Plastic on our plates: how we became plastic eaters

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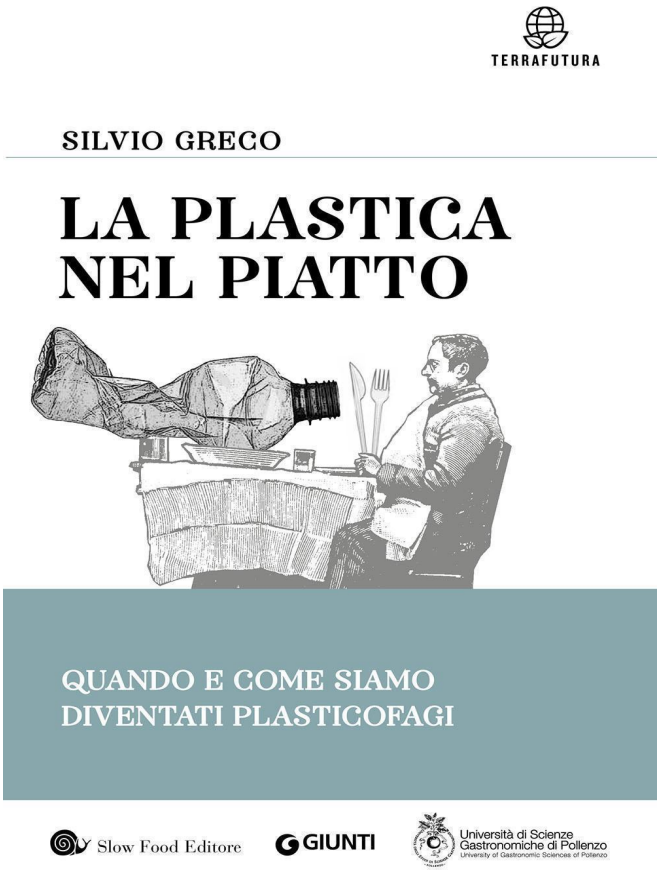

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Plastics have completely revolutionised the existence of human beings on the planet, with consequences that can be considered both good and bad. Its characteristics make it a ubiquitous material in our lives: from food packaging to medicine and surgery, from the automotive industry to the planes we use to travel around the globe. Now, however, research shows us that the release of these materials into the environment is increasingly threatening ecosystems and humans, even contaminating what we eat. We have transformed ourselves into plasticophiles in the space of a century. Now we have to ask ourselves how we became plastic eaters and what consequences our daily ingestion has.

We are in the habit of calling different materials plastics, even though they have different compositions and purposes. With the introduction of the first plastics during the last century, industrial developments seemed endless. In 1912, the German chemist Klatte developed polyvinyl

chloride (PVC) for the first time. Only a year later, the Swiss Brandenberger invented Cellophane, a material we still use today. Transparent, cellulose-based and produced in very thin, flexible sheets, Cellophane is still found in many food packaging products today, extending the life of food. Polyvinyl chloride, on the other hand, has changed the horizons of modern medicine as it has become the most widely used plastic in life-saving single-use medical devices due to its functionality and low production cost. We have developed oxygen and anaesthesia masks, tubing, IV and dialysis bags, vascular, cardiac and eye surgical devices. Plastic has saved lives, but the use of this material is endangering our health on this planet.

The problem with plastics stems from our inability to manage them. We produce in a disposable way: we use it once and throw it away immediately, accumulating huge amounts of waste that we no longer know where to put. So the plastic, dispersed in the environment instead of being collected and processed in sorting and recycling plants, ends up in the soil, sea and rivers, becoming a contaminant. This is not a purely aesthetic problem: the millions of tonnes of plastic we dump in the sea every year have not only destroyed marine habitats by turning them into veritable rubbish dumps, but are also exposing us to the daily intake - through our plates - of elements that are harmful to our health. And we do not know the full consequences of all this for our bodies in terms of toxicity and toxicokinetics.

