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Exposure to bisphenols as a risk factor for the development of allergic diseases and asthma in children

INTRODUCTION

Bisphenols, endocrine disrupting chemicals, are widely used in the industry, e.g., in the production of plastics, resins and thermal paper. Humans are exposed to BPA, BPF and BPS through their daily life. Tolerable daily intake (TDI) of BPA according to The European Food Safety Authority (EFSA) was established of 0.2 ng/kg bw/day.

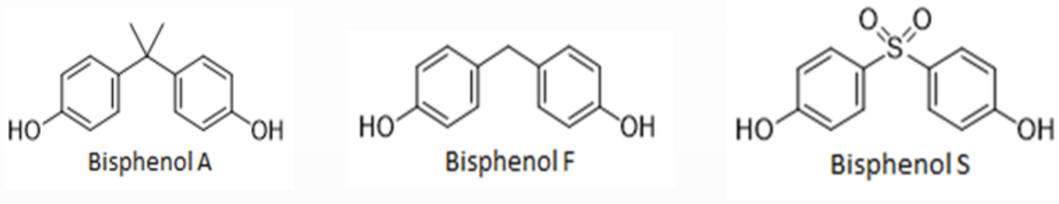

Figure 1. Structural formulae of bisphenol A, bisphenol F and bisfenol S

AIM OF THE STUDY

- ❑ Assessment of exposure to bisphenol a (BPA), bisphenol F (BPF) and bisphenol S (BPS) and selected socio-demographic and lifestyle factors determining exposure of early school and adolescent children in Poland
- ❑ Evaluation of the impact of exposure to BPA, BPF, BPS on the development of asthma and allergies in early childhood and adolescence
- ❑ Assessment of gender-specific relationship between bisphenol exposure and development of asthma and allergies in children

MATERIALS AND METHODS

The analyses planned for the study are based on data and biological material from the Polish Mother-Child Cohort (REPRO_PL). The study is being carried out under an OPUS NCN grant. The study population consists of about 400 children in early childhood who participated in phase III of the REPRO_PL cohort (data available for current analyses) and adolescence – ongoing phase IV of the cohort. The children and their guardian are invited for the study to the Department of Pediatric Internal Medicine and Allergology at the Medical University of Lodz.

