UNIVERSITY OF CALGARY

Is our food *turning* against us?

More than a biological necessity, food is meant to nourish, sustain and unite us. Yet poor diet has become the leading risk of death in Canada. Our researchers study how our food affects our bodies, our health, and even our minds — because while we all know that we are what we eat, we don't yet know why.

Let's explore new answers.

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Should everyone avoid gluten?

Separating the wheat from the chaff when it comes to grain proteins

Few food ingredients are as controversial as gluten, the cereal grain protein linked to celiac disease. But for people who don't suffer from celiac disease, the health benefits of cutting out gluten are less clear.

By Jane Chamberlin

In a news and social climate where "fake news" runs rampant and every tidbit of information is questionable, food is no exception. Depending on where you look, Canadian tomatoes actually come from Mexico, the microbiome is linked to Alzheimer's, eating clean equals weight loss, a beef-only diet works wonders, and eating gluten gives you gut problems.

Food, now more than ever, is washed down with both suspicion and hope. Consumer issues around food are almost unlimited, ranging from animal rights to corporate transparency, from cardiovascular disease to diabetes. It can be hard to sort pseudoscience from hard evidence where food is concerned, and even in the scientific realm, nutrition advice often changes as fast as a berry in a blender.

Dr. Charlene Elliott, PhD, a professor in UCalgary's Department of Communications, Media and Film, and Canada Research Chair in Food Marketing, Policy and Children's Health, admits it's tough to keep up with the latest information on nutrition and science. "It's fun to follow the research on something like, say, coffee," she says. "One month, coffee has health benefits and the next, it causes cancer."

Elliott also says food doesn't exist in a vacuum. "Food isn't just about nutrition," she says. "It has broader social and symbolic meaning." A third-grader who eats brand-name, pre-made, packaged lunches is cool. A millennial who eats beautiful rice bowls is the picture of health. And rejecting wheat is like rejecting the authority of Canada's Food Guide.

And increasingly, the social environment of food includes a deluge of self-proclaimed healthy eating experts, many of whom recommend avoiding gluten. From Deliciously Ella, with her 1.3 million Instagram devotees, to the mysteriously mononymous food blogger, "Jess," author of Choosing Chia (follow her plant-based diet and "you'll easily nourish your body with the nutrients you need to feel at your best!"), social media personalities tell us what to eat and what to avoid — often with little or no basis in science.

> Food isn't just about nutrition. It has broader social and symbolic meaning.
>
> — *Dr. Charlene Elliott, PhD*

Gluten: with us or against us?

Gluten is a prime example of the complexity of the nutrition discourse. It has firm links to celiac disease — but those links are complicated. Not everyone with celiac disease finds relief when they stop eating gluten, and gluten can cause health issues for some without celiac disease or gluten intolerance.

Gluten has created a contentious debate in nutrition and health-care circles. In the *New York Times* bestsellers, *Wheat Belly* and *Wheat Belly 10 Day Grain Detox*, cardiologist William Davis advocates eliminating all wheat from everyone's diet (not just those with celiac disease), and links wheat with heart disease, cancer and more.

On the other hand, responses in the broader medical community, such as a 2017 BMJ article, question the link between gluten and coronary heart disease, and suggest that avoiding gluten may actually lead to increased cardiovascular risk. "The promotion of gluten-free diets among people without celiac disease," the article concludes, "should not be encouraged."

So what is the truth about gluten, then? Is eliminating gluten the only way to treat the discomfort of celiac disease, or are there other ways to mitigate that disorder's effects? And why, if gluten is not inherently unhealthy, does it play the role of villain in narratives like *Wheat Belly*?

What is gluten?

Gluten is actually pretty close to what it sounds like: "gluten" stems from a Latin word meaning "glue." It's a family of proteins that gives foods like bread a stretchy, chewy quality (ever stretched pizza dough into a pan?).

But people have been eating bread and grains for centuries, so why the sudden angst about gluten? One reason is that gluten is now everywhere, according to Dr. Justine Dowd, PhD, a specialist in celiac disease and a postdoctoral fellow in the University of Calgary's Faculty of Kinesiology. "One hundred years ago or so, people were eating gluten but it wasn't added to everything like it is now," says Dowd. "So now it has more of an impact on people's systems."

In fact, gluten often hides in products as a stabilizing or binding agent, popping up in anything from salad dressing to lip balm to MSG to vitamin supplements.

So how do our guts handle this substance? When you eat, say, a slice of rye toast, an enzyme produced in your intestinal wall breaks down the gluten into its two key proteins: gliadin and glutenin. As these proteins pass through your intestines, your immune system checks them out to see if they contain anything harmful. If you have no trouble digesting gluten, these proteins are given a thumbs-up and absorbed.

If you're able to absorb these proteins, your body will thank you, according to Harvard's School of Public Health. Diets high in whole grains, including wheat, are linked to reduced chances of heart attack, stroke, type-2 diabetes and even death. Gluten may also feed the "good" bacteria in our bodies, which keep our guts healthy.

But for those with celiac disease or gluten sensitivities, gluten is not a welcome visitor.

Gluten and celiac disease

In people who are sensitive to gluten, the gut's immune system identifies one of the gluten proteins (gliadin) as dangerous, and attacks it with antibodies. In people with celiac disease, the immune system attacks the gliadin but also attacks the enzyme that broke down the gluten into its two proteins in the first place.

Dowd explains this process: "Your intestine has villi — finger-like projections that absorb nutrients when we eat. Unfortunately, if you have celiac disease, your system's immune response to gluten causes these villi to get flattened. You often can no longer absorb nutrients like iron and B12 as you should, and those valuable nutrients go right through you."

> You often can no longer absorb nutrients like iron and B12 as you should.
>
> — *Dr. Justine Dowd, PhD*

The intestinal barrier that usually keeps food inside the intestines (out of the bloodstream and away from organs), can also start to weaken and the gut can become leaky. "There can start to be gaps in the tight junctions in the intestine," says Dowd, "so bacteria and

toxins can leak out of the intestines and that can lead to the immune system mounting a response to something that would normally be okay."

This response leads to the classic symptoms of celiac disease: bloating, constipation, diarrhea, weight loss, and malabsorption — and also extraintestinal symptoms such as headaches, skin issues, arthritis, neuropathy, infertility, delayed puberty and short stature.

The effects of celiac disease go well beyond not feeling well after eating gluten. "There can also be a variety of long-term problems for people with undiagnosed celiac disease," says Dowd, "such as infertility, osteoporosis, gastrointestinal cancers, joint pain, skin conditions and migraines. We are just starting to realize how the disease manifests itself outside of the intestinal area." And the disease affects hundreds of thousands of Canadians. According to the Canadian Celiac Association, it's likely that one per cent of Canadians have celiac disease.

Dowd says research on celiac disease is still in early days: "Research is just starting to figure out why people with celiac disease have so many different symptoms." She's hoping to find new ways to help people cope with celiac disease and a gluten-free diet. "It's getting easier to manage that diet now," she says, "but it's still tricky. Many people really struggle when they go gluten-free, and some people continue to feel a variety of negative symptoms after they eliminate gluten. We are trying to alleviate those struggles and help elevate the quality of life for those with celiac disease."

Getting the word out on celiac disease, gluten and gut health

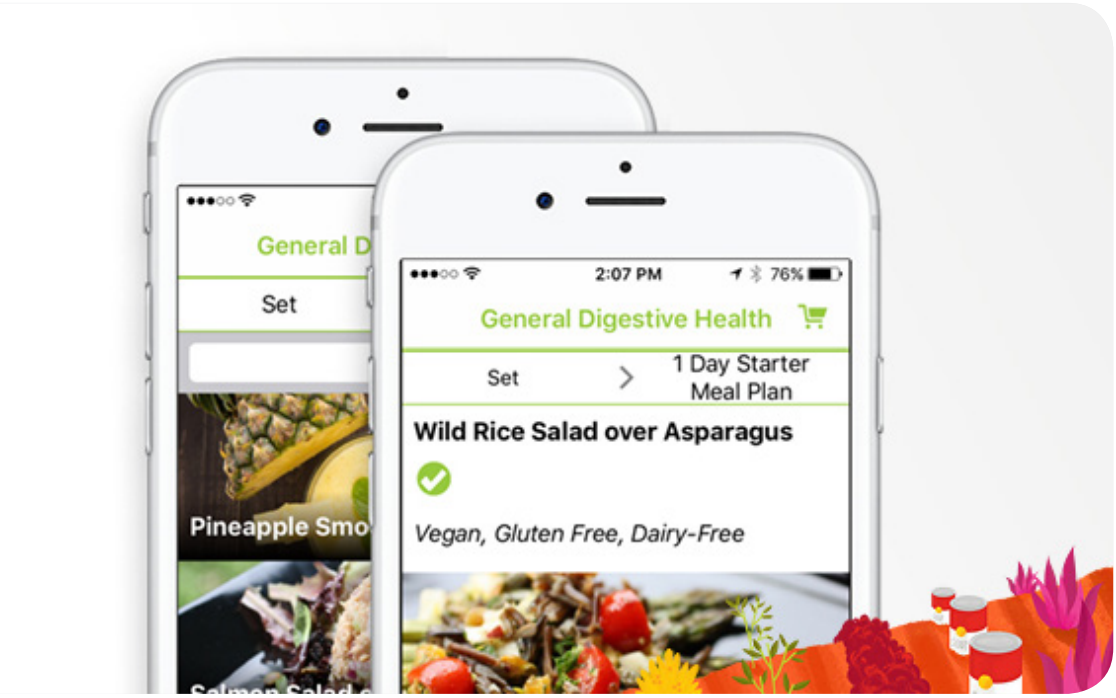
In a world where blogs and Instagram stars often replace evidence-based information sources, it can be challenging to find reliable news on celiac disease and nutrition. To address this problem, Dowd joined forces with Desiree Nielsen, a registered dietitian from Vancouver, and Darlene Higbee Clarkin, CEO and founder of KORE Digital Health Therapeutics. Together they created an app called MyHealthyGut, which has already seen about ten thousand downloads in two years.

