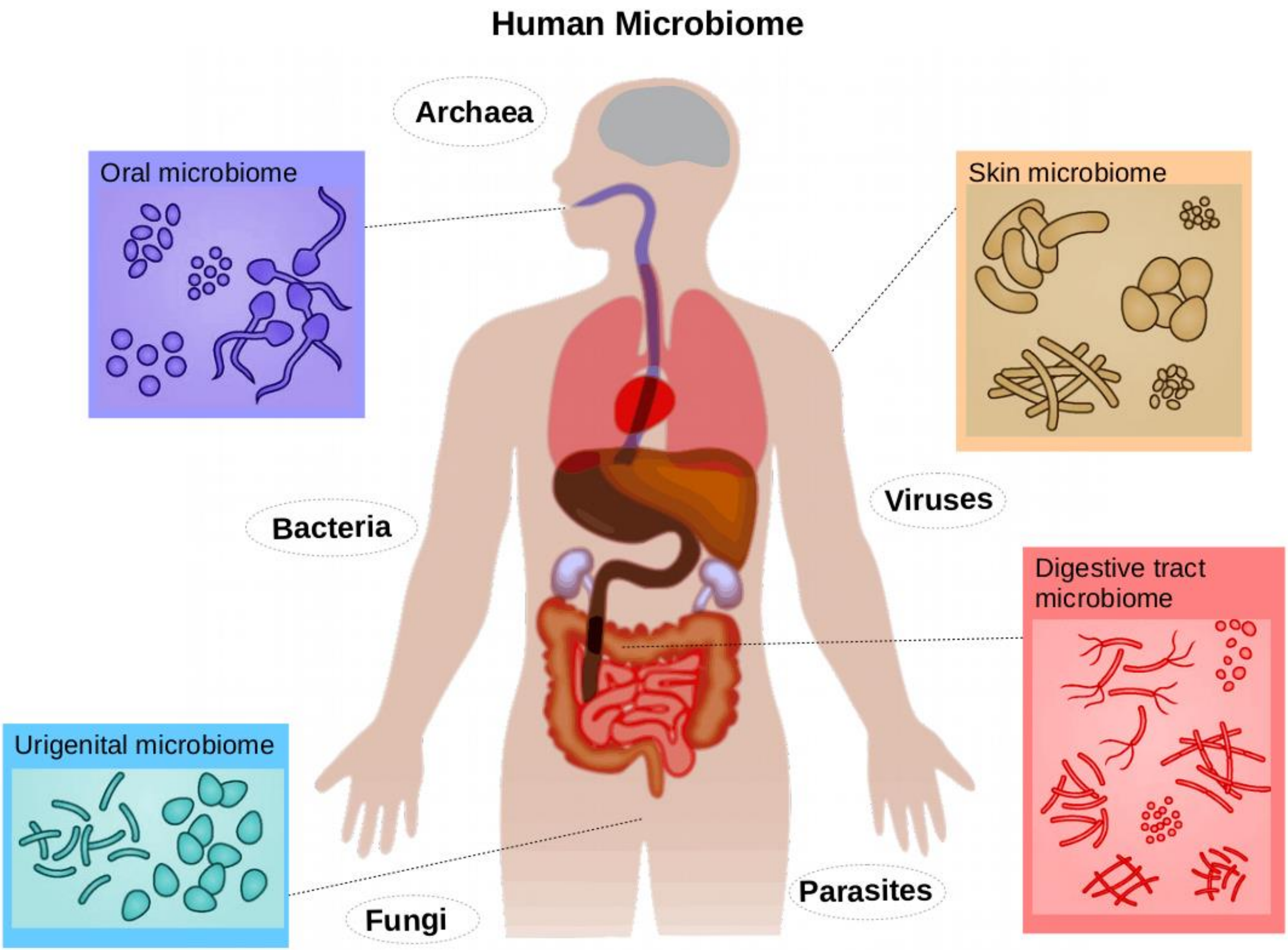
- The importance of personal hygiene
- Sources of contamination from food handlers
- The importance of effective hand hygiene in food processing
- Water quality monitoring and lab testing

The importance of personal hygiene and how workers can contaminate food and food contact surfaces

Why is protective clothing important in food processing?

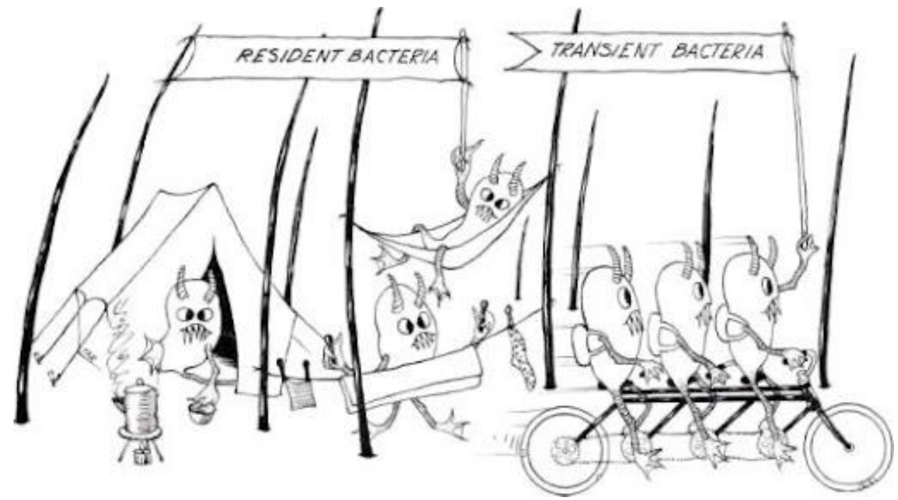
Examples:

