THE CONTROL OF FOOD POISONING IN AN ARMY POST

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INTRODUCTION

DURING World War II a number of large and small outbreaks of food poisoning occurred in Army messes. It should not be concluded, however, that the incidence of food poisoning was greater in Army messes than in comparable civilian restaurants and food establishments. Nor should one conclude that Army sanitation is lax; the reverse is generally true. The fact that numerous food-poisoning outbreaks were reported in the Army during the recent War reflects the strict supervision and control the Army was able to maintain. Sporadic outbreaks involving the major portion of 250 or so men of a company mess or perhaps 1000 or more men in a battalion or regimental mess cannot go unnoticed. Generally, men messing together are quartered in the same barracks or bivouac. Because of the nature of food poisoning, it is ordinarily not possible to conceal an outbreak.

On the other hand, a comparable outbreak of equal magnitude in a civilian restaurant may go entirely unnoticed. Each victim is served his "food poisoning special", after which he returns to his abode to suffer alone without realizing that the others who were likewise served are also in agony. Occasionally two or more persons dining out together may "compare notes" and realize that they have both been poisoned but generally it is only when a large number of persons are served together from a common food source as at an institution, a banquet, or picnic that poisoning becomes evident. Often the symptoms of poisoning appear before the group has disbanded.

Because of the fact that Army messing is controlled, it was possible during the recent War to make certain observations which would not have been possible in civilian food establishments except under rather unusual conditions.

PRELIMINARY OBSERVATIONS

Observations were begun at one Army Post early in the summer of 1942. Outbreaks of food poisoning were reported to the office of the Post Surgeon, and in each instance an immediate investigation was made. These outbreaks were limited to men messing together, eating food prepared and served from an individual mess. By correlating the data relative to the food eaten with data of cases actually affected, it was frequently possible to "incriminate" a given food. However, minor discrepancies in correlation were often noted. As would be expected, all men eating a food containing a poisonous agent are not equally susceptible, and some will not show symptoms. Also, the poisonous agent may not be distributed uniformly throughout a given food. On the other hand, it was frequently observed that a few men who had not eaten the "incriminated" food also stated that they were ill. Whether or not these few cases were purely psychological or were just men malingering was not generally determined. It is possible also that some of these cases were food poisoning resulting from food secured from civilian restaurants or from other sources.

It was not always possible to secure food samples for laboratory analyses, because small amounts of left-over readily-perishable foods were often discarded immediately after serving, or frequently symptoms did not develop

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until several hours later, the suspected food having all been served or discarded previously. When food samples were available, in a number of instances either organisms of the genus *Salmonella* or *Staphylococcus* were isolated and observed to be present in high numbers. Food poisoning as referred to in this report includes possible *Salmonella* infections. Because of the number of outbreaks at the beginning of these observations, it became impractical to perform detailed laboratory studies on each individual sample.

**INCRIMINATING FOODS**

Foods most frequently incriminated were: (1) Potato salad, chicken salad, ham salad, and other similar foods in which certain of the ingredients were first thoroughly cooked, then handled, and finally placed in the refrigerator and held for several hours at an inadequate refrigeration temperature. (2) Non-acid puddings and non-acid cream-filled pies which had either been adequately baked, then contaminated by improper handling and stored for some time at incubation temperature, or possibly which had been inadequately baked and stored at an incubation temperature with or without contamination from handling. Occasionally incubation was prolonged between preparation and cooking. (3) Turkeys and other fowl stuffed and inadequately baked, with or without a period of inadequate refrigeration before or after baking. (4) Ham, meat loaf, and other meats which were first baked, either adequately or inadequately, and then sliced, resulting in a considerable amount of handling and with or without a holding period after slicing. (5) Acid drinks prepared in zinc-coated (galvanized iron) cans misused for serving in the field. Symptoms usually developed very soon after consumption of such drinks—usually within a few minutes. Other types of metallic poisonings were not frequently observed.

It is possible that isolated cases of food infection may have resulted from consumption of contaminated prepared foods or raw vegetables, but unless a large number of cases occur at one time, it is not likely to be traced. No outbreaks of this nature were noted during these observations.

