Microbiological Contamination in Relation to Foodborne Illnesses

**Abstract**

Foodborne illnesses can occur by the consumption of foods that have been contaminated with bacterial pathogens. Consuming these pathogens leads to the various effects on the body, some of which include vomiting and diarrhea. These illnesses occur frequently worldwide and have been a recurring topic in news headlines as outbreaks. To be considered an outbreak, foodborne illnesses must have two or more cases that are linked. Although this may seem easy to classify, foodborne illnesses can be hard to link to microbiological content due to a variety of reasons. Moreover, the rise of these illnesses can be related to obedience with food hygiene law. A 2018 study looked at this relationship and utilized food samples obtained from various businesses to examine microbiological content (Fleetwood, Janet, et al., 2018). Microbiological contamination within food has a strong impact on not only those directly affected, but also can be costly for the world economy. According to the United State Department of Agriculture (USDA), it is estimated that foodborne illnesses cost over $15.6 billion a year (“Burden of Foodborne Illness: Overview.”, 2018). In order to achieve a higher standard of food safety and lower the economic burden of foodborne illnesses, it is imperative to understand food hygiene ratings in relation to foodborne illnesses, and what type of bacteria are causing common foodborne illnesses.

**Introduction**

The Food Standards Agency (FSA) is a governmental organization that regulates food safety and inspection within the United Kingdom. This organization was established in April of 2000 by the Food Safety Act of 1999 (“Food Standards Agency”). Its overall goals were to increase protection of the public’s health, due to rising concerns regarding overall food safety, more specifically food poisoning. The FSA works extensively to promote food hygiene and ensure that proper standards are being met. Additionally, the FSA works to develop plans to decrease foodborne illnesses. A product of the FSA is the Food Hygiene Rating Scheme (FHRS), which was developed in 2010 to acquire a food hygiene rating based upon a multitude of factors. These factors include food handling practices and temperature control, compliance with requirements of structural nature (cleanliness, ventilation, etc.) and confidence in management procedures (Fleetwood, Janet, et al., 2018). Once all factors are taken into consideration, the scores are then interpreted into an overall food rating that is based on a scale of one to five. If a higher score is achieved (4 or 5), the locations are following the correct guidelines and there is no need for action to be taken. Contrarily, a lower score (0, 1, or 2) indicates improvement is necessary. These hygiene scores can play an important role in minimizing foodborne illnesses. A recent study done in the United Kingdom used this platform to investigate the relationship between FHRS and microbiological contamination of food samples (Fleetwood, Janet, et al., 2018).

In the United States alone, it is reported that approximately 48 million people get sick, 128,000 are hospitalized, and 3,000 die from foodborne illnesses each year (“Burden of Foodborne Illness: Overview.”, 2018). Additionally, researchers have identified over 250 foodborne illnesses that can arise. Various pathogens can cause these diseases, such as *Salmonella* and *Escherichia coli* (E. Coli). *Salmonella* is a popular infection that infiltrates the intestines and produces a variety of symptoms, especially those related to the stomach. Complications of *Salmonella* after becoming ill can be detrimental to one’s health. One complication that can be developed is called bacteremia. This occurs if the bacteria enter the bloodstream, and tissues of the body become infected and lead to a more serious condition. One result of bacteremia is meningitis, an infection in the tissues surrounding the spinal cord. Overall, it is important to be aware of preventative measures and correct sanitation of food to guarantee one does not ingest this bacterium. A *Salmonella* infection can occur from ingesting raw chicken or egg products. In order to prevent this infection, washing hands thoroughly before preparing food, storing raw meats away from other foods, and using separate cutting boards when preparing raw meats and vegetables.

Alone, Shiga toxin are responsible for binding to cells and inhibiting synthesis of proteins within the body and *E. coli* is a normal bacterium that lives inside of human intestines (Sandvig, K, and B van Deurs). However, strains of *E. coli* are capable of producing toxins that cause illness. These toxin- producing strains of *E. coli* are known as Shiga toxin-producing *E. coli* (STEC). The cause of infection due to this strain is mainly due to contamination from human feces. For example, one may touch a contaminated surface, such as a door handle, and proceed to put their hands in their mouth, ingesting the bacteria. Another association with STEC is consumption of food products that have been contaminated. In this case, consuming raw produce, undercooked beef, or raw cookie dough have all been linked to STEC. If one were to get an STEC infection, stomach cramps, bloody diarrhea, vomiting, or fever can be some of the suspected symptoms (“Virginia Department of Health.”). Infection from *E. Coli* can be prevented by ensuring meats are cooked thoroughly and fruits and vegetables are washed correctly. While it may seem trivial to some, understanding the consequences of consuming these harmful bacteria and how to prevent oneself from food illnesses should be imperative to all.

**Recent progress**

There have been a variety of studies done on microbiological contamination and foodborne illness relations, as it is a rising topic in today’s society. As technologies advance in order to serve a greater amount of people at catering facilities and restaurants, food hygiene is at utmost importance. A study conducted using food samples from food businesses in England, Northern Ireland and Wales found correspondence between compliance with food safety procedures, reduced food safety risks, and microbiological contamination of food samples. The data were stored in the Local Authority Enforcement Monitoring System (LAEMS) and the UK Food Surveillance System (UKFSS), two systems of the FSA that hold information on food law enforcement actions. For the UKFSS, nine organisms were tested for, including B. cereus, Bacillus Species, C. perfringens, E. coli, Enterobacteriaceae, Listeria species, Salmonella, Staphylococcus aureus and Total Variable Count 30 (Fleetwood, Janet, et al., 2018). The LAEMS uses information from routine checks during the year. For this data, the ratings were converted into FHRS ratings for the sake of comparison. The product type, taken from restaurants, caterers, and retailers, used for LAEMS involved materials in contact, protein foods, and complex foods (e.g. soups, pre-prepared dishes, and desserts) (Fleetwood, Janet, et al., 2018).

Figure 1 shows FHRS scores in comparison to unsatisfactory food samples for LAEMS. More compliant premises exert a lower percentage of unsatisfactory samples. The same is true for the UKFSS Analysis, shown in Figure 2. This evidence solidifies the argument that unsatisfactory samples and level of hygiene compliance have a correlation.

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Figure 1: The relationship between hygiene score compliance and proportion of unsatisfactory samples at a premise by product group (LAEMS) (Fleetwood, Janet, et al., 2018).

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Figure 2: Microbiological Sample Analysis: Proportion of unsatisfactory samples and Compliance Category (UKFSS) (Fleetwood, Janet, et al., 2018).

Additionally, an analysis of foodborne illnesses outbreaks was done during this study and found that there was a significant relationship between the ranking of compliance and outbreaks. This data is shown in Figure 3.

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Figure 3: Compliancy rating in relations to foodborne illness outbreaks per 10,000 years.

**Discussion**

Food safety has always been extremely important in all aspects of food consumption. Whether at home or at a restaurant, one should take caution in food handling and hygiene. As demonstrated in the study above, there is great risk of foodborne illnesses associated with compliancy in food hygiene standards. To uphold these standards, one must take exceptional precautions when preparing food. Minimizing cross-contamination when working with raw chicken, thoroughly washing fruits and vegetables under running water, and ensuring raw meats are cooked to the appropriate temperature are a few ways to reduce chances of consuming harmful bacteria at home. When eating at a restaurant, one may take note of any unsafe food practices, such as chefs not wearing gloves when preparing food. While it is possible to have great experiences with food while not considering the potential risks of foodborne illnesses, it may be in one’s best interest to be conscious of these risks while cooking and dining in restaurants.

References

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