- Hairnet
- Face mask
- White jacket that is washable
- Clean apron and gloves
- Clean boots


Human Microbiome
Archaea
Oral microbiome
Skin microbiome
Viruses
Bacteria
Digestive tract microbiome
Urigenital microbiome
Parasites
Fungi

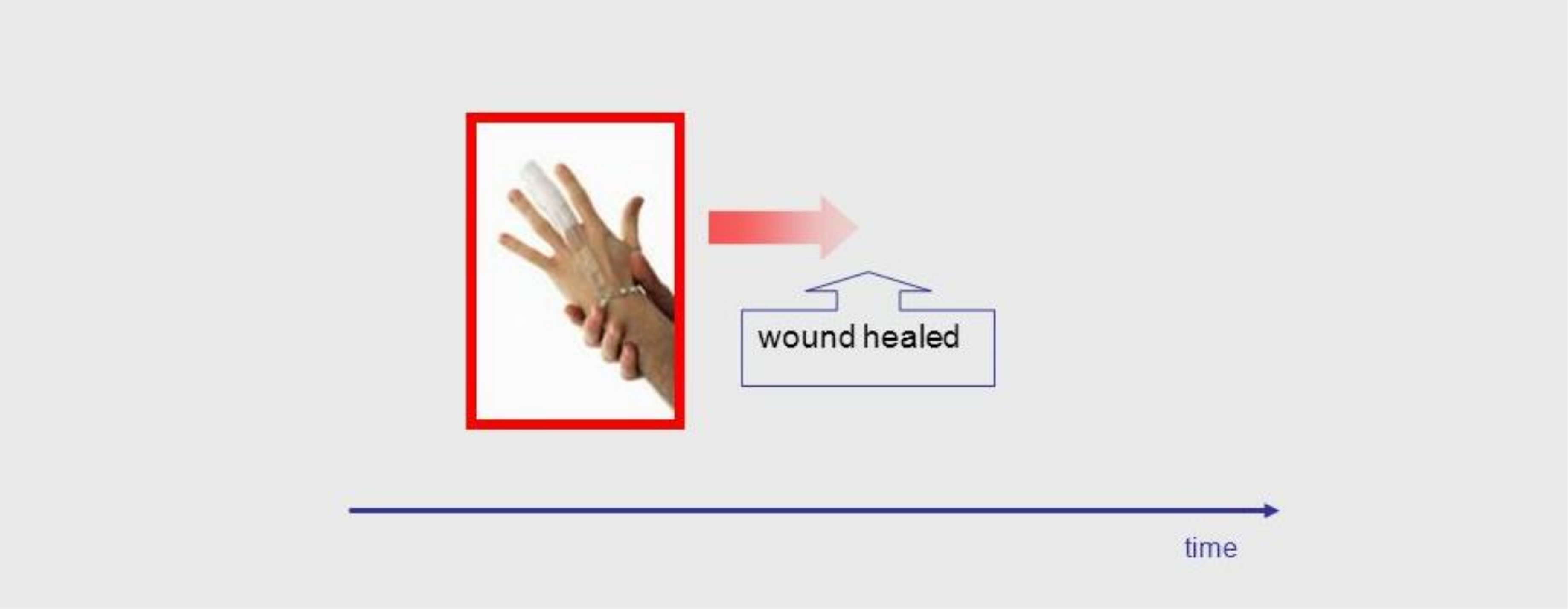
Types of skin flora

- Resident
- Transient
- Infectious/pathogenic



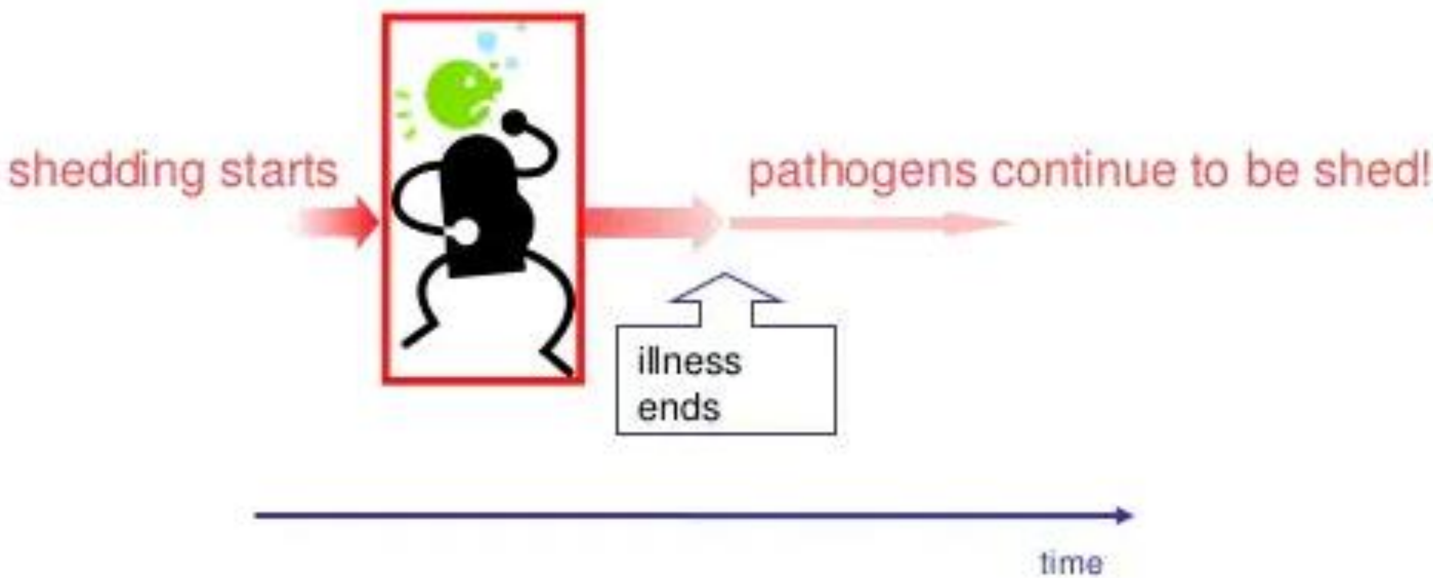
Occurence	Type	Bacteria	Dominant species
Moist and dry areas of skin	staphylococci micrococci	aerobic gram-positive cocci	staphylococcus epidermidis et hominis
Moist and dry areas of skin	coryne bacteria brevi bacteria	aerobe coryneforme rods	
Hair follicles with many sebaceous glands	proprioni bacteria	anaerobic coryneforme rods	proprionibacterium acnes
Hair follicles with many sebaceous glands	malassezia furfur	yeast fungi	pityrosporum ovale

