CHEMWATCH

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CHEMICAL EFFECTS

10-year time course of Hg and organic compounds in Augusta Bay: Bioavailability and biological effects in marine organisms

2022-09-21

In the last century, many Mediterranean coastal areas have been subjected to anthropogenic disturbances from industrial activities, uncontrolled landfills, shipyards, and high maritime traffic. The Augusta Bay (eastern Sicily, Italy) represents an example of a strongly impacted coastal environment with an elevated level of sediments contamination due to the presence of one of the largest European petrochemical plants, combined with an extensive commercial and military harbor. The most significant contaminants were represented by mercury (Hg) and hexachlorobenzene (HCB), derived from a former chlor-alkali plant, and other organic compounds like polycyclic aromatic hydrocarbons (PAHs) and polychlorobiphenyls (PCBs). Since the 1970s, Augusta Bay has become internationally recognized as a contaminated marine environment, although very little information is available regarding the temporal trend of contaminants bioavailability and biological impacts on aquatic organisms. In this study, the Hg and HCB concentrations were investigated over 10 years (from 2003 to 2013) in sediments and invertebrate and vertebrate organisms; these two contaminants' ecotoxicity was further evaluated at a biochemical and cellular level by analyzing the induction of organic biotransformation processes and DNA damages. The results showed high concentrations of Hg and HCB in sediments and their strong bioaccumulation in different species with significantly higher values than those measured in reference sites. This trend was paralleled by increased micronuclei frequency (DNA damage biomarker) and activity of the biotransformation system. While levels of chemicals in sediments remained elevated during the time course, their bioavailability and biological effects showed a gradual decrease after 2003, when the chlor-alkali plant was closed. Environmental persistence of Hg and HCB availability facilitates their bioaccumulation and affects the health status

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of marine organisms, with possible implications for environmental risk, pollutants transfer, and human health.

Authors: Maura Benedetti, Elena Romano, Antonella Ausili, Daniele Fattorini, Stefania Gorbi, Chiara Maggi, Andrea Salmeri, Daniela Salvagio Manta, Giulio Sesta, Mario Sprovieri, Francesco Regoli

Full Source: Frontiers in public health 2022 Sep 21;10:968296. doi: 10.3389/fpubh.2022.968296.

Effects of organic chemicals from diesel exhaust particles on adipocytes differentiated from human mesenchymal stem cells

2022-10-10

Exposure to fine particulate matter (PM2.5) from incomplete fossil fuel combustion (coal, oil, gas and diesel) has been linked to increased morbidity and mortality due to metabolic diseases. PM2.5 exaggerate adipose inflammation and insulin resistance in mice with diet-induced obesity. Here we elucidate the hypothesis that such systemic effects may be triggered by adhered particle components affecting adipose tissue directly. Studying adipocytes differentiated from primary human mesenchymal stem cells, we found that lipophilic organic chemicals (OC) from diesel exhaust particles induced inflammation associated genes and increased secretion of the chemokine CXLC8/interleukin-8 as well as matrix metalloprotease 1. The oxidative stress response gene heme oxygenease-1 and tumour necrosis factor alpha were seemingly not affected, while aryl hydrocarbon receptor regulated genes, cytochrome P450 1A1 (CYP1A1) and CYP1B1 and plasminogen activator inhibitor-2, were clearly upregulated. Finally, expression of β-adrenergic receptor, known to regulate adipocyte homeostasis, was downregulated by exposure to these lipophilic OC. Our results indicate that low concentrations of OC from combustion particles have the potential to modify expression of genes in adipocytes which may be linked to metabolic disease. Further studies on mechanisms linking PM exposure and metabolic diseases are warranted.

Authors: Bendik C Brinchmann, Jørn A Holme, Nadine Frerker, Mia H Rambøl, Tommy Karlsen, Jan E Brinchmann, Alena Kubátová, Klara Kukowski, Tonje Skuland, Johan Øvrevik

Full Source: Basic & clinical pharmacology & toxicology 2022 Oct 10. doi: 10.1111/bcpt.13805.

Exposure to fine particulate matter (PM2.5) from incomplete fossil fuel combustion (coal, oil, gas and diesel) has been linked to increased morbidity and mortality due to metabolic diseases.

