



Case Study:

Gut health and the gut/brain axis

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Kirsty Cullen - [00:00:15]

Welcome to the Fatigue Super Conference. Today, we are discussing the relationship between gut health and the brain as part of our case study series. Today, I will be joined firstly by Martina Cowen, one of our registered nutritional therapists at the Optimum Health Clinic and then by Jess Thomson, our director of psychology.

And throughout the course of the conference, we have a number of featured talks about the importance of gastrointestinal health in relation to Chronic Fatigue Syndrome, including those from Dr. Tom O'Brien, Ben Brown and Donna Gates. And we've also had various discussions about the connection between the gut and the brain and the role of vagal nerve health, which, of course, links the two.

But today, we wanted to take a brief look at the fundamentals of gut health and how we might approach improving the gut/brain connection in clinic with our clients.

So firstly, welcome, Martina.

Martina Cowen

Hello, Kirstie. I'm very happy to be here today.

Kirsty Cullen

So firstly, we have some quite interesting research which considers the role of the gut microbiome and its connection to Chronic Fatigue Syndrome. CFS often presents with a plethora of digestive symptoms. And, you know, there have been various studies now that have identified links between irritable bowel syndrome and CFS. But gut health doesn't always end there, does it, Martina?

Martina Cowen

No it doesn't. And when we're considering gut, we're not always looking firstly at the gut symptoms. We need to consider other clinical signs, such as impact of nutrient deficiencies, inflammation and immune related symptoms, too. And quite simply, this is because the gut has a widespread impact on the body.

Kirsty Cullen

And I think it's really well stated and well recognized now that 70 to 80 percent of our immune system resides in the gut. So, of course, wherever we're considering immune health or inflammation, we really should be starting in the gut.

Martina Cowen - [00:02:16]

Absolutely. And there's also some research that might suggest common alterations to the balance of the gut microbes for those suffering with CFS. So some of the microbes might be higher, while other levels might be lower. And this is really interesting when we come to analyze gastro intestinal festing.

Kirsty Cullen

And so fundamentally, there is the suggestion that the gut microbiome may, at least in part, play a role in perpetuating the chronic inflammation that is so often seen within the CFS picture. So there are quite a few biochemical concepts to consider there.

Let's start by simplifying some of those concepts, one at a time and explain what they mean. Martina, can you describe to us how important it is to have a healthy gut microbiome and what we mean by the term "dysbiosis"?

Martina Cowen

OK, so microbiome is one big ecosystem and it contains between 500 and 1000 species of bacteria, but it also contains viruses, fungi and protozoa. And this whole amounts to about three pounds in weight.

Now the bacteria contain their own DNA and their DNA vastly outnumbers our own human DNA. Isn't that an interesting fact? That the microbes and us, we have a mutually beneficial relationships with one another, so we provide them with a food source and the space to grow, whereas they in turn provide us with beneficial nutrients, they produce vitamins and specific molecules to sustain our body and our own ecosystem.

Now, bacteria also impact on digestion, metabolism and even levels of inflammation. And when the balance is optimal, the relationship works very well and to a great benefit. And bacteria produce short-chain fatty acids and vitamins and other compounds. However, when there's a situation where there's an imbalance of bacteria and possibly even a presence of opportunistic or even potentially pathogenic bacteria, and this can lead to food sensitivities, eczema and even inflammation in the body, among other things.

And this is what we call dysbiosis. So it's a state of harmful interaction between the host and the microbiome.

Kirsty Cullen

Superb. So, clearly, the gut microbiome collectively has many important roles to play in our health. If you can highlight the top key functions for the microbiome, what would those be?

Martina Cowen

So they would have to be the fact that the microbiome supports the host immune system. It also supports digestion and access to nutrients which are central to energy production, help to manage inflammatory levels within the body. And as you know, this plays a key role in Chronic Fatigue.

And then there are links between the microbiome and the brain. So we are considering mood and sleep balance or sleep disturbances, which is something you'll be talking about with Jess later.