Wounds can be a source of pathogenic microorganisms



Ill persons are a source of pathogenic microorganisms

- Food workers can be carriers of pathogenic microorganisms and therefore exhibit no signs of infection.
- Ill persons and permanent carriers are a major threat to food safety → actively shed pathogens



"TYPHOID MARY"

The Extraordinary Predicament of Mary Mallon, a Prisoner on New York's Quarantine Hospita

By Dr. Wm. H. Park., New York Board of Health.

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The importance of personal hygiene in food processing

People who do not maintain an appropriate degree of personal cleanliness, who have certain illnesses or conditions, or who behave inappropriately, can contaminate food and transmit illness to consumers.

Contamination most frequently occurs via the faecal-oral route → when pathogens are present in the faeces of ill, convalescent or otherwise colonized persons.

Outbreaks where food workers have been implicated in the spread of foodborne disease. Sources of contamination and pathogen excretion from infected and colonized workers

Todd et al., 2008.

TABLE 1. *Levels of pathogens in clinical specimens and body excretions*

Pathogen	Source of contamination	Contamination levels (per g or ml)	Reference
Salmonella	Feces while ill or during early convalescence	10^5–10^7 CFU	*126*
	Feces in late excretion period (infants excrete longer than do adults)	10^0–10^3 CFU	
	Feces during convalescence	6×10^3 CFU 15 days after illness	*85*
		5×10^2 to 6×10^7 CFU (median, 6.0×10^6 CFU) <10 days after illness; 1.3×10^2 to 1.6×10^9 CFU (median, 1.0×10^5 CFU) 10–19 days after illness; 0×10^6 to 3.5×10^6 CFU (median, 2.5×10^4 CFU) 20–25 days after illness; 7.0×10^1 to 1.8×10^5 CFU (median, 1.4×10^2 CFU) 6–35 days after illness; 2.0×10^0 to 3.5×10^4 CFU (median, 5.5×10^3 CFU) 42–50 days after illness; 0×10^4 to 6×10^4 CFU (median, 2.5×10^4 CFU) 69–102 days after illness	*103*
	Pus in infected lesions	10^7–10^8 CFU (median) for intra-abdominal and anorectal and soft tissue infections (one sample with almost exclusively *S. aureus* and two with beta hemolytic streptococci)	*70*
S. aureus and *Streptococcus pyogenes*	Saliva in a sneeze from carriers	Typical person infected with streptococci: saliva, 10^0–10^6 CFU; <100 CFU/154 cm^2 1.5–9.5 ft (0.5–2.9 m) from sneeze source. One carrier sneezed twice (days 1 and 6): saliva, 3.2×10^6 to 7.5×10^6 CFU; 23–500 CFU/154 cm^2 1.5–9.5 ft from sneeze source	*48*
S. pyogenes	Saliva in a cough from carriers	10^3–10^6 CFU (1 of 20 persons infected with streptococci coughed 6 CFU/154 cm^2 9.5 ft [2.9 m] from cough source; most of the other 19 persons did not cough any streptococci)	*48*

Outbreaks where food workers have been implicated in the spread of foodborne disease. Sources of contamination and pathogen excretion from infected and colonized workers. (Continued)

Enteroviruses (e.g., coxsackie virus, echovirus, poliovirus)		10^3–$10^{7.5}$ infectious particles; $10^{8.2}$ infectious particles	*41*
Hepatitis A virus	Feces, highest numbers before symptoms begin	10^9 virions	*95*
		10^8 infectious particles	*41*
Norovirus Group G-I	Feces while ill	2.2×10^4 to 2.9×10^{10} copies/g of feces; median, 8.4×10^5 copies/g	*20*
Norovirus Group G-II		2.5×10^4 to 7.7×10^{10} copies/g of feces; median, 3.0×10^8 copies/g	*20*
Norovirus Group G-I		GI 2.79×10^7 copies/g of feces	*98*
Norovirus Group G-I/4		GI/4 2.02×10^8 copies/g of feces	*98*
Norovirus Group G-II		GII, 3.81×10^8 copies/g of feces	*98*
Norovirus Group G-II/4		GII/4 7.96×10^9 copies/g of feces	*98*
Rotavirus	Feces and vomitus while ill	10^{11} particles excreted but only 10^6–10^7 infectious	*129*
		100 times more virus in vomitus than in feces	*24*
		8×10^9 to 10×10^9 infectious particles	*4*
		$>10^{12}$ infectious particles	*8*
		10^{10}–10^{12} infectious particles in feces	*41*
Cryptosporidium spp.		10^8–10^9 oocysts in a single bowel movement	*16*
		10^6–10^7 oocysts; 3×10^9 oocysts/day	*41*
Giardia lamblia or *G. intestinalis*		$<10^9$ cysts daily in stools	*16*
		1×10^6 to 5×10^6 cysts	*41*

