Mind your inner army

Good gut microbes have a positive influence on our health…including weight. And they love to be fed dairy proteins, writes **Mark Moore**

When Mike Ross takes to the field, his most numerous army of supporters is sitting not in the stand or at home but all along his digestive system. Our mouths, stomach, small intestine and large intestine are home to literally billions of micro-organisms.

These minute organisms have evolved with us, providing benefits in return for a "home". What sets Mike and other elite athletes apart from the general population is that he has a greater range (diversity) of microbe species living there. Food products which encourage gut microbe diversity look set to generate huge benefits for farmers and consumers.

Different bodies for different jobs

"A diverse population of these micro-organisms can protect against diseases such as allergies, some cancers and even obesity," says Paul Cotter, who works at Teagasc Moorepark. Paul and colleagues are attempting to understand how the microbes deliver these benefits and why some people have more species than others.

To investigate whether diet and exercise might influence microbe diversity, the Teagasc Moorepark scientists conducted a study on 40 members of the Irish rugby squad. "The elite athletes had a much greater range of microbe species than people who are more sedentary and have poor diets," says Paul Cotter. "Because building and repairing muscle is very important to them, elite athletes eat very large quantities of protein. And, of course, they do a huge amount of exercise."

By contrast, the average western diet is high in fat and carbohydrates and many consumers live relatively sedentary lives.

Mike Ross, speaking at a seminar on nutrition at Teagasc Moorepark, described the practical value of drinks rich in the milk protein whey. "It's a lot easier to drink a protein-rich sports drink based on whey than to eat seven or eight chicken breasts to get your protein."

The study showed that the athletes had a greater number of gut microbe species than sedentary people eating a diet low in protein, fibre, fruit and vegetables. So, is it simply the case that "couch potatoes" eat more and move less than the athletes? "We believe it's not as simple as that," says Orla O'Sullivan who also works at Teagasc Moorepark. "The athletes' varied diet, in particular increased protein intake and exercise levels, were associated with a greater diversity in the gut microbes and this may be influencing health."

How to boost your inner army

- Consume resistant starch (complex carbohydrates) i.e. fibre… some good microbes like those.
- Consume lots of fruit and vegetables… it's better to get your vitamins from natural sources than tablets.
- Do regular exercise.

Research on mice supports this idea. "Studies from other labs have shown that when thin mice were inoculated with the gut microbes from obese mice and remained on the same diet they tended to become fat," says Orla O'Sullivan.

"Also, when mice that are genetically programmed to become fat were inoculated with gut bacteria from thin mice, they tended to remain lean."

The Teagasc scientists have recently completed a piece of research that compares three groups of people in an attempt to identify how new microbes could be encouraged. One group received extra protein; the next group undertook an exercise programme and the third group received both protein and exercise.

The results are in but have yet to be fully analysed. "My guess is that it's probably a bit of both," says Paul Cotter. "A more varied and protein-rich diet and exercise combining to encourage a greater range of gut microbes which, in turn, is supporting general health."

Greater demand for protein, be it from whey or other animal-derived protein, can only boost the price of these foods and help farmer incomes.

Innovative food products

Teagasc scientists and colleagues in the APC Microbiome Institute – an SFI-funded research centre based at Teagasc, UCC and CIT – are working to understand the role of the gut microbiota on human health and how this can be manipulated using food and develop innovative products which could simultaneously benefit consumers and farmers. Some of these products add value by boosting gut microbe diversity.

Some products contain prebiotics (which encourage the growth of microbes) and some contain probiotics (beneficial microbes).

As part of the Infantmet project, Catherine Stanton of Teagasc Moorepark is developing probiotics particularly aimed at boosting infant health.

Products containing whey proteins seem to be particularly valuable in encouraging gut microbes.

"Athletes are increasingly consuming drinks containing whey to build muscle and it's likely that they are boosting their gut microbes too," says Paul Cotter.

Work by Kanishka Nilaweera, also at Teagasc Moorepark, seems to show that consuming whey can help to control weight gain.

Paul Cotter noted that the science of changing the microbiota is not new and is the principle that underlies the use of prebiotics and probiotics. He indicates that consumers should be aware that not all probiotics and prebiotics are the same and that consumers should enquire about the research behind products. Some of those available on the market have a lot of research demonstrating how they can provide benefits in particular situations. Others, unfortunately, have very little/no scientific basis.

Teagasc scientist, and runner, Paul Cotter says regular exercise and a varied diet are good for gut, and all-round, health.

Diet: the young and the old

While diet and exercise may be seen as lifestyle choices, some sectors of the population suffer medical conditions related to their gut microbes. Many scientists already advocate more prudent use of antibiotics to lower the risk of resistance but there's another reason to avoid unnecessary use, particularly in children: broad spectrum antibiotics can damage gut microbes as an undesirable side-effect of treating disease.

Paul Cotter urges the more prudent use of antibiotics and the development of new, more narrow-spectrum, targeted antibiotics, which are less likely to kill off the good gut bacteria as a side effect.

Elderly people who are taking broad-spectrum antibiotics should be particularly careful to protect their gut microbe diversity. "The negative impact of antibiotics on the gut microbes in these individuals can allow an undesirable species called *Clostridium difficile* to become dominant and cause illness. Once it becomes established, it can be particularly difficult to remove this disease-causing species," says Paul Cotter.