**Online Supplement**

**Early life exposure to F-53B induces neurobehavioral changes in developing children and disturbs dopamine-dependent synaptic signaling in weaning mice**

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**F-53B Measurement**

**Standards and Reagents**

We purchased F-53B standards from Wellington Laboratories (Guelph, ON, Canada). Serum F-53B concentrations were analyzed using Formic acid (high-performance liquid chromatography, HPLC grade, >98%), ammonium formate (>99%), and ammonium hydroxide (28.0-30.0%), purchased form Sigma-Aldrich (Milwaukee, WI). Among HPLC grade, methanol and acetonitrile were purchased from Burdick & Jackson (Honeywell International Inc., USA) and Fischer Scientific (Thermo Fisher Scientific Inc., USA), respectively. Distilled water was acquired from Milli-Q (EPED, China).

**Sample Extraction**

Samples were prepared and analyzed, as described previously ([Chu et al., 2020](#_ENREF_3)). Briefly, 2 mL 0.1 M formic acid was added to 0.2 mL serum after the addition of 0.5 ng mixture of isotope-labeled internal standards. The Oasis-HLB cartridge underwent excitation with 2 mL methanol after the addition of 2 mL 0.1 M formic acid. Then, the prepared serum was loaded into the column and washed with 3 mL 0.1 M formic acid, 6 mL 50% 0.1 M formic acid/ 50% methanol, and 1 mL 1% ammonium hydroxide, in that order. The cartridge was dried via vacuum. Then, 2 mL of 1% ammonia acetonitrile was added for elution. Finally, the eluate was reconstituted with a mixture of 70 μL methanol and 30 μL 20 mM ammonium formate, then samples were prepared for detection.

**Quality Control**

F-53B concentrations in the samples were obtained using an internal standard method. Nine calibration curve points were used, between 0.05 and 100 ng/mL, and the coefficient of determination (r2) for each calibration was higher than 0.99. A method blank (calf serum) was extracted with each batch of 22 samples to monitor for any method contamination. We had two kinds of experimental blanks with different matrices in our analysis. One solvent blank (70% methanol/30% water) was injected after every 12 samples to monitor for possible carryover of the instrument. One was a method blank with the commercial calf serum as the matrix to monitor the possible contamination during extraction procedure. Two quality control standard solutions were run to check the instrumental response and drift along with 12 samples. The limit of detection (LOD) of each compound was defined as the minimum detectable concentration with a signal-to-noise ratio of 3 (S/N = 3) in a serum sample. The concentration value below the detection limit would be replaced by LOD /√2 ([Davis et al., 1991](#_ENREF_4)). Materials used in the experiment were immersed in methanol for more than 4 hours to reduce any background effect.

**Table S1.** The WCST index.

|  |  |  |
| --- | --- | --- |
| Index | Meaning | Direction |
| CC | The number of classifications completed after the survey. Its value ranges from 0 to 6, indicating cognitive function. It used to measure the degree to which subjects master concepts classified into different categories. |  |
| CR | The correct number of responses. It indicates that all responses in line with the required response principle. |  |
| PCR | The percentage of correct responses to the total number of responses. It can reflect the ability to abstract and summarize. |  |
| PCLR | The total number of consecutive 3-10 correct responses in the whole survey process, as a percentage of the total number of responses. Low score indicates poor insight of concept formation. |  |
| L-L | Only when three or more classifications have been completed can they be calculated as the average of the difference in the percentage of false responses between two adjacent classifications. The low score indicates that the previous experience cannot be effectively applied, indicating that the learning ability has certain obstacles. |  |
| RA | 128 cards used up or the number of responses used to complete the six categories.  |  |
| RE | The number of incorrect responses during the inspection process, that is, all responses that do not meet the required response principles.  |  |
| PE | It means that after the change of the classification principle, the subject can’t give up the old classification principle, stubbornly continue to classify according to the original classification principle. It can reflect the problems of concept formation─ the use of correction and the plasticity of concept. These results suggest that frontal lobe function is impaired. |  |
| PPE | Persistent errors as a percentage of total responses. high score indicates brain frontal lobe function damage. |  |
| NPE | The difference between the total number of errors and the number of persistent errors. high score indicates inattention or confusion. |  |
| PNPE | Non-persistent errors as a percentage of total responses. high score indicates inattention or confusion. |  |
| PR | It indicates that it is wrong for participants to classify according to a certain attribute, but still used this method. It is the best indicator for brain damage and cognitive transfer ability. |  |

