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ENVIRONMENTAL RESEARCH

Transformation of endocrine disrupting chemicals, pharmaceutical and personal care products during drinking water disinfection

2019-03-18

Pharmaceuticals and personal care products (PPCPs) and endocrine disrupting compounds (EDCs) are frequently detected in drinking water sources. This raises concerns about the formation of potentially more toxic transformation products (TPs) after drinking water disinfection. This study applied a combination of computational and experimental methods to investigate the biological activity of eight EDCs and PPCPs commonly detected in source waters (acetaminophen, bisphenol A, carbamazepine, estrone, 17 α -ethinylestradiol, gemfibrozil, naproxen and triclosan) before and after disinfection. Using a Stepped Forced Molecular Dynamics (SFMD) method, the authors detected 911 unique TPs, 36% of which have been previously reported in the scientific literature. The likelihood that TPs would cause damage to biomolecules or DNA relative to the parent compound based on lipophilicity and the occurrence of structural alerts was calculated, and applied two Quantitative Structure-Activity Relationship (QSAR) tools to predict toxicity via receptor-mediated effects. In parallel, batch experiments were performed with three disinfectants, chlorine, chlorine dioxide and chloramine. After solid-phase extraction, the resulting TP mixtures were analysed by chemical analysis and a battery of eleven in vitro bioassays covering a variety of endpoints. The laboratory results were in good agreement with the predictions. Overall, the combination of computational and experimental chemistry and toxicity methods used in this study suggest that disinfection of the studied EDCs and PPCPs will produce a large number of TPs, which are unlikely to increase specific toxicity (e.g., endocrine activity), but may result in increased reactive and non-specific toxicity.

Authors: Leusch FDL, Neale PA, Busetti F, Card M, Humpage A, Orbell JD, Ridgway HF, Stewart MB, van de Merwe JP, Escher BI.

Full Source: Science of the Total Environment. 2019 Mar 20; 657:1480-1490.

doi: 10.1016/j.scitotenv.2018.12.106. Epub 2018 Dec 11.

This study applied a combination of computational and experimental methods to investigate the biological activity of eight EDCs and PPCPs commonly detected in source waters before and after disinfection.

Carbamazepine, triclocarban and triclosan biodegradation and the phylotypes and functional genes associated with xenobiotic degradation in four agricultural soils

2019-03-18

Pharmaceuticals and personal care products (PPCPs) are released into the environment due to their poor removal during wastewater treatment. Agricultural soils subject to irrigation with wastewater effluent and biosolids application are possible reservoirs for these chemicals. This study examined the impact of the pharmaceutical carbamazepine (CBZ), and the antimicrobial agents triclocarban (TCC) and triclosan (TCS) on four soil microbial communities using shotgun sequencing (HiSeq Illumina) with the overall aim of determining possible degraders as well as the functional genes related to general xenobiotic degradation. The biodegradation of CBZ and TCC was slow, with $\leq 50\%$ decrease during the 80-day incubation period. In contrast, TCS biodegradation was rapid, with $\sim 80\%$ removal in 25 days. For each chemical, when all four soils were considered together, between three and ten phylotypes (from multiple phyla) were more abundant in the soil samples compared to the live controls. The genera of a number of previously reported CBZ, TCC or TCS degrading isolates were present; *Rhodococcus* (CBZ), *Streptomyces* (CBZ), *Pseudomonas* (CBZ, TCC, TCS), *Sphingomonas* (TCC, TCS), *Methylobacillus* (TCS) and *Stenotrophomonas* (TCS) were among the most abundant (chemical previously reported to be degraded is shown in parenthesis). From the analysis of xenobiotic degrading pathways, genes from five KEGG (Kyoto Encyclopedia of Genes and Genomes) Orthology pathways were the most dominant, including those associated with aminobenzoate, benzoate (most common), chlorocyclohexane/chlorobenzene, dioxin and nitrotoluene biodegradation. Several phylotypes including *Bradyrhizobium*, *Mycobacterium*, *Rhodopseudomonas*, *Pseudomonas*, *Cupriavidus*, and *Streptomyces* were common genera associated with these pathways. Overall, the data suggest several phylotypes are likely involved in the biodegradation of these PPCPs with *Pseudomonas* being an important genus.

Authors: Thelusmond JR, Strathmann TJ, Cupples AM.

Full Source: *Science of the Total Environment*. 2019 Mar 20; 657:1138-1149.

doi: 10.1016/j.scitotenv.2018.12.145. Epub 2018 Dec 11.

The present study aimed to determine how IOX and DES disrupt the crosstalk between the developing thyroid gland and cardio-vascular system in zebrafish.

