

# Gut glory

## The gut is your brain

Dietary fibre is well accepted as an important part of the diet and can exert a long range of health benefits, such as reducing plasma cholesterol, decreasing blood pressure, as well as decreasing the risk of cardiovascular diseases. It has been well documented that dietary fibres play a key role in body-weight regulation and reduced risk of related diseases such as diabetes and obesity. Contributed by Henk Hoogenkamp, food industry writer and protein application specialist.

Dietary fibre is a group of complex compounds that include natural and modified substances with different physical and chemical properties which are not digested by enzymes. The most popular classification of dietary fibres is based on their solubility in water, where fibre is divided into insoluble and soluble components. This distinction does not necessarily reflect the physiological effects.

Water insoluble fibres are generally partly or poorly fermented in the large intestine by microflora. When insoluble dietary fibre is consumed, they enhance fecal bulk and reduce intestinal transit time. Soluble dietary fibres enhance or speed up the transit time in the digestive tract and cause delay in gastric emptying of feces, which leads to a reduced rate of glucose absorption. These water-soluble dietary fibres show resistance toward digestion in the small intestine by microflora and generally well fermented in the large intestine.

Disturbances in the gut microbiome might contribute to inflammatory disease of

the gastrointestinal tract. There are reports that psychological stress-related hormones suppress the innate immune system that normally protects the gut from Enterobacteriaceae (*E-coli*).

Several primary gastrointestinal diseases lead to disruption of the mucosal barrier, allowing escalation to a systemic disease such as Crohn's Disease. Without properly functioning immune cells, the cellular wall can break down and allow microbes associated with Crohn's-associated pathological change to invade the gut and trigger symptom flare-ups.

### Gut-brain-axis

The connections between the gut and the brain are extremely complex, with multiple pathways of communication: the nervous, immune, and hormonal systems, which all facilitate messages from the microbiome – the



trillions of micro-organisms that live in our gut and produce molecules like the neurotransmitters found in the brain, such as serotonin and dopamine.

### From taboo to trend

Gut microbes modulate human health way beyond the gut as they have the capability to impact brain health and immune health like preventing viral infections and immune-related illnesses such as allergies. For example, it can be argued that frequent sanitary handwashing is a good thing to help prevent the spread of pathogens, although it may simultaneously decrease microbial diversity and be responsible for a possible rise in chronic illness.

There is a link in the microbiota gut-brain axis with growing evidence that brain and behaviour are influenced by microbiota bacteria-derived metabolites. The microbiome of the gut is not just for optimising the digestion and absorption of nutrients but also for ensuring the overall health and wellbeing. The latter is also associated with the emerging field of medical knowledge on the gut-brain axis. Especially in modern living, the delicate balance of gastrointestinal microbiotas can influence functioning such as sleep patterns, mood, antidepressants, and stress.

It is often said that the gut is the most noticeable barometer linking medical science and every day's digestive function to overall health and wellness. As such, gastrointestinal health, including the functions of pre- and probiotic strains, regulates specific metabolites that aim to improve or enhance human microbiome condition.

To achieve clinically proven gut health benefits, live probiotic strains are important. When probiotics are consumed, they pass through the stomach and reach the intestines where they interact with the gut microbiota and host cells. Dead probiotic cells will not be able to colonise the gut, hence are not as beneficial as live culture cells. Yet, dead probiotic cells still have the capability to release certain compounds that possess immunomodulatory or anti-inflammatory effects.

### Food and mood

The diet has a significant impact on the gut's microbial composition. Food and mood are clearly intertwined. The specific mix of microbes in the gut can reveal the presence of many diseases better than the body's own genes, and it can even predict the risk of dying within the next 15 years. Human microbiome sequencing aimed at prediction, prevention, and treatment of



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possible presence of disease is the new way forward in modern medicine.