And then finally, there's the support of the integrity of the gut wall. Now, of course, we could keep going on with these, but these would be my top five.

Kirsty Cullen

And Martina, you explain there that gut bacteria help us by producing nutrients and they also produce short-chain fatty acids. Now that's a term people maybe aren't quite as familiar with. Could you just

explain what short-chain fatty acids are and why they're so important to gastrointestinal health?

Martina Cowen - [00:05:52]

OK, so whoever has already run a comprehensive stool test, they may be familiar with the term short-chain fatty acids or acetate, butyrate and propionate because they would have heard the nutrition therapist talking about them. But what are they?

So these are simply the end product of certain beneficial bacteria fermenting dietary fiber in the gut. They actually play quite important roles in the gut, which includes providing energy source for the gastrointestinal tract directly, which of course is important in ensuring good gut health.

But it's also thought that they stimulate healing, reduce inflammation, help us to recycle bile salts and help us to control pathogenic species in the gut. So what do low levels tell us?

Now low levels of short-chain fatty acids tell us that there may be an insufficient of fiber variety, but also bacteria variety. So low levels of beneficial bacteria. And this then helps us shape the diet for the client going forward.

Kirsty Cullen

And so in fact we have an example test result, don't we, which really demonstrates this. Do you want to just talk us briefly through this?

Martina Cowen

Yes. Let's have a look at them. So what we see here, we see a test results right on the top, where the overall short-chain fatty acids are really low. You can see they're right down the bottom. Now, you can then see further down the breakdown of the individual short-chain fatty acids. So the butyrate, acetate, propionate and what we see with these is that we've got the acetate literally on the floor, whereas the butyrate and the propionate are very, very high.

You can see how, kind of, spaced they are. They're not within range. So the variety of fibers, the variety of bacteria just isn't there.

Now, a year later. So after an introduction of specific protocol that supports short-chain fatty acid production, we see a real change in the image. And what we see here is the overall short-chain fatty acids are now nicely robust.

But that's not the only thing, when we then look at the breakdown of the short-chain fatty acids, you see improvements here, too.

So we've got far better acetate levels and even the butyrate and propionate have come nicely back into the range. So the variety of fibers through the diet has improved, and that in turn supported the bacteria to produce the short-chain fatty acid. And that's where we've seen these improvements.

Kirsty Cullen

And what I love about those test results is it just demonstrates the power of the diet, doesn't it. And how important dietary foundations are to shaping the health of the gut and beyond.

And of course, one of the other key roles of the gut bacteria is to protect the gastrointestinal wall. So let's just talk a little bit about the structure of the gut wall and why it's so important to general health.

Martina Cowen - [00:08:47]

Absolutely. So when we're thinking about the gut wall, we're thinking about, this wall is just one cell thick. Now these cells are very tightly packed together and the spaces in between them are controlled by tight junction.

Now in healthy people, these tight junctions only allow very specific compounds to pass through, such as the nutrients that we need to sustain our bodies. However, if these junctions are compromised, then other non desirable compounds can pass through into the bloodstream where they will be met with this army of the immune system, which will then these invaders.

Kirsty Cullen

And of course, that kind of typifies immune activation, doesn't it, if we've got a picture of increased intestinal permeability, which goes on and on and on. Then alongside that often we're going to get a picture of increased inflammation and immune activation. We've got an image, haven't we, to share, which kind of nicely demonstrates this. And I'm sure anybody who's seen a nutritional therapist before will be extremely familiar with this image. But for those that haven't, Martina do you just want to talk us through this?

Martina Cowen

Let's have a look. So what we see with this image is the progression of the compromised levels of the tight junctions. So we start the image with nice, healthy, tight junctions, the cells nicely packed together, not allowing any of the non desirable compounds passing through.

Now, the midpoint of the image, you can see the tight junctions are starting to open, so this is compromised tight junction. And then on the right hand side, we see the compounds passing through into the bloodstream and activating this inflammatory immune response.

Kirsty Cullen

Superb. So, there is more interesting research which suggests that ME and CFS subjects have higher levels of what are called bacterial lipopolysaccharides. Now we shorten that to LPS for obvious reasons.