Ioxynil and diethylstilbestrol disrupt vascular and heart development in zebrafish

2019-03-18

Endocrine disruption is one of the consequences of industrialisation and chemicals released into the environment have a profound impact on organisms. Waterborne micromolar concentrations of ioxynil (IOX) and diethylstilbestrol (DES) in fish affect the development of the heart, vasculature and thyroid gland. The present study aimed to determine how IOX and DES disrupt the crosstalk between the developing thyroid gland and cardio-vascular system in zebrafish. Twelve hours post fertilization (hpf) wild type, Tg(fli1:GFP) or Tg(cmalc2:GFPCaaX) zebrafish embryos were exposed to 0.1 μ M IOX or DES for 36 h (up until 48 hpf) or 60 h (up until 72 hpf). Embryos were used for vascular endothelial cell sorting, whole-mount immunohistochemistry, tissue selective transcriptomics, selected gene expression analysis by quantitative real-time polymerase chain reaction analysis and determination of heart rate by live imaging. Exposure of zebrafish embryos to IOX and DES (0.1 μ M) increased heart beat frequency and reduced ventricle volume and aorta diameter. The transcriptome of endothelial cells from blood vessels of hypertrophic, dilated and arrhythmogenic right ventricular cardiomyopathy was significantly changed and compound-specific toxic effects were found in IOX and DES exposed embryos. Both DES and IOX directly affected vascular and heart development and this indirectly impaired thyroid gland development in zebrafish. Even though the toxicity end-point of the two chemicals was similar, their action seemed to be via different gene regulatory pathways and physiological mechanisms. IOX and DES directly disrupt cardiovascular development and there is an associated disruption of thyroid tissue that most likely has long term consequences for this endocrine axis.

Authors: Li YF, Canário AVM, Power DM, Campinho MA.

Full Source: Environment International. 2019 Mar; 124:511-520. doi: 10.1016/j.envint.2019.01.009. Epub 2019 Jan 25.

Species sensitivity distributions for use in environmental protection, assessment and management of aquatic ecosystems for 12,386 chemicals

2019-03-18

The present study considers the collection and use of ecotoxicity data for risk assessment with Species Sensitivity Distributions (SSDs) of chemical pollution in surface water. SSDs are used to quantify the likelihood

The present study considers the collection and use of ecotoxicity data for risk assessment with Species Sensitivity Distributions (SSDs) of chemical pollution in surface water.

that critical effect levels are exceeded. This fits to the European Water Framework Directive, which suggest using models to assess the likelihood that chemicals affect water quality for management prioritisation. The authors derived SSDs based on chronic and acute ecotoxicity test data for 12,386 compounds. The log-normal SSDs are characterised by the median and the standard deviation of log-transformed ecotoxicity data and by a quality score. A case study illustrates the utility of SSDs for water quality assessment and management prioritisation. The authors quantified the chronic and acute mixture toxic pressure of mixture exposures for >22,000 water bodies in Europe for 1,760 chemicals for which we had both exposure and hazard data. Results show the likelihood of mixture exposures exceeding a negligible effect level and increasing species loss, respectively. The SSDs presented in this paper represent a versatile and comprehensive approach to prevent, assess and manage chemical pollution problems.

Authors: Posthuma L, van Gils J, Zijp MC, van de Meent D, de Zwart D.
Full Source: Environmental Toxicology & Chemistry. 2019 Jan 24. doi: 10.1002/etc.4373. [Epub ahead of print]

Characteristics of metal contamination in paddy soils from three industrial cities in South Korea

2019-03-18

Paddy soil contamination is directly linked to human dietary exposure to toxic chemicals via crop consumption. In Korea, rice paddy fields are often located around industrial complexes, a major anthropogenic source of metals. In this study, rice paddy soils were collected from 50 sites in three industrial cities to investigate the contamination characteristics and ecological risk of metals in the soils. The cities studied and their major industries are as follows: Ulsan (petrochemical, nonferrous, automobile, and shipbuilding), Pohang (iron and steel), and Gwangyang (iron and steel, nonmetallic, and petrochemical). Thirteen metals (Al, As, Ba, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, V, and Zn) were analysed using inductively coupled plasma-optical emission spectrometry (ICP-OES). The mean concentration of Cd (1.98 mg/kg) exceeded the soil quality guideline of Canada (1.4 mg/kg), whereas concentrations of other metals were under the standards of both Korea and Canada. Generally, levels of metal concentrations decreased with increasing distance from industrial complexes. Among the three cities, Pohang showed high concentrations of Zn (142.2 mg/kg), and Ulsan and Gwangyang showed high concentrations of Cr (33.9 mg/kg) and Ba (126.4 mg/kg), respectively. These contamination patterns were influenced by the different major industries of each city, which was clearly

In this study, rice paddy soils were collected from 50 sites in three industrial cities to investigate the contamination characteristics and ecological risk of metals in the soils.

demonstrated by the principal component analysis results. Pollution indices suggested that As, Cd, Pb, and Zn were enriched in the paddy soils via anthropogenic activities. Comprehensive potential ecological risk indices were at considerable levels for most sites, especially because of major contributions from As and Cd, which can pose potential ecological threats.

Authors: Cho IG, Park MK, Cho HK, Jeon JW, Lee SE, Choi SD.

