Following the Flow of Nature: The Microbiome and Intermittent Fasting Through the Lens of Traditional Chinese Medicine

Linda Y. Qiu and Thomas Richardson

Abstract

More than half of the human body consists of non-human microbes such as bacteria and viruses. Microbes can cause infection, inflammation, immune system disorders, obesity, diabetes, respiratory and cardiovascular illnesses, even heart failure. Microbes are governed by the cycles of nature, including the cycles of day and night, and are influenced by what and when we eat. Research has shown intermittent fasting to be a promising approach to reducing inflammation, improving metabolic health, and reducing risk factors for cardiovascular disease, possibly through influencing gut microbial composition. This article explores the role of the microbiome and intermittent fasting on human health from the perspective of traditional Chinese medicine (TCM).

Keywords
Microbiome, intermittent fasting, gut bacteria, Chinese medicine COVID-19, circadian rhythm, meridian clock

Introduction

During the current coronavirus pandemic, SARS-CoV-2 is considered to be a primary threat to human health. But what are the underlying reasons that this coronavirus is so harmful to human health? Why do some people get sick while others do not? Viruses are constantly evolving and in fact evolve much faster than the human species. We know that COVID-19 affects populations with pre-existing health conditions - such as heart or lung disease, weak immunity, obesity or diabetes - much more severely than healthy people, many of whom may remain completely asymptomatic. For these reasons, it is important to look at the causes of these pre-existing health conditions. While dietary and lifestyle choices are known to be vital factors in the development and severity of these conditions, one aspect that is rarely mentioned - and which is intimately connected to diet and lifestyle choices - is the human microbiome. When gut microbes are out of balance, they can cause not only obesity and diabetes (Musso et al., 2010), but also disorders of the immune system (Hooper at al., 2012), lung disease (Shah et al., 2021) and heart disease (Brown & Hazen, 2018).

The microbiome

The microbiome refers to the total genetic material of all the microbes (including bacteria and viruses) that exist on and inside the human body. Study of the microbiome has increased dramatically since 2000, partly because of

new genetic sequencing tools. The National Institutes of Health Human Microbiome Project (2007-2016 - see <https://hmpdacc.org/hmp/>) took on the project of sequencing the genome of the human microbiome, focusing particularly on the microbes that inhabit the skin, mouth, nose, digestive tract and vagina. The second phase focused on human and microbiome interactions. This project has revolutionised our understanding of health and medicine.

As the study of the microbiome has deepened, we now know that the number of genes in all the microbes of one person's microbiome is more than 100 times the number of genes in the human genome, even though microbes make up only about one to three per cent of the body's mass because of their small size. The genes of our microbiome therefore essentially represent a second genome which augments the activity of our own. In a sense, more than half of the human body is not actually human, as human cells make up only 43 per cent of the body's total cell count, while the rest are microscopic colonists. One might say that we are more microbial than human (Gallagher, 2018). An estimated 500 to 1000 species of bacteria exist in the human body at any one time (Gilbert et al., 2018). It is also estimated that 380 trillion viruses live on and inside the human body - 10 times the number of bacteria (Pride, 2020). Eight per cent of our DNA consists of remnants of ancient viruses, and another 40 per cent is made up of repetitive strings of genetic material that is thought to have a viral origin (Arnold, 2020). The individual human is therefore a superorganism or holobiont, and has co-evolved with microbes over time.

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The microbiome and health

The microbiome plays a significant role in human health. For example, mitochondria – the powerhouse of the cell - are thought to have evolved from an ancient bacterium that somehow became incorporated into the cytoplasm (Gray, 2012). Today we routinely speak about 'good' and 'bad' bacteria. Viruses fall into the same categories. Some cause illness, some may help us avoid illness, while some just seem to co-exist with us (Pride, 2020). The role of most viruses is not well understood. The vast majority of microbes live in the large intestine. Newborn babies receive their microbiome from their mother while travelling through the birth canal, then pick up more while breastfeeding (Dunn et al., 2017) and through contact with the environment (Tasmin et al., 2017).

