

The curious case of microplastics and their journey to the centre of the gut

Plastic fantastic. Right? Plastic has become one of our favourite materials and is used for so many different items – you think it and it probably has plastic somewhere being used to make, build or package it! But what happens after when we throw it away; it can be burnt, recycled, put into landfill and sometimes causally bobbing along or sitting in the environment. We've all seen the heart-breaking images of wildlife becoming victims and casualties to physical entanglement and stomachs full of plastic bits – but have we considered what happens when we accidentally consume these tiny pieces of plastic?

These tiny pieces of plastics (typically called microplastics) are commonly formed when, sadly plastic ends up being discarded outside waste management pathways into the environment. Once there the plastic experiences natural breakdown processes and causes little pieces to detach and carry on to its new journey.

Microplastics are durable and tough making their possible travel plans varied, lengthy and interchangeable – that can include water and food sources. For example, did you know that even bottled water and sea salt used to make your dinner can contain a small amount of microplastics!

Eating these microplastics means they will enter our digestive system, which includes the stomach and intestines. The small intestines are a very important organ which is mainly responsible for absorbing components that we need to function from our food. To make this process easier the stomach contains a very strong acid that starts to breakdown food into small pieces before it enters the small intestine. The food is then broken down further into microscopic pieces (or smaller) by fluids in the small intestine, called enzymes. This breakdown process allows cells in the small intestine to take food in and distribute throughout our bodies.

So, you're asking what's the big deal about eating a bit of microplastic? Well scientists have looked at the effect seen in animals and have noticed there could be some issues of concern that need investigating. Some studies have shown that eating microplastics can cause some cell damage and potentially cause some inflammation in the small intestine. These side-effects could ultimately lead to a reduction in function of our small intestines – which can lead to wider impacts or development of disease. But the impact on humans is not well understood.

Plastics also contain certain chemicals that are used to improve their function and durability, these are still found in microplastics. Some of these chemicals have been shown to potentially interfere with some hormones and part of the immune system in humans. Sometimes even while travelling through the environment microplastics can act as a sponge and offer a lift for other artificial or natural environmental pollutants that can be harmful to us. It has been suggested that the breakdown process could cause the release of these chemicals associated with microplastics.

However, research into microplastics is relatively new, and currently lacking in certain areas regarding the effect of the digestive breakdown process and microplastics and impact on us.

My PhD is looking to address that current lack of understanding. Firstly, I will be investigating what effect digestive fluids, including the stomach and small intestine, have on microplastics that can be commonly found in the environment, either physically or chemically. Secondly, I will be testing to see if these effects can cause harm to cells that are found in the small intestine.

The first step of my project will be creating some microplastics from different common plastic items that are typically found in the environment. This will involve freezing them in liquid nitrogen and grinding them into the desired size I need. Once I have completed this, I will then put the microplastics through a simulated digestive process. After the microplastics have completed the breakdown process, I will then expose them to small intestine cells in the laboratory and observe for any effects they may show.

This will help to show if there are any hazardous effects that could cause harm to us and establish what risk could be seen from short- or long-term consumption of microplastics. This information can be important for health officials and governments to understand the impacts of ingesting microplastics to the public. Establishing this link now is important to allow prompt required action in order to prevent unnecessary harm to future generations.