Full Source: Environmental Geochemistry & Health. 2019 Jan 23. doi: 10.1007/s10653-019-00246-1. [Epub ahead of print]

MEDICAL RESEARCH

Impact of chronic lead exposure on liver and kidney function and haematologic parameters

2019-03-18

Lead, one of the most widely used metals because of its beneficial physical properties, has been reported to adversely influence several different organs and organ systems. The aim of the present study was to examine the effect of lead exposure on liver and renal function and haematologic parameters. This was a case-cohort study comparing adults with occupational, environmental or opium-related lead exposure with blood lead levels [BLL] $>10\mu\text{g/dL}$ (High blood lead level (HBLL) group and age- and gender-matched normal healthy individuals (Low blood lead level [LBLL] group with $\text{BLL} <10\mu\text{g/dL}$). The complete blood count and concentrations of serum creatinine, urea, aspartate aminotransferase (AST), alanine aminotransferase (ALT) were recorded for subsequent investigation. The mean BLL was significantly higher in the HBLL than in the LBLL groups (51.36 ± 44.72 vs $4.17 \pm 1.97\mu\text{g/dL}$). The Spearman's rho revealed a significant association between BLL and urea ($r = 0.25$, $P < 0.001$), creatinine ($r = 0.16$, $P = 0.02$), AST ($r = 0.42$, $P < 0.001$) and ALT ($r = 0.27$, $P < 0.001$). The median [IQR] serum urea (34 mg/dL [$27-221$]) vs (30 [$27-36$]), creatinine (0.9 mg/dL [$0.8-1$]) vs (0.8 [$0.7-0.9$]), ALT (25 mg/dL [$16-49$]) vs (22 [$16-30$]) and AST concentrations (29 mg/dL [$20-42$]) vs (20 [$18-24$]) were all significantly higher ($P < 0.05$) in the HBLL group compared to the LBLL group. The median [IQR] haemoglobin (12.6 g/dL [$10.4-15.4$]) vs (15.2 [$14.6-16.3$]) and haematocrit (36.9% [$31-44.8$]) vs (45.6 [$43.6-48.2$]) were both significantly lower ($P < 0.001$) in the HBLL group than in the LBLL group. The results indicated that people with chronic lead exposure

The aim of the present study was to examine the effect of lead exposure on liver and renal function and haematologic parameters.

with BLLs greater than 10 µg/dL are at risk of renal, liver and haematologic impairments.

Authors: Nakhaee S, Amirabadizadeh A, Brent J, Mehrpour O.

Full Source: Basic & Clinical Pharmacology & Toxicology. 2018 Nov 24. doi: 10.1111/bcpt.13179. [Epub ahead of print]

Biosafety evaluation of Janus Fe₃O₄-TiO₂ nanoparticles in Sprague Dawley rats after intravenous injection

2019-03-18

Newly synthesised Janus-structured Fe₃O₄-TiO₂ nanoparticles (NPs) appear to be a promising candidate for the diagnosis and therapy of cancer. Although the toxicity of individual Fe₃O₄ or TiO₂ NPs has been studied extensively, the toxicity of Janus Fe₃O₄-TiO₂ NPs is not clear. In this study, the biosafety of both Janus Fe₃O₄-TiO₂ NPs (20-25 nm) and the maternal material TiO₂ NPs (7-10 nm) were evaluated in Sprague Dawley rats after one intravenous injection into the tail vein. Healthy rats were randomly divided into one control group and six experimental groups. Thirty days after treatment, rats were killed, then blood and tissue samples were collected for haematological, biochemical, element-content, histopathological, and Western blot analysis. The results show that only a slight Ti element accumulation in the heart, spleen, and liver could be found in the Janus Fe₃O₄-TiO₂ NP groups ($P > 0.05$ compared with control). However, significant Ti element accumulation in the spleen, lungs, and liver was found in the TiO₂ NP-treated rats. Both Fe₃O₄-TiO₂ NPs and TiO₂ NPs could induce certain histopathological abnormalities. Western blot analysis showed that both NPs could induce certain apoptotic or inflammatory-related molecular protein upregulation in rat livers. A certain degree of alterations in liver function and electrolyte and lipid parameters was also observed in rats treated with both materials. However, compared to Janus structure Fe₃O₄-TiO₂ NP-treated groups, TiO₂ NPs at 30 mg/kg showed more severe adverse effects. The authors concluded that the results showed that under a low dose (5 mg/kg), both NP types had no significant toxicity in rats. Janus NPs certainly seem less toxic than TiO₂ NPs in rats at 30 mg/kg. To ensure safe use of these newly developed Janus NPs in cancer diagnosis and therapy, further animal studies are needed to evaluate long-term bioeffects.

Authors: Su H, Song X, Li J, Iqbal MZ, Kenston SSF, Li Z, Wu A, Ding M, Zhao J.

Full Source: International Journal of Nanomedicine. 2018 Oct 31; 13:6987-7001. doi: 10.2147/IJN.S167851. eCollection 2018.

The objective of this study was to explore the role of the key complement regulatory protein, CD59a, in TCE-induced immune liver injury.

Complement regulatory protein CD59a plays a protective role in immune liver injury of trichloroethylene-sensitized BALB/c mice

2019-03-18

Trichloroethylene (TCE) is a major occupational and environmental chemical compound which causes occupational dermatitis medicamentosa-like of TCE with severe liver damage. Previous studies showed that complement activation was a newly recognised mechanism for TCE-induced liver damage. The objective of this study was to explore the role of the key complement regulatory protein, CD59a, in TCE-induced immune liver injury. The authors firstly evaluated the changes of CD59a expression in liver tissue and then investigated if the changes were associated with membrane attack complex (MAC) formation, nuclear factor kappa B (NF- κ B) activation and liver damage in BALB/c mice model of TCE-induced skin sensitisation in the absence or presence of soluble recombinant rat CD59-Cys. The results showed that low expression of CD59a accompanied by MAC deposition in the liver of TCE-sensitized BALB/c mice, which was consistent in time. In addition, activation of NF- κ B pathway, upregulation of inflammatory cytokine and liver damage also occurred. Additional experiment showed that recombinant rat sCD59-Cys alleviated inflammation and liver damage in TCE-sensitized BALB/c mice. Moreover, recombinant rat sCD59-Cys reduced MAC formation and inhibited NF- κ B activation measured by P-I κ B α and nuclear NF- κ B p65 in the liver of TCE-sensitized BALB/c mice. In conclusion, recombinant rat sCD59-Cys plays a protective role in immune liver injury of TCE-sensitized BALB/c mice.

