2023 精準環境醫學國際研討會

International Symposium of Precision Environmental Medicine

環境荷爾蒙的生物監測與臨床轉譯

Clinical and Transitional Research

大會手冊

April 29, 2023, Kaohsiung

Organizer/

Co-organizer/

目錄 Contents

研討會簡介 Objectives

自從 1962 年「寂靜的春天(Silent Spring)」一書問世以來，環境荷爾蒙(即持久性內分泌干擾化學物質，Endocrine Disrupting Chemicals)的生態及健康威脅廣受各界重視，而隨著工業化社會的發展，環境荷爾蒙的種類也越發多形多樣，從傳統的戴奧辛(Dioxin)、滴滴涕農藥(Dichloro-Diphenyl-Trichloroethane，DDT)、毒性重金屬，到近幾年來受到廣泛重視的鄰苯二甲酸酯類塑化劑(Phthalate)、全氟碳化物(Perfluoroalkyl Substances，PFAS)、多溴二苯醚類阻燃劑(Polybrominated Diphenyl Ethers，PBDEs)、有機磷酸脂類阻燃劑(Organophosphate Flame Retardants，OPFRs)等，這類內分泌干擾物質對人類健康的威脅可說是越來越多元且複雜化。而國際組織及各國政府也陸續建立相關公約及法規來歸類及管理這類有害物質，包含聯合國斯德哥爾摩公約(Stockholm Convention on Persistent Organic Pollutants)、歐盟的 REACH 法規(Registration，Evaluation，Authorization，and Restriction of Chemicals)等都是其中的代表。

我國環保署自 2010 年起連結部會署共同推動環境荷爾蒙管理計畫，於 2022 年邁入第三期計畫階段，計畫目標著重在環境背景監控、食品商品抽測、滾動更新環境荷爾蒙清單，以及針對敏感族群加強檢測及宣導等方向。此外，國家衛生研究院為探討環境中的化學物質對國人健康之影響(如塑化劑、空氣污染物…等)，於 2011 年成立國家環境毒物研究中心，並於 2015 年整合環境醫學研究量能，成立國家環境醫學研究所，以精準環境醫學的角度及暴露體學的概念，探討環境健康風險、環境與國人重大疾病因果關係，以及新興職業及重大職業災害健康風險等議題，因此，環境荷爾蒙的研究也是一大研究重點。

高雄長庚紀念醫院從 2020 年起，由龔嘉德副院長領銜推動「環境荷爾蒙暴露對人體疾病影響之轉譯醫學研究」之整合型研究計畫，邀集國內環境毒物研究翹楚共同指導，從臨床發現健康危害，建立分析技術進行人體暴露檢測，並由醫師於臨床門診提供患者醫療建議、衛教與識能提升，以擴展我國精準環境醫學的醫學研究及臨床應用，提供國人環境荷爾蒙相關的檢測選項及預防醫學服務，期望藉由辦理此次研討會，邀集國內產、官、學、研相關機構與國外專家學者分享討論，透過瞭解國際間最新研究現況及趨勢，提升我國相關領域醫學研究品質，增進國民健康福祉。

主辦、協辦單位 Organizer & Co-organizer

主辦單位 Organizer

國家衛生研究院
National Health Research Institutes

長庚高雄

協辦單位 Co-organizer

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國立高雄科技大學
National Kaohsiung University of Science and Technology

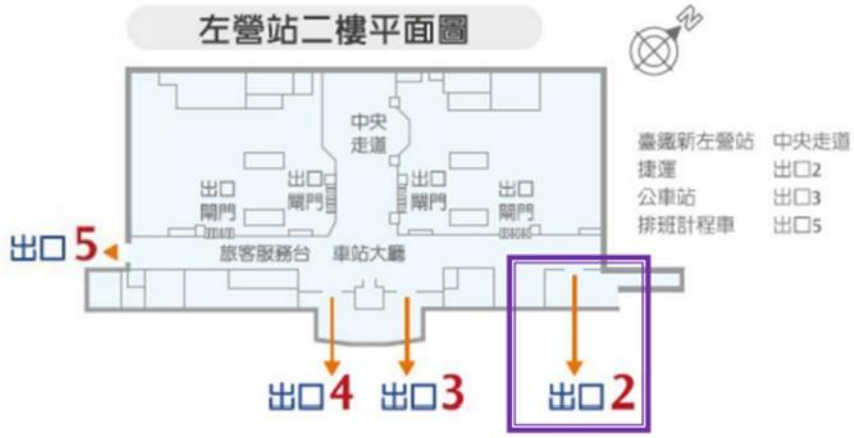
正修科技大學
CHENG SHIU UNIVERSITY

交通資訊、活動平面圖 Traffic Info & Floor Plan

2023 年 4 月 29 日

精準環境醫學國際研討會-左營高鐵站至高雄長庚醫院免費接駁車

日期	接駁路程	發車時間	候車處
4/29(六)	左營高鐵站→高雄長庚醫院	AM 08:50	左營高鐵站 2 號出口 1F 巴士站
4/29(六)	高雄長庚醫院→左營高鐵站	PM 17:40	高雄長庚醫院醫學大樓大門口



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機車 兒童醫院後方-訪客機車停車場：每次 10 元/天。

汽車 (一)第一、二停車場：每小時 20 元，單日最高 240 元。

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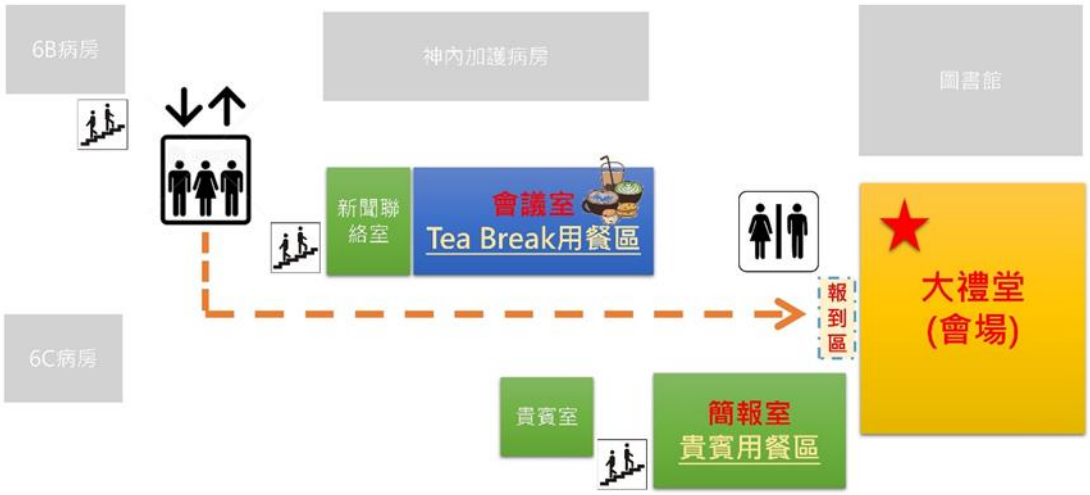
2023年精準環境醫學國際研討會
高雄長庚紀念醫院 醫學大樓 6樓大禮堂 位置圖



研討會議程 Agenda

上午場 Morning session

Time	Event
0830–0910	**Registration**
0910–0940	**Opening Remarks**
0940–1100	**Topic 1** **Endocrine Disrupting Chemicals and Health Impact**
0940–1020	Endocrine-Disrupting Chemicals: Scientific, Economic, Regulatory, and Policy Implications Dr. Leonardo Trasande
1020–1100	Hazards of Endocrine Disrupting Chemicals to Humans and Environments, and Future Investigation Directions Dr. Ching-Chang Lee
1100–1110	**Coffee Break and Group Photo**
1110–1230	**Topic 2** **Endocrine Disrupting Chemicals and Biomonitoring**
1110–1150	Occurrence and Risk Assessment of Environmental Hormones in Marine Organisms Dr. Cheng-Di Dong
1150–1230	Behavioral Effects of Endocrine Disrupting Chemicals on Fish: An Ecotoxicological Perspective Dr. Te-Hao Chen

下午場 Afternoon session

Time	Event
1230–1330	**Lunch and Poster Exhibition**
1330–1450	**Topic 3** **Endocrine Disrupting Chemicals and Clinical Medicine**
1330–1410	Novel Endocrine Disrupting Chemicals: Development and Clinical Application of Phthalate and OPFR Testing Dr. Kai-Fan Tsai
1410–1450	Impact of Pharmaceutical Pollutants and Their Disinfection Byproducts on Water Resource and Wastewater Treatment Technologies Dr. Wei-Hsiang Chen
1450–1500	**Coffee Break**
1500–1620	**Topic 4** **Environmental Toxicology, Endocrine Disrupting Chemicals, and Precision Medicine**
1500–1540	The Possible Roles of Autophagy in Nanomaterial Toxicity and Safety Assessment-Related Alternative Testing: Take the Ag/ZnO NPs for Example Dr. Ying-Jan Wang
1540–1620	Thyroid Hormone Disruption and Other Adverse Outcomes of Organic UV Filters in Humans and Zebrafish Dr. Kyungho Choi
1620–1710	**Oral Presentation and Award Ceremony**
1710–1730	**Closing Ceremony and Remarks**

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2. 參與會議時，人員須全程配戴口罩，除以下符合法規之例外狀況：All attendees must wear masks throughout the conference, except for the following exceptions:
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   (2) 人員進行短暫飲水且周邊人員均配戴口罩或保持社交距離時。Drinking water while the people around are wearing masks or maintaining social distancing.
   (3) 人員進行會議所需之團體合照或個人拍照時。When taking group photos.
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5. 除規劃之用餐及 Coffee Break 區域外，會場室內不開放飲食(短暫飲水除外) Food and beverages (except for drinking water) are not allowed inside the conference venue except in designated dining and coffee break areas

Topic 1: 環境荷爾蒙的健康效應
Endocrine Disrupting Chemicals and Health Impact

與談人 Panelist

王淑麗研究員 Dr. Shu-Li Wang

Dr. Shu-Li (Julie) Wang, PhD
Principal Investigator, National Institute of Environmental Health Sciences, National Health Research Institutes, Miaoli, Taiwan

Biographies:

Julie Shu-Li Wang is a Principal Investigator at the National Health Research Institutes, Taiwan. She obtained BSc from National Taiwan University and M-Phill/PhD from University College London UK in Epidemiology and Public Health. Julie works in the National Institute of Environmental Health Sciences, focusing on early life environment and later health and diseases related to neurological, immune, and endocrine disorders. She is now the chair of ISEE AWPC (International Society for Environmental Epidemiology, Asia and Western Pacific Chapter) and ISEE Fellow and representative to the WHO climate and Health Alliance. In addition, she carried out birth cohort studies such as evaluating environmental factors in pregnant women and follow-up of the offspring at 2, 5, 8, 11, 14, 17, and 21-year-old. There are over 100 papers published in good and prestigious journals. Julie genuinely wishes to collaborate with scientists on Women's and Children's Environmental Health to benefit populational health.

Education:

- 1986–1990: Bachelor of Public Health, College of Medicine, National Taiwan University, Taipei, Taiwan
- 1990-1995: PhD Degree in Epidemiology and Public Health, University College

London, London University, London, UK

- 1995–1996: Post-doctoral Fellow in Gerontology and Epidemiology, Department of Gerontology, Cambridge University, Cambridge, UK
- 1996–1997: Post-doctoral Fellow in Epidemiology, Institute of Biomedical Sciences, Academia Sinica, Taipei, Taiwan
- 2012–2014: Scientist Fellow in Environmental Epidemiology, National Institute of Environmental Health Sciences, National Institutes of Health, Bethesda, MD, USA

Experience & Honor:

- 2022–Present: International Society for Environmental Epidemiology (ISEE) Fellow
- 2021–Present: Taiwan Epidemiology Association, Executive Councilor Elect
- 2020–Present: ISEE (International Society for Environmental Epidemiology) – AWPC (Asia and Western Pacific Chapter) Chair-Elect and Chair
- 2019–Present: Members of Membership and Communication Committees at ISEE
- 2017–Present: Secretary General of ISEE-AC
- 2016–2019: Proposal Reexamination committee member of Department of Life Science (Division of Social Medicine and Division of Mother and Child Medicine), Ministry of Science and Technology (MOST), Taiwan.
- 2015: Proposal Reexamination committee member of Department of Natural Sciences and Sustainable Development (Division of Sustainability), Ministry of Science and Technology (MOST), Taiwan.
- 2009–2010: Who's Who in Medicine and Healthcare
- 2006: Young Scientist Award, National Health Research Institutes, Taiwan
- 2002: Young Scientist Award, Asian Conference Occupational Health Meeting (ACOH)
- 1997: Participate in international academic conference awards, Academia Sinica
- 1996: Participates in international academic conference awards, European Diabetes Association

Refereed Papers:

1. **Wang SL***, Chiou JM, Chen CJ, Tseng CH, Wang CC, Chou WL, Wu TN, Chang LW. Prevalence of non-insulin-dependent diabetes mellitus and related vascular diseases in southwestern arseniasis-endemic and non-endemic areas in Taiwan. *Environ Health Perspect.* 2003; 111(2):115-159.

2. **Wang SL***, Su PH, Jong SB, Guo YL, Chou WL, Papke O. In utero exposure to dioxins and polychlorinated biphenyls and its relations to thyroid function and growth hormone in newborns. *Environ Health Perspect.* 2005; 113 (11):1645-50.

3. Chao HR, **Wang SL***, Su PH, Yu HY, Yu ST, Papke O. Levels of polychlorinated dibenzo-p-dioxins and dibenzofurans in primipara breast milk from Taiwan: estimation of dioxins and furans intake for breastfed infants. *J Hazard Mater.* 2005; 121(1-3):1-10.

4. Chiou JM, **Wang SL***, Chen CJ, Deng CR, Lin W, Tai TY. Arsenic ingestion and increased microvascular disease risk: observations from the south-western arseniasis-endemic area in Taiwan. *Int J Epidemiol.* 2005; 34(4):936-43.

5. **Wang SL***, Chang YC, Chao HR, Li CM, Li LA, Lin LY, Päpke O. Body burdens of polychlorinated dibenzo-p-dioxins, dibenzofurans and biphenyls (PCDD/DFs, PCBs) and its relations to estrogen metabolism in pregnant women. *Environ Health Perspect.* 2006; 114(5):740-745.

6. **Wang SL**, Chang FH, Liou SH, Wang, HJ, Li WF, Hsieh DP. Inorganic arsenic exposure and metabolic syndrome in an industrial area of Taiwan. *Environ Int.* 2007; 33(6):805-11.

7. **Wang SL**, Tsai PC, Guo YL. Increased risk of diabetes and polychlorinated biphenyls and dioxins: 24-year follow-up study of Yucheng cohort. *Diabetes Care*. 2008; 31(8):1574-1579.

8. Lin W, **Wang SL***, Wu HJ, Chang KH, Yeh P, Chen CJ, Guo HR. Associations between arsenic in drinking water and pterygium in southwestern Taiwan. *Environ Health Perspect.* 2008; 116(7):952-955.

9. **Wang SL***, Pan WH, Lee MC, Cheng SP, Chang MC. Predictors of survival among elders suffering strokes in Taiwan – observation from a nationally representative sample. *Stroke.* 2000; 31(10):2354-2360.

10. **Wang SL***, Tseng CC, Chen CJ. 2011. Arsenic and type 2 diabetes and hypertension in human populations. in: health hazards of environmental arsenic poisoning: from epidemic to pandemic. (Chen CJ, Chiou HY, Eds). Health Hazards of Environmental Arsenic Poisoning,135-160. (ISBN)

11. Huang PC, Su PH, Chen HI, Tsai JL, Huang HB, Huang HI, **Wang SL** *, Childhood blood lead levels and intellectual development after ban of leaded gasoline in Taiwan: a 9-year prospective study. *Environ Int*. 2012; 40:88-96.

12. Wang Y, Rogan JW, Chen PC, Lien GW, Chen HY, Tseng YC, Longnecker PM, **Wang SL***. Association between maternal serum perfluoroalkyl substances during pregnancy and maternal and cord thyroid hormones: Taiwan maternal and infant cohort study. *Environ Health Perspect.* 2014; 122(5):529-34.

13. Lien YJ, Ku HY, Su PH, Chen SJ, Chen HY, Liao PC, Chen WJ, **Wang SL***. Prenatal exposure to phthalate esters and behavioral syndromes in children at 8 years of age: Taiwan Maternal and Infant Cohort Study. *Environ Health Perspect*. 2015; 123(1):95-100.

14. Tsai TL, Kuo CC, Pan WH, Chung YT, Chen CY, Wu TN, **Wang SL***. The decline in kidney function with chromium exposure is exacerbated with co-exposure to lead and cadmium. *Kidney Int.* 2017 Sep;92(3):710-720. (Best manuscript award, Professor Chen Hong-Bei Memorial Award; *Best manuscript award of National Medicine Institute Doctoral Student*- the 28th Wang Ming-Ling Award)

15. Wu CF, Chen HM, Sun CW, Chen ML, Hsieh CJ, **Wang SL***, Wu MT. Cohort profile: Taiwan Maternal and Infant Cohort Study (TMICS) of Phthalate exposure and health risk assessment. *Int J Epidemiol.* ***2018; 47(4):1047–1047j.***

16. Kuo CC, Su PH, Sun CW, Liu HJ, Chang CL, **Wang SL***. Early-life arsenic

exposure promotes atherogenic lipid metabolism in adolescence: A 15-year birth cohort follow-up study in central Taiwan. *Environ Int.* 2018;118:97-105.

17. Wen HJ, Huang HB, Tasi TL, **Wang SL***. Health impacts of developmental exposure to environmental chemicals: Chapter 15 – Phthalate, 2019; 375-404. (ISBN:978-981-15-0519-5)
18. Tsai TL, Kuo CC, Pan WH, Wu TN, Lin PP, **Wang SL***. Type 2 diabetes occurrence and mercury exposure – from the National Nutrition and Health Survey in Taiwan. *Environ Int.* 2019; 126:260-267.
19. Wen HJ, Guo YL, Su PH, Sun CW, **Wang SL***. Prenatal and childhood exposure to phthalic acid esters and the vaccination antibody in children: A 15-year follow-up birth cohort study. *Environ Int*. 2020;145:106134.
20. Tsai TL, Lei WT, Kuo CC, Sun HL, Su PH, **Wang SL***. Maternal and childhood exposure to inorganic arsenic and airway allergy - A 15-year birth cohort follow-up study. *Environ Int.* 2021;146:106243.
21. Tsai TL, **Wang SL***, Hsieh CJ, Wen HJ, Kuo CC, Liu HJ, Sun CW, Chen ML, Wu MT, TMICS study group. Association between prenatal exposure to metals and atopic dermatitis among children aged 4 years in Taiwan. *JAMA Network Open*. 2021; 27:4(10) e2131327.
22. Chang CH, Tsai YA, Huang YF, Tsai MS, Hou JW, Lin CL, Wang PW, Huang LW, Chen CY, Wu CF, Hsieh CJ, Wu MT, **Wang SL***, Chen ML*. The sex-specific association of prenatal phthalate exposure with low birth weight and small for gestational age: A nationwide survey by the Taiwan Maternal and Infant Cohort Study (TMICS). *Sci Total Environ*. 2022; 806(Part 3):151261.

座長 Moderator

蘇大成教授 Dr. Ta-Chen Su

Dr. Ta-Chen Su, MD, PhD
Director, Department of Environmental and Occupational Medicine, National Taiwan University College of Medicine, Taipei, Taiwan

Biographies:

Dr. Su has 28 years of experience in academic research and teaching in the fields of preventive cardiology, hyperlipidemia, and occupational and environmental medicine. In past 2 decades, he investigated the impact of environmental pollution on subclinical cardiovascular diseases and endocrine/metabolic health, particularly air pollution and endocrine disrupting chemicals on cardiovascular health in susceptible populations. He led a familial hypercholesterolemia (FH) cohort study and hyperchylomicronemia genetic study in Taiwan since 2008 and established a platform of next generation sequencing for molecular genetic study of FH in National Taiwan University Hospital. Dr. Su serves as an executive committee member of preventive cardiology in Taiwan Society of Cardiology since 2012. He serves as the executive committee member of Asian Pacific Society of Atherosclerosis and Vascular Diseases since 2016. He also serves as the executive committee member of International Atherosclerosis Society Asia Pacific Federation since 2016. He was appointed as the EAS FH Studies Collaboration National Lead Investigator of Taiwan since 2014. He was invited to join as one of the Air Pollution Expert Group, World Heart Federation, since 2019 November. He was appointed as the Director, Department of Environmental and Occupational Medicine, National Taiwan University College of Medicine since 2018 August. He has published more than 200 papers in famous peer-review journals.

Education:

- 2005: PhD Degree, Institute of Occupational Medicine and Industrial Hygiene, College of Public Health, National Taiwan University, Taipei, Taiwan
- 1990: Bachelor of Medicine (MD), College of Medicine, National Taiwan University, Taipei, Taiwan
- 1983: Bachelor of Public Health, College of Medicine, National Taiwan University, Taipei, Taiwan

Experience & Honor:

- Jointly Appointed Professor, Department of Internal Medicine and Cardiovascular Center, National Taiwan University Hospital, Taipei, Taiwan
- Jointly Appointed Professor, Institute of Environmental and Occupational Health Sciences, College of Public Health, National Taiwan University, Taipei, Taiwan
- Deputy Director General, National Taiwan University Experimental Forest, Nantou, Taiwan

Refereed Papers:

1. Chen SY, Chan CC, **Su TC***. Particulate and gaseous pollutants on inflammation, thrombosis, and autonomic imbalance in subjects at risk for cardiovascular disease. *Environ Pollut.* 2017;223:403-408.
2. Lin CY, Chen PC, Hsieh CJ, Chen CY, Hu A, Sung FC, Lee HL, **Su TC***. Positive association between urinary concentration of phthalate metabolites and oxidation of DNA and lipid in adolescents and young adults. *Sci Rep.* 2017;7:44318.
3. Chen SY, Hwang JS, Sung FC, Lin CY, Hsieh CJ, Chen PC, **Su TC***. Mono-2-ethylhexyl phthalate associate with impaired glucose homeostasis and low testosterone in adolescents and young adults. *Environ Pollut.* 2017;225:112-117.
4. **Su TC**, Hwang JJ, Yang YR, Chan CC. Association of long-term exposure to traffic-related air pollution is associated with inflammatory and thrombotic markers in middle-aged adults. *Epidemiology.* 2017;28 Suppl 1:S74-S81.
5. Lin CY, Lee HL, Sung FC, **Su TC***. Investigating the association between urinary levels of acrylonitrile metabolite N-acetyl-S-(2-cyanoethyl)-L-cysteine

and the oxidative stress product 8-hydroxydeoxyguanosine in adolescents and young adults. *Environ Pollut.* 2018 Aug; 239:493-498.

6. Hsiung YC, Lin PC, Chen CS, Tung YC, Yang WS, Chen PL, **Su TC***. Identification of a novel LDLR disease-causing variant using capture-based next-generation sequencing screening of familial hypercholesterolemia patients in Taiwan. *Atherosclerosis.* 2018 Oct; 277:440-447.
7. Lin CY, Hwang YT, Chen PC, Sung FC, **Su TC***. Association of serum levels of 4-tertiary-octylphenol with cardiovascular risk factors and carotid intima-media thickness in adolescents and young adults. *Environ Pollut.* 2019 Mar;246:107-113.
8. Lee CSL, Chou CC, Cheung HC, Tsai CY, Huang WR, Huang SH, Chen MJ, Liao HT, Wu CF, Tsao TM, Tsai MJ, **Su TC**. Seasonal variation of chemical characteristics of fine particulate matter at a high-elevation subtropical forest in East Asia. *Environ Pollut.* 2019 Mar;246:668-677.
9. **Su TC***, Hwang JJ, Sun CW, Wang SL. Urinary phthalate metabolites, coronary heart disease, and atherothrombotic markers. *Ecotoxicol Environ Saf.* 2019 May 30;173:37-44.
10. **Su TC***, Hwang JS, Torng PL, Wu C, Lin CY, Sung FC. Phthalate exposure increases subclinical atherosclerosis in young population. *Environ Pollut.* 2019 Jul;250:586-593.
11. Lin CY, Huang PC, Wu C, Sung FC, **Su TC***. Association between urine lead levels and cardiovascular disease risk factors, carotid intima-media thickness and metabolic syndrome in adolescents and young adults. *Int J Hyg Environ Health.* 2020 Jan;223(1):248-255.
12. Lin CY, Lee HL, Hwang YT, **Su TC***. The association between total serum isomers of per- and polyfluoroalkyl substances, lipid profiles, and the DNA oxidative/nitrative stress biomarkers in middle-aged Taiwanese adults. *Environ Res.* 2020 Mar;182:109064.
13. Lin CY, Lee HL, Jung WT, Sung FC, **Su TC***. The association between urinary levels of 1,3-butadiene metabolites, cardiovascular risk factors, microparticles,

and oxidative stress products in adolescents and young adults. J Hazard Mater. 2020 Sep 5;396:122745.

14. Lin CY, Lee HL, Hwang YT, Wang C, Hsieh CJ, Wu C, Sung FC, **Su TC***. The association between urine di-(2-ethylhexyl) phthalate metabolites, global DNA methylation, and subclinical atherosclerosis in a young Taiwanese population. *Environ Pollut.* 2020;265(Pt B):114912.
15. Lin CY, Lee HL, Hwang YT, Huang PC, Wang C, Sung FC, Wu C, **Su TC***. Urinary heavy metals, DNA methylation, and subclinical atherosclerosis. *Ecotoxicol Environ Saf.* 2020 Nov;204:111039.
16. Chu PC, Wu C, **Su TC***. Association between urinary phthalate metabolites and markers of endothelial dysfunction in adolescents and young adults. *Toxics.* 2021 Feb 6;9(2):33.
17. Han YY, Hsu SH, **Su TC***. Association between vitamin D deficiency and high serum levels of small dense LDL in Middle-Aged Adults. *Biomedicines.* 2021;9(5):464.
18. Chu PL, Lin CY, Sung FC, **Su TC***. Apoptotic microparticles mediate the association between bisphenol A and subclinical atherosclerosis in a young population: A population-based study. *Ecotoxicol Environ Saf.* 2021 Aug 18;224:112663.
19. Lee CK, Wu C, Lin CY, Huang PC, Sung FC, Sung FC, **Su TC***. Positive association between endothelium–platelet microparticles and urinary concentration of lead and cadmium in adolescents and young adults. *Nutrients.* 2021;13: 2913.
20. Lin CY, Lee HL, Wang C, Sung FC, **Su TC***. Association between the total plasma isomers of per- and polyfluoroalkyl substances and erythrograms in young and middle-aged Taiwanese populations. *Ecotoxicol Environ Saf.* 2021 Oct 13;227:112902.
21. Tsao TM, Hwang JS, Tsai MJ, Lin ST, Wu C, **Su TC***. Seasonal effects of high-altitude forest travel on cardiovascular function: An overlooked cardiovascular risk of forest activity. *Int J Environ Res Public Health.* 2021 Sep 8;18(18):9472.

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23. Shu CC, Chen JK, Huang PC, Hwang JS, **Su TC***. Association between urinary manganese and pulmonary function in young adults: a cross-sectional design with a longitudinal cohort validation. *Ecotoxicol Environ Saf.* 2021 Dec 20;227:112937.
24. Shu CC, Lee JH, Tsai MK , **Su TC***, Wen CP*. The ability of physical activity in reducing mortality risks and cardiovascular loading and in extending life expectancy in patients with COPD. *Sci Rep.* 2021 Nov 4;11(1):21674.
25. Chen JK, Wu C, **Su TC***. Positive association between indoor gaseous air pollution and obesity: An observational study in 60 households. *Int J Environ Res Public Health*. 2021, 18(21), 11447.
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27. Lin CY, Chen CW, Lee HL, Wu C, Wang CK, Sung FC, **Su TC***. Global DNA methylation mediates the association between urine mono-2-ethylhexyl phthalate and serum apoptotic microparticles in a young Taiwanese population. *Sci Total Environ.* 2022;808:152054.
28. Chen SY, Wu CF, Wu C, Chan CC, Hwang JS, **Su TC***. Urban fine particulate matter and elements associated with subclinical atherosclerosis in adolescents and young adults. *Environ Sci Technol.* 2022 Jun 7;56(11):7266-7274.
29. Lin PC, Chen CY, Wu C, **Su TC***. Synergistic effects of inflammation and atherogenic dyslipidemia on subclinical carotid atherosclerosis assessed by ultrasound in patients with familial hypercholesterolemia and their family members. *Biomedicines.* 2022 Feb 2;10(2):367.
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between urban and forest parks. *Int J Environ Res Public Health.* 2022 Mar 15;19(6):3451.

31. Lin CY, Wang C, Sung FC, **Su TC***. Association between serum per- and polyfluoroalkyl substances and thrombograms in young and middle-aged Taiwanese populations. *Ecotoxicol Environ Saf.* 2022 May 1;236:113457.
32. Chen SY, Hwang JS, Chan CC, Wu CF, Wu C, **Su TC***. Urban air pollution and subclinical atherosclerosis in adolescents and young adults. *J Adolesc Health.* 2022 Aug;71(2):233-238.
33. Lin CY, Lee HL, Chen CW, Wang C, Sung FC, **Su TC***. Global DNA methylation mediates the association between serum perfluorooctane sulfonate and carotid intima-media thickness in young and middle-aged Taiwanese populations. *Ecotoxicol Environ Saf.* 2022 Aug;241:113782.
34. Shih P, Chu PC, Huang CC, Guo YL, Chen PC, **Su TC***. Hospital occupational health service network and reporting systems in Taiwan from 2008 to 2021. *J Occup Environ Med.* 2023 Feb 1;65(2):e43-e50.
35. Yao CA, Chen IL, Chen CY, Torng PL, **Su TC***. Association between wakeup frequency at night and atherogenic dyslipidemia: Evidence for sex differences. *J Atheroscler Thromb.* 2023 Jan; 30(1):87-99.
36. Chen CY, Chen PH, Chen JK, **Su TC***. Recommendations for ventilation of remodeled negative-pressure isolation wards for COVID-19 patients: A comparison of international guidelines. *J Formos Med Assoc.* 2023 Feb;122(2):91-97.

陳政任教授 Dr. Jenq-Renn Chen

Dr. Jenq-Renn Chen, PhD
Distinguished Professor, Department of Safety, Health and Environmental Engineering, National Kaohsiung University of Science and Technology (NKUST), Kaohsiung, Taiwan

Biographies:

Dr. Chen has held the positions as the chairman of the Department of Safety, Health and Environmental Engineering, the dean of College of Engineering, and the vice president in National Kaohsiung First University of Science and Technology (NKFUST). NKFUST has merged into National Kaohsiung University of Science and Technology (NKUST) since February 2018. He has also been in charge of the Taiwan Environmental Protection Administration (EPA) Southern Center of Emergency Response of Toxic Chemical Substance since 2001, which provides emergency response services to toxic chemical incidents in southern Taiwan.

Education:

- 1993/11: PhD Degree in Chemical Engineering, Imperial College London, London, UK
- 1990/9: Master of Science with Distinction in Chemical Engineering, Imperial College London, London, UK
- 1987/6: Diploma in Chemical Engineering, National Taipei Institute of Technology, Taipei, Taiwan

Experience & Honor:

Dr. Chen has participated in more than 200 hazardous chemical and gas emergency responses and incident investigations in Taiwan, including the catastrophic Kaohsiung explosion in 2014.

Refereed Papers: (past 5 years)

1. Nguyen, T. T., Y. J. Lin, Z. X. Lin, H. C. Tai, H. Y. Tsai, **J. R. Chen***, E. Y. Ngai. Enhanced friction and shock sensitivities of hexachlorodisilane hydrolyzed deposit mixed with KOH. *Journal of Loss Prevention in the Process Industries.* 2021; 71:104455
2. Nguyen, T. T., Y. J. Lin, M. G. Chin, C. C. Wang, H. Y. Tsai, **J. R. Chen***, E. Y. Ngai, J. Chacon, A. Franzi, C. Fifield, J. Baylor, J. Marci, J. Bitner, K. M. Prettyman, N. Ferrera, W. Jordon, T. Szekeres. Characterization and control of energetic deposits from hexachlorodisilane in process tool exhaust lines. *Journal of Loss Prevention in the Process Industries*. 2020; 65:104127
3. Lin, Y. J., T. T. Nguyen, M. G. Chin, C. C. Wang, C. H. Liu, H. Y. Tsai, **J. R. Chen***, E. Y. Ngai, R. Ramachandran. Disposal of hexachlorodisilane and its hydrolyzed deposits. *Journal of Loss Prevention in the Process Industries*. 2020; 65:104136
4. Kaewlaoyoong, A., C. Y. Cheng, C. Lin, **J. R. Chen**, W. Y. Huang, P. Sriprom. White rot fungus Pleurotus pulmonarius enhanced bioremediation of highly PCDD/F-contaminated field soil via solid state fermentation. *Science of The Total Environment.* 2020; 738:139670
5. Yang H.-N., Y. J. Lin, C. H. Liu, M. G. Chin, C. C. Wang, H. Y. Tsai, **J. R. Chen***. Suppression of Flame Propagation in a Long Duct by Segregation with Inert Gases. *Chemical Engineering Transactions*. 2019; 77:247-252
6. Yang, H. N., Y. J. Lin, C. H. Liu, M. G. Chin, C. C. Wang, H. Y. Tsai, **J. R. Chen***. Suppression of flame propagation in a long duct by inertia isolation with inert gases. *Journal of Loss Prevention in the Process Industries*. 2019; 59:23-34.
7. Lin, Y. J., C. H. Liu, M. G. Chin, C. C. Wang, S. H. Wang, Tsai, H. Y., **J. R. Chen***, E. Y. Ngai, R. Ramachandran. Characterization of Shock-Sensitive Deposits from the Hydrolysis of Hexachlorodisilane. *ACS Omega*. 2019; 4(1):pp1416-1424.
8. Kaewlaoyoong, A., C. T. Vu, C. Lin, C. S. Liao, **J. R. Chen**. Occurrence of phthalate esters around the major plastic industrial area in southern Taiwan.

Environmental Earth Sciences. 2018; 77:457

9. Tsai, H. Y., Y. J. Lin, Y. C. Chang, J. S. Lin, **J. R. Chen***, E. Y. Ngai. Unconfined Silane-Air Explosions. *Journal of Loss Prevention in the Process Industries.* 2017; 49B:700-710
10. Tsai, H. Y., H. L. Hung, S. Y. Wu, C. W. Ku, **J. R. Chen***, P. A. Fomin, A. V. Fedorov. Effects of Temperature and Moisture on the Ignition Behavior of Silane Release into Air. *Combustion, Explosions and Shock Waves.* 2017; 53(3):276-282
11. Hung, W., W. Y. Huang, C. Lin, C. T. Vu, S. Yotapukdee, A. Kaewlaoyoong, **J. R. Chen**, Y. H. Shen. The use of ultrasound-assisted anaerobic compost tea washing to remove poly-chlorinated dibenzo-p-dioxins (PCDDs), dibenzo-furans (PCDFs) from highly contaminated field soils. *Environmental Science Pollution Research*. 2017; 24:18936-18945
12. Fomin, P. A., Fedorov, A. V., Tropin, D. A., **J. R. Chen**. Assessment and Control of Detonation Hazard of Silane-Containing Mixtures. *Journal of Engineering Physics and Thermophysics*. 2017; 90 (2):465–479
13. Yang, H. N., J. H. Chen, H. J. Chiu, T. J. Kao, H. Y. Tsai, and **J. R. Chen**. Confined Vapor Explosion in Kaohsiung City - A Detailed Analysis of the Tragedy in the Harbor City. *Journal of Loss Prevention in the Process Industries.* 2016; 41:107-120
14. Yang, H. N., J. H. Chen, H. J. Chiu, T. J. Kao, H. Y. Tsai, and **J. R. Chen**. Kaohsiung vapor explosion - a detailed analysis of the tragedy in the harbour city. *Chemical Engineering Transactions*. 2016; 48:721-726

講員&講題摘要 Speaker & Abstract

Dr. Leonardo Trasande

Dr. Leonardo Trasande, MD, MPP
Jim G. Hendrick, MD Professor of Pediatrics and Professor of Environmental Medicine and Population Health, New York University Grossman School of Medicine, New York, NY, USA

Biographies:

Leonardo Trasande, MD, MPP, is an internationally renowned leader in children's environmental health. His research focuses on identifying the role of environmental exposures in childhood obesity and cardiovascular risks and documenting the economic costs for policymakers of failing to prevent diseases of environmental origin in children proactively. He also holds appointments in the Wagner School of Public Service and College of Global Public Health at New York University (NYU). He is perhaps best known for a series of studies published in the Lancet Diabetes and Endocrinology and the Journal of Clinical Endocrinology and Metabolism that document disease costs due to endocrine disrupting chemicals in the US and Europe of $340 billion and €163 billion annually, respectively. Dr. Trasande leads one of 35 centers across the country as part of the National Institute of Health (NIH) Environmental Influences on Child Health Outcomes program. He is leveraging the NYU Children's Health and Environment Study as well as another birth cohort to examine phthalates, bisphenols, organophosphate pesticides, and polycyclic aromatic hydrocarbons and their effects on fetal as well as postnatal growth and early cardiovascular and renal risks. These two cohorts are part of a larger initiative nationally to identify preventable and environmental factors that influence child health and disease. He is Principal Investigator on numerous other NIH-funded projects. These include a study on prenatal and childhood phthalate and bisphenol exposures in Generation R (a Dutch birth cohort) to examine obesity and cardiovascular risks, as well as another project studying the effect of these dietary

contaminants in children with chronic kidney disease, with the hypothesis that these exposures create oxidant stress and accelerate disease progression. He is also Principal Investigator for a research project comparing the neurodevelopment, cardiometabolic and respiratory profiles of children exposed in utero to the World Trade Center disaster to a comparison group. He has served as a member of numerous scientific committees and expert panels, including the American Academy of Pediatrics Executive Committee of the Council for Environmental Health; the Science and Technical Advisory Committee for the World Trade Center Health Program; the National Children's Study Methodological Review Panel of the National Academy of Sciences; the United Nations Environment Programme Steering Committee on a Global Outlook for Chemicals; and the Board of Scientific Counselors for the National Center for Environmental Health at the Centers for Disease Control and Prevention (CDC). After receiving his bachelor, medical, and public policy degrees from Harvard, he completed the Boston Combined Residency in Pediatrics and a legislative fellowship in the Office of Senator Hillary Rodham Clinton. Prior to coming to NYU, he completed fellowship training in environmental pediatrics. For five years he also was a Lead Investigator in one of the original (Vanguard) locations of the National Children's Study, and Deputy Director for the largest (eighth location) Study Center spanning a region from upstate New York to central New Jersey.

Education:

- 1990–1994: Artium Baccalaureus (AB) in Chemistry (Cum Laude), Harvard College, Cambridge, MA, USA
- 1994–1999: Doctor of Medicine (MD) in Harvard Medical School, Boston, MA, USA
- 1997–1999: Master of Public Policy (MPP) in Health Care Policy, Harvard University John F. Kennedy School of Government, Cambridge, MA, USA

Experience & Honor:

- 1990–1994: Dean's List, Harvard College (all semesters)

- 1991–1994: Harvard College Scholarship
- 1993: Ford Undergraduate Research Grant Award, Harvard College
- 1997–1998: John H. Knowles Fellowship (full tuition scholarship for study at Harvard University John F. Kennedy School of Government)
- 2001: House Arms for service to Adams House, Harvard College
- 2001: Von L. Meyer Traveling Fellowship, Boston Children's Hospital
- 2001: American Academy of Pediatrics Community Access to Child Health Planning Grant
- 2002: White House Fellowship Regional Finalist
- 2002: American Association for the Advancement of Science NIH Science Policy Fellowship Finalist
- 2023: Fellow of the American Academy of Pediatrics
- 2005: Eastern Society for Pediatric Research Travel Award
- 2005: Pediatric Academic Societies Meeting Travel Award
- 2009/2010/2012: Top Reviewer, Environmental Health Perspectives
- 2010: Faculty Member, Delta Omega Society, Beta Omicron Chapter
- 2013: Evan Frankel Lectureship on Pediatrics and the Environment, Johns Hopkins University
- 2018: Bettie Kettell, RN Award for Medical Professional Leadership, Environmental Health Strategy Center

Refereed Papers: (2022 to the present)

1. Spratlen MJ, Perera FP, Sjodin A, Wang Y, Herbstman JB, **Trasande L**. Understanding the Role of Persistent Organic Pollutants and Stress in the Association between Proximity to the World Trade Center Disaster and Birth Outcomes. *Int J Environ Res Public Health*. 2022; 19(4):2008.
2. Rudd KL, Cheng SS, Cordeiro A, Coccia M, Karr CJ, LeWinn KZ, Mason WA, **Trasande L**, Nguyen RHN, Sathyanarayana S, Swan SH, Barrett ES, Bush NR. Associations Between Maternal Stressful Life Events and Perceived Distress during Pregnancy and Child Mental Health at Age 4. *Res Child Adolesc Psychopathol*. 2022; 50(8):977-986.
3. Abellan A, Mensink-Bout SM, Garcia-Esteban R, Beneito A, Chatzi L, Duarte-

Salles T, Fernandez MF, Garcia-Aymerich J, Granum B, Iñiguez C, Jaddoe VWV, Kannan K, Lertxundi A, Lopez-Espinosa MJ, Philippat C, Sakhi AK, Santos S, Siroux V, Sunyer J, **Trasande L**, Vafeiadi M, Vela-Soria F, Yang TC, Zabaleta C, Vrijheid M, Duijts L, Casas M. In utero exposure to bisphenols and asthma, wheeze, and lung function in school-age children: a prospective meta-analysis of 8 European birth cohorts. *Environ Int*. 2022; 162:107178.

4. Malits J, Naidu M, **Trasande L**. Exposure to Endocrine Disrupting Chemicals in Canada: Population-Based Estimates of Disease Burden and Economic Costs. *Toxics*. 2022; 10(3):146.
5. Liu H, Wang Y, Kannan K, Liu M, Zhu H, Chen Y, Kahn LG, Jacobson MH, Gu B, Mehta-Lee S, Brubaker SG, Ghassabian A, **Trasande L**. Determinants of phthalate exposures in pregnant women in New York City. *Environ Res*. 2022; 212(Pt A):113203.
6. Long SE, Jacobson MH, Wang Y, Liu M, Afanasyeva Y, Sumner SJ, McRitchie S, Kirchner DR, Brubaker SG, Mehta-Lee SS, Kahn LG, **Trasande L**. Longitudinal associations of pre-pregnancy BMI and gestational weight gain with maternal urinary metabolites: an NYU CHES study. *Int J Obes (Lond)*. 2022; 46(7):1332-1340.
7. Stevens DR, Bommarito PA, Keil AP, McElrath TF, **Trasande L**, Barrett ES, Bush NR, Nguyen RHN, Sathyanarayana S, Swan S, Ferguson KK. Urinary phthalate metabolite mixtures in pregnancy and fetal growth: Findings from the infant development and the environment study. *Environ Int*. 2022; 163:107235.
8. Jacobson MH, Wang Y, Long SE, Liu M, Ghassabian A, Kahn LG, Afanasyeva Y, Brubaker SG, Mehta-Lee SS, **Trasande L**. The Effect of Maternal United States Nativity on Racial/Ethnic Differences in Fetal Growth. *Am J Epidemiol*. 2022; 16:kwac072.
9. Ferguson KK, Bommarito PA, Arogbokun O, Rosen EM, Keil AP, Zhao S, Barrett ES, Nguyen RHN, Bush NR, **Trasande L**, McElrath TF, Swan SH, Sathyanarayana S. Prenatal Phthalate Exposure and Child Weight and Adiposity from in Utero to 6 Years of Age. *Environ Health Perspect*. 2022; 130(4):47006.

10. Freije SL, Enquobahrie DA, Day DB, Loftus C, Szpiro AA, Karr CJ, **Trasande L**, Kahn LG, Barrett E, Kannan K, Bush NR, LeWinn KZ, Swan S, Alex Mason W, Robinson M, Sathyanarayana S. Prenatal exposure to polycyclic aromatic hydrocarbons and gestational age at birth. *Environ Int*. 2022; 164:107246.
11. Blaauwendraad SM, Gaillard R, Santos S, Sol CM, Kannan K, **Trasande L**, Jaddoe VWV. Maternal Phthalate and Bisphenol Urine Concentrations during Pregnancy and Early Markers of Arterial Health in Children. *Environ Health Perspect*. 2022; 130(4):47007.
12. Ghassabian A, Jacobson MH, Kahn LG, Brubaker SG, Mehta-Lee SS, **Trasande L**. Maternal Perceived Stress During the COVID-19 Pandemic: Pre-Existing Risk Factors and Concurrent Correlates in New York City Women. *Int J Public Health*. 2022; 67:1604497.
13. Filer DL, Hoffman K, Sargis RM, **Trasande L**, Kassotis CD. On the Utility of ToxCast-Based Predictive Models to Evaluate Potential Metabolic Disruption by Environmental Chemicals. *Environ Health Perspect*. 2022; 130(5):57005.
14. Wang Y, Ghassabian A, Gu B, Afanasyeva Y, Li Y, **Trasande L**, Liu M. Semiparametric distributed lag quantile regression for modeling time-dependent exposure mixtures. *Biometrics*. 2022; doi: 10.1111/biom.13702.
15. Blaauwendraad SM, Jaddoe VW, Santos S, Kannan K, Dohle GR, **Trasande L**, Gaillard R. Associations of maternal urinary bisphenol and phthalate concentrations with offspring reproductive development. *Environ Pollut*. 2022; 309:119745.
16. Cavalier H, **Trasande L**, Porta M. Exposures to pesticides and risk of cancer: Evaluation of recent epidemiological evidence in humans and paths forward. *Int J Cancer*. 2022; 152(5):879-912.
17. Dey T, **Trasande L**, Altman R, Wang Z, Krieger A, Bergmann M, Allen D, Allen S, Walker TR, Wagner M, Syberg K, Brander SM, Almroth BC. Global plastic treaty should address chemicals. *Science*. 2022; 378(6622):841-2.
18. Duh-Leong C, Shonna Yin H, Gross RS, Elbel B, Thorpe LE, **Trasande L**, White MJ, Perrin EM, Fierman AH, Lee DC. The Prenatal Neighborhood Environment and Geographic Hotspots of Infants with At-risk Birthweights in

New York City. *J Urban Health*. 2022; 99(3):482-91.

19. Gaylord A, Kannan K, Lakuleswaran M, Zhu H, Ghassabian A, Jacobson MH, Long S, Liu H, Afanasyeva Y, Kahn LG, Gu B, Liu M, Mehta-Lee SS, Brubaker SG, **Trasande L**. Variability and correlations of synthetic chemicals in urine from a New York City-based cohort of pregnant women. *Environ Pollut*. 2022; 309:119774.
20. Hawks RM, Kahn LG, Fang W, Keefe D, Mehta-Lee SS, Brubaker S, **Trasande L**. Prenatal phthalate exposure and placental telomere length. *Am J Obstet Gynecol MFM*. 2022; 4(6):100694.
21. Jacobson MH, Wu Y, Liu M, Kannan K, Lee S, Ma J, Warady BA, Furth S, Trachtman H, **Trasande L**. Urinary Polycyclic Aromatic Hydrocarbons in a Longitudinal Cohort of Children with CKD: A Case of Reverse Causation? *Kidney360*. 2022; 3(6):1011-20.
22. Rajeev PT, Kahn LG, **Trasande L**, Chen Y, Brubaker SG, Mehta-Lee SS. Can blood pressure trajectories indicate who is at risk for developing hypertensive disorders of pregnancy? *Am J Obstet Gynecol MFM*. 2022; 4(6):100741.
23. Shuffrey LC, Lucchini M, Morales S, Sania A, Hockett C, Barrett E, Carroll KN, Cioffi CC, Dabelea D, Deoni S, Dunlop AL, Deutsch A, Fifer WP, Firestein MR, Hedderson MM, Jacobson M, Kelly RS, Kerver JM, Mason WA, Mirzakhani H, O'Connor TG, **Trasande L**, Weiss S, Wright R, Zhu Y, Crum RM, Lee S, Elliott AJ, Monk C. Gestational diabetes mellitus, prenatal maternal depression, and risk for postpartum depression: an Environmental influences on Child Health Outcomes (ECHO) Study. *BMC Pregnancy Childbirth*. 2022; 22(1):758.
24. Sol CM, Gaylord A, Santos S, Jaddoe VWV, Felix JF, **Trasande L**. Fetal exposure to phthalates and bisphenols and DNA methylation at birth: the Generation R Study. *Clin Epigenetics*. 2022; 14(1):125.
25. **Trasande L**. A global plastics treaty to protect endocrine health. *Lancet Diabetes Endocrinol*. 2022; 10(9):616-8.
26. **Trasande L**, Kassotis CD. The Pediatrician's Role in Protecting Children from Environmental Hazards. *Pediatr Clin North Am*. 2023; 70(1):137-50.

