Foodborne Disease During Pregnancy

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Abstract

Food borne illness during pregnancy can cause serious health problems, miscarriage, premature delivery, or even death of mother . Different microorganisms or chemical contaminants can affect the mother and fetus or newborn in a variety of ways. Food borne illness results from the consumption of contaminated foods or beverages , although most of these conditions can also be transmitted through contaminated soil or water . Common symptoms for many of the food borne disease are diarrhea, abdominal cramps , nausea and vomiting .Eating a contaminated food will usually cause illness in one-to-three days ,but sickness can also occur in as soon as 20 minutes after ingestion or as long as six weeks latter . Exposure to some metals ,such as methyl mercury , may take months before any effect are seen because the mercury levels in the body may take time to build up . Food drug administration recommended that pregnant women does not eat dogs or luncheon meats unless they are reheated steaming hot , pregnant women does not eat refrigerated pats or meats spreads (Listeria thrives at refrigerator temperatures) , pregnant women does not consume unpasteurized milk or foods made from and also avoid soft cheese unless they are labeled as made with pasteurized milk . Four simple step to food safety are clean (wash hand and clean food surface often) , separate (do not cross –contamination) ,cook (cook to proper temperatures) and chill (refrigerate promptly)it could be recommended that good food safety practices will benefit pregnant women and their families for a lifetime .

In the past two to three decades, public health authorities in industrialized countries have been faced with an increasing number of food safety problems. In 1983, a Joint Food and Agriculture Organization/World Health Organization Expert Committee on Food Safety 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. More recent data from industrialized countries indicate that annually up to 10% or more of the population may have a foodborne disease. The situation is equally serious in developing countries, where infant diarrhea causes many illnesses and deaths. In addition to known foodborne diseases, public health communities are being challenged by the emergence of new or newly recognized types of foodborne illnesses, often with serious and chronic health consequences. Certain populations (e.g., pregnant women, the elderly, infants and children, immunocompromised persons, and the undernourished) are particularly vulnerable. In economic terms, foodborne illnesses are very costly for industry, health services, and society as a whole (1) .

Many factors have contributed to the increase in foodborne disease. Industrialization, leading to increased wealth and urbanization, has revolutionized the food supply system, resulting in mass production and an explosive increase in the number of food service establishments and food

outlets. Mass production, environmental factors, and inadequate knowledge on the part of food handlers have contributed to increased contamination of primary foodstuffs.

The increase in international trade has increased the risk for cross-border transmission of infectious diseases. The globalization of food (and feed) trade, facilitated by the liberalization of world trade, while offering many benefits and opportunities, also presents new risks (2). Food, a major trade commodity, is also an important vehicle for transmission of infectious diseases. Because food production, manufacturing, and marketing are now global, infectious agents can be disseminated from the original point of processing and packaging to locations thousands of miles away. This multinational approach to food production and distribution and the progressive opening up of world markets have allowed the international food trade to flourish. The value of food trade, U.S. $266 billion in 1994, was more than 300% greater than it was 20 years ago and continues to grow rapidly (3) .

Most of the foodborne illnesses are infections and can be caused by a variety of bacteria, viruses, and parasites that can contaminate foods. Other foodborne diseases are called poisonings and are caused by harmful toxins or chemicals that have contaminated the food. The symptoms of foodborne illness depend on the type of microbe that caused the disease; however, many organisms cause similar symptoms, such as diarrhea, abdominal cramps, and nausea. Although everyone is susceptible to foodborne diseases, certain segments of the population are particularly at risk of contracting a foodborne illness – young children, the elderly, pregnant women, the immuno-compromised and travelers (**4**) .

Pregnant women are at an increased risk for foodborne illness because hormonal changes during pregnancy weaken their immune systems **(1**) . The 6.5 million women who are pregnant each year in the U.S. are at increased risk for some types of food-borne illness. Examples of pathogens of special concern to pregnant women are
Listeria monocytogenes, *Toxoplasma gondii*, *Brucella* species, *Salmonella* species and *Campylobacter jejuni*. Certain organisms can cross the placenta and
increase the fetus's risk of becoming infected. Infection can result in miscarriage,
stillbirth, premature labor or severe complications for the baby (**5**) .

