## Organically grown foods - fad or lifesaver? Creating optimal microbiome health

## Viv Harris

The concept of One Health outlines the health and well-being of humans is inseparably linked to the health of other systems such as soil, plants and animals. Microorganisms are crucial in One Health because they connect each of these components, meaning the health of all ecosystems depends on the health of the microorganisms within it. Our current concept of disease is based on invading pathogens causing disease, but I believe it goes way past this to a concept of an all body microbiome imbalance (gut, nasal, oral) due to many factors such as a highly processed poor diet from impoverished soils, increased use of antibiotics in the whole ecosystem, increased use of pesticides, and other toxic chemicals which all affect the health of our body's microbial populations allowing immune dysfunction (and chronic inflammation resulting in degenerative diseases) and pathogen invasion to occur. In essence, I believe a healthy, thriving microbial population (microbiome) in our body is the cornerstone of immune health and ultimately overall health.

The human gut microbiome is reliant on the environment and food to constantly reinocculate and create optimal microbe balance. Human microbiomes are remarkably similar in components to both the soil and canine microbiomes (however the human microbiome is only 10% of the size of the soil microbiome). Optimal health is determined largely on the health of the body's gut microbiome balance which effects most body systems by regulating immune response through reducing chronic inflammation and allowing immune protection from invading pathogens, to determining moods, energy levels and the way the body functions.

Our human genome has adapted to a wide variety of molecular signals provided by a diverse gut microbial community over the course of evolution and the loss of these microbial signals could disrupt important pathways in the human body, such as the immune system, endocrine signalling pathways and neuroimmune interactions. Beneficial gut bacteria play a role in lowering risk for chronic diseases like asthma, obesity, allergies, dermatitis, inflammatory bowel disease and neurodevelopmental disorders. While gut microbial diversity is decreasing along with urbanisation and biodiversity loss, the prevalence of chronic inflammatory diseases such as inflammatory bowel disease, type-1 diabetes, allergies and asthma is on the rise in Westernised societies (Roslund et al. 2024). The formation of the infant microbiome in the first three years of life is not only important for infant gut function, but also crucial for the development of the immune system thereby influencing infant and eventually adult health (Hirt 2020). Environmental exposure post birth (and even during birth via vaginal delivery) to breastfeeding (supplying microbes and special sugars that promote gut microbial growth), beneficial microbe rich sources such as healthy soil from forests and organically run gardens, exposure to animals especially dogs as well as unsterile environments and unprocessed organically grown foods high in beneficial microbes will feed the infant gut and shape the sequence of microbial community establishment and ultimately the final composition of the mature adult microbiome. This not only applies to humans but also to animals especially canines as we have similar microbiome profiles. So, children and puppies raised in relatively sterile environments won't be getting microbiome stimulating exposure which is highly damaging to the infant health as well as the ultimate adult health of the individual.

There are many things that can disrupt this microbial balance like the use of antibiotics (leading to antibiotic resistance and the sharing of antibiotic resistant genes in the food we eat as well as the death of beneficial microbes), toxic chemicals such as herbicides, insecticides and pesticides

(disruption of gut microbe balance allowing more pathogenic bacteria to multiply and create inflammation in the gut), heavy metals (disruption of metabolic pathways), micro plastics (interference of the biodegradation of harmful toxicants (Luo *et al.* 2019) gut microbiota dysbiosis, intestinal barrier dysfunction and disruption of metabolic pathways) (Luo *et al.* 2019). Other things such as diet (western diets high in processed foods with decreased nutrient and living beneficial microbial levels due to processing), animal proteins which release amines and sulphides when digested that destroy many beneficial gut bacteria, unhealthy fats and lack of dietary fibre (microbiota accessible carbohydrates are essential for the healthy growth of beneficial gut bacteria which keep pathogenic bacteria levels low and produce short chain fatty acids which have been found to modulate the inflammatory response and help maintain homeostasis). Dietary fibre, especially soluble dietary fibre, provide the main carbon and energy source for the gut microbiota and have prebiotic effects by increasing the beneficial bacteria and improving the intestinal environment. These are found in vegetables, fruits, legumes and wholegrains. The current trends for grain free dog diets springs to mind - what's feeding the microbiome? Replacements with legumes?