Keynote Speech Abstract

Endocrine-disrupting chemicals: scientific, economic, regulatory, and policy implications

Dr. Leonardo Trasande, MD, MPP

Abstract:

Endocrine disrupting chemical (EDC) exposure contributes to disease and dysfunction, with annual costs of >2% of GDP in the US and >1% in Europe. Differences in policy explain differences in disease burden and cost. In Europe, general principles for EDCs call for the minimization of human exposure, identification as substances of very high concern, and a ban on the use of pesticides. In the US, screening and testing programs are focused on estrogenic EDCs exclusively, and regulation is strictly risk-based. Since our reports described 15 probable exposure-outcome associations due to EDCs, there has been a deepened understanding of their effects on human health. We have reviewed subsequent additions to the literature and identified new exposure-outcome associations with substantial human evidence. Although systematic evaluation is needed of their probability and strength, the growing evidence supports urgent action to reduce exposure. We suggest: expanded and comprehensive testing to conclusively identify EDCs, and a shift from a flawed, risk-based paradigm to one that proactively excludes chemicals with some evidence of hazardous properties. An international initiative on EDCs supported by the UN could address the weaknesses related to hazard identification and provide much-needed guidance for policies globally.

李俊璋副校長 Dr. Ching-Chang Lee

Dr. Ching-Chang Lee, PhD
Executive Vice President and Spokesman, National Cheng Kung University, Tainan, Taiwan; Distinguished Professor, Department of Environmental and Occupational Health, National Cheng Kung University, Tainan, Taiwan

Biographies:

Dr. Ching-Chang Lee (born in 1957) is the executive vice president and spokesman of the National Cheng Kung University. Dr. Lee is also a distinguished professor of the Department of Environmental and Occupational Health, a joint professor of the Department of Food Safety/Hygiene and Risk Management, and the director of the Research Center of Environmental Trace Toxic Substances in National Cheng Kung University. He served as the chairman and honorary chairman of the Taiwan Indoor Environmental Quality Society. Dr. Lee is mainly engaged in the research on the sampling/analysis and exposure risk assessment of trace toxic substances in indoor and outdoor environments and human health. He has won the Health Professional Award, Ministry of Health and Welfare (2014/2022), and was selected as a fellow of The Academy of Fellows, International Society of Indoor air Quality and Climate, 2016

Education:

- 1987–1992: PhD Degree, Graduate Institute of Environmental Engineering, National Taiwan University, Tainan, Taiwan
- 1980–1982: Master of Environmental Engineering, Graduate Institute of Environmental Engineering, National Taiwan University, Tainan, Taiwan
- 1976–1980: Bachelor of Public Health, Department of Public Health, National Taiwan University, Tainan, Taiwan

Experience & Honor:

- 2016–2021: The Secretary General, National Cheng Kung University, Tainan,

Taiwan

- 2012–2016: Director, Center for Environmental Protection, Safety and Health, National Cheng Kung University, Tainan, Taiwan
- 1999–Present: Director of the Research Center of Environmental Trace Toxic Substances, National Cheng Kung University, Tainan, Taiwan
- 2022–Present: Director, Office of Academic Integrity, National Cheng Kung University, Tainan, Taiwan
- 1996–1999: Director, Department of Environmental and Occupational Health, National Cheng Kung University, Tainan, Taiwan
- 1991–Present: Lecturer, Associate Professor, and Professor of the Department of Environmental and Occupational Health, National Cheng Kung University, Tainan, Taiwan
- 1987–1988: Section Chief of the Environmental Protection Administration, Taiwan (R.O.C.)
- 1986–1987: Section Chief of the Environmental Protection Bureau, Department of Health, Taiwan (R.O.C.)
- 2014/2022: Health Professional Award, Ministry of Health and Welfare, Taiwan (R.O.C.)
- 2016: Fellow, The Academy of Fellows, International Society of Indoor air Quality and Climate

Refereed Papers:

1. Tsung-Ho Ying, Chun-Jui Huang, Chia-Jung Hsieh, Pei-Ju Wu, Chang-Ching Yeh, Ping-Kun Hung, Wei-Hsiang Chang, Meng-Hsing Wu, Hsin Hung, Jung-Wei Chang, Chen-Tai Wang, Rachelle D. Arcega, Trias Mahmudiono, **Ching-Chang Lee (equally contribution with corresponding author)**, Hsiu-Ling Chen. Potential factors associated with the blood metal concentrations of reproductive-age women in Taiwan. *Exposure and Health.* 2023.
2. Rachelle D. Arcega, Rong-Jane Chen, Pei-Shan Chih, Yi-Hsuan Huang, Wei-Hsiang Chang, Ting-Khai Kong, **Ching-Chang Lee**, Trias Mahmudiono, Chun-Chih Tsui, Wen-Che Hou, Hsin-Ta Hsueh, Hsiu-Ling Chen. Toxicity

prediction: An application of alternative testing and computational toxicology in contaminated groundwater sites in Taiwan. *Journal of Environmental Management*. 2023; 328:116982.

3. **Ching-Chang Lee**, Bo-Lun Lin, Yi-Wen Huang, Ning-Syuan Hsu**,** I-Chia Chen, Wei-Hsiang Chang. Simultaneous determination of 24 congeners of 2- and 3-monochloropropanediol esters and 7 congeners of glycidyl esters using direct multi-residue analytical LC-MS/MS methods in various food matrice. *Journal of Food and Drug Analysis.* 2022.
4. Nai-Tzu Chen, Ching-Hui Shih, Chien-Cheng Jung, Nai-Yun Hsu, Chung-Yu Chen, **Ching-Chang Lee**, Huey-Jen Su. Impact of mold growth on di(2-ethylhexyl) phthalate emission from moist wallpaper. *Heliyon.* 2022; 8:e10404
5. Wei-Hsiang Chang, Quang-Oai Lu, Hsiu-Ling Chen, Ning-Syuan Hsu, **Ching-Chang Lee* (corresponding author)**. Insights into the long-term fates and impacts of polybrominated diphenyl ethers in sediment samples in Taiwan: The national project for background monitoring of the environmental distribution of chemical substances (BMECs). *Environmental Pollution*. 2022; 306:119417
6. Wei-Hsiang Chang, Pei-Hsuan Chen, Samuel Herianto, Hsiu-Ling Chen, **Ching-Chang Lee* (corresponding author)**. Aggregating exposures and toxicity equivalence approach into an integrated probabilistic dietary risk assessment for perchlorate, nitrate, and thiocyanate: Results from the National food monitoring study and National Food Consumption Database. *Environmental Research*. 2022; 211:112989
7. Wu-Ting Lin, Ru-Yin Tsai, Hsiu-Ling Chen, Yaw-Shyan Tsay, **Ching-Chang Lee* (corresponding author)**. Probabilistic Prediction Models and Influence Factors of Indoor Formaldehyde and VOC Levels in Newly Renovated Houses. *Atmosphere*. 2022; 13(5):675
8. **Lee, Ching-Chang**; Wu, Yi-Yun; Chen, Colin S.; Tien, Chien-Jung. Spatiotemporal distribution and risk assessment of short-chain chlorinated paraffins in 30 major rivers in Taiwan. *Science of the Total Environment*. 2022; 806(4):150969
9. **Ching-Chang Lee**, Colin S Chen, Zi-Xuan Wang, Chien-Jung Tien. Polycyclic

aromatic hydrocarbons in 30 river ecosystems, Taiwan: Sources, and ecological and human health risks. *Science of the Total Environment*. 2021; 795:148867

10. Wu-Ting Lin, Chung-Yu Chen, **Ching-Chang Lee* (corresponding author)**, Cheng-Chen Chen* and Shih-Chi Lo. Air Phthalate Emitted from Flooring Building Material by the Micro-Chamber Method: Two-Stage Emission Evaluation and Comparison. *Toxics*. 2021; 9(9):216
11. Wei-Hsiang Chang, Samuel Herianto, **Ching-Chang Lee**, Hsin Hung, and Hsiu-Ling Chen. The Effects of Phthalate Ester Exposure on Human Health: A Review. *Science of the Total Environment*. 2021; 786:147371
12. Liu, Pei-Wen; Li, Chung-, I; Huang, Kuo-Ching; Liu, Chiang-Shin; Chen, Hsiu-Lin; **Lee, Ching-Chang**; Chiou, Yuan-Yow; Chen, Rong-Jane. 3-MCPD and glycidol coexposure induces systemic toxicity and synergistic nephrotoxicity via NLRP3 inflammasome activation, necroptosis, and autophagic cell death. *Journal of Hazardous Materials*. 2021; 405:124241
13. Po-Chin Huang, Pao-Lin Kuo, Wei-Hsiang Chang, Shu-Fang Shih, Wan-Ting Chang, **Ching-Chang Lee (corresponding author)**. Prenatal Phthalates Exposure and Cord Thyroid Hormones: A Birth Cohort Study in Southern Taiwan. *International Journal of Environmental Research and Public Health*. 2021; 18(8):4323
14. **Lee, Ching-Chang**; Chang, Wei-Hsiung; Hung, Chung-Feng; Chen, Hsiu-Ling. Fish consumption is an indicator of exposure to non-dioxin like polychlorinated biphenyls in cumulative risk assessments based on a probabilistic and sensitive approach. *Environmental Pollution*. 2021; 268(B):115732
15. **Ching-Chang Lee**; Yi-Hsin Lin; Wen-Che Hou; Meng-Han Li; Jung-Wei Chang, Exposure to ZnO/TiO2 Nanoparticles Affects Health Outcomes in Cosmetics Salesclerks. *International Journal of Environmental Research and Public Health.* 2020; 17(17):6088
16. Wei-Hsiang Chang, Hsiu-Ling Chen, **Ching-Chang Lee (corresponding author)**. Dietary exposure assessment to perchlorate in the Taiwanese population: A risk assessment based on the probabilistic approach.

Environmental Pollution. 2020; 267:115486

17. **Ching-Chang Lee**, Wei-Hsiang Chang, Hsin-Tang Lin, Jung-Wei Chang. Spatiotemporal Patterns of Polychlorinated Dibenzo-p-dioxins and Dibenzofurans and Dioxin-like Polychlorinated Biphenyls in Foodstuffs in Air Quality Regions in Taiwan. *Journal of Food and Drug Analysis*. 2020; 28(3):375-398
18. **Ching-Chang Lee**, Chia-Yi Hsieh, Colin S. Chen, Chien-Jung Tien. Emergent contaminants in sediments and fishes from the Tamsui River (Taiwan): Their spatial-temporal distribution and risk to aquatic ecosystems and human health. *Environmental Pollution.* 2020; 258:113733
19. **Ching-Chang Lee**, Ying Shen, Chun-Wei Hsu, Jer-Pei Fong, Shi-Nian Uang, Jung-Wei Chang. Reduced adiponectin: leptin ratio associated with inhalation exposure to vinyl chloride monomer. *Science of the Total Environment.* 2020; 703:135488
20. **Ching-Chang Lee**, Wei-Hsiang Chang, Hsiu-Ling Chen. Dietary exposure and risk assessment of exposure to hexabromocyclododecanes in a Taiwan population. *Environmental Pollution*. 2019; 249:728-734
21. Wei-Hsiang Chang, Yuh-Shyan Tsai, Jia-Yu Wang, Hsiu-Ling Chen, Wen-Hong Yang, **Ching-Chang Lee (corresponding author)**. Sex hormones and oxidative stress mediated phthalate-induced effects in prostatic enlargement. *Environment International.* 2019; 126:184-192
22. Wei-Hsiang Chang, Shou-Chun Liu, Hsiu-Ling Chen, **Ching-Chang Lee (corresponding author)**. Dietary intake of 4-nonylphenol and bisphenol A in Taiwanese population: Integrated risk assessment based on probabilistic and sensitive approach. *Environmental Pollution*. 2019; 244:143-152
23. Kun-Chih Huang, Yaw-Shyan Tsay, Fang-Ming Lin, **Ching-Chang Lee (equally contribution with corresponding author)**, Jung-Wei Chang (corresponding author). Efficiency and performance tests of the sorptive building materials that reduce indoor formaldehyde concentrations. *PLOS ONE*. 2019; 14(1):e0210416

Keynote Speech Abstract

Human and Environmental Hazards of Endocrine Disrupting Chemicals and Future Research

Dr. Ching-Chang Lee, PhD

Abstract:

Rachel Carson in "Silent Spring" in 1962 described the effects of DDT on sexual development and reproduction. Theo Colborn and her "Our Stolen Future" in 1996 proposed endocrine disrupting chemicals (EDCs) hypothesis. Up to now, public concern about the impact of EDCs on both humans and the environment is growing steadily. Over the past 60 years, lots of research had identified effects of various exogenous chemicals on endocrine processes and functions. Epidemiologic research provides key information towards our understanding of the relationship between environmental exposures like EDCs and human health outcomes. EDCs have two fundamental features, their disruption of hormone function and their contribution to disease and disability. The unique vulnerability of not only children but also adult to low-level EDCs exposures has eroded the notion that only the dose makes the thing a poison. Further research will always be needed to elaborate on the effects of EDCs and other synthetic chemicals on human health with greater precision. The challenges of EDC research in human health effects related to its ubiquity, the likelihood of non-monotonic dose-response relationships, latent effects, and the unpredictable nature of chemical mixtures. Indeed, for certain EDCs with short-half lives and/or who lack an unexposed or low exposed group. Although they may seem arduous, epidemiologic studies still allow us to override the extrapolation between species and are thus, necessary to draw proper conclusions on the causal role of EDCs in affecting human health. Moving forward, an integrative approach to study the health risks associated with EDCs. Expertise in the fields of epidemiology, exposure science, risk assessment and toxicology are indispensable to tackle the challenges of studying EDCs. Finally, research on actions to reduce exposure to EDCs require consideration of the evidence and alternative study on manufacturing practices can be applied to mitigate exposure to EDCs is needed.

Topic 2: 環境荷爾蒙的生物監測
Endocrine Disrupting Chemicals and Biomonitoring

與談人 Panelist

高志明教授 Dr. Jimmy C. M. Kao

Prof. Jimmy (C.M.) Kao, PhD

Chair Professor, Institute of Environmental Engineering, National Sun Yat-Sen University, Kaohsiung, Taiwan

Biographies:

Prof. Jimmy Kao is a chair professor of the Institute of Environmental Engineering at National Sun Yat-Sen University, Taiwan. Prof. Kao has more than 30 years of experiences as a researcher and environmental engineer in contaminated land restoration, soil and groundwater remediation, constructed wetland design/operation, wastewater treatment and reuse, watershed management, contaminated site characterization, sustainable development, and risk assessment.

Education:

- PhD Degree, Department of Civil Engineering, North Carolina State University, Raleigh, NC, USA
- Master of Science, Department of Civil Engineering, North Carolina State University, Raleigh, NC, USA
- Bachelor of Science, Department of Environmental Engineering, National Cheng-Kung University, Tainan, Taiwan

Experience & Honor:

- Director, Institute of Environmental Engineering, National Sun Yat-Sen University, Taiwan

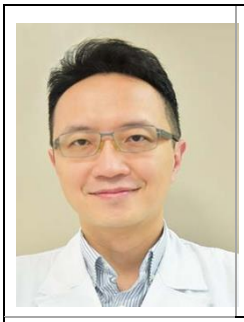
- Coordinator, Environ. Engr. Program, Ministry of Science and Technology, Taiwan
- President, The Chinese Institute of Environmental Engineering, Taiwan
- President, Taiwan Association of Soil and Groundwater Environ. Protection, Taiwan
- Project Manager, Environ. Science and Engr. Division, Geophex, Ltd., NC, USA
- Academic Award, Ministry of Education, Taiwan
- Scientific Chair Professor Award, Far Eastern Y.Z. Science and Technology Memorial Foundation
- Distinguished Researcher Award, Taiwan Ministry of Science and Technology

Refereed Papers:

1. Liu, PF, Chen, CC, Ou, JH, Verpoort, F, Sheu, YT, **Kao, CM**. Application of slow-releasing green denaturing colloidal substrates to contain and bioremediate hexavalent-chromium plume. *J. of Cleaner Production*. 2022; 365:132769
2. Chen, W, Chien, C, Ho, W, Ou, J, Chen, S, **Kao, C.** Effects of treatment processes on AOC removal and changes of bacterial diversity in a water treatment plant. *J. of Environ. Manageent*. 2022; 311(6):114853
3. Lo, KH, Lu, CW, Chien, CC, Sheu, YT, Lin, WH, Chen, SC, **Kao, CM**. Cleanup chlorinated ethene-polluted groundwater using an innovative immobilized Clostridium butyricum column scheme: A pilot-scale study. *J. of Environ. Manageent*. 2022; 311(8):114836.
4. Lin, WH, Chen, CC, Ou, JH, Sheu, YT, Hou, DY, **Kao, CM**, Bioremediation of hexavalent-chromium contaminated groundwater: Microcosm, column, and microbial diversity studies. *Chemosphere*. 2022; 295:133877.
5. Lin, WH, Chien, CC, Lu, CW, Hou, DY, Sheu, YT, Chen, SC, **Kao, CM**. Growth inhibition of methanogens for the enhancement of TCE dechlorination. *Sci. of the Total Environ*. 2021; 787:147648.

座長 Moderator

林建宇副院長 Dr. Chien-Yu Lin



Dr. Chien-Yu Lin, MD, PhD

Deputy Superintendent, En Chu Kong Hospital, New Taipei City, Taiwan

Biographies:

Prof. Dr. Lin is a Nephrology consultant and prestigious researcher in En Chu Kong Hospital, New Taipei City, Taiwan. His research interest focuses on the health impact of perfluorocarbons, phthalates, acrylamide, phenols, heavy metals, and volatile organic compounds. Since 2007, a total of 66 academic articles (including co-authored works) have been published, with a total of 2,599 citations as of February 16, 2023. The H-index is 33 and the i10-index is 46.

Education:

- 1991–1998: Bachelor of Medicine (MD), Yang Ming University, Taipei, Taiwan
- 2005–2007: Master of Public Health, Institute of Occupational Medicine and Industrial Hygiene, National Taiwan University, Taipei, Taiwan
- 2008–2011: PhD Degree, Institute of Occupational Medicine and Industrial Hygiene, National Taiwan University, Taipei, Taiwan

Experience & Honor:

- 2008–2011: Lecturer, School of Medicine, Fu Jen Catholic University, New

Taipei City, Taiwan

- 2011–2018: Assistant Professor, School of Medicine, Fu Jen Catholic University, New Taipei City, Taiwan
- 2018–Present: Associate Professor, School of Medicine, Fu Jen Catholic University, New Taipei City, Taiwan
- 2021–Present: Professor, Department of Environmental Engineering and Health, Yuanpei University of Medical Technology, New Taipei City, Taiwan

Refereed Papers:

1. **Lin CY**, Hsu SH, Chen CW, Wang CK, Sung FC, Su TC. Association of Urinary Lead and Cadmium Levels, and Serum Lipids with Subclinical Arteriosclerosis: Evidence from Taiwan. *Nutrients.* 2023; 15:571.
2. **Lin CY**, Lee HL, Chen CW, Wang CK, Sung FC, Su TC. Global DNA methylation mediates the association between serum perfluorooctane sulfonate and carotid intima-media thickness in young and middle-aged Taiwanese populations *Ecotoxicol Environ Saf.* 2022; 241:113782
3. Wang WJ, Wang CS, Wang CK, Yang AM, **Lin CY**. Urine Di-(2-ethylhexyl) Phthalate Metabolites Are Independently Related to Body Fluid Status in Adults: Results from a U.S. Nationally Representative Survey. *Int J Environ Res Public Health.* 2022; 19(12):6964.
4. **Lin CY**, Wang CK, Sung FC, Su TC. Association between serum per- and polyfluoroalkyl substances and thrombograms in young and middle-aged Taiwanese populations. *Ecotoxicol Environ Saf.* 2022; 236:113457.
5. **Lin CY**, Chen CW, Lee HL, Wu C, Wang CK, Sung FC, Su TC. Global DNA methylation mediates the association between urine mono-2-ethylhexyl phthalate and serum apoptotic microparticles in a young Taiwanese population. *Sci Total Environ.* 2022; 808:152054.
6. **Lin CY**, Lee HL, Wang CK, Sung FC, Su TC. Association between the total plasma isomers of per- and polyfluoroalkyl substances and erythrograms in young and middle-aged Taiwanese populations. *Ecotoxicol Environ Saf.* 2021;

227:112902.

7. Lu CL, **Lin CY**, Lin LY, Chen PC, Zheng CM, Lu KC, Yeih DF. Primary prevention of cardiovascular disease events with renin-angiotensin system blockade in autosomal dominant polycystic kidney disease dialysis patients: A nationwide cohort study. *Medicine (Baltimore)*. 2021; 100(26):e26559.
8. Lee CK, Wu Charlene, **Lin CY**, Huang PC, Sung FC, Su TC. Positive Association between Endothelium–Platelet Microparticles and Urinary Concentration of Lead and Cadmium in Adolescents and Young Adults. *Nutrients.* 2021; 13:2913.
9. Chu PL, **Lin CY**, Sung FC, Su TC. Apoptotic microparticles mediate the association between bisphenol A and subclinical atherosclerosis in a young population: A population-based study. *Ecotoxicology and Environmental Safety.* 2021; 224:112663.
10. Wang WJ, Huang MN, Wang CK, Yang AM, **Lin CY.** Zinc status is independently related to the bone mineral density, fracture risk assessment tool result, and bone fracture history: Results from a U.S. nationally representative survey. *Journal of Trace Elements in Medicine and Biology.* 2021; 67:126765.
11. Wu CC, Wang CK, Yang AM, Lu CS, **Lin CY.** Selenium status is independently related to bone mineral density, FRAX score, and bone fracture history: NHANES, 2013 to 2014. *Bone.* 2021; 143:115631.
12. Wang CK, **Lin CY**, Liao GY Feasibility study of tetracycline removal by ozonation equipped with an ultrafine-bubble compressor equipped with an ultrafine-bubble compressor. *Water.* 2021; 13:1058.
13. **Lin CY**, Lee HL, Hwang YT, Huang PC, Wang CK, Sung FC, Wu CL, Su TC. Urinary heavy metals, DNA methylation, and subclinical atherosclerosis. *Ecotoxicol Environ Saf.* 2020; 204:111039.
14. Wang CK, **Lin CY**, Liao GY. Degradation of antibiotic tetracycline by ultrafine-bubble ozonation process. *Journal of Water Process Engineering.* 2020; 37:101463.

15. Chu PL, Liu HS, Wang CK, **Lin CY**. Association between acrylamide exposure and sex hormones in males: NHANES, 2003-2004. *PLoS One.* 2020; 15(6):e0234622**.**

16. **Lin CY**, Lee HL, Hwang YT, Wang CW, Hsieh, CJ, Wu CL, Sung FC, Su TC. The association between urine di-(2-ethylhexyl) phthalate metabolites, global DNA methylation, and subclinical atherosclerosis in a young Taiwanese population. *Environ Pollut.* 2020; 265(Pt B):114912.

17. **Lin CY**, Lee HL, Jung WT, Sung FC, Su TC. The association between urinary levels of 1,3-butadiene metabolites, cardiovascular risk factors, microparticles, and oxidative stress products in adolescents and young adults. *Journal of Hazardous Materials.* 2020; 396: 122745.

18. **Lin CY**, Lee HL, Hwang YT, Su TC. The association between total serum isomers of per- and polyfluoroalkyl substances, lipid profiles, and the DNA oxidative/nitrative stress biomarkers in middle-aged Taiwanese adults. *Environ Res.* 2020; 182: 109064.

19. **Lin CY**, Huang PC, Wu C, Sung FC, Su TC. Association between urine lead levels and cardiovascular disease risk factors, carotid intima-media thickness and metabolic syndrome in adolescents and young adults. *Int J Hyg Environ Health.* 2020; 223(1): 248-255.

20. Wang WJ, Wu CC, Jung WT, **Lin CY**. The associations among lead exposure, bone mineral density, and FRAX score: NHANES, 2013 to 2014. *Bone.* 2019; 128:115045.

21. Su TC, Hwang JS, Torng PL, Wu C, **Lin CY**, Sung FC. Phthalate exposure increases subclinical atherosclerosis in young population. *Environ Pollut.* 2019; 250:586-593.

22. **Lin CY**, Hwang YT, Sung FC, Su TC. Association of serum levels of 4-tertiary-octylphenol with cardiovascular risk factors and carotid intima-media thickness in adolescents and young adults. *Environ Pollut.* 2019; 246:107-113.

23. **Lin CY**, Lee HL, Sung FC, Su TC. Investigating the association between urinary levels of acrylonitrile metabolite N-acetyl-S-(2-cyanoethyl)-L-cysteine

and the oxidative stress product 8-hydroxydeoxyguanosine in adolescents and young adults. *Environ Pollut.* 2018; 239:493-498.

24. Liu HS, Wen LL, Chu PL, **Lin CY**. Association among total serum isomers of perfluorinated chemicals, glucose homeostasis, lipid profiles, serum protein and metabolic syndrome in adults: NHANES, 2013-2014. *Environ Pollut.* 2018; 232:73-79.
25. Chou HC, Wen LL, Chang CC, **Lin CY**, Jin L, Juan SH.L-carnitine via PPARγ-and Sirt1-dependent mechanisms attenuates epithelial-mesenchymal transition and renal fibrosis caused by perfluorooctanesulfonate. *Toxicol Sci.* 2017; 160(2):217-229.
26. Chen SY, Hwang JS, Sung FC, **Lin CY**, Hsieh CJ, Chen PC, Su TC. Mono-2-ethylhexyl phthalate associated with insulin resistance and lower testosterone levels in a young population. *Environ Pollut.* 2017; 225:112-117.
27. **Lin CY**, Chen PC, Hsieh CJ, Chen CY, Hu A, Sung FC, Lee HL, Su TC. Positive Association between Urinary Concentration of Phthalate Metabolites and Oxidation of DNA and Lipid in Adolescents and Young Adults. *Sci Rep.* 2017; 7:44318.
28. Chu PL, Lin LY, Chen PC, Su TC, **Lin CY.** Negative association between acrylamide exposure and body composition in adults: NHANES, 2003-2004. *Nutr Diabetes.* 2017; 7(3):e246.

趙浩然教授 Dr. How-Ran Chao

Dr. How-Ran Chao, PhD
Distinguished Professor, Department of Environmental Science and Engineering, National Pingtung University of Science and Technology, Pingtung, Taiwan

Biographies:

How-Ran Chao, PhD, graduated from the Department of Environmental Engineering, College of Engineering, National Cheng Kung University, Tainan, Taiwan. He currently served as a distinguished professor in the Department of Environmental Science and Engineering, National Pingtung University of Science and Technology (NPUST), Pingtung, Taiwan. He is also a co-professor in the Institute of Food Safety Management, College of Agriculture, NPUST, Pingtung, Taiwan, and School of Dentistry, Kaohsiung Medical University, Kaohsiung, Taiwan. His major research focus is Environmental Epidemiology, especially for mothers and their offspring exposure to endocrine disrupting chemicals (EDCs) to induce the health risks. He is also interested in flame retardants (FRs) including brominated and organophosphate FRs in the microenvironments and these chemicals to cause the related health effects on the pediatric population. The Caenorhabditis elegans models are used to examine toxicity by testing PM2.5 and nanomaterials or anti-toxic effects by cotreatment of toxicants and natural bioactive compounds.

Education:

- 2002/5–2003/8: Postdoctoral Fellowship, Division of Environmental Health

and Occupational Medicine (Current: National Institute of Environmental Health Sciences), National Health Research Institutes, Miaoli, Taiwan

- 1995–2000: PhD Degree, Department of Environmental Engineering, National Cheng Kung University, Tainan, Taiwan
- 1993–1995: Master of Science, Department of Environmental Engineering, National Cheng Kung University, Tainan, Taiwan
- 1989–1993: Bachelor of Science, Department of Biology, National Cheng Kung University, Tainan, Taiwan
- 1985–1988: High School, Taichung First Senior High School, Taichung, Taiwan

Experience & Honor:

- Editorial Board member, *International Journal of Environmental Research and Public Health* (2021 SCI impact factor: 4.614)
- Guest Editor, *International Journal of Environmental Research and Public Health* (Special Issue: Exposure and Effects of Endocrine Disruptors in Pregnancy and Early Childhood) from 10/31/2017 to 10/31/2018
- Editorial Board member, *Geology, Ecology and Landscapes*
- Co-chairman, 2019 Theory and Technique Taiwan Forum on Sustainable Environment
- Adviser Committee, 2019 Theory and Technique Taiwan Forum on Sustainable Environment
- Technical Committee, 2019 8th International Conference on Environment, Energy and Biotechnology (ICEEB 2018)
- Technical Committee, The Joint Annual Meeting of the International Society of

Exposure Science and the International Society for Environmental Epidemiology-Asian Chapter (ISEE/ES AC 2018)

- Technical Committee, 2018 7th International Conference on Environment, Energy and Biotechnology (ICEEB 2018)

Refereed Papers:

1. Jian-He Lu, Ming-Hsien Tsai, Sen-Ting Huang, Jia-De Lee, Ta-Chih Hsiao, Wan Nurdiyana Wan Mansor, **How-Ran Chao***. PM2.5 Caused Toxic Effects on the Caenorhabditis elegans Models with the Cotreatment of High-dose Glucose and Tempeh. *Aerosol and Air Quality Research.* 2023; 23(2):220340.
2. Wei-Jung Tseng, Jian-He Lu, **How-Ran Chao***, [+], Ming-Hsien Tsai, Yu-Ting Chang, Liang-Jen Wang*, [+], Chih-Cheng Chen[+], Wan Nurdiyana Wan Mansor, Juliana Jalaludin, Chih-Lung Wang, Ying-I Tsai. Associations between Children's Exposure to PM2.5 and their Serum Inflammatory Responses in Taiwan. *Aerosol and Air Quality Research*. 2022; 22(12):220228. ([+] equal to Corresponding author)
3. Ching-Kai Su, Jian-He Lu, **How-Ran Chao***, Wei-Hsiang Chang, Ming-Hsien Tsai, Chih-Lung Wang, I-Cheng Lu, Yu-Ting Chang, Hsiao-Chi Chuang, Wan-Nurdiyana-Wan Mansor, Yi-Chyun Hsu, Ying-I Tsai, Shang-Ming Ma. Polybrominated Dibenzo-p-dioxins/furans (PBDD/Fs) and Diphenyl Ethers (PBDEs) in the indoor and outdoor of Gymnasiums. *Aerosol and Air Quality Research.* 2022; 22 (9):220264.
4. Liang-Jen Wang*, Ying-Hua Huang, Wen-Jiun Chou, Sheng-Yu Lee, Hsin-Yu Chang, Chih-Cheng Chen*, **How-Ran Chao***. Interrelationships among growth hormone, thyroid function, and endocrine-disrupting chemicals on the

susceptibility to attention-deficit/hyperactivity disorder. *European Child & Adolescent Psychiatry*. 2022; https://doi:10.1007/s00787-021-01886-4.

5. Cherng-Gueih Shy[+], Jian-He Lu, Hui-Chen Lin, Min-Nan Hung, Hsiu-Chun Chang, Meng-Lun Lu, **How-Ran Chao***, [+], Yao-Shen Chen [+], Pi-Sheng Wang. Rapid Control of a SARS-CoV-2 B.1.617.2 (Delta) Variant COVID-19 Community Outbreak: The Successful Experience in Pingtung County of Taiwan. *International Journal of Environmental Research and Public Health*. 2022; 19(3):1421. ([+] equal to Corresponding author).
6. Jian-He Lu, Wen-Che Hou*, [+], Ming-Hsien Tsai, Yu-Ting Chang, **How-Ran Chao**[+]. The Impact of Background-Level Carboxylated Single-Walled Carbon Nanotubes (SWCNTs-COOH) on Induced Toxicity in Caenorhabditis elegans and human cells. *International Journal of Environmental Research and Public Health.* 2022; 19(3):1218. ([+]equal to Corresponding author).
7. Ming-Hsien Tsai, **How-Ran Chao***, Wen-Li Hsu, Ching-Chung Tsai, Chu-Wen Lin, Chu-Huang Chen. Analysis of Polybrominated Diphenyl Ethers and Lipid Composition in Human Breast Milk and Their Correlation with Infant Neurodevelopment. *International Journal of Environmental Research and Public Health.* 2021; 18(21):11501.
8. Bing-Jyh Lu, Tzu-Che Lin[+], **How-Ran Chao***, [+], Cheng-Hsian Tsai[+], Jian-He Lu, Ming-Hsien Tsai, Ching-Tzu Chang, Hao Hsieh, I-Cheng Lu, Rachelle D. Arcega, Wei-Hsiang Chang, Hsiu-Ling Chen, Wan Nurdiyana Wan Mansor, Ying-Chieh Lee. The Impact of Air or Nitrogen Non-Thermal Plasma on Variations of Natural Bioactive Compounds in Djulis (Cheno-podium

formosanum Koidz) Seed and the Potential Effects for Human Health. *Atmosphere.* 2021; 12(11):1375. (+equal to Corresponding author).

9. I-Cheng Lu, **How-Ran Chao***, Wan-Nurdiyana-Wan Mansor, Yi-Chyun Hsu, Chun-Wei Peng, Tai-Yi Yu, Wei-Hsiang Chang, Lung-Ming Fu. Fish levels of phthalates, bisphenol-A, nonylphenol, and microplastics in the estuaries of northern Taiwan and the impact on human health. *Toxics.* 2021; 9(10):246.
10. Tai-Yi Yu, **How-Ran Chao***, Ming-Hsien Tsai, Chih-Chung Lin, I-Cheng Lu, Wei-Hsiang Chang, Chih-Cheng Chen, Liang-Jen Wang, En-Tzu Lin, Ching-Tzu Chang, Chunneng Chen, Cheng-Chih Kao, Wan Nurdiyana Wan Mansor, Kwong-Leung J. Yu. Big Data Analysis for Effects of the COVID-19 outbreak on Ambient PM2.5 in Areas That Were Not Locked Down. *Aerosol and Air Quality Research.* 2021; 21(8):210020.
11. Ming-Hsien Tsai, **How-Ran Chao***, Jheng-Jie Jiang, Yu-Hsieh Su, Mariene-syne P. Cortez, Lemmuel L. Tayo, I-Cheng Lu, Hao Hsieh, Chih-Chung Lin, Sheng-Lun Lin, Wan Nurdiyana Wan Mansor, Ching-Kai Su, Sen-Ting Huang, Wen-Li Hsu. Toxicity of low-dose graphene oxide nanoparticles in an in-vivo Caenorhabditis elegans model. *Aerosol and Air Quality Research.* 2021; 21(5):200559.

講員&講題摘要 Speaker & Abstract

董正釱教授 Dr. Cheng-Di Dong

Dr. Cheng-Di Dong, PhD
Distinguished Professor and Dean of College of Hydrosphere Science, National Kaohsiung University of Science and Technology (NKUST), Kaohsiung, Taiwan

Biographies:

- 2018–Present: Distinguished Professor, Department of Marine Environmental Engineering, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan
- 2019–Present: Dean, College of Hydrosphere Science, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan (2019-)
- 專長：海洋棄置物監測與棄置規劃管理、海洋污染防治、土壤與地下水污染監測、水及廢水處理、飲用水檢測與分析

Education:

- 1990–1993: Doctor of Philosophy (PhD), Environmental Engineering, University of Delaware, Newark, DE, USA
- 1988–1990: Master of Environmental Science, New Jersey Institute of Technology, Newark, NJ, USA
- 1978–1983: Bachelor of Chemical Engineering, National Taipei Institute of Technology, Taipei, Taiwan

Experience & Honor:

- 2021/2022: World's Top 2% Scientist for Environmental Sciences
- Citations: > 8000, h-index: 44, i10 index: 203 (Google Scholar); published: > 411 research and review articles until 2023/3
- 2021–Present: Fellow, International Bioprocessing Association (IBA)
- 2020–Present: Editorial Board Member, Bioresource Technology (SCI IF: 11.889)
- 2020–Present: Editor, Sustainable Environment Research (SCI IF: 4.3)
- 2020–Present: Director, Research Center for Biochar, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan
- 2019–Present: Director, Sustainable Environment Research Center, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan
- 2019–Present: Director, Center of Aquatic Product Inspection and Certification, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan
- 2018–2019: Dean, Marine Research and Development, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan
- 2014–2019: Director, Center for the Study of Sediments, National Kaohsiung Marine University, Kaohsiung, Taiwan
- 2014–2018: Dean, Research and Development Affairs, National Kaohsiung Marine University, Kaohsiung, Taiwan
- 2007–2018: Professor, Department of Marine Environmental Engineering, National Kaohsiung Marine University, Kaohsiung, Taiwan

Refereed Papers:

1. VA Thai, TB Nguyen, CP Huang, XT Bui, R Doong, CW Chen, **CD Dong**. Graphene quantum dots (GQDs) decorated zeolitic imidazole framework-67

(ZIF67) electrode for the in-situ oxidation of ciprofloxacin in water. *Environmental Technology & Innovation*. 2023; 30:103039

2. Linjer Chen, Muhammed Arshad, Yuliv Chuang, Yu-Lun Hong, Thanh-Binh Nguyen, Chung-Hsin Wu, Chiu-Wen Chen, **Cheng-Di Dong**. Facile fabrication of efficient tungsten disulfide nanoparticles for enhanced photocatalytic removal of tetracycline (TC) and Pb (II) photoreduction. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*. 2023; 662:131004
3. R Nehru, CW Chen, **CD Dong**. Sonochemically synthesized rod-like bismuth phosphate and carbon black hybrid electrocatalyst for electrochemical monitoring of hazardous sulfamethazine. *Journal of Environmental Chemical Engineering*. 2023; 11(2):109420
4. L Chen, M Arshad, Y Chuang, TB Nguyen, CH Wu, CW Chen, **CD Dong**. A novel nano-heterojunction MoS2/α-Fe2O3 photocatalysts with high photocatalytic and photoelectrochemical performance under visible light irradiation. *Journal of Alloys and Compounds*. 2023; 169577
5. Vaibhav Sunil Tambat, Yi-sheng Tseng, Prashant Kumar, Chiu-Wen Chen, Reeta Rani Singhania, Jo-Shu Chang, **Cheng-Di Dong**, Anil Kumar Patel. Effective and sustainable bioremediation of molybdenum pollutants from wastewaters by potential microalgae. *Environmental Technology & Innovation*. 2023; 103091
6. Cam Thi Hong Tran, Parushi Nargotra, Hoa Thi Cam Pham, Dong My Lieu, Phung Kim Huynh, Hui-Min David Wang, **Cheng-Di Dong**, Chia-Hung Kuo. The effect of carboxymethyl cellulose and β-cyclodextrin as debittering agents

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Keynote Speech Abstract

Occurrence and Risk Assessment of Environmental Hormones in Marine Organisms

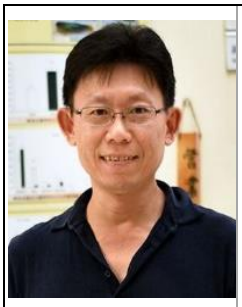
Dr. Cheng-Di Dong, PhD

Abstract:

Environmental hormones, known as endocrine disrupting chemicals (EDCs), are substances that interfere with the endocrine system of an organism and may adversely affect growth, development, and reproduction. These substances come from a variety of sources, including industrial and agricultural activities, pharmaceuticals, and personal care products. EDCs can enter the marine environment through sewage discharge, atmospheric deposition, river transport, and surface runoff. Marine organisms are particularly vulnerable to EDCs because they are exposed to various chemicals released into the ocean and accumulate high concentrations of pollutants in their bodies through bioconcentration or biomagnification. Some of the most common EDCs found in marine environments include plasticizers, pesticides, pharmaceuticals, and polycyclic aromatic hydrocarbons. Studies have shown that marine organisms, including fish, shellfish, crustaceans, and mammals, can accumulate EDCs in their tissues and cause various adverse effects, such as reduced fertility, abnormal development, and impaired immune function. In addition, EDC can also return to the human body through the food chain and cause human health risks. Consumption of contaminated seafood increases human carcinogenic and/or non-carcinogenic health risks. In recent years, there has been increased awareness of the potential risks associated with EDCs in the marine environment, resulting in increased monitoring and regulation of EDCs. This includes developing new regulations and guidelines on

chemical use and disposal and implementing monitoring programs to track levels of EDCs in marine life and their habitats.

陳德豪副館長 Dr. Te-Hao Chen



Dr. Te-Hao Chen, PhD
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Biographies:

- 2018–Present: Deputy Director General, National Museum of Marine Biology and Aquarium, Pingtung, Taiwan
- 2016–Present: Professor, Institute of Marine Biology, National Dong Hwa University, Taitung, Taiwan
- 2016–2018: Director, Department of Biology, National Museum of Marine Biology and Aquarium, Pingtung, Taiwan

Education:

- 2001–2006: PhD Degree in Wildlife Ecology with a minor in Molecular and Environmental Toxicology, University of Wisconsin, Madison, WI, USA
- 1995–1997: Master of Science in Zoology with a focus in Ecology, National Taiwan University, Taipei, Taiwan
- 1991–1995: Bachelor of Science in Zoology, National Taiwan University, Taipei, Taiwan

Experience & Honor:

- 2013–2014: Chair, Institute of Marine Biodiversity and Evolutionary Biology, National Dong Hwa University, Taitung, Taiwan
- 2012–2016: Associate Professor, Institute of Marine Biodiversity and

Evolutionary Biology, National Dong Hwa Universiy, Taitung, Taiwan

- 2011–2016: Associate Research Fellow, National Museum of Marine Biology and Aquarium, Pingtung, Taiwan
- 2007–2012: Assistant Professor, Institute of Marine Biodiversity and Evolutionary Biology, National Dong Hwa Universiy, Taitung, Taiwan
- 2007–2011: Assistant Research Fellow, Department of Biology, National Museum of Marine Biology and Aquarium, Pingtung, Taiwan
- 2006–2007: Research Associate, Department of Biology, National Museum of Marine Biology and Aquarium, Pingtung, Taiwan

Refereed Papers:

1. Mei-Chi Chen, **Te-Hao Chen**. Spatial and seasonal distribution of microplastics on sandy beaches along the coast of the Hengchun Peninsula, Taiwan. *Marine Pollution Bulletin*. 2020; 151:110861
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Keynote Speech Abstract

Behavioral Effects of Endocrine Disrupting Chemicals on Fish: An Ecotoxicological Perspective

Dr. Te-Hao Chen, PhD

Abstract:

生態毒理學是一個結合毒理學和生態學的跨領域科學，關注的是有毒物質在生態系統中的分布、傳遞、累積和對生物的效應。魚類具有很高的生態及經濟重要性，是水生生態毒理學非常重要的研究對象。魚類整個生活史時期牽涉許多種間(如掠食)及種內(如競爭、生殖)的互動，這些都需要靠著適當的行為表現才能達成。暴露環境污染物(例如環境荷爾蒙)可能會改變魚類正常行為，例如運動、攝食、避敵、群游、築巢、求偶、社會行為等，進而影響個體適存度。環境荷爾蒙可以模擬或干擾生物體內天然荷爾蒙的功能，在極低的濃度下影響生物體的生長、發育、繁殖和行為。本人實驗室的主要研究方向之一就是環境污染物對魚類的行為的影響，我們的研究證實環境荷爾蒙在環境濃度之下對魚類運動行為、求偶行為、領域行為、社會行為的影響。目前關於行為生態毒理的資料相當缺乏，未來的研究應該更多地探討環境荷爾蒙等環境毒物在低濃度、長時間暴露下對動物行為的影響，以求更接近真實環境中的暴露情況。

Topic 3: 環境荷爾蒙的臨床檢測與應用
Endocrine Disrupting Chemicals and Clinical Medicine

與談人 Panelist

陳介文副教授 Dr. Jein-Wen Chen

Dr. Jein-Wen Chen, PhD
Associated Professor, Center for Environmental Toxin and Emerging-Contaminant Research and Institute of Environmental Toxin and Emerging-Contaminant, Cheng Shiu University, Kaohsiung, Taiwan

Biographies:

- 2022－Present: Associated Professor, Institute of Environmental Toxin and Emerging-Contaminant, Cheng Shiu University, Kaohsiung, Taiwan

Education:

- PhD Degree, Department of Bio-environmental Systems Engineering, National Taiwan University, Taipei, Taiwan

Experience & Honor:

- 2012–2022: Assistant Professor, Center for General Education, Cheng Shiu University, Kaohsiung, Taiwan
- 2011–2012: Principal Investigator, Super Micro Mass Research and Technology Center, Cheng Shiu University, Kaohsiung, Taiwan
- 2005–2011: Postdoctoral Investigator, National Health Research Institutes, Taipei, Taiwan

Refereed Papers:

1. Liao, CM., Chen, JS., **Chen, JW.** Dynamic model for predicting dust-borne odour concentrations in ventilated animal housing. *Appl. Math. Modelling.* 2000; 24(2):131-145.
2. Liao, CM., **Chen, JW.**, Huang, MY., Chen, JS., Chang, TJ. An inhalation dose

model for assessing dust-borne VOC-odor exposure from feeding in swine buildings. *T. ASAE.* 2001; 44(6):1813-1824.