That food poisoning was a common occurrence and that men were somewhat familiar with it, was evidenced by names attributed to an outbreak such as "the G.I.'s." There was the common belief by Army mess personnel that all food poisoning was caused by inadequate washing of food utensils, resulting in a film of residual soap on the mess gear and utensil; soap was erroneously believed to be the responsible agent.

**ILLUSTRATIVE CASES**

One outbreak which illustrates typically the sequence of events which often took place, occurred during July when the weather was extremely hot. The mess sergeant of the company mess involved was on leave for a few days and one of the first cooks was in charge. Bread pudding was prepared in a 100-ration pan Saturday evening by the baker. Bread pudding was broken into pieces by hand which resulted, of course, in a fair amount of contamination. Following this, milk, eggs, spices, etc., were added, resulting in an ideal culture medium for the bacteria which had originated from the handling of the bread, as well as possibly from other ingredients. This bread pudding was baked, probably inadequately, in a deep layer in the pan and stored at a high room temperature (unrefrigerated) from Saturday night until Monday noon, following which it was served in the company mess at the noon meal. By the middle of the afternoon rather violent and severe gastro-intestinal symptoms appeared in the majority of the men who had eaten the previous meal in the company mess. The men who were ill were suffering to such an extent that hospitalization was ordered. All cases recovered within two or three days.

Food poisoning was in no way
limited to enlisted men’s messes, or even to messes at all, for that matter. In one officers’ mess, a civilian cook opened a No. 10 can of cream-style corn and then changed the menu and set the can of corn on a shelf, unrefrigerated until the following day. The next day the corn (probably initially contaminated by can opener or thumb, or both) was cooked and served for the noon-day meal. The major portion of those messing at this officers’ mess became ill during the next few hours. Isolated cases, in a number of instances, resulted from food prepared in the homes.

A company of men messing in the field one hot day was served lemonade from a galvanized iron can. Within about 30 minutes a large number of the men were vomiting. Upon inspection it was observed that there was a black coating of soluble metallic salt over the entire inside surface of the can. Metallic poisonings of this type ordinarily strike soon—with a few minutes.

These general types of sequence occurred frequently. Generally, however, soldiers were not hospitalized. It became quite clear very soon that first of all, the mess personnel were not adequately trained for coping with the control of food poisoning, and secondly, that all personnel in the mess must be trained because a number of the outbreaks occurred when the mess sergeant was away on pass and a first, or even a second, cook was left in charge. It was clearly shown that “a chain can be no stronger than its weakest link” and even if the mess sergeant and the first cooks were extremely careful, occasionally a second cook, cook’s helper, or baker might be responsible for immobilizing a company (or regiment) through food poisoning.

**CONTROL PROGRAM**

With these facts from several months’ investigations at hand, and with a view to eliminating or certainly reducing the incidence of food poisoning, an intensive program was established. A directive in the form of a memorandum, Subject: “Food Poisoning”, based on references available, both civilian and military, was prepared and issued to each mess on the Post, with orders that all mess personnel immediately familiarize themselves with it and that the memorandum be permanently posted on the bulletin board of each mess hall. Service clubs and post exchanges were likewise included. An exact quotation of this memorandum is to be found in the Appendix at the end of this article.

Immediately following the issuance of this memorandum, an order was issued requiring all mess personnel to attend a lecture of about one hour duration on food sanitation, with particular emphasis placed on food-poisoning control. Classes were “staggered” so as not to disrupt normal operation of the messes.

Following the initial food handlers’ classes for all mess personnel, similar classes were instituted for both military and civilian food handlers in service clubs and post exchanges. These food handlers’ classes were continued for all military and civilian food handlers on the Post, so that new personnel entering the Post could be trained before being placed in responsible food-handling assignments. The course was improved by the use of both military and civilian training films, and by the inclusion of demonstrations.

Cards instructing: “FOOD HANDLERS — COOKS — KITCHEN POLICE, WASH HANDS WITH SOAP AND WATER AFTER USING LATRINE—Avoid Spreading INFECTIOUS DISEASES” were posted in each mess kitchen, post exchange, service club kitchen, and latrine at this Post.