The makeup of the 'Western diet' has significantly changed since World War 2 ended. People are increasingly eating processed and prepared food, ultra-processed food, and (microwave) ready-to-eat meals. Fifty to seventy years after World War 2, an avalanche of petrochemical fertilisers, biocides, pharmaceutical drugs, and other chemicals have filtered down the food supply chain and disrupted the microbes in the gut.

Scientists are beginning to unravel how microbiome microbes in the gut can influence the brain and behaviour, including finding hints about the development of Alzheimer's disease, Parkinson's, autism, schizophrenia, and depression.

Intestines are physically linked to the brain via the vagus nerve. As microbiomes are the centrepiece of the immune system, a disturbance in the gut can cause subtle immune reactions in the body. Some examples are often undefined causes such as nervousness, stress, anxiety, nausea, and the sudden urge to defecate. A healthy gut ensures effective absorption of nutrients and digestive comfort, which

affects mood and contributes to wellbeing. Ingredients that have beneficial influence on the gut microflora and gut function include prebiotics, probiotics, galactooligosaccharides, hydrolysates, and human milk oligosaccharides (HMOs). Infant formulas containing human milk oligosaccharides (HMOs) are gaining a wider use. Breastmilk, or its precision fermented alternative, can be considered a probiotic or even a symbiotic since it contains good bacteria and has a major impact on babies' gut microbiota composition that benefits the development of the immune functions.

The gut-brain-axis is an interesting topic of research linking the condition of the intestines and brains with both physical and bio-chemical influence. In other words, the microbiome or microflora, in conjunction with the brain and intestines, need a multidisciplinary approach from microbiology to gastroenterology and neuroscience. It is hypothesised that neurotransmitter receptors in the gut bacteria communicate directly with the human brain via neural pathways, such as the vagus nerve. By far, most neurotransmitters like serotonin are produced in the gut.

### Probiotics strains

Like any other emerging medical and nutritional insights, the blanket use of the term 'probiotics' has also been under scrutiny. According to the new June 2020 guidelines from the American Gastroenterological Association (AGA), there is not enough evidence to validate the use of probiotics for most digestive diseases. The guideline from the AGA goes even so far in suggesting that patients taking probiotics for Crohn's, irritable bowel disease, and ulcerative colitis should consider stopping in taking these dietary supplements.

It is essential that the public has objective guidance about the appropriate use of and indications for probiotics. It is important to consider the effect of each single-strain or multi-strain formulation of probiotics independently, instead of grouping them all under the same umbrella. In other words, the use of probiotics should be directed at strains that have a clinically proven validation benefit for the consumer and not toward a general catchall platform. Well-designed gastroenterological clinical trials will be needed for the use of strain- and combination-specific probiotics.

### A healthy toxin?

The word 'lectins' has made a resurgence in the vocabulary of medical and nutritional experts. Lectins are a large class of carbohydrate-binding proteins that are highly specific for sugar. Lectins, also known as 'sticky proteins' because of its binding ability of

sugar, are present in many plant foods such as beans, legumes (soy), and grains. These lectins can cause damage to the lining of the gastrointestinal tract or organs and interfere with metabolism, sometimes resulting in physiological digestive discomfort.

Lectins are mostly concentrated in the leaves and seeds of plants, and it does not really matter whether they are grown organically or conventionally. In bioengineered plants, it is common practice to selectively insert lectins to enhance the plant's ability to resist insects. This procedure can be seen as a particular form of GMO.

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Lectins are linked with autoimmune disorders like Crohn's, colitis, thyroiditis, fibromalgia, chronic fatigue, and arthritis. It is also hypothesised that lectins may disrupt the transmission between cells by mimicking or preventing hormonal inputs. Therefore, it is important to know that the vagus nerve plays a determining role in the brain-gut signaling.

While lectins can play havoc with the body, they also contain fragments that are beneficial to the immune system, such as fighting off viruses and pathogens. Some lectins are antimicrobial and demonstrate healing properties like those present in garlic and bitter lemon. Moreover, there are cancer research studies dedicated to lectins because these compounds bind to cell membranes.