The microbes in our digestive tract influence when we like to eat, what we like to eat and contribute to energy production (Alcock, 2014). Besides influencing digestion and metabolism, they are wired into the immune system and dial it up and down (Hooper et al., 2012). There are anatomic communications and complex pathways in the gut–lung axis involving the gut and lung microbes (Enaud et al., 2020). Nutrition and these microbes affect cardiovascular diseases through the gut-heart axis (Lerner et al., 2020). The gut microbiota also plays a role in basic neurogenerative processes such as the formation of the blood-brain-barrier, myelination, neurogenesis and microglia maturation; gut bacteria are therefore integral contributors to development and function of the nervous system, and mental health and disease (Sharon et al., 2016). Many diseases are associated with imbalance of these microbes, including infection, inflammatory bowel disease, obesity, diabetes, cancer, asthma, pneumonia, COPD, cardiovascular diseases, periodontal disease, rheumatoid arthritis, dermatological diseases, multiple sclerosis, fibromyalgia, Parkinson's disease, autism, depression and even heart failure (Wang et al., 2017 & Kamo et al., 2017).

In health, the different microbes live in or on the appropriate sites of the human body and have a harmonious relationship with their host. Disorders occur when microbes appear in larger amounts and in places they are not supposed to be. The reason for this pathological migration and reproduction of microbes is related to changes in the condition of the human organs, tissues and cells, and the surrounding environment (Steffan et al., 2020). In addition, when certain foods are ingested, corresponding microbes living on those foods and their byproducts flourish. For example, high-carbohydrate diets favor the *Prevotella* genus, high-fat and high-protein diets promote the development of *Bacteroidetes* microbial species (Rajoka et al., 2017), whereas dietary fibre provides a competitive advantage to *Bifidobacteria* (Gonzalez-Rodriguez, 2013). Microbiota community structure changes drastically within 24 hours of changing diet (Wu et al., 2011). By introducing dietary signals into the nexus between the host and its microbiota, nutrition can either sustain homeostasis or contribute to disease susceptibility (Zmora et al., 2019).

The microbiome through the lens of TCM

In the practice of traditional Chinese medicine, as well as many other traditions, an important principle is to maintain

the body's homeostasis through harmonising with the cycles of nature — the change of seasons, cycles of day and night, etc. In Tanzania, the Hadza hunter-gatherers continue to live a traditional lifestyle in harmony with seasonal changes. Researchers have monitored their gut microbiome and found that it has cyclic annual reconfigurations, in which some taxa become undetectable in some seasons only to reappear in a subsequent season (Smits et al., 2017). Humans and the microbes in their gut are both part of nature, and therefore share natural rhythms.

Gut microbes' activities vary through the cycles of day and night (Johnson et al., 2017). In the Chinese medicine tradition, the meridian clock theory describes how each meridian has a two-hour time window where it is most active; 5am to 7am corresponds to the Large Intestine, 7am to 9am to the Stomach, the Spleen is 9am to 11am and the Small Intestine is 1pm to 3pm. While more research is needed to understand these daily rhythms, scientific research already shows that many functions of the gastrointestinal tract exhibit similar circadian, or sleep–wake, rhythms. For example, gastric emptying and blood flow are greater during the day than at night, and metabolic responses to a glucose load are slower in the evening than in the morning (Sanders, et al., 1992).