The delivery and sale of non-acid cream-filled pies, chicken salad, and egg salad sandwiches, and similar foods for use in service clubs, post exchanges, and messes were prohibited. Commercial bakeries and other civilian food establishments were advised of
this policy and spot checks were made of delivery trucks entering the Post to enforce compliance. Sanitary inspections were made of establishments furnishing prepared foods to the Post.

Cooperative projects were worked out with local county and city health officers to enforce, as far as possible, a similar policy in the area surrounding the Post. Spot inspections were made of taverns and food establishments adjacent to the Post by military and civilian health officers.

The master menu for the Post was altered to eliminate the preparation and serving of foods which could not be handled in compliance with the food-poisoning memorandum. Fruit pies were substituted for cream-filled pies and extremely perishable or "susceptible" foods were eliminated.

Spot inspections were made of messes, service club kitchens, and post-exchange food counters at all serving hours. Any excessive or unwarranted food handling was noted and corrected on the spot. It was ascertained at the time of each inspection that the food-poisoning memorandum was posted and food handlers were questioned regarding the details of the memorandum. Temperatures of foods and the amount of time elapsing between preparation and serving were noted. Left-over foods were checked as to type and depth of layer in the refrigerator. In some cases, food samples were sent to the laboratory for further study.

RESULTS

At the Army Post under observation, a number* of food poisoning outbreaks occurred each month during the early part of the summer of 1943. Following the issuing of the initial memorandum on food-poisoning control the 19th of July 1943, food poisoning outbreaks stopped immediately and none was reported throughout the summer and fall of 1943. In January 1944, an outbreak occurred in one company mess due to some rice pudding which had been held at room temperature for a period of time and may not have been adequately cooked in preparation. The following May there was an outbreak in a company mess involving the major portion of the men, due to potato salad which was prepared the day before serving and inadequately refrigerated. Throughout 1944, 1945, and most of 1946, beyond which date no specific information is available, there was an outbreak of food poisoning in a mess averaging about every 5 to 7 months, and in each instance it was demonstrated upon investigation that there was a violation of the food-poisoning memorandum. Usually this violation was in the form of preparing foods such as potato salad, for example, too far ahead of serving and placing it in a deep layer in a container and attempting to refrigerate it.

DISCUSSION

Certain types of foods are known to be especially likely to be responsible for food poisoning and food infection. This is particularly true of many unrefrigerated foods in warm weather. Non-acid foods which are freely handled during preparation and are served without cooking or are only partially cooked may be responsible for illness. Organisms of the genus Staphylococcus (Micrococcus) or Streptococcus from the nose and throat, or Salmonella or other enteric organisms from the intestinal tract of man or from other sources such as infected raw meats, insects, rodents, etc., find their way into the foods through food handling during preparation or by other means (improper storage). If such contaminated foods are held without adequate refrigeration for a period of a few hours, permitting incubation there may be developed toxins, as well as high numbers of pathogenic organisms. Factors of importance in this connection are: (1) Non-acid foods are conductive to the growth of certain types of organisms and the production of toxins which may be responsible for food poisoning and food infection. (2)
Several hours may elapse before the center portions of some foods placed in a refrigerator reach refrigeration temperature, and this would allow adequate time for the production of both high counts of bacteria and large amounts of toxin. (3) In a non-acid food, cooking is less effective for “pasteurizing” or sterilizing foods than in an acid medium. (4) When a high bacterial count is built up by incubation of the contaminated food, it requires a longer time or a higher temperature, or both, to destroy completely the microorganisms during cooking. (5) The bacteria may be partially or completely destroyed, yet toxins developed in the food may not be entirely eliminated by the cooking process. (6) Undoubtedly large amounts of even the heat-labile toxins would be more difficult to destroy by cooking than small amounts, other factors being equal. The pH of the food may be of considerable practical significance in this reaction.

Control factors which are within the domain of food handlers are recommended as follows: (1) Prevent excessive handling or other contamination of foods initially, by maintaining personal cleanliness, use of food forceps, forks, etc., and by adequate protection of foods. (2) Shorten the time between preparation and cooking and between cooking and serving, or between preparation and serving for foods handled after cooking. (3) Adequately cook foods (including left-over foods). (4) Adequately refrigerate (just above freezing) all foods which are likely to be responsible for food poisoning. It is not believed that contamination from insects and rodents or improperly cooked infected meat, (eggs, milk, etc.) was the cause of a great number of outbreaks. However, indications are that in some instances baked stuffed turkeys and ham were responsible for some outbreaks of illness.

