



Avoid Contracting Angiostrongyliasis (Rat Lungworm Infection): Wash Fresh Fruits and Vegetables Before Eating!

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Human angiostrongyliasis is an infection caused by a nematode parasite of rats. The tiny parasitic roundworm *Angiostrongylus cantonensis* (pronounced an-gee-o-stron-guh-luss can-tun-en-sis) is commonly called the rat lungworm. The mature, adult form of the nematode is found only in rats. The immature forms (larvae) are passed in the feces of infected rats and can then be ingested by other organisms, including snails and slugs. After two larval molts in the host animal, the larvae reach an infective stage. Rats get infected when they eat the infective larvae. The larvae mature into adult worms in the rat lung. The cycle repeats when the adult worm lays eggs, the eggs hatch, and larvae are excreted in rat feces.

Transmission route to humans

Human angiostrongyliasis can occur through either ingestion of raw or undercooked animals, including (in Hawai'i) snails and freshwater prawns, which contain the infective rat lungworm larvae, or consumption of raw vegetables contaminated with the larvae. Passage of live larvae in humans has not been documented, so it is believed that people are incidental hosts that do not transmit the rat lungworm to other humans or animals. Occurrence of the human infection has been documented in Asia, the Pacific, the Caribbean, and the United States. For details on the biology of the infective organism, its hosts, and its history in Hawai'i and other places where it occurs, see Alicata (1964), *Parasitic Infections of Man and Animals in Hawaii*.

In Hawai'i, various snails and slugs, including the giant African snail, the golden apple snail, and the semi-slug *Parmarion cf. martensi* Simiroth, which is reportedly

displacing the Cuban slug, *Veronicella cubensis*, are known to carry the infective larvae. The semi-slug has a tendency to climb structures and deposit its feces. It is established in commercial papaya plantations and is considered a pest of lettuce and papaya in home gardens. Contamination of produce by one of these animals is believed to have caused the recent incidences of angiostrongyliasis that occurred on the island of Hawai'i.

Angiostrongyliasis symptoms

People react differently to this infection. Some do not have any symptoms, and others have only mild symptoms for a brief period of time. Eosinophilic meningitis may occur, however, as a serious but rare type of infection, with symptoms that occur about 1–3 weeks after ingestion of the parasite and last from a few days to several months. The symptoms may include severe headache, stiffness of the neck and back, tingling or painful feeling in the skin, nausea, and vomiting. Other symptoms are low-grade fever, temporary paralysis of the face, and light sensitivity. In the recent cases on Hawai'i, two people went into comas. Consultation with a health care provider is strongly recommended to confirm the infection and to provide relief from the symptoms.

Treatment of human infections

Because with time the ingested parasite dies, most people, even those with eosinophilic meningitis, do not require medical treatment. Antibiotics are not needed. Usually, the symptoms of the infection are treated (such as with pain medication for headache), rather than the infection itself. Those with severe meningitis may be given other treatments.

Prevention of angiostrongyliasis

Although people can get infected with this parasite, the actual occurrences of infection are unusual and rare. Prevention of the infection is mainly through sanitary food handling practices. On farms and in gardens, efforts should be made to eliminate rodents, snails, and slugs from the vicinity of the growing area. Anyone eating snails and prawns should boil them for at least 3–5 minutes.

Avoiding eating fresh produce out of fear of contracting angiostrongyliasis is not the best preventive measure. Fresh produce is a primary source of bioactive nutrients and functional foods. People are encouraged to eat five servings of fresh fruits and vegetables each day. The key to avoiding angiostrongyliasis is to carefully clean fresh produce before it is consumed.

Why is it important to clean produce before eating it?

One in 10 cases of foodborne illness in the United States today is due to consumption of contaminated fresh fruits and vegetables. Therefore, people need to know how to make raw fruits and vegetables safe to eat. Rinsing produce in drinkable water removes soil, surface microbes, and some pesticides. Cleaning produce properly is especially important when it is for the young (under 5 years old), whose immune systems are not fully developed, or the sick, the elderly, and others with compromised immune systems. However, rinsing produce contaminated with larvae of the parasitic nematode *Angiostrongylus cantonensis* may not remove all the infectious larvae, so it is best not to use produce that is suspected of being contaminated.

Some points about cleaning produce

- It is preferable not to wash produce before storing it in the refrigerator, because moisture in the refrigerator environment encourages microbial growth. Rinsing produce does not remove all microorganisms.
- Organically grown or homegrown produce is not necessarily any cleaner or safer to consume than conventionally grown produce—all produce should be washed before eating.
- Commercial fruit and vegetable wash solutions are not more effective than tap water rinses; studies conducted by the University of Maine Cooperative Extension Service concluded that rinsing fresh produce under a cold-water spray and then soaking it in distilled water

for 1–2 minutes is preferable and more economical than the other wash methods tested.

- Do not use soaps, detergents, or household bleach on produce, because these products are not approved for treating foods to be eaten, and their residues may be harmful.

Procedures for cleaning various fruits and vegetables

Before washing, examine the produce for visible dirt, debris, insects, snails, or slugs. Remove any dirt, debris, and insects, and discard anything that is apparently damaged or contaminated with snails or slugs.

Wash the preparation area, cutting boards, and utensils using hot, soapy water. Clean raw fruits and vegetables (including bananas) well before you peel, cut, eat, or cook them by rubbing the produce with clean hands under running water. Fragile produce, such as lettuce and cabbage, may be sprayed to remove visible materials not meant to be with the food.

Using hot, soapy water, again wash the preparation area, cutting boards, and utensils after peeling produce and before further cutting to avoid transferring microbes from the outside to the inside of the raw produce. In fruits with non-acidic flesh, such as cantaloupes, microbes grow more readily than in acidic fruits, such as apples. Use a vegetable brush for produce with thick skin (melons, cucumbers, winter squash, citrus, potatoes); produce with grooved surfaces, such as cantaloupe, are especially in need of careful scrubbing. Waxy-skinned citrus fruits and cucumbers also may have pathogens sticking to the outside peel. With bunched fruit (blueberries, grapes, raspberries, strawberries, and similar fruits) spray or rinse in a colander with cold water. Remove all visible dirt and debris and use a paper towel to blot the produce dry.

Summary

The following points are important to remember when growing and preparing fresh fruits and vegetables:

- If you grow your own produce, make sure that rodents, snails, and slugs are controlled and excluded from your garden. If you buy directly from a farm or farmstand, inquire about the practices the farmer has in place to avoid contamination of produce with harmful microbes. It is best to buy only from vendors that you know adopt good agricultural practices to protect the safety of your produce.

- Wash, wash, wash—anything raw that you put in your mouth is a risk. Wash your hands before handling food. Wash the preparation area. Wash the produce. Wash your hands again before serving and eating the food.
- Use common sense. While microorganisms are on, in, and around everything, most of them are harmless, or even beneficial, and only a few cause illness. Learn about how to avoid consuming the harmful ones by adopting good food handling practices.

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