OUTBREAK OF SALMONELLA FOOD POISONING AT HIGH ALTITUDE

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ABSTRACT

An outbreak of food poisoning occurred among soldiers of an army unit located at high altitude (3300m) in western Himalayas. A total of 78 of the 103 soldiers who had consumed the incriminated meal suffered from the illness. Sixteen of the 78 had symptoms severe enough to warrant admission to hospital. The symptoms consisted of diarrhoea, vomiting, fever, headache, vertigo and abdominal cramps of varying intensity. *Salmonella enteritidis* was isolated from 6 stool samples and in one blood sample. Epidemiologically, frozen fowl was traced as the probable incriminating food agent responsible for the outbreak. This is probably the first such outbreak being reported from high altitude. It is of significance for the Indian Armed Forces, as the cause of the food poisoning was traced to an inherent shortcoming in the supply of food items to the troops located in far flung and isolated regions and in the cooking practices being followed.

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KEYWORDS : Food poisoning; Frozen fowl; High altitude; Non typhoidal salmonella.

Introduction

Large outbreaks of food poisoning attributed to non typhoidal salmonella have been reported among inmates of schools, army barracks, hospitals [1] and large metropolitan buildings eating from a common kitchen [2]. Foodborne outbreaks due to Salmonella manifest in an explosive fashion, though person to person spread is also known to occur [1]. In contrast to *S.typhi* the incidence of outbreaks due to non typhoidal salmonella have increased dramatically [3] and *Salmonella enteritidis* is being isolated with increasing frequency [4] as the incriminating agent in these outbreaks. However, *S.typhimurium* is still the most common serotype isolated. So far, no outbreak of food poisoning has been documented among the Indian troops located at high altitude. In view of the increasing dependence on frozen foods by troops located in remote areas, such an episode assumes special significance.

Material and Methods

The present outbreak occurred amongst 103 personnel of an army unit, located at an altitude of 3,300m, who had all dined in a common dining hall, partaking of food prepared in a common kitchen.

A case was defined as any person who had symptoms of diarrhoea, vomiting, abdominal cramps or fever and who had eaten from the cookhouse of the affected company of the unit. All 103 personnel who had partaken of the meal were interviewed. Cases requiring admission were admitted to a service hospital located in the same area.

Information was requested on symptoms and food eaten. Attack rates for specific foods were calculated. The cookhouse, dining hall and store of the affected cookhouse were inspected. The process of procurement, transportation and storage of foodstuffs, particularly frozen chicken, was investigated. There was no left-over food available except for egg curry, which was sent for microbiological investigations.

All 15 patients admitted to hospital were managed with intravenous fluids and symptomatic measures. No antibiotics were exhibited. The remaining 63 affected soldiers were kept in the unit lines in a separate barrack and their progress was monitored for a week. Laboratory investigations on the admitted patients included microbiological investigations of stool and blood samples.

In addition, the leftover food and water samples were investigated. Also, blood and stool samples were taken from the catering staff and similarly investigated to rule out the possibility of a carrier amongst them.

Results

A total of 78 soldiers of the 103 who had consumed the food from the same kitchen were affected. The incubation period ranged from 10 hours to 2 days (median -18 hours) of having had dinner, on 29 Jun 1991. Most of the cases (82%) occurred between 12 to 24 hours. Diarrhoea was the commonest symptom affecting 72 of the 78 individuals (92.3%), followed by fever in 65 (83.3%) and vomiting in 58 (74.4%). Other symptoms included, abdominal discomfort, intense bodyache and headache. Fifteen soldiers had symptoms severe enough to warrant hospital admission. They were discharged within 2-5 days.

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TABLE 1
Food specific attack rates

Food item	Those who ate	Number ill	Attack rate (%)	Those who did not eat	Number ill	Attack rate (%)	Diff in attack rate	X^2
Rice (Pulao)	102	77	75.5	1	1	100	(+) 24.5	
Puri	41	24	58.5	62	54	87	(+) 28.5	
Chicken	96	78	81.2	7	1	14.4	66.8	12.48*
Egg curry	87	66	74.7	16	9	56.2	18.5	1.64
Vegetables (tinned)	56	46	82	47	29	61.6	20.11	4.33**
Potatoes	54	41	75.9	49	34	69.3	6.6	0.25
Dal	94	67	71.3	9	7	77.8	(+) 6.5	
Papad	101	76	75.3	2	2	100	(+) 24.7	
Kheer	75	58	77.3	28	20	71.4	5.9	0.12
Rasgulla	72	55	76.4	31	23	74.2	2.2	0.0012
Other sweet	75	51	68	28	17	60.7	7.3	0.48

* X^2 (with Yates correction) = 12.48 ($p < 0.01$), ** $X^2 = 4.33$ ($p < 0.05$)

The attack rates for each food item is shown in Table-1. Attack rates for those who had consumed chicken and canned vegetables were found to be the highest (81.2% and 82% respectively). The difference in attack rate in soldiers who had taken any of these food items was found to be significantly higher than those who had not taken these items. A simple cross-table analysis was done for the soldiers taking chicken and tinned vegetables (Table 2). It indicated that the attack rates were equally high for those who ate chicken, regardless of whether they ate tinned vegetables or not, and were similarly low for those who did not eat chicken, regardless of whether they ate tinned vegetables.

