

## Scientific Papers Detail How Human Brains Contain a 'Spoonful of Plastic' Linked to Ultra-Processed Foods

Articles in Brain Medicine show microplastics from ultra-processed foods accumulate in the brain, potentially contributing to depression, anxiety, and dementia

NEW YORK, NY, UNITED STATES, May 20, 2025 /EINPresswire.com/ -- A remarkable collection of four scientific papers published in the May issue of <u>Brain Medicine</u> goes over the accumulating evidence that microplastics, particularly abundant in ultra-processed foods, are accumulating in the human brain at alarming rates and may contribute significantly to the global rise in depression, anxiety, dementia, and



Brain on Instant Noodles: Visualizing the journey of microplastics from ultra-processed foods to neural tissue.

other neurological disorders. The papers collectively represent a comprehensive analysis of how these pervasive plastic particles might be affecting brain health through multiple interconnected biological pathways that mirror known mechanisms of dietary impacts on mental health.

A Spoonful of Plastic in Your Brain: The Disturbing Reality

The evocative cover of Brain Medicine's May 2025 issue depicts a human brain stippled with colorful microplastic particles alongside a plastic spoon – a striking visual metaphor for the main finding that human brains contain approximately "a spoonful" of microplastic material. This alarming concept is examined in depth across all four articles in this special collection, providing a multi-faceted exploration of what researchers are now describing as a "widespread infiltration" of synthetic materials into the human brain.

"This moment reframes more than a risk profile. It shatters a framework," writes Dr. Ma-Li Wong in her editorial. "For years, whispers within environmental science anticipated the

encroachment. That plastics would enter our biology was inevitable, they said. But even the most pessimistic among them did not expect this: particles in the hippocampus, polymers tangled with neurons, synthetic debris within the very tissues that govern memory, identity, and mood."

The Microplastic-Mental Health Connection: New Evidence

The feature peer-reviewed Viewpoint article by Dr. Nicholas Fabiano (University of Ottawa), Dr. Brandon Luu (University of Toronto), Dr. David Puder (Loma Linda University School of Medicine), and Dr. Wolfgang Marx (Deakin University's Food & Mood Centre), titled "Microplastics and mental health: The role of ultra-processed foods" (https://doi.org/10.61373/bm025v.0068), builds upon their earlier commentary on microplastic accumulation in human tissue.

Their paper synthesizes emerging evidence to propose a novel hypothesis connecting ultraprocessed food consumption, microplastic exposure, and mental health outcomes. The researchers cite substantial evidence linking ultraprocessed food consumption with adverse mental



The calamity of a plastic spoon in your brain: The Brain Medicine May 2025 journal issue highlights the impact of microplastics on brain health, bringing attention to the interface of ultraprocessed food ingestion and brain microplastic accumulation.

health outcomes, including a recent umbrella review published in The BMJ that found people who consumed ultra-processed foods had a 22% higher risk of depression, 48% higher risk of anxiety, and 41% higher risk of poor sleep outcomes.

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As the levels of ultraprocessed foods, microplastics, and adverse mental health outcomes simultaneously rise, it is imperative that we further investigate this potential association."

Nicholas Fabiano, MD

"Ultra-processed foods now dominate the food supplies of high-income countries, with over 50% of energy intake coming from ultra-processed foods in the United States," notes Dr. Fabiano. "Our analysis reveals that greater ultraprocessed food consumption is associated with adverse mental health outcomes, while data from randomized controlled trials has demonstrated improvements to mental health following reduction in ultra-processed food intake."

The Stark Reality of Microplastic Exposure Through Food

What makes the researchers' hypothesis particularly compelling is the novel suggestion that microplastics—tiny plastic particles less than 5mm in size—may be a key mediator in the relationship between ultra-processed foods and poor mental health outcomes.

The paper presents disturbing data showing that foods like chicken nuggets contain 30 times more microplastics per gram than chicken breasts, highlighting the substantial impact of industrial processing on microplastic content. Further, ultraprocessed foods are often stored and heated in plastic, which independently serve as a significant source of microplastic exposure.

