EPIDEMIOLOGICAL INVESTIGATION OF AN OUTBREAK OF FOOD POISONING TRACED TO YOGURT AMONG PERSONNEL OF A MILITARY TRAINING CENTER

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ABSTRACT

Background: A food borne outbreak is usually suspected when there is a history of ingestion of a common food, attack of several people simultaneously and similarity of signs and symptoms in the majority of cases. One such incidence happened in a military training centre where a lunch attended by 110 personnel was arranged. After about three hours, 57 of them reported sick to a local military hospital.

Patients and Methods: A prospective study was performed to probe into the facts under which this outbreak erupted. A sample of 90 personnel who attended the lunch was interrogated for eating of food that was served. Mean age of the participants was 22 years while the range of incubation period was 3-5 hours.

Results: By examining the attack rates for consumers of various foods it was found that eating yogurt was significantly associated with the causing of outbreak. Exposure rates among those who ate yogurt was 94.7 % P <0.001 while odds ratio showed (13.2) almost causative association.

Conclusion: The epidemiological findings points out to the need of having check on the purchasing of food items from outside sources.

Keywords: Food items, yogurt, poisoning, outbreak

INTRODUCTION

An Epidemic is defined as the occurrence of a number of cases of disease usually large or unexpected for a given place and time, while an outbreak as the occurrence of an epidemic disease at a particular time and place [1]. In developing world, infectious diseases transmitted by contaminated food and water are constant and frequently fatal threats to health and affect an estimated 40 million people. Diarrhoeal diseases alone are estimated to cause an annual 2.7 billion cases and 1.9 million deaths. These diseases are also pervasive in industrialized world affecting an estimated 30% of the population each year [2]. WHO therefore recommended all countries to adopt policies, strategies, and technologies to ensure the safety of food with a view to reducing food borne morbidity whatever the cause, and improving the nutritional and hygienic quality of food [3]. Food poisoning is defined as any disease of an infective or toxic nature caused by or thought to be caused by the consumption of food and water [4]. A food borne outbreak is obviously suspected when a number of persons who have eaten a meal together fall ill. There will be a history of ingestion of a common food and similarity of signs and symptoms in the majority of cases [5]. It is characterized by acute gastroenteritis due to contamination with either living bacteria or their toxins or inorganic chemical substances and poisons derived from plants and animals. The bacterias and viruses involved are Salmonella, Staphylococcus aureus, Clostridium perfringens, Clostridium botulinum, Vibrio parahaemolyticus, Bacillus cereus and Norwalk and small round structured viruses (SRSV). Table-1 summarizes the main forms of microbial food poisoning and intoxication commonly

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presenting as sudden outbreaks [6]. Recently new food borne pathogens emerged as threat to the safety of food supply. These are E.Coli:0157:H7, Cyclospora, Cayetanesis, Campylobacter, Listeria monocytogenes and Salmonella sero type enteritidis [2]. Gastroenteritis can be caused by three different types of bacterial toxins, Enterotoxin (Vibrio Cholera, Salmonella Spp, Campylobacter Spp & Enterotoxigenic E.Coli (ETEC), Neurotoxin (Bacillus Cereus, Staph aureus producing enterotoxin B), Cytotoxin (Salmonella Spp, Campylobacter Spp, & Enterohaemorrhagic E.Coli (EHEC) [4]. Various epidemiological features helpful in determining etiology are shown in (table-2). When the incubation period is short (1-6 hours after food consumption) the toxin is usually preformed. Vomiting is usually a major complaint and fever is usually absent. Examples include intoxication from S.aureus or B.cereus. In this case toxin can be detected in the food. When the incubation period is longer (8-16 hours) the organism is present in the food and produces toxin after being ingested. Vomiting is less prominent, abdominal cramps are frequent, and fever is often absent. Toxin can be detected in food or stool specimens [7]. Between a quarter and a third of all reported incidents have no ascertainable cause. In majority of such cases the cause is presumably a bacteria or viral agent, which remains, undetected [8]. A good epidemiological description is urgently required for determination of size of the outbreak, the population groups most severely affected and likelihood of continued spread, so that a hypothesis can be formulated. With the appropriate details of the source and distribution channels of the suspected food coupled with efficient collection of samples, of food, faeces, vomit, etc for laboratory examination, it is possible to correctly study the incidence and draw correct conclusion as possible cause [9]. The object should also include determining total number of bacteria & their relative number of each kind involved. If facilities exist phage typing of the organism should be done to complete the laboratory investigation. In addition stool samples of the kitchen employees and food handlers and water testing should also be done.

