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CHEMICAL EFFECTS

Blood Volatile Organic Compounds as potential biomarkers for poly cystic ovarian syndrome (PCOS): An animal study in the PCOS rat model

2022-11-01

Polycystic ovary syndrome (PCOS) as a common metabolic and endocrinological disorder can affect the metabolic profile in biological fluids. We studied the profile of blood volatile organic compounds (VOCs) in rats with PCOS and controls to identify potential specific biomarkers of blood VOCs in PCOS rats. For this purpose, 30 female adult Wistar rats were assigned to two groups: control and PCOS groups. PCOS model was induced using letrozole gavage (1mg/kg) for 21 days. The rats in the control group received water of the same volume for 21 days. During treatment, a collection of vaginal smears was done every day for estrus cycle determination and weight was measured weekly. On the day after the last administration of letrozole, the rats were killed and their blood and ovaries were collected. Testosterone levels and histologic changes in ovaries were examined. Also, headspace-solid phase microextraction-gas chromatography-mass spectrometry (HS-SPME-GC-MS) analyzed the VOCs in the blood of PCOS and control rats. Multivariate and univariate statistical analyses were used to find the potential biomarkers for a rat model of PCOS. Weight gain, ovarian and vaginal pathological alteration, as well as hyperandrogenemia, confirmed the successful induction of the PCOS in rats. The results of blood VOC analysis showed that nine VOCs were significantly elevated and one VOC decreased in the PCOS group than the control group ($P < 0.05$). The partial least-squares discriminant analysis (PLS-DA) and principal component analysis (PCA) showed good separation of VOCs between the PCOS rats and the control group. The 4-ethylphenol and capric (decanoic) acid were selected as the potential biomarkers for PCOS diagnosis in the blood of the PCOS rats. The blood of PCOS rats had a specific profile of VOCs, which could be detected by GC-MS analysis. These findings can pave the way for further studies towards developing a new screening method for PCOS detection and studying their pathology, based on VOC analysis.

Authors: Mahmoud Sadeghi Ataabadi, Soghra Bahmanpour, Saeed Yousefinejad, Sanaz Alaei

Full Source: The Journal of steroid biochemistry and molecular biology 2022 Nov 1;106215. doi: 10.1016/j.jsbmb.2022.106215.

Polycystic ovary syndrome (PCOS) as a common metabolic and endocrinological disorder can affect the metabolic profile in biological fluids.

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The accumulation of organic contaminants in hair with different biological characteristics

2022-11-02

Human hair has increasingly been used as a noninvasive biomonitoring matrix for assessment of human exposure to various organic contaminants (OCs). However, the accumulation processes of OCs in hair remains unclear thus far, which raised concerns on the reliability of hair analysis results for OCs. Herein, Chinese population was selected as the study subject, the effects of changes in hair biological characteristics, including length and color, on the accumulation of OCs in hair was investigated. With the growing of hair shaft and the increased distance from the scalp, a significant increasing trend was found for levels of polychlorinated biphenyls (PCBs) and organophosphate flame retardants (PFRs) along the hair shafts ($p < 0.05$). Source identification using Chemical Mass Balance model indicated that PCBs in hair were mainly from exogenous sources (air and dust). The accumulation rates of PCB and PFR individuals in the hair shaft decreased with increasing of log Kow values. Additionally, the levels of OCs in hair decreased with the change in color from black to white, probably because of the loss of melanin in white hair. The ratios (R) of Cblack/Cwhite were significantly correlated with the log Kow values for individual chemicals ($p < 0.05$), implying that OCs with high log Kow values tend to accumulate more readily in black hair. The results of this study demonstrated the growth and change in colors of hair, as well as the physicochemical properties of chemicals, play vital roles in the accumulation of OCs in hair. The present study provides fundamental basis for the precise assessment of human exposure to OCs using hair as a biomonitoring matrix in future studies.

Authors: Bin Tang, Jing Zheng, Shi-Mao Xiong, Feng-Shan Cai, Min Li, Yan Ma, Bo Gao, Dong-Wei Du, Yun-Jiang Yu, Bi-Xian Mai

Full Source: Chemosphere 2022 Nov 2;137064. doi: 10.1016/j.chemosphere.2022.137064.

Human hair has increasingly been used as a noninvasive biomonitoring matrix for assessment of human exposure to various organic contaminants (OCs).

