Blood-filtering therapy for high cholesterol also lowered PFAS forever chemicals and plastics in people, study finds

The world's largest apheresis center reports that plastic particles sit inside human tissue and that no one yet knows how the treatment removes the pollutants.

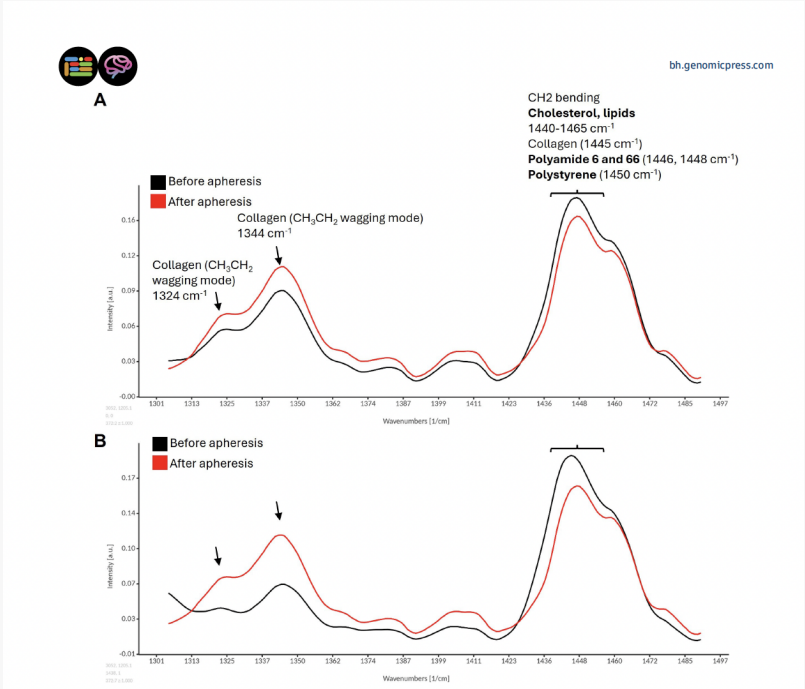


Figure 2. Reduction of cholesterol after apheresis. Using Raman spectroscopy, the levels of cholesterol and associated lipids in patient blood were measured before and after apheresis using two different apheresis systems, such as filtration and adsorption. (A) Inuspheresis. (B) LIPIDsmart™. The Raman peaks characteristic of cholesterol were attenuated after treatment.

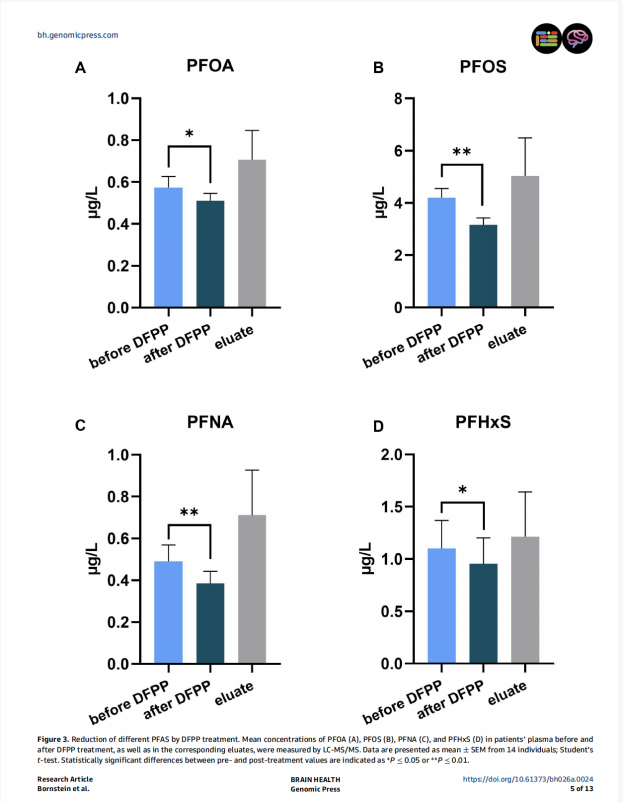
Reduction of cholesterol after apheresis. Using Raman spectroscopy, the levels of cholesterol and associated lipids in patient blood were measured before and after apheresis.

DRESDEN, SAXONY, GERMANY, August 4, 2026 /EINPresswire.com/ -- The machine is not new. Some version of it has run in hospital treatment rooms for about four decades, drawing blood from one arm, separating out the plasma, passing it across a filter or an adsorber, and returning it to the other arm. Physicians call the procedure therapeutic apheresis, and they built it for a narrow purpose: patients whose cholesterol will not come down no matter what they eat. The center at Technische Universität Dresden (Technical University of Dresden) in Germany performs up to 10,000 such treatments a year, the largest such program in the world. What is new is a question the Dresden team asked of the discard bag, reported on 4 August 2026 in the medical research journal Brain Health. If the filter catches fat, and if the pollutants in nearly every human body travel attached to fat, what else is coming out?

