

Salmonella outbreak from microwave cooked food

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SUMMARY

Following a buffet meal served to six guests at a private domestic function, five of the guests and the host developed symptoms of food poisoning. *Salmonella enteritidis* phage type 4 (PT4) was isolated from all four individuals who submitted faecal samples for investigation. Leftover samples of a savoury rice dish consumed by all six ill persons contained 6×10^3 /gm *Salmonella enteritidis* PT4. The rice salad comprised boiled rice, raw carrots, eggs, cheese and curry powder. The curry powder and remainder of the pack of six eggs were negative on microbiological analysis. The rice dish had been prepared by heating in a 500 W microwave oven with a rotating turntable on full power for 5 min. Although the hazards of inadequate microwave cooking are well recognized, this is only the second outbreak of food poisoning from microwave cooking to be reported.

INTRODUCTION

The potential hazards of inadequate microwave cooking are well recognized. In the UK, general government advice to the public has drawn attention to the importance of ensuring that the manufacturer's recommendations are observed when using a microwave oven to reheat food [1]. There has been a dramatic rise in the sale of pre-prepared meals in recent years and these invariably contain detailed information on reheating requirements for microwave ovens including instructions for ovens of different power ratings. However, some catering food outlets will no longer reheat food in a microwave oven, even if for immediate consumption by the customer, because of the perceived risk of food poisoning. Despite these concerns, there has only been one previous published report of a food poisoning incident associated with microwave cooking [2].

During September 1992, a small outbreak of salmonella food poisoning following a buffet supper at a private home was reported to the local Environmental Health Department.

METHODS

The home was visited by one of the authors (S.M.P.) and a list of foods served at the buffet obtained together with details of their preparation. Personal details,

clinical details of illness and food consumption histories were obtained from the guests using a structured questionnaire. Faecal specimens from all the guests and samples of leftover food or food ingredients were sought for microbiological analysis.

RESULTS

Completed questionnaires were obtained from 6 of the 7 persons who had eaten the buffet meal. No information was available for the seventh who was abroad on holiday. The mean age was 31 years (range 28–38 years) and 4 were women. All 6 persons reported illness with diarrhoea, abdominal pain, fever and headache; 3 of the 6 also experienced vomiting. All had become ill the day following consumption of the buffet meal with a median incubation period of 17.5 h (range 13–21 h). Faecal samples were obtained from 4 of the 6 who completed questionnaires and all were positive for *Salmonella enteritidis* PT4.

The buffet meal comprised baked cheese and onion quiche, a savoury rice dish, potato salad, green salad, vegetarian sausage rolls, strawberry mousse and chocolate cake. All the food had been home-made with the exception of the mayonnaise used in the potato salad which was a commercial preparation. All six persons had eaten quiche, the savoury rice salad, sausage rolls, strawberry mousse and chocolate cake. Only leftover quiche and rice dish were available for sampling, both of which had been kept continuously in the refrigerator since the meal. The sample of leftover rice yielded 6×10^3 /gm organisms of *S. enteritidis* PT4. Leftover quiche was also positive for *S. enteritidis* PT4 but only on enrichment. Samples of the curry powder and the remaining eggs from the pack of six eggs used as ingredients in the rice dish and the quiche were all negative on microbiological analysis.

DISCUSSION

On microbiological grounds, the implicated vehicle of infection in this small domestic outbreak of salmonella food poisoning was the savoury rice dish which had been prepared by the host earlier the same day. The dish had been made from cold boiled rice, two raw shell eggs, grated raw carrot, cheese and a commercial curry powder which after mixing was cooked in a domestic 500 W microwave oven with a rotating turntable on full power for exactly 5 min. It was then kept at ambient temperature for 2 h until the buffet supper was served at 9.00 pm. Although there was evidence for the rice dish as the vehicle of infection the source of the outbreak was less clear. Poultry, meat and eggs are recognized as potential sources of salmonella [3]. No poultry or meat was served at the buffet and although the quiche and rice dish contained egg, the remaining eggs were negative for salmonella. Cross-contamination of the rice dish is another possible explanation although no raw meat or poultry had been prepared or stored in the kitchen on that or the previous day. However, the low salmonella count from the leftover quiche (which was baked in a conventional gas oven at gas mark 6 for 45 min) was likely to have been due to cross-contamination, probably from the rice dish. Finally, the food handler might have contaminated the food directly although she did not report any symptoms until the day after the buffet in common with her dinner guests.

One previous outbreak of food poisoning where microwave cooking was implicated has been described. This was an outbreak of *Salmonella typhimurium* food poisoning which occurred following a community picnic in Juneau, Alaska [2]. A cohort study of 60 people who took food home from the picnic found that of 30 persons who reheated leftover roast pork, all 10 who used a microwave oven became ill, compared with none of 20 who used a conventional oven or skillet.

Microwave cooking can achieve cooking temperatures comparable to conventional cooking. In one study, experiments involving preparation of food according to published recipes recorded temperatures of 91–200 °C (using a fluoroptic probe) after microwave cooking compared with 92–194 °C attained in a conventional oven [4]. The same study also found that reheating ready-prepared foods packaged in plastic pouches, trays or dishes according to the manufacturer's instructions resulted in temperatures in the range 61–121 °C. However, uneven heating of food has been postulated to account for the survival of micro-organisms after microwave cooking [5]. One study of chicken contaminated with *S. typhimurium* found that 5 of 9 microwave cooked samples were positive for salmonella compared with 0 of 9 conventionally cooked samples of comparable weight [6]. *Toxoplasma gondii* encysted in mutton and *Listeria monocytogenes* have also been shown to survive microwave cooking [7, 8]. A study of reduction in viable numbers of listeria in broth and *in situ* on chicken skin after variable microwave cooking times found that some organisms could survive microwave heating even when temperatures of over 70 °C were recorded, probably due to the existence of cold spots [8].

The outbreak we describe here illustrates the practical implications of these experimental studies. The incident was almost certainly a consequence of inadequate microwave cooking either due to uneven heating of the rice dish or to insufficient duration of cooking. The potential hazards of microwave cooking include not only food poisoning because of inadequate cooking, but also burn injuries from excessive heating [9–11]. Variable microwave oven power ratings and manual (rather than digital) timers must increase the hazard risk. New microwave technology is addressing some of these problems and 'smart' microwave ovens which gauge correct temperature from steam output of food are now becoming available. In the meantime, all microwave oven users need to be aware of the importance of carefully following the standard recipe or food product instructions when heating food. If no instructions are available food should be heated until piping hot and, to ensure it has attained an even temperature, stirred carefully during heating (where possible) and allowed standing time after cooking.

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