Authors: Wang X, Yu Y, Xie HB, Shen T, Zhu QX.

Full Source: *Ecotoxicology & Environmental Safety*. 2019 Jan 24; 172:105-113. doi: 10.1016/j.ecoenv.2019.01.049. [Epub ahead of print]

Bradykinin contributes to immune liver injury via B2R receptor-mediated pathways in trichloroethylene sensitized mice: A role in Kupffer cell activation

2019-03-18

Previously it has been shown that trichloroethylene (TCE) induced occupational medicamentosa-like dermatitis due to TCE (OMLDT) with immune liver injury, and kallikrein-kinin system (KKS) activation as a probably mechanism underlying the immune damage. Bradykinin (BK) is an important active component of KKS system function, but the specific role of BK in the immune liver injury has never been examined. The

The present study aimed to explore the important role of bradykinin and mechanisms of action in immune liver injury induced by TCE.

present study aimed to explore the important role of BK and mechanisms of action in immune liver injury induced by TCE. TCE sensitisation significantly increased the expression of BK receptor (B2R) in the liver. Compared to blank and vehicle control group, TCE sensitization positive mice developed exacerbated liver injury evidenced by elevated AST, ALT levels and hepatocyte damage. TCE sensitisation also stimulated MAPK and STAT3 activation in liver tissue. B2R antagonist HOE140 ameliorated these changes. Kupffer cells (KCs) of the liver were also activated following TCE sensitization; both CD68+ KCs and CD16/CD32+ M1 type KCs were increased in TCE positive group. Further experiments isolated the KCs from the liver in each group and showed that TCE sensitisation resulted activation of MAPK signal pathway which in turn caused release of the pro-inflammatory cytokines, IL-1 β , IL-6, TNF- α , in KCs; the antagonist HOE140 again decreased these changes in KCs. These results uncover a novel role of BK and B2R cross-talk in KCs activation in TCE sensitised mice, mediated by pro-inflammatory cytokine release via MAPK and STAT3 activation, contributing to the immune liver injury.

Authors: Zhang J, Li N, Yang L, Xie H, Yang Y, Wang H, Wu C, Shen T, Zhu Q.
Full Source: Toxicology. 2019 Jan 24; 415:37-48. doi: 10.1016/j.tox.2019.01.015. [Epub ahead of print]

Hepatic carboxylesterases are differentially regulated in PPAR α -null mice treated with perfluorooctanoic acid

2019-03-18

Hepatic carboxylesterases (Ces) catalyse the metabolism of drugs, environmental toxicants, and endogenous lipids and are known to be regulated by multiple nuclear receptors. Perfluorooctanoic acid (PFOA) is a synthetic fluorochemical that has been associated with dyslipidemia in exposed populations. In liver, PFOA can activate nuclear receptors such as PPAR α , and alter the metabolism and excretion of chemicals. In the present study, the authors sought to test the ability of PFOA to modulate Ces expression and activity in the presence and absence of the PPAR α receptor. For this purpose, male C57BL/6 NCrI mice were administered PFOA (1 or 3 mg/kg, po, 7 days) and livers collected for assessment of Ces expression and activity. PFOA increased Ces1 and 2 protein and activity. Notably, PFOA increased Ces1d, 1e, 1f, 1g, 2c, and 2e mRNAs between 1.5- and 2.5-fold, while it decreased Ces1c and 2b. Activation of PPAR α by PFOA was confirmed by up-regulation of Cyp4a14 mRNA. In a separate study of PFOA-treated wild-type (WT) and PPAR α -null mice, induction of Ces 1e and 1f mRNA and in turn, Ces1 protein, was PPAR α -dependent. Interestingly, in PPAR α -null mice, Ces1c, 1d, 1g, 2a, 2b, and 2e mRNAs and

In the present study, the authors sought to test the ability of PFOA to modulate Ces expression and activity in the presence and absence of the PPAR α receptor.

Ces2 protein were up-regulated by PFOA which contributed to sustained up-regulation of Ces activity, although to a lower extent than observed in WT mice. Activation of the CAR and PXR receptors likely accounted for up-regulation of select Ces1 and 2 subtypes in PPAR α -null mice. In conclusion, the environmental contaminant PFOA modulates the expression and function of hepatic Ces enzymes, in part through PPAR α .

Authors: Wen X, Baker AA, Klaassen CD, Corton JC, Richardson JR, Aleksunes LM.

