Prevention of Food Poisoning in Hospital Patients

B. M. HORWITZ, M. H. FINLAYSON, H. D. BREDE

SUMMARY

Bacteriological investigations of raw and cooked foods and of food handlers in abattoirs, food factories and hospital kitchens show that they are potential sources of food poisoning organisms. The use of reheated (reconstituted) frozen foods is recommended as an ideal means of preventing food poisoning among hospital patients.

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A number of food poisoning outbreaks in hospitals have been recorded in South Africa.[1-3] In order to prevent such outbreaks in the Tygerberg Hospital a comprehensive investigation into all possible sources of food poisoning has been carried out. The investigation covered the bacteriological testing of all raw food supplied to the hospital, the same food after normal cooking, and after subsequent freezing and 'reconstitution' by reheating. In addition, tests were carried out on abattoir, food factory and kitchen personnel.

Bacteriological testing was confined to identifying the pathogenic bacteria present in each sample. Only those organisms recognised as being the cause of food poisoning are referred to.

MATERIALS AND METHODS

Raw Foods

The types of food, the number of specimens examined and the organisms isolated, are shown in Table I. The heaviest contamination occurred in the beef carcasses and beef portions.

Department of Medical Microbiology, University of Stellenbosch and Tygerberg Hospital, Tiervlei, CP
B. M. HORWITZ
M. H. FINLAYSON
H. D. BREDE

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Beef carcasses: 5,8% of specimens from beef carcasses gave a growth of *Salmonella*, and 6,2% *Cl. welchii*.

The *Salmonella* strains were: *S. muenchen* 2; *S. reading* 2; *S. sandiego* 1; *S. johannesburg* 4; *Salmonella* group O 1; *Salmonella* group G 1; and *Salmonella* group H 1.

Beef portions: These showed a high degree of infection with food poisoning organisms. The possibility of the meat becoming infected with these organisms during transport from the abattoir, subsequent handling, and cutting up in the butcher's shop must be considered.

A single inspection of the premises of one of this hospital's meat contractors, where swabs were taken from equipment, etc., showed the presence of *Cl. welchii* and pathogenic *E. coli* on the butcher's block, bandsaws, and the overalls and hands; *Cl. welchii* on the scale, and *Staph. aureus* and pathogenic *E. coli* on the knife.

In addition, a survey of the corned beef pickling barrels in the Divisional Council area of the Cape revealed that of 119 samples taken, 3 were positive for *Salmonella;* 10 for *Cl. welchii;* and 3 for *Staph. aureus*. The extent of the contamination of other raw foods with food poisoning organisms is shown in Table I.

Food Handlers in the Abattoir, Food Factory and Hospital Kitchens

Stool samples and swabs from throats, hands and clothing were examined. The findings are shown in Table II. It appears very likely that some of the organisms found on the meat supplied were derived from human sources.

From Table II it is evident that there is a daily introduction via raw food into the hospital kitchens of pathogenic organisms which are capable of giving rise to food poisoning.

Thorough heating for a sufficient length of time should destroy all vegetative forms of bacteria even in heavily infected food. Samples of food cultured immediately after cooking showed, in some instances, that either the temperature reached, or the length of time the food was heated, was insufficient to destroy all pathogenic organisms present.

TABLE I. ORGANISMS FOUND IN RAW FOODS

	Beef carcasses	Beef portions	Mutton	Chicken	Beef offal	Pork	Meat mince	Sausage	Fish	Vegetables
No. of specimens	**207**	**197**	**64**	**102**	**62**	**48**	**16**	**22**	**60**	**503**
Salmonella	12	13	—	—	5	1	—	1	1	—
Cl. welchii	13	23	—	2	2	1	—	—	—	—
Pathogenic *E. coli*	—	23	2	6	3	1	—	1	—	—
Staph. aureus	3	3	2	4	2	—	1	—	—	9

TABLE II. ORGANISMS FOUND IN ABATTOIR, FOOD FACTORY AND HOSPITAL KITCHEN WORKERS

	Throat swabs	Nose swabs	Stools and rectal swabs
No. of specimens	**578**	**497**	**564**
Staph. aureus	**112**	**141**	—
E. coli **serotype—0142/B**			**1**
—026/B6			**1**
—0125/B15			**4**
—0112/B11			**1**
—086/B11			**1**
—0112/K66			**1**
—0124/K72			**1**
—0114/B			**1**
—086/B7			**1**
Salmonella **group E**			**3**
Salmonella **group J**			**1**
Salmonella **group C**			**7**
Salmonella **group Z**			**3**
Salmonella typhimurium			**1**
Shigella flexneri			**3**
Shigella sonnei			**2**

Alternatively, the cooked food may have become infected by a handler in the kitchen directly or indirectly through infected utensils. The presence of pathogenic bacteria or their toxins has been borne out by a number of small outbreaks of food poisoning (6 in all) among this hospital's staff during the period 1970 - 1973. Three of these outbreaks were due to *Staph. aureus* and three possibly to *Cl. welchii*.

The results of the bacteriological tests carried out on samples of the various cooked foods are shown in Table III.