3. Liao, CM., Huang, MY., **Chen, JW.**, Chang, TJ. Removal dynamics of airborne road dust in a ventilated airspace. *J. Environ. Sci. Health A.* 2002; 37(6):1009-1027.
4. Liao, CM., Lin, MC., Chen, JS., **Chen, JW.** Linking biokinetics and consumer-resource dynamics of Zn accumulation in pond abalone *Haliotis diversicolor supertexta*. *Water Research.* 2002; 36(20):5102-5112.
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6. Liao, CM., Liang, HM., **Chen, JW.**, Chen, JS. A transfer function technique to describe odor causing VOCs transport in a ventilated airspace with mixing/adsorption heterogeneity. *Appl. Math. Computation.* 2003; 140(2-3):255-277.
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16. Su, PH., Chen, JY., **Chen, JW.**, Wang, SL. Growth and thyroid function in children with in utero exposure to dioxin: a five-year follow-up study. *Pediatr. Res.* 2010; 67:205-210.
17. Lin, S., Ku, HY., Su, PH., **Chen, JW.**, Huang, PC., Angerer, J., Wang, SL. Phthalate exposure in pregnant women and their children in central Taiwan. *Chemosphere.* 2011; 82:947-955.
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21. **Chen, JW.**, Li, WF., Wang, YH., Huang, YL., Sun, CW., Chen, CJ., Wang, SL. Arsenic methylation, *GSTO1* polymorphisms, and metabolic syndrome in arseniasis endemic area of southwestern Taiwan. *Chemosphere*. 2012; 88(4):432-438.
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座長 Moderator

龔嘉德副院長 Dr. Chia-Te Kung

Dr. Chia-Te Kung, MD, MPH

Deputy Superintendent, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan

Biographies:

- 2018–Present: 高雄長庚紀念醫院副院長
- 2022–Present: 長庚體系兒少保護工作小組召集人
- 2022–Present: 長庚體系巡迴體檢暨勞工健康管理委員會主席
- 2021–Present: 長庚體系急重症醫療總會委員
- 2019–Present: 高雄長庚紀念醫院醫學教育委員會主席
- 2018–Present: 高雄長庚紀念醫院急診管理委員會主席
- 2018–Present: 長庚學報副總編輯
- 2019–Present: 台灣醫學教育學會理事
- 2014–Present: 台灣急診醫學會理事
- 2013–Present: 高雄市災害防救專家諮詢委員會
- 2005–Present: 衛生福利部高屏區緊急醫療應變中心副執行長
- 1997–Present: 高雄長庚紀念醫院急診醫學科主治醫師

Education:

- 1991: Doctor of Medicine (MD), School of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan
- 2011: Master of Public Health (MPH), Department of Public Health, College of Health Sciences, Kaohsiung Medical University, Kaohsiung, Taiwan

Experience & Honor:

- 2016–2019: 高雄長庚醫院醫學教育委員會副主席
- 2020–2022: 長庚體系醫學教育總會副主席
- 2017–2019: 長庚體系跨院區教學推展推動小組召集人
- 2011–2017: 高雄長庚醫院急診醫學科主任
- 2000–2004: 高雄長庚醫院急診醫學科主任

Refereed Papers:

1. Chih-Cheng Huang, Yun-Ru Lai, Chia-Yi Lien, Ben-Chung Cheng, **Chia-Te Kung**, Yi-Fang Chiang, Cheng-Hsien Lu*. Effectiveness Of Different Methods For Baroreflex Sensitivity Assessment In Determining The Severity Of Cardiovascular Autonomic Neuropathy In Patients With Parkinson's Disease. *Frontiers in Neuroscience*. 2022; 16:833344
2. Yu Lee, Liang-Jen Wang*, Wen-Jiun Chou, Ming-Chu Chiang, Shan Huang, Yi-Chun Lin, Jie-Yi Lin, Nien-Mu Chiu, Chih-Hung Chen, Ing-Kit Lee, **Chia-Te Kung**, Chih-Chi Wang, Mian-Yoon Chong*. Psychological reactions of hospital workers to a pandemic: a comparison of sars-cov-2 in 2020 and sars in 2003. *International Journal of Environmental Research and Public Health*. 2022; 19(2):833
3. Kai-Fan Tsai, Pai-Chin Hsu, Chien-Te Lee, **Chia-Te Kung**, Yi-Chin Chang, Lung-Ming Fu, Yu-Che Ou, Kuo-Chung Lan, Tzung-Hai Yen, Wen-Chin Lee*. Association between enzyme-linked immunosorbent assay-measured Kidney injury markers and urinary cadmium levels in chronic kidney Disease. *Journal of Clinical Medicine*. 2022; 11(1):156

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5. Kai-Fan Tsai, Pai-Chin Hsu, **Chia-Te Kung**, Chien-Te Lee, Huey-Ling You, Wan-Ting Huang, Shau-Hsuan Li, Fu-Jen Cheng, Chin-Chou Wang, and Wen-Chin Lee*. The Risk Factors of Blood Cadmium Elevation in Chronic Kidney Disease. *International Journal of Environmental Research And Public Health*. 2021; 18(23):12337

6. **Kung CT**, Su CM, Hsiao SY, Chen FC, Lai YR, Huang CC, Lu CH*. The Prognostic Value of Serum Soluble TREM-1 on Outcome in Adult Patients with Sepsis. *Diagnostics (Basel)*. 2021; 11(11):1979

7. Chih-Cheng Huang, Yun-Ru Lai, Fu-An Wu, Nai-Ying Kuo, Ben-Chung Cheng, Nai-Wen Tsai, **Chia-Te Kung**, Yi-Fang Chiang, and Cheng-Hsien Lu*. Detraining Effect on Pulmonary and Cardiovascular Autonomic Function and Functional Outcomes in Patients With Parkinson's Disease After Respiratory Muscle Training: An 18-Month Follow-Up Study. *Frontiers in Neurology*. 2021; 12:735847

8. Hung-Chen Wang†, Pei-Ming Wang†, Yu-Tsai Lin, Nai-Wen Tsai, Yun-Ru Lai, **Chia-Te Kung**, Chih-Min Su, Cheng-Hsien Lu*. Effects of Hyperbaric Oxygen Therapy on Serum Adhesion Molecules, and Serum Oxidative Stress in Patients with Acute Traumatic Brain Injury. *Journal of Personalized Medicine*. 2021; 11(10):985

9. Dong-Y Hsieh, Yun-R Lai, Chia-Y Lien, Wen-N Chang, Chih-C Huang, Ben-C Cheng, **Chia-T Kung**, Cheng-H Lu*. Sex-based differences in bacterial meningitis in adults: Epidemiology, clinical features, and therapeutic outcomes. *Journal of Infection And Public Health*. 2021; 14(9):1218-1225

10. Chi-Yung Cheng, **Chia-Te Kung**, Kuan-Han Wu, Fu-Cheng Chen, Hsien-Hung Cheng, Fu-Jen Cheng, Jyun-Bin Huang, Chih-Min Su*. Liver cirrhosis affects serum lactate level measurement while assessing disease severity in patients

with sepsis. *European Journal of Gastroenterology & Hepatology*. 2021; 33(9):1201-1208

11. Tsai MY, Lee IK, **Kung CT***. Dilemmas in managing acute myocardial infarction during Covid-19 pandemic. *Biomed J*. 2021; 44(4):508-511
12. Heng-Chung Kung, Kai-Jung Lin, **Chia-Te Kung** *, Tsu-Kung Lin*. Oxidative Stress, Mitochondrial Dysfunction, and Neuroprotection of Polyphenols with Respect to Resveratrol in Parkinson's Disease. *Biomedicines*. 2021; 9(8):918
13. Chih-Hung Chen, Ya-Hui Cheng, Yuan-Chi Shen, **Chia-Te Kung**, Peng-Chen Chien, Ching-Hua Hsieh*. The Effect of Post-Graduate Year Training on the Self-Efficacy and Emotional Traits of Physicians Facing the COVID-19 Pandemic. *Healthcare (Basel)*. 2021; 9(7):912
14. Shih-Chiang Hung, Chen-Cheng Yang, Chu-Feng Liu, **Chia-Te Kung**, Wen-Huei Lee, Chi-Kung Ho, Hung-Yi Chuang*, Hsin-Su Yu. The Association Pattern between Ambient Temperature Change and Leukocyte Counts. *International Journal of Environmental Research and Public Health*. 2021; 18(13):6971
15. Dong-Yi Hsieh, Yun-Ru Lai, Chia-Yi Lien, Wen-Neng Chang, Chih-Cheng Huang, Ben-Chung Cheng, **Chia-Te Kung**, Cheng-Hsien Lu*. Nationwide Population-Based Epidemiological Study for Outcomes of Adjunctive Steroid Therapy in Pediatric Patients with Bacterial Meningitis in Taiwan. *International Journal of Environmental Research and Public Health*. 2021; 18(12):6386
16. Ng HY, Wen-Chin Lee WC, **Kung CT**, Li LC, Lee CT , Fu LM*. Recent Advances in Microfluidic Devices for Contamination Detection and Quality Inspection of Milk. *Micromachines (Basel)*. 2021; 12(5):558
17. Yuan-Heng Su, Kuan-Han Wu, Chih-Min Su, Chi-Yung Cheng, Cheng-I Cheng, **Chia-Te Kung**, Fu-Cheng Chen*. Influence of the Coronavirus Disease 2019 Pandemic on Patients with ST-Segment Elevation Myocardial Infarction in Taiwan. *Emergency Medicine International*. 2021; 2021:5576220
18. Chun-Chieh Chu, Chih-Min Su, Fu-Cheng Chen, Chi-Yung Cheng, Hsien-Hung

Cheng, **Chia-Te Kung**∗. The timing of last hemodialysis influences the prognostic value of serum lactate levels in predicting mortality of end-stage renal disease patients with sepsis in the emergency department. *Medicine (Baltimore)*. 2021; 100(7):e24474

19. **Kung CT** , Wu KH, Wang CC, Lin MC, Lee CH∗, Lien MH*. Effective strategies to prevent in-hospital infection in the emergency department during the novel coronavirus disease 2019 pandemic. *Journal Of Microbiology Immunology And Infection*. 2021; 54(1):120-122
20. **Kung CT**, Gao H, Lee CY, Wang YN, Dong W, Ko CH, Wang G, Fu LM*. Microfluidic synthesis control technology and its application in drug delivery, bioimaging, biosensing, environmental analysis and cell analysis. *Chemical Engineering Journal*. 2020; 399:125748
21. Sheng-Yuan Hsiao, **Chia-Te Kung**, Chih-Min Su, Yun-Ru Lai, Chin-Cheng Huang, Nai-Wen Tsai, Hung-Chen Wang, Ben-Chung Cheng, Yu-Jih Su, Wei-Che Lin, Yi-Fang Chiang, Cheng-Hsien Lu*. Impact of oxidative stress on treatment outcomes in adult patients with sepsis: A prospective study. *Medicine (Baltimore)*. 2020; 99(26):e20872
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23. Lee IK, Wang CC*, Lin MC, **Kung CT**, Lan KC, Lee CT. Effective strategies to prevent coronavirus disease-2019 (COVID- 19) outbreak in hospital. *Journal of Hospital Infection*. 2020; 105:102-103

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Biographies:

Distinguished Professor Mei-Lien Chen obtained her PhD in Public Health from National Taiwan University. She has been working at the Institute of Environmental Health Sciences, National Yang Ming Chiao Tung University since 1985. Prof. Chen's research has focused on environmental and occupational health, exposure assessment, air pollution and health risk assessment, endocrine disruptor and health, worksite tobacco control, occupational safety, and health training and education. Her current research includes determining the health effect of prenatal exposure to several endocrine-disrupting chemicals (EDC), such as nonylphenols, phthalates, pesticides, and heavy metals. She has been working on various post-exposure health effects like the birth outcome, reproductive effect, attention deficit hyperactivity disorder (ADHD), and exploring metabolomic fingerprints to understand the adverse outcome pathways after EDC exposure. Prof. Chen's current research also focuses on occupational health, promoting the competency of occupational health professionals in the workplace through training and education.

Education:

- PhD Degree in Public Health, National Taiwan University, Taipei, Taiwan

Experience & Honor:

- 1999–2021: Professor, Institute of Environmental and Occupational Health Sciences, National Yang-Ming University, Taipei, Taiwan
- 2017–2021: Distinguished Professor, Institute of Environmental and

Occupational Health Sciences, National Yang-Ming University, Taipei, Taiwan

- 2021–Present: Distinguished Professor, Institute of Environmental and Occupational Health Sciences, National Yang Ming Chiao Tung University, Taipei, Taiwan
- 2008–Present: Board of Directors, Taiwan Occupational Health Association
- 2010–Present: Board of Directors, Taiwan Public Health Association
- 2013–Present: Board of Directors, Taiwan Society for Risk Analysis
- 2017–2020: President, Taiwan Occupational Health Association
- 2020–Present: Honorary President, Taiwan Occupational Health Association

Refereed Papers:

1. Chia-Huang Chang, Boopathi Subramani, Ching-Jung Yu, Jung-Chieh Du, Hsien-Chih Chiou, Jia-Woei Hou, Winnie Yang, Chian-Feng Chen, Ying-Sheue Chen, Betau Hwang, **Mei-Lien Chen***. The association between organophosphate pesticide exposure and methylation of paraoxonase-1 in children with attention-deficit/hyperactivity disorder. *Environment International*. 2023; 171:107702.
2. Kai-Wei Liao, Fang-Chi Chang, Chia-Huang Chang, Yu-Fang Huang, Wen-Harn Pan, **Mei-Lien Chen***. Associating acrylamide internal exposure with dietary pattern and health risk in the general population of Taiwan. *Food Chemistry*. 2022; 50(17):4998-5006.
3. Chia-Huang Chang, Yen-An Tsai, Yu-Fang Huang, Ming-Song Tsai, Jia-Woei Hou, Ching-Ling Lin, Pei-Wei Wang, Li-Wei Huang, Chih-Yao Chen, Chia-Fang Wu, Chia-Jung Hsieh, Ming-Tsang Wu, Shu-Li Wang, **Mei-Lien Chen***. The sex-specific association of prenatal phthalate exposure with low birth weight and small for gestational age: A nationwide survey by the Taiwan Maternal and Infant Cohort Study (TMICS). *Science of The Total Environment.* 2022; 806(Pt 3):151261.
4. Alexander Waits, Chia-Huang Chang, Ching-Jung Yu, Jung-Chieh Du, Hsien-Chih Chiou, Jia-Woei Hou, Winnie Yang, Hsin-Chang Chen, Ying-Sheue Chen, Betau Hwang, **Mei-Lien Chen***. Exposome of attention deficit hyperactivity disorder in Taiwanese children: exploring risks of endocrine-disrupting

chemicals. *Journal of Exposure Science and Environmental Epidemiology.* 2022; 32:69-176 .

5. **Mei-Lien Chen**, Chih-Hsien Chen, Yu-Fang Huang, Hsin-Chang Chen, Jung-Wei Chang*. Cumulative Dietary Risk Assessment of Benzophenone-Type Photoinitiators from Packaged Foodstuffs. *Foods.* 2022; 11:152.
6. Chia-Huang Chang, Ching-Jung Yu, Jung-Chieh Du, Hsien-Chih Chiou, Jia-Woei Hou, WinnieYang, Chian-Feng Chen, Hsin-Chang Chen, Ying-Sheue Chen, Betau Hwang, **Mei-Lien Chen***. The associations among organophosphate pesticide exposure, oxidative stress, and genetic polymorphisms of paraoxonases in children with attention deficit/hyperactivity disorder. *Science of The Total Environment.* 2021; 773:145604.
7. Yu-Fang Huang, Chia-Huang Chang, Pei-Jung Chen, I-Hsuan Lin, Yen-An Tsai, Chian-Feng Chen, Yu-Chao Wang, Wei-Yun Huang, Ming-Song Tsai,* **Mei-Lien Chen***. Prenatal Bisphenol A Exposure, DNA Methylation, and Low Birth Weight: A Pilot Study in Taiwan. *International Journal of Environmental Research and Public Health.* 2021; 18(11):6144.
8. Chia-Huang Chang, Chian-Feng Chen, Yen-An Tsai, Shu-Li Wang, Po-Chin Huang, Bai-Hsiun Chen, Ming-Tsang Wu, Chu-Chih Chen, Chao Agnes Hsiung, **Mei-Lien Chen***. The sex-specific association of phthalate exposure with DNA methylation and characteristics of body fat in children. *Science of The Total Environment.* 2020; 737:139833.

講員&講題摘要 Speaker & Abstract

蔡凱帆醫師 Dr. Kai-Fan Tsai

Dr. Kai-Fan Tsai, MD
Lecturer and Attending Physician, Division of Nephrology, Department of Internal Medicine, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan

Biographies:

Kai-Fan Tsai is a clinical nephrologist and toxicologist in the Kaohsiung Chang Gung Memorial Hospital. His research work focuses on clinical nephrology and the impact of environmental hazards on renal disease. Currently, he is conducting an investigation about the associations between exposure to environmental hazards and prognosis of chronic kidney disease, such as heavy metals, flame retardants, and phthalates.

Education:

- 2004–2011: Bachelor of Medicine (MD), School of Medicine, College of Medicine, Chang Gung University, Taoyuan, Taiwan

Experience & Honor:

- 2021–Present: Lecturer, Division of Nephrology, Department of Internal Medicine, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan
- 2018–Present: Attending Physician, Division of Nephrology, Department of Internal Medicine, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan
- 2019–2020: Attending Physician, Division of Nephrology, Department of Internal Medicine, Kaohsiung Municipal Feng-Shan Hospital (Under the Management of Kaohsiung Chang Gung Memorial Hospital), Kaohsiung, Taiwan

- 2022: Taiwan Clinical Dialysis Association - Outstanding Paper Award

Refereed Papers:

1. Chung-Hsu Lai, Wu Sun, Chen-Hsiang Lee, Jiun-Nong Lin, Ming-Huei Liao, Shyh-Shyan Liu, Tzu-Yao Chang, **Kai-Fan Tsai**, Yi-Chin Chang, Hsi-Hsun Lin, Yen-Hsu Chen*. The Epidemiology and Characteristics of Q fever and Co-infections with Scrub Typhus, Murine Typhus or Leptospirosis in Taiwan: A Nationwide Database Study. *Zoonoses and Public Health*. 2017 Nov; 64(7):517-526
2. **Kai-Fan Tsai**, Lung-Chih Li*, Chien-Ning Hsu, Chih-Che Lin, Yu-Hung Lin, Yu-Fan Cheng, Chih-Chi Wang, Chao-Long Chen. Effects of Conversion From Calcineurin Inhibitors to Sirolimus or Everolimus on Renal Function and Possible Mechanisms in Liver Transplant Recipients. *Journal of Clinical Pharmacology*. 2019 Mar; 59(3):326-334
3. Hua-Rong Zhong, Chiang-Chi Huang, Po-Jung Wu, **Kai-Fan Tsai**, Chien-Hsing Wu, Chien-Te Lee, Terry Ting-Yu Chiou*. Factors Associated With Circuit Set Lifetime in Continuous Venovenous Hemofiltration Therapy. *Acta Nephrologica*. 2019 Mar; 30(1):40-49
4. **Kai-Fan Tsai**, Yung-Lung Chen, Terry Ting-Yu Chiou, Tian-Huei Chu, Lung-Chih Li, Hwee-Yeong Ng, Wen-Chin Lee*, Chien-Te Lee*. Emergence of SGLT2 Inhibitors as Powerful Antioxidants in Human Diseases. *Antioxidants (Basel)*. 2021 Jul; 10(8):1166
5. **Kai-Fan Tsai**, Pai-Chin Hsu, Chia-Te Kung, Chien-Te Lee, Huey-Ling You, Wan-Ting Huang, Shau-Hsuan Li, Fu-Jen Cheng, Chin-Chou Wang, Wen-Chin Lee*. The Risk Factors of Blood Cadmium Elevation in Chronic Kidney Disease. *International Journal of Environmental Research and Public Health*. 2021 Nov; 18(23):12337
6. Ju-Shao Yen, I-Kuan Wang, Chih-Chia Liang, Jen-Fen Fu, Yi-Chou Hou, Chih-Chun Chang, Po-Wen Gu, **Kai-Fan Tsai**, Cheng-Hao Weng, Wen-Hung Huang, Ching-Wei Hsu, Tzung-Hai Yen*. Cytokine Changes in Fatal Cases of Paraquat Poisoning. *American Journal of Translational Research*. 2021 Oct;

13(10):11571-11584

7. **Kai-Fan Tsai**, Pai-Chin Hsu, Chien-Te Lee, Chia-Te Kung, Yi-Chin Chang, Lung-Ming Fu,Yu-Che Ou, Kuo-Chung Lan, Tzung-Hai Yen, Wen-Chin Lee*. Association between Enzyme-Linked Immunosorbent Assay-Measured Kidney Injury Markers and Urinary Cadmium Levels in Chronic Kidney Disease. *Journal of Clinical Medicine*. 2021 Dec; 11(1):156

8. Po-Hsun Chuang, **Kai-Fan Tsai**, I-Kuan Wang, Ya-Ching Huang, Lan-Mei Huang, Shou-Hsuan Liu, Cheng-Hao Weng, Wen-Hung Huang, Ching-Wei Hsu, Wen-Chin Lee, Tzung-Hai Yen*. Blood Aluminum Levels in Patients with Hemodialysis and Peritoneal Dialysis. *International Journal of Environmental Research and Public Health*. 2022 Mar; 19(7):3885

9. Pai-Chin Hsu, Chih-Han Liu, Wen-Chin Lee, Chien-Hsing Wu, Chien-Te Lee, Chien-Hao Su, Yu-Chin Lily Wang, **Kai-Fan Tsai***, Terry Ting-Yu Chiou*. Predictors of Acute Kidney Disease Severity in Hospitalized Patients with Acute Kidney Injury. *Biomedicines*. 2022 May; 10(5):1081

10. Yu-Hsin Liu, **Kai-Fan Tsai**, Pai-Chin Hsu, Meng-Hsuan Hsieh, Jen-Fen Fu, I-Kuan Wang, Shou-Hsuan Liu, Cheng-Hao Weng, Wen-Hung Huang, Ching-Wei Hsu, Tzung-Hai Yen*. Hemodialysis Treatment for Patients with Lithium Poisoning. *International Journal of Environmental Research and Public Health*. 2022 Aug; 19(16):10044

11. Chung-Ming Fu†, **Kai-Fan Tsai**†, Wei-Hung Kuo, Chien-Hsing Wu, Ching-I Yu, Huey-Ling You, Chien-Te Lee*. The Waxing, Waning, and Predictors of Humoral Responses to Vector-Based SARS-CoV-2 Vaccine in Hemodialysis Patients. *Vaccines (Basel)*. 2022 Sep; 10(9):1537 (†: equal to first author)

12. **Kai-Fan Tsai**, Fu-Jen Cheng, Wan-Ting Huang, Chia-Te Kung, Chien-Te Lee, Ben-Chung Cheng, Jin-Bor Chen, Shau-Hsuan Li, Chin-Chou Wang, Liang-Jen Wang, Yu-Che Ou, Wen-Chin Lee*. The associations between renal disease severity and exposure to organophosphate flame retardants in patients with chronic kidney disease. *Environment International*. 2022 Oct; 170:107573

13. Po-Chun Chen, Chiang-Chi Huang, Chung-Ming Fu, Yi-Chin Chang, Po-Jung Wu, Wen-Chin Lee, Chien-Te Lee, **Kai-Fan Tsai***. Real-World Effectiveness of SARS-CoV-2 Vaccine Booster in Hemodialysis Patients with COVID-19 Receiving Molnupiravir. *Viruses (Basel)*. 2023 Feb, 15(2):543

Keynote Speech Abstract

Novel Endocrine Disrupting Chemicals: Development and Clinical Application of Phthalate and OPFR Testing

Dr. Kai-Fan Tsai, MD

Abstract:

The health impact of environmental hazards is a topic of increasing concern. Among the common environmental pollutants, novel endocrine disrupting chemicals (EDCs) such as phthalates and organophosphate flame retardants (OPFRs) have been regarded as hazardous materials that lead to extensive human exposure and have "pseudo-persistence" properties. Since 2020, the research team in Kaohsiung Chang Gung Memorial Hospital has initiated a study project addressing the exposure to novel EDCs in the patient populations in southern Taiwan and the impact of novel EDCs on prevalent clinical diseases. There were 2,235 first-void urine samples in the morning were collected to measure the concentrations of phthalates and OPFR compounds using an ultra-performance liquid chromatography-tandem mass spectrometry, including 1,810 from patients (disease group) and 425 from healthy volunteers (control group). In our analysis, exposure to phthalates and OPFRs was universal in the participants, with overall detection rates of beyond 90%, and the 95th-percentile concentration of ΣOPFR effectively distinguished the disease group from the control group. The associations between OPFR exposure and renal disease severity were identified in patients with chronic kidney disease (CKD), and urinary concentrations of OPFRs and phthalates were correlated with urinary biomarkers of renal tubular injury and oxidative stress in the CKD population. Furthermore, exposure to phthalate was associated with a decreased serum level of insulin-like growth factor-1 and an increased risk of attention deficit hyperactivity disorder (ADHD) in children. In the

animal study using a rat model, adverse effects of OPFR exposure on male reproductive function were also demonstrated. Our findings highlight the multisystemic health impact of novel EDC exposure, which warrants particular attention and further investigations in the patient populations in Taiwan.

陳威翔教授 Dr. Wei-Hsiang Chen

Dr. Wei-Hsiang Chen, PhD
Professor, Institute of Environmental Engineering, National Sun Yat-sen University, Kaohsiung, Taiwan

Biographies:

Dr. Wei-Hsiang Chen is a professor in the Institute of Environmental Engineering at National Sun Yat-Sen University (NSYSU), Kaohsiung, Taiwan. His research focuses on the complex array of environmental physical and chemical processes and the associated applications to solve problems that pose risks to the environment and human health. Dr. Chen is particularly interested in the areas of water and wastewater treatment technology, emerging contaminant and disinfection byproduct, multi-media environmental fate, transport, and distribution, and health risk assessment.

Education:

- 2009: PhD Degree in Environmental Engineering (Minor in Environmental Chemistry), Department of Civil and Environmental Engineering, University of California at Davis, Davis, CA, USA
- 2004: Master of Environmental Engineering, Science, and Management, Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, PA, USA
- 2000: Bachelor of Engineering from the Department of Water Resources and Environmental Engineering, Tamkang University, Taipei, Taiwan

Experience & Honor:

- 2019–Present: Jointly Appointed Associate Professor, Department of Public Health, Kaohsiung Medical University, Kaohsiung, Taiwan
- 2019–Present: Jointly Appointed Associate Professor, Doctor and Master Degree Program in Toxicology, Kaohsiung Medical University, Kaohsiung, Taiwan

- 2018–2022: Associate Vice President for General Affairs, National Sun Yat-sen University, Kaohsiung, Taiwan
- 2018–2022: Deputy Chief of Environmental Protection and Safety Center, National Sun Yat-sen University, Kaohsiung, Taiwan
- 2018–2019: Distinguished Young Scholar, National Sun Yat-sen University, Kaohsiung, Taiwan
- 2022: 財團法人慶恩教育基金會綠色科技論文獎
- 2022: 科技部優秀年輕學者研究計畫
- 2018: 國立中山大學年輕學者獎
- 2017: 中華民國環境工程學會優秀青年工程師獎

Refereed Papers:

1. Guan-Fu Chen, Ying-Chi Lin, Yuan-Chung Lin, Chia-Chi Wang, and **Wei-Hsiang Chen***. Implications of toxicity testing for health risk assessment of vapor-phase and PM2.5-bound polycyclic aromatic hydrocarbons during the diesel engine combustion. *Human and Ecological Risk Assessment*. 2022 Jul; 28(7):802-825
2. Tsung-Hsien Huang, Fang-Tsen Tung, Guan-Fu Chen, and **Wei-Hsiang Chen***. Variations of N concentrations and microbial community in the start-up of anammox using anaerobic heterotrophic sludge: Influence of a long reaction-phase time and comparison of the efficiencies of attached- versus suspended-growth cultures. *Chemosphere*. 2022 Jan; 287:132151
3. **Wei-Hsiang Chen***, Ya-Hong Wang, and Teng-Hsiang Hsu. The competitive effect of different chlorination disinfection methods and additional inorganic nitrogen on nitrosamine formation from aromatic and heterocyclic amine-containing pharmaceuticals. *Chemosphere.* 2021 Mar; 267:128922
4. **Wei-Hsiang Chen***, Chang-Jui Huang, Chih-Hsien Lin, and Chin-Pao Huang. Catalytic degradation of chlorpheniramine over GO-Fe3O4 in the presence of H2O2 in water: The synergistic effect of adsorption. *Science of the Total Environment*. 2020 Sep; 736:139468
5. **Wei-Hsiang Chen***, Tsung-Hsien Huang, and Chung-Ya Wang. Impact of pre-oxidation on nitrosamine formation from a source to drinking water: A

perspective on cancer risk assessment. *Process Safety and Environmental Protection*. 2018 Jan; 113:424-434

Keynote Speech Abstract

Impact of Pharmaceutical Pollutants and Their Disinfection Byproducts on Water Resource and Wastewater Treatment Technologies

Dr. Wei-Hsiang Chen, PhD

Abstract:

Contaminants of emerging concern (CECs) represent chemicals that have not been regulated but may be under scrutiny for future regulation. In recent decades, CECs have received increasing interest because of their continuous inputs and ubiquitous presence in the environment. Pharmaceuticals are released into the environment through pathways including domestic wastewater, medical discharges, feedlot wastewater, manufacturer disposal, and wastewater treatment plants, and represent one example that has been recognized as CECs because of their persistent occurrence in aquatic environments. Besides the concerns for their occurrence, pharmaceuticals form carcinogenic byproducts during chlorination in drinking water and wastewater treatment plants, which were designed to protect the water quality by preventing waterborne diseases. This presentation will reveal the picture of pharmaceutical pollution and its impacts regarding the formation of disinfection byproducts on public health. The N-containing pharmaceuticals and nitrogenous disinfection byproducts will be the compounds of interest. In addition, the talk will introduce possible strategies to limit the negative influences of pharmaceutical pollutants and their disinfection byproducts by using physicochemical treatment technologies employing graphene oxide and biological treatment technologies using anaerobic oxidation.

Topic 4: 環境毒理、環境荷爾蒙與精準醫療
Environmental Toxicology, Endocrine Disrupting Chemicals, and Precision Medicine

與談人 Panelist

王家蓁主任 Dr. Chia-Chun Wang

Dr. Chia C. Wang, PhD
Founding Director, Aerosol Science Research Center, National Sun Yat-sen University, Kaohsiung, Taiwan

Biographies:

Dr. Chia C. Wang received her PhD degree in Chemistry at University of California, Berkeley (2007), and is currently the associate professor of Department of Chemistry and the founding director of Aerosol Science Research Center at National Sun Yat-sen University. Dr. Wang is an aerosol physical chemist and her research involves: (1) developing novel aerosol spectroscopy and instrumentation to advance the fundamental physicochemical properties of bioaerosols and aqueous aerosols, including aerosol VUV photoelectron spectroscopy, (2) aerosols and their impacts to the atmospheric, oceanic chemistry and environmental ecosystem, (3) health effects of aerosols and aerosol inhalation therapy, and (4) formation, regulation and removal of anthropogenic aerosols. Dr. Wang's research also involves the studies of structure-function correlation of hemoglobin and hemoglobin-disorder induced hemoglobinopathies, from which she has developed new therapeutic strategies to treat Hb oxygen-transport defect and hypoxia related diseases, including chronic

obstructive pulmonary diseases (COPD). Dr. Wang has taken the leading role in establishing the Aerosol Science Research Center (ASRC) of NSYSU, which was launched in May 2016 and is currently the first and only aerosol-focused research center in Asia. ASRC actively engages in promoting aerosol research in Taiwan and many countries worldwide. Since the outbreak of COVID-19, Dr. Wang has dedicated efforts in advocating airborne transmission of virus-laden aerosols and effective aerosol precautionary measures to reduce the risk of airborne transmission of respiratory viruses. Dr. Wang's ultimate goal is to restore the homeostasis of our environmental ecosystem, through research, education, collaboration with different communities, and public educational outreach. Dr. Wang also cooperates with the industrial partners to help develop new technologies to reduce emission of environmental pollution. Dr. Wang is the head of "Academic-Industry Research Hub of People and Environment (AIR HoPE)" program, a collaboration between ASRC and the China Steel Corporation (CSC) launched in 2021, with a major goal to reduce the emission of air pollutant produced from industry. In 2017, Dr. Wang established the AeroMUSIC co-learning group to carry out educational outreach activities to work closely with museum(M), universities(U), school teachers (S), industry partners (I) and communities(C) to raise the public awareness of aerosol sciences and their close correlation with the environment, including the atmosphere, land ocean, and human activities. In July 2022, Dr. Wang collaborates with the Taiwan Sustainability Hub (TSH) of the Ministry of Science and Technology of Taiwan and establishes the TSH site at NSYSU for Clean Air & HoPE (Health of People and Earth). In Oct 2022, Dr. Wang joined the international efforts in

promoting the Inner Development Goals (IDG) to facilitate the SDGs and establishes the first IDG hub site in Taiwan.

Education:

- 2007: PhD Degree in Physical Chemistry, University of California, Berkeley, CA, USA (Advisor: Prof. Daniel M. Neumark)
- 2001: Master of Science in Physical Chemistry, National Taiwan University, Taipei, Taiwan (Advisor: Prof. Yuan T. Lee)

Experience & Honor:

- Deputy Secretary-general, Taiwan Association for Aerosol Research, Taiwan
- 2022–Present: Head, Taiwan Sustainability Hub at National Sun Yat-sen University for Clean Air & HoPE (Health of People and Earth), Kaohsiung, Taiwan
- 2021–Present: Head, Academic-Industry Research Hub of People and Environment (AIR HoPE), National Sun Yat-sen University, Kaohsiung, Taiwan
- 2016–Present: Founding Director, Aerosol Science Research Center, National Sun Yat-sen University, Kaohsiung, Taiwan
- 2017–Present: Associate Professor, Department of Chemistry, National Sun Yat-sen University, Kaohsiung, Taiwan
- 2016–2017: Director, Division of Industry and Academic Collaboration, Office of Industrial Collaboration and Continuing Education Affairs, National Sun Yat-sen University, Kaohsiung, Taiwan

- 2010–2017: Assistant Professor, Department of Chemistry, National Sun Yat-sen University, Kaohsiung, Taiwan
- 2008–2010: Postdoctoral Fellow, University of British Columbia, Vancouver, BC, Canada
- 2008–2008: Postdoctoral Fellow, Lawrence Berkeley National Laboratory, Berkeley, CA, USA

Refereed Papers:

1. Jan-Bai Nee*, Yuan-Pin Chang, **Chia C. Wang**. Aerosol emissions and gravity waves of Taal volcano. *Sci. Rep.* 2022; 12:5292
2. **Chia C. Wang***, Kimberley A. Prather*, Josué Sznitman, Jose L. Jimenez, Seema S. Lakdawala, Zeynep Tufekci, Linsey C. Marr. Airborne transmission of respiratory viruses. *Science.* 2021; 373:eabd9149
3. **Chia C. Wang***, Yuan-Pin Chang*, Chao-Yu Chung*. Infrared detection of Criegee intermediates. *J. Chin. Chem. Soc.* 2022; 69(1):22
4. Jan-Bai Nee*, Yuan-Pin Chang, **Chia C. Wang**. Optical properties of volcanic aerosols from eruptions of the Nishinoshima Island observed in Southern Taiwan. *Appl. Opt.* 2021; 60:C8-C11
5. Kimberley A. Prather*, **Chia C. Wang**, Robert T. Schooley. Reducing transmission of SARS-CoV-2. *Science.* 2020; 368:1422-1424
6. Arnab Bagchi, Youqing Yu, Jhih-Hong Huang, Cheng-Cheng Tsai, Wei-Ping Hu*, **Chia C. Wang***. Evidence and evolution of Criegee intermediates, hydroperoxides and secondary organic aerosols formed via ozonolysis of α-pinene. *Phys. Chem. Chem. Phys.* 2020; 22:6528-6537
7. Wei-Ren Chen, Chia-Cheng Chou, **Chia C. Wang***. Phthalides serve as potent

modulators to boost the efficacy of fetal hemoglobin induction therapy for β-hemoglobinopathies. *Blood Adv.* 2019; 3:1493-1498

8. Fan-Yen Lee, Mel S Lee, Christopher Glenn Wallace, Chi-Ruei Huang, Chi-Hsiang Chu, Zhi-Hong Wen, Jhih-Hong Huang, Xue-Sheng Chen, **Chia C. Wang***, Hon-Kan Yip*. Short-interval exposure to ambient fine particulate matter (PM2.5) exacerbates the susceptibility of pulmonary damage in setting of lung ischemia-reperfusion injury in rodent: Pharmacomodulation of melatonin. *Biomed. Pharmacother.* 2019; 113:108737
9. Wei-Ren Chen, Youqing Yu, Muhammad Zulfajri, Ping-Cheng Lin, Zhong-Hang Wu, Meng-Sin Chen and **Chia C. Wang***. Phthalide Derivatives from Angelica Sinensis Decrease Oxygen Affinity of Hemoglobin: A New Allosteric-Modulating Mechanism and Potential Use as 2,3-BPG Substitutes. *Sci. Rep.* 2017; 7:5504
10. Ping-Cheng Lin, Zhong-Hang Wu, Meng-Sin Chen, Yu-Lin Li, Wei-Ren Chen, Tzu-Ping Huang, Yin-Yu Lee and **Chia C. Wang***. Interfacial Solvation and Surface pH of Phenol and Dihydroxybenzene Aqueous Nanoaerosols Unveiled by Aerosol VUV Photoelectron Spectroscopy. *J. Phys. Chem. B.* 2017; 121:1054

座長 Moderator

吳明蒼教授 Dr. Ming-Tsang Wu

Dr. Ming-Tsang Wu, MD, ScD

Director, Research Center for Precision Environmental Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan

Biographies:

Dr. Ming-Tsang Wu has completed his MD from Chung Shan Medical University in Taiwan and PhD from Harvard School of Public Health in the USA. He is a distinguished professor in the PhD Program in Environmental and Occupational Medicine and the Director in Research Center for Precision Environmental Medicine, Kaohsiung Medicine University, Taiwan. His major research interest is on the interactive effects of environmental and occupational exposures, genetic factors, and biomarkers on the health outcomes.

Education:

- 1987: Doctor of Medicine (MD), Chung Shan Medical University, Taichung, Taiwan
- 1992: Master of Occupational Health (MOH), Harvard University, Cambridge, MA, USA
- 1997: Doctor of Science (ScD) in Occupational Health, Harvard University, Cambridge, MA, USA

*Experience & Honor: (*2018-present*)*

- Distinguished Professor, PhD Program in Environmental and Occupational Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan
- Attending physician, Department of Family Medicine, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan
- 2018: 國家品質標章(醫療院所類－醫院社區服務組)；題目「從職場至社區之精準職業暨環境的特色醫療服務－以介入措施降低生活環境汙染物三聚氰胺之暴露」
- 2018: Outstanding Research Award in Ministry of Science and Technology, Taiwan
- 2019: 台灣食品安全及受害者權益促進協會籌備會食安貢獻獎
- 2021: World's Top 2% Scientists 2021
- 2022: 第十九屆國家新創獎-臨床新創獎團隊成員之一；題目「運用精準光譜晶片打造可攜式定量三聚氰胺檢測儀」
- 2022: 國家生技醫療品質獎銅獎；題目「以新穎簡易改良式油煙過濾桶減汙及降低國人潛在性肺腺癌的風險」
- 2022: 國家生技醫療品質獎銀獎團隊成員之一；題目「抗菸抗霾大作戰-空污下的創新健康促進」

Refereed Papers:

1. **Wu MT***, Wu CF, Wu JR, Chen BH, Chen EK, Chao MC, Liu CK, Ho CK*. The public health threat of phthalate-tainted foodstuffs in Taiwan: the policies the government implemented and the lessons we learned. Environ Int. 2012; 44:75-79
2. Wu CF, Chen BH, Shiea J, Chen EK, Liu CK, Chao MC, Ho CK, Wu JR, **Wu**

MT*. Temporal changes of urinary oxidative metabolites of di(2-ethylhexyl)phthalate after the 2011 phthalate incident in Taiwanese children-Findings of a 6-month follow-up. Environ Sci Technol. 2013; 47(23):13754-62 (吳佳芳同學獲得2013年工業衛生暨環境職業醫學國際學術研討會優秀論文獎)

3. Wu CF, Chang-Chien GP, Su SW, Chen BH, **Wu MT***. Findings of 2,731 suspected phthalate-tainted foodstuffs during the 2011 phthalate incident in Taiwan. J Formos Med Assoc. 2014; 113:600-605
4. Tsai HJ, Chen BH (co-first author), Wu CF, Wang SL, Huang PC, Tsai YC, Chen ML, Ho CK, Hsiung CA*, **Wu MT***. Intake of phthalate-tainted foods and microalbuminuria in children: the 2011 Taiwan food scandal. Environ Int. 2016; 89-90:129-37 (蔡惠如同學獲得2015年張吳名任紀念優秀論文獎)
5. Tsai HJ, Wu CF, Tsai YC, Huang PC, Chen ML, Wang SL, Chen BH, Chen CC, Wu WC, Hsu PS, Hsiung C*, **Wu MT***. Intake of phthalate-tainted foods and serum thyroid hormones in Taiwanese children and adolescents. Sci Reports. 2016; 6:30589 (蔡惠如同學獲得2017年台灣流行病學學會碩士研究生論文獎)
6. Lin PID, Wu CF, Kou HS, Huang TY, Shiea J, **Wu MT***. Soap and the removal of di-(2-ethylhexyl)phthalate from hands: N-of-1 and crossover designs. Sci Reports. 2017; 7(1):454
7. Wu CF, Hsiung CA, Tsai HJ, Tsai YC, Hsieh HM, Chen BH, **Wu MT**. Interaction of melamine and di-(2-ethylhexyl) phthalate exposure on markers

of early renal damage in children: The 2011 Taiwan food scandal. Environ Pollution. 2018; 235:453-461

8. Wu CF, Hsiung CA, Tsai HJ, Cheng CM, Chen BH, Hu CW, Huang YL, **Wu MT***. Decreased levels of urinary di-2-ethylhexyl phthalate (DEHP) metabolites and biomarkers of oxidative stress in children exposed to DEHP-tainted foods in Taiwan in 2011: A 44-month follow up. Environ Pollut. 2020; 266(Pt 2):115204
9. Liu CC, Hsieh TJ, Wu CF, Lee CH, Tsai YC, Huang TY, Wen SC, Lee CH, Chien TM, Lee YC, Huang SP, Li CC, Chou YH, Wu WJ, **Wu MT***. Interrelationship of environmental melamine exposure, biomarkers of oxidative stress and early kidney injury. J Hazard Mater. 2020; 396:122726. (劉家駒醫師獲得110年台灣泌尿科學會理事長論文獎及高醫「109年九月月傑出論文獎」)
10. Chang CH, Tsai YA, Huang YF, Tsai MS, Hou JW, Lin CL, Wang PW, Hunag LW, Chen CY, Wu CF, Hsieh CJ, **Wu MT**, Wang SL, Chen ML. The sex-specific association of prenatal phthalate exposure with low birth weight and small for gestational age: A nationwide survey by the Taiwan Maternal and Infant Cohort Study (TMICS). Sci Total Environ. 2021; 29:151261
11. Tsai TL, Wang SL, Hsieh CJ, Wen HJ, Kuo CC, Liu HJ, Sun CW, Chen ML, **Wu MT**, for the TMICS Study Group. Association between prenatal exposure to metals and atopic dermatitis among children aged 4 years in Taiwan. JAMA Network Open. 2021; 4(10):e2131327
12. Tsai HJ, Wu CF, Hsiung CA, Lee CH, Wang SL,Chen ML, Chen CC, Huang

PC, Wang YH, Chen YA, Chen BH, Chuang YS, Hsieh HM, **Wu MT***. Longitudinal changes in oxidative stress and early renal injury in children exposed to DEHP and melamine in the 2011 Taiwan food scandal. Environ Int. 2022; 158:107018

13. Hsu YM, Wu CF, Huang MZ, Shiea J, Pan CH, Liu CC, Chen CC, Wang YH, Cheng CM, **Wu MT***. Avatar-like body imaging of dermal exposure to melamine in factory workers analyzed by ambient mass spectrometry. Chemosphere. 2022; 303(1):134896
14. Chang CH, Tsai YA, Huang YF, Tsai MS, Hou JW, Lin CL, Wang PW, Huang LW, Chen CY, Wu CF, Hsieh CJ, **Wu MT**, Wang SL, Chen ML. The sex-specific association of prenatal phthalate exposure with low birth weight and small for gestational age: A nationwide survey by the Taiwan Maternal and Infant Cohort Study (TMICS). Sci Total Environ. 2022; 806(Pt 3):151261
15. Chen CC*, Wang YH, Wu CF, Hsieh CJ, Wang SL, Chen ML, Tsai HJ, Li SS, Liu CC, Tsai YC, Hsieh TJ, **Wu MT***. Benchmark dose in the presence of coexposure to melamine and di-(2-ethylhexyl) phthalate and urinary renal injury markers in pregnant women. Environ Res. 2022; 215 (Part 1):11418
16. Kaewlaoyoong A, Huang ST, Wang SL, Sun CW, Chen JJ, Kuo CH, Hung CH, Chen SC, Liang CC, Tsai HW, Wu CF, Lin WY, **Wu MT***. Influential factors of urinary arsenic levels in the population residing close to one heavy-industrial area in Taiwan-A case study. Front Environ Sci. 2022; 10:1058408 (Dr. Acharee Kaewlaoyoong received the Outstanding Poster Paper Award, 2022 Precision Environmental Medicine Symposium (Spring Session)-Heavy Metals and Health, Taiwan)

17. Chen HK, Wang SL, Chang YH, Sun CW, **Wu MT**, Chen ML, Lin YJ, Hsieh CJ*, TMICS study group. Associations between maternal phthalate exposure and neonatal neurobehaviors: The Taiwan maternal and infant cohort study (TMICS). Environ Pollut. 2023; 319:120956

18. Chen HM, Chen CC, Chen JJ, Wu CF, Lee SS, Kuo FC, Sun CW, Chen ML, Hsieh CJ, Wang SL, **Wu MT***: Reference intervals for thyroid hormone, sex hormone, and clinical biochemical tests in cord blood from Taiwanese newborn-TMICS Cohort. Clinica Chimica Acta. 2023; 541:117247

莊弘毅教授 Dr. Hung-Yi Chuang

Dr. Hung-Yi Chuang, MD, ScD
Professor and Consultant Physician, Department of Occupational and Environmental Medicine, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan

Biographies:

Dr. Chuang investigated that lead toxicity to kidney function, blood pressure, cardiovascular diseases, metabolic syndrome, cognitive performance, and other measures of autonomic nervous function; in addition, the potential modifying influence of candidate genetic polymorphisms related to oxidative stress, enzyme activity, and cholesterol metabolism. His current research is focused on Gene-lead (Pb) Interactions: This research aims to discover and validate novel genes through the Gene Over Expression Tools in the lead (Pb) exposed workers.

Education:

- 1983–1990: Doctor of Medicine (MD), Kaohsiung Medical College, Kaohsiung, Taiwan
- 1990–1992: Master of Science in Public Health (MSPH), College of Medicine, National Taiwan University, Taipei, Taiwan
- 1996–1999: Doctor of Science (Sc.D., in Occupational Health), Harvard School of Public Health, Harvard University, Boston, MA, USA

Experience & Honor:

- 1996: Scholarship of Endowment for Physician Education (Harvard University)
- 1999: Antonio Award for Research in Occupational Health and Safety (American Bureau for Medical Advancement in China)
- 2002: Young Scientist Award in the 14th International Conference of the International Society of Environmental Epidemiology
- 2004–2006: Commissioner, the Health Bureau of Kaohsiung County Government
- 2006–2009: Professor and Director, Department of Public Health, Kaohsiung Medical University, Kaohsiung, Taiwan
- 2006–2012: Professor and Director-in-general of Kaohsiung Medical University, Kaohsiung, Taiwan
- 2012–2015: Director, Ph.D. Program of Environmental and Occupational Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan
- 2014–2018: President of Asian Associations of Occupational Health (AAOH)
- 2016–2018: Dean of Global Affaire, Kaohsiung Medical University, Kaohsiung, Taiwan
- 2017–2021: President of Taiwan Environmental and Occupational Medical Association

Refereed Papers: (Selected in Gene-Environment interaction in the recent 5 years)

1. Chen CJ, Chang HW, Yang CH, **Chuang HY***, Yu HS. Use of Genetic Algorithm Combinational Single-nucleotide Polymorphisms Could Modify the Association of Blood Lead Levels and Bone Matrix Density.

Epidemiology. 2017; 28 Suppl 1:S121-S5.

2. Huang YC, Chang WC, Shan YH, Lin CY, Wang CL, Dai CY, Ho CK, Wu MT, **Chuang HY***. Toxic Metals Increase Serum Tumor Necrosis Factor-alpha Levels, Modified by Essential Elements and Different Types of Tumor Necrosis Factor-alpha Promoter Single-nucleotide Polymorphisms. *Epidemiology*. 2017; 28 Suppl 1:S113-S20.
3. Yang CC, Chuang CS, Lin CI, Wang CL, Huang YC, **Chuang HY***. The association of the blood lead level and serum lipid concentrations may be modified by the genetic combination of the metallothionein 2A polymorphisms rs10636 GC and rs28366003 AA. *J Clin Lipidol*. 2017; 11(1):234-41.
4. Chen CJ, Lin TY, Wang CL, Ho CK, **Chuang HY***, Yu HS. Interactive Effects between Chronic Lead Exposure and the Homeostatic Iron Regulator Transport HFE Polymorphism on the Human Red Blood Cell Mean Corpuscular Volume (MCV). *Int J Environ Res Public Health*. 2019; 16(3):354-62.
5. Chen TH, Huang JJ, Kung WS, Lee SS, Sun HY, **Chuang HY***. The Association of Serum TNF-α Levels and Blood Multi-Elements Modified by TNF-α Gene Polymorphisms in Metal Industrial Workers. *Int J Environ Res Public Health*. 2019; 16(21): 4079. pii: E4079. doi:10.3390/ijerph16214079.
6. Yang CC, Lin CI, Lee SS, Wang CL, Dai CY, **Chuang HY** *. The association of blood lead levels and renal effects may be modified by genetic combinations of Metallothionein 1A 2A polymorphisms. *Sci Rep*. 2020; 15;10(1):9603.

7. Huang CC, Yang CC, Liu TY, Dai CY, Wang CL, **Chuang HY***. Use of Generalized Additive Model to Detect the Threshold of δ-Aminolevulinic Acid Dehydratase Activity Reduced by Lead Exposure. *Int J Environ Res Public Health*. 2020; 17(16):5712.
8. Chen TH, Huang JJ, Lee HY, Kung WS, Luo KH, Lu JY, **Chuang HY***. The Association of Renal Function and Plasma Metals Modified by EGFR and TNF-α Gene Polymorphisms in Metal Industrial Workers and General Population. *Int J Environ Res Public Health.* 2021; 18(17):9865. doi: 10.3390/ijerph18178965.
9. Chen TH, Kung WS, Sun HY, Huang JJ, Lu JY, Luo KH, **Chuang HY***. The Relationship between Metabolic Syndrome and Plasma Metals Modified by EGFR and TNF-α Gene Polymorphisms. *Toxics.* 2021; 9(9). doi: 10.3390/toxics9090225.
10. Lin CT, Chen TH, Yang CC, Luo KH, Chen TH, **Chuang HY***. Epidermal Growth Factor Receptor (EGFR) Gene Polymorphism May be a Modifier for Cadmium Kidney Toxicity. *Genes (Basel)*. 2021; 12(10):1573. doi: 10.3390/genes12101573.
11. Chen TH, Yang CC, Luo KH, Dai CY, Chuang YC, **Chuang HY***. The Mediation Effects of Aluminum in Plasma and Dipeptidyl Peptidase Like Protein 6 (DPP6) Polymorphism on Renal Function via Genome-Wide Typing Association. *Int J Environ Res Public Health*. 2021; 18(19):10484. doi: 10.3390/ijerph181910484.
12. Yang CC, Dai CY, Luo KH, Lee KW, Wu CH, Hung CH, **Chuang HY** *. Single Nucleotide Polymorphism of TWIST2 May Be a Modifier for the

Association between High-Density Lipoprotein Cholesterol and Blood Lead (Pb) Level. *Int J Environ Res Public Health*. 2022; 19(3):1352.

講員&講題摘要 Speaker & Abstract

王應然教授 Dr. Ying-Jan Wang

Dr. Ying-Jan Wang, PhD

Distinguished Professor, Department of Environmental and Occupational Health, College of Medicine, National Cheng Kung University, Tainan, Taiwan

Biographies:

Ying-Jan Wang, PhD, graduated from the Department of Biochemistry, College of Medicine, National Taiwan University, Taipei, Taiwan. He currently served as a distinguished professor in the Department of Environmental and Occupational Health, College of Medical, National Cheng Kung University, Tainan, Taiwan. The major research focus of his laboratory is to understand the molecular mechanisms responsible for environmental toxicants-triggered toxicity, and carcinogenesis/cancer therapy. He is especially interested in elucidating the role of autophagy in regulating diverse biological processes, such as proliferation, programmed cell death, and inflammation, thereby contributing to cytotoxicity and cancer therapy. By revealing the regulation pathways of autophagy, his research may help to the development of novel and effective preventive strategy to combat diseases.

