

Lastly, since food poisoning is reported to occur far more frequently in canteens, restaurants, hospitals and other residential institutions than in private houses the provision of clean food is a matter of great importance to the owners and managers of all premises in which food is supplied to the public, to the Boards of Management and Superintendents of hospitals and institutions and to commercial firms which manufacture or process food for sale.

In view of the vital importance of clean food, the Committee of the Scottish Branch of The Nutrition Society is to be congratulated on choosing this subject for a symposium and on obtaining the services of such a distinguished group of experts to deal with the many and varied aspects of this problem.

### Public-health aspects of food poisoning

By KENNETH COWAN, *Chief Medical Officer, Department of Health for Scotland,  
St. Andrew's House, Edinburgh 1*

The subject of food poisoning has attracted much attention in recent years partly because of increased incidence in spite of measures directed towards prevention, and partly because of the interesting nature of many outbreaks and the amount of work devoted to their investigation. The gastro-intestinal illnesses which are included in the group of conditions known as food poisoning exclude alimentary infections due to the shigella group and to *Salmonella typhi* and *Salmonella paratyphi* which are statutorily notifiable under the Public Health Acts but even with this limitation food poisoning constitutes a considerable problem.

The extent of the problem can be measured from the report of the Public Health Laboratory Service in England and Wales (Public Health Laboratory Service, 1956). A total of 8961 incidents was recorded in 1955, an increase of 2945 (49%) over 1954. Outbreaks of food poisoning involving more than one family numbered 612; in 723 incidents the outbreak was confined to one family and there were 7626 sporadic cases. Thirty-nine deaths were reported to the laboratory services. In 38% of all incidents the causal organism was not discovered and in outbreaks involving more than one family this percentage was actually 56.

It was not possible in former years to estimate the amount of food poisoning occurring in Scotland on a comparable basis to that in England and Wales because it was not necessary to notify cases. This was remedied by the Food and Drugs (Scotland) Act, 1956, and notification came into operation on 1st August 1956. The total number of incidents reported in Scotland up to the end of 1956 was 626.

The public-health issues involved in food poisoning are related to the immediate action required to investigate and control outbreaks of food poisoning and to the longer-term aspect of the education in hygiene of those engaged in the handling, storage, preparation and cooking of food.

*Investigation and control*

The first criterion is a knowledge of the bacteriological implications and the types of foodstuffs most likely to be involved. This can only be gathered from an adequate system of notification undertaken promptly by the doctor in charge of the case and thorough and complete investigations of all outbreaks by the Medical Officer of Health. The volume of information already available as to causal agents is considerable, the vast majority of cases being due to salmonellas which were the infecting organisms in 59% of the total number of incidents and in 95% of all incidents due to known causes reported in England and Wales. But the gaps in knowledge, particularly about salmonellosis, are also considerable. The occurrence of 3742 sporadic infections by *Salmonella typhi-murium* and of 900 sporadic infections by other salmonellas, whereas only 82 outbreaks and 375 family outbreaks were due to the former and 41 and 129 due to the latter, indicates a pattern of infection which has not been explained by dosage, distribution of the organisms in the foodstuffs or variations in pathogenicity. Fuller investigations of a number of sporadic cases might be useful in obtaining information on the limitations of infection, the production of symptomless excretors and the possible relationship, if any, to food. Buxton (1955) points out that salmonellas have been isolated from about all animal species examined. Domestic pets such as dogs and cats may be potential sources of infection for man and the public-health importance of salmonella infection of these animals must be borne in mind. Although few cases of human infection undoubtedly arising from the handling of diseased animals have been reported, they do not necessarily reflect the extent to which human infections from these sources may occur. When attempting to trace an obscure origin of salmonella infection in a family, domestic pets should not be overlooked as possible sources. Hughes (1957) records a hospital outbreak confined to one L-shaped ward which illustrates possible case-to-case infection without the intervention of food; clothing, bedding, carriers, or possibly dust being the vehicle.