Full Source: Toxicology. 2019 Jan 24; 416:15-22. doi: 10.1016/j.tox.2019.01.014. [Epub ahead of print]

OCCUPATIONAL RESEARCH

Circulating microRNAs as potential biomarkers of occupational exposure to low dose organic solvents

2019-03-18

Circulating microRNAs (miRNAs) have been recently acknowledged as novel and non-invasive biomarkers of exposure to environmental and occupational hazardous substances. This preliminary study investigates the potential role of blood miRNAs as molecular biomarkers of exposure to the most common organic solvents (ethylbenzene, toluene, xylene) used in the shipyard painting activity. Despite the low number of recruited workers, a two-tail standard Students' test with Holm-Bonferroni adjusted p-value shows a significant up-regulation of two miRNAs (miR_6819_5p and miR_6778_5p) in exposed workers with respect to controls. A correlation analysis between miRNA, differentially expressed in exposed workers and in controls and urinary dose biomarkers i.e. methylhyppuric acid (xylenes metabolite), phenylglyoxylic and mandelic acid (ethylbenzene metabolites) S-benzyl mercapturic acid (toluene metabolite) and S-phenylmercapturic acid (benzene metabolite) measured at the end of the work-shift, allowed the identification of high correlation (0.80-0.99) of specific miRNAs with their respective urinary metabolites. MiRNA_671_5p correlated with methylhippuric, S-phenylmercapturic and S-benzyl mercapturic acid while the miRNA best correlating with the phenylglyoxylic acid was miRNA_937_5p. These findings suggest miRNA as sensitive biomarkers of low dose exposure to organic chemicals used at workplace. Urinary DNA and RNA repair biomarkers coming from the oxidation product of guanine have been also associated to the different miRNAs. A significant negative association was found between 8-oxo-7,8-dihydroguanine (8-oxoGua) urinary concentration and miR_6778_5p. The findings of the present pilot study deserve to be tested on a larger

This preliminary study investigates the potential role of blood miRNAs as molecular biomarkers of exposure to the most common organic solvents used in the shipyard painting activity.

population with the perspective of designing a miRNA-based test of low dose exposure to organic solvents.

Authors: Sisto R, Capone P, Cerini L, Sanjust F, Paci E, Pigni D, Gatto MP, Gherardi M, Gordiani A, L'Episcopo N, Tranfo G, Chiarella P.

Full Source: Toxicology Reports. 2019 Jan 8; 6:126-135. doi: 10.1016/j.toxrep.2019.01.001. eCollection 2019.

Chronic low dose exposure of hospital workers to ionizing radiation leads to increased micronuclei frequency and reduced antioxidants in their peripheral blood lymphocytes

2019-03-18

The regular low dose occupational exposure to ionising radiation may induce deleterious health effects, which may be of particular interest to medical radiation workers who daily handle X-ray machines. Human peripheral blood lymphocytes are able to retain the signature of radiation-induced DNA damage; therefore, the present study was undertaken to investigate the DNA damage and antioxidants status in hospital workers occupationally exposed to low doses of X-rays. The peripheral blood lymphocytes of the occupationally exposed and control groups matched for age, gender, tobacco usage, and alcohol consumption were cultured and micronuclei frequency was determined. Activities of antioxidant enzymes and lipid peroxidation were also estimated in their plasma. The micronuclei frequency in the occupationally exposed group (n = 33), increased significantly ($p < .0001$) followed by reduced glutathione-S-transferase ($p < .01$) and catalase ($p < .001$) activities, and increased lipid peroxidation ($p < .05$) when compared to the control group (n = 33). Occupational exposure resulted in an effective dose ranging between 3.14 to 144.5 mSv (40.88 ± 39.86 mSv) depending on the employment duration of 3-29 years (10.33 ± 7.05 years). A correlation between the micronuclei frequency ($p < .05$) and catalase activity ($p < .05$) existed in the occupationally exposed individuals depending on the smoking habit, age, duration of employment, cumulative exposure dose and number of patients handled per day. The authors have observed that protracted low dose exposure to ionising radiation is an inevitable occupational hazard leading to persistence of oxidative stress and increased genomic instability in the radiological technicians depending on the time spent with X-rays,

The present study was undertaken to investigate the DNA damage and antioxidants status in hospital workers occupationally exposed to low doses of X-rays.

cumulative dose received and the number of patients handled daily raising the risk of cancer development.

Authors: Siama Z, Zosang-Zuali M, Vanlalruati A, Jagetia GC, Pau KS, Kumar NS.

Full Source: International Journal of Radiation Biology. 2019 Jan 22:1-15. doi: 10.1080/09553002.2019.1571255. [Epub ahead of print]

High seroprevalence of hepatitis E virus in rabbit slaughterhouse workers

2019-03-18

Hepatitis E virus (HEV) was first detected in rabbits in the year 2009. Rabbit HEV is now known to be widely prevalent in rabbits and tentatively assigned into genotype 3 (HEV-3) as subgenotype-3ra (HEV-3ra). However, its role in human infection remains undetermined. This study was conducted to investigate the prevalence of HEV infection among rabbit slaughterhouse workers and to identify whether the workers exposed to rabbits are at a higher risk of HEV infection. Seventy-five workers at rabbit slaughterhouses and a control group of 421 general adults in the same area in Hebei province, China, were serologically examined for anti-HEV antibodies. HEV seroprevalences between the slaughterhouse workers and the general adults were compared. Age-adjusted prevalence of anti-HEV immunoglobulin G (IgG) in the rabbit slaughterhouse workers and control group was 46.1% and 10.8% respectively. The slaughterhouse workers had significantly higher seroprevalence and an approximately 6.9-fold increased risk for being seropositive for anti-HEV IgG as compared to the general population (odds ratio, 6.9; 95% CI: 4.3, 10.9). In slaughterhouse workers, anti-HEV IgG positive rate was positively associated with working years; in general adults, this rate was positively associated with age. The prevalence of anti-HEV immunoglobulin M (IgM) among exposed workers (6.7%) was significantly higher than that of control groups (1.2%). In conclusion, the seroprevalence of HEV is significantly higher in slaughterhouse workers than in general adults indicating that occupational exposure to rabbits is a potential risk factor for HEV infection.

