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CHEMICAL EFFECTS

Protective effects of polyphenols against endocrine disrupting chemicals

2022-07-12

Endocrine disrupting chemicals (EDCs) are a heterogeneous group of compounds dispersed throughout the environment that possess the ability to alter endocrine system function. While there are numerous routes of exposure to EDCs, the predominant source of many of these compounds is diet, largely due to their widespread use in food contact materials. In recent years, there has been a surge of research aimed at assessing exposure to EDCs, identifying their health implications, and developing approaches to minimize the risks they may entail. Due to their antioxidant and anti-inflammatory potential, polyphenols have been purported to confer protection against EDC-induced health detriments. This review discusses the evidence pertaining to dietary exposure to the two predominant EDCs, bisphenol A and phthalates, in the United States, their associations with diabetes, cancer, and cardiovascular disease outcomes, the potential for polyphenols to mitigate their disease-promoting effects, gaps in knowledge, and recommendations for future research.

Authors: Matthew P Madore, Junichi R Sakaki, Ock K Chun

Full Source: Food science and biotechnology 2022 Jul 12;31(8):905-934.

doi: 10.1007/s10068-022-01105-z.

Differences in the characteristics and pulmonary toxicity of nano- and micron-sized respirable coal dust

2022-07-30

Background: The characteristics of coal dust (CD) particles affect the inhalation of CD, which causes coal worker's pneumoconiosis (CWP). CD nanoparticles (CD-NPs, < 500 nm) and micron particles (CD-MPs, < 5 μm) are components of the respirable CD. However, the differences in physicochemical properties and pulmonary toxicity between CD-NPs and CD-MPs remain unclear. **Methods:** CD was analyzed by scanning electron microscopy, Malvern nanoparticle size potentiometer, energy dispersive spectroscopy, infrared spectroscopy, and electron paramagnetic resonance spectroscopy. CCK-8 assay, ELISA, transmission electron microscope, JC-1 staining, reactive oxygen species activity probe, calcium ion fluorescent probe, AO/EB staining, flow cytometry, and western blot were used to determine the differences

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between CD-NPs and CD-MPs on acute pulmonary toxicity. CCK-8, scratch healing and Transwell assay, hematoxylin-eosin and Masson staining, immunohistochemistry, immunofluorescence, and western blot were applied to examine the effects of CD-NPs and CD-MPs on pneumoconiosis. **Results:** Analysis of the size distribution of CD revealed that the samples had been size segregated. The carbon content of CD-NPs was greater than that of CD-MPs, and the oxygen, aluminum, and silicon contents were less. In in vitro experiments with A549 and BEAS-2B cells, CD-NPs, compared with CD-MPs, had more inflammatory vacuoles, release of pro-inflammatory cytokines (IL-6, IL-1β, TNFα) and profibrotic cytokines (CXCL2, TGFβ1), mitochondrial damage (reactive oxygen species and Ca²⁺ levels and decreased mitochondrial membrane potential), and cell death (apoptosis, pyroptosis, and necrosis). CD-NPs-induced fibrosis model cells had stronger proliferation, migration, and invasion than did CD-MPs. In in vivo experiments, lung coefficient, alveolar inflammation score, and lung tissue fibrosis score (mean: 1.1%, 1.33, 1.33) of CD-NPs were higher than those of CD-MPs (mean: 1.3%, 2.67, 2.67). CD-NPs accelerated the progression of pulmonary fibrosis by upregulating the expression of pro-fibrotic proteins and promoting epithelial-mesenchymal transition. The regulatory molecules involved were E-cadherin, N-cadherin, COL-1, COL-3, ZO-1, ZEB1, Slug, α-SMA, TGFβ1, and Vimentin. **Conclusions:** Stimulation with CD-NPs resulted in more pronounced acute and chronic lung toxicity than did stimulation with CD-MPs. These effects included acute inflammatory response, mitochondrial damage, pyroptosis, and necrosis, and more pulmonary fibrosis induced by epithelial-mesenchymal transition.

