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Bacteria of Foods and Utensils in the Luther College Food Service, Decorah, Iowa

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PEITSO, MARILYN, CHERYL ANDERSON and JOHN TJOSTEM (Department of Biology, Luther College, Decorah, Iowa 52101). Bacteria of Foods and Utensils in the Luther College Food Service, Decorah, Iowa. *Proc. Iowa Acad. Sci.* 81(3): 93-97, 1974.

Total bacteria counts were obtained from precooked frozen entrees and other frozen food items. All the counts were well below federal and state recommended limits. Total bacteria counts were also obtained from representative food preparation surfaces and utensils.

The food service of Luther College, Decorah, Iowa, has been a pioneer in the use of precooked frozen foods. Lorenzo Price, food service director, abandoned the conventional kitchen in favor of the pre-prepared frozen entree system in 1964 at St. Olaf College, Northfield, Minnesota, and in 1968 at Luther College. At Mr. Price's request the Biology Department conducted a two-year program of microbiological testing to investigate the degree of bacterial contamination in frozen foods. Since the use of pre-prepared frozen foods is gaining acceptance in many institutional cafeterias, the results of this study are relevant to expanding numbers of people.

Tests were run weekly, and items to be sampled were rotated each week. Frozen foods and representative surfaces, such as silverware, serving pans, coolers and cafeteria trays, were tested. Specific areas of high bacterial counts were further investigated.

An educational program for the food service employees was an important part of the study. Many trouble spots in food handling develop because the people involved are not aware of the conditions under which bacteria flourish. In meetings with the employees we discussed foods that require special care. For example, we recommended that frozen whole eggs be thawed in the cooler, rather than at room temperature, to avoid the growth of pathogenic *Salmonella*, which is a common contaminant of eggs (Wistreich, 1973).

BACTERIA LEVELS IN FROZEN FOODS

The frozen food samples were taken from the food service kitchen on the day of shipment. A sterile hammer and chisel were used to collect the samples, which were stored for a maximum of three days in sterile sampling bags at -5°C until processing. The samples were analyzed in accordance with recommended procedures (Sharf, 1966). This procedure is outlined in Figure 1. Each item was sampled from one to three times.

Limits for numbers of total bacteria present in frozen foods used in the Luther College food service were chosen after comparing limits for frozen foods recommended by various

laboratories and agencies. For instance, the Association of Food and Drug Officials of the United States has recommended a limit of 100,000 total bacteria/gram of food sampled for precooked frozen beef and chicken pot pies (AFD-OUS, 1969). The armed forces have set a limit of 100,000 total bacteria/gram for precooked frozen meals served to flight crews (Department of Defense, 1964). The Food and Drug Administration has recommended a limit of 50,000 total bacteria/gram for certain frozen, ready-to-eat pies (Department of Health, Education and Welfare, 1972). Recommended limits for uncooked meats range from 250,000 to 10 million total bacteria/gram (Elliott, et al., 1961). The recommended maxima of 100,000 total bacteria/gram for frozen

While most counts were below acceptable limits, the fiberglass cafeteria trays showed counts substantially above the limits. Normal wear eventually exposes the fibrous tray interior, allowing accumulation of soluble foodstuffs and rapid multiplication of bacteria. Worn fiberglass cafeteria trays should be recognized as a potential health hazard.

INDEX DESCRIPTORS: Bacteria of Foods, Bacteria of Utensils, Food Service Bacteriology.