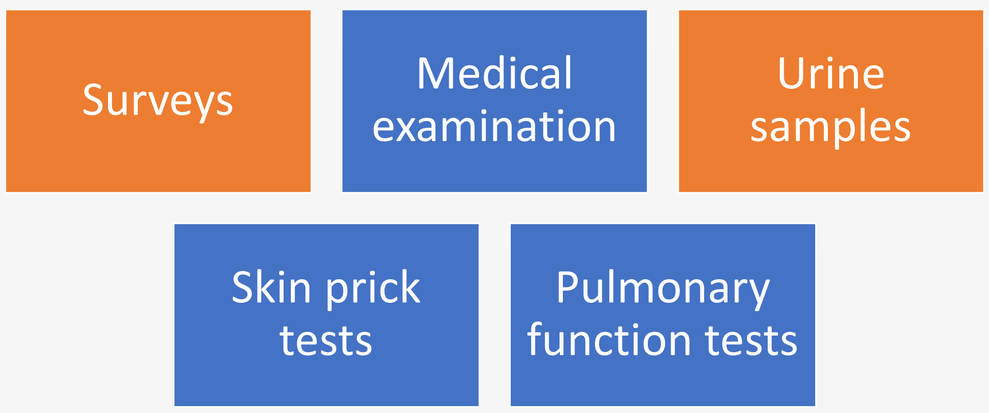

Figure 2. Research methods

ACHIEVEMENTS

- ❑ **The approval of the Bioethics Committee of the Medical University of Lodz has been obtained – decision No. RNN/205/23/KE on 11.07.2023**.
- ❑ 140 children aged 13-16 years were included in the study. Consent to participate in the study was obtained from caregivers and study participants. A medical examination (subject and physical) was performed on each child, morning urine samples were collected and properly preserved (-80°C) until the analyses planned for the study, point skin tests, resting spirometry and measurement of nitric oxide concentration in exhaled air were performed. They were asked to fill out prepared questionnaires on socio-demographic data, exposure to environmental factors and the child's health status. The urinary bisphenol concentration test will be performed collectively for a larger number of collected samples.
- ❑ **A review paper was published: Monika Weteska, Aleksandra Zwolińska, Kornelia Pisarska-Troczyńska, Magdalena Janc, Kinga Polańska, Joanna Jerzyńska, Agnieszka Jankowska. Relationship between prenatal and postnatal exposure to BPA and its analogues (BPS, BPF) and allergic diseases. Int J Occup Med Environ Health. 2023 Nov 27;36(5):575-586.**
  IF 2,0; MNiSW 100
- ❑ A preliminary analysis was performed on the assessment of exposure to bisphenols and the determinants of exposure for 150 children 7 years old.

RESULTS

We quantified the bisphenols BPA, BPF, and BPS in 150 urine samples of 7 year-old children from the Polish Mother and Child Cohort Study (REPRO_PL). Samples were analysed using high performance liquid chromatography with online sample clean-up coupled to tandem mass spectrometry (online-SPE-LC33 MS/MS).

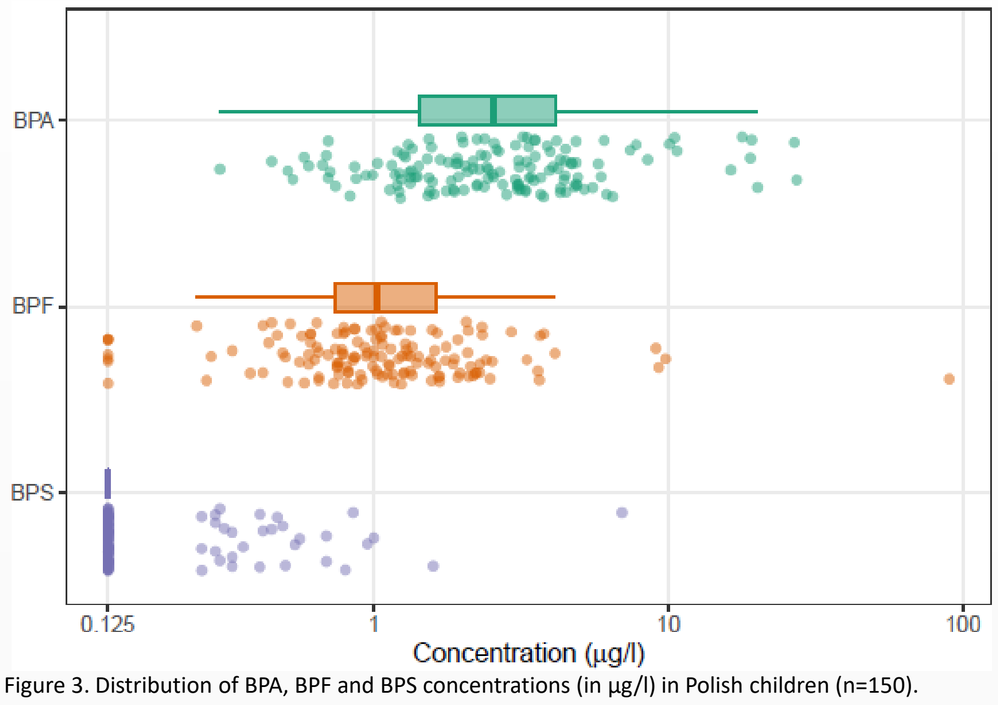

Figure 3. Distribution of BPA, BPF and BPS concentrations (in µg/l) in Polish children (n=150).

BPA, BPF, and BPS were above the LOQ (0.25 µg/L) in 100%, 95%, and 20% of the samples, respectively, with median concentrations of 2.5, 1.0 and 0.13 µg/L. Maximum bisphenol concentrations in children aged 7 years were found for BPF (90 µg/l), followed by BPA (27.3 µg/l) and BPS (7.0 µg/l).

Median daily intakes were calculated: 45.9 ng/kg b.w./day for BPA, 33.1 ng/kg b.w./day for BPF and less than 4.4 ng/kg b.w./day for BPS. (the tolerable daily intake of BPA according to the European Food Safety Authority is 0.2 ng/kg b.w./day).