Authors: Yinci Zhang, Amin Li, Jiafeng Gao, Jiaojiao Liang, Niandie Cao, Shuping Zhou, Xiaolong Tang

Full Source: Respiratory research 2022 Jul 30;23(1):197. doi: 10.1186/s12931-022-02120-8.

Implementation Evaluation of a Cluster Randomized Controlled Trial to Promote the Use of Respiratory Protective Equipment Among Migrant Workers Exposed to Organic Solvents in Small and Medium-Sized Enterprises

2022-07-11

Background: While the effectiveness of several occupational healthcare interventions has been demonstrated, successful implementation of such programs among internal migrant workers (IMWs) in small and medium-sized enterprises (SMEs) has been limited. This study aimed to evaluate the implementation of a three-arm cluster

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randomized controlled trial promoting respiratory protective equipment (RPE) use among IMWs exposed to organic solvents in SMEs and to assess the association between participants' compliance and effectiveness of intervention. Methods:

A total of 60 SMEs were randomly allocated to a low- or high-intensive intervention group, or a control group that did not receive any intervention. The low-intensive intervention group was subjected to both traditional and mHealth occupational health education. The high-intensive intervention group was subjected to the low-intensive group activities and peer education. The Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework was used to guide implementation evaluation of this 6-months intervention. Generalized linear mixed models (GLMMs) were used to evaluate the effects of participants' compliance with the intervention on the primary outcomes, regarding the appropriate use of RPE. Results:

Of 4,527 potentially eligible participants, 1,211 individuals were enrolled, with a reach rate of 26.8%. Sixty of the 66 SMEs approached (90.9%) SMEs adopted the intervention. Fidelity to traditional education (100.0%) and mHealth intervention (97.5%) was higher than fidelity to peer education (20.0%). Peer leaders cited inconvenient time and unfamiliarity with peers as two major barriers to delivering peer education. Compared with the control group, IMWs who complied with the interventions in both groups were more likely to wear RPE appropriately [low-intensive group: adjusted odds ratio (aOR) = 2.58, 95% confidence interval (CI): 1.56-4.28; high-intensive group: aOR = 7.52, 95% CI: 3.72-15.23]. Most participants (95.8%) were satisfied with the program and 93.1% stated that they would maintain the use of RPE in the future. Conclusions:

A multi-component occupational health intervention to promote the use of RPE among IMWs in SMEs was feasible and acceptable. Peer education had great potential to enhance the occupational health behavior of IMWs, and thus strategies to improve participants' adherence to this component warrant further investigation. Clinical trial registration:

<http://www.chictr.org.cn>, identifier: ChiCTR-IOR-15006929.

Authors: Chuangpeng Lin, Tongyang Li, Guanyang Zou, Xudong Li, Li Ling, Wen Chen

Full Source: *Frontiers in public health* 2022 Jul 11;10:772632. doi: 10.3389/fpubh.2022.772632.

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ENVIRONMENTAL RESEARCH

Synthetic polymers in personal care and cosmetics products (PCCPs) as a source of microplastic (MP) pollution

2022-07-22

Intentionally added MPs in PCCPs have created concerning threats to the environment. Therefore, this study aimed to screen synthetic polymers having MPs favoring chemical properties in PCCPs while estimating the theoretical emission into the environment and the level of awareness on the availability of MPs in PCCPs. A questionnaire survey was conducted via Google form using a complete random sampling method (n = 312). Next, a market survey was conducted and theoretical estimations were calculated for the products that recorded the highest MPs favoring polymers. Toothpaste products were identified as mostly used (95.8 %) and face cleanser (20.8 %) as least used. Of those MP ingredients, many chemical ingredients (11) were acrylate copolymers, and dimethicone polymers (5). A total of 21.4 trillion MP particles are released to the environment annually from considered four PCCPs. This study evidenced the availability of MP favoring chemicals in PCCPs in the Sri Lankan market that need further assessments.

Authors: Nawalamudiyanselaya Semini Kushara Nawalage, Bellanthudawage Kushan Aravinda Bellanthudawa

Full Source: *Marine pollution bulletin* 2022 Jul 22;182:113927. doi: 10.1016/j.marpolbul.2022.113927.