Education:

- 1995: PhD Degree in Biochemistry/Molecular Biology, National Taiwan University, Taipei, Taiwan.
- 1991: Master of Science in Biochemistry/Molecular Biology, National Taiwan University, Taipei, Taiwan.
- 1985: Bachelor of Science in Pharmacy, Kaohsiung Medical University,

Kaohsiung, Taiwan

Experience & Honor:

Professional and Research Experience

- 2017–Present: Distinguished Professor, National Cheng Kung University, Tainan, Taiwan
- 2013 March–2013 July: Visiting Scientist, University of Texas M.D. Anderson Cancer Center, USA.
- 2009–2017: Full Professor, National Cheng Kung University, Tainan, Taiwan
- 2003–2009: Associate Professor, National Cheng Kung University, Tainan, Taiwan
- 1998–2003: Assistant Professor, National Cheng Kung University, Tainan, Taiwan

Awards and Honors

- 2020/2021: World's Top 2% Scientists
- 2017–2020/2020–2023: Distinguished professor in National Cheng Kung University
- 2022–2026: President of Toxicology Society of Taiwan (TSTA)
- 2022: Outstanding academic research award, National Cheng Kung University

Refereed Papers:

1. Y-H Wu, R-J Chen, H-W Chiu, L-X Yang, Y-L Wang, Y-Y Chen, Y-L Yeh, M-Y Liao*, **Y-J Wang***. Nanoparticles augment the therapeutic window of RT combined with immunotherapy against cancers: pivotal role of autophagy. *Theranostics*. 2023; 13(1):40-58

2. B-H Mao, Y-K Luo, B-J Wang, C-W Chen, F-Y Cheng, Y-H Lee, S-J Yan* and **Y-J Wang***. Use of an In silico Knowledge Discovery Approach to Determine Mechanistic Studies of Silver Nanoparticles-induced Toxicity from In vitro to In vivo. *Particle and Fibre Toxicology.* 2022; 19:6
3. Y-Y Chen, Y-H Lee, B-J Wang, R-J Chen* and **Y-J Wang***. Skin Damage Induced by Zinc Oxide Nanoparticles Combined with UVB is Mediated by Activating Cell Pyroptosis via the NLRP3 Inflammasome-Autophagy-Exosomal Pathway. *Particle and Fibre Toxicology.* 2022; 19:2
4. Y-L Lee, Y-S Shih, Z-Y Chen, F-Y Cheng, J-Y Lu, Y-H Wu*and **Y-J Wang***. Toxic Effects and Mechanisms of Silver and Zinc Oxide Nanoparticles on Zebrafish Embryos in Aquatic Ecosystems. *Nanomaterials*. 2022; 12:717
5. Lu, H. Y., **Wang, Y. J.*** & Hou, W. C*. Bioaccumulation and depuration of TiO2 nanoparticles by zebrafish through dietary exposure: Size- and number concentration-resolved analysis using single-particle ICP-MS. *J. Hazardous Materials.* 2022; 426:127801
6. Z-Y Chen, Y-C Su, F-Y Cheng, S-J Yan* and **Y-J Wang***. Lifetime bioaccumulation of silver nanoparticles accelerates functional aging by inactivating antioxidant pathways, an effect reversed by pterostilbene. *Environ. Sci.: Nano.* 2021; 8:3774
7. F-Y Cheng, C-H Chan, B-J Wang, Y-L Yeh, **Y-J Wang*** and H-W Chiu*. The oxygen-generating calcium peroxide-modified magnetic nanoparticles attenuate hypoxia-induced chemoresistance in triple-negative breast cancer. *Cancers (Basel).* 2021; 13(4):606
8. R-J Chen, Y-Y Chen, M-Y Liao, Y-H Lee, Z-Y Chen, S-J Yan, Y-L Yeh, L-X

Yang, Y-L Lee, Y-H Wu*, **Y-J Wang***. The current understanding of autophagy in nanomaterial toxicity and its implementation in safety assessment-related alternative testing strategies. *Int J Mol Sci.* 2020; 21(7):2387

9. Y-H Wu; W-S Wu; L-C Lin; C-S Liu; S-Y Ho; B-J Wang; B-M Huang; Y-L Yeh; H-W Chiu; W-L Yang*; **Y-J Wang***. Bortezomib enhances radiosensitivity in oral cancer through inducing autophagy-mediated TRAF6 oncoprotein degradation. *J Exp Clin Canc Res.* 2018; 37:91
10. **Y-J Wang***, J-F Lin, L-H Cheng, W-T Chang, Y-H Kao, M-M Chang, B-J Wang and H-C Cheng. Pterostilbene prevents AKT-ERK axis-mediated polymerization of surface fibronectin on suspended lung cancer cells independently of apoptosis and suppresses metastasis. *J. Hematol. Oncol.* 2017; 10:72-85
11. R-J Chen, P-H Wu, C-T Ho, T-D Way, M-H Pan, H-M Chen, Y-S Ho, **Y-J Wang***. P53-dependent Downregulation of hTERT Protein Expression and Telomerase Activity Induces Senescence in Lung Cancer Cells by Pterostilbene Treatment. *Cell Death Dis*. 2017; 8(8):e2985
12. Y-H Wu, C-W Hong, Y-C Wang, W-J Huang, Y-L Yeh, B-J Wang, **Y-J Wang*** and H-W Chiu*. A novel histone deacetylase inhibitor TMU-35435 enhances etoposide cytotoxicity through the proteasomal degradation of DNA-PKcs in triple-negative breast cancer. *Cancer Letters.* 2017; 400:79-88
13. H-W Chiu, Y-L Yeh, Y-C Wang, W-J Huang, S-Y Ho, P Lin* and **Y-J Wang***. Combination of the novel histone deacetylase inhibitor YCW1 and radiation induces autophagic cell death through the downregulation of BNIP3 in triple-negative breast cancer cells in vitro and in an orthotopic mouse model.

Molecular Cancer. 2016; 15:46

14. B-H Mao, J-C Tsai, C-W Chen, S-J Yan*and **Y-J Wang***. Mechanisms of silver nanoparticle-induced toxicity and important role of autophagy. *Nanotoxicology.* 2016; 10(8):1021-1040
15. H-W Chiu, S-W Lin, L-C Lin, Y-H Hsu, Y-F Lin, S-Y Ho, Y-H Wu*, and **Y-J Wang***. Synergistic cell-killing effects of radiation and proteasome inhibitor in pancreatic cancer through the induction of autophagy and down regulation of TRAF6. *Cancer Letters.* 2015; 365:229-239
16. Y-H Lee, F-Y Cheng, H-W Chiu, J-C Tsai, C-Y Fang, C-W Chen* and **Y-J Wang***. Cytotoxicity, oxidative stress, apoptosis and the autophagic effects of silver nanoparticles in mouse embryonic fibroblasts. *Biomaterials.* 2014; 35(16):4706-4715
17. **Wang, Y.-J.***, Chang, H., Kuo, Y.-C., Wang, C.-K., Siaoa, S.-H., Chang, L. W. and Lin, P. Synergism between 2,3,7,8- tetrachlorodibenzo-p-dioxin and 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone on lung tumor incidence in mice. *J. Hazardous Materials.* 2011; 186:869-875
18. H-W Chiu, J-H Lin, Y-A Chen, S-Y Ho and **Y-J Wang***. Combination treatment with arsenic trioxide and irradiation enhances cell-killing effects in human fibrosarcoma cells in vitro and in vivo through induction of both autophagy and apoptosis. *Autophagy.* 2010; 6:353-365
19. H-W Chiu, S-Y Ho, H-R Guo and **Y-J Wang***. Combination treatment with arsenic trioxide and irradiation enhances autophagic effects in U118-MG cells through increased mitotic arrest and regulation of PI3K/Akt and ERK1/2 signaling pathways. *Autophagy.* 2009; 5:472-483

Keynote Speech Abstract

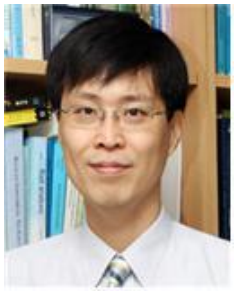
The Possible Role of Autophagy in Nanomaterial Toxicity and Safety Assessment-Related Alternative Testing: Take the Ag/ZnO NPs for Example

Dr. Ying-Jan Wang, PhD

Abstract:

Nanotechnology has rapidly promoted the development of a new generation of industrial and commercial products; however, it has also raised some concerns about human health and safety. To evaluate the toxicity of nanomaterials (NMs) in the traditional manner, a tremendous number of safety assessments and a large number of animals are required. For this reason, it is necessary to consider the use of alternative testing strategies that reduce, refine, or replace (3Rs) the use of animals for assessing the toxicity of NMs. Autophagy is considered an early indicator of NM interactions with cells and has been recently recognized as an important form of cell death in nanoparticle-induced toxicity. Impairment of autophagy is related to the accelerated pathogenesis of diseases. By using mechanism-based high-throughput screening in vitro, we can predict the NMs that may lead to the generation of disease outcomes in vivo. Thus, a tiered testing strategy is suggested that includes a set of standardized assays in relevant human cell lines followed by critical validation studies carried out in animals or whole organism models such as zebrafish (Danio rerio) for improved screening of NM safety. A thorough understanding of the mechanisms by which NMs perturb biological systems, including autophagy induction, is critical for a more comprehensive elucidation of nanotoxicity. A more profound understanding of toxicity mechanisms will also facilitate the development of prevention and intervention policies against adverse outcomes induced by NMs. The development of a tiered testing strategy for NM hazard assessment not only promotes a more widespread adoption of non-rodent or 3R principles but also makes nanotoxicology testing more ethical, relevant, and cost- and time-efficient.

Dr. Kyungho Choi



Dr. Kyungho Choi, PhD, MPH, DVM

Professor, Department of Environmental Health Sciences,

Graduate School of Public Health, Seoul National University,

Seoul, Korea

Biographies:

Dr. Kyungho Choi is an environmental health professor at Department of Environmental Health Sciences, Graduate School of Public Health, Seoul National University in Seoul, Korea. Dr. Kyungho Choi was trained as a Doctor of Veterinary Medicine (1993) and holds Master of Public Health (1995) and PhD in Public Health (1998, Seoul National University). Before joining Seoul National University, he did his postdoc training in aquatic toxicology at School of Public Health, University of Michigan at Ann Arbor, Michigan, USA (1998-2000), and later worked as a consultant (risk assessor and environmental toxicologist) at URS Corps (2001-2003, Chicago, Illinois, USA). In the areas of environmental toxicology, risk assessment, and environmental epidemiology, he has published more than 150 research articles in peer-reviewed journals. His research interests are in identifying adverse health effects of endocrine disrupting chemicals in humans and elucidating underlying mechanisms using experimental models including cell lines and fish. Thyroid hormone disruption by consumer chemicals and its health consequences are among his current topics.

Education:

- 1993: Doctor of Veterinary Medicine, College of Veterinary Medicine, Seoul National University, Seoul, Korea
- 1995: Master of Public Health (MPH), Environmental Health, School of Public Health (Environmental Health Sciences), Seoul National University, Seoul, Korea
- 1998: PhD Degree in Environmental Toxicology, Environmental Health,

School of Public Health (Environmental Health Sciences), Seoul National University, Seoul, Korea

Experience & Honor: (2018–Present)

- 2014–Present: Professor, Environmental Health, School of Public Health, Seoul National University, Seoul, Korea
- 2020–2027: Director, BK21 for Sustainable Health and Environment (BK4SHE), Seoul National University, Seoul, Korea
- 2022–Present: Director, Institute of Health and Environment, Seoul National University, Seoul, Korea
- Journal Editorial Board:
  2022–2024: Editor-in-chief, Korean Public Health Research
  2013–2014: Editor-in-chief, Journal of Environmental Health Sciences
  2022–Present: Associate editor, Environment International
  2018–2020: Associate editor, Toxics
- Award:

  16 May 2018: Seoul National University Research Award

Refereed Papers: (2021-present)

Peer-Reviewed International Journal Articles

1. Shin MY, Choi JW, Lee S, Kim S, Kho Y, **Choi K**, Kim S. Pharmacokinetics of transdermal methyl-, ethyl-, and propylparaben in humans following single dermal administration. *Chemosphere*. 2023; 310:136689.
2. Noh SR, Kim JA, Cheong HK, Ha M, Jee YK, Park MS, Choi KH, Kim H, Cho SI, **Choi K**, Paek D. Exposure to Crude Oil-Related Volatile Organic Compounds Associated with Lung Function Decline in a Longitudinal Panel of Children. *Int J Environ Res Public Health*. 2022; 19(23):15599.
3. Kang MW, Kim Y, Lee I, Park H, Park JY, An JN, Yoo KD, Kim YC, Park NY,

Kho Y, **Choi K**, Lee JP, Lee J. Longitudinal behavioral changes and factors related to reinforced risk aversion behavior among patients with chronic kidney disease during the COVID-19 pandemic. *Sci Rep*. 2022; 12(1):15780.

4. Chae H, Lee I, Jeong Y, Kim S, Choi G, Kim S, Park J, Moon HB, **Choi K.** Urinary paraben concentrations of adult women by fasting status: Comparison between Korea and the United States. *Sci Total Environ*. 2022; 849:157761.
5. Lim S, Kang H, Kwon B, Lee JP, Lee J, **Choi K.** Zebrafish (Danio rerio) as a model organism for screening nephrotoxic chemicals and related mechanisms. *Ecotoxicol Environ Saf*. 2022; 242:113842.
6. Kim MJ, Choi S, Kim S, Lee I, Moon MK, **Choi K**, Park J, Cho YH, Kwon YM, Yoo J, Cheon GJ, Park YJ. Sex, menopause, and age differences in the associations of persistent organic pollutants with thyroid hormones, thyroxine-binding globulin, and peripheral deiodinase activity: A cross-sectional study of the general Korean adult population. *Environ Res*. 2022; 212(Pt A):113143.
7. Lee J, Lee I, Park JY, Kim S, Park H, Jung SK, Lee C, Lee JP, **Choi K.** Exposure to several polychlorinated biphenyls (PCBs) is associated with chronic kidney disease among general adults: Korean National Environmental Health Survey (KoNEHS) 2015-2017. *Chemosphere*. 2022; 303(Pt 1):134998.
8. Ringbeck B, Bury D, Lee I, Lee G, Alakeel R, Alrashed M, Tosepu R, Jayadipraja EA, Tantrakarnapa K, Kliengchuay W, Brüning T, **Choi K**, Koch HM. Biomarker-Determined Nonylphenol Exposure and Associated Risks in Children of Thailand, Indonesia, and Saudi Arabia. *Environ Sci Technol*. 2022; 56(14):10229-10238.
9. Lyu Z, Harada KH, Kim S, Fujitani T, Cao Y, Hitomi T, Fujii Y, Kho Y, **Choi**

K. 2022. Exposure to phthalate esters in Japanese females in Kyoto, Japan from 1993 to 2016: Temporal trends and associated health risks. *Environ Int*. 2022; 165:107288.

10. Mok S, Lim JE, Lee A, Kim S, Kim S, Lee I, Kho Y, Park J, Kim S, **Choi K**, Moon HB. Within- and between-person variability of urinary phthalate metabolites and bisphenol analogues over seven days: Considerations of biomonitoring study design. *Environ Res*. 2022; 209:112885.
11. Kim Y, Lee I, Lee J, Park JY, An JN, Yoo KD, Kim YC, Park WY, Jin K, Kho Y, You M, Kim DK, **Choi K**, Lee JP. First snapshot on behavioral characteristics and related factors of patients with chronic kidney disease in South Korea during the COVID-19 pandemic (June to October 2020). *Kidney Res Clin Pract*. 2022; 41(2):219-230
12. Hwang MY, **Choi K**, Park CH. Urinary levels of phthalate, bisphenol, and paraben and allergic outcomes in children: Korean National Environmental Health Survey 2015–2017. *Sci Total Environ*. 2022; 818:151703.
13. Lee KJ, **Choi K.** Non-carcinogenic health outcomes associated with polycyclic aromatic hydrocarbons (PAHs) exposure in humans: An umbrella review. *Expo Health*. 2023; 15:95-111.
14. Lee I, Park H, Kim MJ, Kim S, Choi S, Park J, Cho YH, Hong S, Yoo J, Cheon GJ, **Choi K**, Park YJ, Moon MK. Exposure to polycyclic aromatic hydrocarbons and volatile organic compounds is associated with a risk of obesity and diabetes mellitus among Korean adults: Korean National Environmental Health Survey (KoNEHS) 2015-2017. *Int J Hyg Environ Health*. 2022; 240:113886.

15. Choi SH, Lee AR, Choi GY, Moon H-B, Kim SK, **Choi K.** Park J. Free Cortisol Mediates Associations of Maternal Urinary Heavy Metals with Neonatal Anthropometric Measures: A Cross-Sectional Study. *Toxics*. 2022; 10:167
16. Astuti RDP, Mallongi A, **Choi K**, Amiruddin R, Hatta M, Tantrakarnapa K, Rauf AU. Health risks from multiroute exposure of potentially toxic elements in a coastal community: a probabilistic risk approach in Pangkep Regency, Indonesia. Geomat. *Nat. Haz. Risk.* 2022; 12:705-735
17. Moon MK, Kim MJ, Lee IA, Kim SM, Choi SH, Park J, Cho YH, Hong S, Yoo J, Park HW, Cheon GJ, Park YJ, **Choi K.** Exposure to Bisphenol A, S, and F and its Association with Obesity and Diabetes Mellitus in General Adults of Korea: Korean National Environmental Health Survey (KoNEHS) 2015–2017. *Expo Health*. 2023; 15:53-67
18. Moon MK, Lee I, Lee A, Park H, Kim MJ, Kim S, Cho YH, Hong S, Yoo J, Cheon GJ, **Choi K**, Park YJ, Park J. Lead, mercury, and cadmium exposures are associated with obesity but not with diabetes mellitus: Korean National Environmental Health Survey (KoNEHS) 2015-2017. *Environ Res*. 2022; 204(Pt A):111888.
19. Wilkinson JL, Boxall ABA, … **Choi K**, Kang H,… Teta C. Pharmaceutical pollution of the world's rivers. *Proc Natl Acad Sci U S A*. 2022; 119(8):e2113947119.
20. Liu X, Lu X, Hong J, Zhang J, Lin J, Jiang M, Liu Q, **Choi K**, Zhang J. Effects of long-term exposure to TDCPP in zebrafish (Danio rerio) - Alternations of hormone balance and gene transcriptions along hypothalamus-pituitary axes. *Animal Model Exp Med*. 2022; 5(3):239-247

21. Jung SK, Choi W, Kim SY, Hong S, Jeon HL, Joo YK, Lee C, **Choi K**, Kim SK, Lee K, Yoo J. 2022. Profile of environmental chemicals in the Korean population – Results of the Korean National Environmental Health Survey (KoNEHS) Cycle 3, 2015–2017. *Int J Environ Res Pub Health*. 2022; 19(2):626

Peer-Reviewed Books and Chapters

1. **Choi K.**, Kim S. (2020) Brominated Flame Retardants (BFRs). In: Kishi R., Grandjean P. (eds) Health Impacts of Developmental Exposure to Environmental Chemicals. Current Topics in Environmental Health and Preventive Medicine. Springer, Singapore. (2020.1)

Keynote Speech Abstract

Thyroid hormone disruption and other adverse outcomes of organic UV filters in humans and zebrafish

Dr. Kyungho Choi, PhD, MPH, DVM

Abstract:

Many organic chemicals, or organic ultraviolet (UV) filters have been used in various consumer products for decades to protect the skin among general population. Many organic UV filters can reach human circulation after the dermal application and are concerned for their potential health outcomes in humans. Some UV filters like benzophenone-3 (BP-3) and octyl methoxycinnamate (OMC), have been banned for use in several regions worldwide, due to their deleterious effects on marine ecosystem. We have observed that BP-3 and its metabolite are associated with decreased thyroid hormones or increased albuminuria in general adult populations of Korea and the USA. Lack of reliable biomarkers of exposure, however, does not allow to conduct relevant biomonitoring and epidemiological investigations on organic UV filters. In the laboratory many organic UV filters including avobenzone, octocrylene, OMC, and BP-3 disrupt thyroid hormone balances in embryo larval zebrafish (Dania rerio) following a short-term exposure. In addition, these chemicals cause alterations in behavior of the fish, which may be related to the transcriptional changes of neuronal genes. Moreover, increased urinary proteins were observed in the fish following exposure to these chemicals. Such toxicological observations made in the fish warrant further epidemiological studies focusing on neurobehavioral outcomes and chronic kidney diseases in association with the exposure to such organic UV filters.

壁報審查委員
Examination Committee

蘇大成教授 Dr. Ta-Chen Su

Dr. Ta-Chen Su, MD, PhD

Director, Department of Environmental and Occupational Medicine, National Taiwan University College of Medicine, Taipei, Taiwan

Biographies:

Dr. Su has 28 years of experience in academic research and teaching in the fields of preventive cardiology, hyperlipidemia, and occupational and environmental medicine. In past 2 decades, he investigated the impact of environmental pollution on subclinical cardiovascular diseases and endocrine/metabolic health, particularly air pollution and endocrine disrupting chemicals on cardiovascular health in susceptible populations. He led a familial hypercholesterolemia (FH) cohort study and hyperchylomicronemia genetic study in Taiwan since 2008 and established a platform of next generation sequencing for molecular genetic study of FH in National Taiwan University Hospital. Dr. Su serves as an executive committee member of preventive cardiology in Taiwan Society of Cardiology since 2012. He serves as the executive committee member of Asian Pacific Society of Atherosclerosis and Vascular Diseases since 2016. He also serves as the executive committee member of International Atherosclerosis Society Asia Pacific Federation since 2016. He was appointed as the EAS FH Studies Collaboration National Lead Investigator of Taiwan since 2014. He was invited to join as one of the Air Pollution Expert Group, World Heart Federation, since 2019 November. He was appointed as the Director, Department of Environmental and Occupational Medicine, National Taiwan University College of Medicine since 2018 August. He has published more than 200 papers in famous peer-review journals.

Education:

- 2005: PhD Degree, Institute of Occupational Medicine and Industrial Hygiene, College of Public Health, National Taiwan University, Taipei, Taiwan
- 1990: Bachelor of Medicine (MD), College of Medicine, National Taiwan University, Taipei, Taiwan
- 1983: Bachelor of Public Health, College of Medicine, National Taiwan University, Taipei, Taiwan

Experience & Honor:

- Jointly Appointed Professor, Department of Internal Medicine and Cardiovascular Center, National Taiwan University Hospital, Taipei, Taiwan
- Jointly Appointed Professor, Institute of Environmental and Occupational Health Sciences, College of Public Health, National Taiwan University, Taipei, Taiwan
- Deputy Director General, National Taiwan University Experimental Forest, Nantou, Taiwan

Refereed Papers:

1. Chen SY, Chan CC, **Su TC***. Particulate and gaseous pollutants on inflammation, thrombosis, and autonomic imbalance in subjects at risk for cardiovascular disease. *Environ Pollut.* 2017;223:403-408.
2. Lin CY, Chen PC, Hsieh CJ, Chen CY, Hu A, Sung FC, Lee HL, **Su TC***. Positive association between urinary concentration of phthalate metabolites and oxidation of DNA and lipid in adolescents and young adults. *Sci Rep.* 2017;7:44318.
3. Chen SY, Hwang JS, Sung FC, Lin CY, Hsieh CJ, Chen PC, **Su TC***. Mono-2-ethylhexyl phthalate associate with impaired glucose homeostasis and low testosterone in adolescents and young adults. *Environ Pollut.* 2017;225:112-117.
4. **Su TC**, Hwang JJ, Yang YR, Chan CC. Association of long-term exposure to traffic-related air pollution is associated with inflammatory and thrombotic markers in middle-aged adults. *Epidemiology.* 2017;28 Suppl 1:S74-S81.

5. Lin CY, Lee HL, Sung FC, **Su TC***. Investigating the association between urinary levels of acrylonitrile metabolite N-acetyl-S-(2-cyanoethyl)-L-cysteine and the oxidative stress product 8-hydroxydeoxyguanosine in adolescents and young adults. *Environ Pollut.* 2018 Aug; 239:493-498.
6. Hsiung YC, Lin PC, Chen CS, Tung YC, Yang WS, Chen PL, **Su TC***. Identification of a novel LDLR disease-causing variant using capture-based next-generation sequencing screening of familial hypercholesterolemia patients in Taiwan. *Atherosclerosis.* 2018 Oct; 277:440-447.
7. Lin CY, Hwang YT, Chen PC, Sung FC, **Su TC***. Association of serum levels of 4-tertiary-octylphenol with cardiovascular risk factors and carotid intima-media thickness in adolescents and young adults. *Environ Pollut.* 2019 Mar;246:107-113.
8. Lee CSL, Chou CC, Cheung HC, Tsai CY, Huang WR, Huang SH, Chen MJ, Liao HT, Wu CF, Tsao TM, Tsai MJ, **Su TC**. Seasonal variation of chemical characteristics of fine particulate matter at a high-elevation subtropical forest in East Asia. *Environ Pollut.* 2019 Mar;246:668-677.
9. **Su TC***, Hwang JJ, Sun CW, Wang SL. Urinary phthalate metabolites, coronary heart disease, and atherothrombotic markers. *Ecotoxicol Environ Saf.* 2019 May 30;173:37-44.
10. **Su TC***, Hwang JS, Torng PL, Wu C, Lin CY, Sung FC. Phthalate exposure increases subclinical atherosclerosis in young population. *Environ Pollut.* 2019 Jul;250:586-593.
11. Lin CY, Huang PC, Wu C, Sung FC, **Su TC***. Association between urine lead levels and cardiovascular disease risk factors, carotid intima-media thickness and metabolic syndrome in adolescents and young adults. *Int J Hyg Environ Health.* 2020 Jan;223(1):248-255.
12. Lin CY, Lee HL, Hwang YT, **Su TC***. The association between total serum isomers of per- and polyfluoroalkyl substances, lipid profiles, and the DNA oxidative/nitrative stress biomarkers in middle-aged Taiwanese adults. *Environ Res.* 2020 Mar;182:109064.

13. Lin CY, Lee HL, Jung WT, Sung FC, **Su TC***. The association between urinary levels of 1,3-butadiene metabolites, cardiovascular risk factors, microparticles, and oxidative stress products in adolescents and young adults. J Hazard Mater. 2020 Sep 5;396:122745.
14. Lin CY, Lee HL, Hwang YT, Wang C, Hsieh CJ, Wu C, Sung FC, **Su TC***. The association between urine di-(2-ethylhexyl) phthalate metabolites, global DNA methylation, and subclinical atherosclerosis in a young Taiwanese population. *Environ Pollut.* 2020;265(Pt B):114912.
15. Lin CY, Lee HL, Hwang YT, Huang PC, Wang C, Sung FC, Wu C, **Su TC***. Urinary heavy metals, DNA methylation, and subclinical atherosclerosis. *Ecotoxicol Environ Saf.* 2020 Nov;204:111039.
16. Chu PC, Wu C, **Su TC***. Association between urinary phthalate metabolites and markers of endothelial dysfunction in adolescents and young adults. *Toxics.* 2021 Feb 6;9(2):33.
17. Han YY, Hsu SH, **Su TC***. Association between vitamin D deficiency and high serum levels of small dense LDL in Middle-Aged Adults. *Biomedicines.* 2021;9(5):464.
18. Chu PL, Lin CY, Sung FC, **Su TC***. Apoptotic microparticles mediate the association between bisphenol A and subclinical atherosclerosis in a young population: A population-based study. *Ecotoxicol Environ Saf.* 2021 Aug 18;224:112663.
19. Lee CK, Wu C, Lin CY, Huang PC, Sung FC, Sung FC, **Su TC***. Positive association between endothelium–platelet microparticles and urinary concentration of lead and cadmium in adolescents and young adults. *Nutrients.* 2021;13: 2913.
20. Lin CY, Lee HL, Wang C, Sung FC, **Su TC***. Association between the total plasma isomers of per- and polyfluoroalkyl substances and erythrograms in young and middle-aged Taiwanese populations. *Ecotoxicol Environ Saf.* 2021 Oct 13;227:112902.

21. Tsao TM, Hwang JS, Tsai MJ, Lin ST, Wu C, **Su TC***. Seasonal effects of high-altitude forest travel on cardiovascular function: An overlooked cardiovascular risk of forest activity. *Int J Environ Res Public Health.* 2021 Sep 8;18(18):9472.
22. Lin CY, Lee HL, Wang C, Sung FC, **Su TC***. Association between the total plasma isomers of per- and polyfluoroalkyl substances and erythrograms in young and middle-aged Taiwanese populations. *Ecotoxicol Environ Saf.* 2021 Oct 13;227:112902.
23. Shu CC, Chen JK, Huang PC, Hwang JS, **Su TC***. Association between urinary manganese and pulmonary function in young adults: a cross-sectional design with a longitudinal cohort validation. *Ecotoxicol Environ Saf.* 2021 Dec 20;227:112937.
24. Shu CC, Lee JH, Tsai MK , **Su TC***, Wen CP*. The ability of physical activity in reducing mortality risks and cardiovascular loading and in extending life expectancy in patients with COPD. *Sci Rep.* 2021 Nov 4;11(1):21674.
25. Chen JK, Wu C, **Su TC***. Positive association between indoor gaseous air pollution and obesity: An observational study in 60 households. *Int J Environ Res Public Health*. 2021, 18(21), 11447.
26. Chen CW, Tang SY, Hwang JS, Chan CC, Hsu CC, Lin CY, **Su TC***. Association between levels of urine di-(2-ethylhexyl)phthalate metabolites and heart rate variability in young adults. *Toxics.* 2021 Dec 12;9(12):351.
27. Lin CY, Chen CW, Lee HL, Wu C, Wang CK, Sung FC, **Su TC***. Global DNA methylation mediates the association between urine mono-2-ethylhexyl phthalate and serum apoptotic microparticles in a young Taiwanese population. *Sci Total Environ.* 2022;808:152054.
28. Chen SY, Wu CF, Wu C, Chan CC, Hwang JS, **Su TC***. Urban fine particulate matter and elements associated with subclinical atherosclerosis in adolescents and young adults. *Environ Sci Technol.* 2022 Jun 7;56(11):7266-7274.
29. Lin PC, Chen CY, Wu C, **Su TC***. Synergistic effects of inflammation and atherogenic dyslipidemia on subclinical carotid atherosclerosis assessed by ultrasound in patients with familial hypercholesterolemia and their family members. *Biomedicines.* 2022 Feb 2;10(2):367.

30. Tsao TM, Hwang JS, Lin ST, Wu C, Tsai MJ, **Su TC***. Forest bathing is better than walking in urban park: Comparison of cardiac and vascular function between urban and forest parks. *Int J Environ Res Public Health.* 2022 Mar 15;19(6):3451.
31. Lin CY, Wang C, Sung FC, **Su TC***. Association between serum per- and polyfluoroalkyl substances and thrombograms in young and middle-aged Taiwanese populations. *Ecotoxicol Environ Saf.* 2022 May 1;236:113457.
32. Chen SY, Hwang JS, Chan CC, Wu CF, Wu C, **Su TC***. Urban air pollution and subclinical atherosclerosis in adolescents and young adults. *J Adolesc Health.* 2022 Aug;71(2):233-238.
33. Lin CY, Lee HL, Chen CW, Wang C, Sung FC, **Su TC***. Global DNA methylation mediates the association between serum perfluorooctane sulfonate and carotid intima-media thickness in young and middle-aged Taiwanese populations. *Ecotoxicol Environ Saf.* 2022 Aug;241:113782.
34. Shih P, Chu PC, Huang CC, Guo YL, Chen PC, **Su TC***. Hospital occupational health service network and reporting systems in Taiwan from 2008 to 2021. *J Occup Environ Med.* 2023 Feb 1;65(2):e43-e50.
35. Yao CA, Chen IL, Chen CY, Torng PL, **Su TC***. Association between wakeup frequency at night and atherogenic dyslipidemia: Evidence for sex differences. *J Atheroscler Thromb.* 2023 Jan; 30(1):87-99.
36. Chen CY, Chen PH, Chen JK, **Su TC***. Recommendations for ventilation of remodeled negative-pressure isolation wards for COVID-19 patients: A comparison of international guidelines. *J Formos Med Assoc.* 2023 Feb;122(2):91-97.

張簡國平教授 Dr. Guo-Ping, Chang Chien

Prof. Guo-Ping Chang Chien, PhD

Director, Center for Environmental Toxin and Emerging-Contaminant Research; Director, Institute of Environmental Toxin and Emerging-Contaminant, Cheng Shiu University, Kaohsiung, Taiwan

Biographies:

Having received my PhD in 1992 from National Cheng Kung University, I became an Associate Professor at Cheng Shiu University (CSU) in 1993, where I briefly researched liquid crystal polymer materials, published 20+ SCI articles, and obtained 5 patents. In 1998, I became a full Professor and established Super Micro Mass Research & Technology Center (CSSM) at CSU. CSSM has actively assisted the government and the private sector in sustainability-related research on environmental impacts, health assessments, food safety, drug detection and analysis, and energy technology for remediation and preventive strategy. Specifically, it focuses on environmental and biological matrices, including air, wastewater, drinking water, groundwater, soil, industrial waste, urine, and blood. My analytical team focuses on metals, ion components, elemental and organic carbon, volatile organic compounds, and persistent organic compounds. I have also collaborated with other researchers on exposure and health risk assessments, especially in residential and occupational settings, and so far, I have authored 200+ SCI articles. In 2020, CSSM was approved by the Ministry of Education to form the Institute of Environmental Toxin and Emerging-Contaminant. I am the director of this institute, and it currently supports 5+ faculty members, 3+ full-time research associates, 5+ full-time technicians and 20+ graduate students.

Education:

- 1992: PhD Degree in Chemical Engineering, National Cheng Kung University,

Tainan, Taiwan

- 1982: Master of Science in Chemical Engineering, National Taiwan University, Taipei, Taiwan
- 1980: Bachelor of Science in Chemical Engineering, National Cheng Kung University, Tainan, Taiwan

Experience & Honor:

- 1982–1984: Engineer in Formosa Plastics Group, Taiwan
- 1993–1994: Postdoctoral Fellow in the Department of chemical engineering of the University of California, Berkery and Lawrence Berkeley National Laboratory of California, US
- 1999–Present: Founder and the Director of Super Micro Mass Research and Technology Center, Cheng Shiu University, Kaohsiung, Taiwan
- 2020–Present: Director at the Institute of Environmental Toxins and Emerging-contaminants, Cheng Shiu University, Kaohsiung, Taiwan
- Member of the on-site evaluation committee for the Bureau of Controlled Drugs at the Department of Health, Taiwan
- Committee member for the Air Pollution division, Environmental Protection Bureau (EPB) of Kaohsiung City Government, Taiwan.
- Committee member for the Environmental Protection Fund, EPB of Kaohsiung City, Taiwan
- Reviewer for top-tier international science journals

Refereed Papers:

1. Hsu CN, Chen WL, Liao WT, **Chang-Chien GP**, Lin S, Tain YL. Hydrogen Sulfide-to-Thiosulfate Ratio Associated with Blood Pressure Abnormalities in Pediatric CKD. Journal of Personalized Medicine. 2022; 12(8).
2. Hsu CN, Hou CY, **Chang-Chien GP**, Lin SF, Tain YL. Dietary Supplementation with Cysteine during Pregnancy Rescues Maternal Chronic Kidney Disease-Induced Hypertension in Male Rat Offspring: The Impact of

Hydrogen Sulfide and Microbiota-Derived Tryptophan Metabolites. Antioxidants. 2022; 11(3).

3. Hsu CN, Yu HR, Chan JYH, Lee WC, Wu KLH, Hou CY, **Chang-Chien GP**, Lin S, Tain YL. Maternal Acetate Supplementation Reverses Blood Pressure Increase in Male Offspring Induced by Exposure to Minocycline during Pregnancy and Lactation. International Journal of Molecular Sciences. 2022; 23(14).
4. Hsu CN, Yu HR, Lin IC, Tiao MM, Huang LT, Hou CY, **Chang-Chien GP**, Lin SF, Tain YL. Sodium butyrate modulates blood pressure and gut microbiota in maternal tryptophan-free diet-induced hypertension rat offspring. Journal of Nutritional Biochemistry. 2022; 108.
5. Kung HC, Hsieh YK, Huang BW, Cheruiyot NK, **Chang-Chien GP**. An Overview: Organophosphate Flame Retardants in the Atmosphere. Aerosol and Air Quality Research. 2022; 22(8).
6. Lee JJ, **Chang-Chien GP**, Lin SF, Hsiao YT, Ke MC, Chen A, Lin TK. 5-Lipoxygenase Inhibition Protects Retinal Pigment Epithelium from Sodium Iodate-Induced Ferroptosis and Prevents Retinal Degeneration. Oxidative Medicine and Cellular Longevity. 2022; 2022.
7. Lee YY, Hsieh YK, Huang BW, Mutuku JK, **Chang-Chien GP**, Huang SW. An Overview: PAH and Nitro-PAH Emission from the Stationary Sources and their Transformations in the Atmosphere. Aerosol and Air Quality Research. 2022; 22(7).
8. Lee YY, Lin SL, Huang BW, Mutuku JK, **Chang-Chien GP**: Seasonal Variations in Concentrations and Chemical Compositions of TSP near a Bulk Material Storage Site for a Steel Plant. Atmosphere. 2022; 13(11).
9. Tain YL, Hou CY, **Chang-Chien GP**, Lin SF, Hsu CN: Perinatal Garlic Oil Supplementation Averts Rat Offspring Hypertension Programmed by Maternal Chronic Kidney Disease. Nutrients. 2022; 14(21).

10. Tain YL, Hou CY, **Chang-Chien GP**, Lin SF, Hsu CN: Perinatal Propionate Supplementation Protects Adult Male Offspring from Maternal Chronic Kidney Disease-Induced Hypertension. Nutrients. 2022; 14(16).

11. Yuan CS, Lai CS, **Chang-Chien GP**, Tseng YL, Cheng FJ: Kidney damage induced by repeated fine particulate matter exposure: Effects of different components. *Science of the Total Environment*. 2022; 847.

顏宗海教授 Dr. Tzung-Hai Yen

Dr. Tzung-Hai Yen, MD, PhD

Director, Clinical Poison Center, Chang Gung Memorial Hospital, Linkou, Tawian

Biographies:

Dr. Tzung-Hai Yen is currently a Professor at the Department of Nephrology and Director of Clinical Poison Center, Chang Gung Memorial Hospital, Linkou, Tawian. He is also works as a Professor of College of Medicine, Chang Gung University, Taoyuan, Taiwan. Dr Yen graduated in Medicine from the National Taiwan University. Following Residency and Nephrology Fellowship training at Chang Gung Memorial Hospital, he was appointed as a Consultant Nephrologist in 2000. In 2003, he was promoted as a Lecturer. Dr Yen also completed a PhD at the London Research Institute, Cancer Research UK in 2006 (Queen Mary, University of London) prior to taking up posts as Assistant Professor (from 2007 to 2010), Associate Professor (from 2011 to 2016) and Professor (since 2016) at the Chang Gung Memorial Hospital. The research interests include nephrology, toxicology and point-of-care testing. Dr Yen also serves as a reviewer for many international and domestic journals/grants.

Education:

- Bachelor of Medicine (MD), National Taiwan University, Taipei, Taiwan
- PhD Degree, Queen Mary University of London, London, UK

Experience & Honor:

- 2009: 臺灣醫學發展基金會論文獎(指導老師)
- 2011: 亞太腎臟醫學會最佳論文(指導老師)

- 2011: 台灣腎臟醫學會最佳口頭報告獎(指導老師)
- 2014: 台灣醫學會雜誌年度最有價值論文獎
- 2016: 台灣腎臟醫學會創新應用論文獎
- 2018: 桃園市牙醫師公會壁報論文獎(指導老師)
- 2018: 長庚醫院優秀論文獎
- 2019: 桃園市牙醫師公會壁報論文獎(指導老師)
- 2020: 長庚醫院臨床應用獎勵獎
- 2021: 長庚醫院優秀論文獎

Refereed Papers:

1. Yen JS, Wu YC, Yen JC, Wang IK, Fu JF, Cheng CM, **Yen TH***. Immune Responses to COVID-19 Vaccines in Patients with Chronic Kidney Disease and Lead Exposure. *Int J Mol Sci*. 2022;23:15003
2. **Yen TH**, Ho WJ, Yeh YH, Lai YJ*. Cathepsin S inhibition suppresses experimental systemic lupus 2 erythematosus-associated pulmonary arterial remodeling. *Int J Mol Sci*. 2022;23:12316
3. **Yen TH**, Chang CW, Tsai HR, Fu JF, Yen HC*. Immunosuppressive therapies attenuate paraquat-induced renal dysfunction by suppressing inflammatory responses and lipid peroxidation. *Free Radic Biol Med*. 2022;191:249-260
4. Yen JS, Wang IK, **Yen TH***. COVID-19 Vaccination & Dialysis Patients: Why The Variable Response. *QJM-INT J MED*. 2021;114:440-444
5. Yang CM, **Yen TH**, Liu HL, Lin YJ, Lin PY, Tsui LS, Chen CH, Chen YP, Hsu YC, Lo CH, Wu TR, Lai HC, Chin WC, Pijanowskak DG, Hwang TL, Lai CS. A real-time Mirror-LAPS mini system for dynamic chemical imaging and cell acidification monitoring. *Sens Actuators B Chem.* 2021;341:130003
6. Yang CM, Chen CH, Akuli N, **Yen TH***, Lai CS*. Chemical illumination modification from an LED to a laser to improve the spatial resolution of IGZO

thin film light-addressable potentiometric sensors. *Sens Actuators B Chem.* 2021;329:128953

7. Wu MY, Hsu MY, Chen SJ, Hwang DK, **Yen TH***, Cheng CM*. Point-of-Care Detection Devices for Food Safety Monitoring - Proactive Disease Prevention. *Trends Biotechnol.* 2017;35:288-300
8. **Yen TH**, Chen KH, Hsu MY, Fan ST, Huang YF, Chang CL, Wang YP, Cheng CM*. Evaluating organophosphate poisoning in human serum with paper. *Talanta.* 2015;144:189-95
9. **Yen TH***, Alison MR, Goodlad RA, Otto WR, Jeffery R, Cook HT, Wright NA, Poulsom R. Epidermal growth factor attenuates tubular necrosis following mercuric chloride damage by regeneration of indigenous, not bone marrow-derived cells. *J Cell Mol Med.* 2015;19:463-73
10. **Yen TH**, Lin JL*, Lin-Tan DT, Hsu CW, Chen KH, Hsu HH. Blood cadmium levels association with 18-month mortality in diabetic patients with maintenance hemodialysis. *Nephrol Dial Transplant*. 2011;26:998-1005
11. **Yen TH**, Alison MR, Cook HT, Jeffery R, Otto WR, Wright NA, Poulsom R*. The cellular origin and proliferative status of regenerating renal parenchyma after mercuric chloride damage and erythropoietin treatment. *Cell Prolif.* 2007;40:143-56

王金洲教授 Dr. Chin-Chou Wang

Dr. Chin-Chou Wang, MD, PhD

Vice Director, Department of Internal Medicine, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan; Attending Physician, Department of Occupational Medicine, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan

Biographies:

- 高雄長庚紀念醫院職業醫學科/胸腔內科主治醫師
- 高雄長庚紀念醫院內科部副部長暨肺癌團隊召集人
- 台灣胸腔暨重症加護醫學會理事
- 台灣肺癌學會理事
- 高雄市胸腔腫瘤疾病防治學會理事長

Education:

- 1983–1990: 中國醫藥大學醫學系醫學士
- 1992–1993: 美國 Tulane 大學公共衛生暨熱帶醫學學院公衛碩士
- 2007–2016: 高雄醫學大學公共衛生學系理學博士(PhD)

Experience & Honor:

- 2008: 長庚技術學院教育部部定助理教授，教字第 025566 號
- 2016: 長庚科技大學教育部部定副教授，教字第 142566 號
- 2022: 長庚科技大學教育部部定教授，教字第 146496 號
- 1999–Present: 高雄長庚紀念醫院胸腔內科主治醫師

- 2007–Present: 高雄長庚紀念醫院職業醫學科主治醫師
- 2009–2015: 高雄長庚紀念醫院胸腔內科科主任
- 2009–Present: 高雄長庚紀念醫院肺癌團隊召集人
- 2010–Present: 行政院衛生福利部疾病管制署諮詢委員
- 2014–Present: 高雄長庚紀念醫院職業醫學科科主任
- 2017–2022: 高雄長庚紀念醫院臨床試驗中心副主任/主任
- 2018–2020: 高雄長庚紀念醫院癌症中心副主任
- 2020–Present: 高雄長庚紀念醫院內科部副部長
- 2017–2020: 台灣胸腔暨重症加護醫學會秘書長
- 2018–Present: 台灣肺癌學會理事
- 2020–Present: 台灣胸腔暨重症加護醫學會理事
- 2022–Present: 高雄市胸腔腫瘤疾病防治學會理事長

Refereed Papers:

1. Cheng SL, Lin CH, **Wang CC**, Chan MC, Hsu JY, Hang LW, et al. Comparison between COPD Assessment Test (CAT) and modified Medical Research Council (mMRC) dyspnea scores for evaluation of clinical symptoms, comorbidities and medical resources utilization in COPD patients. *J Formos Med Assoc*. 2019; 118(1 Pt 3):429-35
2. Hsiao HP, Lin MC, Wu CC, **Wang CC**, Wang TN. Sex-Specific Asthma Phenotypes, Inflammatory Patterns, and Asthma Control in a Cluster Analysis. *J Allergy Clin Immunol Pract.* 2019; 7(2):556-67.e15
3. Hung KY, Chen YM, **Wang CC**, Wang YH, Lin CY, Chang YT, et al. Insufficient Nutrition and Mortality Risk in Septic Patients Admitted to ICU with a Focus on Immune Dysfunction. *Nutrients.* 2019; 11(2)

4. Kuo CS, **Wang CC**, Huang YC, Pavlidis S, Liu CY, Ko HW, et al. Comparison of a combination of chemotherapy and immune checkpoint inhibitors and immune checkpoint inhibitors alone for the treatment of advanced and metastatic non-small cell lung cancer. *Thorac Cancer.* 2019; 10(5):1158-66
5. Lee Y, Lin PY, Lin MC, **Wang CC**, Lu HI, Chen YC, et al. Morbidity and associated factors of depressive disorder in patients with lung cancer. *Cancer Manag Res.* 2019; 11:7587-96
6. Huang SH, Huang AC, **Wang CC**, Chang WC, Liu CY, Pavlidis S, et al. Front-line treatment of ceritinib improves efficacy over crizotinib for Asian patients with anaplastic lymphoma kinase fusion NSCLC: The role of systemic progression control. *Thorac Cancer*. 2019; 10(12):2274-81
7. Chu CH, Chiu TH, **Wang CC**, Chang WC, Huang AC, Liu CY, et al. Consolidation treatment of durvalumab after chemoradiation in real-world patients with stage III unresectable non-small cell lung cancer. *Thorac Cancer.* 2020; 11(6):1541-9
8. Hsu PC, Huang CY, **Wang CC**, Kuo SC, Chu CH, Tung PH, et al. The Combination of Afatinib and Bevacizumab in Untreated EGFR-Mutated Advanced Lung Adenocarcinoma: A Multicenter Observational Study. *Pharmaceuticals (Basel)*. 2020; 13(11)
9. Lee Y, Hung CF, Chien CY, Lin PY, Lin MC, **Wang CC**, et al. Comparison of prevalence and associated factors of depressive disorder between patients with head and neck cancer and those with lung cancer at a tertiary hospital in Taiwan: a cross-sectional study. *BMJ Open*. 2020; 10(6):e037918
10. Wu SG, Chiang CL, Liu CY, **Wang CC**, Su PL, Hsia TC, et al. An Observational Study of Acquired EGFR T790M-Dependent Resistance to EGFR-TKI Treatment in Lung Adenocarcinoma Patients in Taiwan. *Front Oncol.* 2020; 10:1481
11. Chen PY, **Wang CC**, Hsu CN, Chen CY. Association of EGFR Tyrosine Kinase Inhibitor Treatment With Progression-Free Survival Among Taiwanese Patients With Advanced Lung Adenocarcinoma and EGFR Mutation. *Front Pharmacol.* 2021; 12:720687

12. Chen YC, Tsai YH, **Wang CC**, Liu SF, Chen TW, Fang WF, et al. Epigenome-wide association study on asthma and chronic obstructive pulmonary disease overlap reveals aberrant DNA methylations related to clinical phenotypes. *Sci Rep.* 2021; 11(1):5022
13. Huang AC, Huang CH, Ju JS, Chiu TH, Tung PH, **Wang CC**, et al. First- or second-generation epidermal growth factor receptor tyrosine kinase inhibitors in a large, real-world cohort of patients with non-small cell lung cancer. *Ther Adv Med Oncol.* 2021; 13:17588359211035710
14. **Wang CC**, Chiu LC, Ju JS, Lin YC, Fang YF, Yang CT, et al. Durvalumab as Consolidation Therapy in Post-Concurrent Chemoradiation (CCRT) in Unresectable Stage III Non-Small Cell Lung Cancer Patients: A Multicenter Observational Study. *Vaccines (Basel).* 2021; 9(10)
15. **Wang CC**, Chiu LC, Tung PH, Kuo SC, Chu CH, Huang AC, et al. A Real-World Analysis of Patients with Untreated Metastatic Epidermal Growth Factor Receptor (EGFR)-Mutated Lung Adenocarcinoma Receiving First-Line Erlotinib and Bevacizumab Combination Therapy. *Oncol Ther.* 2021; 9(2):489-503
16. **Wang CC**, Lai CH, Chang YP, Chang HC, Tseng CC, Huang KT, et al. Comparing survival and treatment response of patients with acquired T790M mutation second-line osimertinib versus sequential treatment of chemotherapy followed by osimertinib: A real-world study. *Thorac Cancer.* 2021; 12(23):3263-72
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50	Chi-Chang Ho	The association between dietary intake indoor environmental status urinary cadmium
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52	Chung-Yen Chen	COVID-19 infection risk assessment in a kindergarten utilizing continuous air quality monitoring data
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Subchronic effects of microplastic exposure in mouse livers

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Keywords: microplastics, hepatotoxicity, oxidative stress, cytokine, metabolic dysfunction

Introduction

Microplastics (MPs) has become one of the important environmental health issues owing to its wide distribution in our earth. Although the health impacts of MPs on human remains unclear, many studies revealed that MPs induced hepatotoxicity in rodents. However, most studies were focused on the acute or sub-acute effects of MPs. In addition, these studies only examined hepatotoxicity in part. Thus, we used a systematic approach to study the MP-induced subchronic effects in mouse livers.