Todd et al., 2008

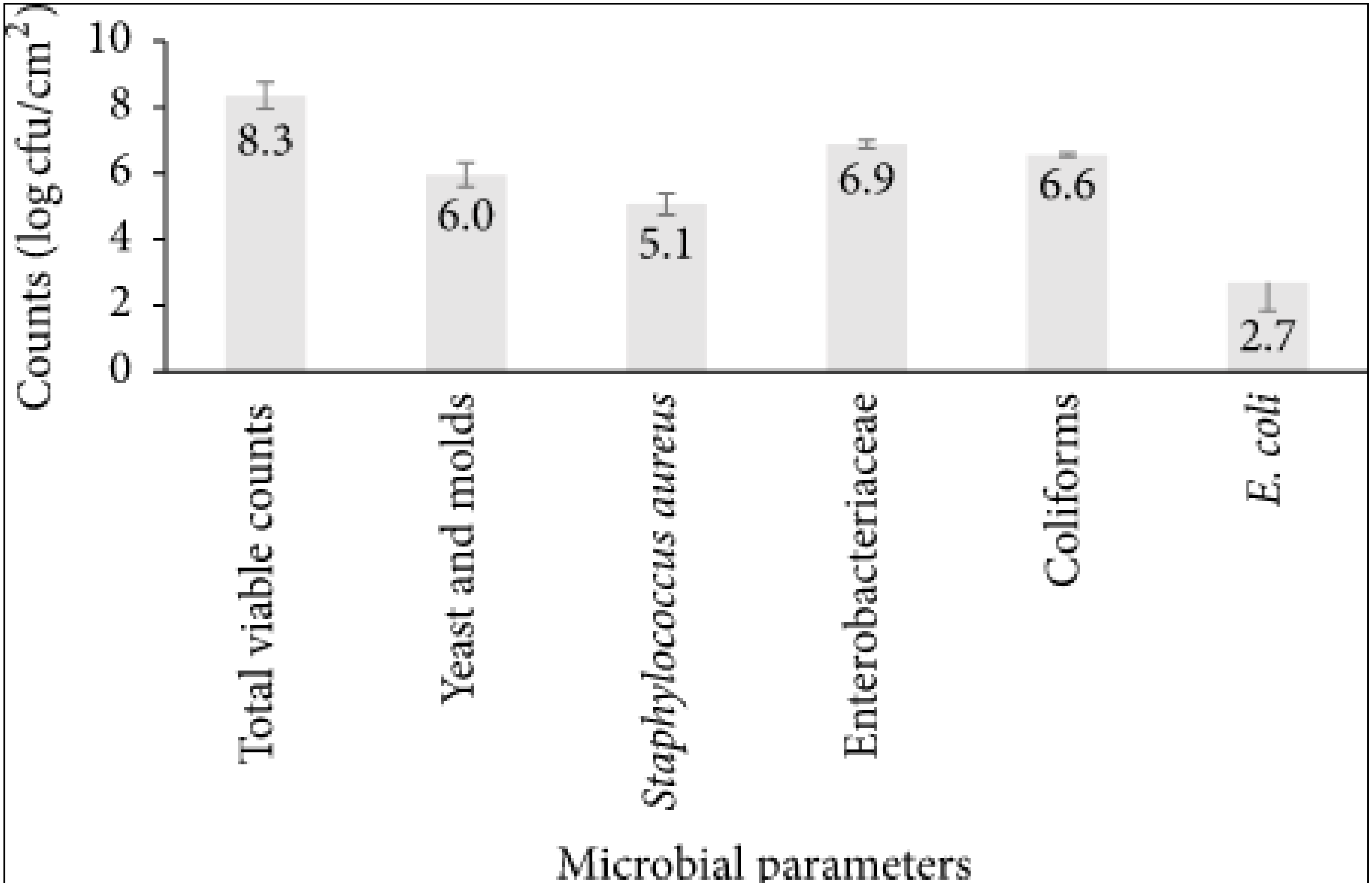
Prevalence of enteric isolates associated with food handlers and surfaces of a food manufacturing plant in Pakistan

Categories	Variables	No. of examinations	No. of detected isolates/ Percent	No. of individual detected isolates/ Percent		
				Enterobacteriaceae	*Coliforms*	*E. coli*
Plan surfaces	Floors	1350	398/ 29.5	195/ 49.0	123/ 30.9	80/ 20.1
	Doors	1275	252/ 19.8	132/ 52.4	74/ 29.4	46/ 18.3
	Walls	900	105/ 11.7	51/ 48.6	31/ 29.5	23/ 21.9
Personals care/ PPEs	Uniform	375	26/ 6.9	11/ 42.3	8/ 30.8	7/ 26.9
	Hair net	360	14/ 3.9	6/ 42.9	4/ 28.6	4/ 28.6
	Hands	370	52/ 14.1	20/ 38.5	17/ 32.7	15/ 28.8
	Papers sheets	220	0/ 0.0	0/ 0.0	0/ 0.0	0/ 0.0
	Shoe cover	370	42/ 11.4	18/ 42.9	14/ 33.3	10/ 23.8