Listeriosis

Listeriosis , a serious infection caused by eating food contaminated with the bacterium Listeia monocytogenes , has recognized as an important public health problem in the united states .The disease affects primarily pregnant women , newborn and adults with weakened immunosystem (6). *L. monocytogenes* is widely
distributed in nature and is found in soil, ground water, plants and animals.
L. monocytogenes is often carried by humans and animals, and has the ability to survive unfavorable conditions, including refrigeration temperatures, food preservatives (salt) , and conditions with little or no oxygen. It is, however, easily

destroyed by cooking(7) . The Centers for Disease Control and Prevention estimates that each year 2,500 people become seriously ill with listeriosis in the United States. Pregnant women are about 20 times more likely than other healthy adults to fall ill with listeriosis . It can be transmitted to an unborn baby through the placenta even if the mother is not showing signs of illness. This can lead to premature delivery, miscarriage, stillbirth, or serious health problems for the newborn (8) . Symptoms of listeriosis vary, but may be flu-like, with sudden onset of fever, chills, muscle aches, and sometimes diarrhea or upset stomach. If the infection spreads to the nervous system, the symptoms may include headache, stiff neck, confusion, loss of balance, or convulsions. During pregnancy, antibiotics are given to treat listeriosis in the mother. In most cases the antibiotics also prevent infection of the unborn baby or newborn. However, some pregnant women may not realize they are sick because the symptoms can take a few days or even weeks to appear, and can be mild. Antibiotics are also given to babies who are born with listeriosis (6) .

Association with Foods

The first reported outbreak of foodborne listeriosis occurred between March and September 1981. Coleslaw was implicated as the cause of 34 cases of perinatal listeriosis and seven cases of adult listeriosis in the Maritime Province of Nova Scotia. Perinatal cases were characterized by acute febrile illness in pregnant women, followed by spontaneous abortion (five cases), stillbirth (four cases), live birth of a seriously ill premature or term infant (23 cases), or live birth of a well infant (two cases). The fatality rate for infants born alive was 27%. The outbreak strain was isolated from two unopened packages of coleslaw from the plant but was not cultured
from the manufacturing plant environment. The incriminated coleslaw was traced to a farm where the cabbage was grown in fields fertilized with sheep manure. Two of the sheep on the farm had previously died from listeriosis (9).
Although listeriosis is more commonly reported as sporadic cases, of which about 20% result from the consumption of unheated hot dogs and undercooked
chicken, there have been many outbreaks involving a variety of foods (1). Hot dogs and deli meats contaminated with *L. monocytogenes* serotype 4b caused a 1998–1999 outbreak affecting 101 individuals in 22 states (6) .The soft cheeses are now infamous for their susceptibility to contamination with *L. monocytogenes,*presumably due to the use of raw milk or because of post-pasteurization contamination. Not only is the manufacturing process open to contamination, but the cheese can serve as a growth environment where *L. monocytogenes* can multiply during the storage period, even under refrigeration at 4°C. Concentrations of *Listeria* as great as 10^6 cfu/g have been noted. Mexican-style cheese made with raw milk was implicated in two separate outbreaks, one in 1984 causing 142 illnesses, and one in 2000–2001 resulting in cases . The mortality rat was 33.8% and 41.7 % ,respectively (10)

Prevention of pregnant women

To avoid infection from *L. monocytogenes*, pregnant women are advised
to practice safe food handling procedures, such as storing all perishable foods at

or below 4° C and using perishable or ready-to-eat foods as soon as possible. If a potentially hazardous perishable food cannot be eaten within four days, it is best to freeze or discard it. Kitchen surfaces, cutting boards and utensils should be washed before and after food preparation (especially after contact with raw meat or poultry). Pregnant women are advised to avoid eating soft cheeses made from raw milk (e.g., Feta), unpasteurized milk and foods made from raw milk, raw or undercooked seafood, refrigerated smoked or precooked seafood, deli seafood salads, and hot dogs, luncheon meats, deli meats and pâté unless reheated to steaming hot before serving or reformulated to prevent *Listeria*. Leftover foods should be reheated to 74° C before eating.
Illness.

