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J. H. LONGWELL, *Director*

Comparative Methods of Cleaning Meat Cutting Tables

R. L. HENRICKSON, R. F. BROOKS, E. BIRMINGHAM, D. E. BRADY

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R. L. Henrickson, R. F. Brooks, E. Birmingham, D. E. Brady

INTRODUCTION

Meat blocks and wood cutting tables used in the meat industry are one of the greatest sources of microbial contamination of meat. A cutting surface that has many cracks, grooves, or a general roughened surface invariably harbors many bacteria, and is more difficult to clean than a smooth one. A problem of great concern to the meat processing industry is that of spoilage and discoloration. Spoilage of meat has been shown to be directly related to the amount of microbial contamination (Moulton 1929). There is some evidence that discoloration may be influenced by microbial contamination (Niven 1951, Butler 1953).

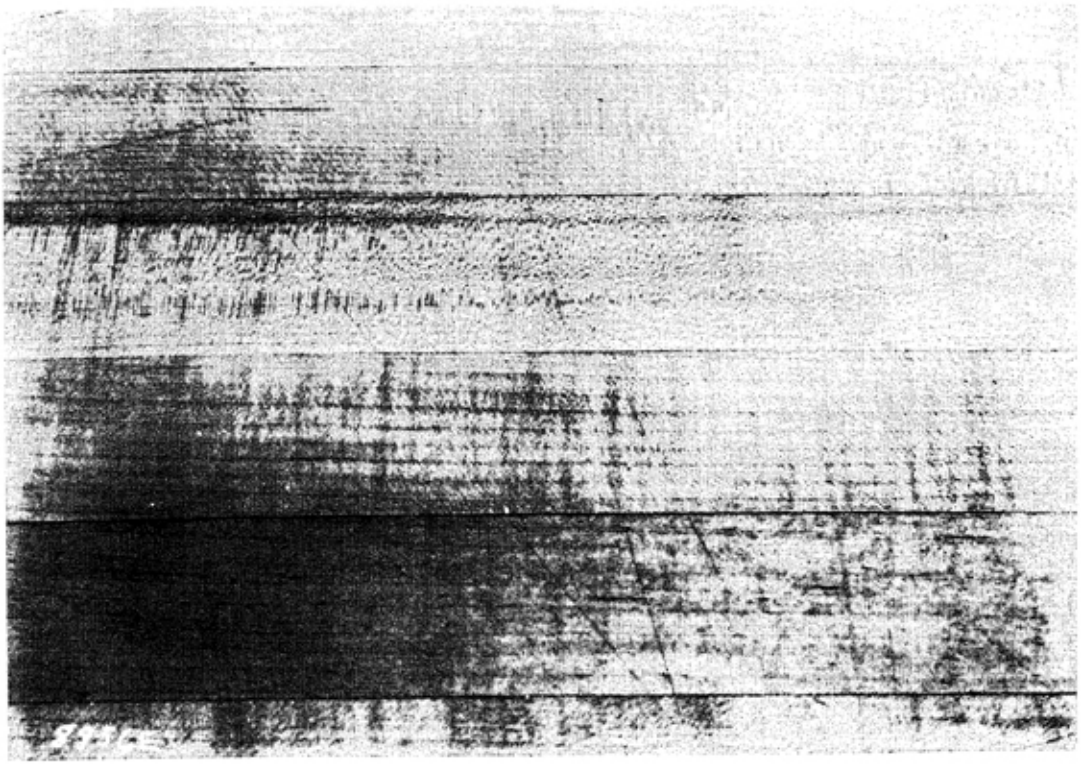
A survey of three prepackaged meat markets selling more than 73,000 packages of meat, poultry, and cheese, indicated that more than 3 percent of all the packages had to be removed from the display case due to spoilage, and that 26 percent of this removal was because of discoloration (Dobbins, Hoecker 1951).

A rough working surface will collect meat juices and fat, and provide an excellent locus for bacterial growth. Contamination from the working surface may be transmitted from one piece of meat to the next, causing all items to be thoroughly inoculated before they are displayed for sale. A high bacterial count may not necessarily be harmful from a public health aspect, but its presence constantly lowers the quality through spoilage or color change. Meat containing large numbers of bacteria is indicative of poor sanitary precautions and improper handling.