In Pakistan Armed Forces mass catering is done at dinner that is a traditional ceremonial function to celebrate a particular event/occasion or day. On this day a common food is served on large scale to all ranks. The dishes are usually prepared from the food items procured from the dependent supply depot. However certain items like sweets, yogurt, ice cream and condiments etc may also be purchased from local market.

This study was aimed to define the magnitude of outbreak in terms of time, place and persons, to determine the particular condition & factors responsible, to identify the source of infection and mode of transmission and to make the recommendations to prevent occurrence .The assessment was done in relation to age, sex, complaints/symptoms, temperature, time of onset of symptoms, and duration of symptoms.

PATIENTS AND METHODS

The setting of the study was the particular place (X Company) of X training center where the outbreak of food poisoning took place. On 24 June at about 1200 hours a lunch was arranged in this company. A total of 110 personnel including officers, (Junniar Commissioned Officers) JCOs, other ranks and locally employed civilians attended the occasion. After about three hours an outbreak of food poisoning erupted and as a result 57 personnel reported ill at local military hospital with symptoms of nausea, vomiting, abdominal cramp, diarrhea and fever. Necessary treatment was provided to the victims and all of them survived. The outbreak occurred at border defense area where there was shortage of advanced laboratory facilities. Moreover talent and techniques to tackle the problem was also deficient. On the instructions of concerning administrative authority a public health

specialist was deputed to investigate the outbreak. The Regimental Medical Officer was included and given the task of examining and registering of the remaining cases daily and if necessary referring them to local hospital. Entire training company personnel were educated/encouraged to report immediately if and when any of the symptoms appear. The eligible personnel were defined as those who attended the particular lunch on 24 Dec in X Company. Cases were defined as those having symptoms of nausea, vomiting, abdominal cramp, diarrhea and fever after consumption of food dishes. Diagnosis of the existence of outbreak was verified by clinical examination of a sample of cases at field hospital. Epidemiological investigation was started within 24 hours before the availability of laboratory results. Since the existence of food poisoning was evident therefore no comparison was done to confirm the existence of an epidemic. Following parameters were formulated.

Defining the Population at Risk:

A complete list of people involved (110) and their history was obtained. and using a random number table, 90 persons including JCOs, (Other Ranks) ORs, recruits and civilians (paid from defense estimates)were selected to survey All were interviewed regarding food eaten during lunch, time of onset of symptoms, symptoms of illness in order of occurrence, personal data such as army number & rank, age and unit. This included 78 personnel who attended lunch and 12 kitchen related personnel.

Rapid Search for all Cases and their Characteristics:

- Medical survey: In the defined area i.e. the military training centre a medical survey was carried out to identify all cases including those who have not sought medical care, and those possibly exposed to risk. As a result 34 personnel including 8-cook house related personnel who were not ill or having other symptoms were identified.
- Preparation of epidemiological case sheet: An epidemiological case sheet was designed for collecting the data from cases and from persons apparently exposed but unaffected.

Searching for More Cases:

Inquiry was done to probe into the existence of additional cases and it was revealed that seven cases of food poisoning occurred in a Regiment who attended the lunch as a band party.

Evaluation of Ecological Factors:

Sanitary status of the cookhouse & dinning hall was satisfactory. Temperature, humidity and air pollution was within normal limits. No population dynamics of insects and animal reservoir were observed.

Further Investigation of Population at Risk:

By the time the investigation started the outbreak was over. However stool and vomit was sent for culture sensitivity to nearest CMH. Examination of suspected food (remnant) items was not done owing to non-availability. Due to limitation total number of bacteria and the relative numbers of each kind involved & phage typing was not done. Results of stool samples of kitchen employs and food handlers were investigated and found normal and up to date. A prospective cum case control study was designed and a questionnaire was prepared. The sample included both persons who were ill and persons who were not.

Data Analysis:

The data was analyzed on ongoing basis, using the classical epidemiological parameters in time, place and person.

- Time: All cases were plotted in chronological distribution of time and a graph was prepared to plot an epidemic curve.

