The *Salmonella* Problem in Lebanon and Its Role in Acute Gastroenteritis

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**ABSTRACT**

The present report presents the available data on the first isolation, occurrence, and distribution of the unadapted group of salmonellae in various nonhuman sources in Lebanon. *Salmonella typhimurium* was the most predominant serotype in poultry. It is the leading serotype in its zoological distribution as it was isolated from 10 animal species. Other unadapted *Salmonella* isolates from poultry, listed according to their descending frequency, included *Salmonella bareilly*, *Salmonella pullorum*, *Salmonella infantis*, *Salmonella oraniemburg*, and *Salmonella aqama*. *Salmonella dublin* was the most frequent in cattle followed by *S. typhimurium*. The four most common serotypes encountered in animal feed were *Salmonella meleagridis*, *Salmonella tennesse*, *Salmonella chester*, and *Salmonella seftenberg*, whereas the most predominant *Salmonella* serotypes recovered from sewage effluent were *Salmonella montevideo*, *Salmonella goetborq*, *Salmonella paratyphi B*, *Salmonella bovis-morbidicans*, *Salmonella livingstone* and *Salmonella muenster*. The latter was isolated from leftover poultry meat that was incubated in four separate food poisoning outbreaks of gastroenteritis which occurred in different places in East Beirut. The same serotype was isolated from the stools of some of the affected patients. Some of the documented *Salmonella* gastroenteritis outbreaks in Lebanon are briefly reviewed. The prevention and control of human salmonellosis are discussed.

The salmonellae may be grouped into three categories on the basis of their host predilection: the salmonellae primarily adapted to humans, those primarily adapted to specific animals, and the unadapted salmonellae which include about 2,000 serotypes with no apparent host preference. Members of the latter group are potentially pathogenic to humans and/or animals and are incriminated in acute gastroenteritis which results from the consumption of contaminated food or water. The epidemiological relationship between human salmonellosis and isolation from meat and other food animal products has been demonstrated (6,8,9).

*Salmonella* gastroenteritis appears to be the most common foodborne illness affecting man today. In recent years, it has emerged as a public health problem that is likely to increase in importance in the future from the medical and veterinary aspects, particularly in developing countries. The anticipated increase in the prevalence of human salmonellosis has aroused great concern and interest among clinicians, veterinarians, bacteriologists, and epidemiologists (18). This increase may be attributed to an actual increase in incidence and to better means of detecting and reporting the infections.

The worldwide growing concern and interest in the reporting of the salmonellae may be attributed to several factors: (i) recognition that acute gastroenteritis due to salmonellae is increasing even in developing countries; (ii) awareness in many countries that a large number of new *Salmonella* serotypes is appearing in respective human and animal populations; (iii) the fact that salmonellosis are true zoonotic infections which are commonly spread from animal to man; (iv) the frequent occurrence of salmonellae in food, food products, animal feed, domestic animals, and other nonhuman sources which cross national boundaries; (v) last but not least, the emergence and establishment of singly and multiple drug-resistant salmonellae associated with human and animal salmonellosis in various countries (8,18).

The present report presents the available data on the first isolation, occurrence, and distribution of the unadapted group of salmonellae in various nonhuman sources in Lebanon. It discusses the epidemiological significance of the unadapted salmonellae, their role as etiological agents of acute gastroenteritis, and the prevention and control of human salmonellosis.

**SALMONELLA SEROTYPES ENCOUNTERED IN LEBANON**

A total of 260 salmonellae representing 36 serotypes were isolated, for the first time, in Lebanon from various animal species (12). *Salmonella typhimurium* was most predominant in poultry followed in descending order by *Salmonella bareilly*, *Salmonella pullorum*, *Salmonella infantis*, *Salmonella oraniemburg*, and *Salmonella aqama*. *Salmonella dublin* was the most frequent in cattle followed by *S. typhimurium*. The latter was the leading serotype in its zoological distribution. It was isolated from 10 animal...
resistance susceptibility threshold can result in sporadic outbreaks from infected animals. Salmonella livingstone (14). A survey was conducted to estimate the prevalence of salmonellae in houses flies. Salmonella enteritidis, S. paratyphi B, and Salmonella typhi were among the serotypes encountered in flies (2).

