High levels of microplastics found in prostate tumors, possibly linked to take-out food

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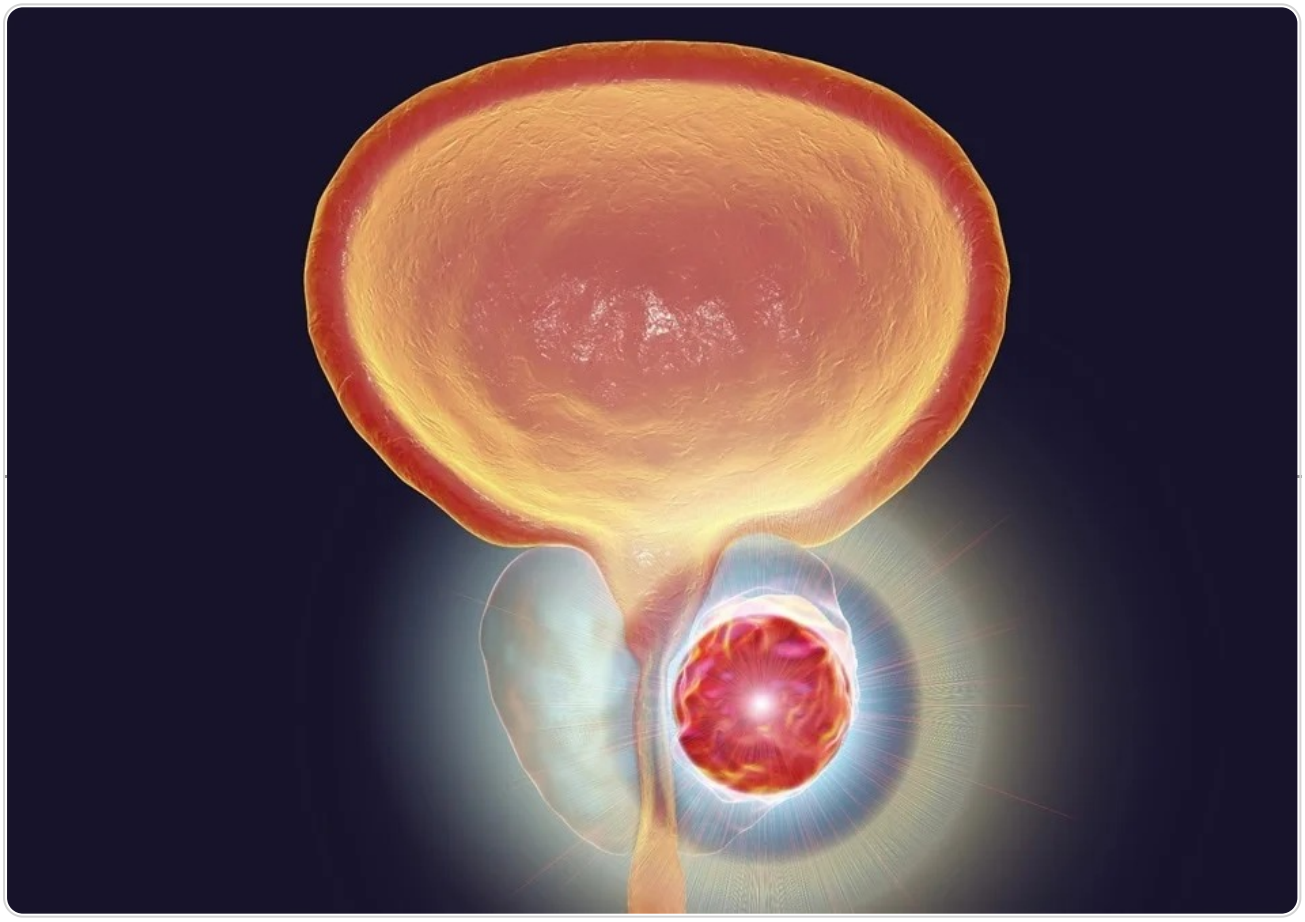
The presence of microplastics in prostate tumors points to potential health risks, and researchers are calling for urgent studies to explore how take-out food may be driving this exposure.