"Our goal was to create an app that would improve overall gut health and empower people with celiac disease to self-manage the condition effectively," says Dowd. She recognizes that it's not an easy diagnosis to receive. "You might think, 'Oh my gosh, I have to cut out gluten — how am I ever going to do that?'"

Nielsen says MyHealthyGut gives people with celiac disease extra support that's crucial for their well-being. "At your doctor's office," she says, "there often isn't the opportunity or time to provide the in-depth education that's critical to thriving with this chronic condition. The app helps those without the financial means to seek private practice care. The app is like a 'dietitian in your pocket' to help you craft an evidence-informed nutrition program."

The app helps you figure out which foods bother you, and its expanded, fee-based version helps you monitor what you eat. "This food log helps you to keep track of what you're eating and how it's making you feel," explains Dowd. "You can also send that information directly to your health-care provider and it creates a chart about how you feel and what you're eating."

Dowd was diagnosed with celiac disease just before she started her PhD program. "I've lived it and can really understand when I talk to participants," she says. "My goal is to empower people living with celiac disease to take a holistic approach to their health so their bodies can heal, and, ultimately, to optimize their well-being in all aspects of life."



Screen captures from the MyHealthyGut app.

Going gluten-free? Be kind to yourself

Because going gluten-free is crucial to the well-being of most people with celiac disease, and because maintaining this diet is often extremely difficult, Dowd is researching other ways to help people manage their diet. She's running a study called POWER-C, which analyzes the effects of strategies like self-compassion and self-regulation for people with celiac disease.

The first study of its kind, POWER-C is ongoing, but preliminary results suggest that self-compassion plays an important role in managing celiac disease and following a gluten-free diet. Self-compassion is a deceptively simple concept — it's giving yourself the same kindness, forgiveness and consideration you would give to someone else. It involves mindfulness and a sense of connection with other people.

Dowd speculates that self-compassion is vital to effectively managing a chronic condition like celiac disease because it creates an environment that is non-judgmental. People exercising self-compassion tend to set more realistic, achievable goals and are kinder to themselves when they reflect on their own progress. It's an environment that nurtures adaptation and improvement, even as it forgives backward steps.

Dowd and her team have heard positive feedback from study participants. Some report that the program helped them get back to traveling; others are now able to explain to friends why they can't have certain foods. So far, the kinder, gentler approach seems to be working.

Exercising your celiac

It's not just diet and self-compassion that can help people manage their celiac symptoms. Dowd is also running a research study investigating how other lifestyle changes, such as exercise, can support a gluten-free, whole-foods diet to improve the lives of people with celiac disease. Her research colleagues include Drs. Raylene Reimer, PhD, Guillaume Millet, PhD, and Nicole Culos-Reed, PhD, all from UCalgary's Faculty of Kinesiology. The study, titled "MOVE-C: Understanding the Relationship Between the Microbiome, Vitality and Exercise in Celiac Disease," enrolled inactive adults with celiac disease and randomized them into either a 12-week program of supervised, progressive, high-intensity interval training and group-based holistic lifestyle education sessions, or a waitlist control group. The lifestyle sessions include information on a whole-foods, gluten-free diet, sleep improvement techniques, and training in self-compassion.

The study is still underway but preliminary results are positive. Initially, Dowd is finding that the people in the exercise group report improvements in following a strict gluten-free diet, feel more compassionate toward themselves, and maintain quality of life better than those in the waitlist control group.

There are several reasons to feel optimistic about exercise as a force for improvement in those with celiac disease. "Exercise may help with increasing blood flow to the intestines, or reducing inflammation," says Dowd. "And some studies are starting to show that exercise might promote a healthy microbiome."

The bacterial environment in the intestine is particularly relevant when people switch to a gluten-free diet. "Often when people first go on a gluten-free diet they resort to the gluten-free aisles at the grocery store," says Dowd. "These primarily contain highly processed foods that are often higher in sugar and calories, but lower in nutrients when compared to their gluten-containing counterparts."

According to Dowd, as people with celiac disease follow a gluten-free diet and their intestines heal, they begin to absorb nutrients and calories again — which

unfortunately often leads to substantial weight gain if they are eating unhealthy foods. "This puts them at higher risk for metabolic syndrome," she says, "which is associated with the microbiome being off-kilter." So if exercise can have a positive influence on the gut and its microbiome, an active lifestyle may become a priority for those with digestive health issues.

> Celiac children or those with gluten intolerance now can eat the same kind of highly processed, low-nutrient foods as the rest of the kids.
>
> *— Dr. Charlene Elliott, PhD*

The downside of gluten-free

A gluten-free diet helps the majority of people with celiac disease, but finding healthy, packaged, gluten-free food is not without its challenges. Charlene Elliott studies food marketing, policy and children's health. Like Dowd, she's concerned about a common assumption made by consumers: that eating products labeled "gluten-free" means you're making *healthy* choices for you or your children.

Healthy or not, gluten-free foods are a burgeoning market. "Gluten-free foods have a sort of 'health halo' for many consumers," says Elliott. Noting the number of parents who purchase gluten-free products for their children (even those without gluten intolerance), Elliott headed up a study to find out whether this health halo is deserved.

Using criteria set out by the Pan American Health Organization (PAHO), Elliott analyzed the nutritional quality of packaged, gluten-free products targeting children, and found that 88 per cent of those foods have poor nutritional quality, compared to 97 per cent of "regular" products. "According to the PAHO criteria, these products labelled gluten-free foods are certainly not 'healthier' choices," says Elliott.

Elliott's study took an even closer look at the gluten backlash, comparing children's gluten-free products to their "regular" equivalents. She found that both categories were similar in caloric content, fat and protein levels. But the gluten-free products had higher levels of free sugars. To their credit, the gluten-free products had lower levels of sodium than their "regular" counterparts. "Overall," says Elliott, "the nutritional content of both categories was poor."

This is a sad commentary on the state of child-specific packaged foods. What Elliott finds troubling is that the products labelled "gluten-free for children" end up being a type of false prize for children with celiac disease. "The food industry has filled a consumer demand," says Elliott, "but it means that celiac children or those with gluten intolerance now can eat the same kind of highly processed, low-nutrient foods as the rest of the kids."

Elliott longs for a more generalized push-back against these kinds of foods. "Shouldn't we be aiming for better diets for all? If we all moved toward eating whole and unprocessed foods, it would be better for kids and adults across the board."

Gluten-free for the non-gluten-sensitive

So the gluten-free diet, which can be crucial to the health of those with celiac disease, has to be taken with a grain of salt. Foregoing gluten is also popular with those who sense that they may not feel well when they eat gluten, or who are simply looking for a way to clean up their diet — witness movements like #eatingclean, blogs like "Deliciously Ella" and books like *Wheat Belly*.

On one hand, according to Nielsen, there are many valid reasons to go gluten-free. "People with irritable bowel syndrome (IBS) or autoimmunity issues may feel much better going gluten-free," she says. "However, gluten does not make 100 per cent of people feel sick. It's not necessary to demonize wheat and gluten. This has gotten out of hand, due in large part to the interaction of celebrity and unlicensed wellness practitioners and influencers. There isn't anything inherently dangerous about eating gluten."

And yet the public chomps at the gluten-free bit. According to Elliott, the food industry sees gluten-free as the fastest-growing category of food intolerance — and a vehicle for corporate growth. According to a study by Transparency Market Research, sales of gluten-free foods globally are projected to reach US$4.89 billion by 2021, up from $2.84 billion in 2014. This trend isn't just due to an increase in consumers with celiac disease. "Mainstream consumers are experimenting with their diets for health-related reasons," says Elliott, "and 'free-from' foods (such as gluten-free) are part of that trend."