Toxoplasmosis

Toxoplasmosis is caused by the protozoan parasite *Toxoplasma gondii and is endemic throught the world .* Approximately 85 percent of women of childbearing age in the United States are susceptible to acute infection with the protozoan parasite *Toxoplasma gondii*. Transmission of *T. gondii* to the fetus can result in serious health problems, including mental retardation, seizures, blindness, and death. Some health problems may not become apparent until the second or third decade of life. An estimated 400 to 4,000 cases of congenital toxoplasmosis occur in the United States each year *(*11)

LIFE CYCLE The *T. gondii* life cycle has three stages: tachyzoite, bradyzoite, and sporozoite. During the acute stage of *T. gondii* infection, tachyzoites invade and replicate within cells and are responsible for congenital infection. The tachyzoites invade all organs, especially the muscles (including the heart), liver, spleen, lymph nodes, and central nervous system (CNS). During latent infection, bradyzoites are present in tissue cysts. Sporozoites are found in environmentally resistant oocysts formed after the sexual stage of the life cycle(12).

Transmission

T. gondii is transmitted to humans by three principal routes *(13)* First, humans can acquire *T. gondii* by eating raw or inadequately cooked infected meat, especially pork, mutton, and wild game (14), or uncooked foods that have come in contact with infected meat. Second, humans can inadvertently ingest oocysts that cats have passed in their feces, either from a litter box or from soil (e.g., soil from gardening, on unwashed fruits

or vegetables, or in unfiltered water). Third, women can transmit the infection transplacentally to their unborn fetus. In adults, the incubation period for *T. gondii* infection ranges from 10 to 23 days after the ingestion of undercooked meat and from five to 20 days after the ingestion of oocysts rom cat feces .

A report from the Economic Research Service of the U.S. Department of Agriculture concluded that one half of toxoplasmosis cases in the United States are caused by eating contaminated meat (15). This conclusion is supported by the findings of a community-based epidemiologic study (16)

Women infected with *T. gondii* before conception rarely transmit the parasite to their fetus, but those who become acutely infected or have reactivation of *T. gondii* during pregnancy (i.e., because of immunosuppression) can transmit the organism transplacentally. The risk of congenital disease is lowest (10 to 25 percent) when maternal infection occurs during the first trimester and highest (60 to 90 percent) when maternal infection occurs during the third trimester (17). However, congenital disease is more severe when infection is acquired in the first trimester. The overall risk of congenital infection from acute *T. gondii* infection during pregnancy ranges from approximately 20 to 50 percent (18) .

Risk Factors

Recent epidemiologic studies have identified the following risk factors for *T. gondii* infection: owning a cat, cleaning a cat litter box (1 9), eating raw or undercooked pork, mutton, lamb, beef, or minced-meat products(20), gardening, eating raw or unwashed vegetables or fruits, eating raw vegetables outside the home (21), having contact with soil, washing kitchen knives infrequently, having poor hand hygiene,(22)

Prevention of Toxoplasmosis in Pregnant Women

Recommendations for the prevention of toxoplasmosis in pregnant women must follow this points according to Center For Disease And Prevention.

* Food should be cooked to a safe temperature (71.1℃). A food thermometer should be used to ensure that meat is cooked all the way through.

*Fruits and vegetables should be peeled or thoroughly washed before they are eaten.

*Cutting boards, dishes, counters, utensils, and hands should be washed with hot soapy water after they have been in contact with raw meat, poultry, or seafood, or with unwashed fruits or vegetables.

