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How Does The Gut Affect the Brain?

We all know that if we think of something delicious, our mouth waters and our tummy can rumble. And when we are anxious, nervous or fearful, we feel butterflies in our tummy. Clearly, the brain affects our digestive system. But can it operate in reverse?

Yes, it can and it does. The gut communicates with the brain via the vagus nerve. The vagus nerve is so important that it is known as the 2nd brain. Eighty per cent of the vagus nerve fibres send information from the Gut to the Brain. Only 20% controls heart function, digestion and breathing.

Scientists have found that gut bacteria produce neurotransmitters such as dopamine, serotonin and GABA all of which play a key role in mood.

Serotonin It is estimated that 90% of serotonin is made in the digestive tract. It impacts your whole body from your emotions to your motor skills. It modulates mood making you feel happier, calmer, more focused and more emotionally stable. It helps with sleeping, eating and digestion. It reduces depression, anxiety, helps to heal wounds, stimulates nausea and is involved in bone health and sexual function.

Dopamine Is a hormone and neurotransmitter. It ferries information between neurons. It is known as the 'feel good' hormone and contributes to feelings of pleasure and satisfaction as part of the brain's reward system.

GABA Is a chemical widely distributed in the brain. Its function is to reduce the activity of neurons to which it binds, producing a calming effect. It helps with feelings of anxiety, stress and fear.

Mental health problems are generally approached from all sorts of angles: genetics, childhood experiences and psychological influences. The last thing that would be considered is a person's digestive system. Yet, renowned Japanese Professor Kazudzo Nishi has estimated that at least one in ten psychiatric conditions are due to self-intoxication coming from the bowel.



Depression

Observational studies of hundreds of thousands of people around the world found a consistent link between a good diet and reduced levels of depression. However, a 2014 study investigating behavioural psychotherapy and dietary advice in preventing major depression in 247 adults with mild depression found that both methods worked equally well in reducing depressive episodes over 2 years.

Further, studies of more severely depressed individuals, randomised to receive either dietary support (Mediterranean style diet) or social support showed that diet can significantly improve mood. In the largest study of 67 depressed patients, a third were 'cured' in the diet group after 12 weeks, compared to only 8% in the control group. These impressive results exceed the average response to 3 months of antidepressant drugs by about threefold.

It is now clear that the complex community of gut microbes that produce thousands of chemicals is key to the link between what we eat and how we feel. On average, patients with depression have a less diverse set of microbe species, especially those with the commonest form of depression associated with anxiety.

A large recent Flemish-Dutch population study of over 2,000 people showed mood and depression were affected by gut diversity, and the microbes that were missing in the depressed people were those producing the key dopamine brain chemicals.

Other Psychiatric Conditions

A vast majority of psychiatric patients suffer from digestive problems which are generally ignored by their doctors probably because a number of doctors are not yet fully aware of the gut/brain connection.

Patients are given drugs for all sorts of mental health conditions, sleep problems etc and these all go into the digestive system to be broken down, absorbed into the blood stream and sent to the brain. And we all know what effect alcohol has on the brain. And where do we put alcohol? Straight into our digestive system.

But we don't have to ingest toxic substances to affect our brain. An unknown number of various neurotoxins are produced by abnormal flora in the gut and these get absorbed through the damaged gut wall (leaky gut) into the bloodstream and taken to the brain.

It is early days in the research of these neurotoxins but a considerable amount of knowledge has been accumulated about some of these neurotoxins. And they are the kind of toxins that can make anybody mentally ill.

In a healthy gut with a good balance and variety of healthy flora, microbes and viruses are not only held under tight control but also contribute to beneficial functions in the gut. But when there is a lack of good flora and the gut lining is damaged, these microbes and viruses can get out of control and cause serious problems. Their by-products get into the bloodstream and travel all around the body, including the brain.



Ethanol and Acetaldehyde

One well known yeast in the gut is *Candida Albicans* and this is present in almost everyone's gut. Normally, glucose is digested into lactic acid, water and energy and but when there is an overgrowth of *Candida* and other yeasts, it is digested in a different way.

In this process, *Candida* and other yeasts convert dietary glucose into alcohol (ethanol) and the by-product acetaldehyde. Being of very small molecular weight, it is easy for these molecules to cross any barrier in the body, including the brain.

This was first discovered in people who appeared to be drunk without consuming alcohol. It was discovered that these people had an overgrowth of yeast in their gut.

Aside from affecting the brain, it can cause damage all over the body such as low stomach acid, liver damage, damage to the gut lining causing malabsorption, pancreas degeneration etc.

Opiates form Gluten and Casein

Gluten is a protein present in grains such as wheat, rye, oats and barley. Casein is a milk protein present in cow, goat, sheep, human and all other milk and milk products. In people whose digestive system is in a poor state, these proteins do not get digested properly and turn into substances with similar chemical structures to opiates, like morphine and heroin.

There has been quite a substantial amount of research done in this area by Dohan, Reichelt, Shattock, Cade and others, where gluten and casein peptides, called gluteomorphins and casomorphins, were detected in the urine of patients with schizophrenia, autism, ADHD, post-partum psychosis, epilepsy, Downs syndrome, depression and some autoimmune problems, like rheumatoid arthritis.

These opiates from grains and milk are thought to get through the blood-brain barrier and block certain areas of the brain, just like morphine and heroin would do.

Clostridia

Many *Clostridia* species are normally found in the human gut eg *Clostridium tetani*. Tetanus is, of course, a deadly disease due to an extremely powerful neurotoxin that it produces.

Many other species of *Clostridia* are also routinely found in the human gut that also produce toxins similar to tetanus toxin as well as many others. So how do we remain healthy? Because they are controlled by our friendly bacteria which does not permit them to flourish and a healthy gut lining that stops them getting into the bloodstream.

However, in people who do not have the beneficial bacteria to protect the gut wall and control *Clostridia*, neurotoxins have a good chance of getting into the bloodstream and hence into the brain and the rest of the nervous system, affecting its development and function.



Members of the clostridia family are almost always found in the stool of both autistic children and adults as well as people with schizophrenia, psychosis, severe depression, muscle paralysis, muscle tone abnormalities and some other neurological and psychiatric conditions. Similar symptoms to that of tetanus such as sensitivity to light and noise are typical symptoms of the conditions mentioned above.

Research at the University of Reading in the UK led by Professor Glenn Gibson found very high levels of Clostridia in the gut of 150 autistic children and a second research programme found similarly high levels in the gut of another 60 autistic children, which were not present in their non-autistic siblings.

Due to the absence or greatly reduced numbers of beneficial bacteria, the digestive system of people with poor gut health can get taken over by pathogenic microbial flora, producing a river of toxicity that is most likely playing a role in autism, schizophrenia, hyperactivity, depression, psychoses, obsession etc.

There is a whole field that has been developed called psychobiotics that focuses on using bacteria for neurological and mental health.