PFAS in Me: Which Ones and How Much?

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Introduction

Bioaccumulation of PFAS in the human body resulting from environmental exposure is a growing public health concern. Recent studies have linked PFAS exposure to adverse health outcomes, including childhood health complications, reduction in kidney functions, thyroid disease, hormone suppression, decreased fertility, increased cholesterol levels, and diabetes, among others.

In this study, we combined low volume blood sampling with the SCIEX QTRAP 7500 system for the analysis of trace level of PFAS. We present here a quantitative workflow capable of accurately quantifying sub-ng/mL levels of 42 PFAS compounds. The analysis was performed on the author, and the results of the analysis are shared to demonstrate what PFAS exposure looks like in a typical American.

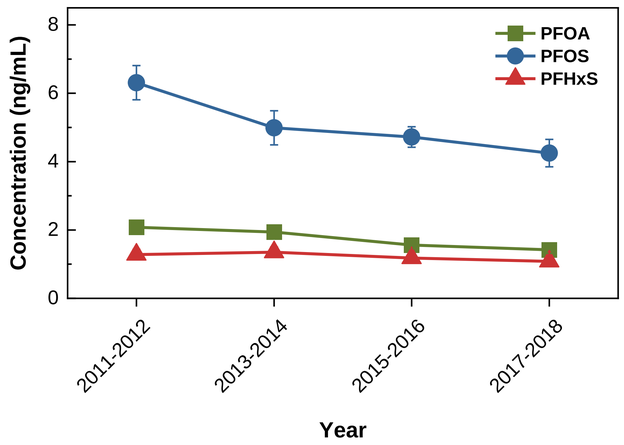


Figure 1. Mean concentration of PFAS in the US population (CDC, NHANES 1999-2018).

What are the current recommendations from the National Academy of Sciences?

≥ 20 (ng/mL) PFAS*

Clinicians should encourage PFAS exposure reduction if a source of exposure is identified, especially for pregnant persons.

In addition to the usual standard of care, clinicians should:
- Prioritize screening for dyslipidemia with a lipid panel (for patients over age 2)
- At all well visits:
  - Assess for signs and symptoms of testicular cancer and ulcerative colitis for patients over 15
  - Conduct thyroid function testing with serum thyroid stimulating hormone (TSH) for patients over age 18
  - Assess for signs and symptoms of kidney cancer including with urinalysis for patients over 45

2 - <20 (ng/mL) PFAS*

Clinicians should encourage PFAS exposure reduction if a source of exposure is identified, especially for pregnant persons. Within the usual standard of care clinicians should:

- Prioritize screening for dyslipidemia with a lipid panel (once between 9 and 11 years of age, and once every 4 to 6 years over age 20).
- Screen for hypertensive disorders of pregnancy at all prenatal visits per the American College of Obstetricians and Gynecologists (ACOG).

<2 (ng/mL) PFAS*

Clinicians should treat patients with serum PFAS concentration below 2 nanograms per milliliter (ng/mL) with the usual standard of care.

*Simple additive sum of MeFOSAA, PFHxS, PFOA, PFDA, PFUDA, PFOS, and PFNA in serum or plasma
**This figure was adapted from the National Academy of Sciences Guidance on PFAS Exposure, Testing, and Clinical Follow-Up (2022)

Figure 2. Guidance for clinicians on exposure determination, PFAS testing and clinical follow-Up (National Academy of Sciences, 2022)

A total of **42 PFAS compounds** were screened for and quantified in serum at **sub-ng/mL**

Key takeaways:

- PFHxS in my sample was 1.5x higher than the average population and may be related to working with aqueous film-forming foams (AFFF) that contained high levels of this compound
- Limited exposure to PFOA and PFOS from drinking water facilities may have contributed to the lower-than-average levels of PFOA and PFOS
- The distribution of linear and branched PFOS was within the expected ratio (Schulz et al., 2020)
- PFOA in human serum is on average 2.9% branched (Schulz et al., 2020). Thus, the amount present in my sample was likely present but below the detection limit

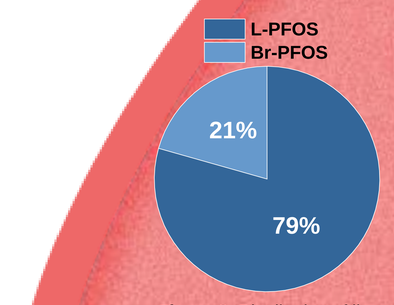


Figure 3. Distribution of linear and branched PFOS.

