Food Safety in Food Security and Food Trade

Food Safety as a Public Health Issue for Developing Countries

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In 1983, a group of internationally renowned experts convened jointly by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) concluded that "illness due to contaminated food was perhaps the most widespread health problem in the contemporary world," and "an important cause of reduced economic productivity." In 1992, the FAO/WHO-sponsored International Conference on Nutrition recognized that hundreds of millions of people suffer from communicable diseases caused by contaminated food and drinking water. The Conference declared that "access to nutritionally adequate and safe food is a right of each individual." In the same year, the U.N. Conference on Environment and Development recognized that food was a major vehicle for the transmission of environmental contaminants—both chemical and biological—to human populations throughout the world and urged countries to take measures to prevent or minimize these threats. In 2000, the World Health Assembly, the supreme governing body of WHO, adopted unanimously a resolution recognizing food safety as an essential public health function.

A wide range of biological and chemical agents, or hazards, causes food-borne diseases with varying degrees of severity, ranging from mild indisposition to chronic or life-threatening illness, or both. These agents include bacteria, viruses, protozoa, helminthes, and natural toxins, as well as chemical and environmental contaminants. In addition to the increase in the prevalence of food-borne illness shown through epidemiological surveillance during the last three decades, devastating outbreaks of diseases such as salmonellosis, cholera, enterohaemorrhagic *Escherichia (E.) coli* infections, and hepatitis A have occurred in both developed and developing countries. Furthermore, cholera and other diarrheal diseases, particularly infant diarrhea, which were traditionally considered to be spread by water or through person-to-person contact, were shown to be largely food-borne.

This brief reviews the incidence and health consequences of *biological* pathogens in developing countries, as these are the most important food safety risks in those parts of the world, and provides an overview of possible methods of control.

BIOLOGICAL PATHOGENS AND THEIR HEALTH CONSEQUENCES

Biological contaminants—largely bacteria, viruses, and parasites—constitute the major cause of food-borne diseases. In developing countries, such contaminants are responsible for a wide range of diseases, including cholera, campylobacteriosis, *E. coli* gastroenteritis, salmonellosis, shigellosis, typhoid and paratyphoid fevers, brucellosis, amoebiasis, and poliomyelitis. Diarrheal diseases, taken together—and especially infant diarrhea—are the dominant food-borne illness problem in the developing world, and indeed one of massive proportions.

Approximately 1.5 billion episodes of diarrhea occur annually in children under the age of 5, resulting in some 1.8 million deaths. It is estimated that up to 70 percent of diarrheal episodes may be caused by food-borne contaminants. Although many different pathogens have been identified, food contaminated with pathogenic *E. coli* causes up to 25 percent of all diarrheal episodes in infants and children, while *Campylobacter jejuni* and *Shigella spp.* account for 10-15 percent and 5-15 percent, respectively.

Infections due to helminthic parasites, such as *Trichinella spiralis, Taenia (T.) saginata,* and *T. solium*, are a worldwide public health problem, particularly affecting developing countries and are acquired through consumption of undercooked or uncooked meat. Ascariasis, one of the most common parasitic infections, is estimated to affect about one billion people. Trematodes, another type of parasite, infect some 40 million people worldwide, particularly in Asia, Africa, and Latin America. More than 10 percent of the world's population is at risk of becoming infected by these parasites, which are transmitted through the consumption of raw or inadequately processed freshwater fish, shellfish, or aquatic plants.

Food-borne illness, with the exception of a few diseases such as botulism, brucellosis, listeriosis, and typhoid fever, is often viewed as mild and self-limiting. Although this may be true in a number of cases, in many other cases the health consequences can be serious, even life threatening. This false perception has, in part, contributed to the lack of attention the problem has received. Food-borne diseases vary in their health consequences depending on the disease agent, the stage of treatment, and the duration of the illness, as well as the age and susceptibility of the individual. Acute symptoms include diarrhea, vomiting, abdominal pain, cramps, fever, and jaundice. In the case of many food-borne diseases, healthy adults recover within a few days to a few weeks from acute health effects.

Some food-borne diseases can, however, cause serious and chronic sequelae on the cardiovascular, renal, articular, respiratory, or immune systems. Examples of health complications associated with food-borne illness are reactive arthritis and rheumatoid syndromes, meningitis, endocarditis, Reiter's syndrome, Guillain-Barre syndrome, and hemolytic uremic syndrome (HUS). It is estimated that up to 10 percent of patients with enterohemorrhagic *E. coli* (including *E. coli* O 157) infection may develop HUS, with a case-fatality rate ranging from 3 percent to 5 percent. The manifestations of listeriosis may include septicemia, meningitis, encephalitis, osteomyelitis, and endocarditis. Cysticercosis, a parasitic infection that is particularly common in South America, may lead to cerebral lesions. The liver flukes *Opisthorchis viverini* and *Clonorchis sinensis* cause mechanical obstruction of the biliary tract as well as recurrent pyogenic cholangitis, and are carcinogenic to humans.