Abbreviations: WCST, Wisconsin card sorting test; CC, Categories completed; CR, Correct response; PRC: Percent correct response; PCLR, percent conceptual level response; L-L, Learning to learn; FMS, Failure to maintain set; RA, Response administered; RE, Response errors; PE, Perseverative errors; PPE, Percent perseverative errors; NPE, Non-perseverative errors; PNPE, Percent non-perseverative errors; PR, Perseverative response.

Bepositive with working memory/executive ability.

Be negative with working memory/executive ability.

**Table S2.** Descriptive statistic on pollutants and WCST index.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | Full name | LOD (ng/mL) | Detectable ratio | Min | 25th | Median | 75th | Max | IQR |
| Pollutant (ng/mL) |  |  |  |  |  |  |  |  |  |
| a F-53B | chlorinated polyfluorinated ether sulfonic acids (Cl-PFESAs) | / | / | 0.00 | 0.74 | 1.12 | 1.82 | 11.59 | 1.07 |
| 6:2 Cl-PFESA | Potassium 9-chloroeicosafluoro-3- oxanonane-1-sulfonate | 0.002 | 99.04% | 0.00 | 0.72 | 1.10 | 1.76 | 10.18 | 1.03 |
| 8:2 Cl-PFESA | Potassium 11-chloroeicosafluoro-3- oxaundecane-1-sulfonate | 0.001 | 78.93% | 0.00 | 0.01 | 0.02 | 0.04 | 1.41 | 0.03 |
| WCST test index |  |  |  |  |  |  |  |  |  |
|  CC | Categories completed | / | / | 0 | 3 | 5 | 6 | 6 | 3 |
|  CR | Correct response | / | / | 10 | 64 | 74 | 83 | 106 | 19 |
|  PCR | Percent correct response |  | / | 7.81 | 53.12 | 65.54 | 75.00 | 89.86 | 21.88 |
|  PCLR | percent conceptual level response | / | / | 0.00 | 45.51 | 60.16 | 71.88 | 87.67 | 26.38 |
|  L-L | Learning to learn | / | / | 0.00 | 0.02 | 0.06 | 0.18 | 3.15 | 0.16 |
|  RA | Response administered | / | / | 69.00 | 111.25 | 128.00 | 128.00 | 128.00 | 16.75 |
|  RE | Response errors | / | / | 7 | 28 | 44 | 60 | 118 | 32 |
|  PE | Perseverative errors | / | / | 0 | 5 | 6 | 8 | 18 | 3 |
|  PPE | Percent perseverative errors | / | / | 0.00 | 3.91 | 5.47 | 6.58 | 14.06 | 2.67 |
|  NPE | Non-perseverative errors | / | / | 2 | 21 | 38 | 54 | 114 | 33 |
|  PNPE | Percent non-perseverative errors | / | / | 2.90 | 19.14 | 29.69 | 42.19 | 89.06 | 23.05 |
|  PR | Perseverative response | / | / | 5 | 10 | 14 | 22 | 98 | 12 |

a F-53B values represent summed concentrations of 6:2 Cl-PFESA and 8:2 Cl-PFESA.

Abbreviations: WCST, Wisconsin card sorting test; CC, Categories completed; CR, Correct response; PRC: Percent correct response; PCLR, percent conceptual level response; L-L, Learning to learn; FMS, Failure to maintain set; RA, Response administered; RE, Response errors; PE, Perseverative errors; PPE, Percent perseverative errors; NPE, Non-perseverative errors; PNPE, Percent non-perseverative errors; PR, Perseverative response.