Table-1: Principle microbial causes of food poisoning outbreak.

Organism	Mechanism	Incubation Period in Hours	Main Symptoms
Salmonella	Infection	12-24	Diarrhea 1-7 days
Staph aureus	Toxin, preformed in food	2-6	Vomiting 6-24h
C.perfringens	Toxin, preformed in food, also in gut	8-22	Diarrhea 1-2 days
C.botulinum	Toxin, preformed in food	12-36	Neurological
V.parahaemolyticus	Infection	12-18	Diarrhea 1-2 days
B.cereus	Toxin, preformed in food	1-5 8-16	Diarrhea 12-24h
Norwalk & Small round structured Viruses(SRSV)	Infection	15-50	Vomiting & Diarrhea 12-72h

Source: (6)

Table-2: Epidemiological features may be helpful in determining etiology.

Recent hospitalization or Antibiotic use	Suggest	C.difficila
Recent foreign travel	"	Salmonella, Shigella, Campylobacter, E coli or V.cholerae
Undercooked Hamburger	"	E.coli, esp:0157:H7
Fried Rice consumption	"	B.cereus.In. In Toxin
Persons eating the same food	"	Staphylococcus aureus.

Source: (7)

Table-3: Attack rates for specific food items.

Food	Group – A Persons who ate specific Food				Group – B Persons who did not eat specific Food				Difference of Attack Rates %
	ILL	Not ILL	Total	Attack Rate %	ILL	Not ILL	Total	Attack Rate %	
Chicken Roast	46	28	74	62.16	11	5	16	68.75	- 6.59
Mutton Curry	51	30	81	62.96	6	3	9	66.66	- 3.7
Mutton Pullao	50	26	76	65.78	7	7	14	50	+ 26
Sweet rice	30	14	44	688.18	27	19	46	58.69	+ 9.49
Yogurt	54	19	73	73.97	3	14	17	17.64	+ 56.33
Chapatti	26	11	37	70.27	31	22	53	58.49	+ 11.76
Fruit (Kino)	48	26	74	64.86	9	7	16	56.25	+ 8.61

- Place: Spot map was not prepared as the X Company was evident to have clustering of cases.
- Person: All persons were allotted an identification number and histories on consumption of specific food items were collected. Since there was no death therefore case fatality rate was not calculated.

Formulation of Hypothesis:

A null hypothesis was formulated with the assumption that there was no difference between persons who ate yogurt and those who did not eat yogurt.

Survey results were analyzed using the statistical package SPSS version 10.0.

RESULT

Age range of the participants of lunch was 17-42 years. Mean age was 22 years while median age was 20 years. Median duration of the symptoms was one hour while range of duration of symptoms was 1-24 hours Range of incubation period was 3-5 hours while median incubation period was three hours. The tabulation of food histories is furnished in (table-3) showing attack rates for specific food items in two categories and difference in attack rates. Table-4 shows cross checking of data of a popular food combination. The epidemic curve of the outbreak was plotted as shown in figure. Further statistical verification was done to test the hypothesis (table-4&5).

DISCUSSION

It is evident from table-3 that the largest difference in attack rate was found in dish yogurt. Exposure rate in attacked persons of this dish was very high 94.73% while Odds ratio (13.2) and Chi-square x 2 value 18.83 (table-4) at one degree of freedom showed P < 0.001 proved statistically yogurt as infected dish. Certain food combination in our society are very popular e.g. mutton pullao with yogurt and in table-5 attack rates for this food combination was analyzed and it was found that mutton pullao was not responsible for this outbreak. The Epidemic curve of this outbreak shows that all cases developed with one incubation period and there was clustering of cases with a narrow interval of time.

Various studies through out the world have been conducted on the causes of food poisoning. By far the most important causes of food poisoning illness are Salmonella and Campylobacter. Raw foods of animal origin are the main sources [10]. A UK based review study on general outbreaks of infectious intestinal disease associated with infected dairy products in England & Wales from 1992-96 revealed that out of 20 outbreaks 11 were due to Salmonella species [11]. A study carried out in Rhode Island revealed that the causative organism in food poisoning outbreak in school students who consumed ham was Staphylococcus [12]. Three outbreaks of Salmonella infections associated with eating Roma tomatoes were detected in USA and Canada in the summer of 2004 [13]. In April 2002 a community outbreak of gastro-enteritis occurred in Italy which was traced to eating of raw shellfish [14]. A study carried out as a result of food poisoning outbreak in an elementary school community in Colombia proved Shigella flexneri as causative organism. A study in France established that surveillance and detection of outbreaks have substantially improved through the use of new typing scheme, particularly those based on molecular techniques. Their routine use, now, allows an early identification of the clonal spread of food-borne bacteria [15]. To determine the causes of gastrointestinal infection associated with the home, review questionnaire study was done in England and Wales on general outbreaks (outbreaks affecting more than one household) of infectious intestinal disease reported to the Public Health Laboratory Service (PHLS) Communicable Disease