*Pregnant women should wear gloves when they are gardening or touching soil or sand, because of the possible presence of cat feces. Afterwards, they should wash their hands thoroughly.

*If possible, pregnant women should avoid changing cat litter pans. If no one else is available to change the cat litter, pregnant women should wear gloves for this task and then wash their hands thoroughly. The litter box should be changed daily, because *Toxoplasma gondii* oocysts require more than 1 day to become infectious. Pregnant women should be encouraged to keep their cats inside and not to adopt or handle stray cats. Cats should be fed only canned or dried commercial cat food or well-cooked table food; they should not be given raw or undercooked meat.

*Health education for women of childbearing age should include information about preventing *T. gondii* transmission from food and soil. At the first prenatal visit, health care providers should educate pregnant women about food hygiene and avoiding exposure to cat feces.

Salmonellosis

Roughly two to four million cases of foodborne salmonellosis occur annually in the
United States, and the estimated 1.3 million cases that occurred in 2000 cost $2.4 billion in medical costs and lost productivity (23). Between 1988 and 1995 there were between 40,000 and 50,000 reported, confirmed cases of salmonellosis annually; since 1997, that number has been below 35,000 (24).
Two clinical manifestations caused by *Salmonella* are recognized: enteric fever
(a severe, life-threatening illness) and the more common foodborne illness syndrome. In both cases, the responsible microorganisms enter the body via the oral route.
Typically, common foodborne illness resulting from *Salmonella* infection is characterized by a self-limiting acute gastroenteritis. Contaminated food or water is the usual, but not the only, vehicle. The incubation period varies from six to 48 hr and generally falls within a range of 12–36 hr. Variation in the incubation time may be attributed to the size of the infecting dose, the virulence (degree of pathogenicity) of the microorganisms, the susceptibility of the host, and the physicochemical composition of the transmitting food. As few as 15 cells can cause illness (6).
Symptoms include diarrhea, abdominal cramps, vomiting, and fever, which generally
last from one to seven days. However, the microorganisms may be excreted in the feces for many weeks after symptoms subside. Although the illness is usually self limiting, there is a 15% mortality rate in elderly who have developed septicemia due to *Salmonella dublin*, and a 3.6% mortality rate in nursing home cases of *Salmonella* Enteritidis (6).

Association with Foods

There are three main ways *Salmonella* can enter the food supply to cause illness.
Animals harbor *Salmonella*, making meats, poultry, eggs, and milk often implicated vehicles. *Salmonella,* which are introduced into the environment, possibly through manure and litter, may persist and contaminate fruits and

vegetables on the farm. Cross-contamination in the food service environment or the home, often between raw poultry and ready-to-eat (RTE) products, such as raw vegetables, can also cause salmonellosis.

Foods of animal origin are vehicles for salmonellosis. *Salmonella* was isolated in 19–54% of cattle carcasses, 1.9% of beef samples at retail and 4.2% of retail chicken samples (25,26). the problem of *Salmonella* in meats and poultry are summarized as follows:

"The animal-to-man link is only one factor in the epidemiology of human salmonellosis. Furthermore, inedible parts of the animal are processed to yield important components of livestock feeds. As a result of poor manufacturing practices (postprocessing contamination), these rendered animal by-products become recontaminated with *Salmonella*, which, in turn, are carried into the feeds. The consumption of these feeds by livestock, followed by animal-to-animal transmission, completes the *Salmonella* cycle (27) .

The CDC estimates that 75% of *Salmonella* Enteritidis cases result from the consumption of raw or undercooked grade A whole-shell eggs (6). This serotype was the second most commonly reported human serotype to the CDC in 2001.Consumption of raw milk may also cause human salmonellosis. In one

study, *Salmonella* was isolated in 6.1% of bulk raw milk samples (28). Between 1972–2000, 16 outbreaks of salmonellosis resulted

from raw milk consumption (29)

While *Salmonella* may survive in contaminated foods as a result of improper cooking, it is more common that cross-contamination of foods after cooking is the source of *Salmonella.* these foods. *Salmonella* can also be transferred from contaminated raw foods to equipment surfaces, such as knives, cutting boards, and counter tops, and then from equipment to previously to reduce the carriage of *Salmonella* by animals.

