RAW MATERIALS CONTAMINATED, TOXICOLOGY AND FOOD RELATED DISEASES IN EUROPE

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Abstract. The dramatic changes in the demographic composition of our population, due to mass migration, wide ranging relationships, tourism and all that concerns "globalization", with consequent impact on social and cultural scenarios, need to be fully considered. In modern times, rapid globalization of food production and trade has increased the potential likelihood of food contamination.

Key words: food, toxicology, pathogenic, pesticides, raw materials

Abbreviation key: EU- European Union, MRL- maximum residue limits.

BACKGROUND

Toxicology is the study of adverse effects of chemicals on living organisms. It is the study of symptoms, mechanisms, treatments and detection of poisoning, especially the poisoning of people. Toxicology is the study of relationships between dose and its effects on the living organism. The chief criterion regarding the toxicity of a chemical is the dose, i.e. the amount of exposure to the substance. Almost all substances are toxic under the right conditions as Paracelsus, the father of modern toxicology said, "*Sola dosis facit venenum*" (only dose makes the poison). Paracelsus, who lived in the 16th century, was the first person to explain the dose-response relationship of toxic substances.

Food borne disease is caused by consuming contaminated foods or beverages. Many different disease-causing mirobes, or pathogens, can contaminate foods, so there are many different food borne infections. In addition, poisonous chemicals, or other harmful substances can cause food borne diseases if they are present in food.

The global incidence of foodborne disease is difficult to estimate, but it has been reported that in 2005 only 1.8 million people died from diarrhoeal diseases. A great proportion of these cases can be attributed to contamination of food and drinking water. Additionally, diarrhoea is a major cause of malnutrition in infants and young children.

In industrialized countries, the percentage of the population suffering from foodborne diseases each year has been reported to be up to 30%, while less well documented developing countries bear the brunt of the problem due to the presence of a wide range of foodborne diseases, including those caused by parasites. The high prevalence of diarrhoeal diseases in many developing countries suggests major underlying food safety problems.

MATERIAL AND METHODS

In Europe the most commonly recognized food borne infections are those caused by the bacteria *Campylobacter ssp.*, *Salmonella ssp.*, and *E. coli* O157:H7, and by a group of viruses called calicivirus, also known as the Norwalk and Norwalk-like viruses.

Campylobacter ssp. is a bacterial pathogen that causes fever, diarrhea, and abdominal cramps. It is the most commonly identified bacterial cause of diarrheal illness in the world. These bacteria live in the intestines of healthy birds, and most raw poultry meat has *Campylobacter* on it. Eating undercooked chicken or other food that has been contaminated with juices dripping from raw chicken is the most frequent source of this infection (2).

Salmonella ssp. is also a bacterium that is widespread in the intestines of birds, reptiles and mammals. It can spread to humans via a variety of different foods of animal origin. The illness it causes, salmonellosis, typically includes fever, diarrhea and

abdominal cramps. In persons with poor underlying health or weakened immune systems, it can invade the bloodstream and cause life-threatening infections.

E. coli O157:H7 is a bacterial pathogen that has a reservoir in cattle and other similar animals. Human illness typically follows consumption of food or water that has been contaminated with microscopic amounts of cow feces. The illness it causes is often a severe and bloody diarrhea and painful abdominal cramps, without much fever. In 3% to 5% of cases, a complication called hemolytic uremic syndrome (HUS) can occur several weeks after the initial symptoms. This severe complication includes temporary anemia, profuse bleeding, and kidney failure.

Calicivirus or Norwalk-like virus is an extremely common cause of foodborne illness, though it is rarely diagnosed, because the laboratory test is not widely available. It causes an acute gastrointestinal illness, usually with more vomiting than diarrhea that resolves within two days. Unlike many foodborne pathogens that have animal reservoirs, it is believed that Norwalk-like viruses spread primarily from one infected person to another. Infected kitchen workers can contaminate a salad or sandwich as they prepare it, if they have the virus on their hands. Infected fishermen have contaminated oysters as they harvested them.

Some common diseases are occasionally foodborne, even though they are usually transmitted by other routes. These include infections caused by *Shigellosis*, hepatitis A, and the parasites *Giardia lamblia* and *Cryptosporidia*. Even strep throats have been transmitted occasionally through food (3, 15, 17, 11).