The other causal agents identified amongst food-poisoning incidents due to known causes during 1955 were staphylococci 3%, *Clostridium welchii* 2%, and there were two cases of botulism in a Mauritian family in England due to imported pickled fish prepared in Mauritius. The relative importance of staphylococcal infection and infection by *Cl. welchii* compared with salmonellosis is, however, more readily demonstrated by the percentage of outbreaks of food poisoning in more than one family; all types of Salmonellae were responsible for 45% and staphylococci and *Cl. welchii* were causal agents in 24 and 28% respectively. The two last types of infection therefore are formidable factors in the production of true outbreaks of food poisoning and together are responsible for a higher proportion of outbreaks than salmonellas.

The main purpose of the investigation of an outbreak of food poisoning is the rapid identification of the vehicle of infection, particularly if the outbreak affects more than one family. Bacteriological examination of specimens from sufferers and examination of the suspected food for bacteriological contamination may result in

establishing a causal relationship between the two; but pending the results of such examinations the doctor in charge of the case or cases should make prompt notification to the Medical Officer of Health in order that immediate investigations may be made. The success of bacteriological work will depend to a large extent on the care with which specimens are collected. Positive results will be more likely from specimens of excreta and vomit obtained early in the illness and from scraps of food likely to be implicated. It is desirable to obtain specimens of faeces from all members of the family, since the symptomless carrier is not uncommon and may have a causal relationship to the outbreak. The general practitioner as the investigator likely to be first in the field has an important role to play in this connexion.

The Medical Officer of Health will be involved in ascertaining a possible common source of infection and the careful taking of histories from patients will have a considerable bearing on the result of the investigation. The vast accumulation of knowledge by the Public Health Laboratory Service and through careful investigations of large numbers of outbreaks as to common sources of infection both of types of micro-organism and of food likely to be involved is a considerable help in identification of possible sources of infection. Taken in conjunction with the time of onset and the nature of symptoms it is possible to gain some idea of the presumptive nature of the causal organism and some indication of the most likely foodstuff to be involved.

With salmonella infections the usual incubation period is between 12 and 24 h but may sometimes be as long as 36 h or more. The organism multiplies freely in the intestinal tract and the symptoms are due to a true bacterial infection, in contrast to those of staphylococcal food poisoning where the organism produces an enterotoxin which may be preformed in the food with a consequently much shorter incubation period. Outbreaks ascribed to infection by *Cl. welchii* are characterized by abdominal pain and diarrhoea. The illness is mild with an incubation period of 8–22 h and is due to heat-resistant strains of the organism which have multiplied in the food, particularly in meat dishes inadequately reheated.

Information about the foods associated with outbreaks of food poisoning in 1955 contained in the report of the Public Health Laboratory Service (1956) shows that processed and made-up meat dishes were responsible for 73% of outbreaks in which the contaminated food was discovered. Reheated meat headed the list with forty-nine outbreaks, and the close association between reheated meat and *Cl. welchii* and between cold ham and bacon and staphylococci is clearly demonstrated. It is of interest that in 1955 only four outbreaks were reported to be associated with eggs compared with an annual average of twenty-nine over the previous 5 years. Most outbreaks reported in previous years were associated with duck eggs and the causal organism in the vast majority of cases was *Salm. typhi-murium*.

An appreciation of the importance of a particular foodstuff as the likely vehicle of infection has a bearing on the rapidity with which the investigation of an outbreak can be brought to a successful conclusion particularly if the association of the presumed causal agent with the vehicle can be established. During the years 1951–3

422 outbreaks involving processed and made-up meat occurred. Of 265 where a causal agent was discovered 114 were of staphylococcal origin, 42 *Salm. typhimurium*, 47 other salmonellas, 49 *Cl. welchii*, 13 other organisms. Of outbreaks involving duck eggs the causative organism in all except one was *Salm. typhimurium*. Where sweetmeats provided the vehicle of infection the largest number of infections was due to salmonellas, but staphylococci, *Cl. welchii* and other organisms were frequently involved.