But Martina, what are LPS and why are they so relevant to this picture of increased intestinal permeability and inflammatory status?

Martina Cowen

OK, so lipopolysaccharide is a compound found in Gram-negative bacteria, and these bacteria shed this metabolic endotoxin. So it's an endotoxin.

Now, lipopolysaccharides can pass through the gut barrier and into the bloodstream, and they can actually damage the tight junction when they're passing through and allow other compounds to pass through into the blood and excite the immune system.

Now, LPS or lipopolysaccharide can cause inflammation, disruption to the gut/brain axis and problems with gastric emptying, which in itself is then a problem of harboring toxins for longer than necessary.

Kirsty Cullen

So given that some of this research suggests that the microbiome might be subtly altered in those with ME/CFS, can you describe what that actually means to the environment in the gut?

Martina Cowen - [00:11:49]

OK, so if we have a lot of Gram-negative bacteria present, for example, there would be more lipopolysaccharide production, which may lead to more inflammation and increased intestinal permeability. And it is thought in research that the translocation of these microbes around the body, that this may provoke the immune activation and inflammation, which are the two key factors common in CFS.

Now, actually, one of the comprehensive stool tests that we use in the clinic demonstrates this nicely as some of the gut disturbances that we look for in association with Chronic Fatigue clients.

Kirsty Cullen

So let's bring that image in, and perhaps you can just talk us through that?

Martina Cowen

Lovely. So when we look at the page, we can see a whole raft of arrows. Now, about midpoint of the page, we see a column, which on top is called the Chronic Fatigue. Now you can see underneath it the different arrows, the ones that point upwards are associated with high level of that bacteria. While the ones pointing downwards are associated with low levels of the bacteria.

So you can see how the disturbances can actually be correlated with Chronic Fatigue. Now, correlated is the key word here. This is not about causation. So bacteria don't cause the CFS. That's not what we're trying to say here.

What we are saying, though, is if you already have CFS. If you already have Chronic Fatigue, then specific levels of the bacteria maybe correlate with some of your symptoms, so maybe making some of your symptoms worse.

Kirsty Cullen

Finally then, I thought it would be really interesting to look at where good dietary intentions might go a little awry and might impact on the gut microbiome in a negative way. And Dr. Tom O'Brien touches on this in his talk for the conference. Often, of course, in clinic we see clients on a gluten free diet or clients who are avoiding high fodmap foods for a period of time.

Martina, do you just want to briefly explain what high fodmap foods are?

Martina Cowen

OK, so high fodmap foods, essentially cause a lot of, create a lot of fermentation in the gut and that can cause symptoms for some of our clients.

So what we tend to do is use this moderate modification of the diet to temporarily reduce these levels of the foods, so that we actually bring a little bit more harmony, kind of make it easier for the client, alleviate some of their symptoms.

However, we need to be very careful about specific levels of bacteria because whilst we are not feeding the problematic side, we're equally not feeding the beneficial bacteria. And that's why the Fodmap diet always has to be considered as a tool, it's not a destination. So there is a finite amount of time when it is beneficial but past that time, it can actually be to the detriment of the beneficial bacteria for the client. We need to kind of monitor that closely. And at some point, there does need to be an intervention where we are supporting the beneficial bacteria and therefore short-chain fatty acids production, etc.

Kirsty Cullen

And I think that's also very true of a gluten free diet. Many people will feel much better and need to

be sort of on a gluten free dietary approach. But of course, that can assimilate itself with a low fiber diet. So we need to be very conscientious about finding alternative foods and/or supplement support, which will ensure we've still got the fiber, the prebiotic support within the diet and the supplement protocol to support that nice, diverse microbiome.

And actually, we've got another test example here to share with you. And if we take a look at this, this demonstrates rather nicely the potential impact of remaining on a low fodmap diet for an extended period of time. Now, whilst the low fodmap dietary approach may be really successful in reducing symptoms like bloating and changes through bowel transit, it may also have quite a detrimental impact, as we said, on the good bacterial flora.