From these results it would appear that *Staph. aureus, Cl. welchii* and *E. coli* are the organisms most likely to cause food poisoning. While *Staph. aureus* is killed by heating for 12 minutes at 65°C[4] and can survive cooking in the interior of a large amount of food where this temperature was not reached, its enterotoxins are destroyed only after 30 minutes' heating at 100°C. The survival of *Cl. welchii* through its heat-resistant spores, is readily understood. The last 3 small outbreaks among staff at this hospital were possibly due to this organism. In only one case was left-over food available for investigation, and *Cl. welchii* was isolated from the meat and the gravy. In the other two outbreaks no left-over food or used dishes were available, but the symptoms suggest contamination with these organisms, or their toxins. Enteropathogenic *E. coli* have long been recognised as a cause of gastro-enteritis, particularly in infants.

METHODS OF PREVENTION

In 1972 an experimental kitchen for the preparation of frozen foods was introduced at Conradie Hospital, Pinelands, to investigate its operation under South African conditions. The bacteriological investigations of both the raw and cooked foods were carried out by us. Most of the results obtained are incorporated in the tables. The frozen food was held long enough for these investigations to be completed before the food was issued.

Basically, the system employed is that immediately after cooking the food is placed in disposable covered aluminium trays, and when cool, frozen in liquid nitrogen to approximately −25°C and then stored in a freezer. After freezing, sample trays of the food are heated in infra-red ray ovens to 80°C for from 20 minutes to 1 hour, depending on the type of food and the size of the container. Samples are then taken for bacteriological culture. If satisfactory, the batch of food is marked as being suitable for issue to the hospital wards. If pathogenic organisms are found, further bacteriological tests are carried out. If still unsatisfactory, the batch is condemned. Food for the wards is issued frozen in trays (4 - 10 portions per tray) from the central kitchen to accessory ward kitchens. Here food is heated in infra-red ray ovens to 80°C and then served onto plates. All left-overs are discarded.

In addition to the above, the following precautions are taken:

1. All food handlers (kitchen staff, and ward-kitchen staff) are tested regularly every 3 months—both throat swabs and faeces samples are taken.

TABLE III. ORGANISMS FOUND IN COOKED FOODS

	Beef	Mutton	Pork	Chicken	Fish	Stew	Vegetables	Macaroni	Mince	Pudding
No. of specimens	**368**	**114**	**114**	**206**	**334**	**216**	**346**	**108**	**192**	**37**
Staph. aureus	**9**	**1**	**2**	**4**	**2**	**7**	**6**	**1**	**1**	—
E. coli **group I**	**2**	**1**	**1**	**2**	—	**1**	**2**	—	—	—
E. coli **serotype O 127**	—	—	—	**1**	**2**	**1**	**2**	—	—	—
E. coli **serotype O 55**	—	—	—	—	**4**	—	—	—	—	—
E. coli **serotype O 114/B**	**1**	—	—	—	—	—	—	—	—	—
E. coli **serotype O 128/B12**	—	—	—	—	—	—	**1**	—	—	**1**
Sh. boydii	—	—	—	—	**1**	—	—	—	—	—
Salmonella **group B**	—	—	—	—	—	—	**1**	—	—	**1**
Salmonella **group C**	**1**	—	—	—	—	—	—	—	—	—
Cl. welchii	**4**	—	—	—	—	—	—	—	—	—

2. The staff are lectured on food hygiene and the absolute necessity for the clean handling of food.

3. The central kitchen used for the production of frozen foods and the ward kitchens for the feeding of patients are supervised by qualified dietitians who are responsible for the enforcement of hygienic handling of all food.

4. Use is made of the agar syringe modification[6] of the Ten Cate agar sausage technique, to check on the efficacy of cleaning of all utensils and working surfaces and as a means of demonstrating to the staff the absolute necessity of good hygiene.

5. Random samples of raw foods and of all cooked foods are taken daily for bacteriological control.

DISCUSSION

There is no doubt that the feeding of heated bacteriologically satisfactory frozen foods immediately after heating, is a practical and effective means of preventing food poisoning. It allows for sufficient time to carry out all the bacteriological tests before use. As the frozen food is heated for a short time to a high temperature (80°C), and then fed almost immediately, very little time is given for multiplication of any pathogenic contaminants. Thus the danger from the human carrier is virtually eliminated. It is a rule in this hospital that all left-overs are discarded.

The success of this method has so far been borne out in practice. Since its institution no outbreaks of food poisoning have occurred in the wards. In those sections of the hospital using food prepared by conventional methods of cooking and direct feeding after cooking, a number of small food-poisoning outbreaks have occurred. In the two kitchens supplying conventional food, the precautions taken are the same as those described for the central kitchen, except that the food is not frozen and then reheated before use. The possibility of infection of food by the human carrier, either directly or indirectly, and the multiplication of the contaminating organisms while the food is kept warm during serving, is thus not eliminated. Unlike the wards, where each container holds only 4 - 10 portions, the containers here are large and hold approximately 20 - 40 portions. When there is a delay some of the food may be held for more than an hour. No containers are re-used until thoroughly cleansed, but with the type of labour available this system could break down. Every attempt is made while serving to keep the food at a high temperature (approximately 80°C), but constant supervision is necessary to enforce this.

The major objection to the use of the frozen food system is that it is more expensive due to the costs added by rapid freezing, freezing rooms, reheating, and disposable containers.[5] The cost of hospitalisation of a patient in this hospital is estimated at ± R30/day. The additional period in hospital following an attack of food poisoning is usually about 2 days. In our opinion the extra cost of the frozen food system is more than offset by the elimination of food poisoning among patients.

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