ENVIRONMENTAL RESEARCH

Transgenerational impacts of micro(nano)plastics in the aquatic and terrestrial environment

2022-10-28

Plastic particles of diameters ranging from 1 to 1000 nm and $> 1 \mu\text{m}$ to 5 mm are respectively known as nanoplastics and microplastics, and are collectively termed micro(nano)plastics (MNPs). They are ubiquitously

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present in aquatic and terrestrial environments, posing adverse multifaceted ecological impacts. Recent transgenerational studies have demonstrated that MNPs negatively impact both the exposed parents and their unexposed generations. Therefore, this review summarizes the available research on the transgenerational impacts of MNPs in aquatic and terrestrial organisms, induced by exposure to MNPs alone or in combination with other organic and inorganic chemicals. The most commonly reported transgenerational effects of MNPs include tissue bioaccumulation and transfer, affecting organisms' survival, growth, reproduction, and energy metabolism; inducing oxidative stress; enzyme and genetic responses; and causing tissue damage. Similarly, co-exposure to MNPs and chemicals (organic and inorganic pollutants) significantly impacts survival, growth, and reproduction and induces oxidative stress, thyroid disruption, and genetic toxicity in organisms. The characteristics of MNPs (degree of aging, size, shape, polymer type, and concentration), exposure type and duration (parental exposure vs. multigenerational exposure and acute exposure vs. chronic exposure), and MNP-chemical interactions are the main factors affecting transgenerational impacts.

Selecting MNP properties based on their realistic environmental behavior, employing more diverse animal models, and considering chronic exposure and MNP-chemical mixture exposure are salient research prospects for an in-depth understanding of the transgenerational impacts of MNPs.

Authors: Muhammad Junaid, Shulin Liu, Guanglong Chen, Hongping Liao, Jun Wang

Full Source: Journal of hazardous materials 2022 Oct 28;443(Pt B):130274. doi: 10.1016/j.jhazmat.2022.130274.

Aromatic amines leachate from cigarette butts into aquatic environments: Is there risk for water organisms?

2022-11-02

There are many toxics, such as aromatic amines (AAs), in cigarette butts (CBs). As CBs are the most abundant litter worldwide, these chemicals may leach into water bodies. In the present work, for the first time, the levels of AAs leachates from CBs in distilled water (DW) and river water (RW) samples were evaluated at different exposure times ranging from 15 min to 30 days. The mean leachate levels of AAs in DW and RW samples were in the range of 0.2-566 and 0.2-596 ng L⁻¹, respectively, with overall mean values of 569 and 556 ng L⁻¹. There was no significant difference ($p > 0.05$) between the total AAs levels as well as the level of each examined AA in DW and RW samples. Aniline (ANL) had the highest leaching rate from CBs into water. The mean leachates of AAs from CBs into water

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were ranked as: ANL > 1-naphthylamine (1-NA) > 2-naphthylamine (2-NA) > 2,6-dimethylaniline (2,6-DMA) > Σ toluidine (Σ TOL) > o-anisidine (o-ASD) > Σ aminobiphenyl (Σ ABP). Ecological risk assessment showed that Σ 7AAs, ANL, p-TOL, o-TOL, 2-NA, and Σ ABP had medium risks to sensitive crustaceans and fish. As AAs are not the only hazardous chemicals which may leach from CBs into aquatic environments, restrictions on littering CBs into the environment are required due to the release of different toxics ultimately causing adverse effects on aquatic organisms.

Authors: Sina Dobaradaran, Torsten C Schmidt, Xenia A M Mutke, Gabriel E De-la-Torre, Ursula Telgheder, Klaus Kerpen, Marcel Plonowski

Full Source: Environmental research 2022 Nov 2;114717. doi: 10.1016/j.envres.2022.114717.

The role of the sewer system in estimating urban emissions of chemicals of emerging concern

2022-10-23

The use of chemicals by society has resulted in calls for more effective control of their emissions. Many of these chemicals are poorly characterized because of lacking data on their use, environmental fate and toxicity, as well as lacking detection techniques. These compounds are sometimes referred to as contaminants of emerging concern (CECs). Urban areas are an important source of CECs, where these are typically first collected in sewer systems and then discharged into the environment after being treated in a wastewater treatment plant. A combination of emission estimation techniques and environmental fate models can support the early identification and management of CEC-related environmental problems. However, scientific insight in the processes driving the fate of CECs in sewer systems is limited and scattered. Biotransformation, sorption and ion-trapping can decrease CEC loads, whereas enzymatic deconjugation of conjugated metabolites can increase CEC loads as metabolites are back-transformed into their parent respective compounds. These fate processes need to be considered when estimating CEC emissions. This literature review collates the fragmented knowledge and data on in-sewer fate of CECs to develop practical guidelines for water managers on how to deal with in-sewer fate of CECs and highlights future research needs. It was assessed to what extent empirical data is in-line with text-book knowledge and integrated sewer modelling approaches. Experimental half-lives ($n = 277$) of 96 organic CECs were collected from literature. The findings of this literature review can be used to support environmental modelling efforts and to optimize monitoring campaigns, including field studies in the context of wastewater-based epidemiology.