Microwaving certain plastic containers can release millions (even billions) of micro- and nanoplastic particles in just minutes," explains Dr. Brandon Luu, an Internal Medicine Resident Physician at University of Toronto. "While research is still evolving, this may represent a significant exposure pathway. Taking small steps to reduce dietary and environmental microplastic exposure could prove meaningful for long-term health.

The hypothesis gains further credibility from recent findings published in Nature Medicine (https://doi.org/10.1038/s41591-024-03453-1) demonstrating alarming microplastic concentrations in the human brain—approximately "a spoon's worth" according to the



The plastic spoon in neural context. This visual metaphor represents the alarming findings that approximately a spoon's worth of microplastic particles has been detected in human brain tissue.



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researchers—with levels three to five times higher in those with documented dementia diagnoses. The microplastics found in the brain were predominantly smaller than 200 nanometers, most often polyethylene, and were 7 to 30 times higher in concentration than those found in other organs such as the liver or kidney.

What's particularly concerning is that this study found a 47% increase in microplastic concentrations in the brain between 2016 and 2024, correlating with the global rise in plastic production," notes David Puder, MD, host of the Psychiatry & Psychotherapy Podcast (<u>https://www.psychiatrypodcast.com/</u>). "Given how ubiquitous plastic is in the processing, packaging, and preparation of ultra-processed foods, it's becoming nearly impossible to avoid exposure. I'm especially alarmed by the fivefold increase in microplastic levels found in the brains of people with dementia. I hope this study sparks further research into the environmental and dietary factors contributing to this accumulation.

Shared Mechanisms of Harm: Overlapping Pathways

A central aspect of the researchers' hypothesis is the remarkable overlap in biological mechanisms through which both ultra-processed foods and microplastics appear to impact mental health.

"From a biological perspective, numerous mechanisms—largely identified through animal studies—are likely at play," explains Dr. Marx. "These include inflammation, oxidative stress, epigenetics, mitochondrial dysfunction, the tryptophan–kynurenine metabolism, the hypothalamic-pituitary-adrenal axis, neurogenesis via brain-derived neurotrophic factor, and chronic diseases such as obesity."

The researchers note that microplastics share strikingly similar mechanisms for their adverse health effects, including oxidative stress, inflammation, immune dysfunction, altered biochemical and energy metabolism, impaired cell proliferation, abnormal organ development, disrupted metabolic pathways, and potential carcinogenicity.

"With particular attention to the central nervous system, microplastics and nanoplastics can induce oxidative stress, which may cause cellular damage and increase vulnerability to neuronal disorders," Dr. Fabiano elaborates. "Particularly, microplastics have been demonstrated to influence neurotransmitters such as acetylcholine, γ-aminobutyric acid, and glutamate, which are commonly implicated in neuropsychiatric disorders."

Tracking Microplastic Exposure: The Proposed Dietary Microplastic Index

To study this relationship more systematically, the authors propose the development of a Dietary Microplastic Index (DMI) to quantify exposure through food consumption.

"Similar to the Dietary Inflammatory Index, which is used to assess the inflammatory potential of

a person's diet, or the Nova food classification system, which categorizes foods based on the extent and purpose of industrial processing, a Dietary Microplastic Index can be developed to assess the microplastic content and risk of accumulation based on the foods consumed," says Dr. Marx.

The researchers suggest that such an index could be integrated into existing dietary-based risk indices and nutritional population-based surveys to enable analysis of long-term microplastic exposure via diet and its correlation with adverse mental health outcomes.

Possible Removal Pathways: A Glimmer of Hope

Complementing the viewpoint article is a peer-reviewed Brevia research paper titled "Therapeutic apheresis: A promising method to remove microplastics?" (https://doi.org/10.61373/bm025l.0056) by Professor Stefan Bornstein and colleagues. This paper examines preliminary evidence that extracorporeal therapeutic apheresis—a technique that filters blood outside the body—may have the potential to remove microplastic particles from human circulation.

