

How the obesity epidemic is taking a toll on our bones and joints

March 25 2019, by Nancy Whelan



Deb Baranec struggled with obesity and osteoarthritis for 30 years. Now she works out six days a week and has lost 190 pounds. Credit: Don Molyneaux, for the McCaig Institute for Bone and Joint Health

Deb Baranec wasn't always obese. As a teenager, she carried a few extra pounds but managed it by being active. Her weight crept up, however, and by the time she suffered her first knee injury while skiing at the age of 27, she weighed close to 200 pounds.

Doctors advised Baranec to lose weight to relieve the stress on her knees.

She went on the first of many diets, started working out, and lost 50 pounds. But eventually her knees hurt too much to continue exercising and her weight increased.

"I'd visit different doctors looking for a solution to my knee pain. I'd see a new orthopaedic surgeon, and be advised to come back when I lost weight. I would try a new diet or [exercise program](#), lose weight, gain it back, and then, gain a bit more—to the point I was 354 lb.," she says.

Unfortunately, stories like Baranec's are becoming more common.

Obesity: A growing problem

According to the World Health Organization, worldwide obesity has nearly tripled since 1975. In 2016, 39 per cent of adults were considered overweight, and 13 per cent were obese (having a body mass index—or BMI—greater than or equal to 30). That's bad news for our bones and joints.

Being overweight is one of the biggest risk factors for developing osteoarthritis (OA). Carrying too much weight causes joint instability and [muscle weakness](#), and increases the load on bones and joints. OA prevalence across Canada has increased in correlation with an aging population and rising rates of obesity. The result is an increased demand for arthritis-related health services, including a marked rise in hip and knee replacements.

A team of McCaig Institute for Bone and Joint Health researchers, comprised of a nutrition expert, a pioneer in biomechanics and an inflammation scientist, are tackling the problem.

Can your diet cause inflammation?

Over a decade ago, UCalgary scientist and registered dietitian Dr. Raylene Reimer, Ph.D., RD, Faculty of Kinesiology, found that a high-fat, high-sugar diet in rats changed the microbes that reside in the gastrointestinal tract, collectively termed [gut microbiota](#).

While using Reimer's high-fat, high-sugar diet to study the effect of obesity on the joints of rats, biomechanist and muscle researcher Dr. Walter Herzog, Ph.D., Faculty of Kinesiology, and graduate student Kelsey Collins made a startling discovery: The gut microbiota changes in rats that were fed a high-fat, high-sugar diet resulted in joint and muscle inflammation, a condition called metabolic OA. Some of these changes occurred as soon as three days into the experiment—even before the rats gained weight.

"This shows that arthritis isn't just caused by wear and tear on a joint. We discovered that a high-fat, high-sugar diet alone can change the muscles and joints of animals," says Herzog. This led the team to wonder whether altering the gut microbiota in obese rats could halt metabolic OA.

Can probiotics help prevent the progression of osteoarthritis?

In 2017, Reimer and her team published a study that showed a prebiotic fibre supplement reduced body fat and altered intestinal microbiota in overweight or obese children.

Armed with this knowledge, Reimer, Herzog and inflammation expert Dr. David Hart, Ph.D., Cumming School of Medicine, wanted to see if using a prebiotic supplement could change gut microbiota, reduce inflammation and improve joint function. Graduate student Jacqueline Rios tested the hypothesis in rats, adding an exercise component as well.

She found that feeding obese rats a prebiotic fibre supplement and/or having the rats perform light to moderate aerobic exercise (walking), completely prevented the damage the high fat/sugar diet caused in the joints of untreated rats. This work was recently published in *Scientific Reports*.

Postdoctoral Fellow Dr. Rafael Fortuna, Ph.D., is currently embarking on a similar study in humans. He wants to determine if prebiotic supplementation can reduce chronic inflammation through changes in the intestinal gut microbiota and improve knee function in patients with obesity and knee osteoarthritis. They are [currently seeking volunteers for this study](#).

"All we ask participants to do is add fibre to a glass of water," says Fortuna. "The goal is to find an inexpensive, easy intervention to prevent the progression of osteoarthritis in adults with obesity. If we can prevent patients from needing a knee replacement that would be great."

Reimer is quick to point out that although the work with prebiotic fibre is promising, it is just one piece of the obesity/OA puzzle: "Obesity is a very complex disease that often requires multiple different strategies—diet and behaviour changes, motivation and exercise—they all play a huge part in helping individuals achieve a healthier body weight."

Exercise and OA

There is no doubt that combining diet with physical activity is key to weight loss. But for someone with obesity and osteoarthritis, exercise can be extremely painful.

"Exercising with OA is easier said than done," says Hart. "There is limited evidence on the safest and most appropriate types of physical

exercises for adults with osteoarthritis and obesity. If we can develop interventions such as using prebiotic fibre to control the gut microbiota, decrease metabolic syndrome, and improve function, more patients with obesity and OA may be able to utilize exercise programs more effectively to enhance weight loss and continue to improve function."

The University of Calgary and University of Alberta are collaborating on a study to understand the impact of different types of exercise programs on mobility, quality of life, medication use, blood markers, and willingness to pay for programming in knee osteoarthritis patients. The study, led by Hart and Dr. Jackie Whittaker, Ph.D., from the University of Alberta, compares two new exercise programs specifically designed for people with osteoarthritis: GLA:D Canada and JointEffort. Both programs feature group exercise sessions, but differ in terms of educational programming and followup. Researchers are [currently seeking volunteers for this study](#).

"The goal of the team is to bring together the findings of the prebiotic fibre work and the exercise study to offer a complete diet and physical activity program for patients struggling with obesity and OA," says Hart. "We want to keep people moving. Ultimately it's not just about joint health. It's about maintaining mobility and quality of life."

Mobility for Life

Baranec eventually received a knee replacement in 2010. When she woke up from surgery, she had an epiphany. "I told myself, 'You've been given a second chance. Don't screw it up,'" says Baranec. "I signed-up for Weight Watchers with my daughter and started exercising six days a week." By the time she received her second knee replacement in 2015, Baranec had dropped 130 pounds.

"It made a huge difference in my recovery and mobility. Every pound I

took off helped my knees." To date, Baranec has lost 190 pounds. "Getting my knees back, keeping the weight off, has given me my life back."

Participate in research

Two UCalgary studies mentioned in this article are currently looking for research participants:

[Can a dietary fibre supplement alleviate knee pain and improve knee function?](#)

Researchers are recruiting individuals 30 to 70 years old with diagnosed knee osteoarthritis, with a BMI greater than 30/kg/m² (calculate here) to participate in this study.

[Understanding the impact of different types of exercise programs on mobility, quality of life, medication use, and blood markers in knee osteoarthritis patients.](#)

Researchers are looking for individuals 50 years of age and older with diagnosed [knee](#) osteoarthritis to participate in this study.

More information: Jaqueline Lourdes Rios et al. Protective effect of prebiotic and exercise intervention on knee health in a rat model of diet-induced obesity, *Scientific Reports* (2019). [DOI: 10.1038/s41598-019-40601-x](#)

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