Methods

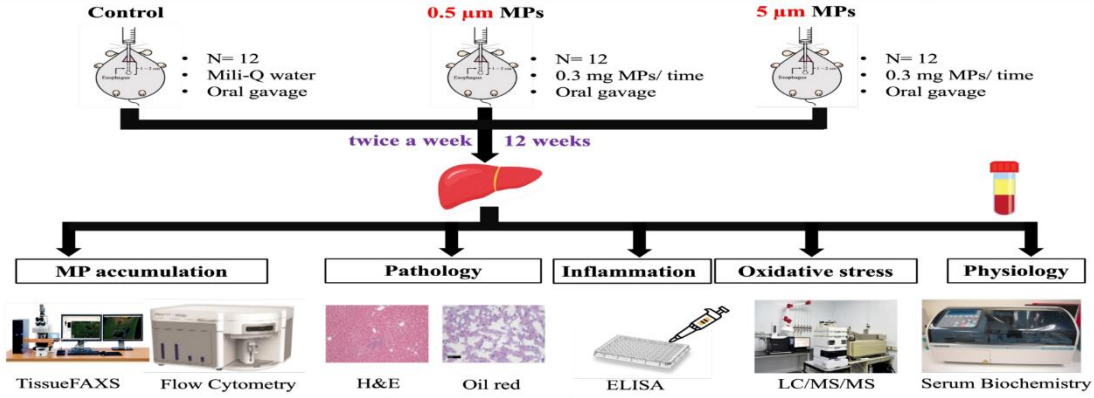


Figure 1. Flow chart of experiments

All the animal experiments in the current study were performed in compliance with the Institutional Animal Care and Use Committee of the College of Medicine and the College of Public Health, National Taiwan University (Permit Number: 20201287)

Results

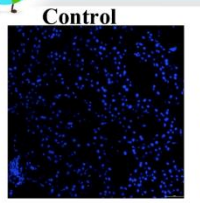


Figure 2. TissueFAXS views in mouse livers

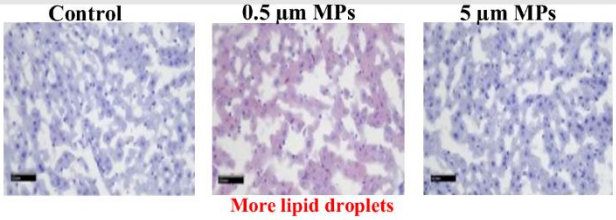


Figure 3. The oil red staining views in mouse livers

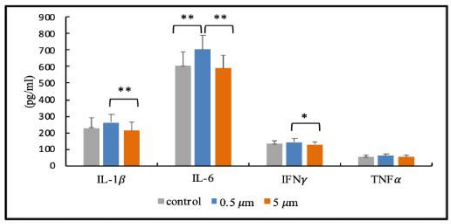
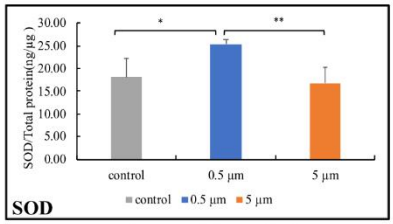


Figure 4. The inflammatory biomarkers in mouse livers



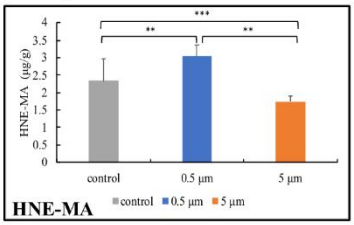


Figure 5. The oxidative stress biomarkers in mouse livers

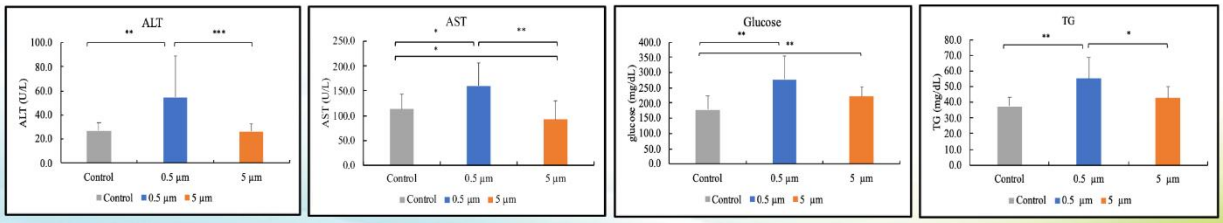


Figure 6. The serum biochemistry biomarkers in mice

Conclusion

Our results demonstrated that subchronic exposure to 0.5 μm MPs caused a MP accumulation in mouse livers and then induced oxidative stress, increased inflammatory cytokines, glucose homeostasis dysfunction, and perturbed lipid metabolism, while less adverse effects were found in the larger MPs (5 μm).

Acknowledgements

The research was founded by the National Science and Technology Council (NSTC 110-2621-M-002-021 and 110-2314-B-002-082) in Taiwan.

Urinary Levels of Organophosphate Flame Retardants Metabolites In A Broad-Spectrum Pediatric Population From Southern Taiwan and Their Potential Health Effects

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Background:

Organophosphate flame retardants (OPFRs) have widely existed in the environment and their metabolites are also observed in urine, but little is known that OPFR metabolites are distributed in a broad-spectrum pediatric population from newborn to a young adult of 18 years of age. This study aimed to investigate urinary levels of OPFRs and OPFR metabolites in Taiwanese infants, young children, schoolchildren, and adolescents from the general population.

Methods:

The different aged groups of subjects (n=136) were recruited from southern Taiwan. Ten chemicals of OPFR metabolites in urine were determined by ultra-performance liquid chromatography-tandem mass spectrometry (UPLC-MS/MS). Associations between urinary OPFRs and their corresponding metabolites and potential health status are also examined.

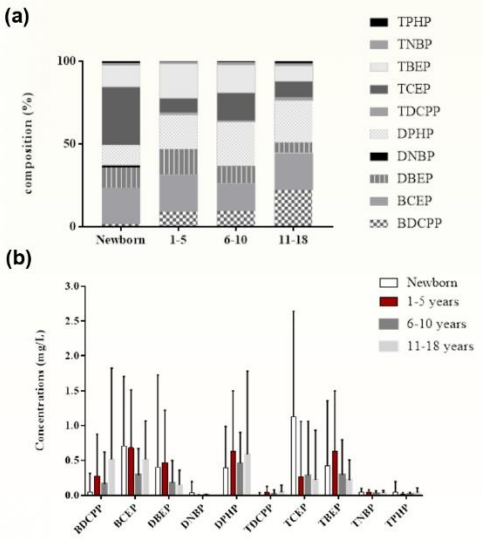

Fig. 1. Urinary levels of OPFRs and OPFR metabolites in the broad-spectrum pediatric population in southern Taiwan are shown as **(a)** the percentage of OPFRs and OPFR metabolites in pediatric urine and **(b)** distribution of OPFR and OPFR metabolite levels in pediatric urine.

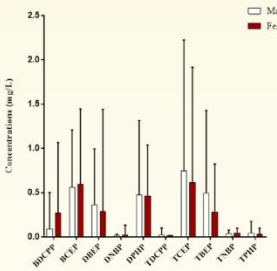

Fig. 2. Urinary levels of OPFRs and OPFR metabolites between male and female subjects in the broad-spectrum pediatric population

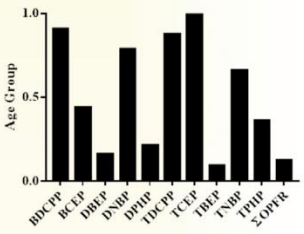

Fig. 3. The Spearman's rho correlation coefficients between age groups and OPFRs or OPFR metabolites in the broad-spectrum pediatric population

Results:

The mean level of urinary Σ10 OPFR in a broad-spectrum pediatric population was 2.25 μg/L. Σ10 OPFR metabolites in urine are 3.25±2.84, 3.06±2.21, 1.75±1.10, and 2.32±2.29 μg/L in the different aged groups of newborn, 1-5 yr, 6-10 yr, and 11-18 yr, respectively, and the border-line significant differences were found among the different aged groups (p=0.125). OPFR metabolites of TCEP, BCEP, DPHP, TBEP, DBEP and BDCPP predominant in urine and were composed more than 90% of the total. TBEP was highly correlated with DBEP in this selected population (r=0.845, p<0.001). The estimated daily intakes (EDIs) of Σ5OPFRs (TDCPP, TCEP, TBEP, TNBP, and TPHP) are 2230, 461, 130, and 184 ng/kg bw/day for newborns, 1-5 yr children, 6-10 yr children, and 11-17 yr adolescents, respectively. The EDI of Σ5OPFRs for newborns is 4.83-17.2 times higher compared to the other pediatric groups.

Conclusions:

To our understanding, this is the first article investigating the urinary OPFR metabolites level in a broad-spectrum pediatric population. There tended to be a higher exposure rates in both newborn stage and home stay age, however little is known about their exposure levels or factors leading to exposure in the pediatric population. Further study should be arranged to clarify between the exposure level and factor relationship.

Acknowledgements: This work was supported by grants from the Chang Gung Memorial Hospital Research Project (CMRPG8K1281).

An Assessment of Association between Non–Hodgkin's Lymphoma Mortality Rates and Pesticide Use in Taiwan

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Keywords: difference-in-difference, Non-Hodgkin's Lymphoma mortality rate, pesticide exposure, farmer mortality rate, farmer health, linear probability model

Introduction

Pesticides are considered to have adverse effects on farmers' health and positively related to Non-Hodgkin's Lymphoma (NHL). In Taiwan, farmers use a large amount of pesticide over the past several decades. Hence, we want to investigate if farmers are more likely to die from NHL comparing to other adults.

Methods

In this study, a longitudinal data, the National Health Insurance database, is used to test if there is a difference in NHL mortality rates between farmers and other adults relating to the usage of pesticides. We use data combining Registry for Beneficiaries and Death of Cause Data of National Health Insurance database from 2000 to 2017 and Farm Health Insurance database that bring in farm household ratio and number of pesticide retail vendors in townships in 2015. Our research targets adults over 25 years old in Taiwan including 2,208,320 farmers and 20,620,696 non-farmers. Since there is no data regarding direct exposure of pesticides for farmers, we use proxy variables to represent the exposures of pesticides and apply the difference-in-difference method to estimate the effect of exposure of pesticides on a farmer's mortality rate due to NHL.

Results

The estimated results indicate that there is no statistically significant difference in the mortality rate of NHL between farmers and non-farmers. However, if only decedents are evaluated, the probability of deaths due to NHL is higher for farmers than non-farmers.

Conclusion

Our findings support higher pesticide exposure level may increase NHL mortality rate of farmers in Taiwan. Since the mortality rate of farmers is lower than that of non-farmers, we don't observe higher crude mortality rates of NHL for farmers. Using only decedent data provides better understanding of the risk farmers facing with respect to pesticide exposure level.

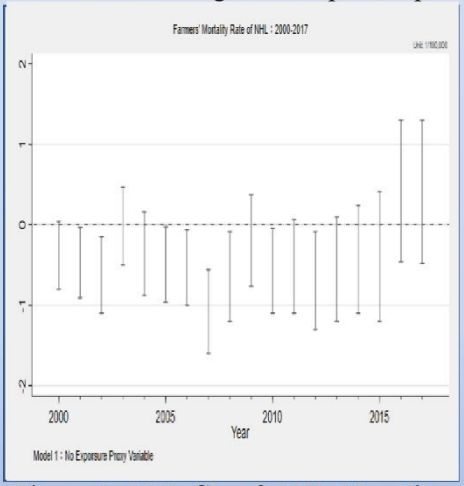

Figure 1. 95% CIs of NHL Mortality Rates for Farmers, 2000 - 2017

Variables	NHL Mortality Rate			
	(1)	(2)	(3)	(4)
Farmers	0.00020	0.00033	0.00022	0.00034
	(0.00013)	(0.00018)	(0.00014)	(0.00018)
Married	0.00365***	0.00359***	0.00369***	0.00364***
	(0.00012)	(0.00012)	(0.00012)	(0.00012)
Male	-0.00143***	-0.00141***	-0.00144***	-0.00141***
	(0.00012)	(0.00012)	(0.00012)	(0.00012)
FHR≧25%		-0.00250***		-0.00249***
		(0.00017)		(0.00017)
Farmer * FHR ≧ 25%		0.00202***		0.00201***
		(0.00036)		(0.00036)
Year Control	Yes	Yes		
Cohort Control			Yes	Yes
Age Control	Yes	Yes	Yes	Yes
Pseudo R2	0.0134	0.0143	0.0133	0.0142
Sample Size	2,470,727	2,470,727	2,470,727	2,470,727

Table 1. Regression Results for Pesticide Exposure Influencing NHL Mortality Rate of Farmers 2000-2017- Farm Household Ratio ≧25%

The roles of urinary novel renal biomarkers in detecting phthalate-associated nephrotoxicity in patients with chronic kidney disease

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Keywords: 8-hydroxy-2-deoxyguanosine, chronic kidney disease, kidney injury molecule-1, phthalates

Introduction

Phthalates are widely used plasticizers in consumer products and are associated with various adverse health effects, including nephrotoxicity. However, a paradoxically positive correlation between creatinine (Cr)-based estimated glomerular filtration rate (eGFR) and urinary phthalate concentration has been recognized in the literature, and the optimal biomarker of phthalate-related kidney damage has not yet been established. In this cross-sectional study, we assessed the possible roles of urinary novel renal biomarkers in detecting phthalate-associated nephrotoxicity in patients with chronic kidney disease (CKD).

Methods

Adult patients with CKD stage 3–5 were recruited to measure the urinary concentrations of eight phthalate metabolites, kidney injury molecule-1 (KIM-1), and 8-hydroxy-2-deoxyguanosine (8-OHdG). The associations between renal biomarkers and urinary Σphthalate were assessed via Spearman's correlation. The effects of phthalate exposure on the urinary concentrations of KIM-1 and 8-OHdG in the enrolled CKD patients were examined in multivariate analyses, adjusting for age, sex, body mass index, diabetes, hypertension, renal function, proteinuria, and covariates with a p-value of < 0.1 in univariate analyses.

Results

In the 163 enrolled patients, the overall detection frequency of urinary phthalate was 100%, with a median Σphthalate of 52.95 μg/g Cr (interquartile range, 31.12–102.29). The urinary Σphthalate was positively correlated with urinary KIM-1 and 8-OHdG (r_s = 0.372 for KIM-1, p < 0.001; r_s = 0.452 for 8-OHdG, p < 0.001) (**Figure 1**). In the multivariate analyses, urinary Σphthalate was identified as an independent predictor of urinary renal biomarkers in the enrolled patients, with a 0.465 log ng/g Cr increase in urinary KIM-1 (95% confidence interval (CI), 0.282–0.647, p < 0.001) and a 0.478 log μg/g Cr elevation in urinary 8-OHdG (95% CI, 0.324–0.632, p < 0.001) by per log μg/g Cr of Σphthalate (**Table 1**).

Conclusion

Phthalate exposure is associated with renal tubular injury and increased oxidative stress in CKD patients. Urinary KIM-1 and 8-OHdG could serve as reasonable biomarkers of phthalate-associated renal damage.

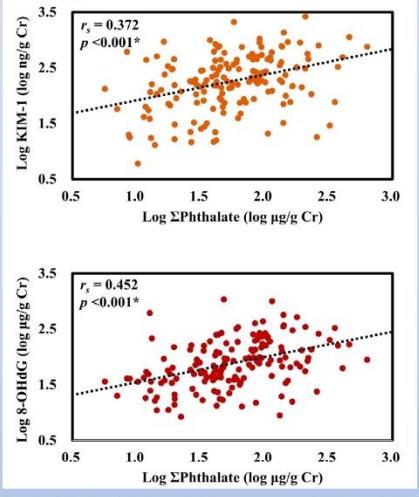

Figure 1. Spearman's correlation between renal biomarkers and urinary phthalates.

KIM-1 (log ng/g Cr)			8-OHdG (log μg/g Cr)		
Factor	β (95% CI)	p-value	Factor	β (95% CI)	p-value
Age (year)	0.009 (0.002–0.015)	0.013*	Age (year)	-0.003 (-0.009–0.002)	0.219
Women	-0.026 (-0.197–0.145)	0.763	Women	-0.027 (-0.173–0.118)	0.710
BMI (kg/m^2)	0.001 (-0.019–0.020)	0.928	BMI (kg/m^2)	-0.003 (-0.018–0.013)	0.754
Diabetes	-0.104 (-0.281–0.073)	0.246	Diabetes	0.044 (-0.101–0.190)	0.548
Hypertension	0.113 (-0.103–0.328)	0.304	Hypertension	-0.074 (-0.252–0.104)	0.410
eGFR (mL/min/1.73m^2)	-0.001 (-0.007–0.004)	0.608	eGFR (mL/min/1.73m^2)	0.002 (-0.003–0.006)	0.498
UPCR (log mg/g Cr)	0.019 (-0.132–0.170)	0.807	UPCR (log mg/g Cr)	0.076 (-0.042–0.195)	0.206
Σphthalate (log μg/g Cr)	0.465 (0.282–0.647)	<0.001*	Σphthalate (log μg/g Cr)	0.478 (0.324–0.632)	<0.001*
Vascular disease	0.053 (-0.145–0.251)	0.597	Smoking	0.090 (-0.157–0.336)	0.474
Heart failure	0.175 (-0.095–0.444)	0.203	Dyslipidemia	0.204 (0.042–0.367)	0.014*
Serum albumin (g/dL)	-0.175 (-0.385–0.036)	0.103	Gout	0.196 (0.063–0.328)	0.004*

Table 1. Factors independently associated with urinary renal biomarkers
Urinary Σphthalate indicated the sum of eight phthalate metabolites measured in this study (i.e., mono-benzyl phthalate, mono(2-ethyl-5-carboxypentyl) phthalate, mono(2-ethylhexyl) phthalate, mono(2-ethyl-5-hydroxyhexyl) phthalate, mono(2-ethyl-5-oxohexyl) phthalate, mono-ethyl phthalate, mono-methyl phthalate, and mono-n-butyl phthalate). 8-OHdG, 8-hydroxy-2-deoxyguanosine; BMI, body mass index; CI, confidence interval; Cr, creatinine; eGFR, estimated glomerular filtration rate; KIM-1, kidney injury molecule-1; UPCR, urinary protein/creatinine ratio. *: p <0.05.

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Endocrine-disrupting compounds and coffee roasting: An Analysis of Emissions and Potential Health Impacts

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Keywords: Emission factors, Endocrine disruptors, PCDD/Fs, PAHs, Nitro-PAHs

INTRODUCTION

The temperature conditions during coffee roasting might be conducive to forming endocrine-disrupting organic compounds. This study investigates the emissions of PCDD/Fs, PAHs, and Nitro-PAHs during the roasting of green coffee beans and alcohol- and honey-infused coffee formulations. Besides measuring the concentrations and describing the congener profiles, the study also calculates the emission factors of these compounds.

METHODS

Green coffee beans were dried to ~16% moisture content and the husk was peeled off. The coffee formulations with coffee beans, alcohol, and honey or granulated sugar were prepared according to the formulas in Table 1. 300 g of the sample was roasted either using fast or slow roasting and the flue gas was isokinetically sampled and the pollutants adsorbed in XAD-2 resin. A GC-MS/MS was used to analyze PAHs and Nitro-PAHs, while HRGC/HRMS was used to analyze PCDD/Fs.

Table 1. Details of the coffee formulations used in the study.

Formula	Composition
A	Arabica green coffee
B-1	2000 g Coffee: 600 mL bourbon whiskey
B-2	2000 g Coffee + 600 mL bourbon whiskey + 100 mL honey
B-3	2000 g Coffee + 600 mL bourbon whiskey + 100 g granulated sugar
C-1	2000 g Coffee + 600 mL red wine
C-2	2000 g Coffee + 600 mL red wine + 100 mL honey
C-3	2000 g Coffee + 600 mL red wine + 100 g granulated sugar
D-1	2000 g Coffee + 600 mL Botrytized white wine
D-2	2000 g Coffee + 600 mL Botrytized white wine + 100 mL honey
D-3	2000 g Coffee + 600 mL Botrytized white wine + 100 g granulated sugar

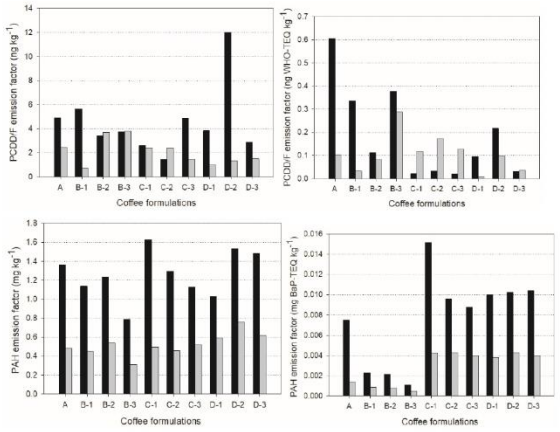

Figure 1. Comparison of PCDD/F and PAH emission factors based on mass and toxic concentrations from different coffee formulations during the fast (black) and slow (grey) roasting methods.

RESULTS

PCDD/Fs and PAHs were detected in the flue gases of all coffee formulations. However, Nitro-PAH concentrations were not detected. The concentrations were higher during the fast than slow roasting method, except for PCDD/F concentrations of some C coffee formulations. All the PCDD/F concentrations were below the regulation limits set for combustion plants (0.1 ng I-TEQ Nm-

CONCLUSIONS

These preliminary results show that PCDD/Fs and PAHs are formed during coffee roasting. However, the concentrations are lower than the regulation limit. Nonetheless, the risk to workers should be investigated.

A New Screening Platform for Endocrine Disrupting Chemicals in Taiwan Zebrafish Technology and Resource Center

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Keywords: EDCs, zebrafish, EASZY, TG250

Introduction

Endocrine-disrupting chemicals (EDCs) released into the environment can adversely affect human and wildlife endocrine systems. To screen and evaluate the estrogenic activity of these compounds, a feasible and practical test platform is essential.

Methods

The Taiwan Zebrafish Technology and Resource Center (TZTRC), a member of the National Core Facility for Biopharmaceuticals (NCFB), offers several toxicity test models. We used the OECD (Organization for Economic Cooperation and Development) test guideline No. 250 (EASZY assay: Detection of Endocrine Active Substances, acting through estrogen receptors, using transgenic Tg(*cyp19a1b:GFP*) Zebrafish embrYos) to evaluate the estrogenic activity of EDCs. The expression of GFP in Tg(*cyp19a1b:GFP*) zebrafish embryos is controlled by the *cyp19a1b* promoter, which requires the activated estrogen receptors to bind to the estrogen response elements on the promoter region, and it is significantly upregulated upon exposure to estrogen or estrogenic compounds.

Results

We used 17α-ethinylestradiol (EE2, 0.05 nM) as a positive control, with a mean fluorescent intensity expected to be nine times more than that of the solvent control. Our findings confirmed that Bisphenol B (BPB) exhibits estrogenic activity similar to other structurally diverse Bisphenol compounds.

Conclusion

In conclusion, our study successfully established an EDCs screening platform based on the OECD TG250 EASZY method. This platform can augment the detection capacity for alternative testing methods in safety testing and assessment within Taiwan.

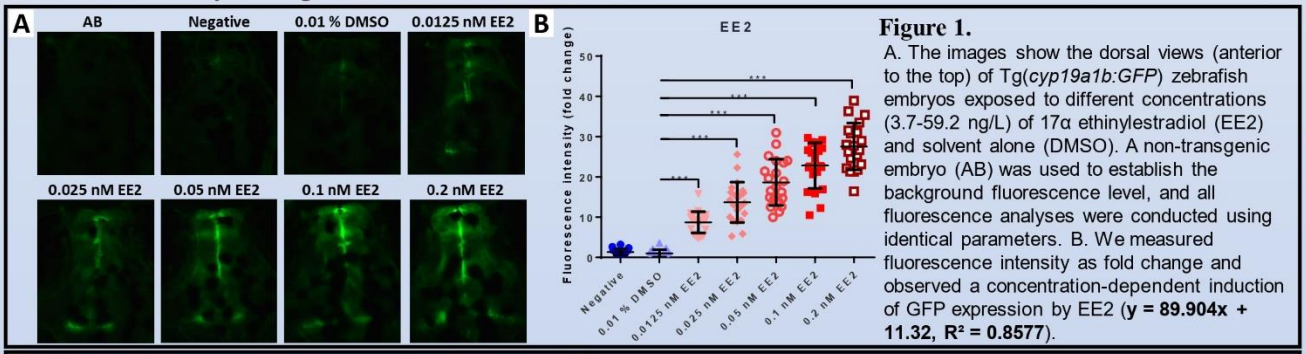

Figure 1.
A. The images show the dorsal views (anterior to the top) of Tg(*cyp19a1b:GFP*) zebrafish embryos exposed to different concentrations (3.7-59.2 ng/L) of 17α ethinylestradiol (EE2) and solvent alone (DMSO). A non-transgenic embryo (AB) was used to establish the background fluorescence level, and all fluorescence analyses were conducted using identical parameters. B. We measured fluorescence intensity as fold change and observed a concentration-dependent induction of GFP expression by EE2 (**y = 89.904x + 11.32, R^2 = 0.8577**).

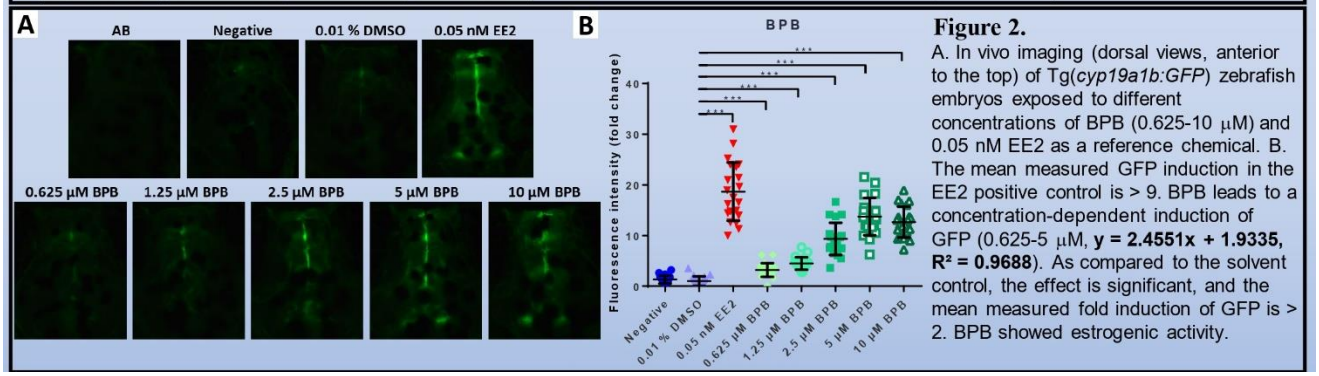

Figure 2.
A. In vivo imaging (dorsal views, anterior to the top) of Tg(*cyp19a1b:GFP*) zebrafish embryos exposed to different concentrations of BPB (0.625-10 µM) and 0.05 nM EE2 as a reference chemical. B. The mean measured GFP induction in the EE2 positive control is > 9. BPB leads to a concentration-dependent induction of GFP (0.625-5 µM, **y = 2.4551x + 1.9335, R^2 = 0.9688**). As compared to the solvent control, the effect is significant, and the mean measured fold induction of GFP is > 2. BPB showed estrogenic activity.

Urine phthalate metabolites are elevated in patients with esophageal squamous cell carcinoma and associated with advanced cancer stage and poor survival

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Keywords: phthalate; esophageal cancer; squamous cell carcinoma; survival

Introduction

The aim of this study was to investigate the role of phthalate in patients with esophageal squamous cell carcinoma (ESCC).

Methods

A total of 116 ESCC patients and 58 controls without any known histories of malignancies were enrolled. All eight urine phthalate metabolites were measured to assess phthalate levels. Clinical and urine phthalate metabolite profiles were compared between subgroups to identify differences, and the effects of phthalates on clinical ESCC outcomes were also examined.

Results

The concentrations of some urine phthalate metabolites were higher in the ESCC group than in the control group, including mono-(3-carboxypropyl) phthalate (MCPP), mono-(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP), mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP), and mono-n-butyl phthalate (MnBP). Higher concentrations of urine phthalate metabolites were associated with clinical T3–T4 status and advanced tumor stage. Patients with higher concentration of mono-(2-ethyl-5-carboxypentyl) phthalate (MECPP), mono-2-ethylhexyl phthalate (MEHP), and MEOHP had lower 1-year and 2-year overall survival (OS) rates than those with lower concentrations of these metabolites in our univariate analysis. Multivariate analysis showed that urinary MEHP of ≥ 3 μg/L and clinical stage IV were independent prognostic factors for worse OS.

Conclusions

The results of our study showed that urine phthalate metabolites are elevated in ESCC patients and associated with advanced tumor stage, and that a high urinary concentration of MEHP is an independent prognostic factor of worse OS.

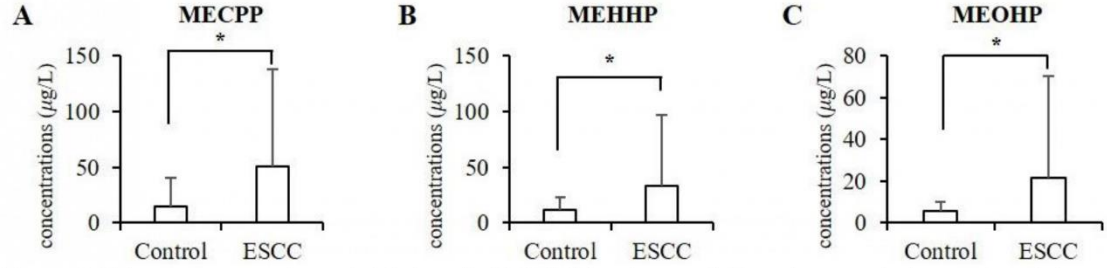

Figure 1. Urinary concentrations of phthalates in 116 ESCC patients and 58 sex/age matched control participants. (A) MECPP; (B) MEHP, and (C) MEOHP. ESCC: esophageal squamous cell carcinoma; MECPP: mono-(2-ethyl-5-carboxypentyl) phthalate; MEHHP: mono-(2-ethyl-5-hydroxyhexyl) phthalate; MEOHP: mono-(2-ethyl-5-oxohexyl) phthalate. *: P≤ 0.001.

Hexabromocyclododecane brominated flame retardant in sediments from riverine, port, and coastal areas of Kaohsiung, Taiwan: Levels, spatial distribution, and potential ecological risks

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Introduction: Hexabromocyclododecane (HBCD) poses a potential threat to the environment and human health because of its persistence, propensity for bioaccumulation, and toxicity. Sediments with a high ability to adsorb organic contaminants are a major sink of HBCD. Because evidence regarding the fate of HBCD in the sediment of a total environment is lacking, we conducted a comprehensive study of the level, distribution, and ecological risk assessment of HBCD in the surface sediment of the Kaohsiung area of Taiwan.

Methods: A total of 16 surface sediment samples were collected from Love River, the Kaohsiung Port area, and the Cijin coastal area in Kaohsiung City, Taiwan. The sample extraction procedure was Soxhlet extraction method and LC-ESI-MS/MS was used in HBCD quantitative method. In potential ecological risk, we used marine algae (*S. costatum*) to conduct an ecological risk analysis.

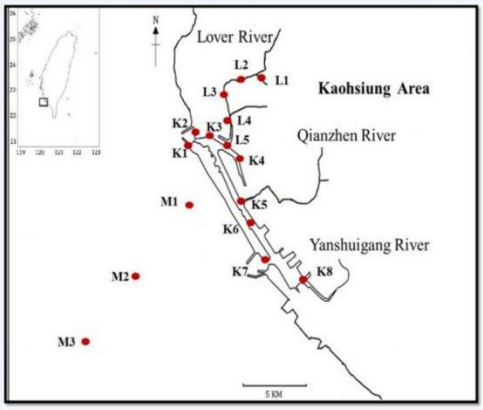

Fig. 1 Love River (L1 to L5), Kaohsiung Port area (K1 to K8), and Cijin coastal area (M1 to M3) sampling sites.

Keywords: *Hexabromocyclododecane, Brominated flame retardant, sediment, ecological risk assessment, Kaohsiung.*

Results: In the sediment collected at stations on Love River and the Kaohsiung Port area, the HBCD concentrations ranged from 10.6 to 320.1 μg/kg dry weight (dw) and not detected (n.d.) to 58.4 μg/kg dw, respectively. In the Cijin coastal area, the HBCD concentrations of sediment collected from the M1, M2, and M3 sites were 896.2, 3.2 (<limit of quantitation), and 10.4 μg/kg dw, respectively. Regarding potential ecological risk, 8 of 16 stations had risk quotient values (RQs) of $0.1 < RQ < 1$, and 5 of 16 stations had $RQ > 1$. The M1 site had the highest risk level ($RQ = 16.39$). Generally, the ecological risk level of the HBCD content in the river, port area, and coastal sediments in the Kaohsiung area to aquatic algae organisms was medium and high. HBCD is a hydrophobic, potentially persistent, bioaccumulative, and toxic compound. Future studies in HBCD-related analyses of marine sediments, particularly those in areas near marine discharge pipes, and ecological risk assessments should be conducted.

Conclusion: These data indicate that domestic sewage and industrial wastewater discharge pose a potential risk to marine environments. Consequently, timely measures to control HBCD-related risks are required. Our study offers insight into the environmental effects of HBCD contamination in sediment and information that can be used to guide environmental policy and safety measures.

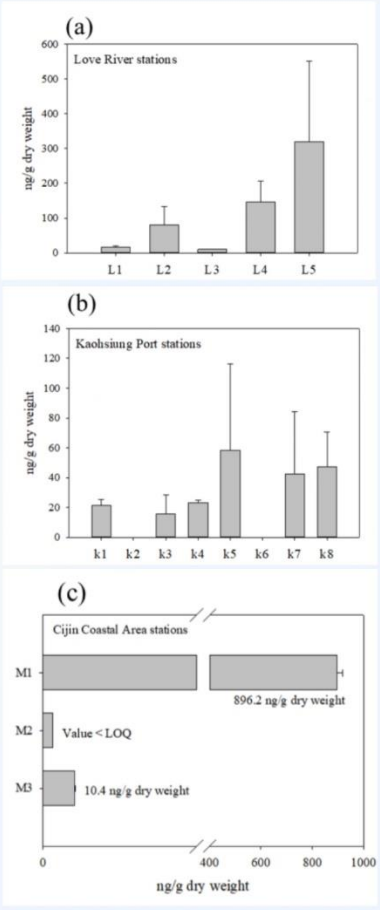

Fig. 2 Concentration of HBCD in sediments obtained from (a) Love River, (b) the Kaohsiung Port area, (c) and the Cijin coastal area

Exposure to Organophosphate Flame Retardants Among 391 Volunteers in Taiwan: Difference between Adults and Children

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Keywords: Organophosphate Flame Retardant, Tris(2-butyloxyethyl) phosphate (TBEP)

Introduction

Organophosphate flame retardants (OPFRs) are ubiquitous in the environment. The compositions and concentrations of different OPFRs metabolites vary in different environments depending on different human activities. The objective of the present study was to evaluate the exposure of different age groups to OPFRs in Taiwan.

Methods

Volunteers provided urine samples and responded to questionnaires including demographic factors, underlying disease, lifestyle information, and occupation from October 2021 to January 2022. OPFR measurements were performed using a Waters Acquity Ultra-Performance Liquid Chromatography system coupled with a Waters Xevo TQ-XS mass spectrometer.

Results

A total of 391 volunteers (74 children and 317 adults) were enrolled in this study. The concentrations (presented as μg/g creatinine) of bis(1,3-dichloro-2-propyl) phosphate (BDCPP, p=0.029) and tri-n-butyl phosphate (TNBP, p=0.008) were higher in the adult group, while the concentrations of bis-2-chloroethyl phosphate (BCEP, p=0.024), diphenyl phosphate (DPHP, p <0.001), tris(1,3-dichloro-2-propyl) phosphate (TDCPP, p=0.009), and Tris(2-butyloxyethyl) phosphate (TBEP, p=0.007) were higher in the child group. Compared with school age children (>6 years), the concentration of di(2-n-butoxyethyl) phthalate (DBEP, 1.14 vs 0.20 μg/g creatinine, p=0.001), DPHP (1.23 vs 0.54 μg/g creatinine, p=0.036), TBEP (1.63 vs 0.29 μg/g creatinine, p<0.001), and the sum of OPFR metabolites (ΣOPFRs, 6.58 vs 2.04 μg/g creatinine, p<0.001) were statistically higher in preschool-aged children. After adjusting for confounding factors, pre-school age (odds ratio (OR):4.579, 95% confidence interval (CI): 1.389-13.115) and current smoker (OR:5.328, 95%CI: 1.858-14.955) were independently associated with the risk of ΣOPFRs higher than 90 percentile.

Conclusion

This study revealed the distribution of different OPFRs metabolites in children and adults. DBEP, DPHP, TBEP, and ΣOPFR were higher in preschool-aged children. Pre-school age and current smoking status were independent risk factors for ΣOPFRs higher than 90 percentile.

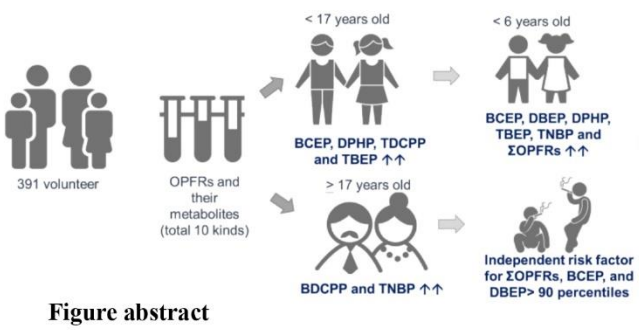

Figure abstract

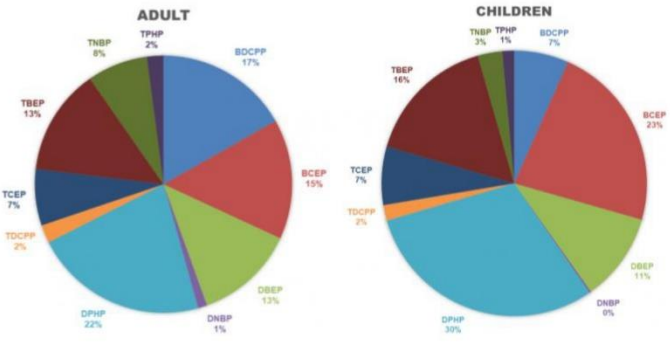

Figure 1.

The percentage of each OPFR metabolite from the sum of OPFRs and their metabolites among adults and child groups.

PAHs & Nitro-PAHs bound to Total Suspended Particulates (TSP) Near Key Point-sources of Emissions in Kaohsiung

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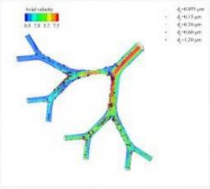
Introduction

The respiratory exposure to **carcinogenic** & **mutagenic** polycyclic aromatic hydrocarbons **(PAHs)** & nitrated-PAHs **(nitro-PAHs)** is an important indicator of health risk in urban areas.



Particle-bound PAHs & nitro-PAHs deposit in the lungs more readily because inertial impaction is more effective than diffusion of their gaseous counterparts.

Fig 1. Particle deposition in lung bifurcations

Purpose of the research

To establish the concentrations, congener profiles, & diagnostic ratios for PAHs & nitro-PAHs bound to total suspended particulates (TSP) in Kaohsiung city & identify the emission sources.

Methods

- TSP samples were obtained near key point sources.
- PAHs & nitro-PAHs were extracted using a Soxhlet.
- Separation, detection, & quantification were performed using GC-MS/MS.

Results

- Congener profiles in **Fig 2** indicate that high molecular weight (HMW) PAHs > low molecular weight PAHs. Implying - dominance of combustion sources. **Benzo (g,h,i) pyrelene, Benzo (b) fluoranthene**, & **Indeno (1,2,3-cd) pyrene** were dominant.
- High nitro-PAHs coincided with high PAHs concentrations, where notable congeners for the nitro-PAHs include **9-nitroanthracene**, **9-nitrophenanthracene**, **2-nitrofluoranthene**, **1-nitropyrene**, & **7-nitrobenz (a) anthracene**. Implying - dominance of atmospheric chemical transformations.
- PAHs & nitro-PAHs in some residential areas & schools) > industrial zones due to atmospheric chemical transformations & contributions from mobile sources.

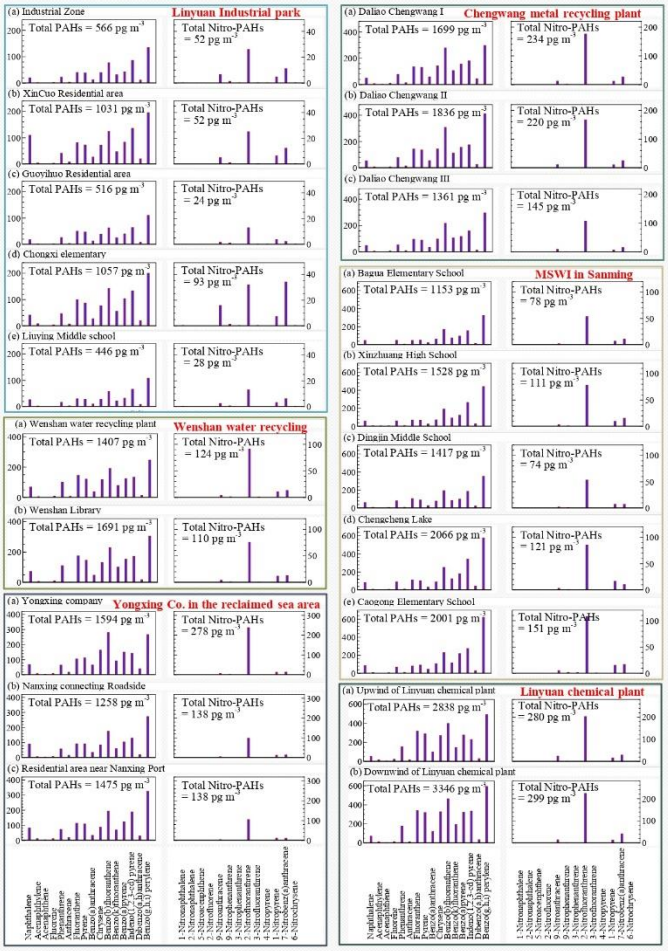
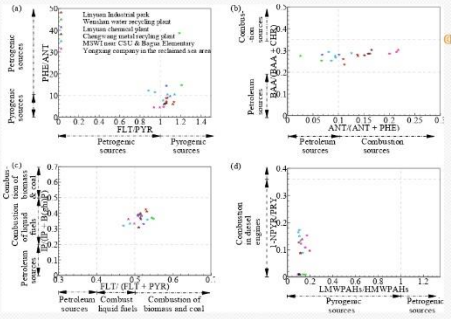


Fig 2. Congener profiles for TSP-bound PAHs & nitro-PAHs



- Diagnostic ratios in **Fig. 3,** indicate the dominance of pyrogenic sources & low contribution from petrogenic sources **(Fig. 3a,b)**.

Fig 3. Cross-plots for the diagnostic ratios

Conclusions

- HMW congeners > LMW congeners.
- Pyrogenic emissions > petrogenic emissions
- To reduce exposure to PAHs & nitro-PAHs attention should be paid to pyrogenic sources.

Keywords: TSP; PAHs; Nitro-PAHs; Congeners; Diagnostic ratios; emission sources

2023年精準環境醫學國際研討會

鋼鐵業懸浮微粒表面多環芳香烴及重金屬排放特徵及其衍生健康影響潛勢

水處理與毒物風險實驗室

陳冠甫[1]、郭皓安[2]、林鈺豪[2]、陶文君[2]、賈雅婷[2]、李佩芯[2]、林貞妤[2]、袁中新[3]、陳威翔[3]*

國立中山大學 環境工程研究所 [1]博士後研究員、[2]碩士、[3]教授

Introduction

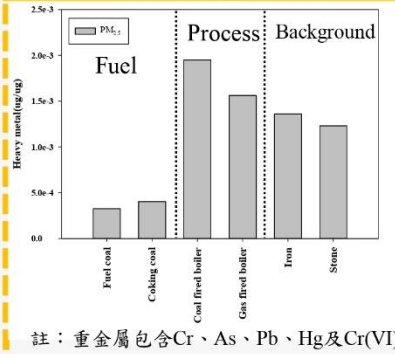
鋼廠冶煉加工過程可能排放大量懸浮微粒(particulate matter, PM)，且製程燃燒常因不完全燃燒易產生多環芳香烴(polyaromatic hydrocarbons, PAHs)及有害金屬蒸氣，並亦可能附著於PM，造成空氣品質下降與人體健康危害之疑慮。

Methods

本研究採集不同燃料(燃料煤及冶金煤)、不同燃燒製程(燃煤及燃氣鍋爐) 及不同現場背景(鐵礦砂及石料料堆)所排$PM_{2.5}$，除分析質量濃度外，亦須分析其PAHs、重金屬及衍生的健康影響潛勢，以瞭解三者之危害程度，並探討其關聯性。

Results and Discussion

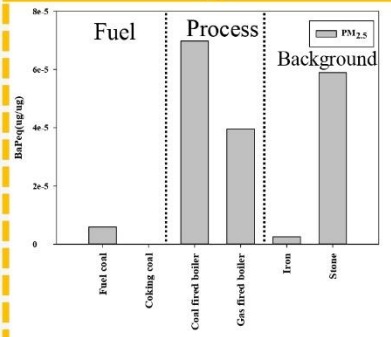
單位質量$PM_{2.5}$內所含重金屬濃度



註：重金屬包含Cr、As、Pb、Hg及Cr(VI)

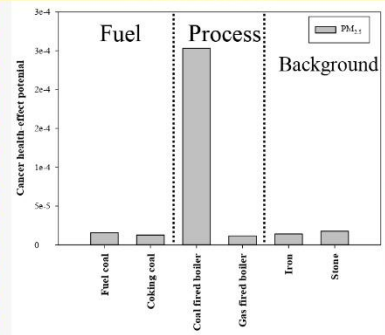
- 比較不同燃料與燃煤製程生成的$PM_{2.5}$得知，若使用燃料分別為燃料煤和冶金煤，經燃煤製程會分別增加6.0和4.8倍的重金屬生成。
- 比較不同燃燒製程生成的$PM_{2.5}$得知，使用燃料若為天然氣可降低20%的重金屬生成。
- 比較不同燃燒製程與不同現場背景生成的$PM_{2.5}$得知，燃煤製程生成$PM_{2.5}$中所含重金屬濃度最高，但鐵礦砂及石料料堆背景生成$PM_{2.5}$中所含重金屬濃度所帶來之影響同樣十分重要。

單位質量$PM_{2.5}$內所含PAHs濃度



- 比較不同燃料與燃煤製程生成的$PM_{2.5}$得知，若使用燃料分別為燃料煤和冶金煤，經燃煤製程會分別增加11.8和1217.5倍的PAHs生成。
- 比較不同燃燒製程生成的$PM_{2.5}$得知，使用燃料若為天然氣可降低40%的PAHs生成。
- 比較不同燃燒製程與不同現場背景生成的$PM_{2.5}$得知，燃煤製程生成$PM_{2.5}$中所含PAHs濃度最高，但石料料堆生成$PM_{2.5}$中所含PAHs濃度所帶來之影響亦不容小視。

不同燃料、製程及現場背景之致癌風險



- 比較不同燃料與燃煤製程生成$PM_{2.5}$所衍生的健康影響潛勢得知若使用燃料分別為燃料煤和冶金煤，經燃煤製程會分別增加16.2和20.0倍的健康影響潛勢生成。
- 比較不同燃燒製程生成$PM_{2.5}$所衍生的健康影響潛勢得知，使用燃料若為天然氣可降低95%的健康影響潛勢生成。
- 比較不同燃燒製程與不同現場背景生成$PM_{2.5}$所衍生的健康影響潛勢得知，燃煤製程生成$PM_{2.5}$所衍生的健康影響潛勢最高，但鐵礦砂及石料料堆所衍生的健康影響潛勢也不容忽視。

Conclusion

- 燃燒製程若使用天然氣為燃料，可降低$PM_{2.5}$表面20%重金屬、40%PAHs、及95%的健康影響潛勢。
- 燃煤製程生成$PM_{2.5}$中所含重金屬和PAHs濃度最高，且衍生的健康影響潛勢亦為最高，而鐵礦砂及石料料堆所生成$PM_{2.5}$所帶來之影響亦不容小覷。

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紅斑狼瘡病患血液中的B細胞的分型和尿液中的OPFRs濃度之相關性

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Keywords:紅斑性狼瘡,腎炎, TDCPP濃度

Introduction

這是環境污染物(1)和病毒感染(2)在紅斑性狼瘡病人的研究的延續。在本研究中，我們希望通過臨床記錄和及臨床B細胞的分析，將B淋巴球對於環境污染物有機磷系阻燃劑（organophosphate flame retardants, OPFRs）的反應做一個初步的釐清。 OPFRs廣泛應用於油漆、建材、家具等，近年已逐漸取代有機溴系阻燃劑，使其全球每年產量100萬噸。OPFRs可透過皮膚接觸、粉塵吸入和飲食攝入等方式進入人體內，造成人體產生神經、免疫、代謝及內分泌系統方面的疾病。OPFRs是一群具有多樣化物理和生理特性的化學物質，作為傳統阻燃劑，例如多氯聯苯(PCBs)和多溴聯苯醚(PBDEs)的替代品而出現(4)。OPFRs被廣泛用作家具、電子產品、建築材料、各種消費品以及化妝品、地板拋光劑、塗料和兒童產品中的熱穩定劑和阻燃劑(5)。OPFRs已在各種環境基質中檢測到，包括土壤、灰塵、沉積物、表面水、海洋、室內空氣和大氣，以及多種生物樣本中(6)。B細胞是免疫系統中一種重要的細胞，其主要功能是產生抗體以對抗入侵的病原體。根據它們在表面表達的不同抗原受體，可以區分出不同的B細胞亞型。

Methods

收集臨床上40位門診長期追蹤且穩定的紅斑性狼瘡病人的血液和尿液檢體做為分析。所有病人皆簽署同意書，此同意書經高雄長庚醫院人體試驗委員會核可。測定血中不同的B細胞亞型和尿液中OPFR的相關性。我們知道，B細胞在對抗病原體時發揮不同的作用，這些作用的協同作用有助於提高人體對病原體的免疫能力。而在本實驗中，我們將會檢測紅斑性狼瘡病患血液中的B細胞的成熟類型和尿液中的OPFRs用來探討B細胞受到影響後的反應。

Results

紅斑性狼瘡患者的基本血液生化結果如Table1，而和B細胞的相關性如Table2所示。

Conclusion

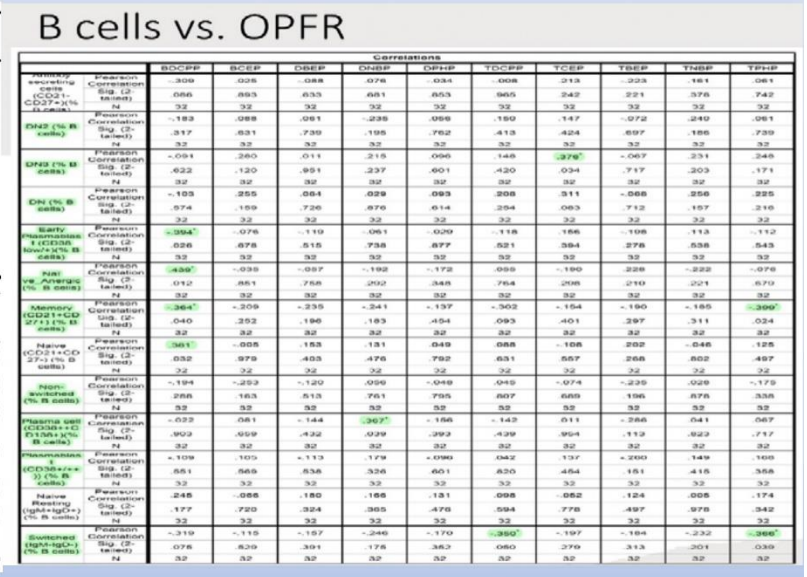
OPFRs在紅斑性狼瘡對於人體的B細胞大多是和B細胞免疫抑制相關（和B細胞成負相關）

Table 1. 紅斑性狼瘡病患基本血液生化結果

	WBC	RBC	HB	HCT	MCV	MCH	PLT	Segment	Lymphocyte	Monocyte
Valid	40	40	40	40	40	40	40	39	39	39
Missing	0	0	0	0	0	0	0	1	1	1
Mean	6.605	4.335	12.315	37.973	88.157	28.580	238.900	67.279	24.213	6.533
Std. Deviation	4.645	0.571	1.951	5.299	7.389	2.894	93.067	12.402	12.341	2.488
Minimum	2.600	3.350	7.800	26.300	70.900	21.000	16.000	38.200	4.000	2.400
Maximum	28.200	5.740	16.100	48.200	112.200	36.400	411.000	89.200	51.000	15.000

	Eosinophil	Basophil	AbsNeutro	ESR	C3	C4	antiDS DNA AB	HSCRP	Albumin	cre (B)
Valid	39	39	39	40	40	40	39	38	38	40
Missing	1	1	1	0	0	0	1	2	2	0
Mean	1.351	0.446	4508.308	29.900	90.305	18.248	167.892	5.409	4.067	0.813
Std. Deviation	1.122	0.387	2871.346	26.088	30.718	12.138	168.562	15.567	0.664	0.349
Minimum	0.000	0.000	1337.000	1.000	24.300	2.090	1.300	0.200	2.550	0.390
Maximum	5.700	2.000	13674.000	98.000	169.000	69.200	680.700	97.160	4.760	2.140

Table 2. OPFRs在人體的B細胞中大多是免疫抑制的效果。



References: 1.Serum parabens and its correlations with immunologic and cellular markers in Southern Taiwan industrialized city systemic lupus erythematosus patients. J Chin Med Assoc, 2022. 85(10):p. 993-99. 2. Inverse Association Between Antiviral Immunity and Lupus Disease Activity. Viral Immunol, 2018. 31(10): p. 689-94.