In certain population groups (for example, the elderly, infants, young children, pregnant women, the malnourished, and the immuno-compromised), the health effects of food-borne diseases may be even more serious. For example, in pregnant women listeriosis can lead to abortion, stillbirth or malformation of the fetus; the overall fatality rate is about 30 percent. In an outbreak of listeriosis in pregnant women in Western Australia, the fatality rate of infected fetuses was as high as 50 percent.

Transplacental infections of *Toxoplasma gondii*, a food-borne pathogen, may occur in some 45 percent of infected pregnant women. In 10 to 20 percent of non-fatal morbidity, the infants may suffer from damage to the central nervous system and retinochoroiditis, leading to blindness. It is believed that infected but asymptomatic infants may also develop some sequelae later in life, most commonly retinochoroiditis. It is estimated that in about 3 of every 1,000 pregnancies worldwide the fetus or infant is affected by toxoplasmosis.

Food-borne diseases are one of the most important underlying factors for malnutrition and, indirectly, for respiratory tract infections in developing countries. Repeated episodes of food-borne diseases over a period of time can lead to malnutrition, with a serious impact on the growth and immune systems of infants and children. An infant whose resistance is suppressed becomes more vulnerable to other diseases, including respiratory tract infections, and is subsequently caught in a vicious cycle of malnutrition and infection. Many infants and children do not survive under these circumstances.

POSSIBLE METHODS OF CONTROL

The health and economic consequences of food contamination often differ among countries and regions of the world and depend on factors such as climate, geography, type of crops produced, and the degree of social and economic development. Nonetheless, the basic principles for prevention and control of food contamination and thus food-borne diseases are similar. In general, three lines of defense may be envisioned.

The first line of defense aims to improve the hygienic quality of raw foodstuffs at the agri/aquacultural level. Certain zoonotic diseases, such as brucellosis or tuberculosis, can be eradicated in animals so that food of animal origin (for example, meat and milk) is free of the pathogens. But for most other animal-borne pathogens (for example, *Salmonella spp., Campylobacter spp.*), eradication of the organisms in most animal populations is currently not possible, even if good animal husbandry is strictly applied. Yet, by applying the principles of good agri/aquacultural practice and animal husbandry and by improving the environmental conditions under which animals and plants are grown, the hygienic quality of raw food products can be improved.

The second line of defense utilizes food-processing technologies. For example, pasteurization, sterilization, fermentation, and irradiation can increase the availability of foods by extending their shelf life and can contribute to their safety by reducing or eliminating pathogenic microorganisms. In countries where milk pasteurization is common practice, it has been possible to prevent many diseases transmitted through milk.

While many food technologies can be used to render food safe, accidental contamination can occur during processing and manufacturing. Therefore, the application of an effective food safety assurance system is essential. The Hazard Analysis and Critical Control Point (HACCP) system is an important development in this area. Its application would help to ensure the safety of processed and manufactured foods. Contemporary approaches to food safety foresee extension of the HACCP system throughout the food chain, from farm to table.

The third and last line of defense is the most critical for microbiological hazards and will protect the health of consumers when the first two fail. It concerns the education of food handlers in the principles of safe food preparation. The term "food handlers" includes professional cooks, persons handling food in food service establishments, including street vending stands and mass catering services, as well as those in charge of the preparation of food in the home. Special efforts should be made to educate those responsible for the preparation of the family's food. In this context, particular attention should be paid to women, who are usually responsible for the care of infants and young children—population groups in which morbidity and mortality rates for food-borne diseases are high.

CONCLUSION

Food should be considered not only an agricultural and/or trade commodity, but also a public health issue. Therefore, food safety has to be seen by the public health community as an essential public health function. Food safety must be integrated along the entire food chain, from farm to table, with the three sectors—government, industry and consumers—sharing responsibility. It is necessary that food safety forms an essential component of health-based nutrition policies and nutrition education. ■

For further reading see WHO, *Foodborne Disease: A Focus for Health Education* (Geneva, 2000); WHO, *Basic Principles for the Preparation of Safe Food for Infants and Children* (Geneva, 1996); WTO/WHO, WTO Agreements and Public Health (Geneva, 2002); "Food Safety and Foodborne Diseases," *World Health Statistics Quarterly* 50 (Nos. 1/2, 1997); and F. K. Käferstein, "Actions to Reverse the Upward Curve of Foodborne Illness," *Food Control* 14 (2003): 101-109.

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