The study investigated whether therapeutic apheresis could remove microplastic-like particles from the human body. Twenty-one patients with a confirmed diagnosis of myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS) related to a postinfectious syndrome received at least two cycles of therapeutic apheresis with double filtration (INUSpheresis).

"The analysis of the patient eluates showed that 14 different substances or mixtures of substances could be detected only in the eluates from these patients with resemblance to, for example, polyamide 6 and polyurethane," explains Professor Bornstein. "These findings suggest that apheresis may indeed have the capability to remove microplastic-like particles from circulation."

"What we have discovered represents a crucial first step in addressing the microplastic accumulation crisis. While we haveve long known these particles are entering our bodies, this is the first evidence that we may have a clinical intervention to potentially remove them. The implications extend far beyond chronic fatigue syndrome: we could be looking at a therapeutic approach for a wide range of conditions where environmental contaminants play a role in pathogenesis," explains Dr. Charlotte Steenblock, senior author of the study and researcher at the Department of Internal Medicine III at the University Hospital Carl Gustav Carus, Technische Universität Dresden.

The researchers emphasize that while their findings are preliminary, they represent the first evidence that a therapeutic intervention may be capable of removing microplastics from the human body. They call for larger studies with quantitative analyses to confirm the effective removal of microplastics through therapeutic apheresis and to assess correlations with symptom improvement in conditions like ME/CFS.

"Based on our findings, we recommend a larger and comprehensive study on the removal of microplastics using various filter systems with different pore sizes to develop strategies for both preventing uptake and facilitating detoxification of accumulated particles," says Professor Bornstein.

A Cultural Tipping Point: The Viral Spoon

The collection is further contextualized by a powerful guest editorial by Dr. Ma-Li Wong titled "Una cuchara de plástico en tu cerebro: The calamity of a plastic spoon in your brain" (<u>https://doi.org/10.61373/bm025g.0062</u>), which frames the collection of papers as not just a scientific warning but a paradigm shift in how we must think about environmental contaminants and brain health.

Dr. Wong notes that the research has already captured global attention, with the concept of "a plastic spoon in your brain" being echoed in over twenty languages across major media outlets worldwide.

"Spain. South Korea. Argentina. Germany. United Kingdom. New Zealand. Canada. USA. Hong Kong SAR and China—The highest viewed Spanish-language website in the world, having surpassed 100 million unique visitors per month: El País. Four of the top five newspapers in Germany: Frankfurter Allgemeine Zeitung (FAZ), Süddeutsche Zeitung (SZ), Die Welt, Die Zeit. The most circulated newspapers in their countries: Daily Mail and New Zealand Herald. National Post. Washington Post. Newsweek. Associated Press. Miami Herald. South China Morning Post. 163.com. A million impressions within days," Dr. Wong writes.

"It was not science communication," she adds. "It was cultural cognition. People understood this. Deeply. Instinctively."

Implications for Public Health and Policy

The research has profound implications for public health policy, food regulation, and individual dietary choices. The authors collectively emphasize several key recommendations:

1. Reduce consumption of ultra-processed foods: The evidence suggests that shifting away from ultra-processed foods toward whole foods may not only improve mental health through established nutritional pathways but also reduce microplastic exposure.

2. Reconsider food packaging and processing methods: The high concentration of microplastics in ultra-processed foods indicates a need to reevaluate industrial food processing techniques and packaging materials.

3. Avoid heating food in plastic containers: Given the evidence that microwave heating of plastic

releases millions of microplastic particles within minutes, consumers should use glass or ceramic containers for heating food.

4. Support further research: The authors call for more primary research into the specific mechanisms by which microplastics might affect brain health and the development of standardized methods to quantify microplastic content in foods and human tissues.

5. Develop regulatory frameworks: The evidence suggests a need for regulatory consideration of microplastic content in foods and food packaging, similar to regulations for other contaminants.

