COMMENTARY

Considering the health hazards associated with the growing prevalence of plastic kitchen utensils

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Received: January 18, 2024; Accepted: March 8, 2024; Published Online: March 12, 2024; https://doi.org/10.59717/j.xinn-med.2024.100059

Citation: Wu Y. and Li J. (2024). Considering the health hazards associated with the growing prevalence of plastic kitchen utensils. The Innovation Medicine **2(1)**: 100059.

Recent modeling results predicted that global plastic use will triple to 1,231 Mt from 2019 to 2060,[1] it should come as no surprise, then, that the ubiquity of plastics in the environment has raised concerns about their environmental and human-health risks in recent years. Plastics are present in many forms in the environment, e.g., industry, electrical, agriculture, packaging, lifecare products and other sectors. Among them, we have to mention the plastic products used in the kitchen. Plastic, as an indispensable material in contemporary society, compared with traditional ceramic or stainless steel material, has become increasingly prevalent in food contact items primarily due to its affordability, cost-effectiveness and lightweight properties. Many tableware and kitchen utensils are made of plastic materials, including plastic bowls, plates, containers, chopsticks, cutting boards, spatulas and so on. Polyethylene, polypropylene, polyethylene terephthalate and polystyrene are commonly utilized as plastic materials for manufacturing a wide range of plastic products. As plastic products are used, the processes of abrasion, degradation, and fragmentation lead to the generation of plastic micro-particles. These tiny particles then disperse into the storage containers of food and beverages, subsequently being consumed by humans through the food chain (see Figure 1).[2] Reusable plastic cutlery and kitchenware in direct contact with food, long-term use will make the original angular chopsticks head become smooth, the same will make the original flat cutting board in the center of the depression (see Figure 1), it is worth exploring where the

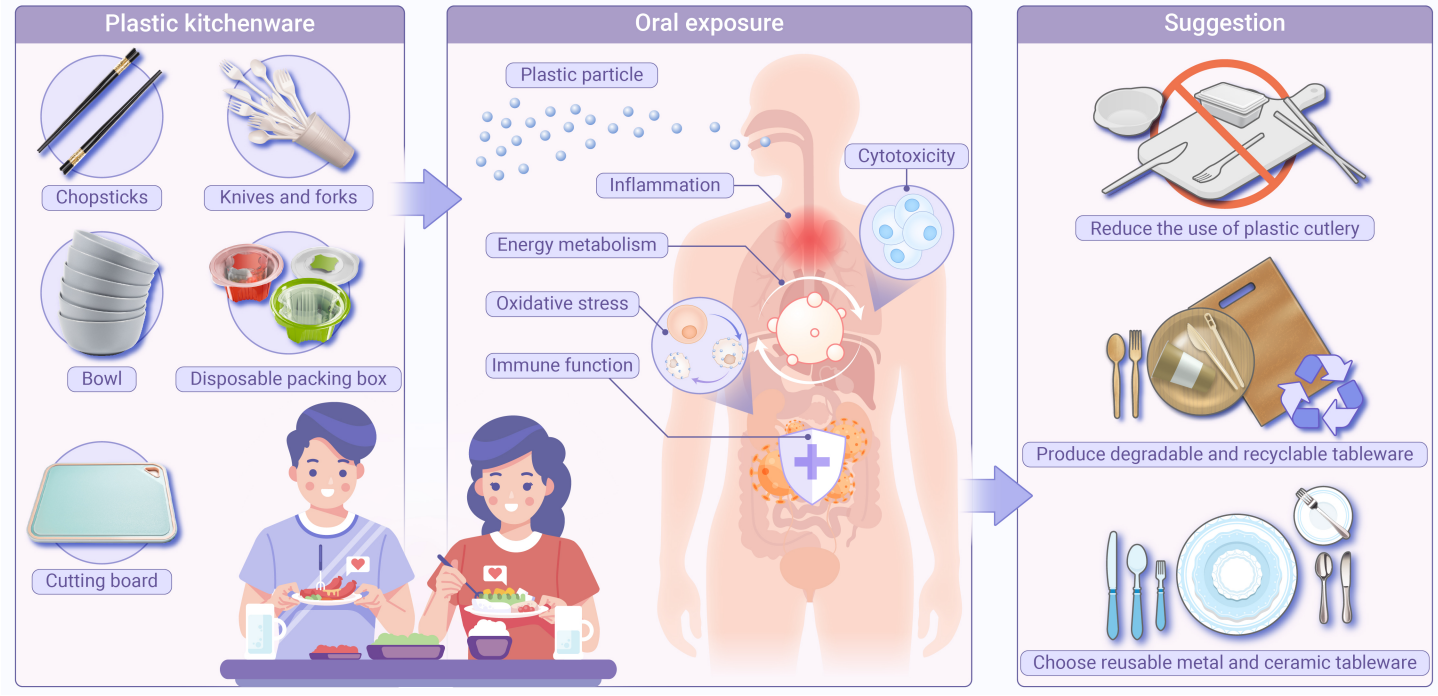

Figure 1. Kitchen and life around plastic.

disappeared portion went.