Elliott cites a study by Hartman group called "Health and Wellness 2017," which gave the top reasons for purchasing gluten-free products:

- Wanted to try something new
- Believe they are healthier
- Trying to lose weight

Only 17 per cent of respondents said they had a gluten sensitivity or allergy.

Which brings us back to Elliott's observation that food isn't just about nutrition. It's about style, education, social hierarchies, status, rejecting authority and exercising personal choice. The world of food has changed dramatically in the last century, and even in the last decade.

It's a tumultuous time for food and foodies, and particularly for those with disorders like celiac disease. Is gluten an angel or a demon? Perhaps only time will tell. But in the meantime, consumers should cast a critical eye on food blogs and labels.

"We're still in the infancy of understanding the relationship between nutrition and disorders like celiac disease," says Dowd. "When I attend conferences I see how far the research has come every year. Ultimately, I feel optimistic that there will be great advances in the years to come."

ABOUT OUR EXPERTS

Dr. Charlene Elliott, PhD, is a professor in UCalgary's Department of Communications, Media and Film in the Faculty of Arts, and Canada Research Chair in Food Marketing, Policy and Children's Health. Her main program of research focuses on obesity and public health, taste and communication, and intellectual property and sensorial communication.

Dr. Justine Dowd, PhD, is a specialist in celiac disease and a postdoctoral fellow in UCalgary's Faculty of Kinesiology. Her research is in the area of health behaviour change and she is specifically using evidence-based strategies, such as self-compassion and self-regulation, to improve quality of life and adherence to a gluten-free diet among people living with celiac disease.

What's the real cost of cheap food?

Nutrition, children, and the factors that shape our eating habits

A growing body of research suggests the amount of processed foods we eat is doing a great deal of harm, and that the more ingrained our eating habits get, the harder they are to change.

By Mike MacKinnon

According to Statistics Canada, the average Canadian household spends $732 per month on food. Obviously, that's a variable figure — for some families, it's trivial, for others, it's simply unrealistic. Either way, for different reasons, a growing amount of that food budget is spent on processed foods. (StatsCan calls these fruit or vegetable "preparations," and "non-alcoholic beverages and other food products.")

The allure of processed foods is strong. For busy families who don't have time to cook, it's much easier to grab a pre-packaged meal on the go and get to the next hockey practice or band concert. For working-class families on a tighter budget, processed foods are often cheaper and more filling than fresh, whole foods. There's a wide array of other forces that shape our food choices as well, including public policy, socioeconomic status, marketing and upbringing.

However, a growing body of research suggests that the sheer amount of processed food we eat has lasting health impacts. From a public health perspective, the costs of poor diets are far higher than we realized before. And the eating habits children learn early on set the stage for lifelong relationships with food.

Plenty unhealthy

We tend to think of food issues in terms of scarcity or not having enough. But it's not that simple. The things we eat too much of also cause a good deal of harm, not

just because they're full of ingredients that aren't good for us, but because they're deficient in the things that are.

"A healthy diet consists of a variety of nuts, seeds, whole grains, fruits and vegetables, limited amounts of low-fat dairy and lean, unprocessed meat, fish, and poultry," says Dr. Norman Campbell, MD, a professor in the Cumming School of Medicine's Departments of Medicine, Physiology and Pharmacology and Community Health Sciences. "The issue is that most of us are eating largely processed food diets, which are deficient in those things."

> The leading risk for death in Canada is now our unhealthy diets.
>
> — *Dr. Norman Campbell, MD*

Processed foods are also full of salt, simple carbs (including sugar), and saturated fats. These fill us up, they last a long time, they're cheap, and we're conditioned to think they taste better. But they wreak havoc on our bodies, causing issues like obesity, diabetes and hypertension, or increased blood pressure.

According to Campbell, the burden on public health systems is reaching crisis proportions. "The leading risk for death in Canada is now our unhealthy diets," he says. "Globally, it's the second-leading risk."

Campbell, whose main area of research is in hypertension prevention, says the condition is responsible for more than 10 million deaths per year globally. Because hypertension attacks blood vessels, and blood vessels are found throughout the body, it can lead to a host of complications, including heart disease, kidney failure, even dementia. About 40 per cent of people over 25 in the world are affected by hypertension, says Campbell, and 80 per cent of those cases are due to unhealthy eating.

In Canada, the hypertension costs are staggering. "It's estimated to go up to $20 billion per year by 2020," says Campbell, who is also a member of the CSM's Libin and O'Brien Institutes. The social costs are just as alarming. "Premature deaths from dietary risk in Canada now exceed tobacco, alcohol and drugs."

More processed food than ever

It isn't news that eating poorly is bad for us. Anyone who's ever overdone it in the Halloween candy bag or at the buffet table knows that. But it's only recently that we're realizing the severity of the problem, and that the science is starting to back up what we know intuitively.

"People have always thought of food as a source of health and enjoyment," says Campbell. "There was a sense that maybe too much saturated fat is bad for you, or sugar is bad for you. But the recognition that these are actually driving the epidemic of diet-related disease, and that our diets are the leading risk of death — that knowledge has only been evolving for 10 years or so."

Our eating habits have also been changing over the past few decades. Humans have been processing and preserving food since we first figured out that drying meat or pickling vegetables made them last much longer. But now, packaged food is the norm rather than the exception.

Think of the age-old axiom about product merchandising in grocery stores, where the "staples" are arranged around the perimeter and at the back, forcing customers to walk through aisles filled with impulse buys. Now think of that arrangement in terms of fresh, whole food versus packaged, processed food. There's a fresh produce section along one side of the store, and maybe a meat counter on the other. In between, aisle upon aisle of processed food in cans, jars, plastic bags, boxes, tubs, jugs, squeeze tubes and freezer cases.

It's the same with restaurants. In the age of corporatization and globalization, more and more of our restaurant choices are fast-food franchises, where food is standardized and prepackaged as much as possible for efficiency.

> People think moderation is not eating every meal at a fast-food restaurant.
>
> — *Dr. Norman Campbell, MD*

As the world has sped up and our lifestyles have become busier, so have our expectations of getting everything fast, cheap and easy. "If you can pick up a package and eat it, it tends to be a lot more convenient and fit into our current lifestyles than say, preparing a meal," says Campbell. "We're trying to do everything fast and efficiently and our diets have gone that way as well."

Whether the food industry is responding to market demand or creating it, one thing is clear: how we eat is dramatically different now than it was even 20 years ago. "We're eating so much unhealthy processed food that our whole concept of moderation is way off spectrum," says Campbell. "Now, people think moderation is not eating every meal at a fast-food restaurant."

Worse, we're passing our bad eating habits on to our children. "Once children start on solid food, they're often fed processed foods," says Campbell. "As they

grow up, they're heavily marketed to with unhealthy foods. They start down this pathway early on and by the time they're adolescents, they have very unhealthy food preferences."

Health is more than a choice

It's all well and good to say we should be eating more whole, unprocessed foods, but preparing those takes time and money. Whether we're part of a middle-class family with packed schedules and little time for cooking, or a low-income, single-parent household in a neighbourhood with limited grocery options, it takes effort to eat as well as we should.

"Telling people to eat more healthily doesn't do anything," says Dr. Dana Olstad, PhD, an assistant professor and registered dietitian in the Department of Community Health Sciences and member of the O'Brien Institute for Public Health. "Everybody knows what's healthy and what isn't. We eat based on our socioeconomic circumstances."

Olstad's research focuses on dietary inequities, or the study of the connections between socioeconomic status, diet and health. "People who are more disadvantaged in society, who have lower levels of education and income, or less prestigious occupations, tend to have poorer quality diets," she says. "That then feeds into their health as well."

According to Olstad, the way we eat is shaped by a complex set of circumstances that include how we grow up, where we live and work, our cultural and ethnic backgrounds, what challenges we face in our daily lives, and what marketing forces we're exposed to.

"If you're working multiple jobs, you don't have time to go home and cook," says Olstad. "To plan out a menu. You're probably getting fast food along the way, or just opening more processed foods, which cost less money, and preparing meals really quickly, not sitting down as a family and eating."

Logistics also play a role. If you don't have a car, for example, your food options are going to be restricted. "Think of carrying a four-litre jug of milk with you on the bus," says Olstad. "Along with fruits and vegetables. Those are all bulky, heavy things and processed foods are much more compact."

Difficult or busy life circumstances can also lead to choosing processed foods as a coping mechanism. "You might just want to eat these foods because it feels better," says Olstad. "You just got home after a really hard day. That stress causes us to want comfort foods. It's kind of like an evolutionary response, where you want filling foods that are going to last."