Study: Identification and analysis of microplastics in para-tumor and tumor of human prostate. Image Credit: Kateryna Kon / Shutterstock

In a recent study published in the journal *eBioMedicine*, researchers attempted to identify, characterize, and quantify microplastics (including their abundances and types) found in human prostate tissue. They used scanning electron microscopy, laser direct infrared spectroscopy, and pyrolysis-gas chromatography-mass spectrometry. They found the presence of three types of

microplastics in both para-tumor and tumor tissue: polyamide, polyvinyl chloride, and polyethylene terephthalate. Additionally, polystyrene was detected in tumor- but not para-tumor tissue. Abundance measures revealed between 181.0 µg/g and 290.3 µg/g of microplastics per unit tissue, with sizes ranging from 20 to 100 µm. However, the study noted that microplastic particle sizes in tumor tissues tended to be larger (between 50 and 100 µm) compared to para-tumor samples, which predominantly had particles between 20 and 30 µm.

The study highlights the strong positive correlation between take-out food consumption and polystyrene abundance, emphasizing the need for safer food packaging alternatives. Furthermore, the presence of microplastics in prostate tissue raises questions about the potential role of environmental factors in the onset or progression of prostate cancer. However, more research is needed to establish causality.

Background

Microplastics (MPs) are minute plastic fragments (<5 mm) that arise from the (usually environmental) degradation of plastic commodities. They are ubiquitous in nature and are easily ingested and assimilated into the tissues of humans and other animals, given their small particle sizes. A growing body of evidence underscores microplastics' negative public health potential, associating these particles with diseases of the placenta, lungs, blood, intestines, and gonads. Microplastics are also observed to be bioaccumulated across food chains, resulting in higher concentrations and physiological damage to higher trophic levels.

Alarmingly, the global prevalence of plastics (and, by extension, microplastics) continues to rise. The rapid industrial development, population growth, and consumeristic trends of the 21st century have promoted this pattern, resulting in a 230-fold increase in plastic production (2019, 460 metric tons) compared to just 70 years prior (1950, 2 metric tons).

> ***Particle shape and size: The microplastics varied in shape, with irregular forms being predominant, and most particle sizes ranged between 20 and 100 µm. Tumor tissues had a higher concentration of larger particles (50-100 µm).***

Alongside their particulate (physical) effects, microplastics are known to have a

strong affinity for toxic plasticizers, including dibutyl phthalate (DBP) and bisphenol A (BPA), with known hormone-altering, often carcinogenic properties. While the impacts of microplastics on a handful of cancers (e.g., blood and lung) have been extensively characterized, their associations with prostate cancers remain unknown. Given the growing prevalence of prostate-cancer-associated morbidity and mortality worldwide (one of the most common male cancers), elucidating the risk factors in prostate cancer genesis is imperative.

About the study

The present study aims to elucidate the properties, abundance, and main types of MPs in prostate tissue (specifically, para-tumor and tumor). Study data was obtained from Peking University First Hospital patients who underwent robot-assisted radical prostatectomy (RARP) between Jan 2023 and July 2024. However, due to the small sample size (22 patients), the results of this exploratory study may not be generalizable to all prostate cancer populations. Larger, more diverse samples are needed to validate these findings. Exclusion criteria included: 1. Patients who underwent neoadjuvant endocrine therapy, 2. Patients with preexisting prostate cancer at baseline, and 3. Lack of expert supervision during RARP procedures.

Data collection included patient's demographic data and medical histories. Sample collection comprised paired para-tumor and tumor tissue excisions (n = 22 each). To identify and characterize microplastics, two paired samples were used for laser direct infrared (LDIR) imaging and scanning electron microscopy (SEM) analysis. For abundance estimations, the remaining 20 pairs were used for pyrolysis–gas chromatography-mass spectrometry (Py–GC/MS) analysis. The National Institute of Standards and Technology (NIST) mass spectrometry database was referenced for microplastic characteristics.

> *"The 11 target polymers were polystyrene (PS), polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polymethyl methacrylate (PMMA), polycarbonate (PC), polyethylene terephthalate (PET), polyamide 6 (PA6), polyamide 66 (PA66), polylactic acid (PLA), and polybutylene terephthalate (PBAT)."*

The patient population’s median age was 66.8 years, with 50% identified as smokers and 36.4% reporting regular alcohol consumption. Nearly 86.4% of

participants consumed bottled water frequently, while 77.3% reported consuming take-out food. These lifestyle factors may contribute to microplastic exposure routes. Participants' demographic variables were evaluated via descriptive statistics – means and frequencies were used to describe continuous and categorical variables. Inter-group comparisons were carried out using Paired *t*-tests. Correlation coefficients were computed using *Pearson* correlation analysis.