In the evening, the digestive system carries out the processes of food transformation and healing activity differently from the daytime (Dantas & Aben-Atha, 2002). According to Chinese medicine theory, there are seven Po (corporeal souls) that are related to the function and consciousness of the physical body. They include Shi Gou (Corpse of Dog, responsible for being physically alert); Fu Shi (Hidden Stool, responsible for food transformation into essence and stool formation); Que Yin (Bird Genital, responsible for sexual desire and reproductive functions); Tun Zei (Swallow Thief, responsible for ingestion, destroying external pathogens and harmful substances); Fei Du (Dissolve Toxin, responsible for dissolving accumulations and toxins, and metabolism); Chu Hui (Clear Filth, responsible for clearing poisons, body metabolites, and wastes); Xiu Fei (Smelling Lung, responsible for smelling and breathing) (see Anon., 317-420). These Po are understood to stay active at night during sleep; we therefore need a good night's sleep to enable them to absorb useful substances, clear waste and restore energy. Healthy people breathe well during sleep and are able to wake quickly if necessary; upon waking up in the morning, they have a high libido, clear head, good appetite and pass full bowel movements. If a person wakes up feeling lethargic and does not have a good bowel movement, one of the reasons could be that Fu Shi - which as 'Hidden Stool' could be associated with microbes in the bowel - did not perform its work well. According to traditional Chinese wisdom, to keep these Po (and therefore the microbes in the gut) functioning harmoniously, it is advisable to have adequate amount of sleep, have a good breakfast to start the day and activate the metabolism, eat a healthy lunch, do not eat late in the evening, and go to bed with a stomach not full of food (Ruddick-Collins, 2018).

Modern lifestyle and the microbiome

The majority of people living in modern society are supplied with food that is largely indiscriminate to the season. Most people eating a typical, modern diet also have decreased microbe diversity and different microbial populations to the gut communities of humans living traditional lifestyles (Moles & Otaegui, 2020). Modern people's tendency to snack all day long and eat a big meal late in the evening has been found to adversely affect the gut microbes' composition and function (Ni et al., 2019). These poor diet choices and habits - along with poor food production, modern processing methods, added food preservatives and sugar, and fast foods - have caused the gut microbiome to change (Ruiz-Ojeda et al., 2020), leading to many modern diseases. Obesity is now viewed as an epidemic which is caused by microbes (Ludwig & Ebbeling, 2018). Many other 'diseases of affluence' are also epidemics that are now spreading to less affluent people (O'Keefe et al., 2015).

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When we put different foods into our gut, different microbes flourish, and their activities then influence what we want to eat. This can be a beneficial or a harmful cycle. People are gradually becoming more aware of the harm from consuming a poor diet, and of how to use food as medicine. There are many diet plans on the market, but many people cannot stay with a given plan for even days and weeks, let alone the amount of time needed to facilitate long-term change in the body. In general people need a wide variety of foods and nutrients. When certain nutrients are at a low level for a while, a healthy body will crave foods that contains those nutrients. Moderation and variety are the golden rules for health.

Fasting, metabolism and the microbiome

Among all the dietary plans available today, one plan that does not restrict the variety of foods - but instead focuses on the time of eating - has been gaining more attention during recent years: intermittent fasting. Intermittent fasting is a dietary pattern that cycles between periods of fasting and eating. There are different ways to do intermittent fasting. A popular and sustainable method is the 16/8 method in which you fast for 16 hours and eat only during 8 hours of each day.

Fasting has been practised throughout human evolution. Ancient hunter-gatherers did not have food available all year-round. Sometimes they could not find anything to eat. As a result, humans evolved to be able to function without food for extended periods of time. In fact, fasting from time to time is - historically and cross-culturally speaking - more normal than always eating three or more meals per day. Fasting is also often done for religious or spiritual reasons in modern times. It can be a safe practice for the majority of people, if done correctly.

