ACUPUNCTURE Today

HERBAL MEDICINE

Important Microorganism Safety Issues for Herbs

John Chen, PhD, PharmD, OMD, LAc

In my last column, I discussed important herbal safety issues surrounding mycotoxins. This time, we will be discussing safety issues surrounding bacteria.

There are two types of bacteria: aerobic and anaerobic. Aerobic bacteria need oxygen for growth and survival; whereas anaerobic bacteria do not require oxygen for growth, and may even die in its presence. Most bacteria are aerobic. Some aerobic bacteria are beneficial, such as those that contribute to the process of decomposition of organic materials in the soil. Others present serious health risks, such as infections affecting various organs and systems of the body. Examples of aerobic bacteria include the *Staphylococcus* species, the *Streptococcus* species, the *Enterobacteriacae* species, the *Pseudomonas* species, the *Mycobacterium* species and many others.

Gram-negative bacteria

Gram staining is a quick test to separate bacteria into gram-positive and gram-negative types. Gram-positive bacteria are those that are stained dark blue or violet by gram staining. Gram-negative bacteria, on the other hand, appear red or pink. The test is useful because it identifies the two distinct types of bacteria based on the structural differences of their cell walls.

Many species of gram-negative bacteria are pathogenic. *Escherichia coli* causes gastroenteritis, urinary tract infections and neonatal meningitis. *Salmonella* infection causes diarrhea, fever, vomiting and abdominal cramps. *Shigella* caused dysentery with diarrhea, fever, nausea, vomiting, stomach cramps, flatulence and straining to have a bowel movement. Other pathogenic gram-negative bacteria include *Hemophilus influenzae*, *Klebsiella pneumoniae*, *Legionella pneumophila*, *Pseudomonas aeruginosa*, *Neisseria meningitidis*, *Neisseria gonorrhoeae* and *Helicobacter pylori*.

Enterobacteria are rod-shaped, gram-negative bacteria that are frequently found in the in the intestines of humans and other animals. Many enterobacteria are a normal part of the gut flora, but some are pathogenic, namely *Salmonella* and *Escherichia coli*.

Yeasts and molds

Yeasts are single-celled fungi that grow in foods in the presence of sugars, organic acids and other easily metabolized carbon sources. Some yeasts are beneficial and used for fermentation in the production of bread and beer. Others, such as yeasts of the *Zygosaccharomyces* genus, spoil food.

Molds are microscopic fungi that grow in the form of multicellular filaments. Molds and mold spores are ubiquitous in nature, and when present in large quantities, present health hazards to humans. In addition, molds produce spores, which when inhaled, can cause serious allergic reactions and respiratory problems.

E. coli

Escherichia coli (commonly called *E. coli*), is a gram-negative enterobacteria commonly found in the lower intestine of warm-blooded animals. Most strains of *E. coli* are harmless. They are part of the normal flora in the gut and benefit the host by producing vitamin K2 and preventing the growth of pathogenic bacteria in the intestines. However, some strains of *E. coli* can cause serious illnesses in humans, such as food poisoning, gastroenteritis, urinary tract infections, and neonatal meningitis. Because of these health risks, it is important to test for *E. coli* in food.

Salmonella

There are approximately 40,000 cases of Salmonella infection reported in the United States each year. Salmonella is a gram-negative enterobacteria that causes salmonellosis, a food-borne illness. Salmonellosis begins with symptoms such as diarrhea, fever, vomiting, and abdominal cramps. Dehydration is a serious complication, as a tremendous amount of water may be lost through diarrhea and vomiting. Adequate hydration is absolutely important for proper recovery. Most people recover without treatment within three to seven days. In severe cases, the salmonella infection may spread from the intestines to the blood, and then to other body sites and can cause death unless treated promptly. Because of the frequency and severity of salmonella infection, its absence in food is of critical importance.

Staphylococcus aureus

Staphylococcus aureus, literally "golden seed," is a anaerobic, gram-positive coccus which appears as grape-like clusters when viewed through a microscope. *S. aureus* is one of the most common bacteria; about 20 percent of the population are long-term carriers. *S. aureus* is frequently found in the nose, throat and skin. *S. aureus* causes a wide range of infections from minor skin infections (e.g., pimples, impetigo boils, cellulitis folliculitis, furuncles, carbuncles) to life-threatening diseases (e.g., pneumonia, meningitis, osteomyelitis, endocarditis, septicemia). *S. aureus* infection is usually spread through direct physical contact: skin-to-skin contact with an infected person, and contact with objects such as towels, sheets, clothing or athletic equipment used by an infected person.

From a health care perspective, it is important to monitor aerobic microbial count in herbal products because high levels of aerobic bacteria present serious health risks. The safety limits of aerobic microbial count are listed in the table.[1,2]

Table: Safety Limits for Microorganisms

	AHPA	EUP
Aerobic bacteria	107 CFU per gram	105 CFU per gram or milliliter
Gram-negative bacteria	104 CFU per gram	103 CFU per gram or milliliter
E. coli	Absent in 1 gram	Absent in 1 gram or milliliter
Salmonella	Absent in 10 grams	Absent in 10 grams or milliliter
Yeasts and molds	105 CFU per gram	104 CFU per gram or milliliter

References

1. American Herbal Products Association. *Guidance on Microbiological Limits*. 2009. Note: These safety limits are for nonliquid dietary supplements.
2. European Pharmacopoeia 6.0. Section 5.1.4. *Microbiological Quality of Pharmaceutical Preparation*. pp 529-30. Note: These safety limits are for herbal medicine drugs (whole, reduced or powdered) of liquid and nonliquid forms.

FEBRUARY 2010