Ingestion of microplastics through food and inhalation has been identified as the main route for microplastics to enter different tissues in the human body, and food and liquids can be contaminated with microplastics in plastic packaging or storage containers. Studies have highlighted the presence of plastic particles in various food products intended for human consumption, including table salts, sea fish, honey, teabags, and drinking water and so on. These findings suggested that individuals may involuntary direct consume plastic particles vary between 74,000 and 121,000 particles from various food products annually, which is largely unavoidable. Then, the use of plastic tableware may increase the likelihood of plastic particles being ingested. Over time, more and more kitchen appliances are made from plastic raw materials, which increases the possibility of microplastic transfer during food preparation and storage. A study that postulated plastic cutting boards as a potential major source of microplastics in human food confirmed the high amounts of microplastics released by plastic cutting boards that have long been used by large fast food chains and restaurants. Another study of non-stick pans in kitchen utensils showed that damaged coatings on the surface of non-stick pans could lead to the removal of 230,000 micro/nanoplastic particles during perennial cooking. More worryingly, temperature affects the release of plastic particles, at a temperature of 95℃, the discharge potential of microplastics from single-use paper cups surges to approximately two to five times higher than that at 10℃, and a study on polypropylene baby bottles found that when the water temperature increased from 25 to 95℃, the concentration of released plastic particles went from 600,000 to 55,000,000 particles/L. In that case, plastic tableware or kitchenware will release more plastic particles if they are in direct contact with hot food, such as hot milk tea, hot coffee, and hot takeout.[3] Increasing levels of microplastics and heat-induced exudates have imposed a long-term and chronic burden on our health, as our bodies have been exposed to the potential risks associated with plastic products over an extended period.

Currently, research on the biological effects of plastic particles has only

been conducted in some parts of the world, but the field has undergone rapid development and exploration in recent years, microplastic particles have been identified in a variety of human biological specimens, including but not limited to blood, sputum, lung and colon tissues, saliva, breast milk, as well as fecal matter.[4] Nonetheless, there are still gaps in our understanding of the precise impact of microplastics on human health, and additional research is required to fill these knowledge gaps. To date, pressing microplastic-related health issues have attracted widespread attention from scientists. Animal studies in mice and zebrafish have shown that plastic particles as tiny as 150 nm can cross cell membranes and translocate to various organs, upon internalization, microplastics stimulate a potent antioxidant response that can result in oxidative stress. The abundant surface area to volume ratio of microplastics, the release of oxidizing substances adsorbed onto their surfaces, and the liberation of reactive oxygen species during inflammatory processes collectively serve as triggers for oxidative stress. Macrophages, as key responders, ingest plastic particles, leading to cytotoxicity, as observed in human brain and epithelial cells. Plastic exposure has also been shown to disrupt energy metabolism and homeostasis by directly affecting metabolic enzymes or indirectly interfering with energy balance. For instance, nano-plastic particles induced changes in lipid metabolism that disrupted energy reserve mobilization in fish, while mice exhibited significantly reduced ATP production in the liver, resulting in decreased lipid metabolism. Plastic exposure also affects immune function, either triggering a systemic or local immune response depending on the distribution of microplastics and the host's response. Combustion-derived microplastics, for instance, caused temporary immunosuppression in mice. After contact with plastics, particles travel through the bloodstream to distant tissues, eliciting a systemic inflammatory response. The main mechanism responsible for microplastic translocation is increased permeability of the epithelial membrane caused by inflammation. Over time, plastic particles accumulate extensively in the liver, kidneys, and intestines, leading to chronic inflammation, impaired organ function, and an elevated risk of tumors. Furthermore, prolonged exposure to microplastics also affects the activation of immune cells in the brain and promotes the neurotoxic process through oxidative stress.[5] According to reports these scientific findings have garnered significant attention and influenced understanding and awareness regarding human exposure to plastics.

The increasing use of plastic containers to store and distribute food, as well as the widespread use of plastic cutlery, disposable plastic cups, plastic bags, and straws, has become a significant unintentional source of plastic consumption. While these products bring convenience and improve hygiene conditions, it's crucial to acknowledge their potential negative impact on food safety. As plastic kitchen products replace traditional materials, when food tableware or kitchenware comes into direct contact with food, we know very little about the effects of microplastics and heat-induced exudates on our bodies. We require further research and attention in order to fully comprehend and appreciate the extent of this overlooked issue. Therefore, it is advisable to opt for reusable metal or glass tableware whenever possible and promote the production of recyclable and biodegradable plastic utensils. We should also raise awareness and educate people about the importance of environmental and health consciousness, encouraging them to prioritize the avoidance of unnecessary plastic tableware. By doing so, we can make a valuable contribution to the well-being of both humanity and the planet.

REFERENCES

1. OECD. (2022). Global plastics outlook: Policy scenarios to 2060. OECD Publishing DOI: 10.1787/aa1edf33-en.
2. Bouwmeester, H., Hollman, P.C., and Peters, R.J. (2015). Potential health impact of environmentally released micro- and nanoplastics in the human food production chain: Experiences from nanotoxicology. Environ. Sci. Technol. **49**: 8932–8947. DOI: 10.1021/acs.est.5b01090.
3. Du, F., Cai, H., Zhang, Q., et al. (2020). Microplastics in take-out food containers. J. Hazard. Mater. **399**: 122969. DOI: 10.1016/j.jhazmat.2020.122969.
4. Malafaia, G., and Barceló, D. (2023). Microplastics in human samples: Recent advances, hot-spots, and analytical challenges. Trends. Anal. Chem. **161**: 117016. DOI: 10.1016/j.trac.2023.117016.
5. Prata, J.C., da Costa, J.P., Lopes, I., et al. (2020). Environmental exposure to microplastics: An overview on possible human health effects. Sci. Total Environ. **702**: 134455. DOI: 10.1016/j.scitotenv.2019.134455.

FUNDING AND ACKNOWLEDGMENTS

This work was supported by the CAS "Light of West China" Program (XAB2022YW17). The funder had no role in study design, data collection and analysis, decision to publish or preparation of the manuscript.

DECLARATION OF INTERESTS

The authors declare no competing interests.