In addition to disease caused by direct infection, some foodborne diseases are caused by the presence of a toxin in the food that was produced by a microbe in the food. For example, the bacterium *Staphylococcus aureus* can grow in some foods and produce a toxin that causes intense vomiting. The rare but deadly disease botulism occurs when the bacterium *Clostridium botulinum* grows and produces a powerful paralytic toxin in foods. These toxins can produce illness even if the microbes that produced them are no longer there.

Other toxins and poisonous chemicals can cause foodborne illness. People can become ill if a pesticide is inadvertently added to a food, or if naturally poisonous substances are used to prepare a meal. Every year, people become ill after mistaking poisonous mushrooms for safe species, or after eating poisonous reef fishes.

The spectrum of foodborne diseases is constantly changing. A century ago, *typhoid fever, tuberculosis and cholera* were common foodborne diseases. Improvements in food safety, such as pasteurization of milk, safe canning and disinfection of water supplies have conquered those diseases. Today other foodborne infections have taken their place, including some that have only recently been discovered. For example, in 1996, the parasite *Cyclospora* suddenly appeared as a cause of diarrheal illness related to Guatemalan raspberries. These berries had just started to be grown commercially in Guatemala, and somehow became contaminated in the field there with this unusual parasite. In 1998, a new strain of the bacterium *Vibrio parahemolyticus* contaminated oyster beds in Galveston Bay and caused an epidemic of diarrheal illness in persons eating the oysters raw. The affected oyster beds were near the shipping lanes, which suggested that the bacterium arrived in the ballast water of freighters and tankers coming into the harbor from distant ports. Newly recognized microbes emerge as public health problems for several reasons: microbes can easily spread around the world, new microbes can evolve, the environment and ecology are changing, food production practices and consumption habits change, and because better laboratory tests can now identify microbes that were previously unrecognized (10, 12).

The infection is usually diagnosed by specific laboratory tests that identify the causative organism. Bacteria such as *Campylobacter*, *Salmonella*, *E. coli* O157 are found by culturing stool samples in the laboratory and identifying the bacteria that grow on the agar or other culture medium. Parasites can be identified by examining stools under the microscope. Viruses are more difficult to identify, as they are too small to see under a light microscope and are difficult to culture. Viruses are usually identified by testing stool samples for genetic markers that indicate a specific virus is present.

The term *alimentary mycotoxicoses* refers to the effect of poisoning by *Mycotoxins* through food consumption. Mycotoxins have prominently affected human and animal health such as an outbreak which occurred in the UK in 1960 that caused the death of 100,000 turkeys which had eaten aflatoxin-contaminated peanut meal and the death of 5000 human lives by Alimentary toxic aleukia (ALA) in the USSR in World War II. The common foodborne Mycotoxins include:

Aflatoxins - originated from *Aspergillus parasiticus* and *Aspergillus flavus*. They are frequently found in tree nuts, peanuts, maize, sorghum and other oilseeds, including corn and cottonseeds. The pronounced forms of Aflatoxins are those of B1, B2, G1, and G2, among which Aflatoxin B1 predominantly targets the liver, which will result in necrosis, cirrhosis, and carcinoma (13, 14).

Fumonisins - Crop corn can be easily contaminated by the fungi Fusarium moniliforme, and its Fumonisin B1 will cause Leukoencephalomalacia (LEM) in horses, Pulmonary Edema Syndrome (PES) in pigs, liver cancer in rats and Esophageal cancer in humans. For human and animal health, both the FDA and the EC have regulated the content levels of toxins in food and animal feed.

Ochratoxins - In Australia, The Limit of Reporting (LOR) level for Ochratoxin A (OTA) analyses in 20th Australian Total Diet Survey was 1 μg/kg, whereas the EC restricts the content of OTA to 5 μg/kg in cereal commodities, 3 μg/kg in processed products and 10 μg/kg in dried vine fruits.

Patulin - Currently, this toxin has been advisably regulated on fruit products. The EC and the FDA have limited it to less than 50 μg/kg for fruit juice and fruit nectar, while limits of 25 μg/kg for solid-contained fruit products and 10 μg/kg for baby foods were specified by the EC (9).

