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WORLDWIDE FOOD SAFETY ISSUES

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Food safety issues are global. This paper provides an overview of food safety issues including microbiological contamination, chemical contamination, naturally-occurring toxins and nutritional inadequacies. A brief overview of genetic engineering (biotechnology) includes consumer concerns.

Keywords: food safety.

Food safety presents problems worldwide. Globalization of the food supply means more food is available for consumers all year. Because food is available, a larger variety of foods can be eaten and therefore, a greater nutrient sourcefor consumers. For example, oranges are available in areas where they cannot be grown or are available during seasons when they are not ripe. Fresh oranges are a great source of vitamin C and can provide that nutrient to the diet all year. Foods that are seasonal and easily shipped provide an economic benefit for the farmers in different parts of the world. However, human health can also be threatened with unique food safety issues when foods are obtained from different parts of the world. Food safety issues should be viewed from a farm to table approach. Everyone in the food chain is responsible for the safety of the food supply.

Food Safety Experts [1, 2] agree that food safety issues include:

1. Microbiological Contamination.
2. Nutritional Inadequacies.
3. Environmental contaminates.
4. Naturally-Occurring Toxins.
5. Pesticide Residues.
6. Food Additives.

Microbiological Contamination

Microbiological contamination of food is the number one problem with food products. Foodborne illness is an illness

that comes from eating food that is contaminated. Symptoms of foodborne illness are flu-like; nausea, vomiting, diarrhea or fever. Many people do not recognize that the illness is associated with harmful microorganisms (pathogens) in food. These harmful microorganisms may be naturally present on food products. For example, raw meat and poultry products were once a live animal or chicken and they are not sterile. Microorganisms (bacteria) can be found in the intestinal tract of the animal or bird and may be present on the raw meat or poultry product. A number of harmful microorganisms have been identified as causing foodborne illness in people. A list of common harmful microorganisms is given in Table 1.

Table 1

Common Foodborne Microorganisms (pathogens) and the Foods They are Associated

Microorganism	Foods or Practice Associated with the Microorganism
Campylobacter jejuni	**Unpasteurized milk, raw and undercooked meat and poultry**
Clostridium botulinum	**Improperly canned foods, vacuum packaged foods**
Clostridium perfringens	**Meat and poultry products, soups, stews**
***Escherichia coli* O157:H7**	**Raw and undercooked meats, unpasteurized milk, contaminated produce**
Listeria monocytogenes	**Hot dogs, sausages, salads, soft cheeses**
Salmonella	**Raw and undercooked poultry and egg products, unpasteurized milk**
Shigella	**Person to person contact, not washing hands after using the restroom, handling food with poorly washed hands**
Staphylococcus aureus	**Commonly found on skin, noses of people; not washing hands when touching face, sneezing, coughing**

Source: www.fsis.usda.gov/Fact_Sheets/FoodborneIllness&Disease [3].

Food safety guidelines [4] to prevent food from being contaminated are:

1. Clean
   - Wash your hands with warm water and soap for at least 20 seconds before and after handling raw and cooked food, after using the toilet, after changing diapers and after handling pets.

- Wash cutting boards, counter tops, dishes and utensils with hot soapy and rinse with hot water after preparing a food item and before preparing another food with the same utensil or dish.
- Consider using paper towels to clean kitchen counters and table tops where food has been prepared. If cloth dish towels and sponges are used, wash them often in the hot water cycle of your washing machine.
- Rinse fruits and vegetables under safe water before peeling and eating raw (example: oranges).
- Scrub fruits and vegetables with a brush and use safe water before preparing these foods for cooking.

2. Separate – do not cross-contaminate

Cross-contamination is how harmful microorganisms spread from one food to another or from a person to food.

- Keep raw meat and poultry separate from fresh fruits and vegetables in your grocery sack and in your refrigerator (harmful microorganisms from raw meat and poultry products can contaminate your fresh produce.
- Clean your counter tops before and after handling raw meat and poultry.
- Do not use the same utensil for preparing raw meats and poultry and produce. Always wash counters and utensils between preparing different foods.

3. Cook
   - Cook beef products to 70°C.
   - Cook poultry products to 82°C.
   - Cook eggs until the yolk is no longer runny.
   - Cook fish to 65°C.
   - In a microwave oven, make sure there are no cold spots. For best results, cover food loosely, stir and rotate foods about half way through cooking. Use dishes and plastic wraps made for use in a microwave oven.
   - Reheat leftover foods to 70°C.
4. Chill
   - Refrigerate (5°C) or freeze meat, poultry, eggs and other perishable foods as soon as you get home from the market.

