

Correspondence

Intranasal levels of lead estimated from airborne pollen and urinary lead levels in Japan

To the Editor:

The report by Xu et al¹ on the relationship between pollinosis and lead exposure is interesting as a new hypothesis. However, we offer some comments on the environmental exposure assessment.

Lead concentration in Japanese cedar pollen has been measured and a concentration of 375 $\mu\text{g}/\text{kg}$ was reported.¹ Assuming spherical shape and standard density ($1 \text{ g}/\text{cm}^3$), a cedar pollen grain with 40 μm diameter weighs approximately $3.5 \times 10^{-8} \text{ g}$. The concentration of airborne cedar pollen was reported to be around 125 grains/ m^3 in March 2019 in the study area (<http://kafun.taiki.go.jp/>). The lead concentration accounted by cedar pollen is only $1.64 \times 10^{-3} \text{ ng}/\text{m}^3$ ($125 [\text{grain}/\text{m}^3] \times 3.5 \times 10^{-8} [\text{g}/\text{grain}] \times 375 [\text{ng-Pb}/\text{g}]$). However, this concentration is much lower than atmospheric lead concentrations measured in Japan ($\sim 10\text{--}30 \text{ ng}/\text{m}^3$ after 2000).² Furthermore, individuals spend more time indoors, where pollen levels are approximately 10% of outdoor concentrations.³ Therefore, when we consider total lead exposure relative to other sources of airborne lead, the contribution from nasal exposure via cedar pollen would be very low.

What is the contribution by cedar pollen to the lead concentration in nasal epithelial lining fluid (NELF)? We assumed that the volume of nasal mucosal mucus was approximately 0.9 mL and that all lead-containing pollen grains were deposited in the nasal cavity (100% deposition). The nasal mucociliary clearance time measured using the saccharin test is 20 minutes.⁴ Lead deposition from the cedar pollen can be estimated as 0.00049 ng ($15 [\text{L}/\text{min}] \times 20 [\text{min}] \times 1.64 \times 10^{-3} [\text{ng}/\text{m}^3]$), yielding a concentration in NELF of $0.00054 \text{ ng-Pb}/\text{mL}$. But the atmospheric lead levels in Japan can account for a concentration of $7 \text{ ng}/\text{mL}$ in NELF ($15 [\text{L}/\text{min}] \times 20 [\text{min}] \times 20 [\text{ng}/\text{m}^3] / 0.9 [\text{mL}]$), which is comparable to the observed lead levels in this study ($\sim 20 \text{ ng}/\text{mL}$). So, lead content in cedar pollen is unlikely to make a substantial contribution to the difference observed between controls and patients in pollinosis season.

In addition, the reported lead concentrations of study participants in urine ($100\text{--}200 \mu\text{g}/\text{g}$ creatinine) were 100-fold higher than previously reported levels in Japanese women ($1.28 \mu\text{g}/\text{g}$ creatinine).⁵ If those concentrations were accurate, the study

participants cannot be a representative sample of the general Japanese population.

Last, in animal studies, a total of $1.75 \mu\text{g}$ lead was administered over 7 days into the nasal cavity of mice using data from the participants. Under the above assumptions, we can estimate that a human would be exposed to $3 \mu\text{g}$ of airborne lead during the same period ($15 [\text{L}/\text{min}] \times 1440 [\text{min}/\text{d}] \times 7 [\text{days}] \times 20 [\text{ng}/\text{m}^3]$). However, mouse body weight is 1000 times smaller than that of humans. The dose per body weight basis is considered high compared with the physiological dose used.

In the article by Xu et al, information on the methods related to the above comments was not sufficient and more details on chemical analysis, exposure assessment, and dose estimation would have been beneficial.

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