The hypothesis behind that question is that these pollutants move through the bloodstream as passengers rather than alone. Consider the scale of the exposure. More than 4700 per- and polyfluoroalkyl substances, known collectively as PFAS and used for decades in nonstick coatings, firefighting foams, and stain-resistant fabrics, are in commercial use or loose in the environment. Biomonitoring finds them in the blood of more than 99 percent of the United States population, and roughly 200 million Americans have been exposed through drinking

water. Their biological half-lives run from 4.8 to 8.5 years, so a compound absorbed at thirty is still measurably present at forty.

And the exposure does not fall where most people assume. A 2018 meta-analysis pooling five human biomonitoring studies found that higher income predicts higher internal PFAS exposure, not lower: a doubling of income was associated with serum PFOS, PFOA, PFNA, and PFHxS roughly 10 to 14 percent higher. Those authors called it the opposite of the environmental justice hypothesis, pointed to diet, particularly fish and seafood in Europe, and to PFAS-treated fabrics, and stated plainly that the exact cause remains unknown (Buekers J, Colles A, Cornelis C, Morrens B, Govarts E, Schoeters G. Socio-Economic Status and Health: Evaluation of Human Biomonitored Chemical Exposure to Per- and Polyfluorinated Substances across Status. Int J Environ Res Public Health. 2018;15(12):2818. DOI: https://doi.org/10.3390/ijerph15122818).



Reduction of different PFAS (per- and polyfluoroalkyl substances) by double-filtration plasmapheresis (DFPP) treatment.

Plastic arrives by a different door and stays just as stubbornly. Individuals are estimated to ingest 39,000 to 52,000 plastic particles a year, rising to between 74,000 and 121,000 once inhalation is counted. Micro- and nanoplastics, meaning fragments small enough to enter the circulation, have been found in human blood, placenta, lung tissue, and brain.

> We did not go looking for this. Apheresis caught per- and polyfluoroalkyl substances (PFAS) and microplastics. Whether the body can be fully cleared of them is the question we can now begin to ask."
>
> *Professor Stefan Bornstein, Technical University of Dresden, Germany*

Now the idea that may fuse two problems into one. PFAS adsorb onto microplastic surfaces at rates up to 250 times higher on environmentally aged plastics, and biophysical work indicates that PFAS partition onto the surfaces of LDL and VLDL, the fat-carrying particles that ferry cholesterol through the blood. From there the paper advances a hypothesis rather than a demonstration: that both classes of pollutant acquire a coat of plasma lipids and proteins, a so-called corona, which would make the resulting particle larger, more stable, and longer lived in the circulation. The authors are explicit that establishing this will require dedicated mechanistic techniques. But the hypothesis makes a prediction testable in patients today. If the pollutants ride on lipoproteins, a machine built to remove lipoproteins at scale should take some

of them along.

What left the blood divided into the expected and the unexpected. The established part held. In 34 individuals sampled immediately before and after each of two double filtration plasmapheresis sessions, a two-stage version of the filtering procedure, C-reactive protein and fibrinogen both fell significantly, at P less than or equal to 0.0001. LDL cholesterol and lipoprotein(a) fell after each session, although the second produced no additional significant reduction. None of that is a surprise. It is the daily business of the unit.