Method of Cleaning

Two systems appear popular in cleaning wooden working surfaces.

The dry cleaning method dates from the early days of the meat industry when it was a common practice to put salt or sawdust on the surface to soak up the residual liquids. The sawdust or salt made it easier to remove large meat particles, and the working surface was then scraped or brushed to cut away the moist wood and residual foreign matter. But the block brush makes the surface rough and susceptible to bacterial invasion (Figure 1). In a few cases it was a practice to add a layer of salt after scraping to draw out additional moisture. The addition of salt had a tendency to bleach the wood and make the surface more attractive. Frequent use of the meat cleaver leaves deep marks, making it impossible to have a smooth, clean block.



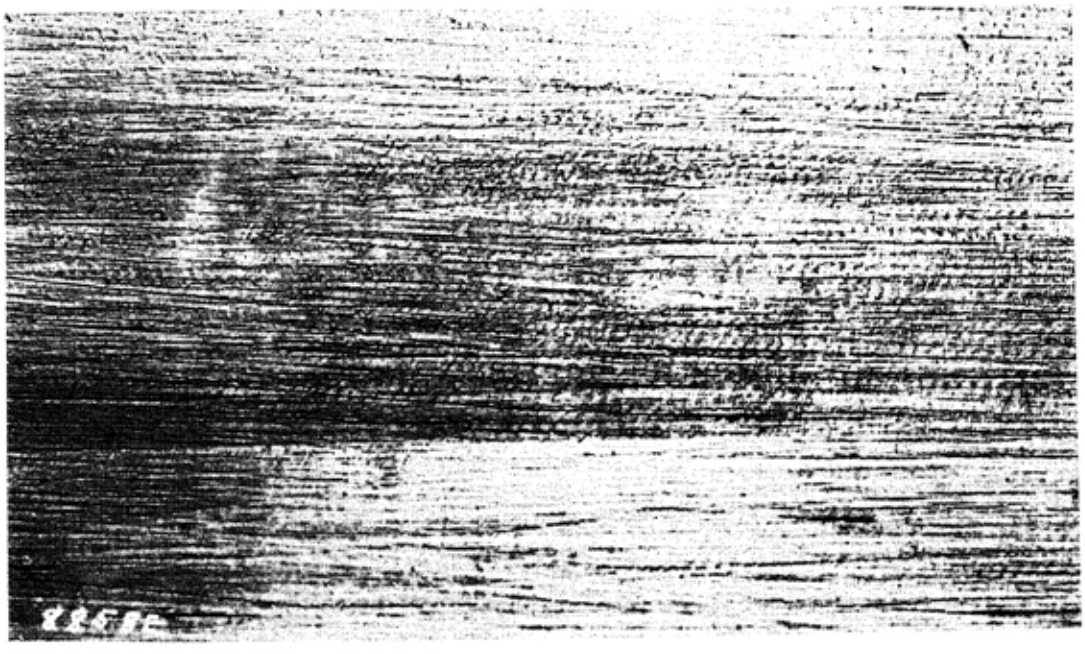


Figure 1. Smooth wooden surface of tables 3, 4 and 5 (top), compared with the rough surface of tables 1 and 2 (bottom).

The second cleaning procedure is often called the wet method. This includes washing the surface with boiling water or soap solutions, and the steaming method. This involves removal of the coarse meat particles with a scraper and then scrubbing the surface with a hot cleaning solution. A stiff fiber brush mechanically loosens the lodged grease and meat liquids. The surface then is rinsed with clean hot water to remove the residual cleanser. A sanitizing solution is placed on the surface for 5 to 10 minutes, then removed and the surface dried. When steam is used, the surface is first cleaned with the aid of a detergent. Then it is rinsed, and steamed dry. A surface cleaned in this manner will remain smooth and easy to clean (Figure 1). Boiling water has been used to clean wood equipment but this method is not practical, due to the difficulty and danger of handling boiling water.

A review of manufacturers' recommendations for cleaning wooden working surfaces revealed that the manufacturers of chemical detergents and soaps recommended the use of a detergent and a sanitizer while the firms making meat blocks suggested the use of a scraper and block brush. This experiment was undertaken to study the kind and amount of bacteria found on wooden cutting surfaces following different methods of cleaning.

