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PFAS plasma concentrations in mid-childhood were associated with less accrual of lean mass from mid-childhood to early adolescence.

Plasma concentrations of per- and polyfluoroalkyl substances and body composition from mid-childhood to early adolescence

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BACKGROUND

- Per- and polyfluoroalkyl substances (PFAS) may alter body composition by lowering anabolic hormones and increasing inflammation.
- Prior studies have found positive, inverse, and null associations of PFAS concentrations with adiposity among children and adolescents.
- Few studies have examined associations of PFAS concentrations with changes in body composition longitudinally.
- No study has examined the association of PFAS plasma concentrations with lean mass.

METHODS

- We studied 426 children in Project Viva, a pre-birth, Boston-area cohort.
- Exposures:** Plasma concentrations of six PFAS quantified by mass spectrometry in mid-childhood (mean age 8y).
- Outcomes:** Changes in dual-energy X-ray absorptiometry measures of total fat mass, truncal fat mass, and lean mass from mid-childhood to early adolescence (mean age 13y).
- We examined associations of individual PFAS with changes in body composition using covariate-adjusted linear regression.
- We examined associations of the PFAS mixture with changes in body composition using covariate-adjusted Bayesian kernel machine regression (BKMR).
- All models were adjusted for child age at mid-childhood visit, race/ethnicity, sex, and calendar year of blood draw; and maternal age at enrollment and gestational weight gain.

CONCLUSIONS

- Children with higher plasma concentrations of PFOS and PFHxS had less accrual of total and truncal fat mass, and children with higher concentrations of PFOS, PFOA, PFHxS, and PFDA had less accrual of lean mass from mid-childhood to early adolescence.
- Children with greater PFAS mixture concentrations had less accrual of lean mass from mid-childhood to early adolescence.
- These findings are important because lean mass tracks from adolescence to adulthood, and low lean mass has been associated with lower bone mineral density and adverse cardiometabolic health.

RESULTS

Table 1. Select characteristics of overall cohort (n=426).

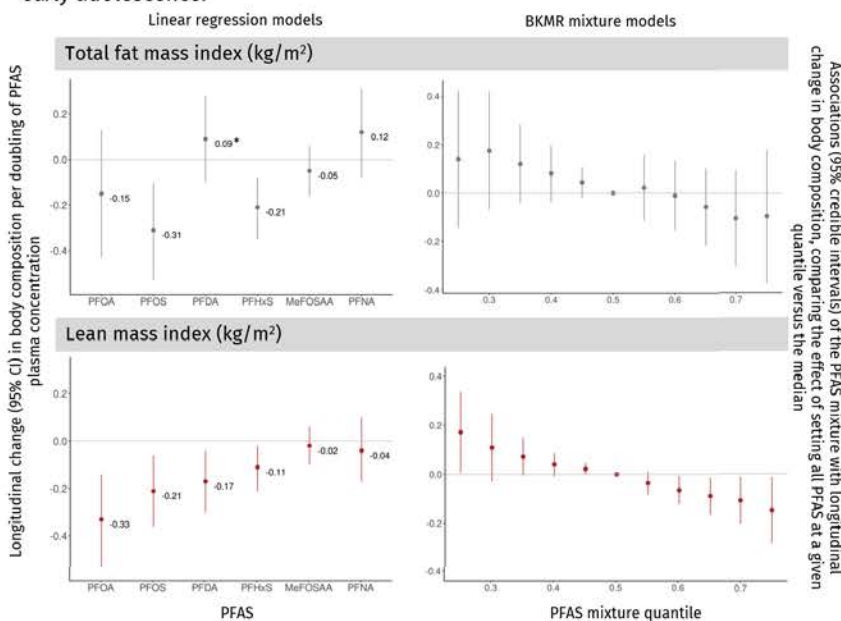
Characteristic	%
Female	49%
Race/ethnicity	
Non-Hispanic Black	21%
Non-Hispanic White	59%
Hispanic	6%
Asian	2%
Other	12%
College-educated mother	67%

Table 2. Median (IQR) and Spearman correlation coefficients of PFAS plasma concentrations in mid-childhood.

	PFOA	PFOS	PFDA	PFHxS	MeFOSAA	PFNA
Median (IQR), ng/mL	4.5 (3.3)	6.5 (5.9)	0.3 (0.3)	1.9 (2.4)	0.3 (0.5)	1.5 (1.2)
Spearman correlation coefficients						
PFOA	1.00					
PFOS	0.77	1.00				
PFDA	0.69	0.57	1.00			
PFHxS	0.57	0.64	0.34	1.00		
MeFOSAA	0.49	0.64	0.32	0.35	1.00	
PFNA	0.45	0.33	0.59	0.12	0.19	1.00

Abbreviations: PFOA, perfluorooctanoate; PFOS, perfluorooctane sulfonate; PFDA, perfluorodecanoate; PFHxS, perfluorohexane sulfonate; MeFOSAA, N-methyl-perfluorooctane sulfonamido acetate; PFNA, perfluorononanoate; IQR, interquartile range.

Figure 1. Covariate-adjusted associations of PFAS plasma concentrations in mid-childhood with changes in body composition from mid-childhood to early adolescence.



Longitudinal change (95% CI) in body composition per doubling of PFAS plasma concentration

Associations (95% credible intervals) of the PFAS mixture with longitudinal change in body composition, comparing the effect of setting all PFAS at a given quantile versus the median

We log_e-transformed PFAS concentrations. We examined but did not include several covariates that did not materially change effect estimates, including maternal prenatal PFAS plasma concentrations, parental body mass index, breastfeeding duration, and dietary intake of dairy, soda, fast food, meat, and fish. All findings for change in truncal fat mass index were similar to total fat mass index findings. * Sex*PFDA interaction term p<0.05, with greater accrual of total fat mass among boys only. There was no effect modification by sex for other PFAS, though associations of PFAS with less accrual of fat and lean mass tended to be stronger among girls in stratified analyses.