Authors: Geng Y, Zhao C, Geng K, Wang C, Wang X, Liu H, Wang Y.

Full Source: Transboundary and Emerging Diseases. 2019 Jan 19. doi: 10.1111/tbed.13130. [Epub ahead of print]

In this study, the authors examined the association between occupational Pb exposure and ECG conduction abnormalities, as well as RyRs in Pb-induced ECG abnormalities.

ECG conduction disturbances and ryanodine receptor expression levels in occupational lead exposure workers

2019-03-18

A significant number of researches have evidenced that occupational lead (Pb) exposure increased risks of cardiovascular disease. However, evidences about the potential effects of Pb on the cardiac conduction system are sparse and inconclusive. Besides, ryanodine receptors (RyRs) induced dysfunction of cardiac excitation contraction coupling which is considered to be one of the mechanisms in cardiovascular diseases. Therefore, the authors examined the association between occupational Pb exposure and ECG conduction abnormalities, as well as RyRs in Pb-induced ECG abnormalities.

METHODS: We investigated 529 Pb smelter workers, and measured blood lead (BPb), zinc protoporphyrin (ZPP), ECG outcomes and RyR expression levels. Based on BPb levels, the workers were divided into three groups: the BPb not elevated group, the BPb elevated group and the Pb poisoning group. Descriptive and multivariable analyses were performed. Compared with the BPb not elevated group, the Pb poisoning group had a higher incidence of high QRS voltage, and a lower level of RyR1 gene expression ($p < 0.05$). Further unconditional multivariable logistic regression analyses showed that high QRS voltage was positively related to BPb ($OR = 1.045$, 95% CI 1.014 to 1.078) and inversely associated with RyR1 expression ($OR = 0.042$, 95% CI 0.002 to 0.980) after adjusting for potential confounders. In addition, multiple linear regression analyses showed that the QTc interval was positively associated with ZPP ($\beta = 0.299$, 95% CI 0.130 to 0.468) after adjusting for potential confounders. This study provided evidences that occupational exposure to Pb may be associated with worse ECG outcomes (high QRS voltage), which might be related to decreased levels of RyR1.

Authors: Xie J, Du G, Zhang Y, Zhou F, Wu J, Jiao H, Li Y, Chen Y, Ouyang L, Bo D, Feng C, Yang W, Fan G.

Full Source: Occupational & Environmental Medicine. 2019 Mar;76(3):151-156. doi: 10.1136/oemed-2018-105463. Epub 2019 Jan 19.

This study examined the prevalence of self-reported symptoms of sensitivity to chlorhexidine solutions among health care workers.

Health care worker sensitivity to chlorhexidine-based hand hygiene solutions: A cross-sectional survey

2019-03-18

Health service hand hygiene programs have seen widespread use of chlorhexidine solutions. Reports of both immediate and delayed hypersensitivity to chlorhexidine are increasing among health care

Technical

CHEMWATCH

workers. This study examined the prevalence of self-reported symptoms of sensitivity to chlorhexidine solutions among health care workers. This study was a cross-sectional online anonymous survey of all workers at a single health service. Of the 1,050 completed responses, 76.3% were female, 35.3% were nurses and midwives, 28% were medical staff, and 8.7% were working in nonclinical areas. Over 95% used chlorhexidine-based hand hygiene products in their workplace. Nurses and midwives most frequently reported asthma (13.7%), contact dermatitis (27.8%), and previous testing for allergy to chlorhexidine (4.9%). There was a correlation between both the presence of atopy, eczema, or dermatitis and the self-reporting of dry skin, eczema, or dermatitis attributed to chlorhexidine use. Occupational chlorhexidine allergy is an important risk to health care workers. Self-reported symptoms of sensitivity to chlorhexidine solutions revealed high reported use and presence of skin symptoms among health care workers. Screening programs need to identify nurses who develop chlorhexidine sensitivity due to occupational exposure. Strategies to mitigate risk should provide alternatives for those with sensitisation.

Authors: Barnes S, Stuart R, Redley B.