SALMONELLA GASTROENTERITIS IN LEBANON

Matossian and Hatem (10) reviewed the zoonoses in Lebanon. According to the authors, salmonellosis is perhaps the most prevalent infection which affects the human and animal hosts of Lebanon. It causes large scale economic losses to livestock and constitutes a potential health hazard to the general population.

Acute gastroenteritis presents a public health problem in all countries regardless of their level of development. Many bacteria, including salmonellae, have been implicated as etiologic agents of febrile gastroenteritis. The ingestion of sufficient quantities of contaminated food or water containing enough Salmonella to exceed a person’s resistance susceptibility threshold can result in sporadic cases or outbreaks of acute gastroenteritis. When the number of salmonellae which are ingested with the food are insufficient to cause illness, the infected individual may become a carrier and may contaminate the foods that are handled.

Some of the documented Salmonella gastroenteritis outbreaks that occurred, to date, in Lebanon are briefly reviewed. Azar and Dowdeswell (1) observed an outbreak of gastroenteritis which affected 50 students. S. typhimurium, recovered from chickens, proved to be the causative agent. In a review of 77 outbreaks of acute gastroenteritis, Merab et al. (11) considered the ingestion of raw meat responsible for 57% of the total cases, milk and milk products 22%, contaminated vegetables 10.4%, and mixed foodstuffs and unknown sources 6.5%. Salmonellae were the main organisms incriminated in these outbreaks.

Nabbut et al. (15) investigated an outbreak of acute gastroenteritis which occurred in the village of Ain Dara, in the Shouf district. The epidemiological and the historical attack rate data showed that the incriminated food was the popular Lebanese dish raw “kibby” prepared from a mixture of ground raw mutton or goat meat, wheat germ, minced onion, salt, and spices pounded together and served with olive oil. About 200 persons of all age groups, ranging from 10 to 70 years, who ate raw “kibby” were affected and showed the usual symptoms of Salmonella gastroenteritis. The symptoms were most severe in the young and elderly persons. Bacteriological cultures of the raw “kibby” and stools from some of the patients grew S. dublin. Persons who ate cooked “kibby” were not affected and remained well. Their stool cultures and cultures from the cooked “kibby” were negative for salmonellae.

A recent survey of the prevalence of salmonellae in poultry meat has shown that 5.7% of the “Shish Tawouk” and deboned meat cultures grew S. muenster (4). “Shish Tawouk” meats are small cubes of raw poultry meat soaked in a mixture of lemon juice, tomato juice, olive oil, pepper, and salt to make the meat more tender and tasty. Deboned poultry slices consist of small pieces of poultry meat from which the bones are removed with no further treatment except for the addition of table salt. Both meat samples are served, after being barredbecued, together with a preparation made up of garlic paste and olive oil. The presence of salmonellae in these two popular delicatessen poultry meat dishes, particularly if they are not adequately barbecued, may result in Salmonella gastroenteritis among the consumers.

