AN ICE-CREAM FOOD POISONING OUTBREAK DUE TO *B. DYSENTERIAE* (SONNE)

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While outbreaks of acute infectious diseases, particularly enteric fever, have frequently been spread through ice-cream, dysentery bacillus outbreaks with this vehicle are very rare, so the present outbreak is worth recording.

Epidemiological features

The first intimation of illness was derived from Dr Court, Medical Officer of Health to Chard Rural District Council and to Ilminster Urban District Council, who reported that at a fete at Dowlish Wake on 17 May 1937, a number of children were taken ill after eating ice-cream, most of the cases developing from 24 hr. to 2 days later. Subsequently a number of other cases came to light associated with ice-cream consumption but infected on other dates. As many of the cases were not under medical supervision it is probable that the returns are incomplete.

The known cases occurred in Chard Rural District, Ilminster, Crewkerne and Chard Borough in the County of Somerset and at Thorncombe and other parts of Dorset adjacent to Chard. Definite cases traced directly to ice-cream infection are as follows:

	Infected		
Area	17 May	23 May	29 or 30 May
Chard Rural and Ilminster	34	19	0
Thorncombe	0	26	0
Crewkerne	0	3	4
Chard Borough	0	36	0
	34	84	4

In addition particulars of other cases were obtained. At Thorncombe there were at least seven subsequent cases of diarrhoea, etc., most being definite contact cases, others unrelated and none associated with the ice-cream. In Chard Rural about fourteen other cases were noted mostly early in June. None were definitely associated with ice-cream infection, but some of the patients had eaten ice-cream. A few were clearly contact cases. Most were suffering only from diarrhoea without other dysentery symptoms, and in two families, investigated in the laboratory, no dysentery bacilli could be found. None of these later cases could be associated in any definite way with the consumption of ice-cream on a specific occasion.

It is clear that the ice-cream was not infected with dysentery bacilli before 17 May when the Dowlish Wake meeting was held in a field at Dowlish Wake

on 17 May. The incriminated ice-cream motor car (vendor H) was in the field, and all the thirty-four known cases were infected there. No cases were associated with a second ice-cream vendor who sold ice-cream from just outside the field.

Evidence is definite that the same vendor's ice-cream was toxic on 23 May, and was particularly infective on that day, for wherever vendor H went, and he covered a fairly wide area, the ice-cream purchased caused dysentery.

There is no real evidence that the ice-cream was infective on any later date. In the Crewkerne cases mentioned in the table in two in one family, the daughter had ice-cream on 29 May thought to be from the incriminated vendor, and her mother had ice-cream from a quite different vendor on 30 May. The mother, however, had been nursing her grandchildren with dysentery infected on 23 May and probably both were secondary cases. In the other two cases ice-cream was eaten on 28 May and the patients were ill on the 30th, and the vendor is said to be the man H., but the evidence that he was in Crewkerne on that day is indefinite. The ice-cream was examined on 25 May, and the vendor states he did not go out for nearly a fortnight and almost certainly he was not at Crewkerne on that week-end.

Extensive inquiries have brought to light no other cases on these dates associated with this ice-cream, and if it was toxic then it is most unlikely there would have been only two cases. It is probably correct to assume that the ice-cream contained dysentery bacilli on 17 and 23 May but was not infective beyond that date, although secondary cases were resulting.

While there was a certain amount of variation the common symptoms were abdominal pain, vomiting and diarrhoea. The stools were often blood-stained and contained mucus. Usually there was some rise of temperature. Convulsions were noted in a few very young children. The illness was comparatively mild, lasting from 3 to 7 days with about 4 days as the average, but leaving some debility. The incubation period varied from less than 24 hr. up to 2 days. There were no deaths.

There was no special sex incidence, and being ice-cream naturally nearly all the cases were in children. Of the 118 primary cases of which particulars were obtainable the age was given in 114:

Under 5 years	34
5–10 ,,	41
10–15 ,,	17
15–20 ,,	3
Over 20 ,,	19
	114

This no doubt corresponds closely with the ages of the consumers. In only one or two cases was there any evidence that persons consumed the ice-cream on 17 or 23 May without illness resulting.