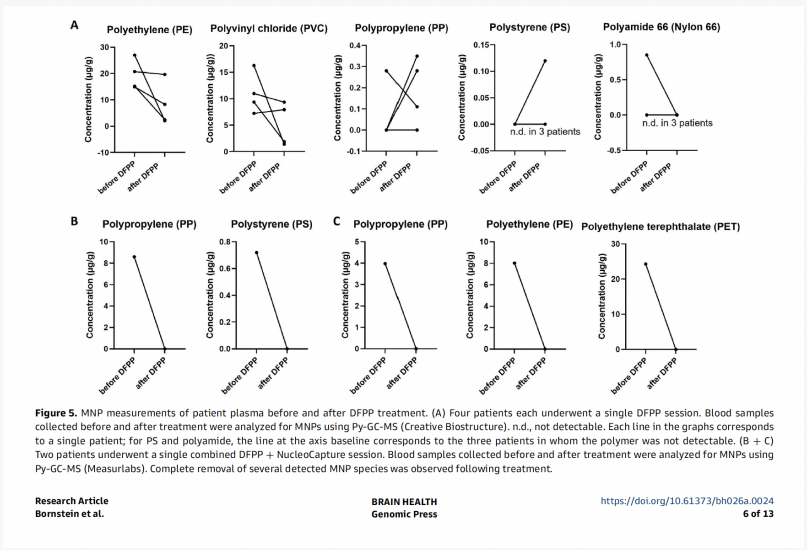


Figure 5. MNP measurements of patient plasma before and after DFPP treatment. (A) Four patients each underwent a single DFPP session. Blood samples collected before and after treatment were analyzed for MNPs using Py-GC-MS (Creative Biostructure). n.d., not detectable. Each line in the graphs corresponds to a single patient; for PS and polyamide, the line at the axis baseline corresponds to the three patients in whom the polymer was not detectable. (B + C) Two patients underwent a single combined DFPP + NucleoCapture session. Blood samples collected before and after treatment were analyzed for MNPs using Py-GC-MS (Measurlabs). Complete removal of several detected MNP species was observed following treatment.

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Micro- and nanoplastics (MNPs) measurements of patient plasma before and after double-filtration plasmapheresis (DFPP) treatment.

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RESEARCH ARTICLE

Therapeutic apheresis: An effective strategy for a combined targeting of circulating lipoproteins, inflammatory markers, PFAS, and microplastics in cardiometabolic and neurodegenerative disease?

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Lipoprotein apheresis is a highly effective and well-established extracorporeal therapy designed to remove lipoproteins from human circulation on a large scale, particularly in patients with progressive cardiovascular diseases when conventional treatments fail to achieve adequate lipoprotein reduction. Beyond its lipid-lowering capabilities, therapeutic apheresis is used to eliminate pathogenic substances, such as autoantibodies and immune complexes, and to exert immunomodulatory effects. Recent research highlights its potential to reduce inflammatory mediators, making it a promising intervention for conditions associated with systemic inflammation, including neurodegenerative diseases and post-infectious syndromes. In addition to its established applications, therapeutic apheresis is being explored as a novel approach to address emerging environmental health challenges, such as the accumulation of per- and polyfluoroalkyl substances (PFAS) and micro- and nanoplastics (MNPs) in living organisms. These pollutants, which are increasingly pervasive in the environment, pose significant health risks, including metabolic disruption, carcinogenesis, and neuroinflammation. Recognizing the urgency of this issue, institutions such as the US Department of Health and Human Services have initiated research programs to develop methods to monitor and remove these contaminants from the human body. Here, our preliminary findings suggest that therapeutic apheresis may represent a promising approach for reducing environmental toxins, alongside its established role in lowering lipoproteins and inflammatory biomarkers, and warrants further systematic clinical investigation. This is based on the hypothesis that PFAS and MNPs form aggregates with lipids and proteins, suggesting that therapeutic apheresis could be an ideal method for clearance. In the initial results, we observed decreases in both PFAS and MNP levels in patient blood and sequestered plasma following double filtration plasmapheresis, although responses varied across individuals and analytes. Tissue and in vitro studies using imaging and functional bioassays may be suitable for demonstrating the potential of apheresis to remove PFAS and MNPs, as well as for assessing the impact of MNPs on cell viability, inflammation, and secretome profiles. These findings could serve as clinical surrogates to guide treatment frequency and evaluate the sustainability of therapeutic apheresis in mitigating health risks associated with environmental pollutants. While larger, well-designed clinical trials are needed to confirm these benefits, these early results could lay the groundwork for future research and clinical applications.

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The new part came from the mass spectrometers. At Medizinisches Labor Bremen, a certified German reference laboratory for environmental toxins, plasma from 14 patients showed reductions of up to 25 percent in perfluorooctanoic acid, perfluorooctane sulfonic acid, perfluorononanoic acid, and perfluorohexane sulfonic acid, with significance ranging from P less than or equal to 0.05 to P less than or equal to 0.001. An independent laboratory, Creative Biostructure, measured four individuals after a single session and found steeper average decreases: 48.9 percent for perfluorooctane sulfonic acid, 43.5 percent for perfluorooctanoic acid, 55.0 percent for perfluorononanoic acid, 75.8 percent for perfluorododecanoic acid, and 47.1 percent for perfluorodecanoic acid. The compounds were also detectable in the eluate, the fraction the machine sets aside and discards.

“We did not go looking for this,” said Stefan R. Bornstein, first and corresponding author, of the Department of Internal Medicine III at University Hospital Carl Gustav Carus, Technische

Universität Dresden. “We have used these systems for years to lower lipoproteins in patients who had no other option. When we finally asked what else was leaving the circulation, two independent laboratories found the same compounds falling in the plasma and turning up in the eluate. It means the machine caught them. It does not yet mean the body is rid of them.”

The plastics proved harder to count than the PFAS. Here the data thin out, and the authors say so plainly. Pyrolysis gas chromatography-mass spectrometry on blood from four patients showed polyethylene decreasing in all four and polyvinyl chloride in three of four. Polypropylene decreased in one patient, increased in two, and was undetectable in the fourth. Polystyrene rose in one patient while polyamide 66 fell. That is not a clean result, and presenting it as one would be a disservice.