The use of chemicals by society has resulted in calls for more effective control of their emissions.

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Supplementary information: The online version contains supplementary material available at [10.1007/s11157-022-09638-9](https://doi.org/10.1007/s11157-022-09638-9).

Authors: Caterina Zillien, Leo Posthuma, Erwin Roex, Ad Ragas

Full Source: *Re/Views in environmental science and bio/technology* 2022;21(4):957-991. doi: [10.1007/s11157-022-09638-9](https://doi.org/10.1007/s11157-022-09638-9).

PHARMACEUTICAL/TOXICOLOGY

Long-term exposure to ambient NO₂ and adult mortality: A nationwide cohort study in China

2022-11

Introduction: A number of population-based studies have investigated long-term effects of nitrogen dioxide (NO₂) on mortality, while great heterogeneities exist between studies. In highly populated countries in Asia, cohort evidence for NO₂-mortality association was extensively sparse.

Objectives: This study aimed to quantify longitudinal association of ambient NO₂ exposure with all-cause mortality in Chinese adults.

Methods: A national cohort of 30,843 adults were drawn from 25 provincial regions across mainland China, and followed up from 2010 through 2018. Participants' exposures to ambient air pollutants were assigned according to their residential counties at baseline, through deriving monthly estimates from high-quality gridded datasets developed by machine learning methods. Cox proportional hazards models with time-varying exposures were utilized to assess the association of all-cause mortality with long-term exposure to ambient NO₂. NO₂-attributable deaths in China were estimated by province and county for years 2010 and 2018, with reference to the counterfactual exposure of 6.9 µg/m³ (the lowest county-level average in this cohort).

Results: We observed a total of 1662 deaths during 224020 person-years of follow-up (median 8.1 year). An approximately linear NO₂-mortality relation ($p = 0.273$ for nonlinearity) was identified across a broad exposure range of 6.9-57.4 µg/m³. Per 10-µg/m³ increase in annual NO₂ exposure was associated with an hazard ratio of 1.127 (95% confidence interval: 1.042-1.219, $p = 0.003$) for all-cause mortality. Risk estimates remained robust after additionally adjusting for the confounding effects of co-pollutants (i.e., PM_{2.5} or/and O₃). In 2018, 1.65 million deaths could be attributed to ambient NO₂ exposure (national average 17.3 µg/m³) in China, representing a decrease of 4.3% compared with the estimate of 1.72 million in 2010 (20.5 µg/m³).

Introduction: A number of population-based studies have investigated long-term effects of nitrogen dioxide (NO₂) on mortality, while great heterogeneities exist between studies.

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Conclusion: This cohort study provided national evidence for elevated risk of all-cause mortality associated with long-term exposure to ambient NO₂ in Chinese adults.

Authors: Yunqan Zhang, Zunyan Li, Jing Wei, Yu Zhan, Linjiong Liu, Zhiming Yang, Yuanyuan Zhang, Riyang Liu, Zongwei Ma

Full Source: *Journal of advanced research* 2022 Nov;41:13-22. doi: [10.1016/j.jare.2022.02.007](https://doi.org/10.1016/j.jare.2022.02.007).

In vivo hypoglycemic effects of bisphenol F exposure in high-fat diet mice

2022-10-31

Bisphenol F (BPF) is a widely used bisphenol A (BPA) substitute plastic additive that has attracted increasing public concerns due to its potential toxic effects on animal and human health. Although previous studies have indicated that BPF might have harmful effects on metabolic homeostasis, the systematic effects of BPF on glucose disorders remain controversial. In this study, mice fed a normal chow diet (ND) and high-fat diet (HFD) were administered BPF at a dose of 100 µg/kg of body weight, and glucose metabolism was monitored after both short- and long-term treatment. Little change in glucose metabolism was observed in BPF-treated ND mice, but improved glucose metabolism was observed in BPF-treated HFD mice. Consistently, BPF treatment led to increased insulin signalling in the skeletal muscle of HFD mice. Additionally, liver metabolite levels also revealed increased carbohydrate digestion and improved TCA cycle progression in BPF-treated HFD mice. Our results demonstrate that sustained BPF exposure at an environmentally relevant dosage may substantially improve glucose metabolism and enhance insulin sensitivity in mice fed a high-fat diet.