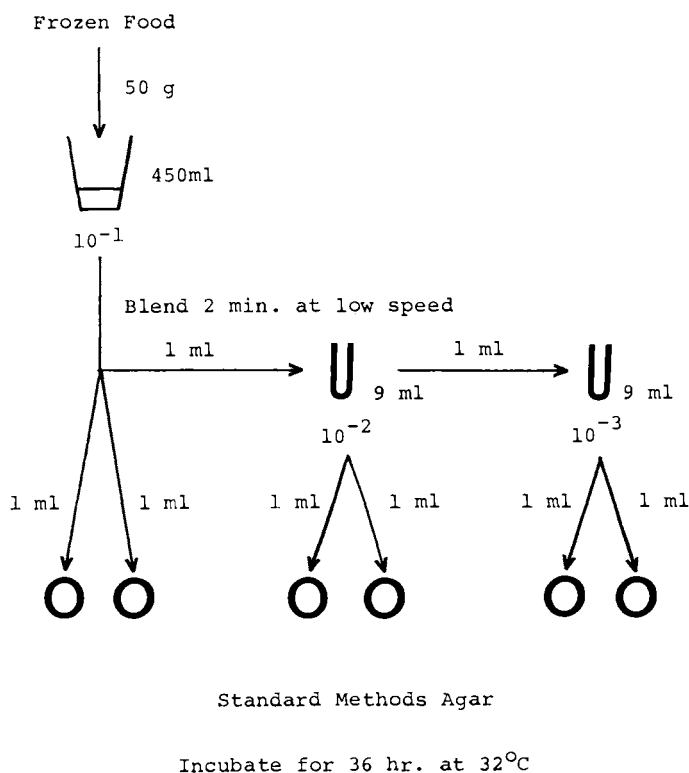


Figure 1. Technique for frozen foods.

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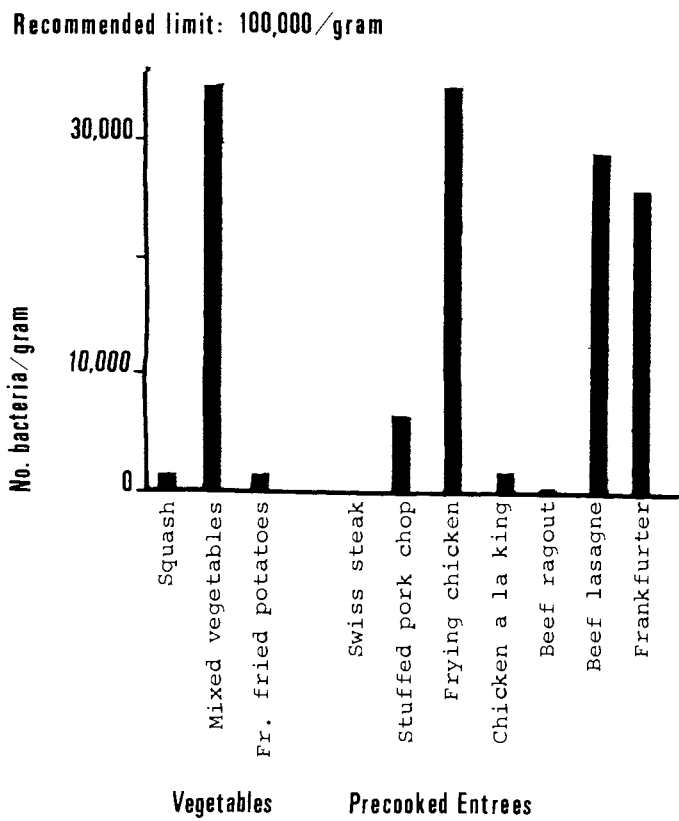


Figure 2. Total bacteria in frozen foods.

