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CHEMICAL EFFECTS

Characteristics of exposure to multiple environmental chemicals among pregnant women in Wuhan, China

2020-09-03

Background: Previous studies on environmental pollutant exposure during pregnancy have mostly focused on individual chemical substances or single urine measurements. Thus, our understanding of the potential cumulative or interactive effects of exposure is limited. Objective:

We aimed to ascertain the characteristics and predictors of exposure to environmental chemicals over three trimesters among pregnant women.

Methods: We measured the concentrations of 34 chemicals in spot urine samples provided by 745 participants in their early, middle, and late pregnancy. We calculated Spearman correlation coefficients (SCC) between exposure levels of multiple chemicals in each trimester. K-means clustering and principal components analysis (PCA) were applied to classify the populations and reduce data dimensionality. We used generalized linear models (GLM) to confirm predictors of each cluster and principal component.

Results: SCC showed that the correlations of chemical concentrations from the same classes were higher than those among concentrations of different classes. Cluster analysis categorized participants into three clusters, and each cluster represented different chemical concentrations. We restricted the principal components to six, which explained more than 50% of the data variations. Several physiological, socio-demographic factors, and behavior patterns were related to different clusters and principal components.

Conclusion: Distinct exposure patterns and dominant exposure components of multiple environmental chemicals among pregnant women might help research the potential health effects of exposure to chemical mixtures and develop relevant public health interventions.

Authors: Huan Chen, Wenxin Zhang, Yanqiu Zhou, Jiufeng Li, Hongzhi Zhao, Shunqing Xu, Wei Xia, Zongwei Cai, Yuanyuan Li

Full Source: The Science of the total environment 2020 Sep 3;754:142167. doi: 10.1016/j.scitotenv.2020.142167.

Background: Previous studies on environmental pollutant exposure during pregnancy have mostly focused on individual chemical substances or single urine measurements.

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Embryonic toxicity of 3,4-dichloroaniline (3,4-DCA) on Javanese medaka (*Oryzias javanicus* Bleeker, 1854)

2020-08-16

Early-life exposure to toxic chemicals causes irreversible morphological and physiological abnormalities that may last for a lifetime. The present study aimed to determine the toxicity effect of 3,4-Dichloroaniline (3,4-DCA) on Javanese medaka (*Oryzias javanicus*) embryos. Healthy embryos were exposed to various 3,4-DCA concentrations for acute toxicity (5, 10, 25, 50, and 100 mg.L⁻¹) and sublethal toxicity (0.10, 0.50, 1.25, 2.50, and 5.00 mg.L⁻¹) for 96 h and 20 days respectively. Acute toxicity test revealed that the median lethal concentration (96h-LC50) was 32.87 mg.L⁻¹ (95 % CI = 27.90-38.74, R2 = 0.95). Sublethal exposure revealed that 1.25 mg.L⁻¹ at 3 days post-exposure (3 dpe) has a significant lower heart rate (120 ± 12.3 beats/min., p < 0.01), while at 7 dpe those exposed to 5 mg.L⁻¹ (141.8 ± 8.3 beats/min) had significantly (p < 0.01) lower heart rate compared to other treatments. Likewise, at 13 dpe, 5.00 mg.L⁻¹ (110.4 ± 17.3 beats/min) and 2.5 mg.L⁻¹ (130.4 ± 8.3 beats/min) were significantly lower (p < 0.001) compared to control. None of the embryos in 5.00 mg.L⁻¹ and 2.50 mg.L⁻¹ treatment groups survived at the end of the experiment. The results indicated a concentration-dependent response. The lowest observed effect concentration (LOEC) that exerted developmental deformities was 0.5 mg.L⁻¹. Javanese medaka embryo have low sensitivity to acute toxicity of 3,4-DCA, but developmental abnormalities at sublethal concentrations were observed.