Authors: Ziquan Lv, Zhi Tang, Suli Huang, Xiaoxiao Hu, Changfeng Peng, Yuhua Chen, Guangnan Liu, Ying Chen, Tingting Cao, Cuilan Hou, Xinyi Wei, Yuebin Ke, Xuan Zou, Huaicai Zeng, Yajie Guo

Full Source: *Chemosphere* 2022 Oct 31;137066. doi: [10.1016/j.chemosphere.2022.137066](https://doi.org/10.1016/j.chemosphere.2022.137066).

Cross-sectional associations between exposure to per- and polyfluoroalkyl substances and body mass index among European teenagers in the HBM4EU aligned studies

2022-11-02

Per- and polyfluoroalkyl substances (PFAS) are widespread pollutants that may impact youth adiposity patterns. We investigated cross-

Bisphenol F (BPF) is a widely used bisphenol A (BPA) substitute plastic additive that has attracted increasing public concerns due to its potential toxic effects on animal and human health.

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sectional associations between PFAS and body mass index (BMI) in teenagers/adolescents across nine European countries within the Human Biomonitoring for Europe (HBM4EU) initiative. We used data from 1957 teenagers (12-18 yrs) that were part of the HBM4EU aligned studies, consisting of nine HBM studies (NEBII, Norway; Riksmaten Adolescents 2016-17, Sweden; PCB cohort (follow-up), Slovakia; SLO CRP, Slovenia; CROME, Greece; BEA, Spain; ESTEBAN, France; FLEHS IV, Belgium; GerES V-sub, Germany). Twelve PFAS were measured in blood, whilst weight and height were measured by field nurse/physician or self-reported in questionnaires. We assessed associations between PFAS and age- and sex-adjusted BMI z-scores using linear and logistic regression adjusted for potential confounders. Random-effects meta-analysis and mixed effects models were used to pool studies. We assessed mixture effects using molar sums of exposure biomarkers with toxicological/structural similarities and quantile g-computation. In all studies, the highest concentrations of PFAS were PFOS (medians ranging from 1.34 to 2.79 µg/L). There was a tendency for negative associations with BMI z-scores for all PFAS (except for PFHxS and PFHpS), which was borderline significant for the molar sum of [PFOA and PFNA] and significant for single PFOA [β -coefficient (95% CI) per interquartile range fold change = -0.06 (-0.17, 0.00) and -0.08 (-0.15, -0.01), respectively]. Mixture assessment indicated similar negative associations of the total mixture of [PFOA, PFNA, PFHxS and PFOS] with BMI z-score, but not all compounds showed associations in the same direction: whilst [PFOA, PFNA and PFOS] were negatively associated, [PFHxS] associated positively with BMI z-score. Our results indicated a tendency for associations of relatively low PFAS concentrations with lower BMI in European teenagers. More prospective research is needed to investigate this potential relationship and its implications for health later in life.

Authors: Tessa Schillemans, Nina Iszatt, Sylvie Remy, Greet Schoeters, Mariana F Fernández, Shereen Cynthia D’Cruz, Anteneh Desalegn, Line S Haug, Sanna Lignell, Anna Karin Lindroos, Lucia Fábelová, Lubica Palkovicova Murinova, Tina Kosjek, Žiga Tkalec, Catherine Gabriel, Denis Sarigiannis, Susana Pedraza-Díaz, Marta Esteban-López, Argelia Castaño, Loïc Rambaud, Margaux Riou, Sara Pauwels, Nik Vanlarebeke, Marike Kolossa-Gehring, Nina Vogel, Maria Uhl, Eva Govarts, Agneta Åkesson
Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Nov 2;120566. doi: 10.1016/j.envpol.2022.120566.

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OCCUPATIONAL

Prevalence and influence factors of occupational exposure to blood and body fluids in registered Chinese nurses: a national cross-sectional study

2022-11-04

Background: Occupational exposure to blood and body fluids poses a threat to medical providers and to nurses especially. This harm is not only physical, but psychology as well and can ultimately impact patient safety. This study aims to understand the prevalence of occupational exposure to blood and body fluids among Chinese registered nurses and explores the factors that influence this exposure.