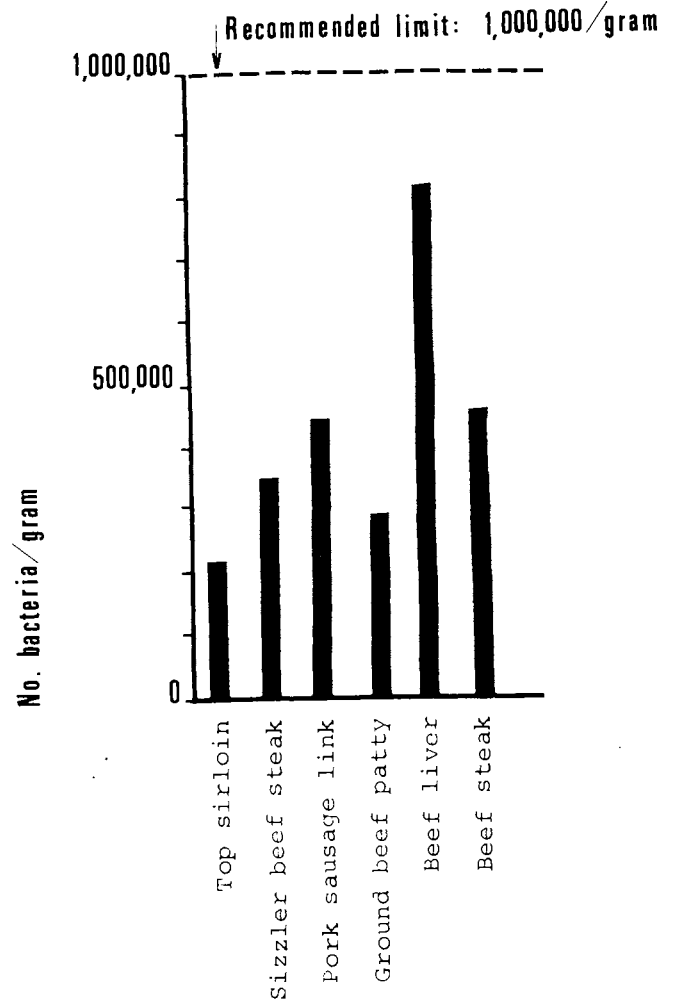


Figure 3. Total bacteria in uncooked meats.

vegetables and precooked frozen foods, and 1 million total bacteria/gram for frozen uncooked meats, are indicated in Figures 2 and 3.

Figures 2 and 3 show that all the food tested, frozen vegetables, precooked frozen entrees and frozen uncooked meats, fell well below the recommended limits for total bacteria. Although low total bacterial counts do not guarantee the absence of pathogens, it has been shown that properly handled food is likely to have low bacterial counts as well as no pathogens (Elliott and Michener, 1961).

Three separate lots of ground beef patties were sampled. The average count was 280,000 bacteria/gram, ranging from 2,600 to 530,000 bacteria/gram. This is a commendably low count when compared with counts from ground beef found in other studies. One survey of supermarket and restaurant ground beef showed counts ranging from 800,000 to 500 million bacteria/gram (Mood, 1971).

The consistently low total bacteria counts indicated that frozen foods have been properly handled after leaving the factory. Improper handling, such as inadequate refrigeration during transit or long periods at room temperature, would result in elevated total bacteria counts.

BACTERIA ON DISHWARE AND SURFACES

Utensils and preparation areas of the food service were tested weekly according to U.S. Public Health Service proce-

dures (U.S. Public Health Service, 1967). Each sample consisted of five articles of the same utensil or surface. An area 8 in.² was swabbed on each of the five articles. After the sample was taken, it was analyzed as diagrammed in Figure 4. Each item was sampled from two to nine times.

The surfaces were divided into two major groups: dishware, and all other surfaces. A lower bacterial limit was recommended for the dishware because these items come into direct contact with the food, whereas the other surfaces normally do not. Dishware, shown in Figure 5, was washed in a dishwasher that reached a temperature of 68°C during the wash cycle and 85°C during the rinse cycle. Fifty total bacteria/in², a level easily obtained through proper washing, was recommended by us as a guideline. Items in the second group, shown in Figure 6, had no prescribed method of cleaning but were washed regularly with detergent and hot water. Two hundred total bacteria/in² served as a guideline for these surfaces. Our experience has shown these levels to be consistently attainable and useful in pointing out areas of contamination.

