

## Preliminary study finds organic vegetables contaminated with wide range of disease-causing microbes

- *Disease-causing amoebas that live on organic spinach and lettuce also shelter human pathogens like Pseudomonas, Salmonella and Helicobacter.*
- *Leafy greens are particularly susceptible to contamination due to their proximity to the ground and the likelihood of people eating them without cooking.*

**\*\*Note: this is a press release from the European Congress of Clinical Microbiology & Infectious Diseases (ECCMID 2022, Lisbon, 23-26 April). Please credit the congress if you use this story\*\***

**Embargo: 2301H UK time Friday 22 April**

New research to be presented at this year's European Congress of Clinical Microbiology & Infectious Diseases (ECCMID) in Lisbon, Portugal (23-26 April), suggests that disease-causing amoebas that live on organic leafy vegetables can shelter human pathogens like *Pseudomonas*, *Salmonella*, and *Helicobacter* and are a potential risk to public health. The study is by Dr Yolanda Moreno and colleagues from Universitat Politècnica de València in Spain.

Foodborne illness from consuming contaminated fresh produce is common and can have serious effects on human health, especially when eaten raw. There is a growing demand for organically grown fruit and vegetables as people strive to eat healthy diets and amid concerns over potential contamination from pesticides, chemical fertilisers and herbicides. However, during growth, harvest, transportation and further processing and handling, fresh produce can be contaminated with pathogens from human or animal sources, through contact with soil, irrigation water, air, rain, insects, and during industrial produce-washing.

Vegetables can become contaminated with certain protozoa (single-celled organisms) such as free-living amoebae (FLA), that feed on bacteria and can act as hosts to pathogenic bacteria (the so-called "Trojan horses") which resist FLA digestion and could be a threat to public health.

"Food and food-related environments create an ideal meeting place for free-living amoebae and pathogenic bacteria", explains Dr. Moreno. "However, comparatively little is known about the occurrence and diversity of free-living amoebae on organic vegetables and their role in transmitting human pathogens."

To conduct a preliminary study of the FLA microbiome isolated from organic vegetables, researchers collected 17 samples of lettuce and spinach from local supermarkets in Valencia between November 2020 and May 2021.

To investigate the degree of contamination, researchers used a metagenomic technique that identifies DNA in all bacteria present inside FLA. The results were assessed to determine what kinds of microbes (Microbiome) were in each sample.

The main bacterial types identified were *Flavobacterium* (found in 10% of vegetable samples) and *Pseudomonas* (10%), many of which do not cause disease in humans. However, a third of samples (34%) contained 52 potentially disease-causing types of bacteria including *Legionella*, *Salmonella*, and *Arcobacter*. The resulting infections can cause illnesses—including pneumonia and gastrointestinal illness.

Moreover, the FLA species *Vermamoeba vermiformis* that commonly causes severe infections in humans was found in a fifth (19%) of vegetable samples; and *Acanthamoeba castellanii*, that can cause blindness and encephalitis were identified in almost two thirds (63%) of samples.

“The presence of bacteria of public health concern contained inside the free-living amoebae suggests that they are vehicles that can easily transmit pathogens capable of reaching humans and causing health problems through contaminated organic vegetables”, says Dr. Moreno. “Contamination can arise as a consequence of treating soil with organic fertilisers such as manure and sewage sludge and from irrigation water. Leafy greens are particularly susceptible to faecal contamination due to their proximity to the ground and the likelihood of humans consuming them without cooking. Our results also stress the need to educate the public on safe and proper handling of fresh organic vegetables before eating them fresh or slightly cooked.”

Despite the important findings, the authors note that the study only included a small sample of leafy organic vegetables from one city in Spain, and larger studies are needed from different countries to understand more about the microbiological quality and safety of organic vegetables.

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**Notes to editors:**

This research was supported by the Spanish Ministerio de Ciencia, Innovación y Universidades.

The authors declare no conflicts of interest.

This press release is based on a poster presentation 191 at the European Congress of Clinical Microbiology & Infectious Diseases (ECCMID). All accepted abstracts have been extensively peer reviewed by the congress selection committee. There is no full paper at this stage, but the authors are happy to answer your questions. The research has been submitted to a medical journal for publication.

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