**Table S3.** Primers used for qRT-PCR.

|  |  |  |
| --- | --- | --- |
| Name | Forward primer | Reverse primer |
| β-Actin | CGAGCAGGAGATGGGAACC | CAACGGAAACGCTCATTGC |
| BDNF | CGACGACATCACTGGCTGACAC | GAGGCTCCAAAGGCACTTGACTG |
| NGF | TTCCTCACCCAGAACTCCACCAG | CCAATGAAGCACGAGCCAGTCC |
| NT-3 | CAGGGAACCAGAGCAGGGAGAG | AATTGTAGCGTCTCTGTTGCCGTAG |
| NT-4/5 | TCCTGGGCTCCATCCTGAACATC | TCATACAGACAAGGCTGGCTTCAAC |
| TH | AGTTTGACCCTGACCTGGACCTG | ATTGGCTCACCCTGCTTGTATTGG |
| DDC | TCGCCACCTCCTCTTCAGTTCG | ATCCACCATCTCCTTGCCTCTCC |
| VMAT2 | CCCGTCGGTGATGATGAAGAATCTG | AGCAATGGATGGCGTGACTAAGAC |
| DAT | TACGGTGTCCAGCAATTCAGTGATG | GACCACGACCACATACAGAAGGAAG |
| MAO-A | CAAGAGCCTGAGTCCAAGGATGTTC | ACAAAGCAGAGAAGAGCCACAGAAG |
| MAO-B | CCCGTCGGTGATGATGAAGAATCTG | AGCAATGGATGGCGTGACTAAGAC |
| COMT | CGGTACTGTCACCAGCAACTCATAC | ATCCATCTGCCTCTGCCTCCTG |
| Drd1 | GCAGCCTTCATCCTGATTAGCGTAG | CAGTTGTCATCCTCGGCATCTTCC |
| Drd2 | CCACTCCGCCACTTCTTGACATAC | CACTGGTCCAAGGCTCAACTTCC |
| Drd3 | GCCATCAGCATAGACAGGTACACAG | CAGCACCCACACAGCCGTAATC |
| Drd4 | CTGGTGCTGCCTCTCTTTGTCTAC | CACGAACCTGTCCACGCTGATG |
| Drd5 | CTCCACTGCTTCCATCCTGAATCTG | GGCTACACGCTGGGTCATCTTG |
| GAP-43 | CCGAGGCTGACCAAGAACATGC | GGTAGGAGAGGACAGGCTCACAC |
| PSD95 | GCTATGAGACGGTGACGCAGATG | GTTGGCACGGTCTTTGGTAGGC |
| SYP | TGGTTTGGAGGGTGAGCGAAATG | AGGGCAGAGAAAGGGTGGAGAAG |

**Table S4.** Basic information (Mean ± SE).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Index | Control(n=6) | 4 μg/L(n=5) | 40 μg/L(n=6) | 400 μg/L (n=8) |
| Pre-pregnancy weight (g) | 19.08 ± 0.58 | 19.62 ± 0.97 | 19.62 ± 0.90 | 19.43 ± 0.69 |
| Delivery weight (g) | 34.28 ± 2.68 | 34.00 ± 4.23 | 36.56 ± 0.79 | 35.66 ± 2.29 |
| Ponderal growth (g) | 15.20± 3.12 | 14.38 ± 3.96 | 16.94 ± 0.63 | 16.23 ± 2.41 |
| Pregnancy period (d)Average litter number | 20.17 ± 1.944.83 ± 2.14 | 19.8 ± 1.106.00 ± 3.39 | 18.83 ± 1.177.33 ± 0.52\*\* | 19.38± 2.077.63 ± 0.92 \*\* |
| weaning mice birth weight (g) | 1.39 ± 0.03 | 1.36 ± 0.03 | 1.40 ± 0.02 | 1.27 ± 0.02 \*\*##&& |

Ponderal growth = Delivery weight – Pre-pregnancy weight

Data were expressed as Mean ± SE. One-way analysis of variance (ANOVA) followed by least significant difference (LSD) was used, and \**P*<0.05, \*\**P*<0.01 versus control. #*P*<0.05, ##*P*<0.01 versus 4μg/L.&*P*<0.05, &&*P*<0.01 versus 40 μg/L.