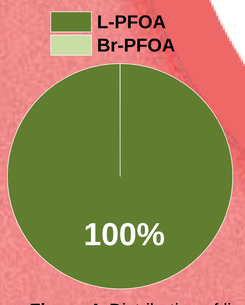


Figure 4. Distribution of linear and branched PFOA.

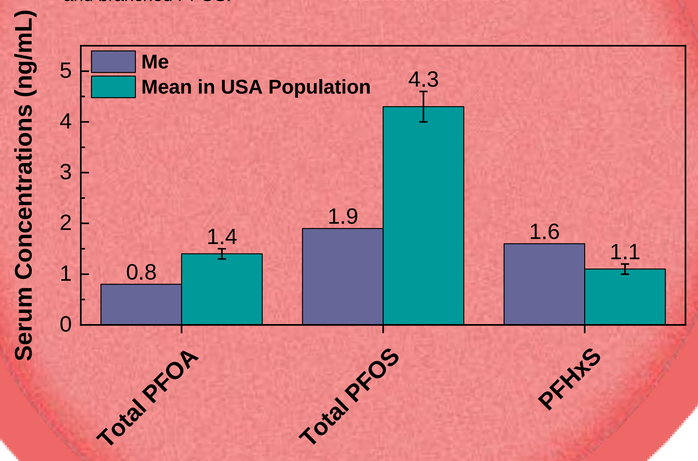


Figure 5. PFAS compounds present in my samples compared to the mean concentration in the United States (CDC, NHANES 1999-2018).

How much PFAS is in you?

Check out all things SCIEX and PFAS here

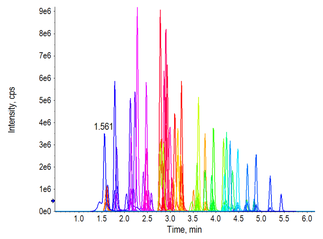
Methods

A finger prick was used to draw capillary blood. The first drop of blood was wiped away with a PFAS-free gauze, and the Mitra device was applied to the subsequent drops of blood.

The Mitra tips contained approximately 30 µL of blood and were placed in polypropylene vials with isotopically labelled internal standards or IDAs (Isotope Dilution Analytes) and acetonitrile to aid with protein removal.

strata™X Polymeric SPE

The extracts were combined, and solid phase extraction (SPE) was performed. Injection internal standards (ISs, or recovery standards) were added to the SPE extract immediately prior to placing it in a new polypropylene vial for analysis.



These extracts were injected onto a Luna Omega PS column at 30°C. Data were collected using a **SCIEX 7500 system** using electrospray ionization (ESI) in negative mode.

REFERENCES

1 CDC (Centers for Disease Control and Prevention) Polyfluoroalkyl Chemicals in the U.S. Population: Data from the National Health and Nutrition Examination Survey (NHANES) 1999–2018 and Comparisons with NHANES 1999–2000 Laboratory Methodology and Public Data Files. 2018.
2 National Academies of Sciences, Engineering, and Medicine. 2022. Guidance on PFAS Exposure, Testing, and Clinical Follow-Up. Washington, DC: The National Academies Press.
3 Schulz, Katarina, Marcia R. Silva, and Rebecca Klaper. "Distribution and effects of branched versus linear isomers of PFOA, PFOS, and PFHxS: a review of recent literature." Science of the Total Environment 733 (2020): 139186.

TRADEMARKS/LICENSING