'Certified Organic Growing' means to grow food and animals with materials derived directly from plants, animals and minerals, without the assistance of fossil fuels (i.e. no use of petrochemical-based pesticides, herbicides, artificial fertilizers, no GMOs) (Albornoz 2015). It goes past just not using toxic sprays etc as it encompasses soil nutrient and microbe maximisation. Organic growing focuses on working with, not against, biological systems, maximizing soil health by cultivating ecosystems of plants and micro and macro soil organisms, from bacteria and fungi to earthworms and insects. The central goal is to maintain or improve the ability of the soil to support plant life and the long-term productivity of the soil. Animal welfare and environmental sustainability are critical issues for organic farmers. This system of food growing fully recognises the vital importance of microorganisms in the soil and concentrates on cultivating an environment that optimises the action of these beneficial microbes by using humates, compost, earthworm vermicast (very rich in beneficial microorganisms), adding effective microorganisms to the soil (inoculants) as well as optimising mineral levels with the addition of Rockdust and other naturally occurring materials such as seaweeds. The action of the microbes on the mineral rich additives makes these available to the plants in the organic system which in turn are consumed by humans and animals, imparting not only the benefits of the increased mineral levels but the highly valuable microbes from the soil that will regularly inoculate the gut in the consumers. Regular reinocculation of beneficial microbes is vital for ongoing health as they are in a state of constant renewal and change.

Using healthy, organically produced soil with no toxic contaminates and a rich microbial population high in soluble carbohydrates for microbial growth, is a far superior probiotic than commercial probiotics in a packaged and processed form as the range and activity of these microbes is often low and compromised. Consuming plants that are grown in this environment often means these microbes are still on the plants and eaten when fresh ensure the reinocculation occurs. These plants also provide the soluble carbohydrates which are vital for flourishing microbial growth. Processing, cooking, and storing will greatly reduce these microbes. I believe there is a possibility here for using actual healthy, organically managed, toxin free, microbe rich soil as a superior probiotic (Indigenous people have routinely eaten soil for centuries. The phenomenon is known as geophagy).

Synthetic petrochemicals (most herbicides, pesticides, insecticides as well as artificial fertilisers) damage or kill soil organisms which are vital for the uptake of minerals and other nutrients and making them available to the plants. Once the soil microbiome is damaged by herbicides (especially Glyphosates as in Round up which is a common herbicide with profoundly negative health implications) the plants are much less able to absorb nutrients especially minerals making the food produced from these plants' nutrient deficient. Glyphosates

interfere with the Shikimate pathway in plants and in major groups of microorganisms impeding the production of aromatic amino acids and therefore proteins (van Bruggen *et al.* 2021). Plants die and so do microbes. It is a probable carcinogen for mammals and can cause organ failure by inhibiting acetylcholinesterase and inducing oxidative stress in non-mammalian species. Whilst it is broken down in the soil its metabolites remain which are taken up by crops and mammals. Glyphosate also chelates micronutrients and competes with adsorption of phosphates. It also leaches into waterways and remains, creating long-term low-level toxicity for plants and animals, especially microbes.

All our food ultimately comes from the soil and food quality is determined by the quality of the soil. Up to the last 100 years or so, most food was grown in soils that weren't contaminated by toxic materials, i.e. were truly organic in nature due to composting, use of available plant and animal matter and the lack of toxic chemicals being applied. But relatively recently our soil mineral and microbial content has markedly decreased due to industrialisation, excess tillage, increased use of synthetic fertilisers and pesticides, fungicides and herbicides which all destroy microbes and chelate minerals. In the US alone, the 1992 Earth Summit reported soil minerals were down by 85% in last 100 years. Dr Linus Pauling, a Nobel prize winning scientist postulated "All disease is caused by a mineral deficiency" which may explain why modern global health is currently so damaged. Low minerals, low microbes leading to low adsorption of minerals in the soil and in our bodies.