育齡婦女卵巢儲量與有機磷阻燃劑的相關性

The association between ovarian reserve and organophosphate flame retardants in women of childbearing age

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Backgrounds

Organophosphate flame retardants (OPFRs), a group of chemicals with diverse physical and physiological properties, are emerging flame retardants that serve as substitutes for traditional flame retardants, such as polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs). Hence, OPFRs have become the second most used group of flame retardants worldwide, and the possible adverse effects of OPFR exposure might include neurotoxicity, developmental toxicity, reproductive toxicity, endocrine-disrupting effects, carcinogenicity, and nephrotoxicity.

Materials and Methods

In this prospective study, total of 99 participants were recruited from August 2021 to October 2022 at the outpatient department of Obstetrics and Gynecology in Chang Gung Memorial Hospital, Kaohsiung Medical Center in Taiwan. The inclusion criteria were as follows: adult women of childbearing age were eligible to participate. Old age(>50 years old), patients using antidepressants and antipsychotics for over months were excluded.

The urinary concentrations of 10 OPFR compounds were measured to evaluate the exposure patterns. Clinical and urinary OPFR profiles were compared among subgroups to identify whether the OPFR compounds were independently correlated with AMH, FSH and LH level. Additionally, lifestyle factors were compared among subgroups stratified by median concentrations of urinary OPFR compounds associated with AMH level.

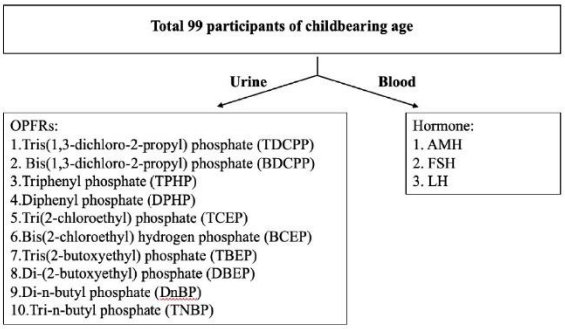

Figure 1. Flow diagram of 99 participants who attended the prospective study.

Results

After adjusting for covariates, the urinary concentration of BDCPP was identified as an independent predictor of lower AMH level (low vs. high AMH(cut-off value: 1.5ng/mL), odds ratio (OR) (95% confidence interval (CI)), 5.714 (1.435–22.727), p = 0.007). Moreover, less urination per day was postively correlated with urinary BDCPP concentration (high vs. low BDCPP(cut-off value: 2.3μg/g Cr), OR (95% CI), 6.750 (1.569–29.032), p = 0.018). FSH and LH were not significantly associated with 10 OPFR compounds in our study.

	AMH≥1.5 (ng/mL) (n = 60)	AMH<1.5 (ng/mL) (n = 39)	*p*-value
Age (year)	35 (31-37)	38 (34-40)	0.008*
BMI (kg/m2)	23.24 (21.08-25.83)	22.40 (19.74-24.72)	0.121
Smoking	1 (1.67)	1 (2.56)	0.825
Drinking	3 (5.00)	1 (2.56)	0.896
FSH (mIU/mL)	7.20 (5.68-8.43)	9.00 (7.20-12.15)	0.006*
LH (mIU/mL)	4.65 (3.13-6.05)	3.55 (2.83-5.50)	0.147
BDCPP (μg/g Cr)	0.000 (0.000-0.715)	0.810 (0.000-1.640)	0.029*
BCEP (μg/g Cr)	0.070 (0.000-0.606)	0.250 (0.000-0.687)	0.167
DBEP (μg/g Cr)	0.001 (0.000-0.010)	0.003 (0.000-0.022)	0.352
DnBP (μg/g Cr)	0.000 (0.000-0.000)	0.000 (0.000-0.000)	0.946
DPHP (μg/g Cr)	0.070 (0.020-0.155)	0.110 (0.020-0.270)	0.073†
TDCPP (μg/g Cr)	0.000 (0.000-0.000)	0.000 (0.000-0.000)	0.966
TCEP (μg/g Cr)	0.000 (0.000-0.000)	0.000 (0.000-0.000)	0.835
TBEP (μg/g Cr)	0.000 (0.000-0.148)	0.000 (0.000-0.135)	0.886
TnBP (μg/g Cr)	0.015 (0.000-0.053)	0.020 (0.000-0.035)	0.994
TPHP (μg/g Cr)	0.015 (0.000-0.040)	0.030 (0.000-0.050)	0.097†
ΣOPFRs (μg/g Cr)	1.107 (0.529-2.402)	2.232 (0.781-6.614)	0.038*

Table 1. Patient characteristics and OPFRs stratified by AMH level, n (%), or median (IQR)

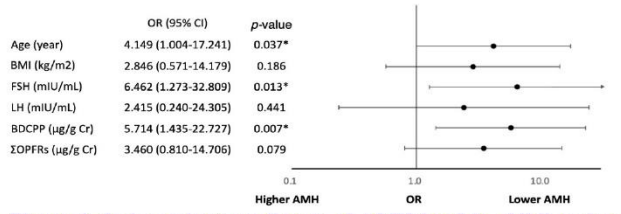

Figure 2. Independent predictors of AMH level in childbearing women

	Low BDCPP vs. High BDCPP		Low ΣOPFRs vs. High ΣOPFRs	
	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
Frequent seafood	0.642 (0.191-2.153)	0.470	0.165 (0.032-0.843)	0.028*
Frequent take-out food	3.111 (0.905-10.689)	0.062	4.429 (1.033-18.993)	0.032*
Less urination	6.750 (1.569-29.032)	0.018*	11.200 (2.368-52.975)	0.005*

Table 2. Environmental and lifestyle factors independently correlated with BDCPP and ΣOPFR concentrations

Summary & Conclusions

Increasing exposure to OPFRs (especially bis(1,3-dichloro-2-propyl) phosphate (BDCPP)) have been associated with lower AMH level. Further large-scale longitudinal studies are required to verify our findings and to evaluate the impact of OPFRs exposure on ovarian reserve.

南臺灣不同空氣污染物與受試者年齡對精液品質的影響

The effect of various air pollution and participants' age on semen quality in southern Taiwan

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Backgrounds

Semen quality plays a major role in male infertility. Therefore, decline in semen quality was a serious problem in human infertility, and also might be one of the causes of decline in fertility rates. Air pollution has become the world's largest single environmental health risk. However, only a few studies with small samples have investigated the health effects of air pollution on semen quality in humans, and the results have been inconsistent.

Materials and Methods

In this retrospective study, 4338 male aged from 21–70 years olds were recruited between 2001 and 2018 from a reproductive medical center. Semen quality was assessed according to standardized methods outlined in the World Health Organization laboratory manual 1999, including total sperm count , progressive sperm motility (%), rapid progressive sperm motility (%), and sperm with normal morphology (%). All designated national air quality automatic continuous monitoring stations measured the levels of air pollution (particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3)), and was documented by Environmental Protection Administration in Taiwan. We collected the levels of air pollution exactly base on the participants' residential address.

Results

In our study, we found progressive sperm motility (%), rapid progressive sperm motility significantly decreased annually (P for trend<0.05). Besides, increasing age influenced the total sperm count , progressive sperm motility, rapid progressive sperm motility, and sperm with normal morphology (P for trend<0.05). Among different air pollution, we observed SO_2 was associated with lower rapid progressive sperm motility and lower sperm with normal morphology (β -0.103, p = 0.043; β 0.118, p=0.001, respectively). However, NO_2 was associated with higher rapid progressive sperm motility and higher sperm with normal morphology (β 0.129, p = 0.002; β 0.127, p<0.001, respectively).

Fig. 1. Different semen parameters change with age

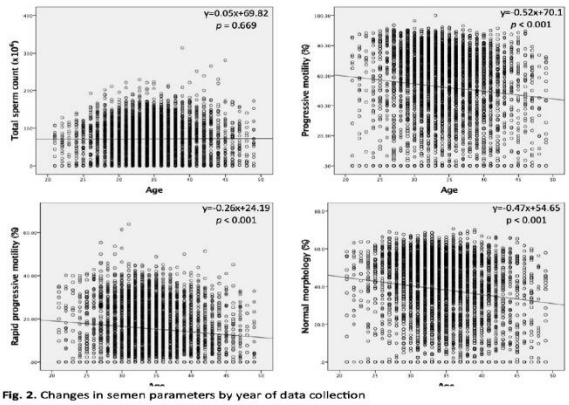

Fig. 2. Changes in semen parameters by year of data collection

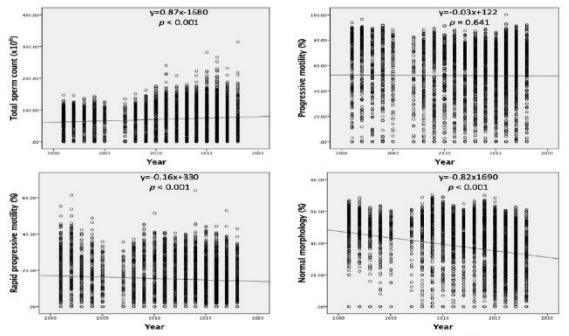

Table 3. Association between semen parameters and air pollutants

Semen parameters	Air pollutant	β (95% CI)	p
Number of sperm (10^6)	PM_{10}	0.018 (-0.011, 0.046)	0.218
	$PM_{2.5}$	-0.010 (-0.027, 0.008)	0.268
	SO_2	-0.140 (-0.319, 0.039)	0.125
	NO_2	0.102 (-0.047, 0.251)	0.180
	CO	0.720 (-3.521, 4.960)	0.739
	O_3	-0.032 (-0.078, 0.014)	0.172
Progressive motility sperm (%)	PM_{10}	-0.001 (-0.013, 0.010)	0.842
	$PM_{2.5}$	0.001 (-0.006, 0.008)	0.708
	SO_2	0.052 (-0.021, 0.124)	0.163
	NO_2	0.006 (-0.055, 0.066)	0.853
	CO	0.315 (-1.405, 2.035)	0.720
	O_3	-0.005 (-0.024, 0.014)	0.598
Rapid progressive motility sperm (%)	PM_{10}	0.003 (-0.013, 0.018)	0.740
	$PM_{2.5}$	<0.001 (-0.009, 0.010)	0.930
	SO_2	-0.103 (-0.202, -0.003)	0.043*
	NO_2	0.129 (0.046, 0.212)	0.002*
	CO	1.301 (-1.071, 3.674)	0.282
	O_3	0.011 (-0.015, 0.036)	0.420
Normal morphology sperm (%)	PM_{10}	0.003 (-0.008, 0.015)	0.606
	$PM_{2.5}$	0.003 (-0.004, 0.010)	0.443
	SO_2	-0.118 (-0.191, -0.046)	0.001*
	NO_2	0.127 (0.067, 0.187)	<0.001*
	CO	0.571 (-1.141, 2.284)	0.513
	O_3	0.011 (-0.007, 0.030)	0.232

* p < 0.05

Summary & Conclusions

Semen quality in southern Taiwan declined recently years. Furthermore, increasing age mainly influenced the sperm with normal morphology, total sperm count, progressive and rapid progressive sperm motility. SO_2 and NO_2 may had association with semen quality, but still need further evidence to confirm it.

Ultrasensitive Portable SERS-based Sensors for Diagnosis of Pesticide Poisoning

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Introduction: Pesticide intoxication is one of the leading causes of suicide attempt particularly in low-come and middle-income countries. In particular, organophosphate (e.g., chlorpyrifos, CPF) and paraquat (PQ) intoxication are common due to easy access in Asia. The pathologic mechanism of toxicity to human by these two pesticides is quite different, and thus early differential diagnosis between organophosphate and PQ intoxication facilitate proper emergent management in a short time. However, there are several limitations in current clinical standard diagnostic methods. Diagnosis by symptoms extremely depends on physician experience. Precise quantitative measurement of pesticide concentration cannot be attained by the urine sodium dithionite assay. Serum analysis for these pesticides is time-consuming and limited in specific facilities; for example, the quantitative measurement of serum PQ level costs at least 4 hours in hospital. Besides, not only for diagnosis purpose, the dynamic and serial monitoring of serum pesticide concentration could also guide the following management of intoxication.

Methods: Herein, a wafer-scale, ultrasensitive, highly uniform paper-based surface-enhanced Raman spectroscopy (SERS) detection platform was demonstrated. The abundant and dense gold nanopearls with narrow gaps could be directly formed on the fluorosilane-modified cellulous fibers having ultralow surface energy via simple thermal evaporation by delicately manipulating the atom diffusion behaviors.

Results: The as-designed paper-based SERS substrate demonstrates a sub-femtomolar detectable concentration (single-molecule level), and a great signal great reproductivity (relative standard deviation=3.97%), even operating with a portable 785-nm Raman spectrometer. Then, we demonstrated an accurate and rapid (< 30 min) differential diagnosis of intoxication from PQ and CPF via the analysis of one drop of serum based on the SERS paper, thus accordingly leading to the timely and proper treatment. Then, the serum samples collected from seven patients with acute pesticide exposure were analyzed via the SERS papers. According to their characteristic SERS spectra, the ingested pesticide species could be facilely determined as PQ (n=4, PI 1,2,6, and 7) or CPF (n=3, PI 3, 4, and 5) for the seven patients, which are perfectly matching the clinical diagnosis.

Conclusion: In summary, this scalable, portable, ultrasensitive fibrous SERS substrate opens a novel pathway for practical on-site detection in various applications, such as biofluid analysis, point-of-care diagnostic and precision medicine.

Keywords: Paper-based surface-enhanced Raman spectroscopy, pesticide, point-of-care diagnosis

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The significance of exposure to organophosphate flame retardants in patients with esophageal squamous cell carcinoma

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Keywords: organophosphate flame retardants; esophageal cancer; squamous cell carcinoma; survival

Introduction

Organophosphate flame retardants (OPFRs) are emerging and widespread environmental pollutants with potential impact on human health, including cancer. However, the significance of exposure to OPFRs in patients with esophageal squamous cell carcinoma (ESCC) remains unknown.

Methods

We conducted a cross-sectional study to measure urinary concentrations of 10 OPFR compounds in 87 patients with ESCC and correlated them with clinicopathological parameters and overall survival.

Results

The concentrations of some urine phthalate metabolites were higher in the ESCC group than in the control group, including bis(1,3-Dichloro-2-propyl) phosphate (BDCPP), bis(2-chloroethyl) phosphate (BCEP), tris(1,3-dichloro-2-propyl) phosphate (TDCPP). Univariately, urinary BCEP≧0.1μg/L (P=0.004), urinary TDCPP≧0.01μg/L (P=0.038), clinical T classification T4 (P=0.021), clinical N classification N2/3 (P=0.024), and clinical 8th AJCC stage IV (P=0.001) were significantly associated with inferior overall survival. In multivariate comparison, urinary BCEP≧0.1μg/L (P=0.033, odds ratio: 2.182), urinary TDCPP≧0.01μg/L (P=0.029, odds ratio: 2.002), and clinical 8th AJCC stage IV (P=0.029, odds ratio: 2.606) were independently associated with inferior overall survival.

Conclusions

Our findings suggested that elevated urinary BCEP and TDCPP were independently associated with advanced stage and poor overall survival in patients with ESCC, highlighting the potential of these OPFRs on ESCC progression.

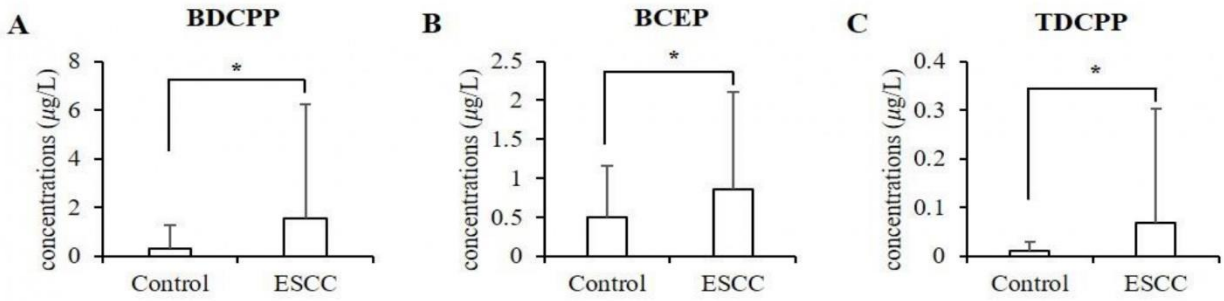

Figure 1. Urinary concentrations of OPFRs in 87 ESCC patients and 87 sex and age (+/- 4 years) matched control participants (A) BDCPP; (B) BCEP, and (C) TDCPP. ESCC: esophageal squamous cell carcinoma; BDCPP : bis(1,3-Dichloro-2-propyl) phosphate ; BCEP bis(2-chloroethyl)phosphate; TDCPP : tris(1,3-dichloro-2-propyl)phosphate. *: P≤ 0.005.

A CMOS MEMS based Membrane-bridge type Nanomechanical Sensing Device for Blood Lead Concentration Detection

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Introduction: Lead ions are difficult to metabolize in the human body and accumulation can result in organ failure and cause many diseases. In this study, we developed a CMOS MEMS based nanomechanical sensor with low cost, high sensitivity, quantitative detection, and real-time detection of lead ion concentration in the human body. The conductive polymer PEDOT:PSS that reacts with lead ions can generate stress and then produce a change in the resistance signal. As a result, this device can measure the concentration of lead ions in human serum samples with a linear range of 0.1 to 500 ppm, and the limit of detection of the sensor can reach 0.14 ppm.

Methods: In this study, the conductive polymer PEDOT:PSS was used as the identification element, and the film-forming properties of the conductive polymer were used to titrate 1 μL of the conductive polymer on the surface of the bridge-like membrane wafer with a micropipette and bake it at a constant temperature and time. PEDOT: PSS becomes a thin film after baking and adheres to the surface of the chip. When the conductive polymer reacts with lead ions, the bridge-like membrane generates stress and strain, which deforms the piezoresistive material and produces a change in resistance signal.

Results: According to the experimental results, this study measured the lead ion concentration in the human body, which were 0.1 ppm, 1 ppm, 10 ppm, 100 ppm and 500 ppm, and obtained a linear curve of the concentration change with the resistance. The limit of detection is 0.11 ppm. This study confirms that the bridge-like membrane nanomechanical sensor modified with conductive polymer has the ability to detect the lead ions concentration in the human body.

Conclusion: Our study provided a new device for blood lead detection using commercial CMOS MEMS compatible process, with on-chip thermal effect compensation module, polymer modified sensing array, small sample amount required (5 μL), and high sensitivity (0.01 ppm).

Keywords: Bridge-like membrane sensing, conductive polymer, PEDOT:PSS, human body detection, heavy metal ion

Exposure variability and determining factors of environmental endocrine disruptors- arsenic, cadmium, and lead in urine samples for schoolchildren in Taiwan

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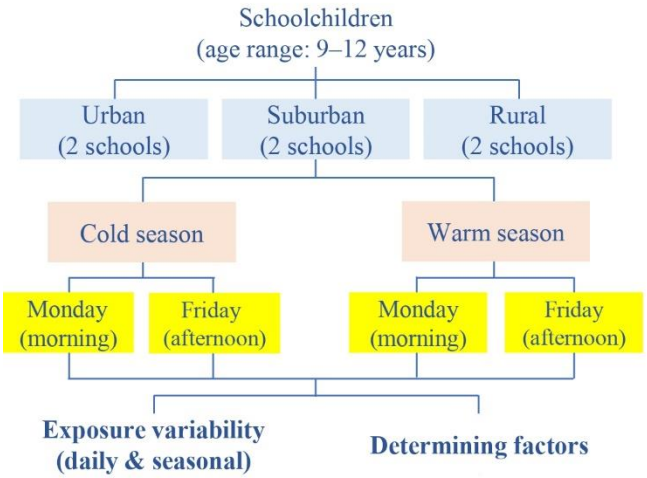
Keywords: urinary metal, children, exposure assessment, determining variable

Introduction

Exposure to environmental endocrine disruptors such as arsenic (As), cadmium (Cd), and lead (Pb) may cause adverse health effects in children. Human biomonitoring is commonly used for internal exposure estimates from all exposure routes. Urinary heavy metal levels in schoolchildren vary greatly over time, and research on the determinant variables explaining variance components in urinary metal exposure is limited. This study assessed metal concentrations and variability in the urine of schoolchildren and explored their important determining factors.

Methods

Urinary samples from 321 children (urban: 114; suburban: 152, and rural: 55) were collected for the 2014-2015 periods. Urine samples for children were collected at school on Monday mornings (8–9 a.m.) and Friday afternoons (3–4 p.m.) for one week during the warm (May to June) and cold (January to December) seasons to capture daily and seasonal variations. A total of 1176 spot urine samples were collected during the study period. Information on sex and body mass index was also collected from the school health offices.



In statistics, The mixed-effects model with log-transformed urinary metal concentrations was used to estimate the within-subject (σ^2_W) and between-subject (σ^2_B) variance components. The determinants were treated as fixed effects in the model. To evaluate the potentially high exposure to heavy metals for the study population, we calculated the "probability of overexposure (θ)"compared with the reference value (RV_{95}).

$$\theta = P\{\mu_{x(i)} > RV_{95}\} = 1 - \Phi\left\{\frac{\ln(RV_{95}) - \mu_y - \frac{\sigma^2_W}{2}}{\sqrt{\sigma^2_B}}\right\}$$

Results

The GM concentrations for As, Cd, and Pb were 58.4, 0.532, and 1.27 μg/g creatinine, respectively. Creatinine-corrected As, Cd, and Pb showed poor reproducibility (ICC= 0.046–0.311). Overall, the θ of As and Cd were >99.9%, while Pb was 87.1%. Location, season, sex, and urinary creatinine could affect urinary metal levels.

Model coefficients and variance components for spatial, temporal, and biological factors associated with urinary metals

Variables	As		Cd		Pb	
	E%	SE	E%	SE	E%	SE
Location (Ref.: rural)						
Urban	26.0*	0.089	− 25.3*	0.058	− 41.8*	0.065
Suburban	7.00	0.085	− 32.6*	0.056	− 35.0*	0.062
Season (Ref.: cold)						
Warm	− 15.1*	0.037	− 8.80*	0.027	16.0*	0.029
Time of sampling (Ref.: Afternoon)						
Morning	18.0*	0.036	− 4.00	0.026	11.0*	0.028
Sex (Ref.: girls)						
Boys	− 7.20	0.057	8.00*	0.036	− 12.3*	0.041
BMI (Ref.: 18.5≤ and <24)						
<18.5	11.0	0.058	11.0*	0.038	10.0*	0.043
≥24	12.0	0.092	2.00	0.060	0.00	0.067
σ^2_W	0.324	0.017	0.169	0.009	0.202	0.011
σ^2_B	0.136	0.020	0.045	0.008	0.061	0.010

*p-value ≤0.05, Effect% (E%) = (exp(β)-1) × 100; SE: standard error,

Conclusion

The repeated measurements of spot urine samples across seasons in individuals for long-term exposure estimates of metals were suggested. This biomonitoring survey of a large number of urine samples provided useful information on toxic metals and on the important determinants of exposure in schoolchildren.

國內高使用量藥品乙醯胺酚經高級氧化程序降解之鹵乙醯胺生成潛勢

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前言

乙醯胺酚（acetaminophen，Apap）係用於治療發燒及疼痛之非類固醇消炎藥物，為國內大量使用藥物之一，使用量隨著COVID-19的疫情上升而增加。因人體的**吸收率低**，Apap可透過排泄等方式進到廢污水處理和飲用水消毒程序中，經水處理之加氯消毒易生成高致癌性之**含氮消毒副產物鹵乙醯胺**（haloacetamides，HAcAms），其造成飲用水系統中之一大隱憂。

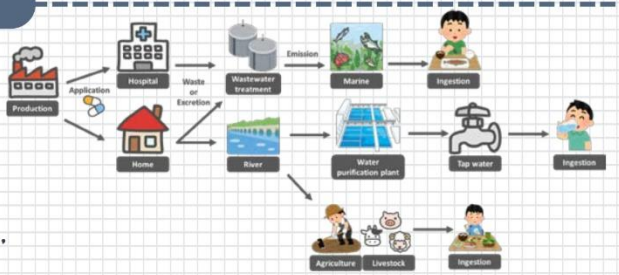
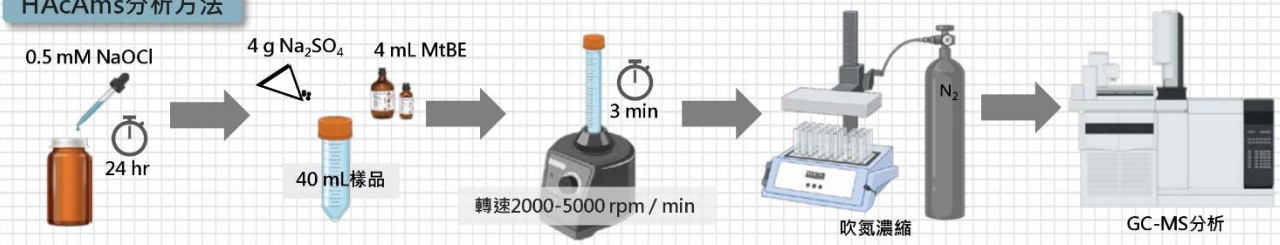


圖1、環境中PPCP流佈

方法

HAcAms分析方法



*Apap使用UPLC-MS/MS分析

結果

不同AOP程序去除Apap

添加Fe_3O_4@GO作為催化劑，搭配氧化劑H_2O_2或$Na_2S_2O_8$時，可有效降解水中Apap，且$Na_2S_2O_8$/Fe_3O_4@GO**去除率可達99.9%**。

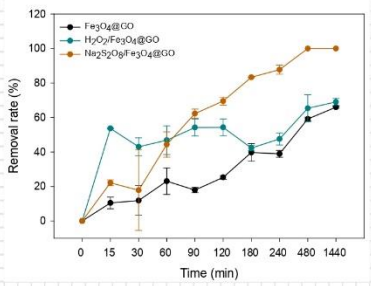


圖2、不同AOP降解水中Apap之效果

處理後HAcAms生成潛勢

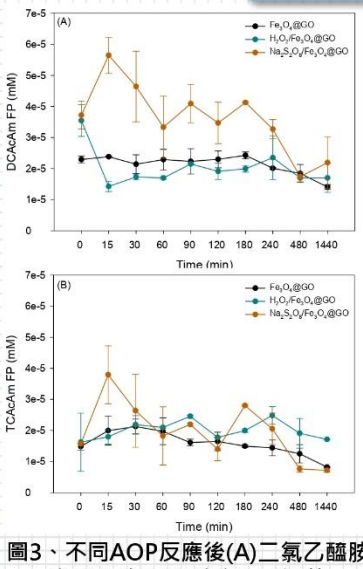
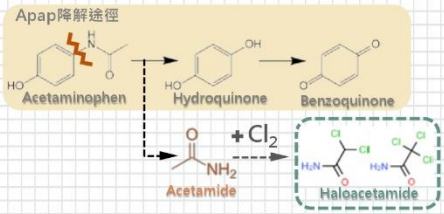


圖3、不同AOP反應後(A)二氯乙醯胺和(B)三氯乙醯胺之生成潛勢

添加氧化劑$Na_2S_2O_8$雖可有效降解水中Apap，但在短時間內**致癌性HAcAms生成潛勢較高**，但若延長反應時間，HAcAms生成潛勢仍逐漸降低。



氧化劑會**優先攻擊**Apap結構上之**乙醯胺官能基**，在經過加氯消毒後較容易生成HAcAms。

結論

1. AOP技術可**有效去除水中Apap**，惟須注意氧化劑之選用與反應時間之控制。
2. 若將來此技術應用於廢污水處理系統，應可有效**降低**水中**藥品污染物**與其衍生**致癌副產物生成**之危害。

本計畫感謝國科會經費支持 MOST -110-2628-E-110-001-

Keywords: $PM_{2.5}$, dust level, PBDE, PBDD/F, toxicity

The Effects of $PM_{2.5}$ from Southern Taiwan on the Induction of Toxicity in *Caenorhabditis elegans*

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Introduction: Particulate matter (PM) is considered the air pollutant. Health effects caused by inhaled $PM_{2.5}$ are associated with oxidative stress, particles' chemical components, exposure intensity and age. However, the toxic effects and composition of $PM_{2.5}$ collected from suburban, residential, and industrial sites in southern Taiwan remain unclear.
Caenorhabditis elegans (C. elegans) has many characteristics that are common in higher organisms, we selected them to estimate whether PM2.5 induced toxic effects in *C. elegans*.

Methods:

$PM_{2.5}$ samples were collected using a high flow sampler (SIBATA HV-1000R)

sampling location

- Suburbs: Ronghua Elementary School, Dongning Elementary School, Alian
- Residential areas (traffic pollution sources): Chaozhou Elementary School, Renai Elementary School, Lingya District, Kaohsiung
- Industrial Zone: Daihatsu Company

$PM_{2.5}$ Sample weighing and extraction

$PM_{2.5}$ extracts exposed to *C. elegans*

- Lethality Assay
- Growth Measurement Assay
- Reproductive Assay
- Locomotion Assay
- lifespan Assay

Results:

Table 1. Analysis results of PAHs in $PM_{2.5}$ collected from suburban areas, residential areas, and industrial areas

PAHs in $PM_{2.5}$	Suburban site		Residential site		Industrial site	
ng	Average ± SD	Max.	Average ± SD	Max.	Average ± SD	Max.
PM2.5 concentration	43.1 ± 15.6	54.0	85.0 ± 55.3	148.8	57.8	57.8
Napthalene (Nap)	491.1 ± 46.4	526.2	369.5 ± 21.4	390.1	376.1	376.1
Acenaphthylene (AcPy)	10.6 ± 6.5	17.9	9.8 ± 3.7	13.3	8.3	8.3
Acenaphthene (AcP)	<2.0	5.3	<2.0	0.0	<2.0	0.0
Fluorene (Flu)	16.2 ± 13.1	30.8	14.3 ± 5.7	19.5	15.0	15.0
Phenanthrene (PA)	37.5 ± 10.4	45.6	34.4 ± 4.4	37.7	39.5	39.5
Anthracene (Ant)	8.6 ± 2.0	10.0	4.9 ± 0.4	5.1	5.7	5.7
Fluoranthene (FL)	58.9 ± 36.0	91.8	49.8 ± 20.6	71.5	45.9	45.9
Pyrene (Pyr)	61.1 ± 38.3	96.7	50.2 ± 20.4	72.8	49.1	49.1
Benzo[a]anthracene (BaA)	29.7 ± 20.1	47.8	23.0 ± 9.2	33.2	32.2	32.2
Chrysene (CHR)	72.5 ± 51.4	119.9	67.7 ± 33.1	95.4	98.5	98.5
Benzo[b]fluoranthene (BbF)	141.0 ± 106.6	241.7	120.6 ± 57.2	161.0	198.9	198.9
Benzo[k]fluoranthene (BkF)	62.3 ± 50.9	112.3	48.0 ± 24.1	68.5	71.1	71.1
Benzo[a]pyrene (BaP)	109.3 ± 99.2	211.9	79.8 ± 47.6	134.7	72.4	72.4
Indeno(123-cd)pyrene (IND)	361.7 ± 279.8	630.3	254.9 ± 127.1	399.8	224.2	224.2
Dibenz[a,h]anthracene (DBA)	26.7 ± 20.6	46.8	14.5 ± 4.5	19.2	20.3	20.3
Benzo[g,h,i]perylene (BghiP)	406.8 ± 344.4	761.1	302.2 ± 177.6	502.2	231.8	231.8
Total PAH	1893.0 ± 1117.0	2978.5	1443.4 ± 504.5	2022.2	1489.2	1489.

The results revealed that total $PM_{2.5}$ concentrations are in the ranges of 23.5–54.0 μg/m^3, 50.1–148.8 μg/m^3 and 57.8 μg/m^3 for the suburban site, residential site and industrial site, respectively. Total Polycyclic Aromatic Hydrocarbons (PAHs) concentrations in $PM_{2.5}$ are in the ranges of 747.0–2978.5 ng, 1097.0–2022.2 ng and 1489.2 ng for the suburban sites, residential sites and industrial site, respectively.Using *C. elegans* as an in vivo animal model, we found that exposure to 0.1–100 mg/L $PM_{2.5}$ could induce toxicity in nematodes that affects growth, reproduction, and locomotion behavior. Among them, the toxic effect of $PM_{2.5}$ collected in residential and industrial sites were greater than those in suburban sites. In addition, suburban $PM_{2.5}$ treatment significant decreased antioxidant gene mRNA expression, but industrial $PM_{2.5}$ treatment significant increased mRNA expression of the antioxidant gene in *C. elegans*.

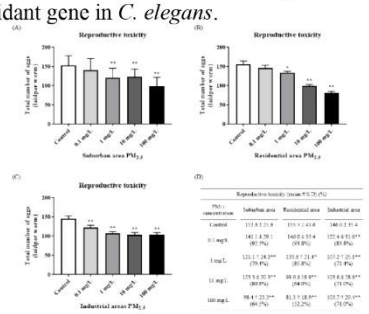

Figure 1. After 24 hours of exposure to different concentrations of $PM_{2.5}$ in (A) suburbs, (B) residential areas, and (C) industrial areas, the effect on the number of eggs laid by *C.elegans* and (D) the analysis results. *p < 0.05; **p < 0.01 versus the control group.

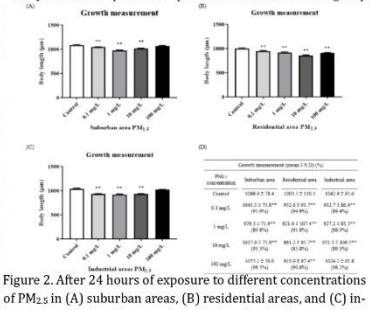

Figure 2. After 24 hours of exposure to different concentrations of $PM_{2.5}$ in (A) suburban areas, (B) residential areas, and (C) industrial areas, the effects on the body length of *C.elegans* and (D) analysis results. *p < 0.05; **p < 0.01 versus the control group.

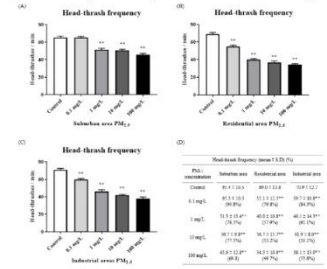

Figure 3. After 24 hours of exposure to different concentrations of $PM_{2.5}$ in (A) suburban areas, (B) residential areas, and (C) industrial areas, the impact on the frequency of head oscillations of *C.elegans* and (D) analysis results. *p < 0.05; **p < 0.01 versus the control group.

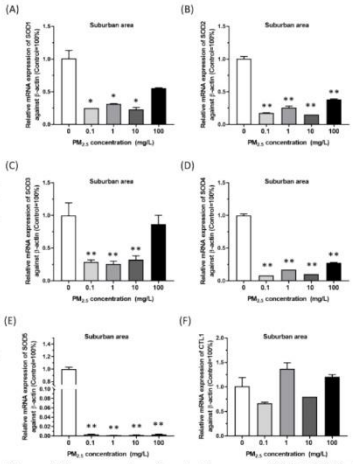

Figure 4. The expression of antioxidant genes (SOD1, SOD2, SOD3, SOD4, SOD5, CTL1) was analyzed by real time PCR after *C.elegans* were exposed to different concentrations of suburban $PM_{2.5}$ for 24 hours. *p < 0.05; **p < 0.01 versus the control group (T-test).

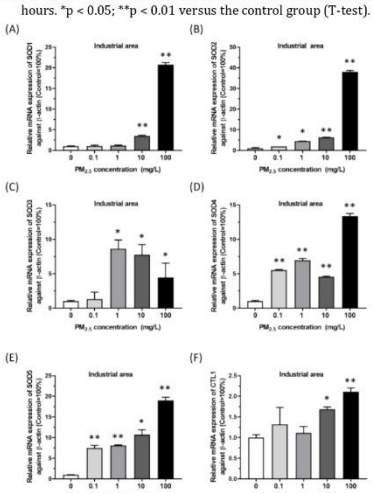

Figure 5. The expression of antioxidant genes (SOD1, SOD2, SOD3, SOD4, SOD5, CTL1) was analyzed by real time PCR after *C.elegans* were exposed to different concentrations of industrial $PM_{2.5}$ for 24 hours. *p < 0.05; **p < 0.01 versus the control group (T-test).

Conclusion: These findings reveal that residential and industrial $PM_{2.5}$ have more serious health effects than suburban $PM_{2.5}$, and *C. elegans* is a sensitive in vivo model that can be used for the biological evaluation of the toxicity of particulate matter.

Comparison of DRE and HRE Responses to AhR Signaling - An In Vitro Dual-Luciferase Reporter Assay

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Keywords: DRE, HRE, AhR, ARNT, HIF-α

Introduction

DREs (dioxin response elements), also known as xenobiotic response elements (XREs), within the promoter regions of target genes have been reported to depend on aryl hydrocarbon receptor (AhR) transcriptional regulation. Hypoxia response elements (HREs) are also regulated by AhRs to sense oxidative stress[1]. This homeostasis of signaling pathways control cell proliferation, migration, and senescence[2]. However, the regulatory dynamics of the triggering of the transactivation domain by the AhR complex still need to be elucidated in different kinds of biological activities.

Methods

To study DRE and HRE regulation by xenobiotics and environmental AhR ligands or agonists, we established AhR reporter cell lines in various cell types. The AhR reporter construct consists of a DRE fusion inducible SEAP (secreted embryonic alkaline phosphatase) and HRE fused to Lucia luciferase. We screened for AhR activity by stimulating cells with some typical ligands. We further examined extracts of medicinal plants and mushrooms and evaluated them through the time course of dual luciferase activity. In addition, AhR-related mRNA expressions, such as Cyp1a1, SULT1a1, and UGT1a8 expression, were detected by qPCR. Furthermore, we performed immunofluorescent staining of the AhR counterparts ARNT and HIF-α to discriminate pathways of AhR transcriptional activity. To elucidate whether metabolites induce AhR transcriptional activity, we assessed the activity of the tryptophan metabolizing enzyme aldehyde dehydrogenase (ALDH) using spectrophotometric analysis and flow cytometry.

Results

- Some extracts with higher DRE luciferase activity were dose-dependently associated with significant tryptophan metabolizing enzyme activity.
- ALDH sensitivity was increased in specific cell types independent of DRE and HRE reporter activity after stimulating the extracts.
- Immunofluorescent staining signals of AhR counterparts ARNT and HIF-α and mRNA expression levels of AhR target genes suggested specific downstream responses to DRE and HRE at specific time intervals.

Conclusion

The established experimental system, based on dissecting the DRE/HRE decision pathway from AhR stimulation, may be a valuable tool for assessing cellular responses to xenobiotic and environment-host interactions.

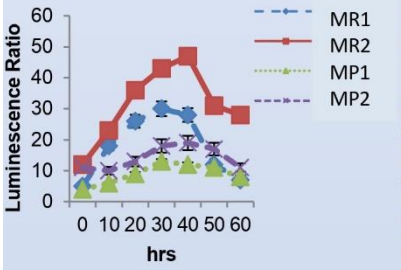
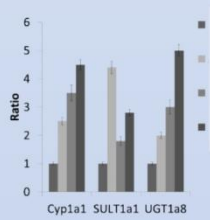


Fig. 1 AhR reporter cell line screening. DRE-SEAP, HRE-Lucia luciferase and firefly luciferase (control luciferase) were transduced into multiple cell lines. Extracts of medicinal plants (MP) and mushrooms (MR) were incubated to AhR reporter cells and evaluated dual luciferase activity. I3C and FICZ (5 μM) treated for 20h and further incubated with luminol as control. The DRE/HRE activity was detected by measuring chemiluminescence and SEAP for different time intervals. Data show mean ± SD from two independent experiments.



no.	Primer name	Primer sequence
1	CYP1A1 forward	CAAGAGGAGCTAGAC ACAGTGATT
2	CYP1A1 reverse	AGCCTTTCAAACTTGT GTCTCTTGT
3	SULT1A1 forward	GGAGTTCATGGACCA CAGCATC
4	SULT1A1 reverse	CCTGCCATCTTCTCCG CATAGT
5	UGT1A8 forward	GCTCTAAAAGCAGTC ATCAATGAC
6	UGT1A8 reverse	GTGCCTCATCACAAA CTCCACC

Fig. 2 Transcriptional activation of AhR/ARNT regulated genes. The expression level of mRNA for the AhR was evaluated by RT-qPCR. The PCR products were quantified using SYBR green real-time PCR by Roche LightCycler LC480 Instrument. Sample transcript levels were normalized to the expression of the housekeeping gene *GAPDH*.

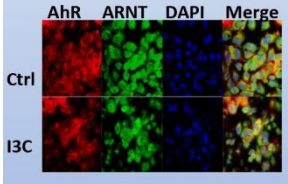


Fig. 3 Subcellular localization of AhR and ARNT. Reporter cells were stimulated with AhR ligand for and fixed cells by cold methanol. Immunofluorescence staining of AhR and ARNT using anti-AhR and ARNT antibodies with fluorescence-conjugated secondary antibodies. The fluorescence signal were analyzed by confocal microscopy

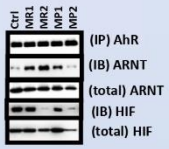


Fig. 4 Coimmunoprecipitation of AhR with ARNT and HIF. Reporter cell were stimulated with AhR ligands for 20h and were fractionated to nucleus and cytosol fractions or lysis by RIPA buffer for harvesting total lysates. The lysates were precleared by protein A beads and immunoprecipitation (IP) with anti-AhR antibody. After PBST washing, pulldown lysates were subjected to SDS-PAGE and transfer to PVDF membrane for ARNT or HIF-α antibodies immunoblotting (IB).

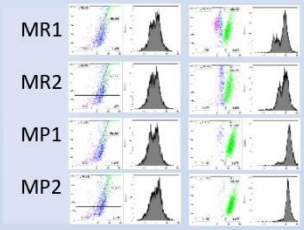


Fig. 5 ALDH and IDO activity, Reporter backbone cell were stimulated with extracts for 20h and were stained with ALDEFLUOR dye. The ALDH activity was monitored by flow cytometry. The changes of fluorescence were analyzed using Kaluza Analysis Software.

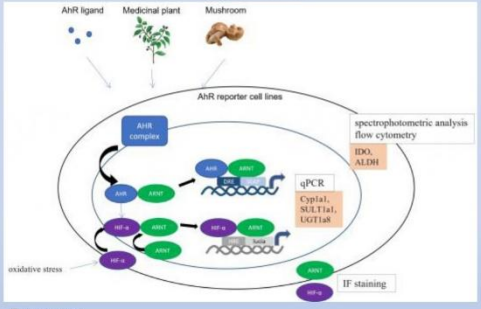


Fig. 6 Concept map.

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2. Aryl hydrocarbon receptor (AhR) reveals evidence of antagonistic pleiotropy in the regulation of the aging process. Salminen A. Cell Mol Life Sci. 2022 Aug 20;79(9):489.

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Impact of $PM_{2.5}$ in Pingtung Atmosphere on the toxic effects on A549 cells

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Introduction

Aerodynamics Fine particulate matter with a diameter of less than 2.5 μm ($PM_{2.5}$) is a serious air pollutant associated with health problems. $PM_{2.5}$ is attached to many toxic substances, such as polycyclic aromatic hydrocarbon (PAHs), which is formed by the polymerization of two or more benzene rings. PAHs are widely distributed in the environment. There are a lot of type of PAHs such as carcinogenic and mutagenic. The most potent PAH carcinogens identified include benzo [a] anthracene, benzo [a] pyrene, and dibenz [a,h] anthracene. In this study, the biological model of A549 cells was used to analyze the growth, death, wound repair and gene expression of cells exposed to $PM_{2.5}$, and to investigate the content of heavy metals and PAHs in $PM_{2.5}$.

Materials and Methods

The method that used in this experiment are the high-flow sampler SIBATA was used to collect atmospheric samples in three areas (suburban, urban and industrial) in southern Taiwan. Then the sample of $PM_{2.5}$ was divide into two different sample. The first samples were sent to Taiwan Zhengxiu University of Science and Technology to analyze composition of heavy metals and polycyclic aromatic hydrocarbons(PAHs) in the atmosphere . The second samples were exposed to the A549 cell model to analyze the cell growth, death, wound healing and cell gene expression. The genes were measured by Real Time PCR. The detected genes included (Anti-oxidant genes CuSOD, MnSOD, CAT, GPX-1, GPX-2, Anti-inflammatory genes IL-4, IL-6, IL-8, IL-10 and calibration gene GAPDH). The statistical analysis and drawing software used are Excel 2016, Prism7, ImageJ.