And here we can see, for example, that the levels of good bacteria are extremely low, through a range of sort of the classic families here. Isn't that right?

Martina Cowen - [00:16:15]

That's right. And let's not forget, these bacteria actually represent a big amount of our gut microbiome. So while we see this as just a few lines here, they make up a big percentage of the microbiome that we have.

So when we see the levels being low, low, low, we do need to reconsider the kind of dietary interventions that we're utilizing with this client and really shift into supporting the beneficial microbiome, so we get that overall benefit, overall health benefit for the client.

Kirsty Cullen

Martina, that's been fascinating, a wealth of information, so thank you very much for joining us today.

Martina Cowen

You're very welcome. I've really enjoyed it. Thank you very much.

Kirsty Cullen

Jess, I would really like to bring in your expertise here, can you tell us a little bit about the gut/brain axis and describe why it's so important?

Jess Thompson

Yeah, sure. So the gut/brain axis enables bidirectional, which means in both directions, communication between the gut microbiota and the brain. So the gut can impact on the brain, cognitive function, behavior and mood, but also stress and anxiety can in turn impact on the gut.

So understanding the connectivity between the two is really important in helping us improve symptoms in both systems. For example, dysbiosis in your gut bacteria can actually change brain activity.

Kirsty Cullen

And of course, we can't have this discussion without talking in more detail about the role of the vagus nerve, can you describe what the vagus nerve is and why it's so important to not only repair recovery, but also to gut health?

Jess Thompson

Yeah, sure. So the vagus nerve is like the body's motorway from the brain to the gut, and back again. It goes in both directions. It starts at the base of the brain. And it's actually a pair of nerves that innervates a lot of our internal organs. It's a really important part of the nervous system and your ability

to either fight and run, or rest and digest. And we know that if a person gets stuck in fight and flight, it really impacts on their ability to rest and digest.

So they don't have the best access to the nutrients needed for mitochondrial function and energy production. And also can't get the rest they need as they're not in a healing state.

Kirsty Cullen - [00:18:32]

So can you tell us a little bit more about the vagal nerve in your clinical practice and within the fatigue community specifically, Jess?

Jess Thompson

Yeah, sure. So when working with people with Chronic Fatigue, one of the things we're doing is helping them to understand what state they're in and teaching them different ways of shifting from the stress state of fight, flight or freeze, and into the safe and social or healing state.

Kirsty Cullen

And what about the role of probiotics when it comes to mood balance, because there's some quite interesting research about that.

Jess Thompson

Yeah, sure. So in the research, there's some evidence that probiotics may actually alleviate depressive symptoms. And the evidence suggests that by generally supporting the gut and the balance of the microbiome, it's possible to have a positive impact on symptoms linked to depression, which is really useful to know.

Kirsty Cullen

I think that's superbly useful, because obviously it means that alongside psychology support for low mood and depression, we can also be working in tandem with psychology practitioners as nutritional therapists, supplementing with probiotics and prebiotics, and making sure that there's improved access to things like fermented foods and plant foods, and really sort of have a dual impact potentially on mood directly.

What are some of the other benefits of a healthy microbiome when it comes to cognitive function and behavior?

Jess Thompson

Sure, so there's quite a lot of emerging research in this area. In one study, consumption of probiotics reduced self blame scores. So that kind of tendency to criticize, which can be prevalent in things like anxiety and depression. And also increased focus on problem solving. And then another longer study, over a period of six months, the researchers studied the effects of a probiotic in 42 adults suffering from stress and exhaustion and it was found that their general condition actually improved by 41 percent. And seventy three percent of the participants rated the treatment effect as good or very good.

So taken together, the findings from these studies and many more demonstrate that it's likely that daily consumption of a probiotic supplement could have a positive effect in improving mood, anxiety and cognitive symptoms.

Kirsty Cullen

So Martina discussed the role of LPS and associated inflammation. And this is interesting because these factors, the inflammation, the LPS, may actually impact on brain and behavior in quite specific

ways. Can you explain a little bit more about that?