Two patients treated with double filtration plasmapheresis plus a selective nucleic acid adsorption device, NucleoCapture, produced something more striking. In one, all detectable polystyrene and polypropylene were removed. In the other, polyethylene, polypropylene, and polyethylene terephthalate. No other plastic species remained detectable in either. With a sample size of two the authors call this suggestive, and offer a testable explanation: some circulating plastic may be bound to extracellular chromatin or vesicles, and so removable by adsorption alongside filtration.

A third approach, Nile Red staining with flow cytometry at the Germans Trias i Pujol Research Institute, found an average reduction of about 70 percent in nanoparticle counts across four patients. That number is arresting and should be handled with tongs. It did not reach significance at that cohort size, and it counts particles without confirming they are plastic, since Nile Red stains hydrophobic substances generally.

Plastic also turned up inside human tissue, not only in the circulation. The circulating measurements are only half of it. Using Raman spectroscopy, a technique that identifies materials by the way they scatter laser light, on human eyelid skin, the team detected and spatially mapped polystyrene particles inside the tissue itself, confirming that these materials do not merely pass through the bloodstream but sit in ordinary human tissue where they can be found and identified. That capability may matter more than any single number here, because it turns tissue burden into something measurable.

A second experiment asked whether the burden does harm. Human adrenal cells of the NCI-H295R line, a standard laboratory cell line, exposed to 30 nanometer polystyrene beads showed a trend toward cell death, measured as lactate dehydrogenase release. Serum drawn before apheresis changed nothing. Serum drawn after apheresis showed a downward trend in that signal. Three replicates. A trend, not a proof.

What the authors refuse to claim deserves as much attention as what they report. The limitations section is unusually candid, and reporters should read it. Sample sizes are small. Patient indications and apheresis systems were heterogeneous. The plastic assays are

exploratory, the field lacks validated standardized methods, and contamination during sampling is a real hazard when the analyte is plastic and the world is full of it. There is no randomized controlled trial and no long-term outcome data. Because patients were not consistently paired across the datasets, the authors state that they cannot claim a shared clearance mechanism.

The most important caveat is temporal. Everything measured here reflects acute post-procedural change in what is circulating. Whether repeated sessions can shift steady-state levels, and what happens to total body burden, remains unknown, and an initial drop may be partly offset by mobilization from tissue reservoirs.

On safety, the record is reassuring without being blank. Therapeutic apheresis is generally considered safe and well tolerated in experienced centers, with adverse events usually mild and transient: hypotension, dizziness, fatigue, nausea, and citrate-related symptoms from anticoagulation-induced hypocalcemia. Allergic reactions occur mainly where donor plasma is used for replacement, which the systems studied here avoid entirely.

The case for taking out the carrier rests on that distinction. Conventional plasma exchange replaces what it removes with donor plasma or albumin, which may itself carry environmental toxins. Double filtration and adsorption remove targeted substances directly, with no replacement fluid and no second exposure. For lowering a toxic burden, the method that does not top the patient back up has a structural advantage.

“For years we treated the lipoprotein as the disease,” said Charlotte Steenblock, senior author, of the Department of Internal Medicine III at University Hospital Carl Gustav Carus, Technische Universität Dresden. “If it proves to be a vehicle as well, the question shifts from whether we can measure these pollutants in people to what happens when we take some of them out.”

The urgency is recognized at the policy level. The Advanced Research Projects Agency for Health, within the United States Department of Health and Human Services, has launched STOMP, a 144 million dollar program to build the toolbox for measuring and affordably removing micro- and nanoplastics from the body.

“Let me be clear about what we have not shown,” Bornstein said. “There is no randomized controlled trial here. We have not demonstrated that apheresis removes plastic already bound in tissue, and whether it can reach those deposits, perhaps through exosomes or other flux mechanisms, is the key question in front of us. Our next step is to expose large animals to micro- and nanoplastics labeled with radiotracers or iron, image them by PET and MRI, and look again after apheresis. None of this displaces the first priority, which remains preventing exposure. Cleaning up afterwards is the harder and more expensive way to solve the problem. And this is not a disease of poverty. Some of the highest levels are carried by the people who can afford the expensive fish.”

What the Dresden group has produced is a first look through a fogged mask, wiped just clear

enough to show there is something down there worth swimming toward.

The peer-reviewed research article in Brain Health titled “Therapeutic apheresis: An effective strategy for a combined targeting of circulating lipoproteins, inflammatory markers, PFAS, and microplastics in cardiometabolic and neurodegenerative disease?” is freely available via Open Access, starting on 4 August 2026 in Brain Health at the following hyperlink: https://doi.org/10.61373/bh026a.0024.

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