Authors: Musa Adamu Ibrahim, Syaizwan Zahmir Zulkifli, Mohammad Noor Amal Azmai, Ferdaus Mohamat-Yusuff, Ahmad Ismail

Full Source: Toxicology reports 2020 Aug 16;7:1039-1045. doi: 10.1016/j.toxrep.2020.08.011.

Early-life exposure to toxic chemicals causes irreversible morphological and physiological abnormalities that may last for a lifetime.

Neuroprotective effect of *Costus afer* on low dose heavy metal mixture (lead, cadmium and mercury) induced neurotoxicity via antioxidant, anti-inflammatory activities

2020-08-15

Humans are constantly exposed to heavy metals due to their ubiquity in the environment. Hence, this study investigated the possible protective effect of *Costus afer* aqueous leaf extract (CALE) against low dose heavy metal mixture (LDHMM)-induced neurotoxicity. Male albino rats were divided into 6 equal groups. Group 1 served as the normal control receiving only deionized water. Group 2 served as the toxic control receiving on metal mixture (20 mg/kg PbCl₂, 1.61 mg/kg CdCl₂ and 0.40 mg/

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kg HgCl₂), groups 3, 4 and 5 were co-treated with metal mixture and CALE (750, 1500 and 2250 mg/kg body weight, respectively) and group 6 was treated with metal mixture and ZnCl₂. All treatments were administered through oral gavage for 90 days. Oxidative stress biomarkers [malondialdehyde (MDA), superoxide dismutase (SOD), glutathione content (GSH) and catalase (CAT)], inflammatory cytokines [interleukin-6 (IL-6) and interleukin-10 (IL-10)], histopathological changes and heavy metal concentration were determined in brain of rats. Results indicated that LDHMM significantly increased ($p < 0.05$) the lipid peroxidation marker (MDA) and the pro-inflammatory cytokine (IL-6), while lowered levels of the oxidative biomarkers (SOD, CAT and GSH) and anti-inflammatory cytokine (IL-10). Also, LDHMM caused some histopathological changes such as reactive gliosis and glia cell proliferation. LDHMM elevated the lead, cadmium and mercury concentrations in the brain. Severity of the distorted cortical parameters were ameliorated by CALE administration. The CALE induced significant protective effect on LDHMM-mediated neurotoxicity in a dose-dependent manner which may be a result of its antioxidant anti-inflammatory and metal chelation mechanisms.

Authors: Brilliance O Anyanwu, Chinna N Orish, Anthonet N Ezejiyor, Ify L Nwaogazie, Orish E Orisakwe

Full Source: Toxicology reports 2020 Aug 15;7:1032-1038. doi: 10.1016/j.toxrep.2020.08.008.

ENVIRONMENTAL RESEARCH

Environmental management accounting and innovation in water and energy reduction

2020-09-05

The objective of the study is to analyse the role of environmental management accounting (EMA) and the innovation of products and processes in reducing energy and water consumption. To carry out the study, data from PINTEC2017 on innovation activities from 55 sectors in Brazil from 2015 to 2017 were analysed. The hypotheses were tested with the application of structural equation modelling using SmartPLS. The results show that environmental management accounting (EMA) affects product innovation directly and process innovation indirectly through environmental management techniques. These results show that the use of EMA techniques contributes differently to each stage of innovation (processes and products). Thus, industries with new and improved products for the national market innovate their processes with the use of new technologies, training and innovation activities. These

The objective of the study is to analyse the role of environmental management accounting (EMA) and the innovation of products and processes in reducing energy and water consumption.

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results are most evident in the sectors of paper and cellulose, petroleum products, chemicals and the manufacturing of machinery for extraction and construction. These results show that environmental management techniques interact with process innovation, mainly in industries that promote product innovation, and that process innovation has led to a reduction in water and energy consumption.

Authors: Fabricia Silva da Rosa, Rogério João Lunkes, Alcindo Cipriano Mendes

Full Source: Environmental monitoring and assessment 2020 Sep 5;192(10):621. doi: 10.1007/s10661-020-08586-7.