So, here is the lectin paradox: a protein compound that might be both good and bad, considering that "the dose makes the poison". For most people, the safe dietary way forward is to significantly rotate the consumption and the variety of plant species, while making sure that lectins and offending complex sugars are eliminated by soaking and heating above 100C when beans and legumes are part of the dietary intake. Besides soaking and cooking, time-tested fermentation methods are especially effective, virtually eliminating lectins by means of pre-digestive techniques that have been practiced by traditional cultures around the globe for many centuries. A side note: Yeast has an ability to ferment and disrupt the lectins, as well as a significant portion of the sugars.

### The intestinal digestion

The cells that line the gastrointestinal tract have a dual performance: it is important that the lectins are kept in the gut while these mucosal cells (enterocytes) simultaneously allow safe passage of the food nutrients.

The 'stickiness' of the lectins allows binding with the lining, particularly the villi, of the small intestine, ultimately creating intestinal damage and sometimes causing the so-called 'leaky gut syndrome'. Once the intestinal breach exists, the lectins and possibly the other toxins — such as chemical disruptors — can leak into the bloodstream causing autoimmune attacks. Compromised intestinal villi means reduced absorption of nutrients, including proteins and minerals, as the injured gut lining changes the gut flora. Increased intestinal permeability from lectins, acid-reducing medication, and anti-inflammatory over-the-counter pharma drugs frequently cause the leaky gut syndrome.

For some lectin-sensitive people, the overload of lectins has outpaced the body's ability to adapt and compromised the function to properly digest certain grains and legumes, such as pulses and beans. In addition, the use of chemical fertilisers and biocides (insecticides, pesticides, herbicides) in modern farming have compromised the soil bacteria, which has negatively affected or depleted levels of zinc, selenium, and magnesium that are increasingly associated with diseases such as metabolic syndrome.

Non-steroidal anti-inflammatory medication like ibuprofen and naproxen, as well as lectins and lipopolysaccharides, can break the intestinal mucosal cell border. This breach allows larger molecules to "invade" the body, ultimately causing a plethora of often-undefined illnesses. Consumption of certain food (micro)compounds to manipulate certain processing properties is often hidden on the label ingredient declaration. A trick to avoid declaring the presence of certain "compounds" on a food or beverage label is to use the terminology "carry-over effect" in the primary processing of ingredients that are used in the formula.

### Gut disrupting

Medical doctors may routinely prescribe non-steroidal anti-inflammatory medication (NSAID) to cure gastrointestinal discomfort. Some of these drugs are ibuprofen, naproxen, and aspirin. Unfortunately, prolonged use could not only harm the stomach lining but also -equally important- damage the lining of the small intestine.

To reduce lectin sensitivity, natural anti-inflammatory products can be considered: boswellia extract, fish oil, and vitamin D. Also, glucosamine sulfate might be helpful in relieving pain since it binds and immobilises wheat germ agglutinin and other lipopolysaccharides in the gut. Lipopolysaccharides are molecules that make up the cell walls of certain bacteria in the microbiome gut. The multiplicity of microbes is collectively called the microbiome or holobiontes amply present in the gut and on the skin.

The right balance of microbes is essential for maintaining or restoring health, which subsequently averts disease. Good microbes need good nourishment, which often means drastically cutting down on sugar intake, as well as being cautious of some environmental disruptors notorious for feeding the bad microbes.

The same is true for parabens, a chemical used as a preservative in cosmetics. The various manmade forms of parabens discourage the growth of microbes, and these chemicals are mostly used in personal care products such as shampoos, hair conditioners, deodorants, and lotions. Parabens are highly effective in low doses for preventing the growth of fungi, bacteria, and yeast, thus a beneficial and inexpensive solution to extend shelf life as well as safety of products.