The Path Forward: Research Priorities

The researchers identify several critical areas for future investigation:

1. Longitudinal epidemiological studies: Research tracking microplastic exposure over time and correlating it with mental health outcomes would provide stronger evidence of causation.

2. Quantification methods: Development of standardized methods to measure microplastic content in foods and human tissues is essential for consistent research.

3. Intervention studies: Clinical trials examining whether reducing microplastic exposure through dietary changes or other interventions improves mental health outcomes.

4. Removal techniques: Further research into methods to remove microplastics from the human body, building on the promising preliminary findings on therapeutic apheresis.

5. Mechanistic studies: More detailed investigation of the specific biological pathways through which microplastics might affect brain function and mental health.

A Call to Action: Beyond Warning to Reckoning

Dr. Wong's editorial frames the collection as a fundamental paradigm shift in our understanding of environmental contaminants and human health.

"What emerges from this work is not a warning. It is a reckoning," writes Dr. Wong. "The boundary between internal and external has failed. If microplastics cross the blood-brain barrier, what else do we think remains sacred?"

The researchers emphasize that while more primary research is needed, their analyses add another dimension to the growing case for reducing ultra-processed food consumption and developing better methods to detect and potentially remove microplastics from the human body. "The scientific debate is currently underway among analytical experts regarding the validity of microplastic detection methodologies in human samples," notes Dr. Wong. "From recent advancements in blood sampling techniques to improved multivariate quantification using non-targeted pyrolysis GC-MS and innovative biosensing approaches, the field is rapidly evolving. These ongoing refinements are essential as we work toward developing standardized methods that yield valid, reproducible, and reliable data, ultimately enabling evidence-based preventive strategies and medical interventions in the future."

## From Laboratory to Leadership

As we conclude this editorial, a striking convergence surfaces. US Health and Human Services (HHS) Secretary Kennedy's recent declaration that "Microplastics are everywhere—in our water, our soil, our food, even our organs" elevates what began as scientific observation into governmental recognition (https://x.com/SecKennedy/status/1924130814318518463). RFK Jr's framing of the crisis not as "pollution" but as "market failure" echoes precisely what our researchers have documented: systems-level collapse requiring systems-level intervention. The Secretary's commitment to "fix the incentives and stop this toxic cycle" represents the policy response our findings demand. Whether through rewarding companies developing sustainable packaging or regulating chemicals near food sources, we are witnessing the rare moment when scientific alarm translates to governance action.

The plastic spoon is no longer just in our brains. It is now on policymakers' desks. What these papers initiated in laboratories may now find completion in legislation. This is how science should work: not as isolated knowledge, but as catalyst for correction. The environment inside us has finally become visible to those with the power to protect it.

## Conclusion: A Paradigm-Shifting Collection

The May 2025 issue of Brain Medicine represents a watershed moment in our understanding of how environmental contaminants, particularly microplastics in ultra-processed foods, may be affecting brain health. The four papers collectively present a compelling case for a previously unrecognized pathway by which dietary choices may impact mental health and cognitive function.

"As the levels of ultra-processed foods, microplastics, and adverse mental health outcomes simultaneously rise, it is imperative that we further investigate this potential association," concludes Dr. Fabiano. "After all, you are what you eat."

The articles on microplastics and brain health from the May 2025 issue of Brain Medicine are available via Open Access at the following URLs:

1. "Human microplastic removal: what does the evidence tell us?" by Fabiano, Luu, and Puder

(https://doi.org/10.61373/bm025c.0020)

2. "Microplastics and mental health: The role of ultra-processed foods" by Fabiano, Luu, Puder, and Marx (<u>https://doi.org/10.61373/bm025v.0068</u>)

3. "Therapeutic apheresis: A promising method to remove microplastics?" by Bornstein et al. (<u>https://doi.org/10.61373/bm025l.0056</u>)

4. "Una cuchara de plástico en tu cerebro: The calamity of a plastic spoon in your brain" by Wong (<u>https://doi.org/10.61373/bm025g.0062</u>)

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