Review on the ecotoxicological impacts of plastic pollution on the freshwater invertebrate *Daphnia*

2022-07-30

The environmental impacts of plastic pollution have recently attracted universal attention, especially in the aquatic environment. However, research has mostly been focused on marine ecosystems, even though freshwater ecosystems are equally if not more polluted by plastics. In addition, the mechanism and extent to which plastic pollution affects aquatic biota and the rates of transfer to organisms through food webs eventually reaching humans are poorly understood, especially considering leaching hazardous chemicals. Several studies have demonstrated extreme toxicity in freshwater organisms such *Daphnia*. When such keystone species are affected by ambient pollution, entire food webs are destabilized and biodiversity is threatened. The unremitting increase in plastic contaminants in freshwater environments would cause

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impairments in ecosystem functions and structure, leading to various kinds of negative ecological consequences. As various studies have reported the effects on daphnids, a consolidation of this literature is critical to discuss the limitations and knowledge gaps and to evaluate the risk posed to the aquatic environment. This review was undertaken due to the evident need to evaluate this threat. The aims were to provide a meaningful overview of the literature relevant to the potential impact of plastic pollution and associated contaminants on freshwater daphnids as primary consumers. A critical evaluation of research gaps and perspectives is conducted to provide a comprehensive risk assessment of microplastic as a hazard to aquatic environments. We outlined the challenges and limitations to microplastic research in hampering better-focused investigations that could support the development of new plastic materials and/or establishment of new regulations.

Authors: Afshin Samadi, Youngsam Kim, Sang-Ah Lee, Young Jun Kim, Maranda Esterhuizen

Full Source: Environmental toxicology 2022 Jul 30. doi: 10.1002/tox.23623.

Long-term air pollution exposure, greenspace and health-related quality of life in the ECRHS study

2022-07-27

Background: Associations of long-term exposure to air pollution and greenspace with health-related quality of life (HRQOL) are poorly studied and few studies have accounted for asthma-rhinitis status. **Objective:** To assess the associations of air pollution and greenspace with HRQOL and whether asthma and/or rhinitis modify these associations. **Methods:** The study was based on the participants in the second (2000-2002, n = 6542) and third (2011-2013, n = 3686) waves of the European Community Respiratory Health Survey (ECRHS) including 19 centres. The mean follow-up time was 11.3 years. HRQOL was assessed by the SF-36 Physical and Mental Component Summary scores (PCS and MCS). NO₂, PM_{2.5} and PM₁₀ annual concentrations were estimated at the residential address from existing land-use regression models. Greenspace around the residential address was estimated by the (i) mean of the Normalized Difference Vegetation Index (NDVI) and by the (ii) presence of green spaces within a 300 m buffer. Associations of each exposure variable with PCS and MCS were assessed by mixed linear regression models, accounting for the multicentre design and repeated data, and adjusting for potential confounders. Analyses were stratified by asthma-rhinitis status. **Results:** The mean (SD) age of the ECRHS-II and III participants was 43 (7.1) and 54 (7.2)

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years, respectively, and 48 % were men. Higher NO₂, PM_{2.5} and PM₁₀ concentrations were associated with lower MCS (regression coefficients [95%CI] for one unit increase in the inter-quartile range of exposures were -0.69 [-1.23; -0.15], -1.79 [-2.88; -0.70], -1.80 [-2.98; -0.62] respectively). Higher NDVI and presence of forests were associated with higher MCS. No consistent associations were observed for PCS. Similar association patterns were observed regardless of asthma-rhinitis status. **Conclusion:** European adults who resided at places with higher air pollution and lower greenspace were more likely to have lower mental component of HRQOL. Asthma or rhinitis status did not modify these associations.

Authors: Anne Boudier, Iana Markevych, Bénédicte Jacquemin, Michael J Abramson, Simone Accordini, Bertil Forsberg, Elaine Fuertes, Judith Garcia-Aymerich, Joachim Heinrich, Ane Johannessen, Bénédicte Leynaert, Isabelle Pin, Valérie Siroux

Full Source: The Science of the total environment 2022 Jul 27;157693. doi: 10.1016/j.scitotenv.2022.157693.