TABLE 2
Cross table analysis

	Soldiers who ate chicken			Soldiers who did not eat chicken		
	Total	Number ill	Attack rate (%)	Total	Number ill	Attack rate (%)
Number who ate tinned veg	51	42	82.4*	5	1	20**
Number who did not eat tinned veg	45	36	80*	2	—	—**

* $X^2 = 0.008$ ($p > 0.05$); ** X^2 = (with Yates Correction) = 3.4 ($P > 0.05$)

Salmonella enteritidis was isolated from 6 stool samples and one blood sample among those admitted in the hospital. The organism grew profusely on MacConkey's medium. It fermented glucose with gas, produced hydrogen sulphide and was methyl red positive. Serologically, the organism agglutinated with salmonella poly 'O' antiserum and showed agglutination for 1, 9, and 12 'O' antigens. The 'H' antigen was monophasic and showed agglutination with g and m antisera in phase 1. Hence, it was assigned the antigenic formula 1, 9, 12 g, m. On the basis of biochemical reactions and antigenic structure, it was identified as *Salmonella enteritidis*. Antibiotic sensitivity by Stokes method showed sensitivity to ampicillin, streptomycin, chloramphenicol, nalidixic acid, gentamicin, and norfloxacin. The water samples were found to be satisfactory (most probable number of coliforms < 1 per 100 ml). No pathogenic organisms could be isolated from the leftover egg curry or from stool/blood samples of the 5 catering staff which were examined. Blood count and other biochemical parameters were within normal limits.

Epidemiological investigations brought out that the frozen fowl had been supplied by a firm at sea level. They had been slaughtered on 24 June and frozen in polythene bags the same day (each bag contained 15 birds). The bags were removed from the firm's refrigerator on 28 June at around 0530 hours for onward transportation to the forward location at high altitude, by air. They reached the local supply unit at 1200 hours on the same day, by which time partial thawing had set in. The birds were issued to the affected unit at around 1500 hours on 28 June and were cooked only on the following evening (29 June). There was no refrigeration facility available in the unit.

Discussion

Salmonella enteritidis and Salmonella typhimurium are known to cause an invasive type of food poisoning. In Salmonellosis, the small intestine is the main site of infection with occasional involvement of the colon giving rise to dysenteric symptoms. The main source of infection are domestic poultry products [5], eggs and meat [6]. In recent studies *Salmonella enteritidis PT 4* has been isolated from 21 per cent of chilled and frozen chicken in England [7], and in as many as 50 per cent of chickens in the USA [3]. Incubation period is usually 12-24 hours but it has been reported to vary from 6 hours to 9 days [2].

The explosive nature of the food poisoning in one particular company of a unit pointed to a food borne infection. Diarrhoea, fever, abdominal pain and vomiting, which were the main symptoms, correlate with the pattern of outbreak of Salmonella infection, which was clinched by the growth of *Salmonella enteritidis* in the stools and blood of patients. Working backward from time of onset and median incubation period, the dinner consumed on the previous evening was incriminated as the meal containing the source of infection.

The attack rates in those soldiers who had consumed chicken and tinned vegetables, and the differ-

ence in attack rates between those who had consumed these items and those who had not, pointed towards fowl and tinned vegetables as the probable sources of infection. Further cross table analysis incriminated fowl as the cause of the infection. These fowl had been slaughtered on 24 June and had been deep frozen in polythene bags (each bag containing 15 birds). They were removed from refrigeration at 0530 hours on 28 June and cooked only the next evening. They had remained unrefrigerated for more than 24 hours. The cooking was carried out in a container of inadequate size where 15 birds were cooked together without use of pressure cooker. At the altitude where the birds were cooked (approximately 3,300 m), the boiling point of water is considerably lower than at sea level.

The procedure of deep freezing 15 birds in a bag, the method of their transportation, distribution and the storage in the unit prior to cooking, gave ample opportunities for the infection to multiply even if one bird was infected. Further, the cooking practice adopted may not have been sufficient to destroy salmonellosis because of the improper penetration of heat into the central portions, while cooking [8].

The role of food handlers in this food poisoning was ruled out as the food was cooked just prior to being served. Salmonella poisoning could not have occurred, as there was not sufficient time interval between contamination of the food and its consumption. Also, the blood and stool samples of the food handlers were negative for salmonella. However, it would be pertinent to mention that the food handlers had also taken part in the meal and 2 of the 5 food handlers had symptoms of food poisoning. Further, human carriage of non typhoidal salmonella has been shown to play a negligible role in causing such explosive outbreaks [8], though its role has been overemphasized in many quarters. In a study of 566 outbreaks in UK only 2 per cent were found to be related to a specific food handler [9].

This outbreak of salmonella food poisoning has highlighted the importance of proper ante and post mortem examination of the fowls and livestock, prior to refrigeration and also of regular monitoring of the cold chain during transportation of frozen food items to the troops located in remote areas. It also, highlights the importance of proper thawing and pressure cooking of such frozen items, especially in high altitude areas.

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