Table-4: Test of significance – pearson Chi–Square test X^2.

Food	Value at d.f 1	Interpretation
Chicken Roast	0.246	P>0.05
Mutton Curry	0.048	P>0.05
Mutton pullao	1.26	P>0.05
Sweet rice	0.871	P<0.05
Yogurt	18.83	P<0.001
Chapatti	1.30	P>0.05
Fruit (Kino)	0.42	P>0.05

Table-5: Attack rates for food combination.

	Persons who ate Yogurt			Persons who did not eat Yogurt		
	No	No. ILL	Attack Rate%	No	No. ILL	Attack Rate%
Ate Mutton Pullao (Rice)	63	47	74.60	13	4	30.76
Did not eat mutton pullao (Rice)	10	7	70	4	-	0

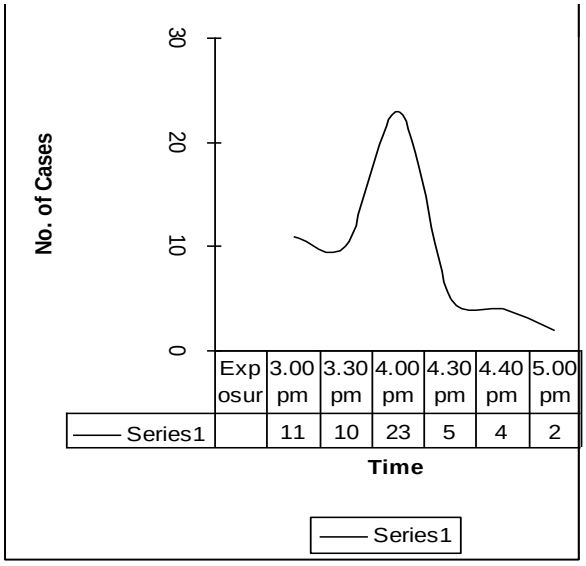

Figure: Epidemic curve.

Surveillance Centre from 1992 to 1999 and it revealed that the risk of hospitalization from outbreaks linked to the home was higher than that linked with outbreaks related to other premises [16]. In Pakistan a study in Gadap,an industrial suburb of Karachi found that an outbreak of gastro-enteritis occurred due to consumption of faecally contaminated well water which was most probably due to rotavirus [17].

In Pakistan Armed Forces cases of food poisoning resulting from consumption of food at large gathering are not uncommon. Cadets and recruits in Pakistan military academy and other training centers remain exposed to such circumstances. After analyzing the survey result it was exposed that the loophole was the purchasing of infected yogurt from civil market. Kitchen temperature provided ideal condition for bacteria to grow. Moreover epidemic curve, few cases of pyrexia, short incubation period and recovery of patients in 24 hours provided additional clues for the suspicion of growth of Staphylococcus aureus/B.cereus. Lab result later on confirmed the growth of Staphylococcus aureus.

CONCLUSION

It is evident from this study that the surveillance on procuring of food items for mass catering should be mandatory to avoid notable loss in man working hours.

RECOMMENDATION

In the light of study conducted, the X training centers authorities were advised following preventive & control measures:

- No food items to be purchased from civil market especially the dairy product and meat.
- Yogurt should be made in clean utensil. Vegetable/fruits addition should be done after soaking for half an hour in a solution of water and water sterilizing powder WSP.
- A high degree of personal hygiene among individuals engaged in the handling, preparation and cooking of the food to be maintained. Hands must be frequently washed and habits avoided which would encourage transfer of Staphylococci from the nose and mouth of the food handlers to foodstuffs.
- Individuals suffering from infected wounds, boils diarrhea, dysentery, throat infections etc. should not be allowed to handle food.

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