PHARMACEUTICAL/TOXICOLOGY

Exocrine pancreatic cancer and living near to waste sites containing hazardous organic chemicals, New York State, USA - an 18-year population-based study

2022-07-25

Objectives: The etiology of exocrine pancreatic cancer (EPC) remains unknown except for family history and smoking. Despite recent medical advances, rates of pancreatic cancer incidence and mortality are increasing. Although existing evidence suggests a potentially causal relationship between environmental chemical exposures and pancreatic cancer, whether residential exposure impacts pancreatic cancer rates remains unknown. **Material and methods:** The authors identified 28 941 patients diagnosed with exocrine pancreatic cancer in New York State exclusive of New York City for the years 1996-2013. Descriptive statistics and negative binomial regression were used in this ecological study to compare pancreatic cancer hospitalization rates among patients who lived in zip codes with hazardous waste sites (HWSs) containing persistent organic pollutants (POPs) and volatile organic pollutants (VOCs) compared with clean zip codes with no identified hazardous waste sites. The authors assessed the effect of selected known and suspected human carcinogens on the EPC hospitalization rates by subgroup analyses. **Results:** Compared with the

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clean sites, the pancreatic cancer hospital discharge rate in the “VOCs without POPs” and “VOCs and POPs” sites, after adjustment for potential confounders were 1.06 (95% CI: 1.03-1.09) and 1.05 (95% CI: 1.01-1.08), respectively. In the analysis by specific chemicals, rate ratios (RR) for the benzene (RR = 1.12) and ethylbenzene (RR = 1.34) in the non-chlorinated VOCs group, trichloroethylene (RR = 1.07) and tetrachloroethylene (RR = 1.11) in the chlorinated VOCs group, chlorinated pesticides (RR = 1.11) and PCBs (RR = 1.05) in the POPs groups were statistically significant (p-values <0.05) compared with clean sites. Conclusions: Compared

with the clean sites, the pancreatic cancer hospital discharge rate in the “VOCs without POPs” and “VOCs and POPs” sites, after adjustment for potential confounders were 1.06 (95% CI: 1.03-1.09) and 1.05 (95% CI: 1.01-1.08), respectively. In the analysis by specific chemicals, rate ratios (RR) for the benzene (RR = 1.12) and ethylbenzene (RR = 1.34) in the non-chlorinated VOCs group, trichloroethylene (RR = 1.07) and tetrachloroethylene (RR = 1.11) in the chlorinated VOCs group, chlorinated pesticides (RR = 1.11) and PCBs (RR = 1.05) in the POPs groups were statistically significant (p-values <0.05) compared with clean sites.

Authors: Bayarmagnai Weinstein, Alan da Silva, David O Carpenter
Full Source: International journal of occupational medicine and environmental health 2022 Jul 25;145794. doi: 10.13075/ijomh.1896.01886.

OCCUPATIONAL

Critical review and analysis of literature on low dose exposure to chemical mixtures in mammalian in vivo systems

2022-07-27

Anthropogenic chemicals are ubiquitous throughout the environment. Consequentially, humans are exposed to hundreds of anthropogenic chemicals daily. Current chemical risk assessments are primarily based on testing individual chemicals in rodents at doses that are orders of magnitude higher than that of human exposure. The potential risk from exposure to mixtures of chemicals is calculated using mathematical models of mixture toxicity based on these analyses. These calculations, however, do not account for synergistic or antagonistic interactions between co-exposed chemicals. While proven examples of chemical synergy in mixtures at low doses are rare, there is increasing evidence that, through non-conformance to current mixture toxicity models,

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suggests synergy. This review examined the published studies that have investigated exposure to mixtures of chemicals at low doses in mammalian in vivo systems. Only seven identified studies were sufficient in design to directly examine the appropriateness of current mixture toxicity models, of which three showed responses significantly greater than additivity model predictions. While the remaining identified studies were unable to provide evidence of synergistic toxicity, it became apparent that many results of such studies were not always explicable by current mixture toxicity models. Additionally, two data gaps were identified. Firstly, there is a lack of studies where individual chemical components of a complex mixture (>10 components) are tested in parallel to the chemical mixture. Secondly, there is a lack of dose-response data for mixtures of chemicals at low doses. Such data is essential to address the appropriateness and validity of future chemical mixture toxicity models.