**Table S5.** Organ coefficient of maternal mice (Mean ± SE).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Organ coefficient | Control（n=6）c | 4 μg/L(n=5) | 40 μg/L(n=6) | 400 μg/L (n=8) |
| heart | 0.63 ± 0.06 | 0.67 ± 0.12 | 0.62 ± 0.07 | 0.58 ± 0.10 |
| liver | 5.40 ± 0.83 | 6.09 ± 0.70 | 5.91 ± 0.52 | 5.70 ± 0.95 |
| stomach | 1.31± 0.36 | 1.26 ± 0.30 | 1.58 ± 0.40 | 1.20 ± 0.22 |
| thymuslung | 0.19 ± 0.030.58 ± 0.07 | 0.17 ± 0.090.66 ± 0.06 | 0.23 ± 0.110.61 ± 0.08 | 0.20 ± 0.040.58 ± 0.11 |
| kidney | 1.37 ± 0.15 | 1.39 ± 0.08 | 1.32 ± 0.06 | 1.12 ± 0.45 |
| spleen | 0.33 ± 0.09 | 0.36 ± 0.03 | 0.33 ± 0.05 | 0.31 ± 0.04 |
| brain | 1.97 ± 0.24 | 1.91 ± 0.39 | 3.60 ± 1.37\*\*## | 2.56 ± 1.19 |

Organ coefficient = (organ weight / body weigh) \* 100 %

Data were expressed as Mean ± SE. One-way analysis of variance (ANOVA) followed by least significant difference (LSD) was used, and \**P*<0.05, \*\**P*<0.01 versus control. #*P*<0.05, ##*P*<0.01 versus 4μg/L. &*P*<0.05, &&*P*<0.01 versus 40 μg/L.

**Table S6.** Organ coefficient of weaning mice (Mean ± SE).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Organ coefficient | Control（n=10） | 4 μg/L(n=10) | 40 μg/L(n=10) | 400 μg/L (n=10) |
| heart | 0.66 ± 0.06 | 0.65 ± 0.06 | 0.68 ± 0.07 | 0.61 ± 0.05& |
| liver | 5.95 ± 0.52 | 5.62 ± 0.50 | 5.62 ± 0.30 | 6.12 ± 0.91 |
| stomach | 1.27± 0.36 | 2.36 ± 0.98\*\* | 1.75 ± 0.70 | 1.62 ± 0.46# |
| thymuslung | 0.53 ± 0.040.84 ± 0.09 | 0.55 ± 0.050.81 ± 0.09 | 0.50 ± 0.060.87 ± 0.14 | 0.49 ± 0.09#0.85 ± 0.18 |
| kidney | 1.44 ± 0.28 | 1.35 ± 0.09 | 1.33 ± 0.08 | 1.37 ± 0.13 |
| spleen | 0.36 ± 0.03 | 0.34 ± 0.02 | 0.36 ± 0.19 | 0.40 ± 0.06 |
| brain | 3.29 ± 1.05 | 4.59 ± 1.11\*\* | 3.80 ± 0.36 | 4.28 ± 0.93\* |

Organ coefficient = (organ weight / body weigh) \* 100 %

Data were expressed as Mean ± SE. One-way analysis of variance (ANOVA) followed by least significant difference (LSD) was used, and \**P*<0.05, \*\**P*<0.01 versus control. #*P*<0.05, ##*P*<0.01 versus 4μg/L. &*P*<0.05, &&*P*<0.01 versus 40 μg/L.