Eating what's available

Even if our daily circumstances aren't conspiring against us, says Olstad, what we learn as children programs how we eat later in life. "The habits that become ingrained in childhood are dependent on your socioeconomic circumstances as a child," she says. "Could your parents afford to feed you healthfully? And what were the habits you learned from them?"

Further complicating matters is what food options are available and which products the food industry chooses to put in front of us. "Regardless of our socioeconomic circumstances, we're all influenced by our food environments," says Olstad. "And our food environment is always pushing the unhealthy food because that's what's marketed, it's very convenient, it's cheap, and it's available everywhere we go."

> Our food environment is always pushing the unhealthy food.
>
> *— Dr. Dana Olstad, PhD*

Think of the recent trend where grocery chains partner with fast-food outlets or coffee shops, so that there's even more processed food being sold at the supermarket. "Now, you go to a grocery store and half of it's basically a restaurant," says Olstad. "It's not even a choice so much anymore because it's pushed at you in so many different ways. And given how busy we all are, we're all trying to save money, save time. So you naturally just go with what's there and it becomes part of your patterns of eating."

The foundations of eating

Picking up on our parents' food habits may begin a lot earlier than we realize — even in the womb. As a fetus develops, its hypothalamus — the part of the brain that reads our environments — can already read and react to what's going on around it.

"The hypothalamus is your body's thermostat," says Dr. Deborah Kurrasch, PhD, an associate professor in the Cumming School of Medicine's Departments of Medical Genetics and Biochemistry & Molecular Biology. "It constantly measures your body and says, 'am I hungry? Am I full? Am I hot? Am I cold?' and adjusts your metabolism to compensate."

Kurrasch, who researches hypothalamic development, says her findings show that a fetus's environment can change the hypothalamus. "We're finding that different maternal stressors affect how

the hypothalamus develops, which then affects how it functions later in life." In other words, what's going on with mom is reflected in how a baby's brain develops in utero.

As an example, Kurrasch cites a study from the 1940s, when Nazi Germany occupied the Netherlands and many Dutch were on the brink of starvation. Children whose mothers were pregnant during the famine, but who were born shortly after the war ended and food restrictions were lifted, showed curious side effects. "Children that were in their mothers' bellies during this time were shown to have a high risk of metabolic type-2 diabetes and cardiovascular disease," says the member of the CSM's Alberta Children's Hospital Research Institute (ACHRI) and the Hotchkiss Brain Institute. "The question of why food restrictions caused these increased risks led to a field of study called fetal programming."

Kurrasch says the study found that because food was in short supply during these pregnancies, the fetuses programmed themselves to expect the same shortages once they were born. But that's not what happened. "When they were born and it turns out there was plenty of food, their hormones and signaling centres were ill-prepared to deal with it," says Kurrasch. "As a result, they developed metabolic syndromes and other problems."

Erasing maternal stigma

Kurrasch says understanding hypothalamic development is especially important in a time when mothers are scrutinized and judged over everything they do or don't do. The risks of pregnancy are well-known, but we don't necessarily know how certain circumstances lead to certain outcomes, and as a result, whether these changes are really mom's fault.

> We're slipping back into a period of blaming mothers.
>
> — *Dr. Deborah Kurrasch, PhD*

"There are epidemiological studies that say, 'Mom did this and therefore the kids have a higher rate of that,'" says Kurrasch. "'Mom gained a lot of weight and therefore the developing child is at risk for metabolic disorders, diabetes, obesity, ADHD, take your pick.' I've always asked how? That's always jumped over. How does the developing brain know Mom is fat or stressed? How did those signals get passed to the developing brain and what did the developing brain do differently once they received them? We have no handle on that."

Knowing that something happens without knowing why it happens can lead to blaming and shaming, says Kurrasch. "We're slipping back into a period of blaming mothers," she says. "We're being nicer about it, but when something happens in development, we're implying that Mom did something wrong and that led to this."

According to Kurrasch, having a better understanding of cause and effect will help make pregnancy easier for mothers, and perhaps reduce risks. "I want to understand on a more molecular level what's happening, and maybe take some pressure off Mom," she says. "Because moms are already under a lot of pressure. They can't eat this, they can't bathe with that. Some women get really stressed about this. So let's understand the process a little bit better so maybe Mom can understand, too."

Keep calm and carry on feeding

When it comes to looking down on mothers for their choices, breastfeeding is an area fraught with potential judgment and recriminations. Mothers who don't breastfeed, or don't breastfeed long enough, or breastfeed for too long, are all subject to having their parenting fitness questioned.

But some mothers can't breastfeed. Either their babies won't take the breast, or there's a physical circumstance that prevents breastfeeding, such as blocked ducts or a mastectomy. Or they simply choose not to. Yet the pressure to do so is so great, some mothers resort to drastic, risky measures, such as ordering breastmilk online from strangers.

The anxiety over doing the best we can for our babies is understandable. Babies grow at phenomenal rates before and after birth — growth rates humans never experience again in their lives — and they need good nutrition to do so. But according to Dr. Tanis Fenton, PhD, pressuring ourselves to be perfect isn't the best way to give our kids a head start, nor set them up with good habits for life.

"Breastfeeding is a great way to feed a baby," says Fenton, an associate professor and dietitian in the Department of Community Health Sciences, who specializes in neonatal infant nutrition. "But it doesn't work for everybody. So we need a plan 'B,' and the only safe and affordable plan 'B' is infant formula. But right now, infant formula is considered in some media to be pretty close to poison."

The stigma surrounding infant formula is indicative of the anxiety and mixed messaging around kids' nutrition in general. "The messaging people get makes nutrition at any age seem impossible," says Fenton. "And it's actually quite simple and straightforward."

Clean your plate (if you want to)

Paradoxically, parental concern over nutrition can lead to problematic relationships with food, says Fenton. For example, insisting that children finish everything on their plates forces them to ignore their bodies' natural responses to food.

"Even a newborn baby has appetite control," says Fenton, a member of the O'Brien Institute and ACHRI. "They know when they're hungry, they know when they're full. But as parents, we think we know better about how much they need, because we care about their health."

According to Fenton, the ideal parent-child-food interaction involves a concept called "the division of responsibilities," developed by dietitian Ellyn Satter. In this model, parents decide when to offer food and what food to offer, and children decide if and how much they will eat.

However, in many homes, some combination of the reverse happens: children decide what they want to eat, and parents decide how much they'll eat. This can lead not only to picky eaters and constant battles at the dinner table, but can also affect children's ability to self-regulate.

"If we're encouraged to ignore our hunger and satiety, then we probably won't be very good at using them well," says Fenton. This could become an issue later, when children start being exposed to food-related messaging. "So much is marketed to us about food. It's constant. Plus, everywhere you go, people are usually carrying a beverage or food with them. We're getting cues to respond to food constantly."

Stick to the basics

Food marketing can also undermine parents' confidence in their own abilities, says Fenton. "Unfortunately, the solutions that are being promoted to parents is that it has to be all ketogenic and kale and avocadoes," she says. "But it's not that tricky. You don't have to eat just a narrow list of foods to be healthy. Good nutrition is a whole variety of foods. Generally, what most North Americans need to do to improve their nutrition is to eat more vegetables."

And it's more than nutrition. Taking a more relaxed approach to feeding children can have enormous benefits to the family's well-being. "The eating environment is important to the psychological health of the family," says Fenton. " We need to prepare some simple, basic food, then relax and enjoy our time at the table with the kids. We're busy and always jumping into the car for this or that, so the few minutes we get with our families is a time to improve quality of life. You can't enjoy your food if everyone's upset because it's not perfect or someone's not eating their vegetables."

Marketing food to children

As much as parents wish it weren't so, there comes a time when they realize that they aren't the only influence in their children's lives. Other relatives, friends, teachers and peers all play roles in shaping children's personalities and desires. As do the things they watch, read and listen to. And the forces of marketing are likely the biggest influence of all.

Any parent who's stood in a checkout line, with candy and chocolate on racks at children's eye level, trying desperately to withstand the onslaught of pestering and begging, knows just how powerful marketing to children can be.

Beyond sweets and junk food and the cereal aisle, however, the food industry has created an entire category of "kid's food." Virtually any type of food you can buy has a kid's version, from string cheese to yogurt squeeze tubes to animal-shaped chicken nuggets — all highly processed, the majority high in sugar, salt or fat.

"The entire category of children's food suggests that kids need special foods that are distinctly made for them," says Dr. Charlene Elliott, PhD, a professor in the Department of Communications, Media and Film in UCalgary's Faculty of Arts, and a member of the Cumming School of Medicine's O'Brien and Alberta Children's Hospital Research Institutes. "This category of food is almost entirely created by the food industry."