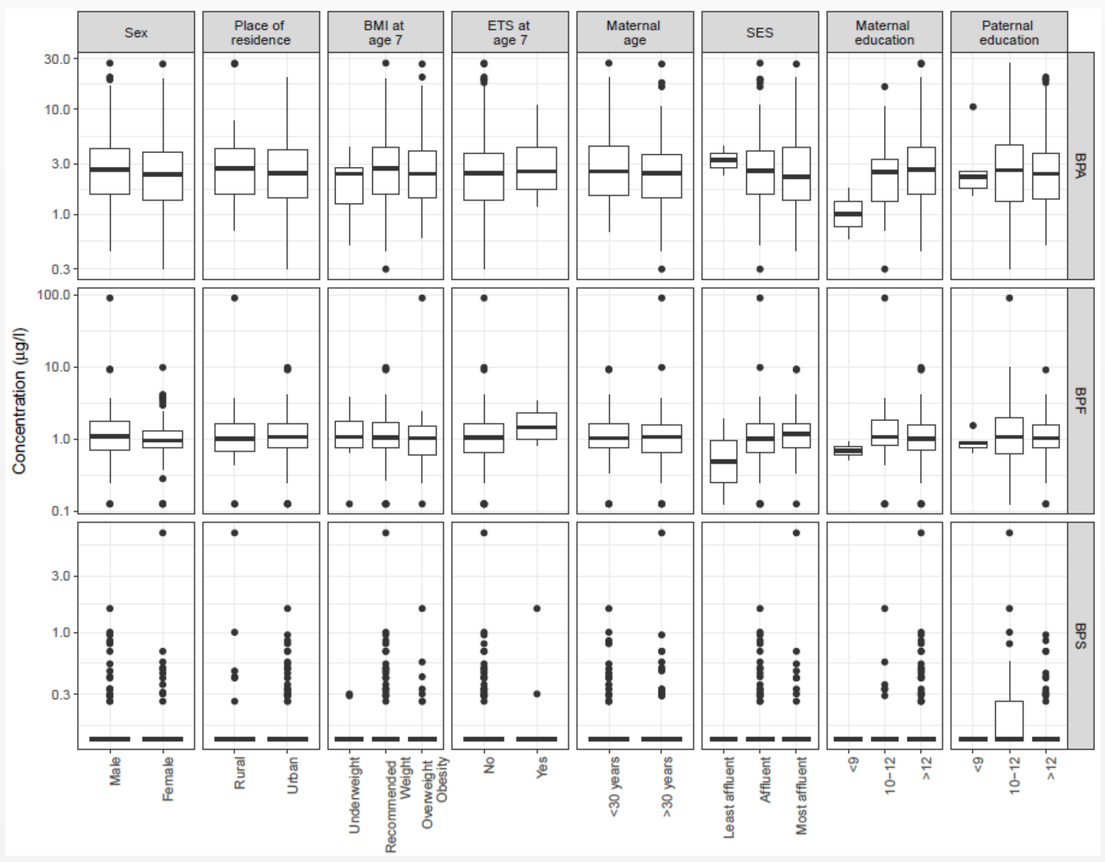

Figure 4: Boxplots of bisphenol concentrations (in µg/l) in 7-year old children for several sociodemographic characteristics: children's sex, place of residence, BMI and exposure to ETS at age 7, maternal age, socio-economic status (SES), maternal and paternal educational level.

There were no statistically significant associations between bisphenol concentrations and socio-demographic and lifestyle characteristics. **Tobacco exposure at age 7, maternal education and, to a lesser extent, socioeconomic status, were associated with bisphenol concentrations in children, with a positive association, except for BPA, for which socioeconomic status was negative**. **Boys had a higher median daily intake than girls**

CONCLUSIONS

BPA exposures in Polish children were above safe levels in 100% of the samples when comparing to the TDI established by EFSA. Reduction and prevention of the supply of this compound should be implemented. We were not able to find any statistically significant associations between bisphenol concentrations and socio-demographic and life-style characteristics, although a trend was found with environmental tobacco smoke, maternal educational level and socio-economic status.