Chemical pollution imposes limitations to the ecological status of European surface waters

2020-09-09

Aquatic ecosystems are affected by man-made pressures, often causing combined impacts. The analysis of the impacts of chemical pollution is however commonly separate from that of other pressures and their impacts. This evolved from differences in the data available for applied ecology vis-à-vis applied ecotoxicology, which are field gradients and laboratory toxicity tests, respectively. With this study, we demonstrate that the current approach of chemical impact assessment, consisting of comparing measured concentrations to protective environmental quality standards for individual chemicals, is not optimal. In reply, and preparing for a method that would enable the comprehensive assessment and management of water quality pressures, we evaluate various quantitative chemical pollution pressure metrics for mixtures of chemicals in a case study with 24 priority substances of Europe-wide concern. We demonstrate why current methods are sub-optimal for water quality management prioritization and that chemical pollution currently imposes limitations to the ecological status of European surface waters. We discuss why management efforts may currently fail to restore a good ecological status, given that to date only 0.2% of the compounds in trade are considered in European water quality assessment and management.

Authors: Leo Posthuma, Michiel C Zijp, Dick De Zwart, Dik Van de Meent, Lidija Globevnik, Maja Koprivsek, Andreas Focks, Jos Van Gils, Sebastian Birk

Full Source: Scientific reports 2020 Sep 9;10(1):14825. doi: 10.1038/s41598-020-71537-2.

Aquatic ecosystems are affected by man-made pressures, often causing combined impacts.

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OCCUPATIONAL

The relationship between impaired lung functions and cytokine levels in formaldehyde exposure

2020-09-08

Exposure to formaldehyde (FA) causes detrimental effects on respiratory system. Inflammation is one of the mechanisms responsible for these effects. Our aim is to demonstrate the possible effect of formaldehyde on inflammation biomarkers and pulmonary function tests. One hundred ninety-eight male workers in a fiber production factory are included. Eighty two of them were not exposed to FA. Thirty nine workers were exposed to FA for 4 h or more in a work shift and 77 workers were exposed less than 4 h. Statistically significant differences were found for FA, TNF- α , and IL-6 levels and pulmonary function test parameters (FEV1 and FVC) between no exposure and exposure groups. The results revealed a correlation between decrement in pulmonary function tests and an increase in cytokine levels concordant with the duration of FA exposure. The results may emphasize that FA exposure shows its effect on pulmonary system via inflammatory pathways.

Authors: Ozgur Oztan, Lutfiye Tutkun, Vugar Ali Turksoy, Serdar Deniz, Aybike Dip, Servet Birgin Iritas, Deniz Boz Eravci, Mehmet Erdem Alaguney
Full Source: Archives of environmental & occupational health 2020 Sep 8;1-7. doi: 10.1080/19338244.2020.1816883.

Assessment of circulating miR-20b, miR-221, and miR-155 in occupationally lead-exposed workers of North-Western India

2020-09-09

Lead (Pb), a toxic heavy metal, is capable of inducing several adverse health effects following its accumulation in the body. Lead is a potential carcinogen, capable of causing multisystem alterations. Recent reports identify small regulatory RNA molecules-miRNAs-which show differential expression in individuals exposed to similar levels of lead. These miRNAs can become potential molecular biomarkers of lead toxicity in the future and may unravel the possible molecular pathways through which this metal may exert its toxic manifestations. The present study aimed to assess the circulating levels of miRNA-20b, 221, and 155 in occupationally lead-exposed workers and correlate them with blood lead levels. One hundred ten participants working in various factories of Jodhpur and 97 participants not occupationally exposed to lead were recruited after

Exposure to formaldehyde (FA) causes detrimental effects on respiratory system.