Ali et al., 2016

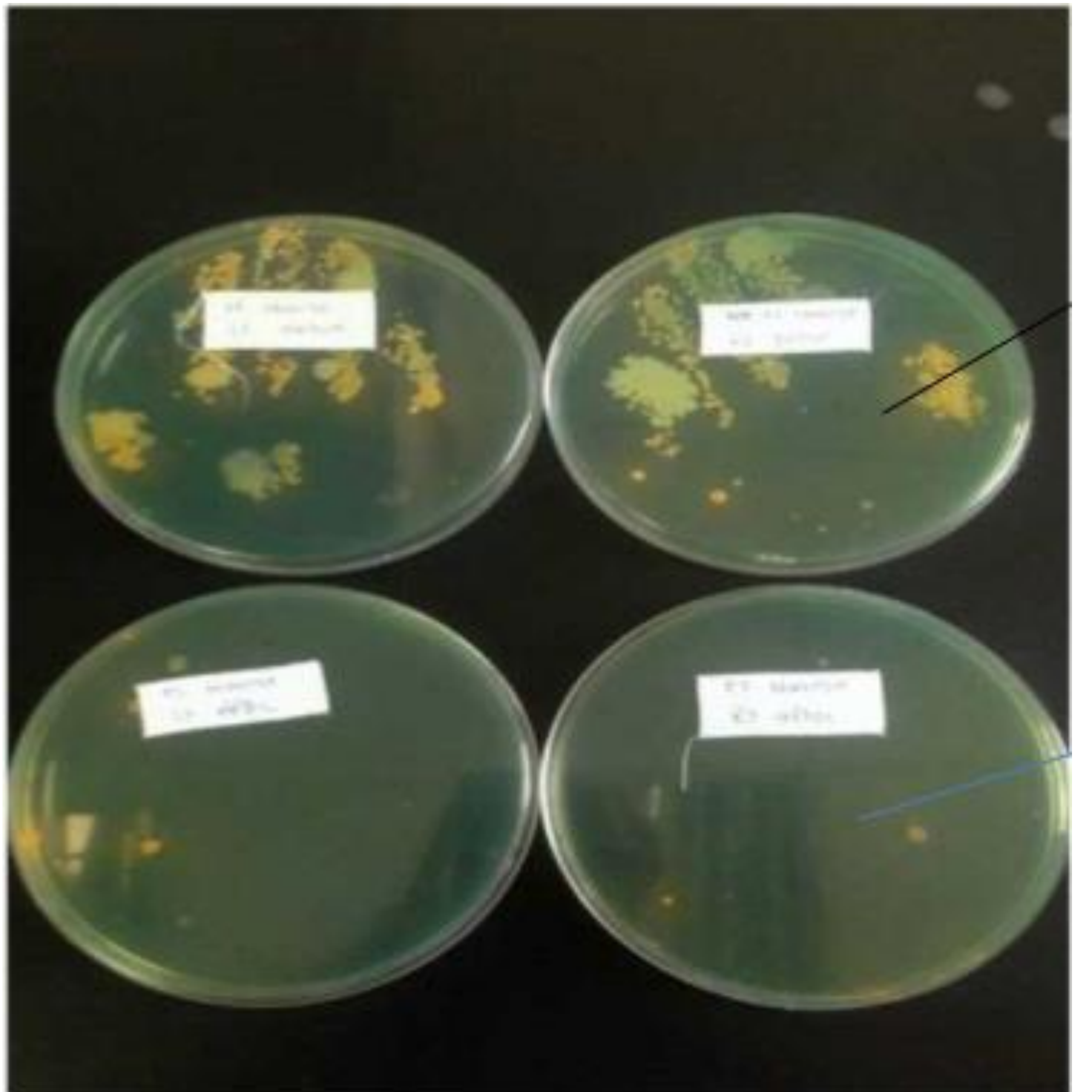
Level of personal hygiene and microbial load on hands of sweet potato puree processing plant workers in Kenya