Study findings

The patient population's median age was 66.8 years, with mean body mass index (BMI) and prostate volume elucidated as 25.4 kg/cm^2 and 45.9 mL, respectively. Notably, 50% (n = 11) of patients were smokers, and 36.4% (n = 8) regularly consumed alcohol. Alarmingly, almost all patients were found to frequently consume packaged bottled water (86.4%) and take-out food (77.3%).

LDIR and SEM imaging revealed the presence of four main MPs (PS, PE, PP, and PVC) across both tissue types analyzed. Surprisingly, PS could only be detected from tumor tissue but not para-tumor tissue. All MPs detected ranged in size from 20 to 100 µm, but the majority measured 20 to 50 µm.

> ***Patient correlations: The study found a positive correlation between polystyrene levels in tumor tissues and the frequency of take-out food consumption, further linking lifestyle choices to microplastic exposure.***

Py–GC/MS analysis revealed that the mean abundance of MPs in para-tumor tissue was 181.0 µg/g. In comparison, mean MP abundance in tumor tissue was observed to be significantly higher (290.3 µg/g), suggesting differential MP adsorption/uptake across these tissue types.

Despite the paper's aim to unravel the risk associations between MPs and prostate cancer, the small sample size and limitations of the methodology prevent any strong conclusions regarding causality. The findings, while valuable, serve as a stepping stone for further research, particularly in understanding whether microplastics contribute to cancer development or act as biomarkers for exposure. Additional research on the causal relationship between MPs and cancer is required before action plans

against the former can be devised.

Conclusions

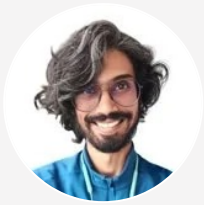
The present study explores the health associations between MP and the prostate organ. Study findings reveal that at least four microplastic types (PS, PE, PP, and PVC) are assimilated into prostate tissue following consumption. Assimilation efficiency was found to vary between prostate tissue types, with the para-tumor tissue depicting significantly lower MP abundance (181.0 µg/g) compared with tumor tissue (290.3 µg/g). Furthermore, PS could only be detected from the tumor tissue and was absent from para-tumor tissue.

Notably, participant behavioral investigations revealed frequent utilization of packaged drinking water and take-out food, suggesting potential MP exposure routes and highlighting the safer food packing alternatives.

> *"…our study provides valuable insights into the presence of MPs in the human prostate and sheds light on the potential implications of MPs on prostate health. Future longitudinal studies should be conducted to enhance the understanding of the dynamic interplay and potential causal connections between MPs and prostate health over time."*

Journal reference:

- Deng, C., Zhu, J., Fang, Z., Yang, Y., Zhao, Q., Zhang, Z., Jin, Z., & Jiang, H. (2024). Identification and analysis of microplastics in para-tumor and tumor of human prostate. In eBioMedicine (Vol. 108, p. 105360). Elsevier BV, **DOI** – 10.1016/j.ebiom.2024.105360, https://www.thelancet.com/journals/ebiom/article/PIIS2352-3964(24)00396-7/fulltext



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Hugo Francisco de Souza is a scientific writer based in Bangalore, Karnataka, India. His academic passions lie in biogeography, evolutionary biology, and herpetology. He is currently pursuing his Ph.D. from the Centre for Ecological Sciences, Indian Institute of Science, where he studies the origins, dispersal, and speciation of wetland-associated snakes. Hugo has received, amongst others, the DST-INSPIRE fellowship for his doctoral research and the Gold Medal from Pondicherry University for academic excellence during his Masters. His research has been published in high-impact peer-reviewed journals, including PLOS Neglected Tropical Diseases and Systematic Biology. When not working or writing, Hugo can be found consuming copious amounts of anime and manga, composing and making music with his bass guitar, shredding trails on his MTB, playing video games (he prefers the term 'gaming'), or tinkering with all things tech.