Lead Exposure Induced Neural Stem Cells Death via Notch Signaling Pathway and Gut-Brain Axis

2022-10-04

Numerous studies have examined the effects of lead (Pb) on cognitive ability. It is essential for the brain to maintain its functions through the differentiation of neural stem cells into various types of cells. Despite this, it remains unclear how Pb exposure affects neural stem cells and how it does, so the Pb-exposed mice were treated with the Notch inhibitor DAPT after we established the Pb exposure models. Neuronal stem cells and autophagy were assessed by immunofluorescence staining and western blot. The microbiota of the feces was also analyzed using the 16S rRNA amplicon sequencing technique. In this study, we found that Pb exposure caused neural injuries and deficits in neural stem cells, whereas DAPT rescued the damage. With DAPT, Pb-induced autophagy was partially reversed. Exposure to Pb also reduced inflammation and damaged gut barrier function. Furthermore, Pb exposure led to low bacterial diversity, an increase in pathogen abundance, and an unusual mode of interaction. Taken together, this study revealed that damages in neural stem cells contributed largely to cognitive impairment during Pb exposure, and this process was partially dependent on the Notch pathway and gut dysbiosis.

Authors: Lijuan Sun, Yuankang Zou, Peng Su, Chong Xue, Diya Wang, Fang Zhao, Wenjing Luo, Jianbin Zhang

Full Source: Oxidative medicine and cellular longevity 2022 Oct 4;2022:7676872. doi: 10.1155/2022/7676872.

Numerous studies have examined the effects of lead (Pb) on cognitive ability.

ENVIRONMENTAL RESEARCH

Toenail zinc as a biomarker: Relationship with sources of environmental exposure and with genetic variability in MCC-Spain study

2022-11

Background: Toenails are commonly used as biomarkers of exposure to zinc (Zn), but there is scarce information about their relationship with sources of exposure to Zn.

Objectives: To investigate the main determinants of toenail Zn, including selected sources of environmental exposure to Zn and individual genetic variability in Zn metabolism.

Methods: We determined toenail Zn by inductively coupled plasma mass spectrometry in 3,448 general population controls from the MultiCase-Control study MCC-Spain. We assessed dietary and supplement Zn intake using food frequency questionnaires, residential proximity to Zn-emitting industries and residential topsoil Zn levels through interpolation methods. We constructed a polygenic score of genetic variability based on 81 single nucleotide polymorphisms in genes involved in Zn metabolism. Geometric mean ratios of toenail Zn across categories of each determinant were estimated from multivariate linear regression models on log-transformed toenail Zn.

Results: Geometric mean toenail Zn was 104.1 µg/g in men and 100.3 µg/g in women. Geometric mean toenail Zn levels were 7 % lower (95 % confidence interval 1-13 %) in men older than 69 years and those in the upper tertile of fibre intake, and 9 % higher (3-16 %) in smoking men. Women residing within 3 km from Zn-emitting industries had 4 % higher geometric mean toenail Zn levels (0-9 %). Dietary Zn intake and polygenic score were unrelated to toenail Zn. Overall, the available determinants only explained 9.3 % of toenail Zn variability in men and 4.8 % in women.

Discussion: Sociodemographic factors, lifestyle, diet, and environmental exposure explained little of the individual variability of toenail Zn in the study population. The available genetic variants related to Zn metabolism were not associated with toenail Zn.

Authors: Enrique Gutiérrez-González, Pablo Fernández-Navarro, Roberto Pastor-Barriuso, Javier García-Pérez, Gemma Castaño-Vinyals, Vicente Martín-Sánchez, Pilar Amiano, Inés Gómez-Acebo, Marcela Guevara, Guillermo Fernández-Tardón, Inmaculada Salcedo-Bellido, Victor Moreno, Marina Pinto-Carbó, Juan Alguacil, Rafael Marcos-Gragera, Jesús Humberto Gómez-Gómez, José Luis Gómez-Ariza, Tamara García-Barrera, Elena Varea-Jiménez, Olivier Núñez, Ana Espinosa, Antonio J Molina de la Torre, Amaia Aizpurua-Atxega, Jessica Alonso-Molero, María Ederra-Sanz, Thalia Belmonte, Nuria Aragonés, Manolis Kogevinas, Marina Pollán, Beatriz Pérez-Gómez

Full Source: Environment international 2022 Nov;169:107525. doi: 10.1016/j.envint.2022.107525.