Most of the surfaces and utensils sampled fell within the recommended limits, as seen in Figures 5 and 6. This indi-

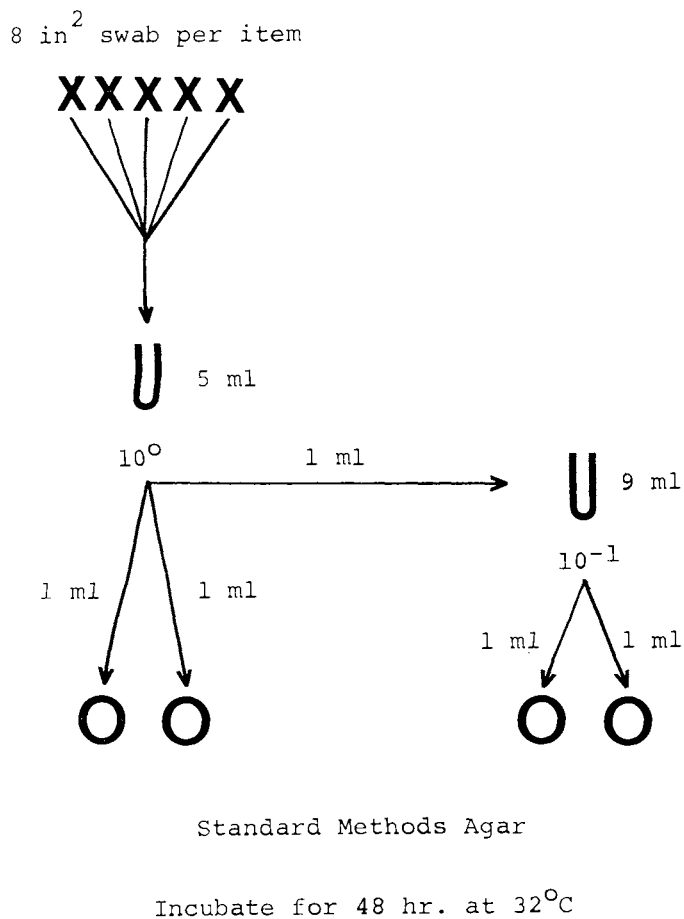


Fig.4

Figure 4. Technique for surface tests.

cates that the general cleanliness of the food service is good. For those items with counts noticeably above the recommendations, further investigation was considered.

The levels of bacteria for the salad bowls and the cafeteria trays on which the students carry their food were alarmingly above the limit, even immediately after dishwashing. The salad bowls, with an average count of 450 bacteria/in², and the trays, with 4,300 bacteria/in², both were made of a porous material. A more intensive study of the trays was made to investigate the extremely high counts.

BACTERIA LEVELS IN WORN FIBERGLASS TRAYS

The cafeteria trays were purchased over ten years ago and have been in use since that time, each tray having been used an estimated 4,000 times. The trays consist of fiberglass material with an internal metal frame, covered with a non-woven glossv coat.

A group of new trays of similar composition was obtained. These trays were put into normal use in the food service, so they could be used in a comparative study. This study was