Artificial fertilisers such as superphosphates which are used for modern plant production has sped up plant growth but the imbalanced nitrogen levels, lack of mineral input and lack of sustainable farming practices have destroyed the soil structure, water retaining ability and lowered organic matter in the soil. All these things destroy the diversity of soil microbes which are fundamental to our health and that of the whole environment. The soil becomes contaminated with toxins as the bio degeneration by microbes is gone, there is a largely reduced mineral content in the soil (due to lack of mineral based fertilisers and the important microbes that make them available to the plants) leading to mineral deficient plants that are nutritionally inferior, more inclined to be attacked by pests due to plant weakness, weeds flourish in the impoverished soils leading to the increased need for toxic pesticides and herbicides which ultimately enter our bodies and those of food producing animals as well as companion animals and continue to massively damage our gut microbiomes.

Growing certified organic food and animals involves meeting strict certification rules on what can be used in the organic systems, how animals are treated and what chemicals can and can't be used on crops. There are no pesticides, herbicides, fungicides, heavy metals or soil microbe inhibitors, so eating organic produce will only enhance and not damage the gut flora of consumers which is especially important if pregnant or breastfeeding. The retail cost of organic foods reflects the much greater input of time and effort to meet these standards and are, in fact the actual cost of growing food. Most nonorganic certified foods are mass produced and aren't usually addressing optimal nutrient, welfare and environmental concerns, so are cheaper to produce but are often detrimental to the animals, people and environments that are used to produce them. The idea that certified organically grown food is a fad, costs more and isn't worth it shows a lack of understanding of the massive benefits that these products can offer.

Growing organically certified soil and therefore crops involve a major focus on soil microbiomes, mineral replenishment and creating an actively growing and self-sustaining biological system that needs to be very carefully protected to reduce outside contamination from less than sustainable practices. These healthy microbe systems will bio degenerate any unwanted toxins and will absorb the minerals and make them available to the plants, creating nutrient dense foods which in turn will be eaten and healthy gut flora will digest and make the minerals available to the animals. Without all of these complex systems operating, adding minerals and nutrients is a waste of time as they are not absorbed by the host animal, plant, human or otherwise.

So, in conclusion, organically grown soil and food is a vital part of linking humans to the environment and animal kingdoms via the microbial populations that are vital for our health. The lack of contaminants and vastly superior nutrient levels in organically grown foods and soils indeed make them a potential lifesaver and well worth growing them yourself or paying more to benefit from their superior health properties.

## References

Luo T *et al.* Interaction between microplastics and microorganism as well as gut microbiota: A consideration on environmental animal and human health. *Science of the Total Environment* 667: 94-100, 2019

Roslund MI et al. Scoping review on soil microbiome and gut health - Are soil microorganisms missing from the planetary health plate? *People and Nature*, 2024

**Hirt H.** Healthy soils for healthy plants for healthy humans: How beneficial microbes in the soil, food and gut are interconnected and how agriculture can contribute to human health, *EMBO*, 2020

**Dong TS, Gupta A.** Influence of Early Life, Diet, and the Environment on the Microbiome. *Nat Med* 22: 713-222, 2016

**Guan Z-W** *et al.* Soluble Dietary Fiber, One of the Most Important Nutrients for the Gut Microbiota *Molecules* 26(22): 6082, 2021

Albornoz S. What Does "Organic" Really Mean? *Sustainable Food Center*, 2015 https://sustainablefoodcenter.org/latest/gardening/what-does-organic-really-mean

van Bruggen AHC *et al.* Indirect Effects of the Herbicide Glyphosate on Plant, Animal and Human Health Through its Effects on Microbial Communities. *Frontiers in Environmental Science* 9, 2021