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obtaining due informed consent. Blood lead level (BLL) was estimated by graphite furnace atomic absorption spectrophotometry (GF-AAS). Circulating miRNAs were isolated from serum by Qiagen miRNA isolation kit and converted to cDNA by commercial kit. Expression profiles of miR-20b, miR-221, and miR-155 were performed in RT-PCR using Qiagen miRNA PCR assays. The blood lead level (mean \pm SD) of occupationally lead-exposed subjects was $6.94 \pm 11.96 \mu\text{g/dL}$ while that of non-exposed was $2.39 \pm 4.66 \mu\text{g/dL}$. Out of the three miRNAs, miR-155 and miR-221 were significantly upregulated, while miR-20b did not show significant difference among study groups. The fold change of miR-20b, miR-221 and miR-155 expression were 1.08, 2.71 and 2.07 respectively. Functional analysis revealed that these miRNAs have the potential to trigger various genes and cellular pathways. The findings of our study highlight the importance of miRNA dysregulation in lead-exposed individuals that may contribute to the systemic effects of lead toxicity.

Authors: Prasenjit Mitra, Taru Goyal, Preeti Singh, Shailja Sharma, Praveen Sharma

Full Source: Environmental science and pollution research international 2020 Sep 9. doi: 10.1007/s11356-020-10676-5.

Evidence of Absence: Bayesian Way to Reveal True Zeros Among Occupational Exposures

2020-09-11

Objectives: Workplace exposure measurements typically contain some observations below limit of detection. The current paradigm for exposure data interpretation relies on the lognormal distribution, where censored observation are assumed to be present but not quantifiable. However, there are setting were such assumptions are untenable and true zero exposures cannot be ruled out. This issue can be non-trivial because decisions about compliance depend on the adequacy of the lognormal model.

Methods: We adapted previously described statistical models for mixture of true zeros and lognormal distribution to function within Bayesian procedure that overcomes historical limitations that precluded them from being used in practice. We compared the performance of the new models and the traditional lognormal model in simulation. Their implementation is illustrated in diverse datasets.

Results: The approach we propose involves estimating the proportion of true zeroes, and the geometric mean and standard deviation of the lognormal component of the mixture. This can be implemented in practice either based on the truncated lognormal model fit to the observed data,

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or on the censored Bernoulli-lognormal mixture model, which has the advantage of allowing for multiple censoring points. Both models can be implemented via a free online application. In simulations, when none of the censored values were zeros, all estimation procedures led to similar risk assessment. However, when all or most of the censored values were zeros, the traditional approach that assumes lognormal distribution performed noticeably worse than newly proposed methods, typically overestimating noncompliance. Application to real data suggests that we cannot rule out presence of true zero exposures in typical measurement series gathered by occupational hygienists.

Conclusions:

Forcing the usual lognormal model to data containing a large proportion of censored values can bias risk assessment if a substantial part of the censored points are true zeroes. The Bernoulli-lognormal model is a suitable and accessible model that can account for such challenging data, and leads to unbiased risk assessments regardless of the presence of true zeros in the data.

Authors: Jerome Lavoue, Igor Burstyn

Full Source: Annals of work exposures and health 2020 Sep 11;wxaa086. doi: 10.1093/annweh/wxaa086.

PHARMACEUTICAL/TOXICOLOGY

Plasma perfluoroalkyls are associated with decreased levels of proteomic inflammatory markers in a cross-sectional study of an elderly population

2020-09-08

Perfluoroalkyl substances (PFAS) have been linked to immunotoxicity in experimental studies. Although PFAS exposure is associated with altered immune response in epidemiological studies of children, it is less known whether this is observed also in elderly adults. Eight PFAS and 86 proteins were measured in plasma from 965 elderly individuals from Sweden (all aged 70, 50% women). PFAS were measured using isotope-dilution ultra-pressure liquid chromatography coupled to tandem mass spectrometry. Proteins were measured using a multiplex proximity extension assay (PEA) and covered among others inflammatory marker proteins such as monocyte chemoattractant proteins, tumor necrosis factors, and interleukins. We examined cross-sectional associations using multivariable linear regression at two levels of adjustment. We observed significant decreases in levels of 24 proteins in relation to a ln-unit increase in PFAS concentrations following adjustment for sex, sample storage time