EXPERIMENTAL PROCEDURE

The new maple top meat cutting tables used in this study were located in the Missouri Station's meat-processing laboratory, and received uniform use during the daily processing. The room temperature was maintained at 50 to 55°F and the relative humidity at approximately 55 percent. Filtered air was circulated through the room making the conditions nearly ideal for meat processing.

Cleaning methods were assigned, one to each of five tables. The chosen methods conformed closely to the methods now being used throughout the meat industry. Block scrapers were used on all tables to remove the grease and large particles of meat that would remain after each cutting period. The assigned cleaning methods were applied daily following completion of the day's classes. The cleaning methods were: (1) Block brush; (2) block brush + salt; (3) detergent + rinse + salt; (4) detergent + rinse; (5) detergent + rinse + sanitizer. Separate block brushes were used for each of the first two tables. The hot (140°F) detergent solution used in treatments 3, 4, and 5 was made in the concentration recommended by the manufacturer. The same cleaning water was used for tables 3, 4, and 5, approximating commercial practice; however, the order of cleaning was changed each day. In treatments 2 and 3 the salt was medium fine, commerial grade as recommended for use in preserving and seasoning meat products. Hot (160°F) tap water was use for the rinse in treatments 3, 4, and 5. A separate bucket of water and wash cloth was used for each table. The rinse was

followed in each case by wiping the surface dry with a clean, laundered cloth.

The technique used to evaluate the various cleaning methods included physical observations of the wood surface, as well as determining the bacteriological counts on the surface of the tables. Physical observations included surface smoothness, development of cracks, uniform wear of surface, warping and ease of cleaning. The bacteriological study involved two sampling techniques: (1) Direct contact plating, and (2) swab count (Figure 2). Since the method of obtaining surface bacterial counts has not been standardized and there is still some question which method gives the most accurate result, both methods were applied. Physical observations and bacteriological samplings were made before the morning operation started.

The surface area of the table was divided into 8-inch squares, using a stiff wire template, and each square was assigned a number. A table of random numbers was used to determine which square would serve as the sampling area at successive times. The same corresponding surface on each of the tables was sampled at any one period.

The contact plates from each treatment were taken in duplicate and in each case across the connecting seams of the table. The duplicate plates permitted one to be incubated at 37°C (98°F) and one at 15°C (59°F).