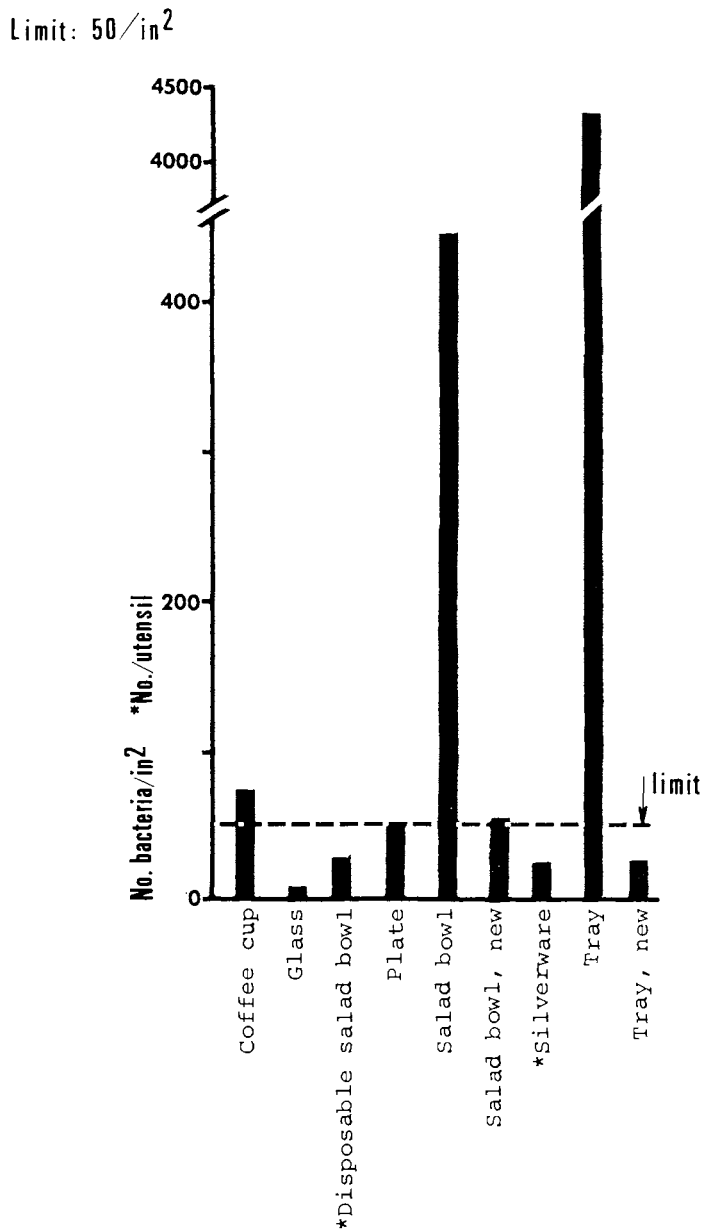


Figure 5. Total bacteria on dishware.

designed to determine the ability of the tray to absorb foods, and the number of bacteria within the tray that survive dishwashing. Two old trays were compared with two new trays in each procedure.

The absorbing ability of the trays was determined through the following procedure. The trays, taken directly from the dishwasher, were sterilized by autoclaving at 15 lbs. pressure for 15 minutes. The sterile trays were then immersed in 400 ml of nutrient solution containing bacteria cultured from trays, and incubated in a covered container for 24 hours. The trays were put through a normal dishwashing cycle and immersed for 24 hours in 400 ml sterile saline. This allowed the bacteria and nutrients to be drawn out of the trays into