Results and Discussion

Table1. Analyzed concentration of $PM_{2.5}$, heavy metals and PAHs in the atmosphere of three areas (suburban, urban and industrial)

Heavy Metals in $PM_{2.5}$	Suburban		Urban		Industrial	
	Average ± SD	Maximu m	Average ± SD	Maximu m	Average ± SD	Maximu m
$PM_{2.5}$ Conc. (μg/m³)	43.1 ± 15.6	54.0	85.0 ± 55.3	148.8	57.8	57.8
Na (μg/m³)	139.5 ± 32.4	155.0	148.7 ± 55.8	233.0	75.7	75.7
Mg (μg/m³)	80.1 ± 10.2	90.4	94.8 ± 34.1	134.0	63.0	63.0
Al (μg/m³)	285.7 ± 53.6	314.0	448.3 ± 277.9	767.0	241.0	241.0
K (μg/m³)	128.2 ± 50.3	179.0	151.6 ± 83.1	244.0	85.5	85.5
Ca (μg/m³)	14.2 ± 2.9	17.6	19.0 ± 3.3	21.3	<12.5	0.0
Ti (μg/m³)	4.6 ± 0.6	5.2	5.9 ± 2.4	8.7	4.9	4.9
V (μg/m³)	0.7 ± 0.2	0.9	0.9 ± 0.4	1.1	0.3	0.3
Cr (μg/m³)	4.4 ± 1.1	5.7	4.2 ± 0.4	4.6	4.2	4.2
Mn (μg/m³)	6.7 ± 1.7	8.4	7.1 ± 2.4	8.6	8.9	8.9
Fe (μg/m³)	209.3 ± 20.8	217.0	274.0 ± 118.8	397.0	201.0	201.0
Co (μg/m³)	<0.2	-	<0.2	-	<0.2	-
Ni (μg/m³)	5.8 ± 1.7	7.8	7.7 ± 1.8	8.9	5.7	5.7
Cu (μg/m³)	1.8 ± 0.3	2.1	3.7 ± 2.9	5.8	6.6	6.6
Zn (μg/m³)	25.7 ± 4.3	30.5	22.4 ± 9.4	32.7	40.9	40.9
As (μg/m³)	1.1 ± 1.2	2.4	0.3 ± 0.1	0.4	0.4	0.4
Se (μg/m³)	0.5 ± 0.2	0.6	0.4 ± 0.1	0.4	0.3	0.3
Rb (μg/m³)	0.7 ± 0.4	1.0	<0.2	0.8	<0.2	0.0
Sr (μg/m³)	1.0 ± 0.2	1.2	1.4 ± 0.5	1.9	0.8	0.8
Mo (μg/m³)	26.8 ± 1.6	28.2	23.9 ± 1.4	25.3	26.6	26.6
Pm (μg/m³)	<0.2	-	<0.2	-	<0.2	-
Eu (μg/m³)	<0.2	-	<0.2	-	<0.2	-
Pd (μg/m³)	<0.2	-	<0.2	-	<0.2	-
Cd (μg/m³)	<0.2	-	<0.2	-	<0.2	-
Sn (μg/m³)	0.6 ± 0.3	0.8	0.5 ± 0.2	0.7	1.1	1.1
Sb (μg/m³)	0.5 ± 0.1	0.5	0.3 ± 0.2	0.7	0.7	0.7
Ba (μg/m³)	4.5 ± 0.4	4.8	6.1 ± 1.6	7.9	8.5	8.5
Pt (μg/m³)	<0.2	-	<0.2	-	<0.2	-
Hg (μg/m³)	<0.2	-	<0.2	-	<0.2	-
Tl (μg/m³)	<0.2	-	<0.2	-	<0.2	-
Pb (μg/m³)	4.1 ± 0.9	5.1	3.8 ± 1.9	6.0	13.2	13.2
Li (μg/m³)	<0.2	-	<0.2	-	<0.2	-
Be (μg/m³)	<0.2	-	<0.2	-	<0.2	-
Ag (μg/m³)	<0.2	-	<0.2	-	<0.2	-

PAHs in $PM_{2.5}$	Suburban		Urban		Industrial	
	Average ± SD	Maximum	Average ± SD	Maximum	Average ± SD	Maximum
$PM_{2.5}$ concentration (μg/m³)	43.1 ± 15.6	54.0	85.0 ± 55.3	148.8	57.8	57.8
Napthalene (Nap)	491.1 ± 46.4	526.21	369.5 ± 21.4	390.10	376.12	376.12
Acenaphthylene (AcPy)	10.6 ± 6.5	17.86	9.8 ± 3.7	13.31	8.25	8.25
Acenaphthene (AcP)	<2.0	3.25	<2.0	0.00	<2.0	0.00
Fluorene (Flu)	16.2 ± 13.1	30.83	14.3 ± 5.7	19.51	15.02	15.02
Phenanthrene (PA)	37.5 ± 10.4	45.55	34.4 ± 4.4	37.75	39.48	39.48
Anthracene (Ant)	8.6 ± 2.0	10.03	4.9 ± 0.4	5.13	5.74	5.74
Fluoranthene (FL)	58.9 ± 36.0	91.82	49.8 ± 20.6	71.73	45.90	45.90
Pyrene (Pyr)	61.1 ± 38.3	96.74	50.2 ± 20.4	72.80	49.09	49.09
Benzo[a]anthracene (BaA)	28.7 ± 20.1	47.79	23.0 ± 9.2	33.20	32.17	32.17
Chrysene (CHR)	72.5 ± 51.4	119.89	47.7 ± 10.1	95.44	98.48	98.48
Benzo[b]fluoranthene (BbF)	141.0 ± 106.6	241.73	120.6 ± 37.2	161.01	198.95	198.95
Benzo[k] fluoranthene (BkF)	62.3 ± 50.9	112.33	48.0 ± 24.1	68.49	71.13	71.13
Benzo[e]pyrene (BeP)	109.3 ± 99.2	211.86	78.85 ± 47.6	134.66	72.44	72.44
Indeno(123-cd)pyrene (IND)	361.7 ± 279.8	630.29	254.9 ± 127.1	399.79	224.25	224.25
Dibenz[a,h]anthracene (DBA)	26.7 ± 20.6	46.85	14.5 ± 4.5	19.19	20.30	20.30
Benzo[g,h,i] perylene (BghiP)	406.8 ± 344.4	781.05	302.2 ± 177.6	502.20	231.83	231.83

- *Table 1 show the results of heavy metal composition analysis for concentration of arsenic in suburban area (1.1 ± 1.2 μg/m3) > industrial area (0.351 μg/m3) > urban area (0.3 ± 0.1 μg/m3).*
- *The concentrations of mercury and cadmium were less than 0.2 μg/m3. Concentrations of heavy metals such as arsenic, cadmium and mercury were all lower than the per capita daily intake (DI).*
- *The most highest result for PAHs concentration of benzo [a] pyrene was in suburban area (361 ± 279 ng)> residential area (254 ± 127 ng)> industrial area (72.4 ng).*
- *The concentration of benzo [a] fluorescence was higher in industrial area (198.9 ng) than in suburban area (141.0 ± 106.6 ng) than in residential area (120.6 ± 57.2 ng).*
- *The main PAHs (benzo [a] pyrene, Benzo [a] fluorine) in three of these regions were lower than the per capita daily intake (DI) in the health risk assessment*

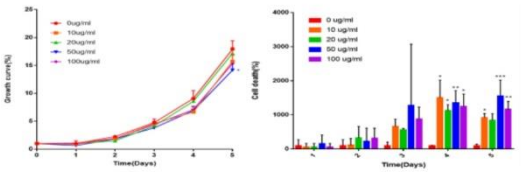

Fig.2 Growth curve and death rate of A549 cells exposed to $PM_{2.5}$ (0, 10, 20, 50, 100 μg/ml)
(a) Growth curve ; (b) Death rate

- *The growth, death of A549 cells exposed to different concentrations of $PM_{2.5}$ were shown in Fig.2. In the growth curve, 20 μg/mL and 0 μg/mL on the fourth day were similar, while the rest concentrations were much lower than 0 μg/mL, and 50 μg/mL. .*
- *The growth curve show the concentration of 50 μg/ml has the lowest growth rate and the highest cell death compare to other concentration.*
- *The exposure to 50 μg/mL cc was the main concentration affecting cell growth and death.*

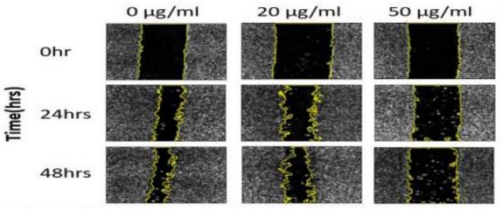

Fig.3 Wonder healing of A549 cells exposed to $PM_{2.5}$ (0, 20, 50 μg/ml)

- *Figure 3 show the result of wound healing. Considering that $PM_{2.5}$ samples are limited the concentration of PM2.5 that been used are 20 and 50 μg/ml which is the most important factor affecting the growth and death of A549 cells.*
- *It can seen from the figure 3 that concentration of 50 μg/ml is obviously slower to healed.*
- *Using ImageJ, it can be calculated that the area healing rates for 20 μg/ml was 62% and for 50 μg/ml the healing rate was 6%.*
- *It can been conclude that the concentration $PM_{2.5}$ of 50 μg/ml had the slower wound healing rate*

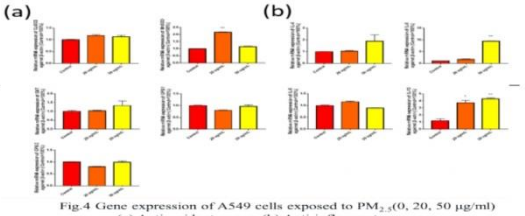

Fig.4 Gene expression of A549 cells exposed to $PM_{2.5}$ (0, 20, 50 μg/ml)
(a) Anti-oxidant genes (b) Anti-inflammatory genes

- *Fig.4 shows the gene expression of A549 cells (a) anti-oxidant gene (b) anti-inflammatory gene.*
- *In the part of the anti-oxidant gene, except for the correlation between MnSOD 20 μg/ml and 0 μg/ml, other genes did not have particularly high expression.*
- *There was a significant correlation between 50 μg/ml and 0 μg/ml in both IL-6 and IL-10 anti-inflammation genes, which confirmed that an environment with high concentration of $PM_{2.5}$ would cause higher inflammatory factors, thus leading to DNA damage.*

Conclusion

The concentrations of major heavy metals and PAHs were lower than the average daily intake (DI). The 50 μg/ml concentration of $PM_{2.5}$ in the A549 cell test was the main concentration that affects cell growth, death, wound repair, and gene expression. Therefore, the A549 cell exposure test was considered to be an easily available and reliable test to assess the toxicity of $PM_{2.5}$, but these assumptions need to be further studied.

$PM_{2.5}$ emitted from an air fryer and its adverse effects on *Caenorhabditis elegans models*

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Introduction

In recent years, as people's dietary habits change, a lot of modern families use air fryers, which are used in enclosed spaces to generate cooking fumes emitting to the indoor air. An air fryer is designed as a small oven with function of countertop convection to simulate deep frying of food without oil. Air fryers use circulation of heated air in oven to cook food without submerging in oil. Most scientists recognize air pollutants including $PM_{2.5}$ generated from an air fryer to affect indoor air quality. It is still unclear the characteristics or toxicity of indoor air related with air fryer emission. The polluted indoor air possibly affects human health to cause several adverse health effects, such as heart attack and respiratory and cardiovascular diseases. $PM_{2.5}$ has been classified as a Class I carcinogen by the World Health Organization (WHO). Therefore, this study aimed to characterize the indoor $PM_{2.5}$ pollution emitted from air fryers to further test the effect of $PM_{2.5}$ toxicity on *Caenorhabditis elegans* (*C. elegans*). The life cycle of *C. elegans* is divided into embryonic, larval, and adult stages, and the hatchlings go through four stages from L1 to L4, with a life span of about 2-3 weeks and a 60-80% genetic similarity to humans. The endpoints of toxicity in *C. elegans* were conducted to test five major items: lethality assay, reproductive assay, locomotor assay, growth measurement, and lifespan analysis

Materials and Methods

Experiment

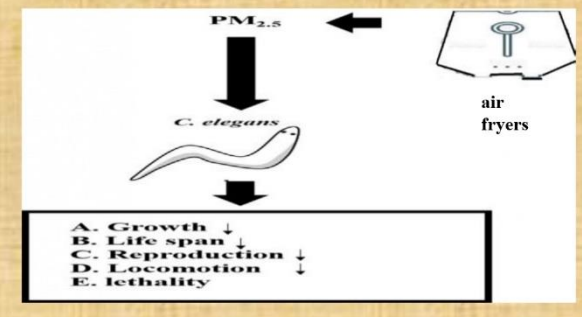


Fig 1. The method of *C.elegans* experiments

Results and Discussion

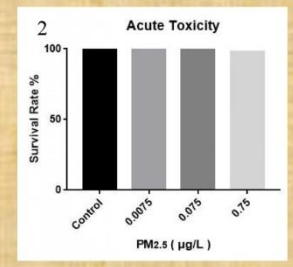


Fig 2. The Acute Toxicity of *C. elegans* exposed to different concentrations of $PM_{2.5}$

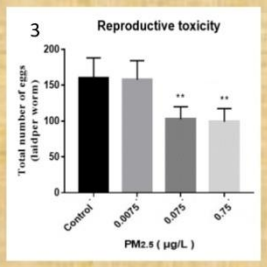


Fig 3. Reproductive toxicity of *C. elegans* exposed to different concentrations of $PM_{2.5}$

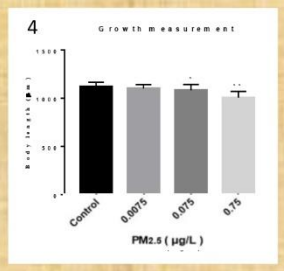


Fig 4. *C. elegans* exposure to different concentrations of $PM_{2.5}$ for Growth measurement

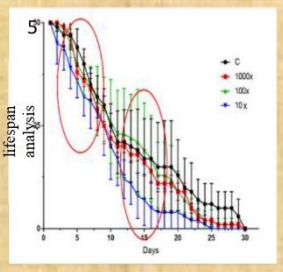
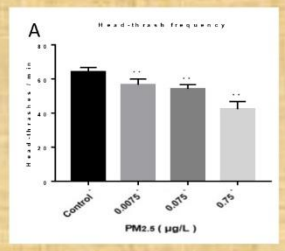


Fig 5. lifespan analysis of *C. elegans* exposed to different concentrations of $PM_{2.5}$ to determine the effect



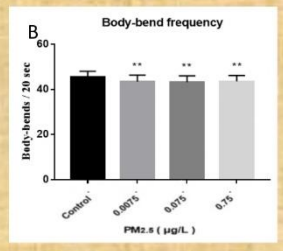


Fig 6(A,B). The effect of movement behavior of elegans exposed to different concentrations of $PM_{2.5}$ is shown on the left for the effect of head swinging and on the right for the effect of body bending

For the nematode test, there was no significant difference in the lethality test Fig 2, and the change in lethality will be investigated again in the future by exposing to higher concentrations or increasing the exposure time. In the reproductive toxicity test Fig 3, $PM_{2.5}$ did not have any significant effect on *C. elegans* at 7.5×10^{-3} μg/L. The reproductive toxicity effect on *C. elegans* started at 7.5×10^{-2} μg/L and 7.5×10^{-1} μg/L. A reduction in the number of offspring due to $PM_{2.5}$ was observed compared to the control group. In terms of locomotor behavior, Fig 6(A,B), the effect of $PM_{2.5}$ reduced the locomotor behavior of *C. elegans*, and the reduction in head movement and body bending was also found to be more pronounced. In the body length measurement, Fig 4, the concentrations of 7.5×10^{-1} μg/L, 7.5×10^{-2} μg/L, and 7.5×10^{-3} μg/L showed a gradual decrease in body length, so it was inferred that higher $PM_{2.5}$ concentrations would cause *C. elegans* to have shorter body length. In Fig 5, it was found that the number of nematodes at concentrations of 7.5×10^{-2} μg/L and 7.5×10^{-3} μg/L was lower than that of the control group after the fifteenth day, thus it was observed that exposure to high concentrations of $PM_{2.5}$ samples shortened the life span of *C. elegans* over a long period of time.

Conclusion

1. 0.075-0.75 μg/L air fryer $PM_{2.5}$ will cause nematode reproductive toxicity, neurotoxicity, affect development and shorten life span.
2. Prolonged exposure to $PM_{2.5}$ in air fryers is worth further clarification of the impact on human health.
3. It is also suggested that other physiological characteristics of *C. elegans* can be studied and evaluated for different aspects.

Nano-toxic effects of Boron Carbide (B_4C) nanoparticles on *Caenorhabditis elegans*

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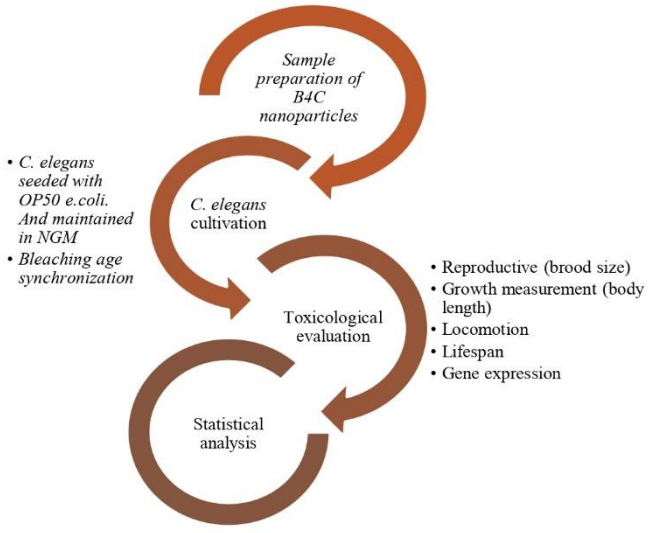
Introduction

Boron carbide (B_4C) is a widely known boron-carbon ceramic material. It is one of the hardest ceramic materials known, falling short to diamond and cubic boron nitride. Its other properties consists of high melting point (2427°C) and good mechanical properties. Due to its unique properties, the material has been used for several industrial application such as cutting tools, grinding wheels, neutron absorber in nuclear power, and ballistic armor. Due to the increasing demand for B_4C as a sapphire abrasive, increasing amount of B_4C waste are produced which causes environmental issues. *Caenorhabditis elegans(C.elegans)* is an advantageous model organism for environmental toxicity due to its transparency of its body, short life span, and reproduction rate. In addition, *C. elegans* possess similar biochemical pathways to humans which helps with the evaluation of possible nanotoxicity of nanoparticles in humans. This study aims to evaluate the potential adverse effects of concentrations of boron carbide in *C. elegans,* specifically the reproduction, growth measurement, locomotion, lifespan, and gene expression.

Materials and Methods

C. elegans wild-type N2 was cultivated and maintained in nematode growth medium (NGM) and seeded with E.coli OP50 at 20°C. The nematodes were sustained until eggs emerged and then age synchronized eggs were obtained through bleaching age synchronization technique for the toxicity assay. The physiological changes from the nematodes were observed using a dissecting microscope.

For the toxicity assay, the nematodes are exposed to 40, 80, 160, 320 mg/L. Growth measurement was performed by taking pictures of L4 nematodes body length after 72 hours of exposure. The photography was prepared using ImageJ software. For the locomotion assay, the head thrashing and body bending of nematodes under 72 hrs of exposure were observed for 1 min and 20 secs, respectively. The brood size of the nematodes were observed. For the lifespan assay, the nematodes exposed for 72 hrs were placed in a new NGM and were counted every day until all nematodes were dead. The exposed nematodes were collected and the total RNA conc. were extracted using TRIzol reagent which was then followed by RT-PCR. The gene expression of SOD-1, SOD-3, CTL-2, MTL-2, and Cyp35a2 were quantified.



Results and Discussion

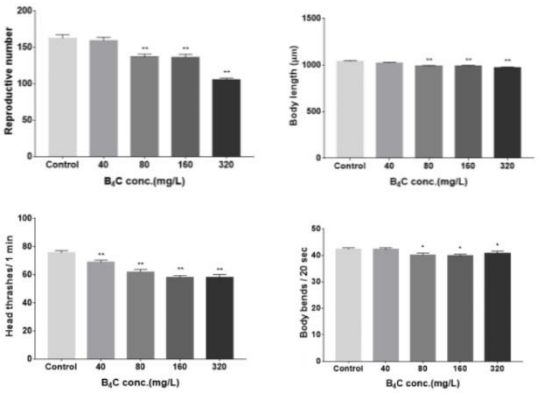


Figure 1. Toxic assessment on *C.elegans* after B_4C exposure. Reproductive (top left). Body length (top right). Locomotion-Head thrashing (bottom left). Body bending (bottom right).

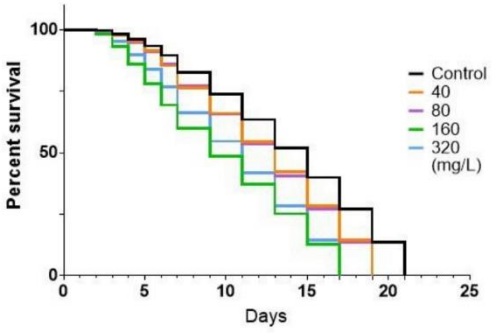


Figure 2. Lifespan evaluation after exposure to B_4C concentrations

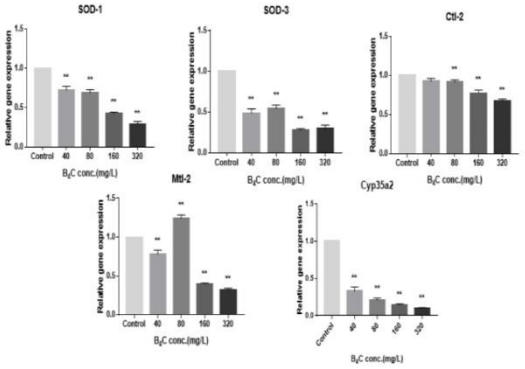


Figure 3. Effect of B_4C on gene expression in *C. elegans*. SOD-1, SOD-3, CTL-2 (top left to right). MTL-2 and CYP35a2 (bottom left and right).

Conclusion

Consequently, the prolonged exposure to higher concentrations of B_4C resulted to negative effects in reproduction, locomotion, shortens lifespan, induces oxidative stress, and decreases metal detoxification in *C.elegans*. It is recommended to further investigate the interaction of B_4C nanoparticles to the environment.

Urinary Phthalate Metabolites and Human Semen Quality Parameters

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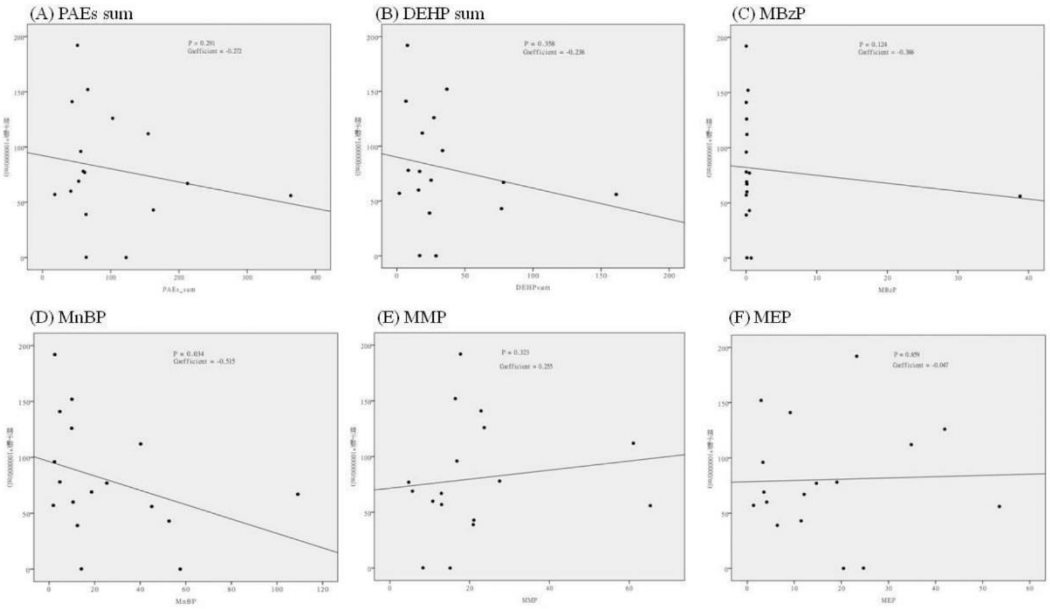
Introduction: Exposure to phthalates has been demonstrated to have adverse impacts on male reproductive functions in animal studies, however, the findings in human studies have been inconsistent. Our aim is to explore the association between environmental phthalates exposure and human semen quality.

Methods: One spot urine sample and semen sample were collected from 33 healthy volunteers. Urinary concentration of 8 phthalate metabolites (monobenzyl phthalate (MBzP), monoethyl phthalate (MEP), monomethyl phthalate (MMP), mono-n-butyl phthalate (MBP), mono-(2-ethyl-5-carboxypentyl) phthalate (MECPP), mono-(2-ethylhexyl) phthalate (MEHP), mono(2-ethyl-5-hydrohexyl) phthalate (MEHHP), mono(2-ethyl-5-oxohexyl) phthalate (MEOHP) was assessed by high performance liquid chromatography and Tandem mass spectrometry. Semen quality parameters (semen volume, sperm counts, the percentage of motile sperms and sperm with normal morphology) were determined according to the WHO laboratory manual. The associations between urinary phthalate metabolites and semen quality were evaluated by Spearman correlation

Results: All 8 urinary phthalate metabolites were associated with decrease in semen concentration but only MBP (metabolite of dibutyl phthalate (DBP)) was statistically significant (r=-0.515, p=0.034). Negative association between sperm motility and MBzP, MEHP, MEP and MBP were observed but did not achieve statistical significance. Increased percentage of sperms with abnormal morphology was associated with MECPP, MEHHP and MEOHP, MEP and MBP, but the result was not statistically significant.



Conclusion: Our findings suggest that phthalates exposure from surrounding environment may result in human semen quality impairment.

Keywords: Phthalates exposure, male reproduction, semen quality

Effects of Chinese herbal extracts on the expression and distribution pattern of a Caenorhabditis elegans fluorescent protein that is a β-synuclein/fluorescent fusion protein for anti-aging herbal screening

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Introduction

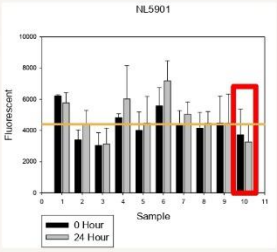
The relationship between diet and aging is a hot research topic now. Many researches have devoted to what to eat can delay aging and prolong life, or what kind of eating habits can reduce the risk of aging. Different diet content will have different effects on human body. Parkinson's disease is a neurodegenerative disease that often occurs in the elderly. It is characterized by the degeneration and death of dopamine neurons and the deposition of a-synuclein. The pathogenesis is not yet clear, but it always derives from factors such as the aging of microglia and reduction of mitochondrial function due to mitochondrial oxidation. Chinese herbal medicine has been considered as a good medicine solving method for strengthening the body and is widely used in the treatments of diseases of Chinese people. Furthermore, it has been recorded in the literature that Chinese herbal medicine has antibacteria, anti-inflammation, and anti-oxidant effects.. Most of these studies have shown that Chinese herbal medicines have anti-aging effects. In this study, different Chinese herbal medicine extracts will be used to evaluate the effect on the expression and distribution patterns of a fluorescent protein in muscle cells of *Caenorhabditis elegans (C.elegans)* that has an overexpressed β-synuclein/fluorescent fusion constructs. Anti-aging Chinese herbal medicine study is under studying and keeping going on.

Keywords : Herbal medicine; Caenorhabditis elegans; Aging; Parkinson's disease

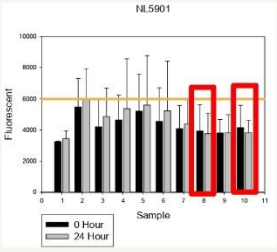
Methods

1. The mature *C. elegans* NL5901 was rinsed with M9 Buffer and placed in the groove.
2. In the 96-well fluorescent-counting black plates, we add 180 uL of nematode *C.elegans* suspension to each well.
3. 20 uL Chinese herbal medicine extract each was added to each well, and the feeding material for control group was OP50.
4. Then place the fluorescent-counting black plates in a 20°C incubator for 24 hours or 48 hours.
5. The excitation light source is F485 nm and the absorption light is F535 nm source.
6. Then we use SigmaPlot 2000 to draw the data histograms with Error Bars.

Results

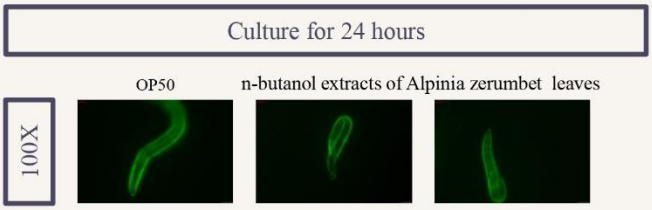


1. Control
2. OP50
3. Alpinia zerumbet root alcohol layer
4. Alpinia zerumbet root hexane layer
5. Alpinia zerumbet root butanol
6. Alpinia zerumbet stem alcohol layer
7. Alpinia zerumbet stem butanol
8. Alpinia zerumbet leaf alcohol layer
9. Alpinia zerumbet leaf hexane layer
10. Alpinia zerumbet leaf butanol

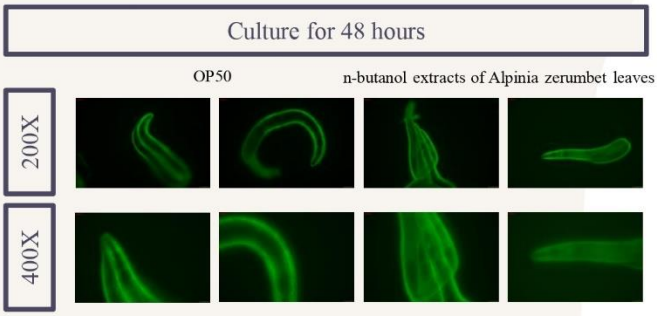


1. Control
2. OP50
3. Murraya paniculata leaf alcohol layer
4. Murraya paniculata leaf hexane layer
5. Murraya paniculata leaf ethyl acetate layer
6. Murraya paniculata leaf butanol
7. Kandelia obovate alcohol layer
8. Kandelia obovate hexane layer
9. Kandelia obovate ethyl acetate layer
10. Kandelia obovate butanol

Through the fluorescence counting, it can be found that after 24 hours of culture, the *C. elegans* who ate the extracts of the Alpinia zerumbet leaves, Kandelia obovata, and Kandelia obovata have a tendency to decrease fluorescence, accounts during the cultivation period.



We use an inverted fluorescent microscope to observe the effects of Alpinia zerumbet leaves on the expression and distribution patterns of *C. elegans* fluorescent proteins. It can be found that after eating the extracts of Alpinia zerumbet leaves for 24 hours, the proteins at the tip of the head aggregate changing.



We use an inverted fluorescent microscope to observe the effects of the extracts of Alpinia zerumbet leaves on *C. elegans* fluorescent proteins. It can be found that after eating the extracts of Alpinia zerumbet leaves for 48 hours, the amounts of *C. elegans* fluorescence protein decreased, and aggregated lower and the distribution of these fluorescent proteins change a lot.

Conclusion

Chinese herbal medicine has been proved to have antibacterial, anti-oxidation, anti-aging effects. The current results show that the hexane extracts of Kandelia obovata, butanol extracts of Kandelia obovata and the butanol extracts of Alpinia zerumbet can reduce the amounts and distribution patterns of β-synuclein/fluorescent fusion protein constructs in muscle. They indicate that they have reducing effects on fusion protein aggregation and their distribution patterns. That means that some extracts can affect the aggregation of fusion proteins in the muscles of nematodes, and they will be concerned and used in the anti-aging fields in the future.

Urinary Levels of Organophosphate Flame Retardants Metabolites in Children with Attention-Deficit / Hyperactivity Disorder

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Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental disorder among children and adolescents. Exposure to environmental chemicals or toxics may be linked to the susceptibility to ADHD. Organophosphate flame retardants (OPFRs) have widely existed in the environment and their metabolites are also observed in urine. This study aims to investigate the potential relationships between ADHD and urinary levels of OPFRs.

Methods and Materials

This study contained 63 children with ADHD (mean age: 9.4 years) and 66 healthy control children (mean age: 10.9 years). Ten chemicals of OPFRs (BDCPP, BCEP, DBEP, DNBP, DPHP, TDCPP, TCEP, TBEP, TNBP, and TPHP) in urine were determined by ultra-performance liquid chromatography-tandem mass spectrometry (UPLC-MS/MS). Associations between urinary OPFRs and ADHD characteristics were also examined.

Results

The mean level of urinary Σ_{10} OPFRs in the ADHD group (7.7 ± 5.8 ppb) were significantly higher than which in the control group (1.5 ± 1.2 ppb) (Table1, Figure 1, $P < 0.001$). The levels of individual ten OPFRs (except for DNBP and TDCPP) in ADHD were also higher than the control group (Table 2, $P < 0.05$). Nonetheless, the levels of phthalate or OPFR metabolites were not significantly correlated with the symptom severity in children with ADHD.

Table 1. ΣOPFRs levels in urine

Σ10 OPFRs	Control	ADHD
Min	0.220	0.279
Q1	0.494	4.154
Q2	1.038	6.832
Q3	2.185	9.647
Max	6.143	27.168
IQR	1.691	5.493

IQR: interquartile range

Figure1. Box plot of ΣOPFRs levels

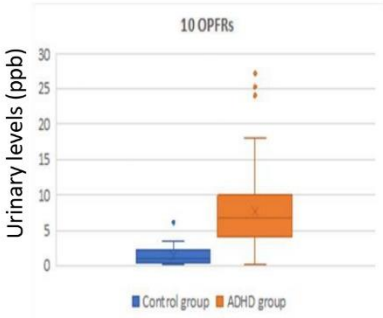

Table 2. OPFRs levels(ppb) in urine

	Control	IQR	ADHD	IQR
TDCPP	0.000	0.000	0.000	0.026
BDCPP	0.000	0.000	0.246	0.384
TCEP	0.000	0.000	0.000	3.847
BCEP	0.228	0.512	0.996	2.544
TBEP	0.075	0.303	0.516	1.369
DBEP	0.000	0.209	0.194	0.621
TNBP	0.010	0.040	0.039	0.059
DNBP	0.000	0.000	0.000	0.000
TPHP	0.000	0.020	0.000	0.055
DPHP	0.255	0.410	0.862	1.108

Conclusions

In comparison to healthy controls, children with ADHD exhibited higher urinary levels of OPFRs. According to the results in this study, the possibility of an adverse impact of environmental toxins on neurodevelopment may exist. Further study is warranted to clarify the association of exposure level and ADHD manifestations.

懷孕母鼠暴露嘉義山區顆粒性及水溶性$PM_{2.5}$影響雄性子代大鼠生殖功能之超代效應

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前言 / Introduction：

流行病學研究發現細懸浮微粒($PM_{2.5}$)可能是造成生殖健康風險的主要空氣污染物之一，但懷孕期間暴露$PM_{2.5}$如何影響雄性子代之超代生殖毒性研究仍缺乏。

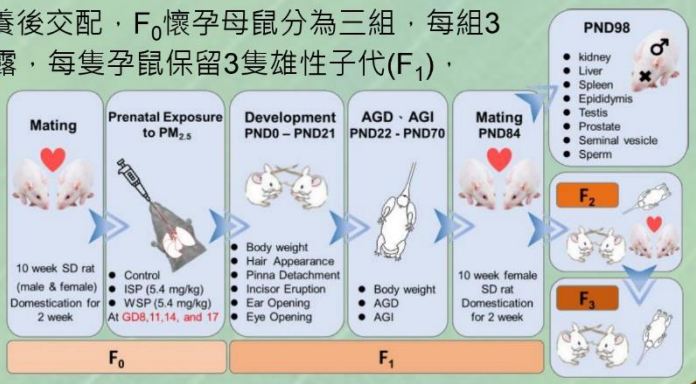
本研究以懷孕母鼠氣管滴注水溶性$PM_{2.5}$(WS-$PM_{2.5}$)與顆粒性$PM_{2.5}$(WI-$PM_{2.5}$)，探討懷孕期間暴露$PM_{2.5}$是否對雄性子代生殖功能造成超代效應。

方法 / Methods：

10週大F_0雄性與雌性SD大鼠，馴養後交配，F_0懷孕母鼠分為三組，每組3隻，於懷孕時期第8、11、14與17天暴露，每隻孕鼠保留3隻雄性子代(F_1)，至出生後(PND) 98天進行犧牲，此循環進行至F_3。

暴露條件：

1.控制組：PBS水溶液 200 μL/隻
2. WS-$PM_{2.5}$組：5.4 mg/kg
3. WI-$PM_{2.5}$組：5.4 mg/kg



結果 / Results：

F1的WI-$PM_{2.5}$組與WS-$PM_{2.5}$組的AGD、AGI均顯著低於控制組；F_1精子活動力$PM_{2.5}$暴露組均顯著下降；WS-$PM_{2.5}$與WI-$PM_{2.5}$組精子粒線體功能異常率、H_2O_2、$O_2^{\cdot-}$、DNA斷裂指數均顯著升高；WS-$PM_{2.5}$組右睪丸與WI-$PM_{2.5}$組右副睪尾、左右睪丸重量均顯著下降。F_2的WI-$PM_{2.5}$組與WS-$PM_{2.5}$組的AGD均顯著低於控制組、WI-$PM_{2.5}$組的AGI顯著縮短；F_2精子活動力$PM_{2.5}$暴露組均顯著低於控制組。F_3的WI-$PM_{2.5}$組的AGD、AGI均顯著低於控制組。

結論 / Conclusion：

懷孕母鼠暴露WI-$PM_{2.5}$與WS-$PM_{2.5}$發現F_1、F_2與F_3雄性子代的AGD、AGI縮短與精子活動力造成下降之趨勢，並且降低生殖功能中的睪丸與副睪尾重量推測可能對雄性子代生殖功能造成傷害。因此懷孕母鼠暴露WI-$PM_{2.5}$與WS-$PM_{2.5}$可能會對雄性子代產生超代效應。

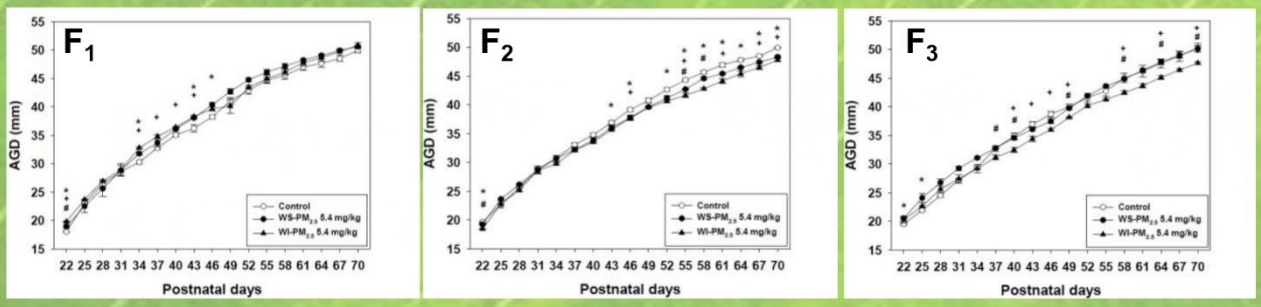


Figure 1. The anogenital distance (AGD) in F_1 , F_2 and F_3.

n: Offspring number; All data was expressed as means ± S.E.; $^{*}p < 0.05$ as compared with control and WS-$PM_{2.5}$ group; $^{+}p < 0.05$ as compared with control and WI-$PM_{2.5}$ group; $^{\#}p < 0.05$ as compared with the WS-$PM_{2.5}$ and WI-$PM_{2.5}$ group.

親代雄性大鼠暴露嘉義山區顆粒性及水溶性$PM_{2.5}$影響雄性子代生殖功能之超代研究

曾永志[1], 呂汶峰[1], 李家偉[1], 賴慶紓[2], 許昺奇[1*]

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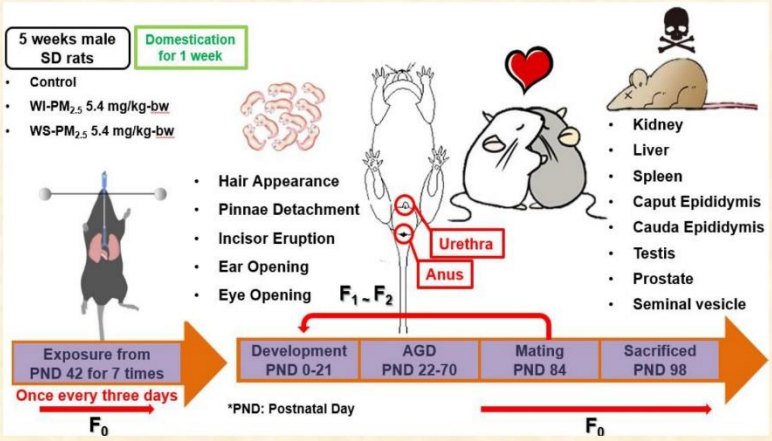
前言

空氣污染中的細懸浮微粒(Particulate matter, PM)動力學直徑 ≤ 2.5 μm的顆粒物($PM_{2.5}$)，被歸類為第一級的致癌物質並可能對生殖功能產生危害。文獻指出長年來嘉義地區在空氣污染季節的$PM_{2.5}$數值皆居於全台之冠，故本研究目的以雄性大鼠為實驗對象，收集嘉義梅山$PM_{2.5}$，以氣管滴注方式進行暴露，探討親代公鼠直接暴露空氣中顆粒性$PM_{2.5}$(WI-$PM_{2.5}$)與水溶性$PM_{2.5}$(WS-$PM_{2.5}$)是否會影響雄性F_1與F_2子代生殖功能之超代效應。

方法

購入5週大雄性SD大鼠，馴養一周後以氣管滴注方式進行暴露，於出生後 (PND) 第42天每隔三天暴露一次，共暴露7次。暴露條件如下：1. 控制組：PBS水溶液：200 μL/隻；2. WS-$PM_{2.5}$組：劑量 5.4 mg/kg；3. WI-$PM_{2.5}$組：劑量 5.4 mg/kg。F_0雄性大鼠於PND84時與新進雌性大鼠進行交配產生F_1子代。每隻孕鼠保留1隻雄性子代，至PND98犧牲，此實驗循環至F_2子代。

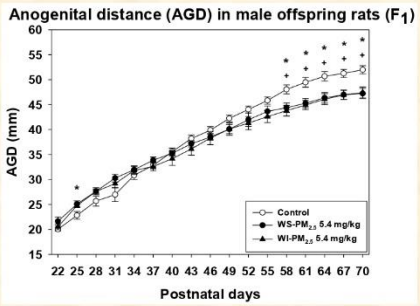


結果

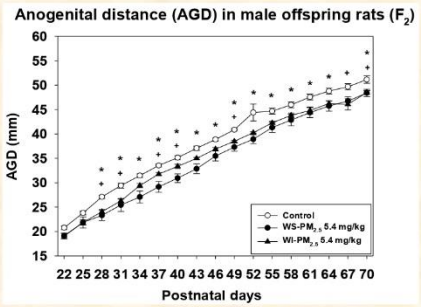
AGD與AGI上，F_1與F_2於PND58至PND70，WI-$PM_{2.5}$組及WS-$PM_{2.5}$組皆顯著低於控制組。犧牲時生殖臟器重量上，F_0的WI-$PM_{2.5}$組儲精囊重量顯著高於控制組；F_1的WI-$PM_{2.5}$組左右副睪頭、左右副睪尾、左右睪丸和前列腺重量皆顯著低於控制組。精子型態上，F_0與F_1的WI-$PM_{2.5}$與WS-$PM_{2.5}$組正常精子的比例皆顯著低於控制組，且WI-$PM_{2.5}$組彎尾及多重異常的精子比例皆顯著高於控制組。

結論

暴露WI-$PM_{2.5}$及WS-$PM_{2.5}$具有造成雄性子代AGD縮短、生殖臟器重量、精子活動力顯著下降的趨勢，並造成正常精子比例顯著降低，異常比例升高之情形。顯示暴露嘉義山區顆粒性及水溶性$PM_{2.5}$會對雄性子代生殖系統造成超代效應。



圖一：F_1雄性子代AGD變化圖



圖二：F_2雄性子代AGD變化圖

For the curves, *p. +p <0.05, * indicates a significant difference between the WS-$PM_{2.5}$ and control groups; + indicates a significant difference between the WI-$PM_{2.5}$ and control groups.

Dust concentrations of polybrominated diphenyl ethers (PBDEs) and dibenzo-*p*-dioxins/furans (PBDD/Fs) in drugstores from southern Taiwan

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Introduction

PBDEs are chemicals used as flame retardants in various industrial and commercial products. They are highly toxic, persistent, and can accumulate in the food chain. PBDEs can be found in many environmental matrices, including indoor dust. Studies have shown that the concentration of PBDEs in indoor dust can indirectly reflect people's living habits and activities in the indoor environment. There are three ways in which PBDEs adhere to dust, including release from fireproof materials, direct contact with dust during use, and abrasion of used products. Fine particles with a larger surface area/volume have a greater ability to retain chemical contaminants. Pharmacies must be cleaned frequently to avoid drug contamination by inhalation or exposure to mixed drugs or dust. The use of a dust collector can help reduce drug contamination, but the release of flame retardants during the use of electrical products may deposit PBDEs in pharmacy dust and medical equipment. This project will explore the concentration of PBDEs in indoor dust in pharmacies. This project aims to explore the concentration and possible sources of PBDEs and PBDD/Fs in indoor environmental dust of pharmacies

Methods

14 Samples from pharmacies
- Collected 10g dust
- Questionnaire survey
- Sampling period total of 4 months

Sieved the collected samples
- Through 100 mesh
- Stored in brown bottle

Data Analyze
- Soxhlet Extraction Method
- Sent to Cheng Shiu University Super Micro Mass Research & Technology Center

Statistical Verification Calculations
- SPSS & Excel
- Relationship between PBDEs and PBDD/Fs pollution sources in pharmacies.

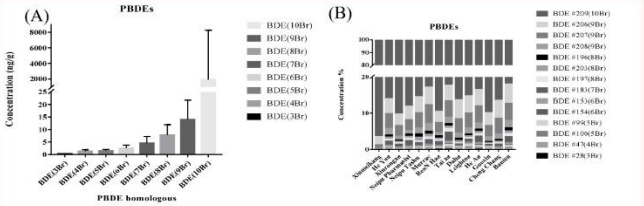

Figure 1. Mean value of PBDEs homologues and percentages of PBDEs in 14 pharmacies.

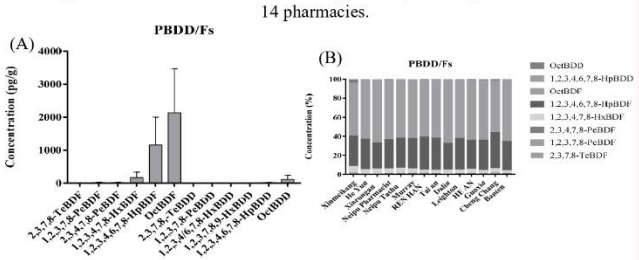

Figure 2. Mean value of PBDD/Fs congeners and individual concentrations of PBDD/Fs in 14 pharmacies.

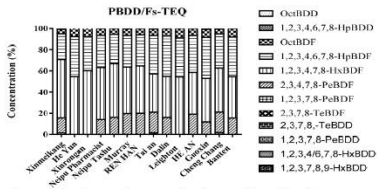

Figure 3. Toxic Equivalent Characteristic Profile of Indoor Dust in pharmacies.

Results

Mean level of Σ_{14}PBDEs was 2165 ± 6559 ng/g and the predominate homologue of decaBDE was 2050 ng/g in indoor dust collected from the pharmacies. BDE-209 was consisting at least 80% of the total. Dust levels of PBDD/Fs were between 1.04±0.300 ng/g and 8.91±1.83 ng/g to get mean value of 3.54 ± 2.44 ng/g in pharmacies. Considering their toxicities, the WHO TEQ levels of PBDD/Fs were ranged from 0.115 to 16.9 with mean of 39.4 pg WHO 2005-TEQ /g. Characteristics or distributions of dust PBDD/Fs in 14 pharmacies were consistent, indicating that OctBDF was mainly contributed to ΣPBDD/Fs. According to the experimental results, it can be known that the concentration of BDE-2090 in all fields is distinctly higher than those whose PBDEs from di to nano. To make our amazement, BDE-209 is still abundant and widespread in indoor dust from the pharmacies after decaBDE was banned to use since 2018. In addition, if TEQ levels of PBDD/Fs were considered, 1,2,3,4,7,8-HxBDF, 1,2,3,4,6,7,8-HpBDF, 2,3,4, 7,8-PeBDF were the main contributors to ΣPBDD/F WHO2005-TEQs. According to the preliminary analysis of the data analysis results of this study, regular cleaning habits, the number of electrical appliances and the frequency of use of electrical appliances may be the main factors affecting the concentration of PBDEs in the indoor environment. The concentration of BDE-209 in all samples is much higher than that of other congeners (80-99%), presumably because it has been banned in recent years and has not been completely eliminated. Because the concentration of PBDDs in each sample was extremely low, there was no obvious contribution to the overall concentration. In terms of PBDD/Fs toxicity, although 1,2,3,4,7,8-HxBDF has the highest proportion of toxicity, its concentration proportion is the lowest, so it is speculated that there is no obvious potential toxicity hazard. In addition, the main contribution of homologues in TEQ is still in the form of PBDF (1,2,3,4,7,8-HxBDF, 1,2,3,4,6,7,8-HpBDF, 2,3,4 ,7,8-PeBDF) was the main contributor, while PBDDs in the three samples in this study had no significant toxicity contribution.