Jess Thompson - [00:20:59]

Yeah, sure. So there's some research to suggest that levels of antibodies against LPS from Gram-negative enterobacteria are higher in patients with depressive disorders than in controls. So it does appear there's a link. And we also see an increase in inflammation and inflammatory mediators with LPS.

Interestingly, researchers identified increased levels of markers in patients suffering from depression. So this research highlights that further to increase activation of the immune system, we might expect to see behavioral and psychological impacts.

Kirsty Cullen

So given this two way connection, can you tell us a little bit more about the tools that you might use in clinic, Jess, to support a decrease in stress and anxiety?

Jess Thompson

Yeah, sure. So I wanted to talk through a few stress reduction tips that people can easily incorporate into their day. For lots of people, relaxation just means kind of zoning out in front of the television at the end of the day. But actually, that isn't enough, necessarily, to get the body into a healing state. It actually does little to reduce the damaging effects of stress because you need to activate your body's natural relaxation response.

You can do this by practicing relaxation techniques such as breathing exercises, mindfulness and thought diffusion exercises.

So I wanted to go through these briefly, starting with mindfulness. Now, sometimes people think of mindfulness as a really big thing that they have to practice for a long time to get the hang of. But it's actually a really simple and very powerful practice of training our attention to what's going on in the here and the now. So the sensations, thoughts and emotions we're experiencing in the now, in a non-judgmental way. And it's really powerful and helpful because it can interrupt that habit of getting lost in thoughts, about the future or the past, which can generate more stress on top of the stresses of everyday life.

So while it's easy to think of mindfulness as a certain state of mind, there are actually several ways to practice or engage in mindfulness, with varying areas of emphasis. And the two I wanted to mention today are mindfulness using your senses. So simply bringing your mind to the present moment by noticing four things you can see and four things you can hear, and this can be done anywhere, any time.

And the second is mindfulness of breath. So just taking a few moments to really bring your attention fully to your breathing, that sensation as you breathe in, taking in all of the detail, the temperature of the air, how it feels, just repeating that for a few breaths.

And the second stress reduction technique I wanted to mention is actually breathing exercises. So studies have shown that breathing exercises can actually improve cognitive function, encourage positive thoughts and reduce anxiety.

And actually, again, it's really simple to do. So how to practice deep breathing is to sit comfortably with your back straight, put one hand on your chest, the other hand on your stomach. Breathe in through your nose. And the hand on your stomach should rise while the hand on your chest should move very little.

And then exhaling through your mouth, pushing out as much as you can, while contracting your tummy muscles. And the hand on your stomach should move in as you exhale, but your other hand

should move very little. Just continuing to breathe in through your nose and out of your mouth, trying to inhale enough so your lower abdomen rises and falls.

And the final stress reduction tip is thought diffusion, which simply means the habit of stepping back from the thoughts and letting them come, be and go. You can do different things, you can imagine that you are the sky and the thoughts of the clouds, or that you are the driver of a bus and your thoughts are the passengers. The key really is to drop the struggle with the thoughts. And remember that you are the thinker, not the thoughts.

And these tips are all really simple, the difficulty can be in actually remembering to do them. So it can be helpful, in order to incorporate any of these into your routine, to create a habit anchor.

So there's research that shows that combining a 30 second action, like the breathing technique, the thought diffusion technique or mindfulness of senses or breathing, with a habit anchor, can actually make new routines more likely to stick.

And the habit anchor is something you already do as part of your existing daily routine, like brushing your teeth, that you attach the new 30 second action to. So, for example, trying the breathing exercises whilst making a cup of tea, mindful exercises while making food, or thought diffusion practices while brushing your teeth.

Kirsty Cullen - [00:25:39]

Thank you, Jess, that's so useful because, of course, those exercises are only as useful as they are practical. So, finding a way to incorporate them in everyday life on a consistent basis is key to success, isn't it?

Jess Thompson

Absolutely, yeah.

Kirsty Cullen

Jess, thank you for your time today. It's much appreciated.

Jess Thompson

No problem.