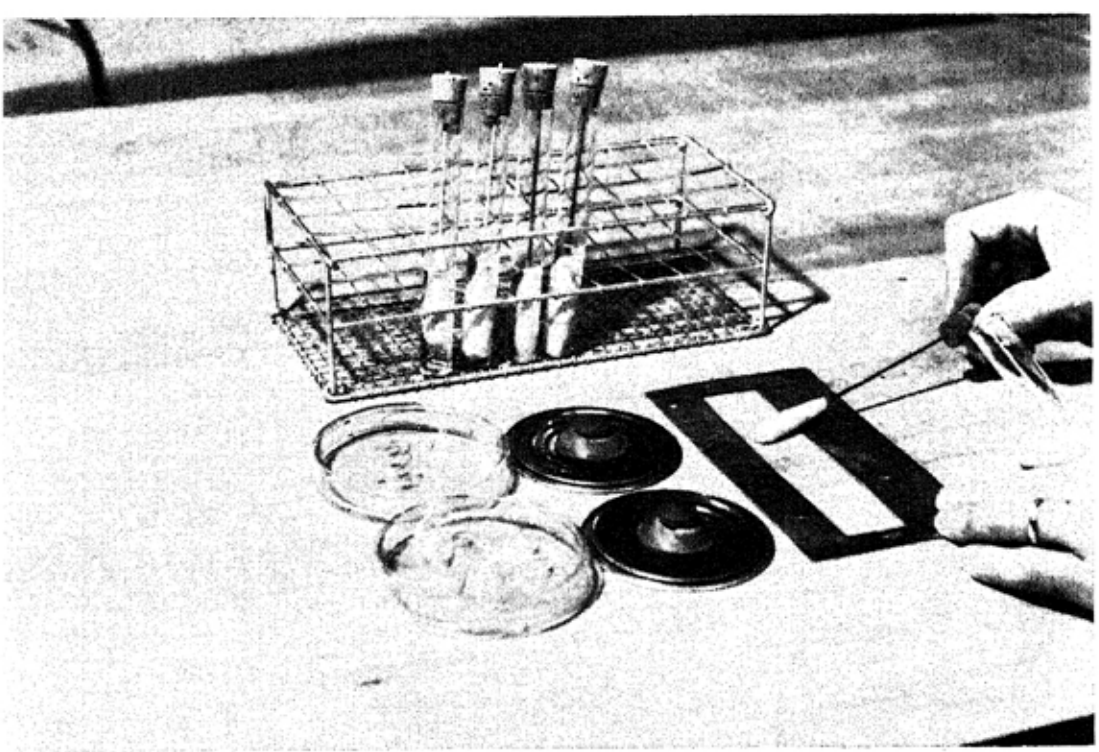


Figure 2. Contact plate and swab methods of obtaining surface bacterial counts.

The medium used was tryptone-glucose-beef extract agar. Incubation was for 3 days at 37°C and 7 days at 15°C. Bacterial counts were calculated on the basis of colonies per square inch of table surface.

In the swab technique, dry sterile cotton swabs were transferred to test tubes containing 10 ml. of sterile 0.8 percent saline solution just prior to sampling the surfaces. To ensure that the proper area was swabbed each time, templates made of thin sheet aluminum were used (Figure 2). A separate sterile template was used for each of the five tables. The area outlined by the template was the same as that covered by the contact plate. In each case the swabbing was done across the grain of the wood and the connecting seams.

The used swab was replaced in the saline solution and shaken vigorously for 5 minutes to free the microorganisms from the swab. Decimal dilutions of the saline suspension were plated in duplicate, incubated at 37°C for three days or at 15°C for 7 days, and colony counts made in the conventional manner. Results were recorded as the number of organisms per square inch of table surface.

Pure cultures were isolated from each set of samples for identification, endeavoring to obtain all the different colony types that appeared. Specific attention was given to colonies appearing as the predominant flora.

RESULTS

Samples taken over a two-year period showed a consistently higher bacterial count by the swab method, compared to the contact plate technique. In many instances, the colonies on the contact plates were too numerous to count and therefore made the recording of accurate results by this method impossible (Figure 3). The most appropriate use of the contact plate method would seem to be in obtaining relative, rather than absolute, measurements of bacterial contamination on flat surfaces. It was possible to obtain a definite count with the swab method since multiple serial dilutions were made and appropriate plates for counting could be selected. The average total counts for the various cleaning methods throughout the sampling period are shown in Table 1.

TABLE 1 -- TOTAL MICROORGANISMS PER SQUARE INCH OF WOODEN CUTTING SURFACE*

Swab Count Method

Incubation Temp.		Treatment 1	2	3	4	5
37° C.	Bact.	100	133	55	410	41
	Molds	1	1	<1	1	<1
15° C.	Bact.	323	300	58	497	63
	Molds	1	1	1	1	<1