Parabens easily penetrate the skin, and current theories state that they interfere with hormone functions since they can mimic estrogen, the primary female sex hormone. Unlike the EU Commission on Endocrine Disruption that has restricted its use, the FDA has ruled parabens to be safe, citing there is no evidence that these chemicals are harmful towards human health.

Parabens also occur naturally in certain foods such as strawberries, carrots, and onions. These parabens are metabolised when eaten, and therefore less estrogenic compared to when used in cosmetics and applied on the skin.

### Hidden in plain sight

Another example is transglutaminase that is used for organoleptic purposes, as well as an additive to glue or bind pieces of meat and seafood to enhance appearance and increase economic value. Transglutaminase is also used in gluten-free bread and cookies as a replacement of the rising agent yeast, and it serves to mainly improve the shape and appearance of gluten-free dough products.



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Unfortunately, transglutaminase is also associated with a neurotransmitter, which disrupts a condition known as ataxia. The latter is a neurological sign consisting of lack of voluntary coordination of muscle movements that is systematic of some central nervous system disorders like body movement or limb coordination. There is evidence that consuming transglutaminase sensitises to gluten, even though the consumer has no previous ill reaction to gluten. Not only transglutaminase but also the frequently used emulsifiers like polysorbate, lecithin, and xanthan are associated with potentially altering the microbiome makeup of the gut.

## The Most Known Intestinal Gut Disruptors

### Broad-spectrum antibiotics

Although effective in treating bacterial infections, these antibiotics eliminate most of the microbes in the gut, which will take months or even years to rebalance. Antibiotics cannot tell the difference between good and bad gut bacteria. It kills both.

### Stomach acid blockers

Also known as acid-reducing medications, these are drugs that decrease the production of stomach acid or neutralise it. They are commonly used to treat conditions related to excessive stomach acid production, such as gastroesophageal reflux disease (GERD), peptic ulcers, and heartburn. Some examples of acid blockers are proton pump inhibitors (PPIs), H2 blockers and antacids. It is important to use these medications under the guidance of a healthcare provider, as long-term use without proper monitoring can have potential side effects and risks.

### Artificial sweeteners

Aspartame, sucralose, and saccharin can alter the gut holobiome, starving off the good bacteria and supporting overgrowth of bad gut bacteria. In addition, it should be mentioned that the human body cannot distinguish between the sweetness of sugar and the calorie-free sweeteners, prompting overeating which ultimately leads to weight gain.

### Endocrine disruptors

These low-dose estrogen-like hormone disruptors are omnipresent in plastic, sunscreen lotions, preservatives, food stabilisers, scented cosmetics, and in even on cash register receipts. Endocrine-disrupting problems include reproduction issues, female hormone-sensitive cancers, diabetes type 2, metabolic diseases, thyroid issues, as well as unpaired development of the brain. Butylhydroxytoluene (BHT) is frequently used in foods like (prepackaged) bread, crackers, and snacks to block the oxidation of the polyunsaturated oils in whole grains. BHT is an endocrine-disruptive preservative with estrogen-like properties associated with early puberty in girls and imbalance in the hormonal cycle of menopausal women.

The intricate relationship between the gut and overall health is becoming increasingly evident, with dietary fibre playing a crucial role in promoting well-being. As we delve into the gut-brain axis, we recognise the profound impact of gut microbes on brain health and immune function. The evolving field of microbiome research reveals how the Western diet shift has affected gut health, potentially contributing to various diseases. Probiotic strains, though under scrutiny, are essential for maintaining a balanced microbiome. The paradox of lectins highlights the need for a diverse plant-based diet and mindful food processing. Gut disruptions, whether induced by medications or additives, can have far-reaching consequences, emphasizing the importance of informed choices. From the impact of antibiotics to the pitfalls of stomach acid blockers, understanding these disruptors is crucial for maintaining gut health. As we uncover the hidden influences on the gut, it becomes clear that a holistic approach, incorporating nutrition, microbiology, and environmental awareness, is vital for achieving and sustaining overall well-being. **APFI**



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