Malavi et al., 2018



Effective handwashing/hand hygiene

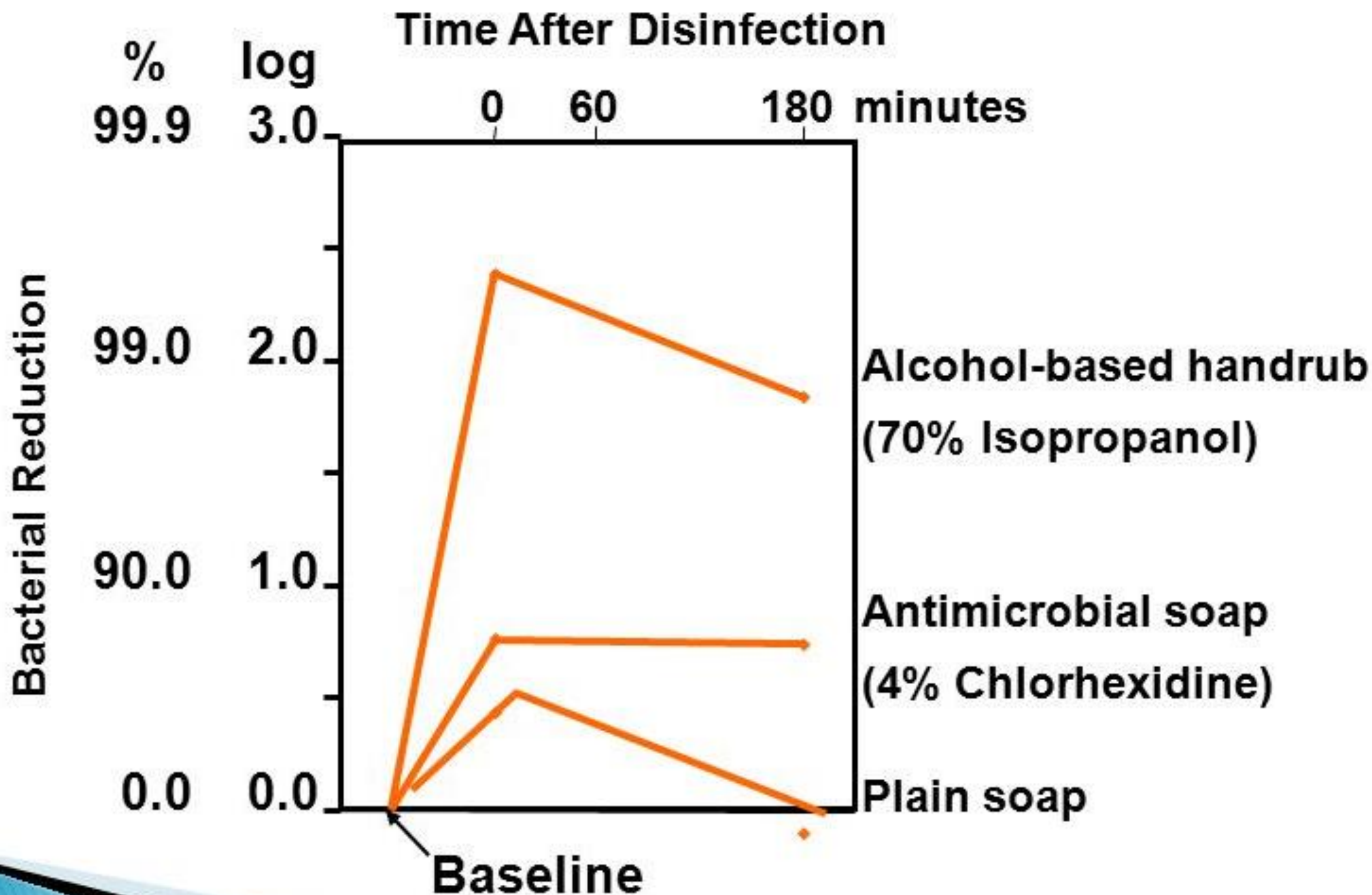
Hand cultures – before vs after hand hygiene



BEFORE

AFTER

Ability of Hand Hygiene Agents to Reduce Bacteria on Hands



FSN Food Safety News
Breaking news for everyone's consumption

Gloves Alone Aren't Enough for Food Safety

By Laurel Curran on October 11, 2010

Gloves have become something of a symbol of food safety but, in fact, can inspire a false sense of security, conclude the authors of a series of studies published in the Journal of Food Protection.

The authors say that, contrary to common knowledge, even gloves used properly in food preparation can't by themselves adequately protect against food contamination. And gloves may actually pose a number of unforeseen risks because the confidence they provide may encourage risky behavior.

The authors suggest that even the best gloves are no substitute for regular, thorough hand washing.

They explain that the warm, moist environment inside every glove is an ideal place for microbial proliferation. Glove brands differ in quality and material–vinyl gloves are more susceptible to rips than Latex gloves, for example–and bacteria can travel though the tiniest holes or tears. Long fingernails or rings greatly increase the likelihood of glove puncture, a double threat because nails and jewelry tend to harbor higher concentrations of harmful bacteria than bare hands.

The longer gloves are worn, the more likely their effectiveness as a barrier will be breached. Numerous studies recommend that food preparers should ideally put on

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Management responsibilities

Personal hygiene is a management responsibility

Management is responsible for providing

Financial means to provide facilities and resources (human and technical) to ensure GHP.

Clear guidance about expected personnel hygiene behaviour (including how to deal with sickness, absence due to sickness, disregard of hygiene rules, responsibilities, etc.)

Hygiene culture through clear commitment to GHP, visible support of QS personnel, requirement to adhere to hygiene rules for all hierarchy levels.

Controlled personnel flow

- Enter the factory only at the personnel main entrance
- Walk to the designated changing room
- Wash your hands with soap and dry with the paper towel
- Throw used paper towel in the garbage bin without touching it with the hands
- Take your personal clothes for factory work out of the designated locker
- Change city clothes into personal clothes and put city clothes in the personal locker
- Take out clean white factory uniform out of the uniform bin
- Put on factory clothes and boots
- Wear hairnet and mouth cap
- Wash hands with soap, rinse with water, disinfect with sanitizer and dry hands with paper towel
- Throw used paper towel in the garbage bin without touching it with your hands
- Wear clean gloves
- Walk through the boot cleaning station to enter the processing area

Visible signage to actively communicate personal hygiene measures

Maintaining vigilance over health of workers

"Workers should be reminded that any symptoms of illness or infection that might be passed on through food or the working environment should be reported immediately to a supervisor!"