Trichothecenes - sourced from *Cephalosporium*, *Fusarium*, *Myrothecium*, *Stachybotrys* and *Trichoderma*. The toxins are usually found in molded maize, wheat, corn, peanuts and rice, or animal feed of hay and straw. Four trichothecenes, T-2 toxin, HT-2 toxin, diacetoxyscirpenol (DAS) and deoxynivalenol (DON) have been most commonly encountered by humans and animals. The consequences of oral intake of, or dermal exposure to, the toxins will result in Alimentary toxic aleukia, neutropenia, aplastic anemia, and thrombocytopenia and/or skin irritaion. In 1993, the FDA issued a document for the content limits of DON in food and animal feed at an advisory level. In 2003, US published a patent that is very promising for farmers to produce a trichothecene-resistant crop.

Natural toxins - Several foods can naturally contain toxins, many of which are not produced by bacteria. Plants in particular may be toxic; animals which are naturally poisonous to eat are rare. In evolutionary terms, animals can escape being eaten by fleeing; plants can use only passive defenses such as poisons and distasteful substances, for example capsaicin in chili peppers and pungent sulphur compounds in garlic and onions. Most animal poisons are not synthesized by the animal, but acquired by eating poisonous plants to which the animal is immune, or by bacterial action (16).

RESULTS AND DISCUSSION

Raw foods of animal origin are the most likely to be contaminated like raw meat and poultry, eggs, unpasteurized milk, and raw shellfish. Because filter-feeding shellfish strain microbes from the sea over many months, they are particularly likely to be contaminated if there are any pathogens in the seawater. Foods that mingle the products of many individual animals, such as bulk raw milk, pooled raw eggs, or ground beef, are particularly hazardous because a pathogen present in any one of the animals may contaminate the whole batch. A single hamburger may contain meat from hundreds of animals. A single restaurant omelet may contain eggs from hundreds of chickens. A glass of raw milk may contain milk from hundreds of cows. A broiler chicken carcass can be exposed to the drippings and juices of many thousands of other birds that went through the same cold water tank after slaughter.

Fruits and vegetables consumed raw are a particular concern. Washing can decrease but not eliminate contamination, so the consumers can do little to protect themselves. Recently, a number of outbreaks have been traced to fresh fruits and vegetables that were processed under less than sanitary conditions. These outbreaks show that the quality of the water used for washing and chilling the produce after it is harvested is critical. Using water that is not clean can contaminate many boxes of produce. Fresh manure used to fertilize vegetables can also contaminate them. Unpasteurized fruit juice can also be contaminated if there are pathogens in or on the fruit that is used to make it.

A few simple precautions can reduce the risk of foodborne diseases:

Cook meat, poultry and eggs thoroughly. Using a thermometer to measure the internal temperature of meat is a good way to be sure that it is cooked sufficiently to kill bacteria. For example, ground beef should be cooked to an internal temperature of 160^{o} F. Eggs should be cooked until the yolk is firm.

*Separate***:** Don't cross-contaminate one food with another. Avoid cross-contaminating foods by washing hands, ustensils and cutting boards after they have been in contact with raw meat or poultry and before they touch another food. Put cooked meat on a clean platter, rather back on one that held the raw meat.

Chill: Refrigerate leftovers promptly. Bacteria can grow quickly at room temperature, so refrigerate leftover foods if they are not going to be eaten within 4 hours. Large volumes of food will cool more quickly if they are divided into several shallow containers for refrigeration.

Clean: Wash produce. Rinse fresh fruits and vegetables in running tap water to remove visible dirt and grime. Remove and discard the outermost leaves of a head of lettuce or cabbage. Because bacteria can grow well on the cut surface of fruit or vegetable, be careful not to contaminate these foods while slicing them up on the cutting board, and avoid leaving cut produce at room temperature for many hours. Don't be a source of foodborne illness yourself. Wash your hands with soap and water before preparing food. Avoid preparing food for others if you yourself have a diarrheal illness.

*Report***:** Report suspected foodborne illnesses to your local health department. The local public health department is an important part of the food safety system. Often calls from concerned citizens are how outbreaks are first detected. If a public health official contacts you to find out more about an illness you had, your cooperation is important. In public health investigations, it can be as important to talk to healthy people as to ill people. Your cooperation may be needed even if you are not ill (1).