**Table S7.** Published studies on serum F-53B concentration among newborn and general population.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference | Pollutant | City | Age(years) | number | Sample | Median(ng/mL) | Min(ng/mL) | Max(ng/mL) |
| Newborn |
| ([Li et al., 2021](#_ENREF_13)) | 6:2 Cl-PFESA | Beijing | newborn | 84 | core serum | N/A | N/A | N/A |
| ([Cai et al., 2020](#_ENREF_1)) | 6:2 Cl-PFESA | Maoming | newborn | 424 | core serum | 0.32 | 0.17 a | 0.49 b |
| ([Chen and Yin, 2017](#_ENREF_2)) | 6:2 Cl-PFESA | Wuhan | newborn | 32 | core serum | 0.6 | 0.1 | 2.64 |
| ([Xu et al., 2019](#_ENREF_24)) | 6:2 Cl-PFESA | Hangzhou | newborn | 98 | core serum | 0.731 | N/A | N/A |
| ([Liu et al., 2021](#_ENREF_16)) | 6:2 Cl-PFESA | Wuhan | newborn | 942 | core serum | 0.74 | 0.50 a | 1.08b |
| ([Liu et al., 2020](#_ENREF_15)) | 6:2 Cl-PFESA | Wuhan | newborn | 374 | core serum | 0.78 | 0.54a | 1.13 b |
| ([Pan et al., 2017b](#_ENREF_21)) | 6:2 Cl-PFESA | Wuhan | newborn | 100 | core serum | 0.8 | 0.3 a | 2.13 b |
| **This study** | **6:2 Cl-PFESA** | **Guangzhou** | **6-11** | **314** | **serum** | **1.10** | **0.72 a** | **1.76 b** |
| ([Lin et al., 2020](#_ENREF_14)) | 6:2 Cl-PFESA | Beijing | newborn | 117 | core serum | 1.57 | N/A | N/A |
|  |  |  |  |  |  |  |  |  |
| ([Li et al., 2021](#_ENREF_13)) | 8:2 Cl-PFESA | Beijing | newborn | 84 | core serum | N/A | N/A | N/A |
| ([Liu et al., 2021](#_ENREF_16)) | 8:2 Cl-PFESA | Wuhan | newborn | 942 | core serum | N/A | N/A | N/A |
| ([Cai et al., 2020](#_ENREF_1)) | 8:2 Cl-PFESA | Maoming | newborn | 424 | core serum | < LOD | 0.008 | 0.01 **b** |
| ([Chen and Yin, 2017](#_ENREF_2)) | 8:2 Cl-PFESA | Wuhan | newborn | 32 | core serum | 0.01 | <MLQ | 0.08 |
| ([Lin et al., 2020](#_ENREF_14)) | 8:2 Cl-PFESA | Beijing | newborn | 117 | core serum | 0.0177 | N/A | N/A |
| **This study** | **8:2 Cl-PFESA** | **Guangzhou** | **6-11** | **314** | **serum** | **0.02** | **0.01 a** | **0.04 b** |
| ([Xu et al., 2019](#_ENREF_24)) | 8:2 Cl-PFESA | Hangzhou | newborn | 98 | core serum | 0.021 | N/A | N/A |
| ([Liu et al., 2020](#_ENREF_15)) | 8:2 Cl-PFESA | Wuhan | newborn | 374 | core serum | 0.03 | 0.02 a | 0.05 b |
| ([Pan et al., 2017b](#_ENREF_21)) | 8:2 Cl-PFESA | newborn | newborn | 100 | core serum | 0.03 | 0.01 a | 0.07 b |
| General population |
| ([Gao et al., 2018](#_ENREF_6)) | 6:2 Cl-PFESA | Wuhan | N/A | 15 | serum | N/A | < LOD | 0.73 |
| **This study** | **6:2 Cl-PFESA** | **Guangzhou** | **6-11** | **314** | **serum** | **1.10** | **0.72 a** | **1.76 b** |
| ([Jin et al., 2020b](#_ENREF_10)) | 6:2 Cl-PFESA | Beijing | 3-91 | 263 | serum | 1.4 | < LOD | 7.66 |
| ([Kang et al., 2020](#_ENREF_12)) | 6:2 Cl-PFESA | Beijing | Adult | 28 | serum | 1.55 | 0.448 | 4.34 |
| ([Jin et al., 2020c](#_ENREF_11)) | 6:2 Cl-PFESA | Shenzhen | 14-73 | 103 | serum | 1.57 | < LOD | 20.6 |
| ([Jin et al., 2020c](#_ENREF_11)) | 6:2 Cl-PFESA | Shijiazhuang | 18-82 | 307 | serum | 1.59 | 0.159 | 24.7 |
| ([Mi et al., 2020](#_ENREF_18)) | 6:2 Cl-PFESA | Shenyang | 34-94 | 1238 | serum | 1.754 | 1.19a | 2.528b |
| ([Gao et al., 2016](#_ENREF_7)) | 6:2 Cl-PFESA | Wuhan | N/A | 15 | serum | 1.8 | < LOD | 4.3 |
| ([You et al., 2022](#_ENREF_26)) | 6:2 Cl-PFESA | Shenyang | 49-77 | 1038 | serum | 1.98 | 1.19 a | 3.02 b |
| ([Yao et al., 2020](#_ENREF_25)) | 6:2 Cl-PFESA | Huantai | 0-96 | 977 | serum | 2.311 | 0.058 | 29.91 |
| ([Jin et al., 2020c](#_ENREF_11)) | 6:2 Cl-PFESA | Jinan | 19-88 | 254 | serum | 2.53 | < LOD | 500 |