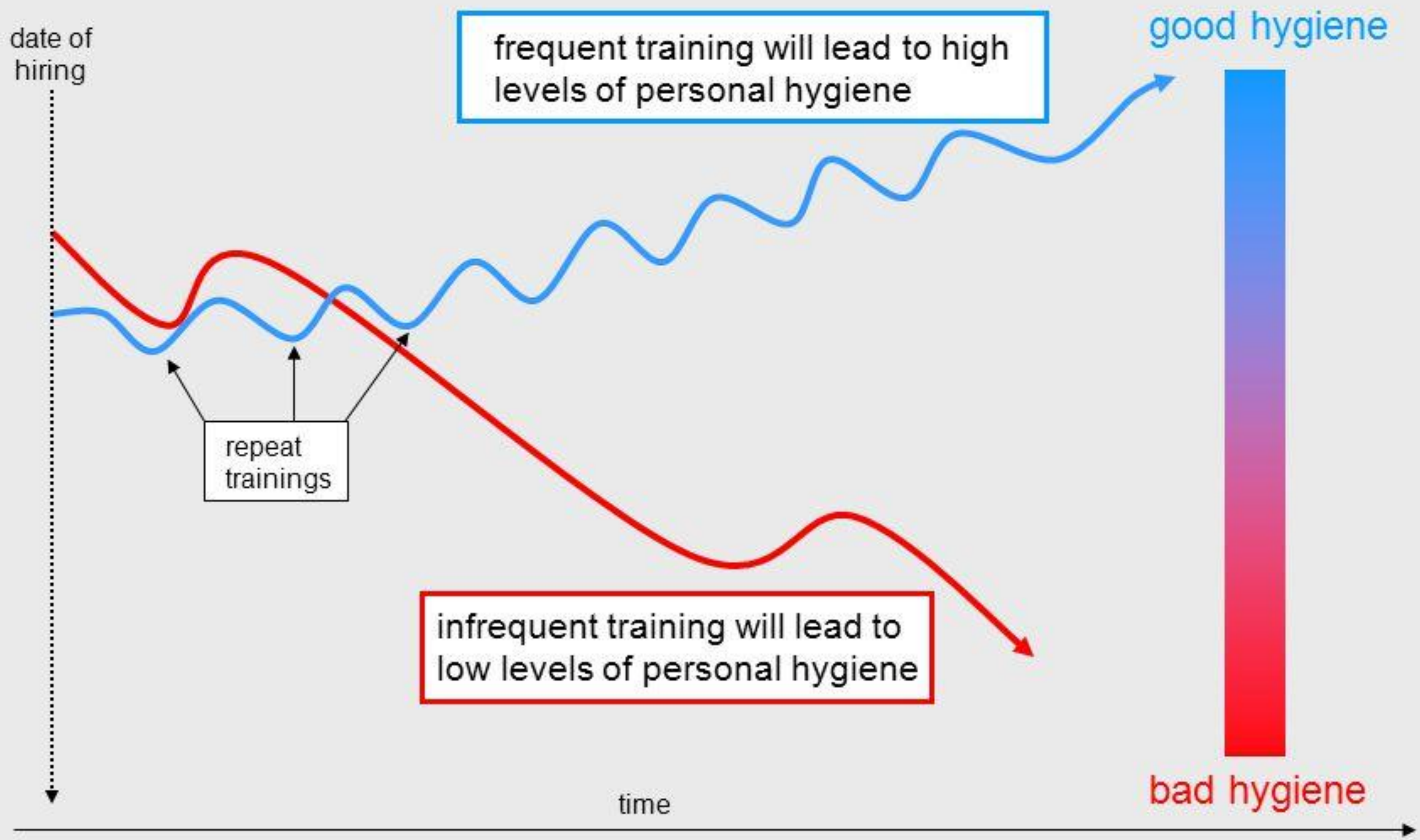
Workers should be reminded to report:

- Illnesses with symptoms of diarrhoea or vomiting
- Sore throat accompanied with a fever
- Infected sores (anywhere on the body)
- Discharge from eye, nose, ear or mouth
- Digestive issues
- Relevant medical history eg typhoid/paratyphoid

Food safety and hygiene training

Regular training sessions can promote good hygiene and a positive food safety culture within the organization.

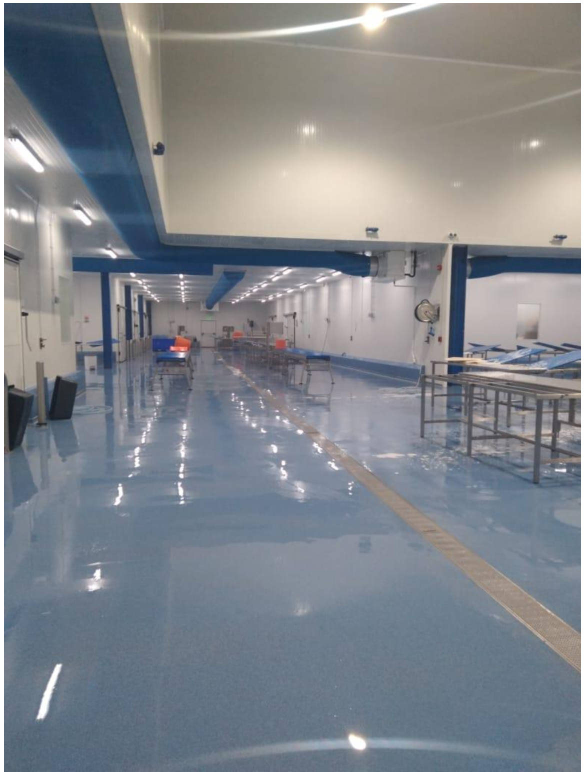
Training starts on day one and needs regular repeating



Safety of water and ice

Clean, safe water is required for:

- Ice used for cooling fish
- Cleaning and sanitation



The importance of quality of water in food processing

- The chemistry of the water, the hardness in particular, greatly affects the performance of cleaning chemicals and can be corrosive to materials
- Water can also contain a significant number of microorganisms. Water used for cleaning and sanitizing must be potable and pathogen-free
- When used in food processing it must be free from undesirable color, odor, taste, and impurities that are harmful to consumers and result in low-quality products
- Unsafe water, which results due to direct contamination or improper or inadequate water treatment processes, generally results in a contaminated food product.