There were at least four itinerant ice-cream vendors who supplied ice-cream over this period in the areas implicated, and as ice-cream vans are usually somewhat similar in general type and purchasers not observant it took a good deal of trouble on the part of the various Medical Officers of Health and others concerned before the facts could be ascertained with any precision. Inquiry into the day-by-day itinerary of the different vendors, and using detailed descriptions of the different vans, it was possible to ascertain with certainty that all the cases were associated with ice-cream from a particular vendor H. Early attention was drawn to this man, since he was known to have been in the field selling ice cream on 17 May when the outbreak started. Also, as he used to live in Chard and was well known by sight, complete identification was possible without great difficulty. This vendor showed great reluctance to submit a detailed itinerary of his daily visits, and what he did submit was clearly inadequate and far from accurate.

Over the period when the ice-cream was infective, i.e. up to 25 May, it was being made in a lock-up garage. This had a cement floor and galvanized iron sides and roof but no other conveniences, i.e. no drain, water supply or lighting. The utensils had to be taken home to be washed, and he lived in a back-to-back house which is condemned and waiting to be demolished. This house has a water supply but no means of obtaining hot water other than by heating water on a gas ring or open fire. The cleaning of the utensils is not likely therefore to have been very effective.

The methods of preparation were very simple, the milk being mixed with ice-cream powder, sugar and some fresh eggs, put into a metal canister and the contents frozen by standing the container in a mixture of ice and salt. It was frozen in the morning and then taken out on the rounds. Mr H. has a motor van and also a tricycle, while the ice-cream was also taken by rail.

The milk was obtained direct by him from a recognized milk vendor, H. fetching it himself in the early morning. Inquiries amongst the customers of this milk gave no evidence of cases, this excluding the raw milk as the source of infection. During the infective period the milk was used raw and not heated in any way.

Both H. and his wife, who participates in the business, deny that they had diarrhoea or been ill in any way. H. has been in the business for a good many years, and no evidence of previous outbreaks have been associated with him or his father-in-law, for whom he used to work.

BACTERIOLOGICAL INVESTIGATIONS

Only included are those which bear upon the outbreak. For example, other ice-creams were sampled with negative results, a number of later cases of diarrhoea in the district were investigated to see if dysentery bacilli were present, etc., and this work is not included. They were all carried out at the Somerset County Council Laboratory at Taunton by Mr D. R. Wood, F.I.C., the Bacteriologist and Public Analyst.

Our attention was not drawn to the outbreak for some time, so unfortunately we were unable to obtain any ice-cream until 25 May. The ice-cream as made in the original cylinder was brought to the laboratory early that morning by Dr Allen, M.O.H. of Taunton, and examined at once. We were unable to find any dysentery or *Salmonella* bacilli, but it was heavily contaminated with *B. coli*. Two guinea-pigs inoculated subcutaneously from sediment both died of malignant oedema within 2 days.

No significant organisms were isolated from faeces samples from two patients examined 24 and 26 May, but from two further cases examined on 26 May dysentery bacilli were isolated. Later several further samples yielded this bacillus. Five samples of blood, two being the same cases from which the bacilli were isolated, were tested for agglutination with a long series of *Salmonella* and dysentery bacilli. All were negative except with the Sonne dysentery bacillus, for which positive agglutination was obtained with a dilution of 1 : 125, negative 1 : 250.

With considerable difficulty one sample of faeces was obtained from H. on 12 June and one from his wife on 11 June. Both were solid and yielded no *Salmonella* or dysentery bacilli.