In outbreaks occurring in more than one family the Medical Officer of Health and his team of workers will have as a prime duty the tracing of the contaminated food back to its common source and the follow-up of actual or potential infections in households where the food may have been consumed. Inquiries in a number of infected households may provide evidence leading to a food vendor or supplier or to further investigations in a restaurant, canteen or other communal eating centre. Here the opportunities for infection of the food which is the possible source of infection will manifest themselves from the methods employed in the handling, storing, preparation or cooking of the food. Poor hygienic conditions, lack of attention to strict personal hygiene and a history of recent illness amongst the staff will all require the detailed attention of the investigators. Patient and careful inquiry and the taking of specimens from members of the staff likely to be implicated may result in a successful conclusion as to the cause of the outbreak and its elimination, but all too frequently either because of late notification of the cases, or because of inability to pinpoint bacteriologically the origin of the infection, only a presumptive cause or none at all can be discovered. It cannot be overemphasized that early action is the most important factor in elucidation.

### Prevention

The primary public-health aspect of food poisoning is prevention and although its prevalence is widespread the principles involved in prevention are simple. They are related in the main to the practice of a high standard of personal hygiene amongst those engaged in the handling, preparation and cooking of food, and in the exercise of adequate precautions to prevent the contamination of food in storage.

The application of the principles is not quite so simple. It includes the education of workers in the food industry, their supervision to ensure continuous good practice, the provision of all necessary facilities to enable precept to be put into practice, education of the public in the standard of food hygiene to be expected, the provision of adequate and proper storage in food premises and an appreciation of the role of vermin in contamination of food.

Education of those employed in the handling of food has as its object the inculcation of a knowledge of the simple bacteriology of food poisoning, the relationship of infection in man to contamination of the food and an appreciation of the reason and the need for the continuous practice of hygienic methods by people dealing with food.

The relationship not only of alimentary infections to the possible contamination of food but of septic conditions of the hand and the potentialities of the conveyance

of harmful micro-organisms from the nose, infected ears or by coughing or sneezing must be taught. This though going a long way to improve standards will in itself be insufficient. Adequate supervision of the workers by trained supervisors must also form part of the régime. With a good background of knowledge on the part of the worker and an efficient system of supervision, conditions in so far as the workers are concerned will approximate to the ideal, namely elimination of person-to-food infection. Experience proves that employees do not resent education and supervision. On the contrary it makes them feel that they are doing a vitally important job in which everyone is interested and they become proud of the high standard achieved and zealous in maintaining their good reputation (Oldershaw, 1955).

If food handlers have been taught the principles of hygiene and if supervision is adequate the other essential is the provision of premises and equipment which will enable the principles to be put into practice with the maximum ease. Facilities for the promotion of cleanliness must be such as to enable hand washing to be carried out before commencing work, frequently during the day and particularly after visiting the toilet. This implies sufficient hand basins with running water, or a plentiful supply of clean water, and soap. Communal towels are to be avoided and the use of the nail brush will be encouraged by supplying a sufficiency for the staff. Clean overalls to protect the food from contamination from the clothes are desirable. Premises should be kept free from dust and dirt and protected against vermin. Food and utensils should be protected from flies and refuse removed from the premises and kept in bins with well-fitting covers. All equipment must be kept scrupulously clean, and facilities for efficient cleansing of utensils include adequate sinks with a sufficient supply of hot water. Sinks should preferably be of the double-unit type and if of the constant-flow variety will minimize the possibility of washing up in water already contaminated with the washings of innumerable previous articles. Provision of efficient dish-washing machines will save labour and achieve good results, but even where washing and rinsing are carried out by hand constant changing of the hot water will achieve a high standard of cleanliness. The large number of outbreaks of food poisoning due to processed or made-up meats emphasizes the need for adequate refrigerator space where dishes cooked the day before and reheated before eating may be stored in conditions which inhibit bacterial growth (Cowan, 1955).

The high proportion of sporadic cases and of outbreaks confined to one family points also to the need for adequate precautions in the home to prevent infection of food either during storage or in its preparation.

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