Changes in physical properties cannot be relied upon for detecting poisonous food. Knowing the exact history of the food is the most important one factor in controlling food poisoning, and in deciding whether a given food is safe for consumption. Only the food handler can be sure of this and he must be thoroughly trained and competent.

The problem of food poisoning at this Army Post appeared largely to center around the control of the genera *Staphylococcus* (*Micrococcus*), *Streptococcus*, and *Salmonella*, and not the botulism organism. There is need for continued investigations relative to the control of these non-spore-forming microorganisms in foods.

In light of newer knowledge regarding the rapid development of food poisoning toxin or high bacterial counts resulting in a greater initial inoculation in the case of food infections, there is need for a restudy of the field of food refrigeration because of the poor heat conduction of certain foods when in deep layers in the refrigerator.

Experiments conducted in the hospital laboratory (1943) at the Army Post, revealed that when organisms of the genera *Salmonella* and *Staphylococcus* were each inoculated into separate lemon cream pie, they were not recovered after 24 hours at room temperature. When these lemon cream pies were held for a few days at room temperature, an alcoholic fermentation resulted due to yeasts. Other types of cream-filled pies supported growth of *Salmonella* organisms. *Staphylococcus* organisms also grew abundantly in these cream-filled pies. No cases of food poisoning were observed at this Post due to lemon cream pie. The pH is apparently the limiting factor; however, additional investigations need to be made in this field. Cathcart *et al.* (1947) have reported studies relative to the growth of food poisoning organisms in pastry fillings under conditions of low pH. The Army has recognized that acid foods are less likely to be responsible for food poisoning. A circular prepared early in the War recommends the addition of
vinegar and pickle mixes to sandwiches to aid in preservation.\textsuperscript{13}

The procedure described in this report for controlling food poisoning in Army messes at this Post can well be applied to the control of food poisoning in civilian restaurants and other food establishments, including the home. If health authorities responsible for sanitary control of drug-store sandwich bars, soda-fountain counters, and even some of our largest restaurants could observe each outbreak of food poisoning, as is possible to do in the Army, they could not afford to sit idly by while poorly-trained food handlers dispense chicken salad sandwiches and other similar foods which have been heavily contaminated during preparation and held for long periods of time at "so-called" refrigeration temperatures.

In connection with this study, samples of chicken salad were taken for laboratory analyses from a drug-store sandwich bar in a city in the vicinity of the Post. Bacterial plate counts were extremely high (in the millions per gram)\textsuperscript{21} and an inspection was made to investigate the method of preparation and handling. It was learned that chicken salad, egg salad, and other similar foods were prepared by hand the afternoon before delivery in a central kitchen in a city about 10 miles away. Delivery was made to several drug stores (as this was a chain drug-store company)\textit{early} the following morning. The particular branch drug store from which the laboratory sample of chicken salad was taken did not normally open until about 8:00 A. M. or later, and since the delivery man could not get into the store, he left the chicken salad in an unrefrigerated container on the sidewalk in the hot summer sun. It was some time near 9:00 A. M. or later when the chicken salad was actually placed in a refrigerator or in a refrigerated counter and was undoubtedly several hours later before the mass was cooled to refrigeration temperature.

Because this period of unrefrigerated exposure, together with the heavy initial contamination, was conducive to the production of foods likely to be responsible for food poisoning, the manager of the chain drug store kitchen was warned. In the meantime the wife of one of the city health department sanitary inspectors inadvertently stopped in at this drug store in question and ate a chicken salad sandwich. Within about two hours she became violently ill with what appeared to be typical staphylococcus food poisoning. The local health department took action and improved the situation.

This chain of events could be repeated many times with other types of foods. In a number of instances, potato salad was being prepared in a city about 50 miles away and delivered to a large supermarket in which it was held in open pans inside a poorly refrigerated glass counter for several days—until sold!

The transportation of heavily contaminated, unrefrigerated, non-acid foods from one city to another, requiring considerable time, is a dangerous procedure. Baked pastries likely to cause food poisoning should, of course, be first thoroughly baked, then protected from contamination through handling or otherwise, and kept under adequate refrigeration at all times—even in the delivery truck. Even with these precautions, a "break in the chain of control" may result in a sporadic outbreak of food poisoning.