Prevention o Salmonellosis f in Pregnant Women

Pregnant women should follow general safe food handling practices, including washing hands often with hot, soapy water, especially after using the bathroom and before and after handling food. Hands and working surfaces should be thoroughly washed after contact with raw meat, fish, poultry, and foods that will not undergo further cooking. Fresh fruits and vegetables should be rinsed well before eating, and food such as raw milk and raw milk products, raw or undercooked eggs, raw sprouts, raw or undercooked meat and poultry, and unpasteurized fruit juices should be avoided.

Campylobacteriosis

Recent evidence suggests that *Campylobacter* causes 2–4 million cases per year in the

United States (30). Common symptoms of *Campylobacter* enteritis include profuse watery or sticky diarrhea (sometimes containing blood), abdominal cramps, headaches, muscle pain, and nausea. The mortality rate is low (0.1%) and often occurs in susceptible populations such as the elderly, young, or immunocompromised . Human volunteer and retrospective studies of food-associated outbreaks of C*ampylobacter* enteritis revealed that ingesting relatively small numbers (only a few hundred cells) of *C. jejuni* can produce

illness . Symptoms manifest after an incubation period of two to five days, and generally last 7–10 days (6)

Association with Foods

Studies have revealed that as many as 30–100% of poultry, 40–68% of cattle, and up to 76% of swine carry *C. jejuni* or *C. coli* in their intestinal tracts (25). Surveys of U.S. retail fresh red eat and poultry show that 12–35% of turkey, 64% of chicken, 2–5% of pork, 0–5% of beef, 8% of lamb and 9% bulk tank raw milk contained *C. jejuni* and/ or *C. coli* (31) . It is estimated that roughly half of all cases of *Campylobacter* entertitis are associated with undercooked chicken or cross-contamination with raw chicken (6). In a 1996 outbreak, raw lettuce served as the vehicle for *Campylobacter* infections, presumably after contact with raw chicken (32). Other foods implicated as vehicles of outbreaks include raw milk, raw beef, clams, and cake (likely contaminated by a *C. jejuni*-infected food handler). Consumption of *C. jejuni*-contaminated raw milk from an organic dairy farm made 75 Wisconsin residents ill in 2001 (33).

Prevention of Campylobacteriosis in Pregnant Women

To avoid campylobacteriosis, pregnant women are advised to consume only pasteurized milk and milk products and to thoroughly cook meat, poultry and shellfish. Hands, surfaces, cutting boards and utensils that come in contact with raw meat, poultry or fish should be washed well with hot, soapy water.

Chemical Contaminants In Fish

Fish can play an important role in a healthy and balanced diet , they are a great source of protein, vitamins, and minerals, and are low in saturated fat. Also, many fish contain a type of fatty acid (omega-3) that plays a role in the prevention of heart disease(34) . Most fish are safe to eat. However, fish can accumulate environmental chemical contaminants that could harm human health. Unborn babies and developing children are especially vulnerable to the effects of consuming chemically contaminated fish. This does not mean that women of childbearing age, pregnant or breastfeeding women, or children should stop eating fish, but it does mean that informed decisions must be made about the types of fish to eat, the amount of fish to eat, and how often to eat fish (35) .