| ([Jin et al., 2020c](#_ENREF_11)) | 6:2 Cl-PFESA | Wuhan | 16-82 | 284 | serum | 3.01 | <LOD | 73.7 |
| ([Han et al., 2021](#_ENREF_8)) | 6:2 Cl-PFESA | Jinan | 25-74 | 153 | serum | 3.28 | 1.98 a | 5.10 b |
| ([Jin et al., 2020a](#_ENREF_9)) | 6:2 Cl-PFESA | Anji | 18-70 | 85 | serum | 3.7 | <LOD | 25.0 |
| ([Jin et al., 2020c](#_ENREF_11)) | 6:2 Cl-PFESA | Tianjin | 2-78 | 114 | serum | 3.83 | <LOD | 204 |
| ([Pan et al., 2017a](#_ENREF_20)) | 6:2 Cl-PFESA | Huantai | N/A | 48 | serum | 4.19 | 1.49 a | 9.84 b |
| ([Liu et al., 2022](#_ENREF_17)) | 6:2 Cl-PFESA | Guangzhou | 45-71 | 1303 | serum | 4.48 | 2.05 a | 7.75 b |
| ([Shi et al., 2016](#_ENREF_22)) | 6:2 Cl-PFESA | Wuhan | N/A | 8 | serum | 4.78 | 1.87 | 5.94 |
| ([Jin et al., 2020c](#_ENREF_11)) | 6:2 Cl-PFESA | Shouguang | 1-88 | 191 | serum | 4.87 | 0.276 | 32.7 |
| ([Wang et al., 2018](#_ENREF_23)) | 6:2 Cl-PFESA | Nanjing | 2-81 | 223 | serum | 5.677 | 0.094 | 319.69 |
| ([Pan et al., 2019](#_ENREF_19)) | 6:2 Cl-PFESA | Nanjing | 24-35 | 664 | serum | 6.088 | 0.441 | 96.06 |
| ([Duan et al., 2020](#_ENREF_5)) | 6:2 Cl-PFESA | Tianjin | 19-87 | 252 | serum | 8.64 | 3.39 a | 22.3 b |
|  |  |  |  |  |  |  |  |  |
| ([Han et al., 2021](#_ENREF_8)) | 8:2 Cl-PFESA | Jinan | 25-74 | 153 | serum | N/A | N/A | N/A |
| ([Gao et al., 2018](#_ENREF_6)) | 8:2 Cl-PFESA | Wuhan | N/A | 15 | serum | <LOD | N/A | <LOD |
| ([Gao et al., 2016](#_ENREF_7)) | 8:2 Cl-PFESA | Wuhan | N/A | 15 | serum | <LOD | <LOD | <LOD |
| ([Jin et al., 2020c](#_ENREF_11)) | 8:2 Cl-PFESA | Shenzhen | 14-73 | 103 | serum | <LOD | <LOD | <LOD |
| ([Jin et al., 2020b](#_ENREF_10)) | 8:2 Cl-PFESA | Beijing | 3-91 | 263 | serum | <LOD | <LOD | 0.199 |
| ([Jin et al., 2020c](#_ENREF_11)) | 8:2 Cl-PFESA | Wuhan | 16-82 | 284 | serum | <LOD | <LOD | 0.828 |
| ([Jin et al., 2020c](#_ENREF_11)) | 8:2 Cl-PFESA | Shijiazhuang | 18-82 | 307 | serum | <LOD | <LOD | 1.01 |
| ([Jin et al., 2020c](#_ENREF_11)) | 8:2 Cl-PFESA | Shouguang | 1-88 | 191 | serum | <LOD | <LOD | 1.99 |
| ([Duan et al., 2020](#_ENREF_5)) | 8:2 Cl-PFESA | Tianjin | 19-87 | 114 | serum | <LOD | <LOD | 2.79 |
| ([Jin et al., 2020c](#_ENREF_11)) | 8:2 Cl-PFESA | Jinan | 19-88 | 254 | serum | <LOD | <LOD | 67.5 |
| ([You et al., 2022](#_ENREF_26)) | 8:2 Cl-PFESA | Shenyang | 49-77 | 1038 | serum | 0.01 | 0.001 a | 0.03 b |
| ([Mi et al., 2020](#_ENREF_18)) | 8:2 Cl-PFESA | Shenyang | 34-94 | 1238 | serum | 0.011 | 0.001 a | 0.025 b |
| ([Kang et al., 2020](#_ENREF_12)) | 8:2 Cl-PFESA | Beijing | Adult | 28 | serum | 0.017 | 0.0005 | 0.105 |
| **This study** | **8:2 Cl-PFESA** | **Guangzhou** | **6-11** | **314** | **serum** | **0.02** | **0.01 a** | **0.04 b** |
| ([Yao et al., 2020](#_ENREF_25)) | 8:2 Cl-PFESA | Huantai | 0-96 | 977 | serum | 0.029 | <LOD | 1.764 |
| ([Liu et al., 2022](#_ENREF_17)) | 8:2 Cl-PFESA | Guangzhou | 45-71 | 1303 | serum | 0.03 | 0.01 a | 0.06 b |
| ([Jin et al., 2020c](#_ENREF_11)) | 8:2 Cl-PFESA | Tianjin | 2-78 | 252 | serum | 0.06 | <LOD | 0.26 b |
| ([Pan et al., 2017a](#_ENREF_20)) | 8:2 Cl-PFESA | Huantai | N/A | 48 | serum | 0.06 | 0.02 a | 0.19 b |
| ([Jin et al., 2020a](#_ENREF_9)) | 8:2 Cl-PFESA | Anji | 18-70 | 85 | serum | 0.068 | <LOD | 1.2 |
| ([Pan et al., 2019](#_ENREF_19)) | 8:2 Cl-PFESA | Nanjing | 24-35 | 664 | serum | 0.081 | <LOD | 3.769 |
| ([Shi et al., 2016](#_ENREF_22)) | 8:2 Cl-PFESA | Wuhan | N/A | 8 | serum | 0.083 | 0.036 | 0.105 |
| ([Wang et al., 2018](#_ENREF_23)) | 8:2 Cl-PFESA | Nanjing | 2-81 | 223 | serum | 0.098 | <LOD | 9.377 |