Fasting has immediate effects on metabolic health. Even a single fasting interval (e.g. overnight) can reduce basal concentrations of many metabolic biomarkers associated with chronic disease, such as insulin and glucose. For example, patients are required to fast for 8 to 12 hours before some blood tests to achieve steady-state fasting levels for many metabolic substrates and hormones. Such overnight fasting can be stretched to 16 hours relatively easily and safely. Research shows that intermittent fasting may be a promising approach to improving metabolic health. Intermittent fasting might directly affect gut microbial composition, function and interaction with the host (Karakan, 2019). As detailed above, the gut microbiome impacts metabolic health and has a circadian rhythm that is entrained by food signals. An extended fasting period (i.e. gut rest) could lead to reduced gut permeability and as a result to blunted postprandial endotoxemia and reduced systemic inflammation (Patterson et al., 2017). When inflammation is reduced, many chronic diseases improve or can even be healed. Intermittent fasting can also help with losing weight and belly fat, without having to consciously restrict calories. It can reduce insulin resistance, lowering blood sugar by three to six per cent and fasting insulin levels by 20 to 31 per cent, which should protect against type 2 diabetes (Barnosky et al., 2014). Intermittent fasting may also reduce risk factors for heart disease, prevent cancer, aid the growth of new nerve cells, and confer protection in cases of CNS autoimmunity (Gunnars, 2020). Studies have shown that rats who are made to fast live 36 to 83 per cent longer. (Goodrick, 1982). It is quite possible that it can help humans to live longer, too.

When choosing the hours to fast, it is better to follow a set schedule in order to 'train' the microbes to follow a rhythm.

Recommendations

In order to lessen the chances of being adversely affected by the quickly evolving SARS-CoV-2 as well as other new viruses, one of the most important things to pay attention to - besides the quality of air we breathe - is the variety of foods we put into our gut and our eating rhythm - when we choose to eat or not to eat - and therefore the activity of the microbes in our guts. Intermittent fasting may be an easy, simple and sustainable method for many people to use dietary rhythm to prevent illness and/or facilitate the treatment of existing disorders (Gnoni et al., 2021).

When choosing the hours to fast, it is better to follow a set schedule in order to 'train' the microbes to follow a rhythm. The 16/8 method fits the pattern of our circadian rhythm better than other intermittent fasting methods such as fasting for two days a week, alternate day fasting or meal skipping. If using the 16/8 method, it is better to eat the last meal in the early afternoon and have a good breakfast instead of eating a big dinner and having the first meal at noon. Modern scientific studies suggest that the feeding-fasting rhythm stimulates the fluctuation of our gut microbiota and a series of subsequent molecular alterations, which in turn restore a healthier circadian clock that resembles our inherent clock formed throughout millions of years of human history (Hu et al., 2020). Besides the timing of meals, knowing which foods to avoid is also important. Added sugar, artificial sweeteners and preservatives are particularly important to avoid. They adversely affect the gut microbes and are primary causes of food addiction and many other disorders such as obesity and diabetes (Singh et al., 2017; Faruque et al., 2019).

Patients with COVID-19, heart or lung conditions, weakened immunity, obesity or diabetes and those who are taking medication should fast under a doctor's supervision. People who have a history of eating disorders, who are underweight or have low blood pressure, as well as children, teenagers and women trying to conceive or who are pregnant or breastfeeding, are suggested not to fast. Those unable to fast can instead follow a vegetarian diet or vegan diet, eating mainly greens, beans, onions, mushrooms, berries, and seeds (the 'GBOMBS' diet) to benefit the variety and activity of their gut microbes (Tomova et al., 2019), regulate

the appetite and improve health, and then try intermittent fasting when it is appropriate.

Conclusion

The microbiome plays a significant role in our health and well-being, affecting not only appetite and digestion but also the development of many chronic and acute diseases. One relatively straightforward way to improve the health of the microbiome is to engage in intermittent fasting. More research is needed to understand the effects of intermittent fasting and how it affects the microbiome, but it has been shown not only to improve overall health and well-being, but to reduce obesity and diabetes, improve immunity, reduce inflammation, and may thereby help to diminish the likelihood of developing severe reactions to viruses such as COVID-19 (Chaari et al., 2020 & Mccalmon et al., 2021). When practising intermittent fasting, eating early in the morning and avoiding late night feeding are recommended (Sutton et al., 2018), which follows our natural circadian rhythm and the flow of nature.

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