Full Source: American Journal of Infection Control. 2019 Feb 11. pii: S0196-6553(19)30025-2. doi: 10.1016/j.ajic.2019.01.006. [Epub ahead of print]

PUBLIC HEALTH RESEARCH

Associations of blood levels of trace elements and heavy metals with metabolic syndrome in Chinese male adults with microRNA as mediators involved

2019-03-18

Metabolic syndrome (MetS) is a global health problem with an increasing prevalence. However, effects of trace elements and heavy metals on MetS and the mechanism underlying this effect are poorly understood. A preliminary cross-sectional study was conducted in 2015. Significantly higher blood concentrations of lead (Pb), cadmium (Cd), copper (Cu), and selenium (Se) were observed in the MetS group. With a priori adjustment for age, the concentration of Cu and Se in the blood was associated with a 2.56 - fold [95% confidence interval (CI), 1.11, 5.92] and 3.31 - fold (95% CI, 1.4, 7.82) increased risk of MetS, respectively. Moreover, increased blood Se concentrations were associated with body mass index (BMI) [odds ratio (OR): 2.56; 95% CI, 1.11, 5.93], high blood pressure [for both systolic and diastolic blood pressures (SBP and DBP); OR: 3.82; 95% CI, 1.47, 7.31 for SBP and OR: 2.56; 95% CI, 1.18, 5.59 for DBP], and hypertriglyceridemia (OR:

A preliminary cross-sectional study was conducted on the effects of trace elements and heavy metals on metabolic syndrome.

3.3; 95% CI, 1.51, 7.2). In addition, the expression of miR-21-5p, miR-122-5p, and miR-146a-5p was significantly higher in subjects with MetS than those without MetS. Increased expression of miR-21-5p was significantly associated with increased SBP ($\beta = 5.28$; 95% CI, 0.63, 9.94) and DBP ($\beta = 4.17$; 95% CI, 0.68, 7.66). Moreover, Cu was positively associated with miR-21-5p ($\beta = 3.02$; 95% CI, 0.07, 5.95), whereas Se was positively associated with miR-122-5p ($\beta = 2.7$; 95% CI, 0.64, 4.76). The bootstrapping mediation models indicated that miR-21-5p partially mediated the relationships between Cu level and SBP/DBP. This study suggested that Cu and Se were both associated with MetS, and miR-21-5p participated in the development of MetS associated with Cu.

Authors: Guo X, Yang Q, Zhang W, Chen Y, Ren J, Gao A.

Full Source: Environmental Pollution. 2019 Feb 6; 248:66-73. doi: 10.1016/j.envpol.2019.02.015. [Epub ahead of print]

Second-hand smoke exposure in adulthood and lower respiratory health during 20 year follow up in the European Community Respiratory Health Survey

2019-03-18

Early life exposure to tobacco smoke has been extensively studied but the role of second-hand smoke (SHS) for new-onset respiratory symptoms and lung function decline in adulthood has not been widely investigated in longitudinal studies. The aim of the present study is to investigate the associations of exposure to SHS in adults with respiratory symptoms, respiratory conditions and lung function over 20 years. Information from 3011 adults from 26 centres in 12 countries who participated in the European Community Respiratory Health Surveys I-III and were never or former smokers at all three surveys were used. Associations of SHS exposure with respiratory health (asthma symptom score, asthma, chronic bronchitis, COPD) were analysed using generalised linear mixed-effects models adjusted for confounding factors (including sex, age, smoking status, socioeconomic status and allergic sensitisation). Linear mixed-effects models with additional adjustment for height were used to assess the relationships between SHS exposure and lung function levels and decline. Reported exposure to SHS decreased in all 26 study centres over time. The prevalence of SHS exposure was 38.7% at baseline (1990-1994) and 7.1% after the 20-year follow-up (2008-2011). On average 2.4% of the study participants were not exposed at the first, but were exposed at the third examination. An increase in SHS exposure over time was associated with doctor-diagnosed asthma (odds ratio (OR): 2.7; 95% confidence interval (95%-CI): 1.2-5.9), chronic bronchitis (OR:4.8; 95%-CI:

The aim of the present study is to investigate the associations of exposure to SHS in adults with respiratory symptoms, respiratory conditions and lung function over 20 years.

1.6-15.0), asthma symptom score (count ratio (CR): 1.9; 95%-CI: 1.2-2.9) and dyspnoea (OR: 2.7; 95%-CI: 1.1-6.7) compared to never exposed to SHS. Associations between increase in SHS exposure and incidence of COPD (OR: 2.0; 95%-CI: 0.6-6.0) or lung function (β : -49 ml; 95%-CI: -132, 35 for FEV1 and β : -62 ml; 95%-CI: -165, 40 for FVC) were not apparent. Exposure to second-hand smoke may lead to respiratory symptoms, but this is not accompanied by lung function changes.

Authors: Flexeder C, Zock JP, Jarvis D, Verlato G, Olivieri M, Benke G, Abramson MJ, Sigsgaard T, Svanes C, Torén K, Nowak D, Jögi R, Martinez-Moratalla J, Demoly P, Janson C, Gislason T, Bono R, Holm M, Franklin KA, Garcia-Aymerich J, Siroux V, Leynaert B, Dorado Arenas S, Corsico AG, Pereira-Vega A, Probst-Hensch N, Urrutia Landa I, Schulz H, Heinrich J. Full Source: Respiratory Research. 2019 Feb 14;20(1):33. doi: 10.1186/s12931-019-0996-z.