Methyl mercury

Mercury is a naturally occurring element in the environment and is also released into the air through industrial pollution. Mercury that falls from the air can accumulate in streams, rivers, lakes, and oceans. Bacteria in the water cause chemical changes that transform mercury into methyl mercury, which can be toxic. Fish absorb methyl mercury as they feed in these waters. Long-lived, larger fish that feed on other fish accumulate the highest levels of methyl mercury (e.g., freshwater fish such as largemouth bass, walleye, and pike and marine fish such as shark, sword fish, king mackerel, and tilefish). Tuna steaks and canned albacore tuna generally contain higher levels of methyl mercury than canned light tuna. Women of childbearing age, pregnant and breastfeeding women, and children need to pay special attention to limiting their exposure to methyl mercury exposure from fish because it can cause irreversible damage to the developing brain, the nervous system, and possibly the heart. Unborn babies, infants, and children are more sensitive to methyl mercury than adults because the brain and other parts of the nervous

system are not fully developed. Exposure to methyl mercury may affect their behavior and lead to learning problems later in life, and very high levels of exposure may affect neurological development resulting in symptoms similar to those of cerebral palsy (36) .

Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) are mixtures of human-made substances ranging
from oily liquids to waxy solids. The U.S.Environmental Protection Agency banned
the manufacture of PCBs in 1979, but the ban did not require removal of PCB-containing materials still in service. Ongoing use, storage, and disposal of products that contain PCBs are the remaining sources in the environment. PCBs have been found in soil, water, air, plants, and animals in all regions of the world. Fish and other animals accumulate . PCBs in fatty tissue, skin, and internal organs. Larger, older fish generally will have higher levels of PCBs than smaller, younger .fish Fatty fish (such as carp, buffalo, gar, and cat-fish) may contain higher levels of PCBs than lean fish (such as largemouth bass, walleye, and crappie). PCBs vary in toxicity and have been demonstrated to cause a variety of adverse health effects. Infants of women that have eaten fish with high levels of PCBs may have lower birth weights, delayed physical development, and learning difficulties. In addition, PCBs may affect the immune system, reproductive organs, skin, stomach, thyroid, kidney, and liver, and may increase the risk of cancer (37)

Fish-Consumption Recommendations

The Food and Drug Administration and the Environmental Protection Agency have issued a joint consumer advisory about mercury in fish and shellfish for women who are or might become pregnant, breastfeeding women, and young children (38). By following these three recommendations for selecting and eating fish or shellfish, women and young children will receive the benefits of eating fish and shellfish, and be confident that they have reduced their exposure to the harmful effects of mercury.

1- Do not eat shark, swordfish, king mackerel, or tilefish because they may contain
high levels of mercury.

2- Eat up to 12 ounces (two average meals) a week of a variety of fish and shellfish that are low in mercury.

- Five of the most commonly eaten sea foods that are low in mercury are shrimp, canned light tuna, salmon, Pollock, and catfish.
- . Albacore (“white”) tuna and tuna steaks have more mercury than canned light tuna. So, when choosing the two meals of fish and shellfish , up to 6 ounces (one average meal) of albacore or tuna steak can be eaten per week.

3- Check local advisories (see contact information on the next page) about the safety
of fish caught by family and friends in local lakes, rivers, and coastal areas. If no advice is available, eat up to 6 ounces (one average meal) per week of fish caught from local waters, but do not consume any other fish that week.

The same recommendations should be followed when feeding fish and shellfish to children, but the serving sizes should be smaller. The Texas

Department of Health Seafood Safety Division provides these general guidelines to protect against chemical contaminants in fish from Texas waters:
- Eat smaller, younger fish. These fish generally contain lower levels of chemical contaminants than larger, older fish.
- Remove skin, dark muscle tissue, and visible fat from fish before cooking, then broil, grill, or bake — allowing fat to drip away from the meat. This practice reduces the risk of exposure to many chemical contaminants (except methylmercury).
-Eat fish from a variety of water bodies to reduce risk of exposure to any one chemical contaminant or group of chemical contaminants.
- Eat some commercially caught fish or substitute other sources of lean protein (i.e. chicken, venison, lean red meat, beans, or soy products) for recreationally caught fish.
-Internal organs of fish may contain high levels of chemical contaminants and should not be eaten.

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