Authors: Chris S Elcombe, Neil P Evans, Michelle Bellingham
Full Source: Critical reviews in toxicology 2022 Jul 27;1-18. doi: 10.1080/10408444.2022.2091423.

Exploring the Link Between the Serum/Blood Levels of Heavy Metals (Pb, As, Cd, and Cu) and 2 Novel Biomarkers of Cardiovascular Stress (Growth Differentiation Factor 15 and Soluble Suppression of Tumorigenicity 2) in Copper Smelter Workers

2022-07-19

Objective: Studying the association between the occupational exposure to Pb, As, Cd, and Cu with the serum levels of 2 novel biomarkers of cardiovascular stress; growth differentiation factor 15 and soluble suppression of tumorigenicity 2, in some Egyptian Cu smelter workers.
Methods: Forty-one exposed workers and 41 administrative controls were clinically evaluated. Serum/blood levels of heavy metals and biomarkers were measured for both groups. Results: The smelter workers showed significantly elevated levels of heavy metals and biomarkers compared with controls. The elevated serum levels of both biomarkers were significantly and positively correlated with each other, the levels of heavy metals, and the duration of employment of the exposed workers. Conclusions: There was a significant association between the levels of heavy metals and both biomarkers

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among the smelter workers. Further prospective studies should be performed.

Authors: Basma Hussein Mourad, Ghada Hossam El-Sherif

Full Source: Journal of occupational and environmental medicine 2022 Jul 19. doi: 10.1097/JOM.0000000000002624.

Elevated exposures to respirable crystalline silica among engineered stone fabrication workers in California, January 2019-February 2020

2022-07-28

Background: Workers fabricating engineered stone face high risk for exposure to respirable crystalline silica (RCS) and subsequent development of silicosis. In response, the California Division of Occupational Safety and Health (Cal/OSHA) performed targeted enforcement inspections at engineered stone fabrication worksites. We investigated RCS exposures and employer adherence to Cal/OSHA's RCS and respiratory protection standards from these inspections to assess ongoing risk to stone fabrication workers. **Methods:** We extracted employee personal air sampling results from Cal/OSHA inspection files and calculated RCS exposures. Standards require that employers continue monitoring employee RCS exposures and perform medical surveillance when exposures are at or above the action level (AL; 25 $\mu\text{g}/\text{m}^3$); exposures above the permissible exposure limit (PEL; 50 $\mu\text{g}/\text{m}^3$) are prohibited. We obtained RCS and respiratory protection standard violation citations from a federal database. **Results:** We analyzed RCS exposures for 152 employees at 47 workplaces. Thirty-eight (25%) employees had exposures above the PEL (median = 89.7 $\mu\text{g}/\text{m}^3$; range = 50.7-670.7 $\mu\text{g}/\text{m}^3$); 17 (11%) had exposures between the AL and PEL. Twenty-four (51%) workplaces had ≥ 1 exposure above the PEL; 7 (15%) had ≥ 1 exposure between the AL and PEL. Thirty-four (72%) workplaces were cited for ≥ 1 RCS standard violation. Twenty-seven (57%) workplaces were cited for ≥ 1 respiratory protection standard violation. **Conclusions:** Our investigation demonstrates widespread RCS overexposure among workers and numerous employer Cal/OSHA standard violation citations. More enforcement and educational efforts could improve employer compliance with Cal/OSHA standards and inform

Background: Workers fabricating engineered stone face high risk for exposure to respirable crystalline silica (RCS) and subsequent development of silicosis.

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employers and employees of the risks for RCS exposure and strategies for reducing exposure.

Authors: Krishna Surasi, Brittany Ballen, Justine L Weinberg, Barbara L Materna, Robert Harrison, Kristin J Cummings, Amy Heinzerling

Full Source: American journal of industrial medicine 2022 Jul 28. doi: 10.1002/ajim.23416.