- Never let raw meat, poultry, fish, eggs and cooked foods sit at room temperature for more than 2 hours (only 1 hour if the temperature is above 30°C.
- Put leftover foods in smaller containers (not a large kettle) for storage in your refrigerator (5°C).
- Leftover foods should be used within 4 days.
- The World Health Organization added a fifth guideline: Use safe water and raw materials [5]. Specific recommendations are:
- Use safe water or treat it to make it safe (boil water if it does not come from a safe source).
- Select fresh and wholesome foods.
- Choose foods processed for safety, such as pasteurized milk.
- Do not use food beyond its expiry date.

In food processing, HACCP (Hazard Analysis Critical Control Points system) has been implemented to prevent, eliminate or reduce contamination from harmful microorganisms of food during processing [6]. HACCP Steps are:

HACCP Principle 1: Identify Hazards

HACCP Principle 2: Identify Critical Control Points

HACCP Principle 3: Establish Critical Limits

HACCP Principle 4: Establish Monitoring Procedures

HACCP Principle 5: Establish Corrective Actions

HACCP Principle 6: Establish Verification Procedures

HACCP Principle 7: Establish Record Keeping Procedures

Food Safety standards for each country may differ. In the United States, the United States Department of Agriculture [6] and the Food and Drug Administration [1]have food safety standards for food processing and foodservice operations. Codex Alimentarius contains food safety standards developed by the Joint FAO/WHO Food Standards Program [7]. Many countries base their standards on this document.

Nutritional Inadequacies

Food security or not enough food is a problem not only in developing countries but in areas where poverty exists. People do not have enough food to eat, do not have the resources to obtain

the necessary food or are lacking key nutrients. In developing countries, vitamin A, iron and iodine in addition to malnutrition may occur. The World Health Organization [8] provides statistics for each country for the health status of the population.

Naturally-Occurring Toxins

Plants and animals can produce toxins, chemicals that are poisonous if eaten by humans. Plant toxins include toxic fungi (mushroom) which should not be eaten. Potatoes that are «sunburned» with the green discoloration contain a toxic compound called solanine which cannot be destroyed by cooking. Aflatoxin is a toxin produced by a mold that grows on grains, corn peanuts and other nuts. This toxin is a liver toxin and is a carcinogen. *Clostridium botulinum*, a bacteria, produces a deadly toxin when this bacteria grows in food. Scromboid fish produce histamine and Ciguatera fish poisoning are two examples of naturally-occurring toxins associated with fish.

Chemical Contamination

Environmental Contaminates, Pesticide Residues and Food Additives may be considered chemical contaminates in food. Environmental pollution of the air, soil and water may be sources of toxic metals, PCBs and dioxins. Chemicals such as pesticides, animal drugs and other agrochemicals may be considered environmental contaminates if improperly use as they were intended to be used.

Food safety begins with the supplier of agricultural inputs such as fertilizer, pesticides, herbicides, and veterinary drugs such as hormones and antibiotics. The agricultural producer of food is responsible for the safe use and appropriate level of application of these agrochemicals. Each agrochemical has its specific risk and agricultural suppliers and producers need to know how to properly handle each agrochemical to prevent that specific chemical from entering into the food chain.

Food additives and contaminates resulting from food manufacturing can be a health risk also. Examples of these chemicals are histamine, bishenol A, melamine, and acrylamide. More information on specific chemical contaminates can be found at www.who.int/foodsafety/chem[9].

Food Safety in the European Union

Monitoring and Quality Assurance in the Food Supply Chain (MoniQA) is a European Commission that brings together over 100 institutions from 35 countries with the means to react fast to emerging food safety issues. In a recent publication, they listed the food safety issues of 2011 [10].They are:

1. Melamine
2. Dioxin in Irish Pork
3. Clembuterol
4. Nano-tech in food
5. Hormones in drinking water
6. Use of plastic in the food industry
7. Swine flu
8. *Listeria*
9. *E. coli* (EHEC) species such as *E. coli* O157:H7

From this list, three of the recent concerns are microbial (Listeria,E.coli, Swine flu) with the remaining issues chemical.

Genetic Engineering of Foods

Genetic engineering (also called biotechnology) is the directed addition of a foreign gene or genes to the genome of an organism. A gene contains information that will give the new organism a trait. Genetic engineering is only one type of genetic modification. Traditional breeding also modifies the new organism that results from this processing. Traditional plant breeding involves crossing two plants to improve the traits of the new plant which is also genetically altering the resulting new plant.