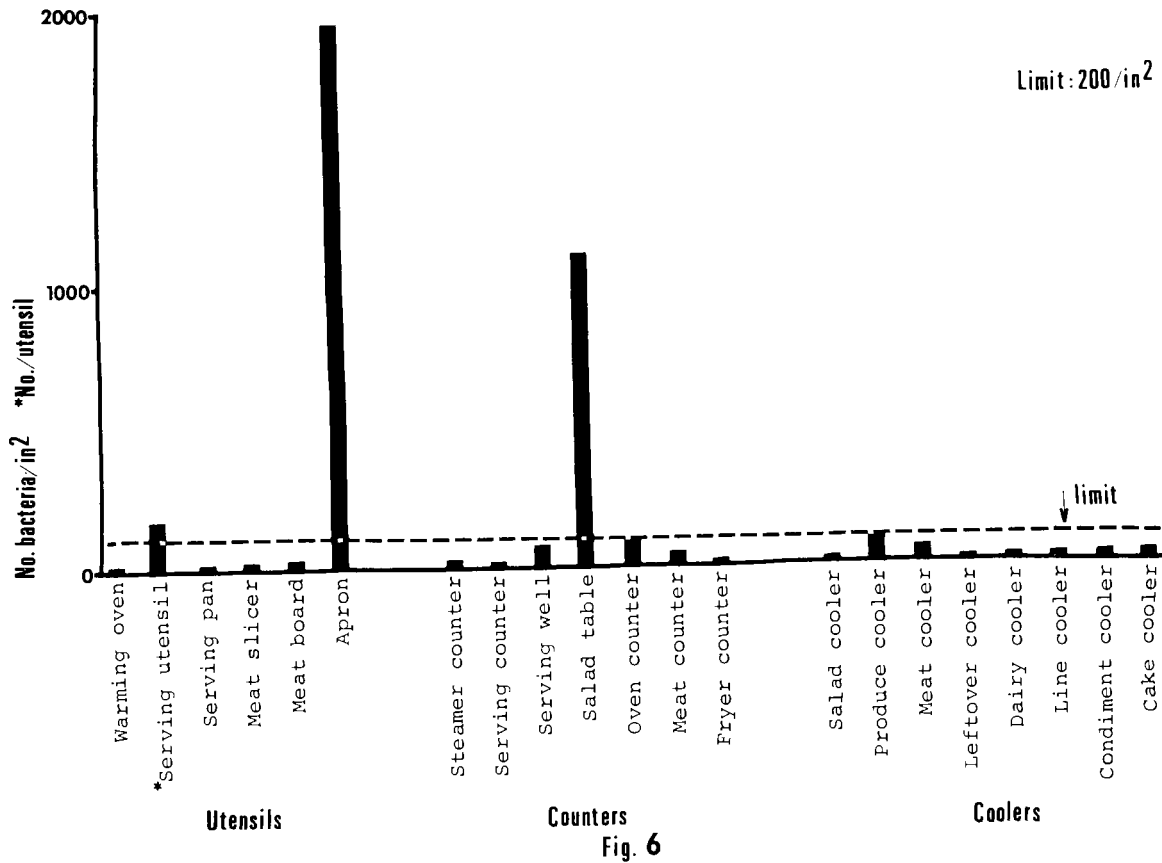


Figure 6. Total bacteria on surfaces.

the saline, where more growth occurred. Counts taken from this solution showed that the old trays supported a growth of 500 bacteria/ml. These data indicate that the old trays, acting very much like sponges, absorbed bacteria and nutrients, resulting in a growth of bacteria not removed by dishwashing. The solution in which the old trays were immersed supported almost 200 times more bacteria than a similar solution from new trays.

To determine the number of bacteria that survive dishwashing, the following procedure was used. The trays were taken directly from the dishwasher and immersed in 400 ml of sterile saline in a covered container for 24 hours to draw bacteria from the trays into the solution. During the 24-hour period, the trays were kept at 4°C to prevent multiplication of bacteria. The saline in which old trays were immersed contained 7,000 bacteria/ml, while that of new trays contained 10 bacteria/ml. This study shows that the old trays, after dishwashing, harbored 700 times more bacteria than the new trays.

DISCUSSION

We believe that the use of worn fiberglass trays constitutes a potential health hazard. Through normal use the glossy, impervious finish develops cracks and wears off, exposing the

porous fiberglass interior of the tray. Soluble and particulate food, nutrients for the growth of bacteria, become lodged in the rather spongy interior. Dishwashing does not remove all of the food and the insulating property of the fiberglass apparently protects the bacteria from the heat of the dishwasher. Stacking the moist, warm trays after washing provides the ideal environment for rapid growth of bacteria. Repeated use of worn trays results in the accumulation of nutrients and bacteria within the fiberglass interior. Persons using the trays often put food, such as peanut butter, bread, fruits and desserts, on the trays. The health hazard lies in the possibility of pathogenic bacteria becoming lodged in the trays.

Food and water-borne pathogens, such as *Salmonella* and *Shigella*, could multiply within the trays and cause disease. Should a tray become contaminated with such pathogens, the warm, moist, closely stacked trays would provide an ideal situation for rapid growth and spreading of the organism from one tray to another. Through continued use of these trays, many people could be infected before the source of contamination was detected. This possibility is emphasized by the abundance of Gram-negative rods present in cultures obtained from freshly washed trays.

Our concern over old, porous fiberglass trays as a potential health hazard extends to all institutional cafeterias because of the widespread use of these trays. Hospital kitchens, especially, run the risk of spreading pathogenic bacteria through the use of worn fiberglass trays. Every institutional food fa-

cility should be aware that, through normal use, fiberglass trays deteriorate to a point where they become laden with bacteria that survive the dishwashing process.

We recommend that a study of the duration of the outer coat of the trays be made. Due to scratching or marring it is possible for the interior of the trays to be exposed after a single use. We also recommended that nonporous materials be considered as a replacement for fibrous material now commonly used in the manufacture of cafeteria trays.

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