Electronic waste (e-waste) recycling releases mercury (Hg) into the environment, though to our knowledge Hg levels at such sites have yet to be examined on a worldwide basis.

Systematic Review and Meta-Analysis of Mercury Exposure among Populations and Environments in Contact with Electronic Waste

2022-09-20

Electronic waste (e-waste) recycling releases mercury (Hg) into the environment, though to our knowledge Hg levels at such sites have yet to be examined on a worldwide basis. A systematic review of scientific studies was conducted to extract, analyze, and synthesize data on Hg levels in e-waste products, environments near recycling sites, and in

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people. Data were extracted from 78 studies from 20 countries, and these included Hg levels in 1103 electrical and electronic products, 2072 environmental samples (soil, air, plant, food, water, dust), and 2330 human biomarkers (blood, hair, urine). The average Hg level in products was 0.65 µg/g, with the highest levels found in lamps (578 µg/g). Average soil and sediment Hg levels (1.86 µg/g) at e-waste sites were at least eight times higher than at control sites. Average urinary Hg levels (0.93 µg/g creatinine) were approximately two-fold higher among e-waste workers versus control groups. Collectively, these findings demonstrate that e-waste recycling may lead to Hg contamination in environments and human populations in close proximity to processing sites. These findings contribute to a growing knowledge base of mercury exposure through diverse source-exposure pathways, and the work has potential policy implications in the context of the Minamata Convention.

Authors: Gwen Aubrac, Ashley Bastiansz, Niladri Basu

Full Source: International journal of environmental research and public health 2022 Sep 20;19(19):11843. doi: 10.3390/ijerph191911843.

PHARMACEUTICAL/TOXICOLOGY

Hematological indices as indicators of inflammation induced by exposure to pesticides

2022-10-14

Pesticide toxicity, both acute and chronic, is a global public health concern.

Pesticide toxicity, both acute and chronic, is a global public health concern. Pesticides are involved in abnormal inflammatory responses by interfering with the normal physiology and metabolic status of cells. In this regard, inflammatory indices aggregate index of systemic inflammation (AISI), monocyte-to-high-density lipoprotein ratio, monocyte-to-lymphocyte ratio (MLR), neutrophil-to-lymphocyte platelet ratio (NLPR), neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio, systemic immune inflammation index, and systemic inflammation response index (SIRI) have been used as predictive markers of inflammatory status in several diseases and also in acute poisoning events. This study aimed to determine systemic inflammation indices and their relationship with pesticide exposure from urban sprayers in 302 individuals categorized into three groups (reference group and moderate and high exposure groups). The data suggest that the AISI, MLR, NLPR, and SIRI indices were significantly higher in the exposed groups compared with the reference group. In conclusion, this study proposes that inflammation indices warrant further attention in order to assess their value as early biomarkers of acute and chronic pesticide intoxication.

Authors: Miguel Alfonso Ruíz-Arias, Irma Martha Medina-Díaz, Yael Yvette Bernal-Hernández, Juan Manuel Agraz-Cibrián, Cyndia Azucena González-Arias, Briscia Socorro Barrón-Vivanco, José Francisco Herrera-Moreno, Francisco Alberto Verdín-Betancourt, José Francisco Zambrano-Zaragoza, Aurora Elizabeth Rojas-García

Full Source: Environmental science and pollution research international 2022 Oct 14;1-11. doi: 10.1007/s11356-022-23509-4.

Pharmacokinetics of transdermal methyl-, ethyl-, and propylparaben in humans following single dermal administration

2022-10-08

Parabens are common chemicals used as preservatives in foods, cosmetics, and personal care products.