Not only do these artificial differences make it harder for parents to get kids to eat more nutritious food, they normalize poor eating habits. Elliott, who holds the Canada Research Chair in Food Marketing, Policy and Children's Health, says once these habits are formed, they follow children into adulthood. "Taste preferences are formed early on, and persist over time," she says. "If you teach kids from a very young age to be accustomed to a high level of sweetness, and the majority of kids' foods are high in sugar, then when are they supposed to grow out of these preferences? Is it supposed to suddenly turn off? That's unlikely."

While we would assume that tastes and palates evolve as we grow into adulthood, Elliott says the high levels of added sugars and salt in processed foods make it more difficult to change habits later.

And this just isn't about taste. It is also about the way that foods are marketed to children as vehicles for fun and entertainment. As the kids who have been raised on these foods are growing up, Elliott says, food marketers are beginning to target adults in the same way they target children. "The appeals towards adults in the last decade or so have become increasingly infantilized," she says. "A dominant appeal in current marketing strategies is about the fun and entertainment of eating food, even for adults."

The evolution of marketing

Elliott, who has studied the progress of children's food marketing, says that as concerns over the nutritional value of kids' food have risen, marketers have adapted their messaging. "In 2005, when I did my first content analysis of children's packaged supermarket food, 'kids' food was marketed with reference to fun and, perhaps surprisingly, artificiality," she says. "FunCheez, Funshine biscuits, and packages that made verbatim claims to fun and play and the entertaining elements of the food. There were glow in the dark yogurt tubes, and drink crystals that 'magically' changed colour. Kids' food was designed as more playful than 'regular' food."

Over time, Elliott noted that there was "a pushback against the artificiality of foods," she says. "There was a jump in the number of products labelled 'made with real.' Made with real fruit. Made with real chocolate. Which is interesting, because one should assume that food is made with real food."

The latest step Elliott has noticed is a move from "made-with-real" to "free from." Free from artificial colours. Free from artificial flavours. Free from gluten. As parents become more concerned about feeding their children healthy food, the number of gluten-free products targeted toward children has skyrocketed.

In one recent study, Elliott compared the nutritional content of gluten-free processed kids' foods to "regular" processed kids' foods. The study was inspired by the research that shows that many consumers without gluten sensitivity are purchasing these foods because they believe that gluten-free products are healthier than their gluten-containing counterparts. Elliott's study revealed that the products labelled gluten-free were not nutritionally superior than 'regular' foods. "Parents are paying three times the price for these products because they believe there is a nutritional advantage, but there is none."

Teaching kids to see food for what it is

Part of the difficulty in telling good food from junk, particularly for children, is that they aren't equipped to read the cues and signs on food packaging. "I've done a whole series of focus groups with children, grades one to nine, getting them to look at food packaging," says Elliott. "How do they determine what's a healthy food?"

Elliott says the results were surprising. "Many grade nine students could not determine a healthy packaged food item — even when they were specifically looking for it," she says. "They were persuaded by the pictures on the front of the package, marketing claims like 'supergrains,' or even the colour of the box."

In response, Elliott and her team developed a series of fact sheets and lesson plans for teachers and public health practitioners to help kids navigate food packaging. They include information and tips about common marketing techniques including cartoon characters, the use of colours to persuade, front-of-package claims, marketing techniques and slogans, nutrition fact labels, and misspellings.

"It's getting them to think," says Elliott. "'No, I don't want to be manipulated, and this isn't healthy even though it pretends to be.'"

It's the drinks, too

It isn't just unhealthy food that is causing concerns for kids. One particularly alarming example of marketing an unhealthy product toward children is in energy drinks. Often packaged similarly to sports drinks, energy drinks are found next to sugary sodas and iced teas and vitamin waters in stores. With bright colours and claims of "extreme" athleticism and performance, these drinks have been growing in popularity with kids.

But the high levels of caffeine and sugar in energy drinks make them dangerous to children. Concern grew to the point that in 2010, Health Canada convened a panel of experts to make recommendations regarding legislation to govern energy drinks.

> The marketing is very much aligned with sex appeal and high-risk sports.
>
> *— Dr. Jane Shearer, PhD*

"At that time, there was little regulation," says Dr. Jane Shearer, PhD, an associate professor in UCalgary's Faculty of Kinesiology and in the Department of Biochemistry & Molecular Biology at the Cumming School of Medicine. "Any company could come to market with an energy drink containing as much caffeine as they wanted, with no regulation or warning labels."

Shearer and her colleagues made a series of recommendations which the government adopted. "We included a warning label, for example, that says they're not recommended for kids," she says. "Not recommended for breastfeeding women or pregnant women. Should be consumed in moderation. We limited the amount of caffeine you can have in each container. We limited the serving format, whether the container is resealable or not."

While the regulations were a good start, Shearer says they don't go far enough. The marketing of energy drinks is still very much targeted to children and adolescents, she says, in particular young males. "The marketing is very much aligned with sex appeal and high-risk sports," says Shearer, a member of ACHRI. "The logos are very masculine and evoke feelings of superiority, of partying, of extreme sport."

Shearer says that strong industry resistance is also a barrier. "People would say Canada already has some of the strictest regulations in the world," she says. "And lobbyists come out of the woodwork when new legislation is proposed. But we have to balance industry interests with the health of Canadians."

What's the answer?

For Dr. Campbell, regulation is a key component in making it easier for Canadians to choose healthy eating. "When we look at the major threats to our lives and well-being, we have regulations," he says. "We have speed limits and we have speeding tickets. We have regulations about how tobacco can be sold, and to whom, and how it can be marketed. Same with alcohol. So if unhealthy food is the leading risk for death in Canada, why would we not regulate that?"

In order to urge the federal government to ensure access to nutritious food for all Canadians, Campbell, Olstad and colleagues recently developed the Calgary Statement. Part online petition, part call to action, the Calgary Statement calls for "food environments through public policies that support Canadians in maintaining healthy diets where they live, learn, work, and play."

But laws and regulations about food can't be the only approach when we look at all the factors that lead to people's eating habits and choices. "A superficial approach would be to readjust the cost of these things to make the desirable things less expensive and the undesirable things more expensive," says Campbell. "But we're living in one of the richest countries in the world. Then we have vulnerable groups of Canadians who are below the poverty line and many of them include children. A much deeper approach would be to reduce that disparity."

ABOUT OUR EXPERTS

Dr. Norman R.C. Campbell, MD, is a professor of medicine, community health sciences, and physiology and pharmacology in UCalgary's Cumming School of Medicine. Norman is a member of the O'Brien Institute for Public Health and the Libin Cardiovascular Institute of Alberta. He seeks to improve hypertension control, unhealthy diets and physical inactivity, and is known around the world for his work in sodium reduction.

Dr. Dana Olstad, PhD, is an associate professor in the Department of Community Health Sciences in UCalgary's Cumming School of Medicine. She holds Adjunct academic appointments in the Faculty of Kinesiology at the University of Calgary and in the School of Public Health at the University of Alberta. She is also a Registered Dietitian.

Dr. Deborah Kurrasch, PhD, is an associate professor in the Cumming School of Medicine's Departments of Medical Genetics and Biochemistry & Molecular Biology. She is a member of the Alberta Children's Hospital Research Institute and principal investigator at the Kurrasch Lab.

Dr. Tanis Fenton, PhD, is an associate professor and dietitian in the Department of Community Health Sciences at UCalgary's Cumming School of Medicine. She is nutrition research lead for Alberta Health Services, and an evidence Analyst for Dietitians of Canada. Tanis is also the Invited Chair for the Working Group for the development of evidence-based nutrition practice guidelines for preterm infants, the US National Institutes of Health and the US Academy of Nutrition and Dietetics' "Pre-B" Project.

Dr. Charlene Elliott, PhD, is a professor in the Department of Communications, Media and Film in UCalgary's Faculty of Arts, and a member of the Cumming School of Medicine's O'Brien and Alberta Children's Hospital Research Institutes. Her research focuses on food, policy and health, especially in the context of children's health.

Dr. Jane Shearer, PhD, is an associate professor in the Faculty of Kinesiology and the Department of Biochemistry and Molecular Biology at the Cumming School of Medicine. She is a member of the Alberta Children's Hospital Research Institute at the CSM. Her goal is to develop an interdisciplinary research program examining the interactions between nutrition, genes and the development of metabolic diseases including diabetes and cardiovascular disease.

Can a meal be medicine?

How what we eat affects our gut health, which affects our wellness

In the fight against chronic diseases, researchers expand the search for cures and treatments to include diet and environmental factors, and examine the connection between the gut and the brain.

By Jennifer Allford

We've all heard it a million times: 'You are what you eat.' From the Canada Food Guide to endless articles about nutrition, we're told to limit the sugar, watch the saturated fats and make sure we eat lots of fruit and vegetables.

As researchers serve up more science about diet, nutrition and how it affects the bacteria in our intestinal tract — our gut microbiota, or microbiome — we're learning that what we eat may help manage, treat and even prevent conditions from inflammatory bowel disease to obsessive compulsive disorder.