Geographic and socio-economic variation in markers of indoor air pollution in Nepal: evidence from nationally-representative data

2019-03-18

In low-income countries such as Nepal, indoor air pollution (IAP), generated by the indoor burning of biomass fuels, is the top-fourth risk factor driving overall morbidity and mortality. The authors present the first assessment of geographic and socio-economic determinants of the markers of IAP (specifically fuel types, cooking practices, and indoor smoking) in a nationally-representative sample of Nepalese households. Household level data on 11,040 households, obtained from the 2016 Nepal Demographic and Health Survey, were analysed. Binary logistic regression analyses were conducted to assess the use of fuel types, indoor cooking practices, indoor smoking and IAP with respect to socio-economic indicators and geographic location of the household. More than 80% of the households had at least one marker of IAP: 66% of the household used unclean fuel, 45% did not have a separate kitchen to cook in, and 43% had indoor smoking. In adjusted binary logistic regression, female and educational attainment of household's head favoured cleaner indoor environment, i.e., using clean fuel, cooking in a separate kitchen, not smoking indoors, and subsequently no indoor pollution. In contrast, households belonging to lower wealth quintile and rural areas did not favour a cleaner indoor environment. Households in Province 2, compared to Province 1, were particularly prone to indoor pollution due to unclean fuel use, no separate kitchen to cook in, and smoking indoors. Most of the districts had a high burden of IAP and its markers. Fuel choice and clean

In this study commercial off the shelf low-cost and low-power photo-ionisation detector (PID) sensors are used as simple detectors in VOC analysis systems based on GC

indoor practices are dependent on household socio-economic status. The geographical disparity in the distribution of markers of IAP calls for public health interventions targeting households that are poor and located in rural areas.

Authors: Ghimire S, Mishra SR, Sharma A, Siweya A, Shrestha N, Adhikari B.
Full Source: BMC Public Health. 2019 Feb 14;19(1):195. doi: 10.1186/s12889-019-6512-z.

Low-cost photoionisation sensors as detectors in GC × GC systems designed for ambient VOC measurements

2019-03-18

Conventional volatile organic compound (VOC) monitoring based on thermal desorption - gas chromatography-mass spectrometry (TD-GC-MS) or gas chromatography-flame ionisation detector (TD-GC-FID) is relatively cumbersome and expensive. In this study commercial off the shelf low-cost and low-power photo-ionisation detector (PID) sensors are used as simple detectors in VOC analysis systems based on GC, including a miniaturised GC × GC device with portable, low-cost, and low-energy-consumption features. PID sensors produce a voltage signal positively proportional to VOC concentration, which when incorporated into a TD-GC system gave limit of detection of 0.02 ppbV for isoprene. To test PID performance in real-world applications, PID sensors were deployed as (i) a second alternative detector in a GC-Quadruple Time Of Flight Mass spectrometry (GC-Q-TOF-MS), and (ii) the main detector in a compact two-dimensional gas chromatograph (GC × GC). PID sensors with 10.6 eV and 11.7 eV lamps were used to measure eight toxic chemicals including organic sulfide and organic phosphonates via GC; two species were ionised by a 10.6 eV lamp and four species by the 11.7 eV lamp. Commercially available low-cost PIDs designed for standalone could be straightforwardly and effectively re-used as detectors in compact GC × GC systems, in this work showing excellent VOC sensitivity, fast response and low operational demands compared to comparable field instruments based on GC-FID or MS.

Authors: Pang X, Nan H, Zhong J, Ye D, Shaw MD, Lewis AC.
Full Source: Science of the Total Environment. 2019 May 10; 664:771-779. doi: 10.1016/j.scitotenv.2019.01.348. Epub 2019 Feb 5.

Lead exposure during sensitive developmental periods on sexual maturation. This study examined the association of prenatal and early childhood lead exposure with pubertal stages in boys and girls in Mexico City.

Early lead exposure and pubertal development in a Mexico City population

2019-03-18

Previous studies have examined the association between blood lead levels and pubertal timing in adolescent girls; however, the evidence is lacking on the role of lead exposure during sensitive developmental periods on sexual maturation. This study examined the association of prenatal and early childhood lead exposure with pubertal stages among 264 boys and 283 girls aged 9.8-18.0 years in Mexico City. The authors measured maternal bone lead (a proxy for cumulative foetal exposure to lead from maternal bone stores mobilized during pregnancy) at 1 month postpartum. Blood lead was measured annually from 1 to 4 years. Pubertal stage was assessed by a paediatrician. The authors examined the association between lead and pubertal stages of breast, pubic hair and genitalia using ordinal regression. Age at menarche was evaluated using Cox proportional-hazard models. Multivariate models showed that maternal patella lead and early childhood blood lead were inversely associated with breast growth (patella OR = 0.72, 95% CI: 0.51-1.00; blood OR = 0.70, 95% CI: 0.53-0.93) in girls. Girls with maternal patella lead in the 3rd tertile and child blood lead in the 2nd tertile had a later age at menarche compared with girls in the 1st tertile (patella HR = 0.60, 95% CI: 0.41-0.88; blood HR = 0.65, 95% CI 0.46-0.91). Additionally, early childhood blood lead was negatively associated with pubic hair growth (OR = 0.68, 95% CI: 0.51-0.90) in girls. No associations were found in boys. The authors concluded that the data suggest that higher prenatal and early childhood exposure to lead may be associated with delayed pubertal development in girls but not boys. The findings are consistent with previous analyses and reinforce the reproductive effects of lead for girls.

Authors: Liu Y, Téllez-Rojo MM, Sánchez BN, Zhang Z, Afeiche MC, Mercado-García A, Hu H, Meeker JD, Peterson KE.

Full Source: Environment International. 2019 Apr; 125:445-451. doi: 10.1016/j.envint.2019.02.021. Epub 2019 Feb 11.