Parabens are common chemicals used as preservatives in foods, cosmetics, and personal care products. Although transdermal exposure to parabens occurs, studies on human pharmacokinetics (PK) following dermal exposure to parabens are scarce. In this study, the PK following dermal exposure to parabens was determined and compared with our previous findings on oral exposure. A paraben mixture cream containing 0.8% deuterated methyl-, ethyl-, and propylparaben (MeP-d4 0.26%; EtP-d4 0.26%, and PrP-d4 0.28%) was dermally applied to the whole arm of five male volunteers at a dose of 24 g/person over 30 min. Blood and urine samples were collected at several intervals over the course of 48 h to measure the levels of MeP-d4, EtP-d4, and PrP-d4 and their conjugated metabolites using HPLC-MS/MS. As a result of non-compartmental analysis, the average peak values of total (sum of conjugated and unconjugated metabolites) MeP-d4, EtP-d4, and PrP-d4 were reached at 7.8 h, 10.5 h, and 5.3 h, indicating a slower absorption rate compared to that of oral exposure (<2 h). The terminal elimination half-lives of MeP-d4, EtP-d4, and PrP-d4 were 12.2 h, 12.0 h, and 9.3 h, respectively. Fractional urinary excretion (Fue) of total MeP-d4, EtP-d4, and PrP-d4 was 1.7%, 2.3%, and 1.9%, respectively. The Fue of total and unconjugated PrP-d4 following dermal exposure was five times lower and three times higher, respectively, compared with those after oral exposure, suggesting that PrP is relatively less metabolized to the conjugated form after dermal exposure. Taken together, dermal exposure to paraben leads to a longer apparent half-life and results in higher proportions of biologically active unconjugated parabens in the systemic circulation as compared to oral exposure. This

study provides insights into the kinetic properties of parabens and their metabolites in humans.
Authors: Mi-Yeon Shin, Jeong Weon Choi, Seungho Lee, Sungmin Kim, Younglim Kho, Kyungho Choi, Sungkyoon Kim
Full Source: Chemosphere 2022 Oct 8;136689. doi: 10.1016/j.chemosphere.2022.136689.

OCCUPATIONAL

Learning from healthcare workers' experiences with personal protective equipment during the COVID-19 pandemic in Aotearoa/New Zealand: a thematic analysis and framework for future practice

2022-10-14
Objectives: Safety and welfare are critical as pandemic-related demands on the healthcare workforce continue. Access to personal protective equipment (PPE) has been a central concern of healthcare workers throughout the COVID-19 pandemic. Against the backdrop of an already strained healthcare system, our study aimed to explore the experiences of healthcare workers with PPE during the first COVID-19 surge (February-June 2020) in Aotearoa/New Zealand (NZ). We also aimed to use these findings to present a strengths-based framework for supporting healthcare workers moving forward.
Design: Web-based, anonymous survey including qualitative open-text questions. Questions were both closed and open text, and recruitment was multimodal. We undertook inductive thematic analysis of the dataset as a whole to explore prominent values related to healthcare workers' experiences.
Setting: October-November 2020 in New Zealand.
Participants: 1411 healthcare workers who used PPE during surge one of the COVID-19 pandemic.
Results: We identified four interactive values as central to healthcare workers' experiences: transparency, trust, safety and respect. When healthcare workers cited positive experiences, trust and safety were perceived as present, with a sense of inclusion in the process of stock allocation and effective communication with managers. When trust was low, with concerns over personal safety, poor communication and lack of transparency resulted in perceived lack of respect and distress among respondents. Our proposed framework presents key recommendations to

Objectives: Safety and welfare are critical as pandemic-related demands on the healthcare work-force continue.

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support the health workforce in terms of communication relating to PPE supply and distribution built on those four values.
Conclusions: Healthcare worker experiences with PPE access has been likened to 'the canary in the coalmine' for existing health system challenges that have been exacerbated during the COVID-19 pandemic. The four key values identified could be used to improve healthcare worker experience in the future.
Authors: Cervantée E K Wild, Hailey Wells, Nicolene Coetzee, Cameron C Grant, Trudy A Sullivan, José G B Derraik, Yvonne C Anderson
Full Source: BMJ open 2022 Oct 14;12(10):e061413. doi: 10.1136/bmjopen-2022-061413.

Occupational health effect of TCE exposure: Experiment evidence of gene-environment interaction in hypersensitivity reaction