The problem of the dispersion in the environment and the intrusion of plastics into our food lies in the degradation of these materials. In fact, before being assimilated by the environment, this waste fragments into many tiny pieces, the so-called microplastics and nanoplastics; these enter the marine trophic chain, ingested by phytoplankton. Phytoplankton, in turn, provide food for larger organisms, including several species of fish, crustaceans, dolphins, sharks, molluscs and other mammals that we end up finding on our tables ourselves. In short, the plastic that ends up in the sea comes back to us in the form of fish (EFSA, 2016). Smaller fish accumulate quantities of plastic based on their mass. Those who feed on them, such as tuna and swordfish, consequently take in and ingest the plastic they eat. So the bigger the fish we eat, the greater the density of plastics it contains. We eat plastic indirectly - about 5 grams per week (Wit & Bigaud, 2019) - especially when we have shellfish on our plates. Because we eat them whole, we ingest everything they have absorbed, whereas fish we eviscerate, thus eliminating the contents of their stomachs.

Table salt, bottled water, honey and beer

It is mainly fish that brings plastic to our plates, but not only that. The non-marine shopping we do, put under the magnifying glass, shows even more alarming data. In 2017, a team of Spanish researchers studied 21 types of table salt. The samples included marine salts, before and after packaging. The microplastic content found was 50-280 MPs/kg of salt, with polyethylene-terephthalate (PET) as the most frequently detected polymer, followed by polypropylene (PP) and polyethylene (PE). The results indicate that, even though the microparticles could come from multiple sources, there remains in any case a background presence of microplastics in the environment (Iñiguez et al., 2017).

Even worse is the idea that not even a glass of water can come to our rescue. Tiny plastic polymers have even been detected in bottled mineral water, used for drinking all over the world. As few microplastics have been reported in underground drinking water, it is suspected that they enter bottled water mainly during the cleaning and filling of the bottle (Weisser et al., 2021).
The bottles in which we buy water are generally made of PET, polyethylene terephthalate, a material that can release plastic fragments into the contained solvent (Pivokonsky et al., 2018). A 2021 study, conducted in Malaysia, investigated the presence of microplastics in locally produced bottled water. A total of 40 bottled water samples of 4 local products were studied. A total of 2,022 microplastics were detected in the samples, with an average of 50.6 particles per bottle. Beads, fibres and fragments were detected in all samples, but fibre (48%) and fragment (36%) made up the majority (84%) of the microplastics in the samples (Wong et al., 2021).

Even taking refuge in beer would not be completely safe from the ingestion of plastic, which is a mixture of barley, hops, water and plastic polymers. A study of 24 German beer brands bottled in glass (including the ten most popular in Germany) showed that out of 12 ales, 5 wheat beers and 7 non-alcoholic beers bought in supermarkets, every single bottle contained plastic fragments, fibres and granules (Liebezeit & Liebezeit, 2014).

These plastic fragments and fibres have also been detected in honey marketed and consumed in Europe and America. Using techniques of microfiltration and degradation of organic matter with hydrogen peroxide, followed by continuous rinsing of the compound with deionised water, a group of scientists recorded a worrying 12% presence of microplastics in honeys in glass jars on the market (Diaz-Basantes, Conesa & Fullana, 2020). In terms of composition, the main microplastics found were polyethylene, polypropylene and polyacrylamide.

The authors of these two studies on beer and honey point out that the fact that there are microplastics in these products may be due both to their presence in the raw materials (water, barley, hops, etc.) and to the production process, during which the use of plastic elements is omnipresent (Liebezeit & Liebezeit, 2014) (Diaz-Basantes, Conesa & Fullana, 2020).

We can therefore go so far as to call ourselves plastic-eating mammals, given the numerous plastic fragments we ingest every day along with the food and drink we consume. How much and what damage these invasions of microplastics can cause to our health is the question that immediately arises. However, this is a question to which scientists have yet to find a definitive answer, as there is a lack of studies on the effects on our bodies.

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