The bacillus isolated had the usual cultural characters common to the dysentery group, while its fermentative characters were acid production in glucose and mannitol, very slight persistent acid in lactose on the fourth day, no acid production from xylose, sorbitol or salicin. No indole production. Litmus milk became very slightly acid in 4 days, remaining so until the fourteenth day when it clotted. A methyl-red positive reaction in glucose peptone phosphate after 5 days' incubation. These characters are those of the Sonne strain and also differentiate it from the allied *dispar* strain. The strains isolated agglutinated to the full titre with standard specific serum for the Sonne bacillus and did not agglutinate with various sera for the other dysentery types or *Salmonella* types.

As no information was available as to the behaviour of dysentery bacilli in ice-cream two experiments were carried out. Ice-cream was prepared in the laboratory as made by vendor H. but was then sterilized. Both samples were then inoculated with the Sonne strain isolated, to the extent of about 150–300 organisms per c.c. In the first experiment at room temperature (approximately 65° F.) there was no multiplication at 1, 5 or 7 hr., the figures showing a small decrease, but no later examinations were made. In the second experiment the ice-cream was kept frozen (0–1° C.). It showed no multiplication at end of 7 hr. but slight increase at 48 and 56 hr., the counts being about double. At the end of 4 days the plates showed no dysentery bacilli. These experiments are given merely to show that the ice cream was not a suitable medium for multiplication.

DISCUSSION

Individual cases and contact spread outbreaks due to the Sonne type of dysentery bacillus have been recorded by many investigators and the extensive literature need not be reviewed. The fairly extensive prevalence of Sonne infections is well illustrated by the work of Nebarro & Signy (1932), who made positive bacteriological examinations of all cases exhibiting diarrhoea admitted to the Great Ormond Hospital for Sick Children. During the four years 1929–32, 106 dysentery infections were found, eighty-seven being Sonne, eighteen Flexner Z and one Flexner W.

On the other hand, comparatively few Sonne outbreaks have been traced to infected food. In the four food-poisoning outbreaks described by Savage & White (1925) as due to dysentery bacilli, in three the organisms were culturally identical with the Sonne-Thjøtta type but differed completely in serological type, so none can be considered as Sonne outbreaks.

The first clearly recognized Sonne outbreak due to milk is that recorded by Fyfe (1927). This was at St Andrews in 1926 with about 150 cases, most within a period of 8 days but extending in all over 20 days. The symptoms were those of mild dysentery with a few severe cases but no deaths. Mucus was usually in the stools, and blood also in a good many cases. A particular milk supply was implicated, infected from a case on the farm. Topley & Wilson (1936) mention three other milk spread outbreaks, all abroad, and an outbreak reported by Leuchs & Heim in 1930 due to infected cheese and involving fifty-one persons.

The outbreak of Sonne dysentery in February 1930, described by Cann & Nevasquez (1931), amongst the nursing staff at Guy's Hospital in which about 100 were affected was due to food infection, since all were associated with food eaten in the nurses' dining room. No specific article of food could be incriminated, but two of the kitchen maids were carriers of this bacillus and were probably the source of infection.

In the outbreak of twenty-four cases of Sonne dysentery at Rugby school in 1931 Smith (1931) suggested that some uncooked food was the source of infection, but no evidence implicating any food was found.

The above appear to be the only Sonne outbreaks in any way associated with infected food.

The only other dysentery outbreak with ice-cream as the vehicle which I have been able to trace is one in Worcester City in June 1930. Through the kindness of the M.O.H. (Dr A. J. B. Griffin), who lent me his files, I can supply the following summary. The outbreak was an explosive one and consisted of twenty-four cases with one death. Of these cases the fatal one (a child of 10 months) was a direct contact, the other twenty-three had all consumed ice-cream (strawberry ice) from one particular shop, on or about 13 June. Dysentery bacilli (Flexner W) were recovered from the stools of at least ten cases. Apparently all the infected ice-cream was eaten on the one day, and that submitted to the Ministry of Health Laboratory was subsequent and

showed no dysentery bacilli. Stools from the two vendors were also negative for dysentery organisms. The ice-cream after mixture was allowed to stand overnight, frozen the following morning and distributed. No evidence was available as to how the ice-cream became infected. The milk supply was exonerated. There was only one secondary case. The symptoms were severe in some patients, and in these mucus and blood was present in the stools. All but two of the cases were children.