In the Army the problem of preparing and serving foods likely to cause food poisoning is of no minor magnitude. This problem is even augmented in field serving without complete refrigeration and the menu often has to be "tailored" to fit the needs for sanitary precautions. Similar changes in the menu should be considered in civilian food establishments and in the home, especially for picnics.

\textbf{Conclusions}

The program described in this report, which was effective for the con-
control of food poisoning in an Army Post, may well be considered for use by health officers responsible for sanitary control of civilian restaurants and other food establishments, as well as in the home. Important points to be included in an effective program should be: (1) Education of all food handlers concerned through food handlers’ schools, demonstrations, training films, etc. (2) Posting of memoranda for the control of food poisoning in each food establishment kitchen. (3) Frequent inspections by health department officials to ascertain that each food handler is familiar with details of the food poisoning memorandum, and to ascertain that there is strict compliance with recommendations. (4) Spot-checking of occasional food samples by laboratory procedures to insure that foods are being properly cared for. (5) Provisions for adequately training new food handlers before they are assigned to duty.

Some outbreaks observed indicate that there is still need for further study to solve completely some of the perplexing control problems. These problems are largely of a practical nature such as the temperatures and times of refrigeration, cooking, etc., as well as the relationship of pH to growth and toxin production of microorganisms responsible for food poisoning.

While the medical examination of each food handler is important both initially and periodically, from a practical standpoint it is often not possible to make a complete examination, including complete laboratory analyses. Because of this, it is believed that much greater returns for effort expended can be realized by placing emphasis on reduction of food handling and food contamination for reducing the incidence of food poisoning and food infection. It is clear, however, that a medical examination is important from the standpoint of eliminating known human sources of infection.

Summary

A program which was effective for controlling food poisoning at an Army Post during the recent war was described. It was pointed out that Army messing conditions are such that even a small outbreak of food poisoning is obvious, whereas it is difficult, if not impossible, to trace a similar outbreak in a civilian food establishment except where large groups are eating together as at a banquet, picnic or institution. This type of procedure should be effective for controlling food poisoning in civilian food establishments, and in the home. The one most important factor in deciding if a food is safe for consumption is to know the exact history of the food as to preparations, refrigeration, time of holding, adequacy of cooking and other factors. Only the food handler can be sure of all these factors, and it is important that he be thoroughly and adequately trained.

Appendix

Food Poisoning Control Memorandum successfully employed in the Army:

1. Periodic outbreaks of food poisoning have been observed, particularly during warm weather, due to improper preparation and serving of foods by mess personnel. With continued emphasis placed on food conservation, food poisoning sometimes results, due to the carrying over of certain types of foods. Food poisoning, characterized by vomiting, diarrhea, or both, is caused chiefly by toxins produced by certain bacteria growing in a favorable environment. The spread of infectious disease germs through food due to excessive food handling should not be overlooked.

These bacteria are commonly found in the nose, throat and intestinal tract of humans; the hands are usually contaminated and food which is handled generally becomes so contaminacted. Non-acid puddings (chocolate, vanilla, etc.) custard, pumpkin pie, bread pudding, cream-filled pies (except lemon) cream-filled cakes, potato salad, chicken salad, salmon salad, shrimp salad, pork salad, hash, etc., are ideal media for these micro-organisms to grow and produce toxins. Non-acid foods such as those above which are freely handled during preparation and served without subsequent cooking, or are only partially cooked, then allowed to incubate at room temperature for a
period of a few hours, are generally responsible for the observed outbreaks of food poisoning. Foods placed in the refrigerator in deep layers are usually not sufficiently cooled; shallow layers are much more satisfactory.