Note: LOD, limit of detection; MLQ, limit of quantification; a, 25th; b, 75th; N/A, not available.

**Table S8.** The concentrations of F-53B in pregnant and weaning mice.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | Placenta ( μg/mg) a | Fetal liver ( μg/mg) a | Breast milk ( μg/mL) a | Serum ( μg/mL) b |
| Control | ND | ND | ND | ND |
| 4 μg/L | 2.58 ± 1.98 | 0.08 ± 0.03 | 3.91 ± 0.00 | N/A |
| 40 μg/L | 2.23 ± 0.82 | 0.33 ± 0.05 | 25.40 ± 6.43 | 10.62 ± 7.38 |
| 400 μg/L | N/A | N/A | 95.36 ± 47.09 | 22.72 ± 14.49 |

Note: ND, Not detected; N/A: Not applicable; a Pregnant mice (GD14，n=2~6)；b Weaning mice (PND21, n=3~6); Data were expressed as Mean ± SE.

 F-53B values represent the concentration of 6:2 Cl-PFESA, the main component of F-53B.

337 elementary students selected from Guangzhou, Guangdong Province, China.

(173 boys, 141 girls)

No

Excluded, n=17

Complete WCST

Yes

No

Excluded, n=6

Complete basic information

Yes

Population for final analysis

N=314

**Figure S1.** Flow-chart presenting the selection process of the participants.



**Figure S2.** Flow-chart of the animal experiment.

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