Methods: A cross-sectional online survey was conducted for 31 province-level divisions in China, using a self-created questionnaire entitled Status Survey on Occupational Exposure in Nurses. Descriptive statistics were used to describe both the demographic characteristics of the respondents and the characteristics of occupational exposure. Categorical variables were presented as frequencies and percentage, and the relationship between possible influential factors and the occurrence of occupational exposure was determined using binary logistic regression.

Results: Out of a total of 20,791 nurses analyzed, over half (52.1%) of them had experienced occupational exposure to blood or body fluids, but over 1/3 (34.6%) of them did not ever report their exposures to a supervisor/official. The top three causes of under-reporting were: the source patient failed to test positive for infectious pathogens (43.6%), perception of a burdensome reporting process (24.6%), and indifferent attitude towards being infected (16.9%). Nurses who worked over 8 hours per day had higher risks of exposure (OR 1.199, 95% CI 1.130 to 1.272, $P < 0.001$, respectively). The occupational exposure risk from providing 1-2 types of PPE is 1.947 times that of providing 9-10 types of PPE (OR 1.947, 95% CI 1.740 to 2.178, $P < 0.001$). Likewise, the occupational exposure risk of providing 1-2 types of safety-engineered injection devices is 1.275 times of that of providing 5-6 types (OR 1.275, 95% CI 1.179 to 1.379, $P < 0.001$).
Conclusions: Occupational exposure to blood and body fluids in registered nurses is common, but the rate of under-reporting such exposure is high. Implementing engineered “sharp” injury prevention devices, following exposure prevention procedures, giving sufficient education and training to healthcare personnel on exposure prevention and control, and

Background: Occupational exposure to blood and body fluids poses a threat to medical providers and to nurses especially.

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developing exposure reporting policies are all steps that can both reduce exposure and increase its reporting.

Authors: Lihui Zhang, Qi Li, Ling Guan, Lu Fan, Yunxia Li, Zhiyun Zhang, Sue Yuan

Full Source: BMC nursing 2022 Nov 4;21(1):298. doi: 10.1186/s12912-022-01090-y.

Occupational disease predictors in the nickel pyrometallurgical production: a prospective cohort observation

2022-11-05

Background: Pyrometallurgical nickel production exposes workers to a wide range of occupational risk factors, including nickel aerosol, occupational noise and heat, but occupational (compensation) claims do not get enough attention in the literature. We, therefore, aimed to identify and analyze new occupational disease predictors in order to tailor prevention measures in the nickel pyrometallurgical production workers.

Methods: In a prospective observational study, a cohort of workers grouped in 16 occupations (N = 1424, 88% males, median age 39 (interquartile range (IQR) 31-47 years)), was fixed in 2007 at a large nickel production plant in the Russian High North. We then followed the cohort until 2021 and analyzed the association of selected predictors, including exposure to nickel and occupational group, with the risk of an occupational (compensation) claim in a Cox regression analysis.

Results: With 18,843 person-years of observation, occupational disease claims were confirmed in 129 workers (9% of the initial cohort, N = 108 men (84%)). Top three diagnoses were chronic bronchitis (3.81 cases/1000 workers/year), sensorineural deafness (2.36 cases/1000 workers /year) and musculoskeletal disorders (1.90 cases/1000 workers/year). Smoking was significantly associated with each diagnosis (adjusted hazard ratio (HR) ranged from 2.56 (95% confidence interval (CI) 1.17-5.57) for bronchitis to 6.69 (95% CI 1.46-30.64) for chronic obstructive pulmonary disease (COPD)). High nickel exposure was associated with occupational bronchitis and occupational asthma, whereas associations of occupational groups were also identified for COPD, asthma and musculoskeletal disorders.

Conclusion: Smoking, high exposure to nickel and specific exposure in the occupational groups increase the risk of occupational disease claims and should be prioritized directions for targeted intervention.

Authors: Sergei Syurin, Denis Vinnikov

Full Source: Journal of occupational medicine and toxicology (London, England) 2022 Nov 5;17(1):21. doi: 10.1186/s12995-022-00362-2.

Background: Pyrometallurgical nickel production exposes workers to a wide range of occupational risk factors, including nickel aerosol, occupational noise and heat, but occupational (compensation) claims do not get enough attention in the literature.