Water-Borne Food Contaminants

Table1: Microbial diseases originating in water

No:	Disease	Factor
1	Cholera	*Eltor/ Vibriocholera*
2	Bacillary Dysentery	*Shigellas*
3	Typhoid	*Salmonella typhi*
4	Para typhoid	*S.para typhi A,B,C*
5	Gastroenteritis	Other *salmonellas, proteose, shigella*
6	Infantile diarrhea	Pathogen type of general *Escherichia Coli*
7	Leptospirosis	Different kinds of *leptospira*
8	Tularemia	*Pastoral, Tularensis*

Table 2 : Diseases which infect through Parasitic and Protistas.

No	Disease	Factor
1	Amoebic dysentery	Entamoba histolytic
2	Giardiasis	Giardia lamblia
3	Balantidiasis	Balantidium coli
4	Daracunculus	Deracunculus
5	Desitomatosis	Fasula hepatica or Dicroselum

Drinking water quality guidelines by different agencies

Parameters	Units	WHO	NEMA-Kenya	US-EPA	EU-Framework
Physico-chemical					
pH	pH units	6.5–8.5	–	6.5–8.5	6.5–9.5
Conductivity	µs/cm at 20 °C	–	–	–	2,500
Microbial					
Total viable counts at 37 °C/mL	CFU	–	100	500	20/mL
Total coliforms	CFU	Undetectable/100 mL	Absent	<1/100 mL	0/100 mL
E. coli	CFU	Undetectable/100 mL	Absent	<1/100 mL	0/100 mL
Enterococci	CFU	Undetectable/100 mL	Absent		0/100 mL
Sulphite-reducing anaerobes	CFU	Undetectable/100 mL	Absent		0/100 mL

Source: Donde *et al.* (2013).

Laboratory testing – water quality monitoring

- Frequency of testing
- Samples
- Number of samples
- Parameters

Article

November 21, 1953

SANITATION OF CRUSHED ICE

JAMA. 1953;153(12):1101. doi:10.1001/jama.1953.02940290033012

Abstract

One of the most interesting problems that have recently demanded attention is that of the sanitary quality of the crushed ice used for ice water and other iced drinks. Because water-borne diseases may easily be spread by contaminated ice, ice used in iced drinks or in direct contact with food should conform bacteriologically to the accepted standards for potable water. Recent investigation 1 has shown that crushed ice for these purposes is often heavily contaminated with coliform organisms. These organisms may be introduced into crushed ice in many ways, chief among which are the introduction of dust during freezing into the cake from which the crushed ice is made; contamination of the cake from the floors of freezing rooms, trucks, and restaurants; and contamination from chippers, crushed ice containers, or human hands during dispensing. Of these, handling during dispensing was found to be the most prolific source. In an effort

> J Water Health. 2017 Jun;15(3):410-417. doi: 10.2166/wh.2017.159.

Microbiological quality of ice and ice machines used in food establishments

Hamparsun Hampikyan [1], Enver Baris Bingol [2], Omer Cetin [2], Hilal Colak [2]

Affiliations + expand

PMID: 28598345 DOI: 10.2166/wh.2017.159

Abstract

The ice used in the food industry has to be safe and the water used in ice production should have the quality of drinking water. The consumption of contaminated ice directly or indirectly may be a vehicle for transmission of pathogenic bacteria to humans producing outbreaks of gastrointestinal diseases. The objective of this study was to monitor the microbiological quality of ice, the water used in producing ice and the hygienic conditions of ice making machines in various food enterprises. Escherichia coli was detected in seven (6.7%) ice and 23 (21.9%) ice chest samples whereas E. coli was negative in all examined water samples. Psychrophilic bacteria were detected in 83 (79.0%) of 105 ice chest and in 68 (64.7%) of 105 ice samples, whereas Enterococci were detected only in 13 (12.4%) ice samples. Coliforms were detected in 13 (12.4%) water, 71 (67.6%) ice chest and 54 (51.4%) ice samples. In order to improve the microbiological quality of ice, the maintenance, cleaning and disinfecting of ice machines should be carried out effectively and periodically. Also, high quality water should be used for ice production.

Microbial Quality of Ice Machines and Relationship to Facility Inspections in the Toledo, Ohio, Area

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Abstract Ice might contribute meaningfully to foodborne illness. Ice machines and ice scoops can be contaminated by microbial pathogens, resulting in people consuming contaminated ice. Typical of most states within the U.S., in Ohio assessments of ice machines and related equipment are part of mandated food service facility inspections by local health agencies. These visual inspections, however, might provide insufficient protection from microbial contamination. To explore the potential for disease transmission, we conducted microbiological surveys of ice throughout the Toledo–Lucas County Health Department service area in Ohio.

We regularly found microbial contaminants, mostly nonpathogenic bacteria and fungi, within ice machines. The relative abundance of bacteria and fungi was significantly greater on the gaskets of ice machines than on ice machine bin walls or ice scoops. Microbial contamination of ice machines did not vary significantly by facility hazard potential class or inspection results.

The regular nature of microbial colonization of ice machines indicates that a meaningful potential exists for disease transmission. The nature of the

Health risks from contaminated ice rarely are reported, although evidence documented in the literature is sufficient to establish its potential for causing illness. For example, contaminated commercial ice has been implicated as a cause of Norwalk-like-viruses-related gastroenteritis on a cruise ship in Hawaii (Herwaldt et al., 1994). Another outbreak aboard a cruise ship was associated with consumption of ice contaminated by enterotoxigenic *E. coli* (ETEC). In that outbreak, water bunkered from Mexico or Guatemala was inadequately chlorinated and introduced ETEC into the ice machines (Koo et al, 2010).

Norovirus outbreaks have also been reported in several venues associated with ice. Contaminated water and ice from improperly set up and sanitized community dispensers caused an outbreak of norovirus gastroenteritis illness in a community in Ari-

Any questions?