Food related disease in Europe control and prevention measures Many countries participating in the WHO programmes for the control of foodborne infections and

intoxications in Europe make their data on epidemiological surveillance of foodborne disease available online.

The **Rapid Alert System** for combating counterfeit medicines is a moderated electronic communication network involving the designated focal person and representatives of countries and areas in the Region, WHO and partner organizations. The system transmits information on cases of counterfeit medicine in an effort to alert authorities so that they can take timely action (4).

The system was initiated by the Western Pacific Regional Office of the World Health Organization in collaboration with partner organizations to protect public safety as part of the implementation of the Regional Strategy for Improving Access to Essential Medicines in the Western Pacific Region, 2005 – 2010.

The main purpose is to alert member countries and areas and relevant partner organizations, through their focal points and representatives in the network, about a case or cases of counterfeit medicines detected in any countries. The system also allows the collection of reports, as well as the dissemination and sharing of information related to counterfeit medicine.

The objectives of RAS include:

- encourage ministries of health, other relevant ministries, medicine regulatory authorities, law enforcement agencies, non-governmental organizations and international organization to report through this system when counterfeit medicine is detected;
- distribute in a timely manner alert notifications about specific counterfeiting incidences through an active messaging system;
- stimulate rapid follow-up action on the reported cases through interactive communication;
- advocate intensified surveillance of counterfeit medicine in high- risk areas and premises, such as markets, rural areas, unlicensed outlets, etc.;
- minimize adverse impacts of counterfeit medicine through rapid dissemination of information and timely action by relevant authorities;
- monitor actions taken by countries, including investigation, removal of counterfeit medicine from the distribution system, etc.; and
- encourage public warnings about counterfeit medicines by the authorities.

Members of RAS, mainly the designated focal points from countries and areas or representatives of the partner organizations, are encouraged to participate in the discussion of the reported case including the necessary follow-up actions. The designated focal points in the countries or areas are encouraged to communicate the case with relevant authorities. Appropriate actions for any reported cases will depend on each country or area. Recommendations from discussions with RAS members may be taken into account as appropriate (4, 5, 6, 7).

Confirmed cases will be incorporated into the WHO database.

CONCLUSIONS

The vast majority of citizens living in Europe have significantly increased their life expectancy and quality through the last fifty years. This great result was mainly due to the improvement in both economic and social status of our societies but also to the better general hygienic conditions after the II World War.

The dramatic changes in the demographic composition of our population, due to mass migration, wide ranging relationships, tourism and all that concerns “globalization”, with conseguent impact on social and cultural scenarios, need to be fully considered. In

modern times, rapid globalization of food production and trade has increased the potential likelihood of food contamination. In modern times, rapid globalization of food production and trade has increased the potential likelihood of food contamination. Due to this, health inequalities within and between Countries have been growing, as has the use and cost of health care. Considerable and convincing evidence exists indicating that significant economic benefits can be achieved by improving population health not only in developing, but also in developed Countries. As a consequence, a more dynamic approach to the prevention and control of infectious diseases has to be done, to consolidate the previously discussed good results obtained so far and to continue improving the people's health status.

Consequently, the Commission engaged in a wide-ranging stocktaking exercise to review the strengths and weaknesses of the consumer product safety mechanisms currently in place in Europe.

Ensuring product safety is a complex activity in which many actors play a role. Therefore, this stocktaking has addressed all the main actors in this process, including the activities in the Member States, our relationships with China and the US and, last but not least, the role of economic operators. Given its important role in defending the interests of European consumers, the Commission has also endeavored to ensure a close involvement of the European Parliament.

An overview of the activities undertaken with the stakeholders, analyzing the state of facts and identifying possible issues for further consideration are outlined below.

Many outbreaks of foodborne diseases that were once contained within a small community may now take place on global dimensions. Food safety authorities all over the world have acknowledged that ensuring food safety must not only be tackled at national level but also through closer linkage among food safety authorities at international level. This is important for exchanging routine information on food safety issues and to have rapid access to information in case of food safety emergencies.

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