Eventually, we may see the day where diet and nutrition are incorporated into personalized medical treatments. Your doctor writes you a prescription for a specific diet consisting of foods that will interact with your specific gut bacteria to achieve better health.

"We're learning that the same diet can have different effects on different people and we don't know why that is," says Dr. Maitreyi Raman, MD, author, clinical associate professor in the Department of Medicine at the Cumming School of Medicine (CSM), and medical director of the Alberta Centre of Excellence for Nutrition and Digestive Diseases. "It could be disease, it could be genetics or the underlying microbiota interactions. These are exactly the things that warrant more research."

With new diets and nutritional fads appearing seemingly every other month, we've been trained to think of some foods as "good" and others as "bad." There is general agreement that it's better to eat fresh foods than processed foods, but even some foods considered "healthy" can be unhealthy for some people to eat.

"We can't be so blanket-like in our approach to foods and generalized comments about good foods or bad foods," says Raman. "We have to understand, especially in the context of disease, how individual foods that are considered healthy still could have a role in disease progression." Improving our health may come down to a personalized approach to what we eat.

Your gut and mental health

The intestinal bacteria in our gut have an impact well beyond our bellies. In addition to breaking down food, synthesizing vitamins and harnessing energy from carbohydrates, our gut microbiota communicate with our brains. We're learning this gut-brain axis can play a significant role in our mental health.

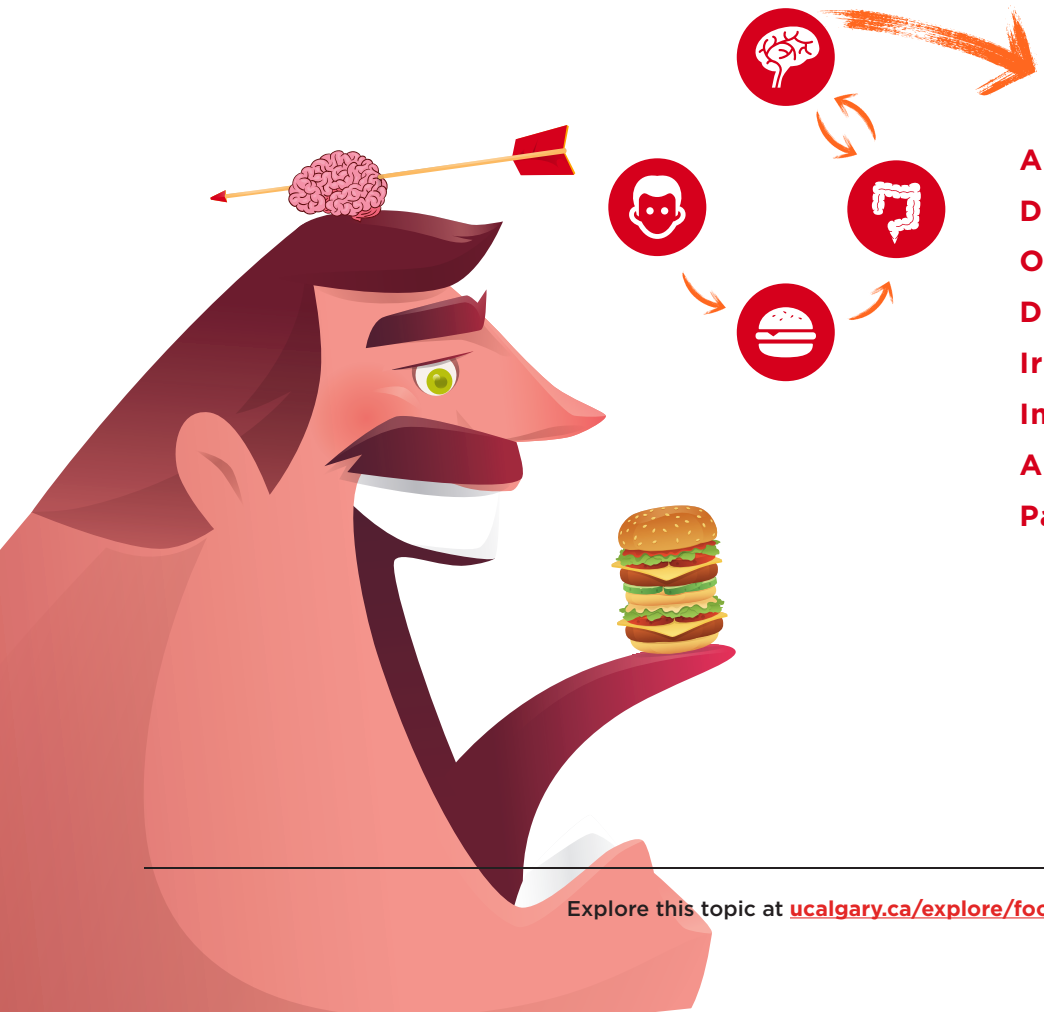
"One of the things that researchers have identified in the last number of years is that there's a link between our gut microbiota and our brain," says Dr. Raylene Reimer, PhD, a professor in UCalgary's Faculty of Kinesiology and the Department of Biochemistry and Molecular Biology in the Cumming School of Medicine. "The bacteria in our gut make chemical signals that can act on the brain. It's a two-way traffic communication system. They communicate with each other and thereby influence things like mood, depression and anxiety."

Reimer and her graduate student, Emily Macphail, have begun studying how gut bacteria may affect youth who have been diagnosed with obsessive compulsive disorder (OCD). The chronic condition causes people to experience intense worry over largely irrational concerns, such as being contaminated by household germs. People with OCD might perform repetitive actions, such as hand washing, to try to reduce the stress they feel from worrying about contamination by germs. As many as two per cent of Canadians will experience an episode of OCD over the course of their lifetimes and it's uncommon for someone to recover from the disorder without some form of treatment.

"Our hypothesis is the bacteria in the gut might affect the behaviour in youth with OCD," says Reimer,

GUT-BRAIN AXIS

Possible effects



Anxiety
Depression
Obesity
Diabetes
Irritable bowel syndrome
Inflammatory bowel disease
Autism
Parkinson's disease

who is also a member of the CSM's Alberta Children's Hospital Research Institute. "We want to look at the two-way path between the gut microbiota and the brain and specifically the metabolites that the gut bacteria are producing."

Different types of bacteria produce different metabolites, or small molecules that signal to other parts of the body. If the gut bacteria change, the signals change too. "We're really interested in seeing if we can manipulate the bacteria towards a healthier profile. Then the signals that they send up to the brain will also be healthier signals than if you have a bacterial community that's distressed and imbalanced."

> Our hypothesis is the bacteria in the gut might affect the behaviour in youth with OCD.
>
> — *Dr. Raylene Reimer, PhD*

It's been well-established that having the 'right' gut bacteria is important for overall health and can reduce the risk of obesity, type 2 diabetes and other chronic diseases. To encourage the right bacteria, you need to consume microbiota-friendly foods like dietary fibre. "One of the best fuels to feed the bacteria in our intestine is dietary fibre," says Reimer. "And all kinds of fibre are better than just focusing in on one kind." Dietary fibre helps maintain a diverse bacterial community made up of many different species that contribute important functions to the human body.

In her study of children with obesity, published in *Gastroenterology*, Reimer found that kids who consumed fibre in the form of a prebiotic supplement nearly doubled the amount of *Bifidobacterium* — one of the good bacteria in their intestinal tracts. Taking the supplement for several months also decreased the children's body fat and level of blood triglycerides, a type of fat that can increase the risk of heart disease. In another study in *The American Journal of Clinical Nutrition*, Reimer showed that taking a prebiotic fibre supplement can suppress appetite, a factor that can help manage weight.

While she used supplements in the studies, Reimer says people who are healthy can likely get all the fibre they need from food. And while you're at the grocery store stocking up on fruit, vegetables, whole grains and nuts and other items loaded with fibre, she suggests picking up plenty of yogurt, sauerkraut and other fermented foods that contain probiotics — the good bacteria.

"But if you already have obesity, mild depression, or type 2 diabetes, then the doses of prebiotic and probiotics you get in foods may not be enough," Reimer says. "It's difficult to modify the disease course enough to really make a difference just with food. If we are looking to manage a disease, it's much more likely that you'll need supplements." If you do take prebiotic and probiotic supplements, you need to take them every day in order to continue to make a difference and influence your gut microbiota. (Ask your doctor or pharmacist to recommend a good supplement or check this scientific source.)

As researchers learn more about how the bacteria in our gut affects the rest of our bodies, from producing more fat cells to sending signals to our brains, Reimer advises that we eat more fibre. "I preach that message all the time," she says. "If you give the healthy bacteria the right food, you are setting yourself up for better overall health."