Biotechnology has been used many food and nutrition areas. The first commercially produced genetically engineered product was human insulin. In 1982, human insulin was produced for diabetes treatment. Before 1982, animal insulin from the pancreases of cows and pigs were used. The synthetic human insulin has advantages which include less insulin allegories to the animal insulin and more rapid absorption. The next major use of the food biotechnology was the production of an enzyme, chymosin,which replaced the rennet, the old source of chymosin, used in cheese production. Rennet came from the stomachs of

calves and the chymosin produced as a result of biotechnology is pure and the resulting cheese quality is higher.

More recently, examples of foods and crops that have been produced using biotechnology are:

- Rice modified to have higher carotene (a vitamin A precursor.
- Soybeans and canola that result in oils with reduced saturated fat content.
- Tomatoes with delayed ripening traits that have better flavor and remain fresher longer.
- Soybeans, canola, corn, cotton, and potatoes which are resistant to insects or herbicides.
- Squash that is resistant to a virus that kills the vegetable on the vine.

These foods have undergone rigorous testing before the foods are allowed in the market.

Consumer Concerns

Labeling of Genetically Modified Foods

Labeling is required if a known allergen has been introduced, the nutritional content has been changed and the product's composition has been changed (required by FDA). Consumers who want to avoid eating foods or products made by biotechnology processes have the right to choose.

Allergies

Allergies are abnormal responses that some people have that involve unusual reactions of their immune systems to protein components of foods. All allergens are proteins but only a few proteins produce an allergic reaction in humans. An example is a protein in peanuts is a common allergen for people. By using genetic engineering techniques, it is possible to transfer an allergen (protein) from a specific gene from one organism into another organism. A gene from Brazil-nuts was transferred to soybeans and the resulting soybean contained a protein with an allergen from the Brazil-nuts. This soybean was not allowed to be used in production.

Antibiotic Resistance

Research has demonstrated that consumers are more willing to accept plants that are produced by biotechnology (transferring

genes from one plant species to another plant species), but not when animals may be produced by biotechnology.

Antibiotic resistance is a serious public health issue, but currently the problem exists due to the overuse of medicines containing antibiotics. Consumers have concerns about the transfer of genes from bacteria into plants as bacteria may have developed a genetic resistance to a specific antibiotic. The United States Food and Drug Administration (FDA)does not allow using marker genes that code for clinical antibiotic resistance when using biotechnology techniques [1].

Environment

Consumers have been concerned about the Monarch butterfly that have eaten the pollen from the Bt corn, a genetically modified corn. Many of the butterfly larvae died or failed to thrive. Researchers have found that the use of externally applied Bt (a pesticide) and the destruction of wildlife habitats present a greater threat to beneficial insects such as the Monarch butterfly.

Another environmental issue with the use of crops produced by genetic engineering is that weeds will cross pollinate with a crop and create a «super» weed that is resistant to herbicides or pesticides. To reduce the risk of cross-pollination of like species with a biotechnology developed crop, USDA Animal and Plant Health Inspection Service (APHIS) has established regulations that must be adhered to in the development of genetically engineered crops [11]. Examples of crops that can cross naturally in nature are: wild mustard can cross with canola and a weed, goatgrass, can cross with wheat. Therefore, if a genetically modified wheat species was developed, appropriate testing must be conducted to insure that the new species transfer this new gene to the weed that may be found in the same.

WHO conducted an evidence-based study of food biotechnology and provides additional support to these consumer concerns [12].

Distance Education Lessons

To learn more about genetic engineering (biotechnology), a number of lessons are available on the internet at http://passel.unl.edu [13].

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Джулія Олбрайт. ***Всесвітня безпека харчових продуктів.***

Питання продовольчої безпеки носять глобальний характер. Ця стаття містить огляд питань безпеки харчових продуктів, включаючи мікробіологічне забруднення, хімічне забруднення, природні токсини і продукти незадовільної якості. У статті наведено аналітичний огляд споживання продуктів генної інженерії (біотехнології).

Джулия Олбрайт. ***Всемирная безопасность пищевых продуктов.***

Вопросы продовольственной безопасности носят глобальный характер. Эта статья содержит обзор проблем безопасности пищевых продуктов, включая микробиологическое, химическое загрязнение, природные токсины и продукты неудовлетворительного качества. Приведен краткий аналитический обзор потребления продуктов генной инженерии (биотехнологии).