2. Acid foods, such as fruit pies, lemon cream pie, fruit desserts, vegetable salad free of mayonnaise, and fruit gelatin desserts, may generally be stored with safety for a period of a day or so. Generally speaking, fruits and fruit products are not good culture media for food poisoning bacteria, and are reasonably safe. However, acid drinks such as lemonade, coffee and tea, and acid desserts, such as fruit salad and fruit gelatin, should not be stored for long periods of time in contact with metal and should never be placed in zinc-coated containers such as galvanized cans (G.I.), because of the danger of food poisoning. Contrary to popular belief, foods may be safely stored in the tin cans in which they are packed by the manufacturer, after they have been opened, provided they are properly refrigerated; tin and iron are relatively nontoxic. No cases of food poisoning have been observed due to the storage of acid foods or drinks in aluminum containers and it is considered that the use of aluminum stock pots for such is reasonably safe.

3. The following recommendations are submitted as an aid in the reduction of food poisoning and food infection, and will be carried out by mess personnel:
   a. Thoroughly wash the hands with soap and water before working with foods and reduce all food handling to a minimum; avoid contamination of hands by touching face and clothing; make use of utensils such as forks, spoons, forceps, etc., for preparation and serving.
   b. Non-acid foods, such as puddings (chocolate, vanilla, etc.) custard, pumpkin pie, bread pudding, cream-filled pies (except lemon), cream-filled cakes, potato salad, chicken salad, salmon salad, shrimp salad, pork salad, hash, etc., which may be freely handled during preparation and served without subsequent cooking or only partial cooking, should be prepared only a short time before serving, preferably not more than one hour and in no case more than three hours. These foods should be refrigerated in a shallow layer so as to facilitate chilling and will not be stored from one meal to the next.
   c. Avoid the preparation and serving of acid foods and drinks such as fruit salads, vegetable salads, fruit gelatin dessert, lemonade, orangeade, coffee and tea, in zinc-coated containers.
   d. Refrigerate (below 40° F.) left-over foods, such as meats, creamed vegetables, etc., in a shallow layer and serve them the following meal. In the event that it becomes necessary to hold such foods for several hours (e.g. overnight), they may be made much safer by thoroughly cooking and avoiding contamination by handling before subjecting them to adequate refrigeration.
   e. Many of the toxins produced by food poisoning bacteria are not destroyed by heat, once they are formed; however, the food poisoning bacteria may be killed, hence any heat treatment of food should be carried out before a long incubation period has elapsed.

4. This memorandum will be posted in each mess hall, service club kitchen, and post exchange kitchen. Reference is made to WD Circulars No. 4, 6 January 1942, and No. 277, 20 August 1942. All mess personnel will familiarize themselves thoroughly with this directive.

REFERENCES

2. Disease Outbreaks Conveyed through Foods Other Than Milk and Milk Products in the U. S. in 1944, as Reported by State and Territorial Health Authorities, U. S. Public Health Service, Sanitary Engineering Division, Milk and Food Section.
6. War Department Circular No. 4, 6 January 1942.

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He discussed some recent developments of importance to the food industry such as the low temperature evaporator, drying from the frozen state, monosodium glutamate, cottonseed protein and converted rice which retains as much as 75 to 80 percent of the vitamins in the original rice.

Through research, Dr. Howard said food will be made more palatable, nutritious and economical. To achieve this, continuity of research is all important as research cannot be purchased on a package basis.

H. P. Smith
Recording Secretary

Russell L. Pollitt—1900–1949

Russell L. Pollitt, President of the Central Illinois Dairy Technology Society, passed away Sunday, May 22nd, at the Lake View Hospital in Danville, Illinois. Mr. Pollitt had been ill only a short time having undergone surgery a few weeks previously in Chicago.

At the time of his death, Mr. Pollitt was Manager of the Danville branch of Beatrice Foods. He was born August 11, 1900, at Germantown, Kentucky. He graduated from the University of Illinois in 1923 with a major in dairy manufacture. Besides the widow, he leaves one son, Gene, a student in the Danville High School.

Russell Pollitt was a man of excellent character. He was a leader in his church, active in civic work, took part in numerous industry affairs, and was considered an outstanding administrator by Beatrice officials. He has served as President of the Central Illinois Dairy Technology Society since January 1, 1949.

During the past year, Mr. Pollitt has served as President of the Illinois Milk Dealers Association. He was a member of the Danville Consistory, The American Legion, Danville Chamber of Commerce, Danville Planning Board, and was past senior Councilor of the Commercial Traveller’s Association.

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17. Personal communication from Col. C. J. Gentzkow, Army Medical Center (1942).