Four outbreaks of gastroenteritis affecting 40-50 persons each occurred in different places in East Beirut in the summer of 1989. Epidemiological investigation, food history, and clinical information were solicited from the victims by questionnaire. Laboratory findings revealed that the incriminated food was lightly cooked poultry meat contaminated with S. muenster originating from a poultry farm with a previous history of salmonellosis. S. muenster was isolated from the stools of some of the patients and from the leftover poultry meat. The attack rates in persons who ate the contaminated meat was 100%. The patients showed symptoms and signs characteristic of salmonellosis, including fever, diarrhea, nausea and/or vomiting, dehydration, abdominal pain, and general fatigue. The incubation period ranged between 14 and 32 h with an average of 18 h. About 10% of the patients sought the care of a physician and 5% were hospitalized. Recovery was complete in 3 to 4 d. However, the majority of the patients did not feel well until the 7th d. No fatalities were reported (Nabbut, unpublished data). Similar outbreaks and sporadic cases of acute Salmonella gastroenteritis with mild symptoms do occur in Lebanon, from time to time. The sources and vehicles of these infections cannot be traced because many of these mild cases are never seen by a physician, and stool cultures are not routinely obtained from the affected persons, even from those who seek medical treatment. It is speculated that the reported incidence of salmonellae in humans, animals, foods, and environments in Lebanon represent only a small fraction of the actual occurrence. It is also speculated that the incidence of outbreaks of
foodborne diseases among the general population, family outbreaks, and sporadic cases have increased during the 16 years of war in Lebanon. The factional fighting, sieges, shortage of electricity, fuel and water, and other hardships have lowered the standard of living and the sanitary conditions and had an increasing impact on the incidence of foodborne diseases. There are no existing data from the Lebanese Ministry of Public Health or any other source to support this speculation, because the Ministry discontinued the issuance of the Annual Report of Vital and Health Statistics during the war. The Lebanese data on salmonellosis appear to be comparable to those in Saudi Arabia and other countries in the Middle East. Nabbut et al. (16) reported the isolation of 264 salmonellae, representing 65 different serotypes in Saudi Arabia from various animal species, animal feed, sewage, and sludge. Some of these serotypes are common between Lebanon and Saudi Arabia. S. muenster, S. typhimurium, and other salmonellae have been implicated in gastroenteritis in Lebanon and Saudi Arabia (1,7,11,12,17). Gosling and Kassim (7) examined feces from 1,017 patients with gastroenteritis in the King Abdulaziz University Hospital, Jeddah, Saudi Arabia, and 78 (7.7%) grew salmonellae. Twenty different serotypes were observed, S. typhimurium being the most common.

PREVENTION AND CONTROL OF HUMAN SALMONELLOSIS

Unlike typhoid fever, in which human cases and carriers are the sole source of infection, Salmonella gastroenteritis usually originates from animal sources. Salmonellosis is one of the most important public health and animal health disease problems. Its prevention and control in animals are not dealt with in this report. However, it is a prerequisite for its control in man. The prevention and control of foodborne diseases in general and salmonellosis in particular require the attention, cooperation, and coordination of the activities of the entire food production, food processing and food service industries, public health workers, general practitioners, veterinarians, laboratory technicians, homemakers, and consumers. Furthermore, effective control is highly dependent on the identification of the various sources and reservoirs of salmonellae and the implementation of the necessary measures to prevent the transmission of these salmonellae to humans. The institution of nationwide education programs of employees, particularly food handlers, and the general population at large and the stress of the importance of proper food handling practices, personal and community hygiene, and food sanitation are additional preventive measures of paramount importance.

The factors which contribute to the wide occurrence of foodborne salmonellosis in developed and particularly in developing countries include: inadequate cooking and cooling, reheating, preparing the food a day or more before serving, consuming leftover foods stored at ambient temperature, and other factors (5,8). These factors favor the multiplication of the contaminating salmonellae in foods. The ingestion of large numbers of salmonellae is usually necessary to cause foodborne febrile gastroenteritis. Prevention of bacterial multiplication by proper refrigeration of raw and lightly cooked foods is essential to any control program. The systems used for monitoring of food handling and food processing, although in existence in Lebanon, are deficient and are not always followed up, particularly during the 16 years of civil war. It is, therefore, strongly recommended to establish a central public health agency or authoritative body to set up regulations, guidelines, procedures, and standards for foods and food products. The Lebanese Standards Institution started its work in 1964 setting up required standards for all locally produced industrial products. However, its work is far from being complete and none of the existing food standards are adhered to. There are, at present, serious considerations and attempts for the establishment of a Research Institute for Food and Drug Analysis in the Faculty of Medical Sciences at the Lebanese University (3). One of the main responsibilities of this institute will be to formulate standard methods for the microbiological examination of all types of local and imported foods and food products and to set up microbiological standards for these commodities.

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REFERENCES

3. Bikhazi, A., Director, School of Pharmacy, Faculty of Medical Sciences, Lebanese University (Personal communication).