*Average of 30 weekly samplings

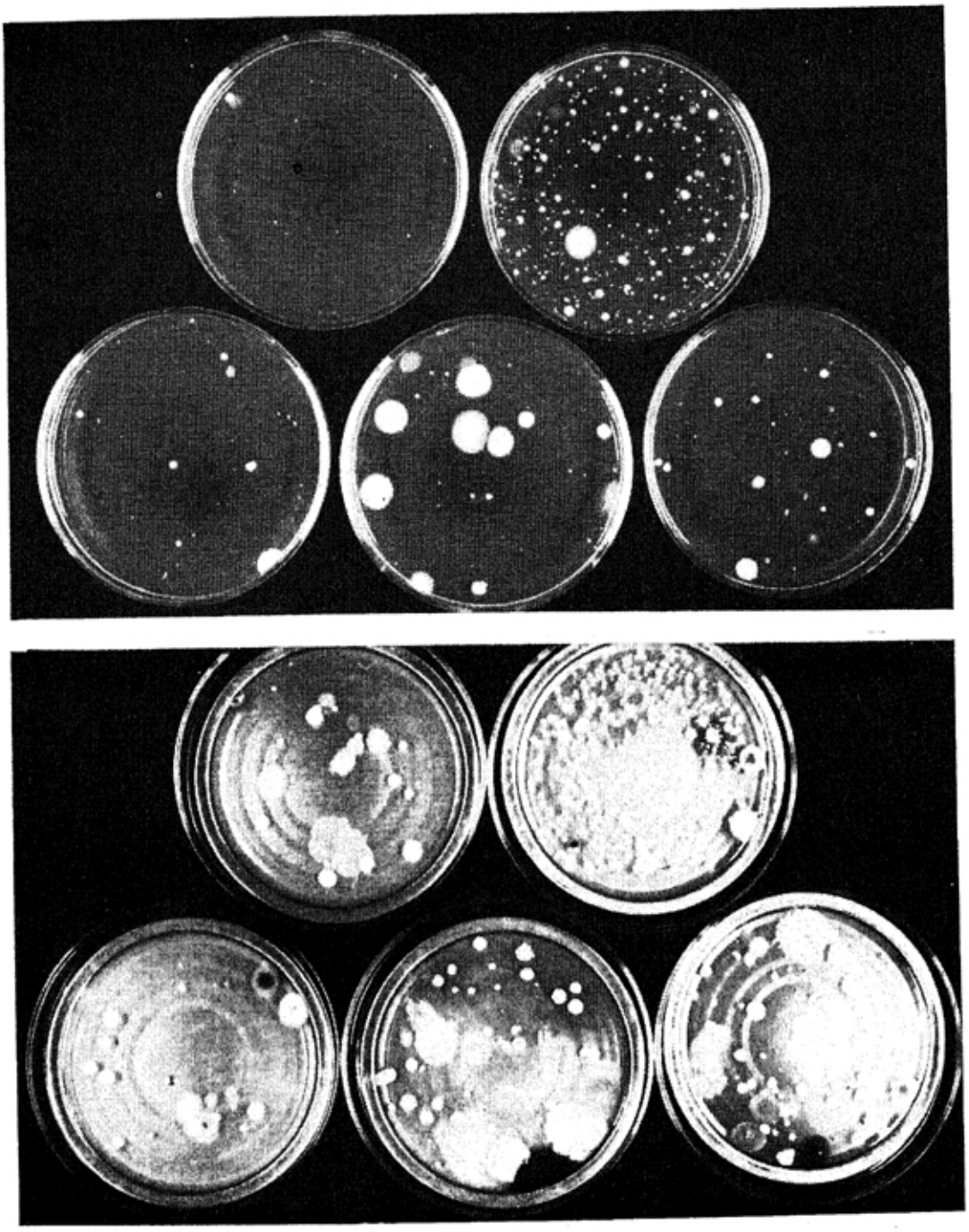


Figure 3. Top photo—Typical total count by the swab method (same dilution on all plates). Bottom photo—typical plate growth by the contact method.

The bacteria found on tables cleaned with the block brush (1 and 2) were predominantly spreading spore formers typical of *Bacillus sp.* (Table 2).

The surface cleaned with an alkalin detergent and covered with salt (3) harbored many bacteria commonly found in soil, water, and air. The

TABLE 2 -- DISTRIBUTION OF GENERA OF BACTERIA ISOLATED FROM MEAT CUTTING TABLES CLEANED BY THE VARIOUS METHODS

	Relative frequency of occurrence				
Genus	Block Brush	Block brush + salt	Detergent + rinse + salt	Detergent + rinse	Detergent + rinse + sanitizer
Micrococcus	++++	+++++	+++	+++++	++
Bacillus	+++++	++++	+		+
Achromobacter	+++	+++	+++	+++++	++
Flavobacterium	+	+		+++	
Streptococcus	++	+++++	+	+++	+
Sarcina	+++	++		+	+
Diplococcus	+	+		++	
Alcaligenes	++	+++	+++	+++++	++
Yeast	++	+	+		+

surface washed with a detergent and rinsed (4) gave the highest total count (Table 1 and Figure 3). The bacteria were found to be typical contaminants from the air. A similar flora was encountered on Table 5 (detergent + rinse + sanitizer). The relative effectiveness of the different cleaning methods is shown in Figure 3. The use of a detergent + rinse + salt gave a low bacterial count (treatment 3), but the salt had to be removed before the cutting operation could proceed, causing inconvenience and delay. There were no differences in the physical condition of the cutting surfaces, other than the progressive roughening of tables 1 and 2, due to the use of the block brush.

The most efficient and economical method of cleaning meat blocks and tables was to use a detergent + rinse + sanitizer (treatment 5).

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