2022-10-12
Background: Recently, Trichloroethylene (TCE) induced TCE hypersensitivity syndrome (THS) has attracted the attention of many researchers in the field of environmental and occupational health. Studies have revealed that Human leukocyte antigen (HLA) polymorphisms were the important genetic determinants of the diseases, but the potential molecular mechanism remains unclear.
Objective: This study aimed to investigate the association between THS and HLA at the molecular level.
Method: We chose the human B-lymphoblastoid cell line Hmy2.C1R transfected with cDNA of HLA-B*13:01 and HLA-B*13:02 to analyze the characteristics of HLA-B-binding peptides and investigate the effect of TCE on the binding affinity of peptides to the HLA-B molecules. Further, the mathematical model was used to identify the possible interaction between TCE and HLA-B*13:01 or HLA-B*13:02 molecule.
Results: 54 HLA-B*13:01-binding peptides and 85 HLA-B*13:02-binding peptides were identified. Comparing the protein sequences of HLA-B*13:01 and HLA-B*13:02, amino acids were different at positions 94, 95 and 97. The results of the binding affinity of self-peptides to HLA molecules in the presence of TCE showed that TCE significantly decreased the binding affinity of peptides to HLA-B*13:01 only, but did not affect that of HLA-B*13:02. Molecular docking model showed that there was a unique high-affinity binding mode between TCE and HLA-B*13:01 (but not HLA-B*13:02), and the binding site located in the region of F pocket, suggesting that the unique structure of the F pocket of HLA-B*13:01 might provide the possibility of binding TCE. The pathogenesis of interaction

Background: Recently, Trichloroethylene (TCE) induced TCE hyper-sensitivity syndrome (THS) has attracted the attention of many researchers in the field of environmental and occupational health.

between HLA-B*13:01 and TCE might belong to the model of the alteration of the HLA-presented self-peptide repertoire.
Discussion: This study explored the molecular mechanism of the association between THS and HLA-B*13:01, and had important implications for understanding the role of gene-environment interaction in the development of complex environment-related diseases.
Authors: Bo Jiao, Shuai Liu, Mengnan Yi, Jun Zhang, HaiJun Yang, Haiqin Jiang, Huawei Duan, Yong Niu, Meili Shen, Yang Cao, Hongsheng Wang, Yufei Dai
Full Source: Chemico-biological interactions 2022 Oct 12;110220. doi: 10.1016/j.cbi.2022.110220.

Gestational exposure to organophosphate esters and infant anthropometric measures in the first 4 weeks after birth

2022-10-08

Background: Few studies have examined whether gestational exposure to organophosphate esters (OPEs), widely used chemicals with potential endocrine-disrupting potency and developmental toxicity, is associated with impaired infant growth.
Methods: We analyzed data from 329 mother-infant pairs in the Health Outcomes and Measures of the Environment (HOME) Study (2003-2006, Cincinnati, Ohio, USA). We quantified concentrations of four OPE metabolites in maternal urine collected at 16 and 26 weeks of gestation, and at delivery. We calculated z-scores using 2006 World Health Organization (WHO) child growth standards for the 4-week anthropometric measures (weight, length, and head circumference), the ponderal index, and weekly growth rates. We used multiple informant models to examine window-specific associations between individual OPE metabolites and anthropometric outcomes. We further modeled OPEs as a mixture for window-specific associations with 4-week anthropometric outcomes using mean field variational Bayesian inference procedure for lagged kernel machine regression (MFVB-LKMR). We stratified the models by infant sex.
Results: Diphenyl phosphate (DPHP) in mothers at 16 weeks, and bis(2-chloroethyl) phosphate (BCEP) and bis(1,3-dichloro-2-propyl) phosphate (BDCIPP) at delivery were positively associated with z-scores of weight, length, and head circumference in all infants at 4 weeks of age. After stratifying by infant sex, positive associations were only observed in males for DPHP at 16 weeks and BCEP at delivery and in females for BDCIPP at delivery. Negative associations not present in all infants were observed in males for di-n-butyl phosphate (DNBP) at 26 weeks of gestation with

Background: Few studies have examined whether gestational exposure to organophosphate esters (OPEs), widely used chemicals with potential endocrine-disrupting potency and developmental toxicity, is associated with impaired infant growth.
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weight z-score and DPHP at delivery with head circumference z-score. Results were generally similar using MFVB-LKMR models with more conservative 95 % credible intervals. We did not identify consistent associations of gestational OPE metabolite concentrations with the ponderal index and weekly growth rates.
Conclusion: In this cohort, exposure to OPEs during gestation was associated with altered infant anthropometry at 4 weeks after birth.
Authors: Weili Yang, Joseph M Braun, Ann M Vuong, Zana Percy, Yingying Xu, Changchun Xie, Ranjan Deka, Antonia M Calafat, Maria Ospina, Heather H Burris, Kimberly Yolton, Kim M Cecil, Bruce P Lanphear, Aimin Chen
Full Source: The Science of the total environment 2022 Oct 8;857(Pt 1):159322. doi: 10.1016/j.scitotenv.2022.159322.