> It's been well-established that having the 'right' gut bacteria is important for overall health and can reduce the risk of obesity, type 2 diabetes and other chronic diseases.
>
> — *Dr. Raylene Reimer, PhD*

Exploring brain connection with IBS

People who have gastro-intestinal (GI) disorders also experience higher rates of anxiety and depression, and those who have anxiety and depression are reported to have more GI symptoms. It's thought that a better understanding of the gut-brain axis will help people with irritable bowel syndrome(IBS), inflammatory bowel disease (IBD) and other chronic diseases. (Unlike IBD, IBS is a less serious disorder which causes no inflammation or damage to the bowel.)

"The gut and the brain could be connected in so many different ways," says Dr. Remo Panaccione, MD, a professor in the Department of Medicine at the Cumming School of Medicine, director of the Inflammatory Bowel Disease Clinic and a renowned researcher in the field of IBD. "During different times of stress, does stress itself change the microbiome?"

This is one of the questions the IMAGINE study seeks to answer. The Canada-wide longitudinal study is looking at the role of diet and the gut-brain axis in IBS and IBD. "IBS is probably one of the most common digestive disorders in the western world," says Panaccione.

Canada and Alberta have the highest reported rates anywhere. One in every 150 Canadians is diagnosed with IBD — and we don't know why. "When we think about chronic disease in general, we see that there is

a big difference in prevalence of disease depending on location," says Raman. "For example, people in Africa and Asia tend to experience inflammatory bowel disease far less than we do in North America."

But as these areas become more industrialized and their environments — and diets — change, we're seeing higher rates all over the world, says Panaccione, who is a member of the CSM's Snyder Institute. Researchers are trying to find out why it's more prevalent in Alberta. "We think it's probably a combination of the genetic pool here and something distinct within the environment," he says. "Because not only do we see rates that are high in people who are born in Alberta, but we see people who move here develop inflammatory bowel disease."

No one knows what causes IBD, which includes Crohn's disease and ulcerative colitis. Panaccione and dozens of other researchers in a total of 17 institutions across Canada are recruiting patients to explore the triggers that may cause the cramping, constipation and other painful symptoms associated with these disorders. "There's a lot of interest in not only the diet, and how diet affects the microbiome but also how your psychological stressors work," says Panaccione. "How does the mind interact with the gut to cause symptoms? We know that both of those play a big role."

The IMAGINE researchers will follow their patients' diets, symptoms, stressors and microbiomes over many years by collecting stool, urine and blood samples, and having them fill out questionnaires about their psychological symptoms. "The hope is to better understand the key mechanisms in the diet-microbiome-host relationship," says Panaccione. "It's very exciting because we may find clues and predictably alter a person's diet and microbiome or their gut-brain axis without using drugs."

Feeding the health of people with IBD

Crohn's disease is a painful, debilitating type of IBD that causes inflammation of the digestive tract and tissues in the bowel. While various treatments can bring about relief or remission, there is no cure. People with Crohn's suffer with abdominal pain, severe diarrhea, fatigue and malnutrition.

Raman and her colleagues have studied 100 people with Crohn's for three years (and counting). The researchers have developed a diet that aims to reduce inflammation in the digestive tract and relieve the painful effects of the disease. "The anti-inflammatory diet was developed by correlating specific food items and nutrients to blood cytokines as well as stool inflammation," she says. "We've shown that our diet improves all these inflammatory parameters in the setting of Crohn's disease."

The anti-inflammatory diet has managed to alter people's short-chain fatty acids (the nutrients created when bacteria eat sugar in the gut), an exciting finding with long-reaching implications. "Short-chain fatty acids are derivatives of the underlying gut microbiome," says Raman. "So the fact that we've been able to change the short-chain fatty acid profile suggests there's an opportunity to use diet to improve inflammation in patients."

In another ongoing study, Raman and her colleagues are looking at whether sulfur in the diet worsens the

symptoms for people with ulcerative colitis (UC), a painful chronic disease of inflammation of the innermost layer of the intestinal wall. They're studying how sulfur "mechanistically" induces inflammation and whether altering diet can help.

> There's an opportunity to use diet to improve inflammation in patients.
>
> — *Dr. Raylene Reimer, PhD*

Sulfur occurs naturally in well water in rural communities across Alberta. And it shows up in a lot of processed foods like deli meats. But you'll also find sulfur in a lot of so-called "healthy" foods at the grocery store. "Probably the highest level of sulfur comes from meats, particularly red meats, some chicken and other poultry," says Raman. "Other sources would be cruciferous vegetables. Broccoli is a big source of sulfur, as are eggs and dried fruits like apricots, peaches and raisins."

For many decades, researchers have been looking to genetics to find answers about chronic diseases. That emphasis is changing, Raman says, to include a larger examination into the person's environment, and "diet and nutrition are a big piece of that environmental influence."

Fettucine with fermentation

Fermentation is the process by which microorganisms, such as bacteria or yeast, break down a substance and change it into something else. With beer, wine and spirits, fermentation is what changes sugars into alcohol. In sourdough bread, yeast breaks down carbohydrates and gluten in the flour. And that's why it's long been known that sourdough bread is a healthier choice when you're making a sandwich.

"Sourdough culture is a bacteria. That bacteria imparts a lot of beneficial impacts on the food and we've known this for generations," says Dr. Jane Shearer, PhD, an associate professor in the Faculty of Kinesiology and the CSM's Department of Biochemistry and Molecular Biology. "It produces different compounds. It alters vitamins. It breaks down the gluten a little bit. And so we know sourdough bread has a healthier metabolic profile for individuals."

Now she's working to see whether fermented pasta shows similar health benefits. Shearer and her colleagues are working with Kaslo Sourdough, a Kootenay-based sourdough pasta producer, to study whether their fermented product encourages lower blood-glucose responses, influences insulin levels and benefits the bacteria in the gut.

"The hypothesis is that the fermented product is the healthier choice," says Shearer, who is a member of the Alberta Children's Hospital Research Institute at the CSM. "If the digestion is changed and the glucose response is slower, then that might be a healthier choice, for example, for somebody who's concerned about blood glucose, which would be somebody with diabetes."

In the year-long study, people came into the lab and some ate sourdough pasta and others ate conventional pasta. The researchers monitored their blood glucose responses after they ate. Initially the people had one serving a week and later in the study they ate pasta five days in a row.

"We haven't analyzed the data yet," says Shearer. "But we're looking to see if you were consuming this pasta on a regular basis, compared to your conventional pasta, does it have an impact on the way you digest it, on your gut bugs, and how your body responds to it."

Kaslo Sourdough makes their pasta based on an old recipe that's been passed down in the family for generations. While the company keeps their recipe for fermented pasta secret, the benefits of eating fermented products is well known. "Over history, it's really been a game-changer," says Shearer.

Another frontier for research

Dr. Silviu Grisaru, MD, an associate professor in the CSM's Department of Paediatrics, treats a lot of children with nephrotic syndrome, an autoimmune disorder that causes the kidneys to excrete too much protein in the urine. The child experiences swelling in the eyelids, feet, ankles and abdomen. If the disease isn't treated, infections or thrombosis can develop, causing the child to have trouble breathing and eating. Treatment is effective but may cause serious side effects including weight gain, high blood pressure, swelling, mood swings, insomnia and fatigue.

"Patients just start pouring huge amounts of protein into their urine and they have to go on steroids for a number of weeks to induce a remission, but in many, the disease recurs once the steroids are stopped," says Grisaru, a pediatric nephrologist at the Alberta Children's Hospital and member of the Alberta Children's Hospital Research Institute at the CSM. The majority of kids have multiple cycles of recurrence and remission until the disease never recurs while others experience ongoing relapses and progression to kidney failure.

Grisaru spends a lot of time talking to parents and explaining that doctors don't know what causes their children's disease. "All we are able to tell the parents is that it involves the immune system," he says. "But we don't really know what triggers it and the medications that we have to treat their children have serious adverse effects. Almost always at the end of the discussion, the parents ask 'Maybe it's something in the diet, maybe we could control the disease by eliminating or adding something to the diet?'"

And maybe it is.

Grisaru says doctors frequently hear stories from parents about how changing their children's diet — removing dairy or gluten, for example — appears to help their children's symptoms. "The literature is full of anecdotal case reports ascribing positive results to dietary changes, which are known to be associated with changes in gut microbiota," he says. And he's hopeful that as more and more research furthers our understanding about the role gut microbiota plays in our physical and mental health, researchers can start exploring possible connections between bacteria in the gut and children suffering with autoimmune diseases.

"I think the microbiome story is very promising," he says. "There may be patients that, due to their genetic makeup, are susceptible to certain diet-related changes in their microbiome affecting their immune system. Or they may be susceptible to chemicals found in the environment or processed foods, affecting interactions between their immune systems and microbiome. Those are two leading theories explaining how diet may trigger autoimmune disease."