In the Somerset outbreak the symptoms were mild, and this is in accordance with most Sonne infections, particularly when the disease occurs in epidemic form. For example, in the School spread outbreak in Denton, near Manchester, recorded by MacGill & Downie (1932), there were about 100 cases and no deaths, while in another Sonne outbreak in three Yorkshire villages recorded by Pickles (1932) there were 120 cases and no deaths. Individual Sonne infections may show considerable severity and death may occur. Evans (1928) and Harvey (1933) have given details of such fatal cases, while in the Great Ormond St Hospital series quoted above the Sonne death rate was 4·5%.

On the bacteriological side no new features were met with and the diagnosis was clear-cut. Ice-creams vary so much in composition that the two experiments quoted are quite inadequate to settle the extent to which dysentery bacilli can multiply in ice-cream under different conditions.

On the public health side the chief point of interest is the practical measures which can be taken to deal with potential carriers handling food. The regulations are "The Public Health (Infectious Diseases) Regulations 1927", and the pertinent article reads:

(1) If a Medical Officer of Health has grounds for suspecting that any person in the District who is employed in any trade or business concerned with the preparation or handling of food or drink for human consumption is a carrier of enteric fever or dysentery infection, he shall report accordingly to the Local Authority who may give notice in writing to the responsible manager of the trade or business concerned certifying that for the purpose of preventing the spread of the disease they consider it necessary for their Medical Officer of Health or a Medical Officer of Health acting on his behalf to make a medical examination of such suspected person, and the responsible manager and all other persons concerned shall give to the Medical Officer of Health all reasonable assistance in the matter.

(2) If from the result of any such examination, or from bacteriological or protozoological examination of material obtained at any such examination, or from any other evidence which he may deem sufficient for the purpose, the Medical Officer of Health is of opinion that the specified person is a carrier of enteric fever or dysentery infection, the Medical Officer of Health shall report to the Local Authority who may give a notice in writing to that effect to the responsible manager and to the suspected person with a view to preventing, during a period to be specified in such notice, the employment of the person to whom the notice relates in the conduct of the trade or business, or in any other trade or business concerned with the preparation or handling of food or drink for human consumption.

In the outbreak there was complete evidence implicating the ice-cream, but no real evidence as to how it became infected in its dirty surroundings. The milk was exonerated, and that H. or his wife was a carrier of the bacillus was

the most likely hypothesis, the single negative results of two very unsatisfactory samples being of no weight. When the question of operating this section arose, no fresh cases were arising, and the M.O.H. of Taunton where the ice-cream was made did not consider he could justifiably put this section into operation and demand a series of bacteriological examinations of the stools without actually suspending the vendor with payment of compensation if we failed to prove him a carrier. It is worth noting that the wording of clause (1) merely authorizes a "medical" examination, and although clause (2) visualizes laboratory examinations the compulsion only is in the first clause, and it is not clear that "medical" also includes laboratory examinations.

The article is not free from ambiguity, and should be amplified by a specific requirement that any suspected person handling food must submit to any necessary clinical and laboratory examinations considered necessary without prejudice to the separate question of suspension from his work.

Very careful supervision was maintained over the preparation and sale of the ice-cream, and these steps were sufficient to prevent any further cases. While the carrier hypothesis was unsubstantiated, the use of sterilized instead of raw milk, the provision of suitable premises, and the much greater attention to cleanliness in preparation and storage which resulted prevented any further cases.

SUMMARY

An outbreak in May 1937 of about 130 cases of mild Sonne dysentery with no deaths. The outbreak was spread by ice-cream made under very unsatisfactory conditions, but no carrier case or specific source of infection ascertained. The very scattered nature of the outbreak, involving five different sanitary areas, with place of preparation in a sixth, is a feature of interest.

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