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in freezer, and correction for multiple testing. Associations of PFAS and hepatocyte growth factor (HGF) and macrophage colony-stimulating factor 1 (CSF-1) remained significant (p -value < 0.05) following full covariate adjustment for smoking, exercise habits, education, energy, and alcohol intake, body mass index (BMI), glomerular filtration rate (GFR) as well as corticoid- and COX-inhibitor treatment. CSF-1 was inversely associated with perfluorohexane sulfonic acid (PFHxS) β : -0.08; 95% confidence interval (CI): -0.13, -0.02, perfluorooctanoic acid (PFOA) β : -0.04; 95% CI: -0.07, -0.006, perfluorononanoic acid (PFNA) β : -0.04; 95% CI: -0.08, -0.003, perfluorodecanoic acid (PFDA) β : -0.03; 95% CI: -0.06, -0.003, and perfluoroundecanoic acid (PFUnDA) β : -0.05; 95% CI: -0.08, -0.02. The magnitude and direction of PFAS vs protein relationships were similar also for HGF. Our findings implicate PFAS exposure with decreased levels of proteomic markers of inflammation in elderly humans.

Authors: S Salihovic, L Lind, A Larsson, P M Lind

Full Source: Environment international 2020 Sep 8;145:106099. doi: 10.1016/j.envint.2020.106099.

Monoacylglycerol acyltransferase 1 knockdown exacerbates hepatic ischemia-reperfusion injury in mice with hepatic steatosis

2020-09-11

Background and aims: Nonalcoholic fatty liver disease (NAFLD) is becoming the most common indication for liver transplantation. The growing prevalence of NAFLD not only increases the demand for liver transplantation, it also limits the supply of available organs since steatosis predisposes grafts to ischemia-reperfusion (IR) injury and many steatotic grafts are discarded. We have shown that monoacylglycerol acyltransferase 1 (MGAT1), an enzyme that converts monoacylglycerol to diacylglycerol, is highly induced in animal models and patients with NAFLD and is an important mediator in NAFLD-related insulin resistance. Herein, we sought to determine whether Mogat1 (gene encoding MGAT1) knockdown in mice with hepatic steatosis would reduce liver injury and improve liver regeneration following experimental IR injury.

Approach and results: Antisense oligonucleotides (ASO) were used to knockdown expression of Mogat1 in a mouse model of NAFLD. Mice then underwent surgery to induce IR injury. We found that Mogat1 knockdown reduced hepatic triacylglycerol (TAG) accumulation, but unexpectedly exacerbated liver injury and mortality following experimental IR surgery in mice on a high fat diet. The increased liver injury was associated with robust effects on the hepatic transcriptome following IR injury including

Background and aims: Nonalcoholic fatty liver disease (NAFLD) is becoming the most common indication for liver transplantation.

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enhanced expression of proinflammatory cytokines and chemokines and suppression of enzymes involved in intermediary metabolism. These transcriptional changes were accompanied by increased signs of oxidative stress and an impaired regenerative response.

Conclusions: We have shown that Mogat1 knockdown in a mouse model of NAFLD exacerbates IR injury and inflammation and prolongs injury resolution, suggesting that Mogat1 may be necessary for liver regeneration following IR injury and targeting this metabolic enzyme will not be an effective treatment to reduce steatosis-associated graft dysfunction or failure.

Authors: Kim H H Liss, Shelby E Ek, Andrew J Lutkewitte, Terri A Pietka, Mai He, Priya Skaria, Eric Tycksen, Daniel Ferguson, Valerie Blanc, Mark J Graham, Angela M Hall, Mitchell R McGill, Kyle S McCommis, Brian N Finck

Full Source: Liver transplantation : official publication of the American Association for the Study of Liver Diseases and the International Liver Transplantation Society 2020 Sep 11. doi: 10.1002/lt.25886.