Grisaru is exploring the feasibility for interventional controlled dietary trials in children with chronic autoimmune diseases in Calgary, hoping that a study may provide evidence needed to consider using diet to help his young patients. "There is a lot of interest from the parents to try to avoid side effects associated with conventional medications," he says. "In many, this motivation is strong enough to consider wdietary interventions."

One day, Grisaru and other doctors who treat everything from autoimmune disease to depression may be able to help treat their patients with food. As researchers discover more about how the bacteria in our gut interact with the rest of the body — and affect our overall physical and mental health — the day may come soon when doctors start prescribing specific, personalized menus as medicine. Instead of stopping by the pharmacy, we'll head to the grocery store to pick up more yogurt and peruse the fresh produce aisle for the ingredients we need for better health.

ABOUT OUR EXPERTS

Dr. Maitreyi Raman, MD, is a clinical associate professor in the Department of Medicine at the Cumming School of Medicine and medical director of the Alberta Centre of Excellence for Nutrition and Digestive Diseases. Her research is focused on nutrition support, including both enteral and parenteral nutrition. These research interests include investigating the effects of novel lipids on liver function in patients with parenteral nutrition induced liver disease, and assessing health outcomes of enteral nutrition in patients with advanced cirrhosis on the liver transplantation waiting list.

Dr. Raylene Reimer, PhD, is a professor in UCalgary's Faculty of Kinesiology and the Department of Biochemistry and Molecular Biology in the Cumming School of Medicine. She is also a member of the Alberta Children's Hospital Research Institute at the CSM. Her research group's interests focus on understanding the full potential of nutrition to prevent and treat obesity and type 2 diabetes.

Dr. Remo Panaccione, MD, is a professor in the Department of Medicine at the Cumming School of Medicine and director of the Inflammatory Bowel Disease Clinic. He is also a member of the Snyder Institute for Chronic Diseases at the CSM. His special interest lies in the implementation and performance of clinical trials of new therapies in IBD. He also performs research in identifying new targets to develop new therapies in IBD.

Dr. Jane Shearer, PhD, is an associate professor in the Faculty of Kinesiology and the Department of Biochemistry and Molecular Biology at the Cumming School of Medicine. She is a member of the Alberta Children's Hospital Research Institute at the CSM. Her goal is to develop an interdisciplinary research program examining the interactions between nutrition, genes and the development of metabolic diseases including diabetes and cardiovascular disease.

Dr. Silviu Grisaru, MD, is an associate professor in the Department of Paediatrics at the Cumming School of Medicine and a pediatric nephrologist at the Alberta Children's Hospital as well as a member of the CSM's Alberta Children's Hospital Research Institute. His research focuses on pediatric kidney disease and fetal renal morphologic abnormalities.

When healthy eating becomes unhealthy:

A look at orthorexia nervosa

Most people are familiar with common eating disorders such as bulimia or anorexia nervosa, which are characterized by unhealthy relationships with food. But what happens when someone becomes obsessed with eating well?

By Jennifer Allford

It's one thing to ask for your Hollandaise sauce on the side of your eggs benedict at brunch or to prefer fruit over French fries at lunch. But if you become so concerned with healthy eating habits that they start to rule what and with whom you eat, you may have an emerging problem called orthorexia nervosa.

First named about 20 years ago, orthorexia nervosa has yet to be thoroughly researched or fully defined. And so far, it's not listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM), the American Psychiatric Association's classification of mental disorders and the agreed-upon guide for psychiatrists, psychologists and other mental health-care professionals.

"There isn't one definition for orthorexia nervosa where everyone has agreed 'this is the best way to diagnose this problem,'" says Dr. Kristin von Ranson, PhD, a professor in the Department of Psychology in UCalgary's Faculty of Arts and director of the Eating Behaviours Laboratory. "But the gist is that it describes people who get really obsessed with healthy, clean eating and carry it too far. For example, someone who has such strict rules about what they can eat that they're not able to go to a restaurant or to someone's house and eat something there because it would not suffice for them."

At this stage, orthorexia nervosa is mentioned more in the media than in the scientific literature. It's hard to know whether further research will determine that it's

its own distinct eating disorder or a subtype of some other mental disorder. It may be classified as a type of obsessive-compulsive disorder. Or it may be determined that it's more about eating, shape and weight, which means it may be classified as an eating disorder like anorexia nervosa.

"It's not clear how distinct it is from anorexia nervosa," says von Ranson. "In anorexia nervosa, people purposely eat less than their body needs to become underweight and feel better about themselves. It's a complicated disorder that involves being underweight, even starving, but orthorexia is not centred on a person's weight." While people diagnosed with anorexia nervosa are concerned with their body image, that may not be the case with people who show symptoms of orthorexia nervosa.

Yet another eating disorder may be relevant to the emerging discussion around orthorexia nervosa — avoidance and restrictive food intake disorder, or ARFID. "Regular people call it picky eating, but people can do it to such a degree that it causes them problems. It's pretty extreme," she says. ARFID, where people limit their food intake — because of lack of interest, how foods look, smell, taste, feel or appear, or concern over aversive consequences of eating — was just added to the DSM in 2013.

It can take decades to gather enough research about a disorder that it can be recognized in the DSM. "First, what is it?" says von Ranson. "Are we all talking about the same thing? And second, are we sure that it really is a problem that is distinct from other things that we already know about? It has to be demonstrated that it matters that someone has one problem rather than the other."

Too-clean eating in high-performance athletes

In one of the first studies of its kind in Canada, Georgia Ens, who just graduated from UCalgary's Faculty of Kinesiology, did her Masters' thesis on orthorexia nervosa in high-performance athletes. "It looks different for athletes," she says. "With sports, the whole idea of sport performance gets added into the mix. This individual needs to fuel their body for this particular sport so their eating attitudes are going to be based around their sport performance demands."

She recruited 72 elite athletes competing in different sports at the national or international level, and asked them to fill out two surveys to share their thoughts about food and eating. She found that about 14 per cent of them expressed "some sort of disordered eating attitude." That's more than triple what we see in a "normal" population. "I wasn't shocked," says Ens. In fact, 75 per cent of the athletes she surveyed experienced some symptoms of orthorexia nervosa.

High-performance athletes are always looking for that extra edge that will set them apart, and diet is one of the factors they can control. "Even though it's not an officially recognized category, there are athletes that fall into this pattern of eating," says Dr. Dave Paskevich, PhD, an associate professor and associate dean in the Faculty of Kinesiology, and Ens' supervisor. "They're so focused on how they prepare their food and how they want to fuel their body that they start making comments to others. 'How could you eat that?' Because of that, they become socially isolated or they don't want others to see what they're eating."

The athletes may also suffer anxiety when they can't follow their strict diets while competing in foreign countries — for example, wanting to have broccoli for breakfast in South America. "But also from a health perspective you can start becoming so concerned about what you eat that maybe without good nutritional advice you start to cut out things that could actually be beneficial to your performance," says Paskevich.

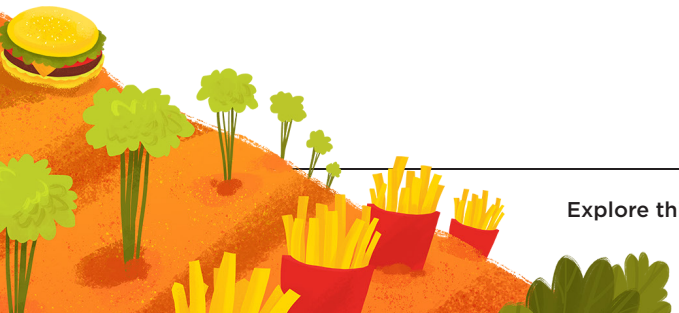
Aesthetic athletes — such as divers, gymnasts and figure skaters — are concerned about their body image because competition judges rate them in part on how their bodies look. For this reason, it's known that these athletes are at risk for eating disorders. "But we don't know whether hockey players or soccer players are at risk," says Ens. "The research for my thesis started to uncover what's going on across all sport types and I want to take a deeper look at other sports to see what's going on there." She is planning to do more research into orthorexia nervosa in a PhD.

The field could certainly use a lot more research to help high-performance athletes understand their extreme eating habits may be hurting, not helping, their performance. "There are so many different ways to eat and there is no one right way," says Paskevich. "We want to make sure that at the end of the day you're fueling your body properly."

ABOUT OUR EXPERTS

Dr. Kristin von Ranson, PhD, is a professor in the Department of Psychology in UCalgary's Faculty of Arts and director of the Eating Behaviours Laboratory. Her research focuses on eating disorders, specifically questions related to etiology, classification, and assessment of eating problems and body image.

Dr. David Paskevich, PhD, is an associate professor and associate dean (academic) in UCalgary's Faculty of Kinesiology. His interests center on the integration of the science-practitioner model, bringing the science of sport psychology into practical/applied settings. His current research interests include coping, group dynamics, leadership, mental toughness, psychological hardiness and performance on demand.



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