Conclusion

Regular cleaning, number and frequency of electrical appliances may affect PBDE concentration indoors. BDE-209 found in all samples was high due to recent ban. PBDD/Fs generated in electronic waste, metal smelting and waste incineration. PBDFs were the main contributor to TEQ, while PBDDs had no toxic contribution. Health risk assessment study showed no significant non-carcinogenic or carcinogenic risks from indoor dust in the pharmacy to staff or customers.

Reduced toxicity on *Caenorhabditis Elegans after nematodes with cotreatment with* $PM_{2.5}$ and resveratrol

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Introduction

Particulate Matter 2.5 ($PM_{2.5}$) as an environmental pollutant is gradually increasing nowadays. They come from a variety of sources, such as industrial processes, transportation, and agriculture. Exposure to high levels of $PM_{2.5}$ can cause health problems, including respiratory and cardiovascular diseases. Resveratrol, a polyphenol compound found in red grapes has been found that can resist reactive oxygen and nitrogen substances, and inhibit the damage caused by $PM_{2.5}$. However, the toxicological effects of $PM_{2.5}$ co-exposure with resveratrol on human health remain unclear. In this research, *Caenorhabditis elegans* (*C. elegans*), a non-parasitic nematode feeding on microorganisms, was used to determine the impact of the toxic effects of B_4C nanoparticles. This is due to the *C. elegans* having similar genes to humans, as a biological model.

Methods

C. elegans was cultivated and maintained according to the flowchart in Fig. 1. Maintained *C. elegans* in nematode growth-medium agar plates (24 g of agar, 2.4 g of NaCl, and 2.0 g of protein in 780 mL DD water) and fed with *E.coli* OP50 at 20°C as a standard protocol (Brenner, 1974). Maintained the nematodes until a high density of eggs appears, washed the nematodes from NGM, put them into a centrifuge tube, and the nematodes were lysed with a bleaching mixture leaving only the eggs to obtain age-synchronized populations of L1 nematode larvae in preparation for the exposure experiments and toxicity assays. All physiological observations were done under a dissecting microscope.

The effectiveness of resveratrol in reducing the toxic effect of $PM_{2.5}$ was determined with these three parameters:

- Locomotion Assay, referring to the previous research method, picked *C. elegans* exposed for 72 hours to a new well-plate, and using a microscope observed the number of head swings in 1 minute and body bends in 20 seconds.
- Reproductive Assay is to calculate the number of offspring (larvae and unhatched eggs) to assess whether exposure to resveratrol on *C. elegans* will affect the reproductive system of nematodes.
- Lethality analysis is to transfer the exposed *C. elegans* to a new NGM without *E. coli*, 50 nematodes at each concentration, and calculate the number of surviving nematodes in the NGM every day until all of them died.

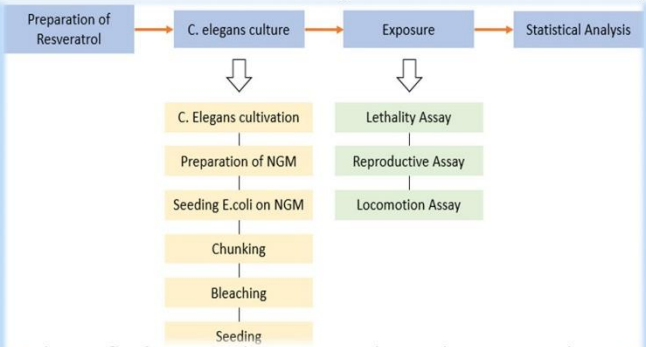

Fig. 1: *C. elegans* maintenance and experiment procedures

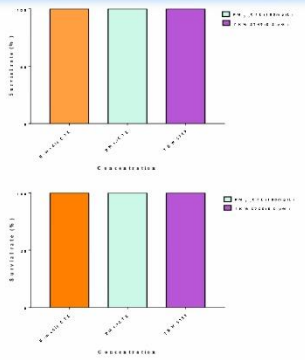

Fig. 2: Lethality behavior of TKW5749 and TKW5750

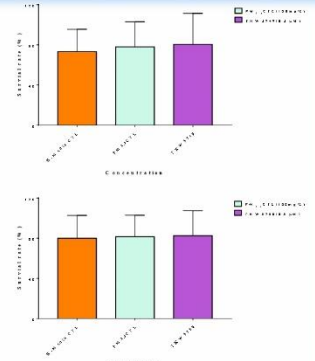

Fig. 3: Reproductive toxicity of TKW5749 and TKW5750

Results

The results of statistical analysis showed that *C. elegans* with exposure to $PM_{2.5}$, and $PM_{2.5}$ co-exposure with resveratrol did not affect lethality behavior (Fig. 2). There was no significant difference in each exposure concentration, and the survival rate did not decrease. In Fig. 3, there was no significant difference in reproduction toxicity. The difference may come from the congenital differences of each nematode and there were a few plates with large deviations, resulting in the number of reproductive offspring between each concentration. The difference shows that resveratrol may not be able to effectively slow down the impact of $PM_{2.5}$ toxicity on the reproductive system. However, in Fig. 4, resveratrol was effective in reducing the toxic effects of $PM_{2.5}$ and caused a significant impact on nematode locomotion behavior in both samples. The increment of head trashes and body bends of nematodes can be inferred that the resveratrol reduced nerve damage.

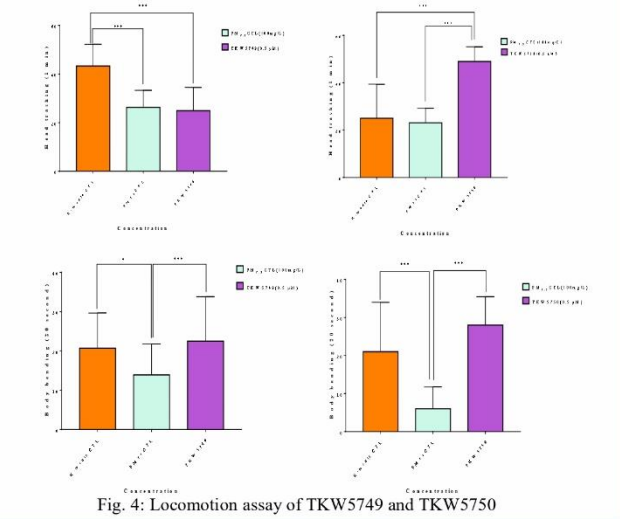

Fig. 4: Locomotion assay of TKW5749 and TKW5750

Conclusion

Resveratrol may be an initiative on reducing the toxic effects of PM2.5. Hence, more research is needed to determine whether these effects are also seen in humans. However, some studies state that resveratrol may have negative effects on health when consumed in large amounts and it is also recommended to conduct a more in-depth analysis of resveratrol.

Toxic effects of *Caenorhabditis elegans* exposed to nanomaterials of titanium dioxide (TiO_2)

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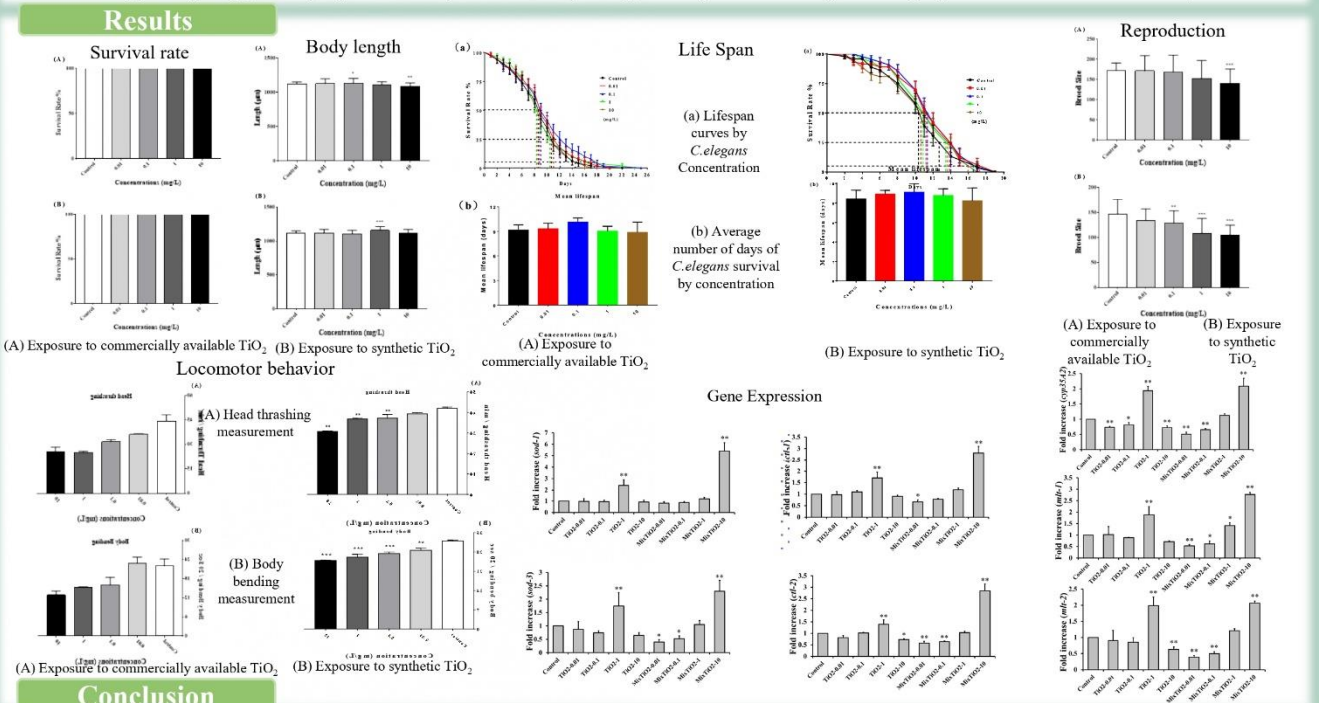
Introduction

Titanium dioxide (TiO_2), known also as titanium (IV) oxide or titania, is a naturally occurring titanium oxide. TiO_2 is a widely used compound in various industries due to its attractive chemical and physical properties. It is used in industries including paints, cosmetics and skin care, and food colorings. Additionally, can also be used in pharmaceuticals, environmental treatment, thin films, semiconductors, and as a photocatalyst. However, there are concerns regarding the usage of TiO_2 in various countries due to its possible toxic and carcinogenic effect on the human body. *Caenorhabditis elegans* (*C. elegans*) is a small, free-living soil nematode and is commonly used as a model organism for biological research due to being inexpensive, bioethical, and an easy model animal to maintain. This study investigated on the toxicity of TiO_2 using *C. elegans* as the model organism. Assays were prepared including lethality, lifespan, growth, reproduction, locomotion, and oxidative stress were prepared to evaluate the toxicity of TiO_2.

Methods

- *C. elegans* Preparation
  - -*C. elegans* were maintained in the nematode growth medium (NGM)
  - -Age synchronized L1 stage nematodes were obtained by following the bleaching method
- TiO_2 preparation
  - -Commercially available TiO_2 (Degussa P25) was used for the experiment
  - -Synthetic TiO_2 (T50-2h) is prepared by the laboratory of Prof. Yi-Jie Lai, Department of Environmental Safety and Health, National Kaohsiung University of Science and Technology
  - -Four concentration level (10, 1, 0.1, and 0.01 mg/L) was made for the experiments
- Acute exposure
  - -Age synchronized L1 nematodes were maintained until L3/young L4 stage
  - -A 12-well plate, each well containing different TiO_2 concentration, were seeded with approximately 200 worms
- Assays preparation
  - -Lethality, lifespan, growth, reproduction, locomotion, and gene expression assays were prepared and used for the experiments

Results



Conclusion

From the results of the experiments, there was little to no observable difference between the control group and the exposed group for the lethality and growth assays for all concentration of TiO_2. There was also no shortening of life span of the nematodes observed. However, there is a decrease in the brood size produced by the nematodes exposed to TiO_2, specially at 1 mg/L and 10 mg/L concentration for both synthetic and commercially available TiO_2. In the locomotion assay, exposure to commercially available TiO_2 shows a more pronounced decline in both head thrashing and body bending of the nematodes at increasing level of concentration compared to synthetically prepared TiO_2. Expressions of sod-1, sod-3, ctl-1, ctl-2, cyp35A2, mlt-1, and mlt-2 was observed. Nematodes exposed to commercially available TiO_2, specifically at exposure concentration of 1 mg/L , showed upregulation of all observed genes. The same is observed for nematodes exposed with synthetic TiO_2 but for concentration of 10 mg/L. In lower concentrations of synthetic TiO_2, gene expressions were reduced to almost half compared to the control.

Evaluate the suitability of urinary reference intervals for organophosphate flame retardants in healthy adult population from Southern Taiwan.

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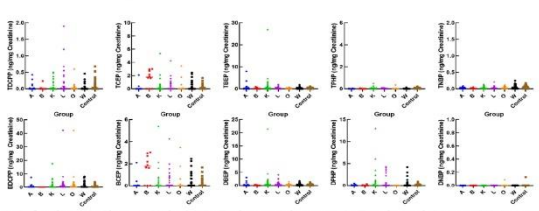
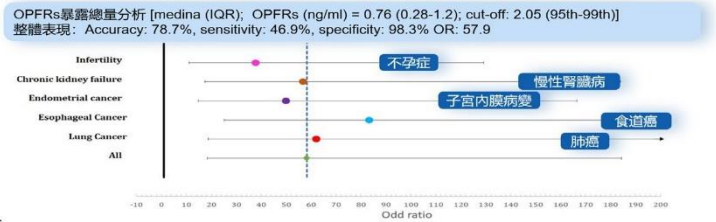
Introduction: Organophosphorus flame retardants (OPFRs) are chemical compounds that are incorporated into materials to decrease their flammability. The chemical makeup of this substance closely resembles that of human hormones. The relevant hormones are often misidentified and utilized in the human body, causing disturbances in typical physiological processes and resulting in dysfunctions within the endocrine system. In recent years, research has confirmed that exposure to OPFRs can lead to various health hazards, including neurotoxicity, endocrine disruption, hepatotoxicity, and reproductive dysfunction. It is noteworthy that there is currently no laboratory in Taiwan equipped to detect the presence of these compounds in human samples. This study aims to develop a biomonitoring method for OPFRs that can offer dependable data on the degree of exposure to each distinct OPFR. Moreover, the objective of this study is to confirm the appropriateness of OPFRs as biomarkers in the field of environmental medicine.

Methods: The Waters ACQUITY UPLC I-Class and Xevo TQ-XS IVD systems were specifically developed to detect and quantify ten OPFRs present in urine samples. The methodology verification and confirmation have been successfully evaluated in accordance with the CLSI C62A guidelines. The research comprised a cohort of 538 subjects, comprising 78 individuals experiencing infertility, 167 with chronic kidney failure , 96 diagnosed with esophageal carcinoma, 99 with lung carcinoma, and 98 with endometrial carcinoma. Additionally, the analysis included a reference group consisting of 175 individuals. The current research employed ANOVA to compare the differences in the levels of ten OPFRs compounds in urine samples obtained from individuals of diverse ethnicities. The study employed ROC curve analysis to identify the optimal decision threshold for disease detection. Additionally, the chi-square test was utilized to assess the disease risk and validate the suitability of the established reference range.

Results: The levels of Bis-2-chloroethyl phosphate (BCEP) in the urine of patients with chronic kidney failure, as well as those diagnosed with lung or esophageal cancer, were found to be significantly elevated (6.23±2.19 ng/mL) compared to the control group (0.89±0.38 ng/mL). The findings of this research demonstrate that individuals experiencing gynecological disorders (4.29±1.97 ng/mL) exhibit a considerably elevated level of Bis-1,3-dichloro-2-propyl phosphate (BDCPP) in comparison to the control group (0.76±0.32 ng/mL). The findings suggest that a concentration of ten OPFRs exceeding 2.05 ng/mL was associated with a 37.8% likelihood of infertility (95% CI: 11.07). The study population showed a significant risk (83.3, 95% CI: 25.25) for developing esophageal cancer, as indicated by the statistical analysis ($p < 0.001$).



A: Infertility, K: Chronic Kidney, O: Endometrial cancer, L: Esophageal Cancer, W: Lung Cancer



Conclusion: We have developed a testing methodology for OPFRs and have verified the reference values through a series of thorough analyses and discussions. This methodology will enhance our comprehension of the correlation between endocrine-disrupting substances and illnesses.

有機磷阻燃劑與肺癌患者表皮生長因子受體突變之相關性

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Keywords: Organophosphate flame retardants, lung cancer, epidermal growth factor receptor

Introduction

有機磷阻燃劑(Organophosphate flame retardants, OPFRs) 普遍分布於戶外或室內環境中之灰塵和空氣中，人體經由呼吸吸入可能對肺部造成損傷。動物實驗證實暴露於OPFR除了導致肺泡壁水腫及增厚外，亦可能增加轉譯因子Nuclear factor kappa B(NF-κB)訊息傳導路徑表現，因此可能導致腫瘤如肺癌、乳癌、大腸直腸癌的發生。表皮生長因子受體(Epidermal growth factor receptor, EGFR)突變為肺癌患者選擇標靶藥物的關鍵，然而，NF-κB的活化會增加表皮生長因子受器-酪胺酸激酶抑制劑(EGFR-tyrosine kinase inhibitor)的抗藥性，因此本實驗設計欲了解OPFR與EGFR突變之相關性。

Methods

本試驗收錄自2020年10月至2022年1月共97位肺癌病患，排除13位未有EFGR基因資訊個案，納入剩餘84位受試者於最後分析中。本試驗設計經長庚醫療財團法人人體試驗倫理委員會(202001032B0C501)通過，經研究人員向受試者說明執行知情同意並完成受試者同意書後進行收案。針對尿液檢體未檢出之樣本，分析時賦予偵測極限/√2之數值，類別變項使用卡方檢定或費雪精確檢定，連續變項使用曼惠特尼U檢定，p值小於0.05視為顯著。

Results

肺癌患者尿液有機磷阻燃劑整體檢測頻率為98.81%，中位數濃度為2.01ng/mL(四分位距0.86-4.06)，顯示肺癌患者普遍暴露於有機磷阻燃劑中。有4種目標化合物的檢測頻率≥50%，大多數尿液採樣中可偵測到DPHP(88.10%)和TnBP(85.71%)，其次是TBEP(63.10%)和DBEP(52.38%)。剩餘6種化合物的檢測頻率<50%，分別為TPHP(48.81%)、BCEP(47.62%) 、BDCPP (36.90%)、TDCPP(25.00%) 、TCEP(14.29 %)及DnBP(7.14%)。我們選擇檢測頻率≥50%的有機磷阻燃劑進行分析，並根據基因表現分組。EGFR突變組的尿液中TBEP顯著降低。DBEP作為TBEP的代謝物，在兩組中沒有達到顯著差異。此外，在 EGFR 突變患者中，DBEP、DPHP 和 TnBP 呈現降低趨勢。

Conclusion

本試驗顯示OPFR為潛在EGFR突變之預測因子，尤以TBEP為最適合之指標，EGFR突變肺癌患者尿液中TBEP濃度較低，可作為臨床評估EGFR-TKI藥物反應參考。

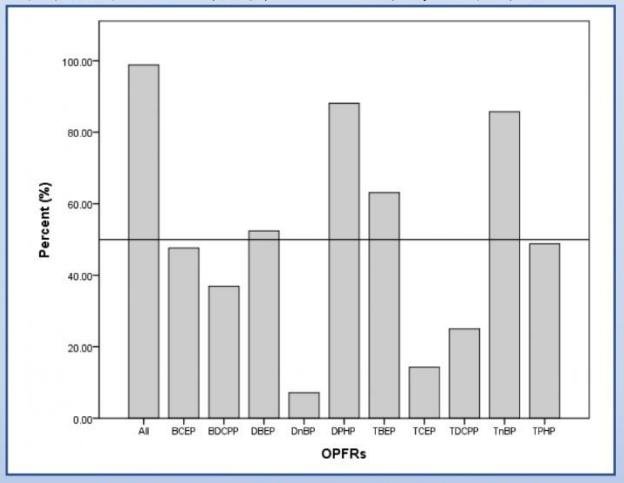

Figure 1. 肺癌患者尿液中有機磷阻燃劑之檢測頻率

	Wild-type EGFR (n=29) n (%) or median (IQR)	EGFR mutant (n=55) n (%) or median (IQR)	*p*-value
Age (year)	65 (56-70)	65 (59-72)	0.557
Sex			0.010*
Female	11 (37.9%)	37 (67.3%)	
Male	18 (62.1%)	18 (32.7%)	
Cell type			0.018*
Adenocarcinoma	23 (79.3%)	53 (96.4%)	
Others	6 (20.7%)	2 (3.6%)	
Lung cancer stage			0.600
1 and 2	1 (3.4%)	3 (5.5%)	
3	6 (20.7%)	7 (12.7%)	
4	22 (75.9%)	45 (81.8%)	
Diabetes	8 (28.6%)	7 (12.7%)	0.076
Hypertension	8 (28.6%)	19 (34.5%)	0.583
Smoking	19 (65.5%)	10 (18.2%)	<0.001*
Alcohol drinking	6 (20.7%)	4 (7.3%)	0.087
∑OPFRs (ng/mL)	1.81 (0.91-4.17)	2.39 (0.83-4.07)	0.717
DBEP (ng/mL)	0.23 (0.02-0.53)	0.02 (0.02-0.33)	0.114
DPHP (ng/mL)	0.18 (0.10-0.46)	0.15 (0.04-0.40)	0.239
TBEP (ng/mL)	0.22 (0.03-0.52)	0.04 (0.02-0.25)	0.039*
TnBP (ng/mL)	0.04 (0.02-0.06)	0.03 (0.02-0.05)	0.363

* $p < 0.05$

Table 1. EGFR表現之肺癌患者基本特徵

Abbreviations: BCEP, bis(2-chloroethyl) phosphate; BDCPP, bis(1,3-dichloro-2-propyl) phosphate; DBEP, Di-(2-butoxyethyl) phosphate; DnBP, di-n-butyl phosphate; DPHP, diphenyl phosphate; TBEP, tris(2-butoxyethyl) phosphate; TCEP, tris(2-chloroethyl) phosphate; TDCPP, tris(1,3-dichloro-2-propyl) phosphate; TnBP, tri-n-butyl phosphate; TPHP, tri-phenyl phosphate.

Cigarette Aerosols-Induced Cell Damage and its Effect on α-synuclein Aggregation Behavior

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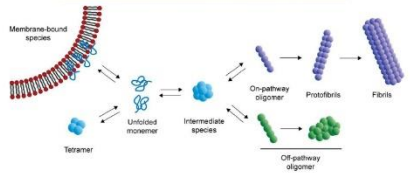
Abstract

Tobacco smoke is one of the largest public health threats the world has ever faced. The International Agency for Research on Cancer (IARC) has identified tobacco smoke as a carcinogen with a significant impact on human health. Therefore, in collaboration with Professor Chia Chun Wang's laboratory, we collected cigarette aerosols and investigated their effects on cells and signal pathways. Additionally, a previous population cohort study observed that particulate matter might increase the incidence of Parkinson's disease[1]. α-synuclein is a neuronal protein that is known to aggregate and form Lewy bodies during pathological changes, which is considered a pathological feature of Parkinson's disease. Therefore, we used fluorescence cross-correlation spectroscopy (FCCS) to observe changes in the oligomeric state of α-synuclein in SH-SY5Y cells after treatment with cigarette aerosols.

Introduction

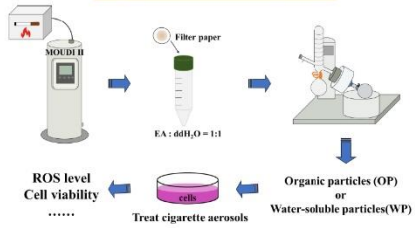
The process of α-syn aggregation



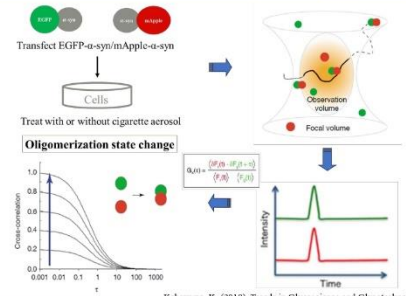
Du, X. Y., et al. (2020). International journal of molecular sciences, 21(22), 8645.

Method

Cigarette aerosols collection



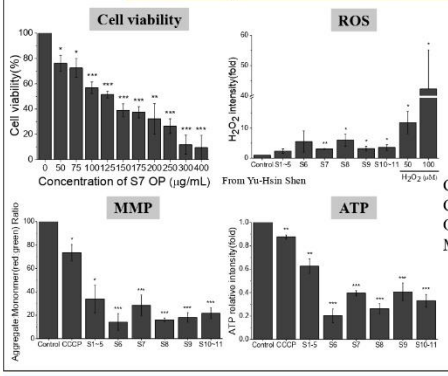
Fluorescence cross-correlation spectroscopy (FCCS)



Kabayama, K. (2018). Trends in Glycoscience and Glycotechnology, 30(174), E47-E53.

Results

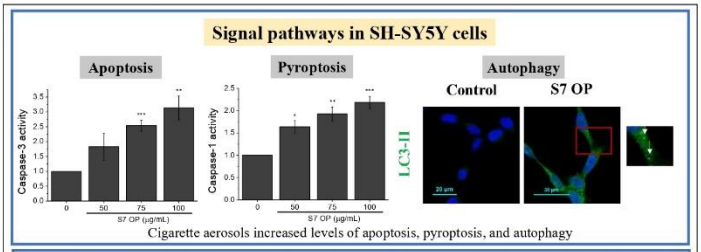
Effects of cigarette aerosols in SH-SY5Y cells



S1 (>1 μm)
S6 (1~0.56 μm)
S7 (0.56~0.32 μm)
S8 (0.32~0.18 μm)
S9 (0.18~0.1 μm)
S10-11 (<0.1 μm)

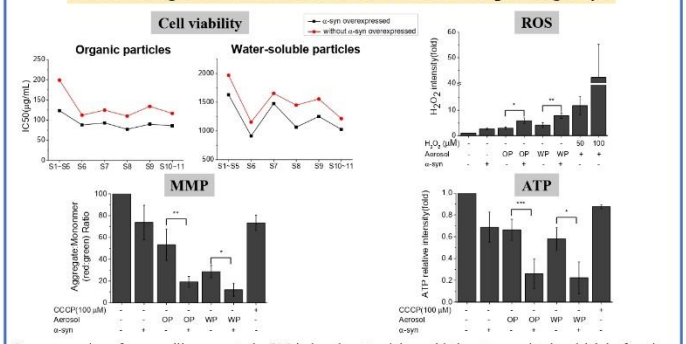
Cigarette aerosols caused :
Cell viability ⬇
Oxidative stress ⬆
Mitochondrial dysfunction

Signal pathways in SH-SY5Y cells



Cigarette aerosols increased levels of apoptosis, pyroptosis, and autophagy

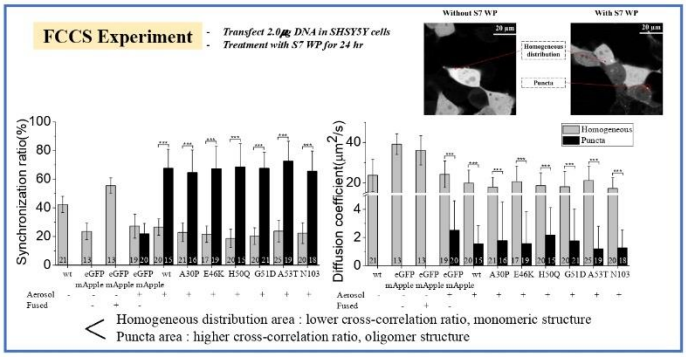
Effects of cigarette aerosols in SH-SY5Y cells overexpressing α-syn



Over-expression of α-syn will aggravate the PM-induced cytotoxicity, oxidative stress, mitochondrial dysfunction

FCCS Experiment

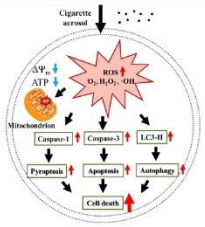
- *Transfect 2.0μg DNA in SHSY5Y cells*
- *Treatment with S7 WP for 24 hr*



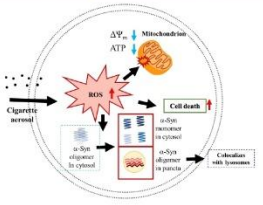
Homogeneous distribution area : lower cross-correlation ratio, monomeric structure
Puncta area : higher cross-correlation ratio, oligomer structure

Conclusion

Effects of cigarette aerosols in SH-SY5Y cells



Effects of cigarette aerosols in SH-SY5Y cells overexpressing α-synuclein



Future work

1. Observe time-dependent changes in the oligomeric state of α-synuclein in SH-SY5Y cells after treatment with cigarette aerosols for 48 hours.

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紅斑狼瘡病患血液中的ESR和尿液中的TDCPP濃度乘積為腎炎獨立危險因子

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Keywords:紅斑性狼瘡,腎炎,C3, ESR, TDCPP濃度

Introduction

這是環境污染物(1)在紅斑性狼瘡病人的研究的延續。紅斑性狼瘡腎炎是一種自體免疫性疾病，它是由於免疫系統攻擊身體組織和器官，導致腎臟發炎和損傷。這種疾病通常與紅斑性狼瘡相關聯，它會影響身體的多個器官和組織，包括腎臟、皮膚、關節、肺部和心臟等。在紅斑性狼瘡腎炎中，免疫系統會攻擊腎臟的小血管和腎小球，導致腎臟功能受損。這種疾病的症狀包括高血壓、蛋白尿、血尿、水腫和腎功能受損等。如果不及時治療，紅斑性狼瘡腎炎可能會導致腎衰竭和其他嚴重併發症。治療包括免疫抑制劑和類固醇等藥物，以控制病情並緩解症狀。OPFRs和慢性腎病變有關(2)，所以我們在這個研究中想要找出紅斑性狼瘡腎炎的獨立危險因子。

Methods

收集臨床上40位門診長期追蹤且穩定的紅斑性狼瘡病人的血液和尿液檢體做為分析。所有病人皆簽署同意書，此同意書經高雄長庚醫院人體試驗委員會核可。我們將病人分成每天蛋白尿超過0.5公克和少於或等於0.5公克，此一標準是以單次的尿液中的蛋白和肌肝酸比值做為標準。經過分組後，我們比較兩組間的臨床數據和尿液OPFRs的濃度差異，以無母數分析（Mann-Whitney test)找出可能造成每天蛋白尿超過0.5公克的獨立危檢因子如下：Hb, ESR, C3, Albumin, Hct, TNBP。但是其中，因為ESR本身為發炎、貧血(Hb ，Hct)、營養不良(Albumin)和腎炎的相關因子，因此，我們在計算邏輯迴歸時，即只有納入ESR和C3,而因為過去我們的研究中(2)指出，OPFR和慢性腎病變有關，所以我們將除了TNBP以外的數個p值接近0.05的OPFR進入運算邏輯迴歸。因此，我們加入了TPHP(p=0.065),TDCPP(p=0.083), and BCEP(p=0.095).再來，我們也將ESR和各個OPFR的乘積也一起放入邏輯迴歸，因為ESR代表體內發炎的整體現象，和各個OPFR代表環境的因素，所以我們預期將兩者相乘更能代表紅斑性狼瘡患者受到自己體內發炎和環境因素的影響狀況。

Results

紅斑性狼瘡患者的單變項無母數分析（Mann-Whitney test)結果如Table1，而邏輯迴歸的計算結果如Figure1圖中表格淺綠色處所示，同時圖為Area under Curve（AOC）。

Conclusion

邏輯迴歸的結果顯示，C3和ESR和尿液中的TDCPP濃度乘積為腎炎獨立危險因子

Independent Samples T-Test

	W	p	Hodges-Lehman	95% CI Lower	95% CI Upper
ESR	29.5	0.002	-23.591	-50	-8
C3	158	0.027	25.868	4	48.2
antiDS DNA AB	69	0.133	-65.39	-276.7	18.6
TPHP (ppb)	61	0.065	-0.144	-0.361	0.004
TDCPP (ppb)	63.5	0.083	-0.167	-0.526	0.011
BCEP (ppb)	65	0.095	-0.7	-1.864	0.27
TNBP (ppb)	43	0.009	-0.143	-0.299	-0.019

Note. Mann-Whitney U test.

Table 1. 紅斑性狼瘡病患單變項無母數分析結果

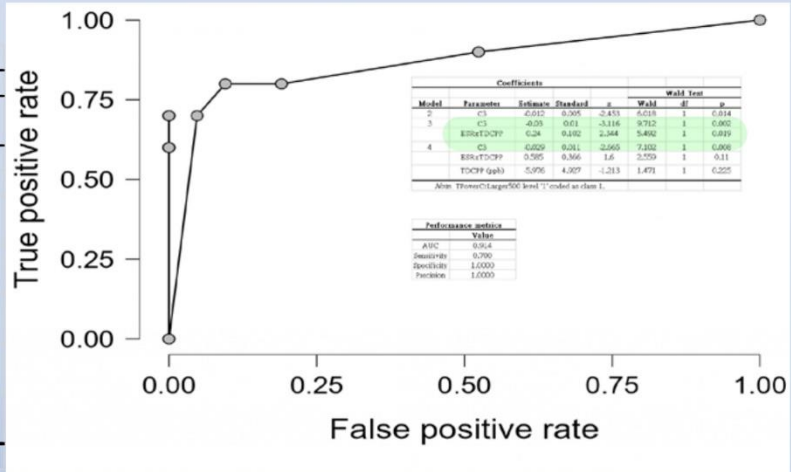

Figure 1. Area under Curve和邏輯迴歸如綠色處:：C3和ESR*TDCPP乘積為腎炎獨立危險因子

References: 1.Serum parabens and its correlations with immunologic and cellular markers in Southern Taiwan industrialized city systemic lupus erythematosus patients. J Chin Med Assoc, 2022. 85(10):p. 993-99. 2.The associations between renal disease severity and exposure to organophosphate flame retardants in patients with chronic kidney disease. Environment International 170 (2022) 107573.

有機磷阻燃劑與婦科雌激素失調相關疾病的關係：從子宮內膜腫瘤探討

The relationship of endocrine disrupting chemicals and gynecologic estrogen dysfunction disease: focus on endometrial cancer

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Yu-Che Ou[1,2*], Kuo-Chung Lan[2], Hao Lin[2], Hung-Chun Fu[2], Chen-Hsuan_Wu[2], Ching-Chang Tsai[2], Wan-Ting Huang[4], Chia-Te Kung[1,2,3]

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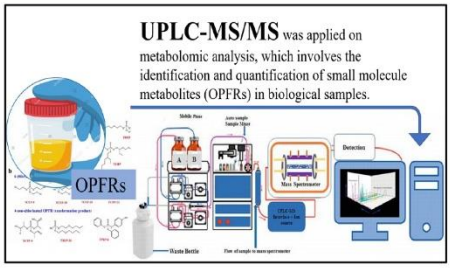
Backgrounds

- Background: Organophosphate flame retardants (OPFRs) are commonly used in various consumer products to prevent fire hazards. However, OPFRs have been linked to several health problems, including cancer. The aims of this study were to investigate the association between urine levels of OPFRs and endometrial cancer and to explore the correlation between concentrations of parent OPFR compounds and their metabolites.

Method and statistics analysis

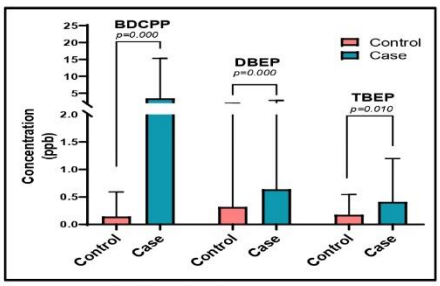
- To recruit 152 women including 76 women with uterine tumors and 76 women as control group. Ultra Performance Liquid Chromatography system(UPLC/MS) was applied to detect metabolites of 10 OPFRs in the urine. The questionnaires will be applied on information collection for lifestyles, clarify the possible sources of OPFRs exposure from living habits.
- Statistical analysis was performed using SPSS statistical software for Windows version 21 (SPSS for Windows, version 21). *P* value less than 0.05 were considered statistically significant.



Results

- **Table**. Estimated Odds ratios (OR) and 95% confidence intervals (95% CI) of groups-lifestyle association using a questionnaire targeting known sources of exposure in total 152 cases.
- Multiple variation regression : The ORs is statistically significantly associated (*p<0.05)* between groups and age, drink, medicine, occupation, family history of cancer and BDCPP.
- Univariate regression : The ORs is statistically significantly associated (*p<0.05*) between with age, BMI, regular handwashing, medicine, chronic disease, occupation, family history of cancer, BDCPP, DBEP, TBEP.
- The average exposure concentration of 3 OPFRs are plotted in figure.
- The level of 3 OPFRs (BDCPP, DBEP, TBEP) in case group were significantly higher than control group, respectively (*p<0.05*) .

Characteristics	Multiple variation regression			Signle variation regression		
	OR	(95% CI)[a]	*p* value	OR	(95% CI)[a]	*p* value
Age	5.713	1.526-21.386	0.010	7.333	3.285-16.373	.000
BMI	1.427	0.504-4.038	0.503	3.459	1.748-6.841	.000
Drink	8.256	1.299-52.485	0.025	2.662	0.889-7.971	.080
Meals out/per week	0.392	0.135-1.144	0.087	.715	0.370-1.380	.317
Regular handwashing	0.360	0.079-1.644	0.187	.264	0.091-0.763	.014
Plastic container using	1.733	0.482-6.227	0.400	.940	0.472-1.871	.861
Chilled-ready meals	0.307	0.067-1.409	0.129	.240	0.090-0.638	.004
Urinate times daily	1.904	0.414-874	0.408	3.787	1.310-10.945	.014
Frequent seafood	0.419	0.142-1.235	0.115	.767	0.404-1.454	.416
Frequent meat	1.137	0.255-5.066	0.866	.734	0.300-1.795	.498
Medicine	5.415	1.648-17.799	0.005	5.750	2.804-11.791	.000
Chronic disease	1.657	0.479-5.731	0.425	3.856	1.909-7.787	.000
Occupation	3.212	1.109-9.304	0.032	2.619	1.334-5.141	.005
Family history of cancer	3.572	1.229-10.384	0.019	2.805	1.448-5.430	.002
Family history of chronic disease	0.625	0.190-2.054	0.439	1.587	0.812-3.102	.176
BDCPP1	7.968	2.144-29.609	0.002	6.790	2.755-16.737	.000
DBEP1	2.656	0.856-8.242	0.091	4.538	2.278-9.039	.000
TBEP1	2.074	0.666-6.459	0.208	2.699	1.387-5.252	.003



Summary & Conclusions

we first proof that urine concentration of OPFRs get significantly different between control and endometrial cancer, evaluate OPFRs may adversely affect human reproductive health through their hormone-dependent and perturbed endocrine pathways.

Reference

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Acknowledgment

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Differentiating Benign Pulmonary Lesions from Suspected Lung Cancer in Never Smokers: Based on a Comprehensive Questionnaire

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Introduction: With the widely use of lung cancer screening, there is a growing concern that benign lung lesions are frequently misidentified as lung cancer. Distinguishing between benign and malignant lung lesions with precision is still a crucial challenge. This study aimed to characterize pulmonary lesions that were initially suspected to be lung cancer but were later confirmed as benign following surgical resection.

Methods: Between November 2021 and October 2022, a total of 391 never-smoker patients presenting with focal pulmonary lesions, and who had been suspected by surgeons with lung cancer, were included in this study. Prior to undergoing the operation, patients were required to complete a comprehensive questionnaire. The diagnoses of the patients were subsequently confirmed by expert pathologists after resection. Multivariable logistic regression models were employed to differentiate patients with benign lung diseases from lung cancer patients.

Results: Out of the 391 cases reviewed, 309 were confirmed with malignant pathology, while 82 were benign. After adjusted by age and gender, the odds ratios (OR) for five risk factors in favored of misidentifying benign lesions as lung cancer were statistically significant, including comorbidity of diabetes mellitus (OR 2.92, $p = 0.018$), higher household income (OR 2.06, $p = 0.022$), living in a newer house (OR 1.98, $p = 0.021$), living in a house never painted (OR 2.33, $p = 0.011$) and self-reported unusual odor near home (OR 2.12, $p = 0.008$).

Conclusion: Diabetes mellitus, household income and home environment were factors influencing on the diagnosis of lung cancer. A questionnaire before operation could help distinguishing patients with high risk on misidentification.

Keywords: environmental epidemiology, modeling

Dietary Habits and β-Adrenergic Agonists in Urine of Representative Population in Taiwan

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Keywords: β-adrenergic agonist, human biomonitoring (HBM), diet habits, 4 feet poultry, meat, offal

Introduction

Recently, due to the permission of American beef and pork import, β-adrenergic agonists have become a high-profile issue. However, except ractopamine in the United States, β-adrenergic agonists are illegal feed additives in most countries. Hence, there are fewer relative research about not only distribution but dietary exposure.

This study aimed to establish the distributions of 8 kinds of β-adrenergic agonists among a representative of population in Taiwan. Besides, the detection results of residual β-adrenergic agonists in meat couldn't represent actual exposure of the population although the government have enacted maximum residue level (MRL) standards of residual β-adrenergic agonists in meat and related products. Therefore, the other objective of this study was to find out the association between the diet habits (types of food especially meat) and the detection rates of 8 kinds of β-adrenergic agonists.

Methods

The nationwide representative samples used in this study came from Human Biomonitoring (HBM) in 2019. The cases were enrolled from population which residents are over 7 years old and registering in the main island of Taiwan and Penghu area, and the sampling methods referred NAHSIT enrollment include stratified, multiple stage and cluster sampling. According to previous studies, the main exposure route was ingestion of meat or related products containing β-adrenergic agonists residues. The half-lives of β-adrenergic agonists were very short. β-adrenergic agonists would be excreted trough urine or feces within two days. Although it might accompany by some corresponding metabolites, most of β-adrenergic agonists still were excreted as their parent compounds. Thus, the chosen specimen was urine. After urine was hydrolyzed, extracted and purified, liquid chromatograph tandem mass spectrometer (LC/MS/MS) would be used to detect 8 kinds of common β-adrenergic agonists as analytes: ractopamine, clenbuterol, terbutaline, salbutamol, zilpaterol, cimaterol, tulobuterol and fenoterol. Then in the statistics part, the detected results would be combined with the variables about poultry-related products ingestion in nutrition and diet questionnaire for analysis by using Fisher's exact test and Logistics regression.

Results

According to the results of Fisher's exact test, the detection rate of clenbuterol was much higher than the other 7 kinds of β-adrenergic agonists, and whether the case took respiratory or cardiac medication wouldn't affect detection rates of the whole population. The distribution of 8 kinds of β-adrenergic agonists in sex group was even. However, the detection rates of clenbuterol in under-18-year-old groups were higher than the other group, and in the 19-64-year-old group, clenbuterol detection rate was higher than that of the group over 65 years old. Then, salbutamol detection rate of eastern group and tulobuterol detection rate of northern group was higher than the other area groups.

In terms of exposure of β-adrenergic agonists from specific food ingestion, the logistics regression analysis results showed that 4 feet poultry ingestion frequency positively related to clenbuterol detection rate, and meat product would increase the risk of tulobuterol detection. Similarly, offal ingestion frequency had positive association with detection of tulobuterol and fenoterol. In the other hands, vegetable ingestion and terbutaline detection were negatively correlated.

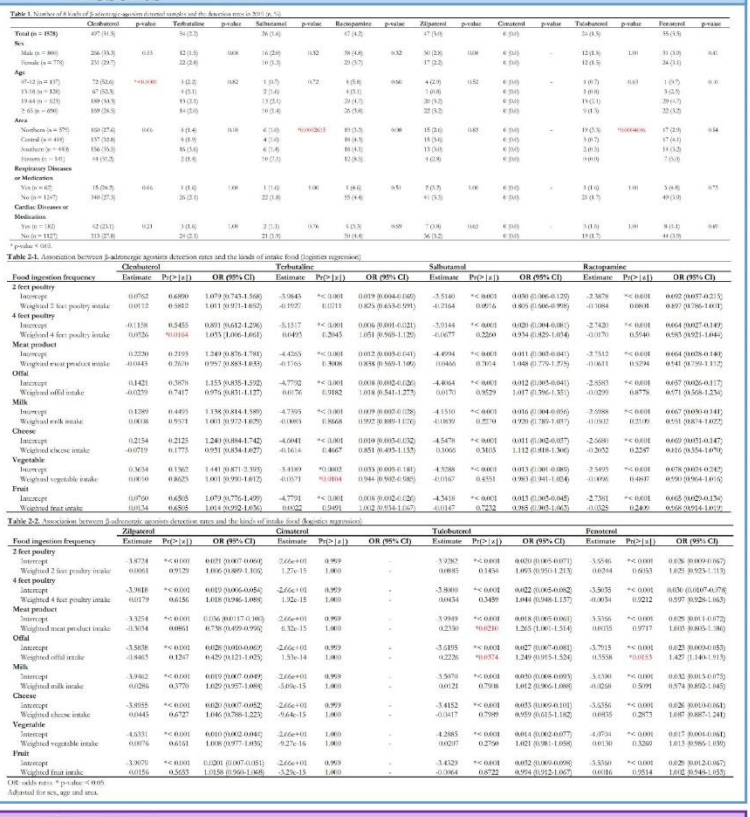

Table 1. Number of 8 kinds of β-adrenergic agonists detected samples and the detection rate in 2019 (n, %)

	Clenbuterol	p-value	Terbutaline	p-value	Salbutamol	p-value	Ractopamine	p-value	Zilpaterol	p-value	Cimaterol	p-value	Tulobuterol	p-value	Fenoterol	p-value
Total (n = 1578)	497 (31.5)		54 (3.2)		26 (1.6)		67 (4.2)		67 (5.0)		6 (0.0)		24 (1.5)		35 (3.5)	
Sex																
Male (n = 800)	266 (33.3)	0.33	32 (3.5)	0.08	16 (2.0)	0.32	38 (4.8)	0.32	36 (2.8)	0.08	6 (0.0)	-	12 (1.5)	1.00	31 (3.9)	0.41
Female (n = 778)	231 (29.7)		22 (2.8)		10 (1.3)		29 (3.7)		17 (2.2)		6 (0.0)		12 (1.5)		24 (3.1)	
Age																
07-12 (n = 137)	72 (52.6)	*<0.0001	3 (2.2)	0.82	1 (0.7)	0.72	5 (3.6)	0.66	4 (2.3)	0.52	6 (0.0)	-	3 (0.7)	0.63	1 (0.7)	0.4
13-18 (n = 128)	67 (52.3)		4 (3.1)		2 (1.6)		4 (3.1)		3 (0.8)		6 (0.0)		3 (0.8)		3 (2.3)	
19-64 (n = 823)	309 (34.8)		31 (3.1)		13 (1.1)		29 (3.7)		20 (3.3)		6 (0.0)		19 (2.1)		29 (4.7)	
≥ 65 (n = 490)	159 (28.5)		16 (3.0)		10 (1.6)		25 (5.0)		22 (5.2)		6 (0.0)		9 (1.3)		22 (5.2)	
Area																
Northern (n = 575)	160 (27.6)	0.01	3 (0.4)	0.10	4 (1.0)	*0.0002015	10 (2.3)	0.06	15 (2.6)	0.83	6 (0.0)	-	19 (2.3)	*0.0004696	17 (2.0)	0.54
Central (n = 410)	137 (32.8)		8 (0.9)		4 (1.0)		16 (4.5)		15 (3.6)		6 (0.0)		3 (0.7)		17 (4.1)	
Southern (n = 440)	156 (35.5)		16 (3.6)		6 (1.4)		16 (4.3)		13 (3.0)		6 (0.0)		2 (0.5)		14 (3.2)	
Eastern (n = 153)	44 (30.2)		3 (0.4)		10 (7.1)		12 (8.5)		4 (2.8)		6 (0.0)		0 (0.0)		7 (5.0)	
Respiratory Diseases or Medications																
Yes (n = 62)	15 (24.2)	0.61	1 (1.6)	1.00	1 (1.6)	1.00	1 (1.6)	0.51	2 (3.7)	1.00	6 (0.0)	-	1 (1.6)	1.00	3 (4.8)	0.75
No (n = 1247)	340 (27.3)		26 (2.1)		22 (1.8)		55 (4.4)		41 (3.3)		6 (0.0)		21 (1.7)		49 (3.9)	
Cardiac Diseases or Medication																
Yes (n = 182)	62 (33.1)	0.21	3 (1.6)	1.00	2 (1.1)	0.76	5 (2.7)	0.69	7 (3.8)	0.62	6 (0.0)	-	3 (1.6)	1.00	8 (4.4)	0.40
No (n = 1327)	313 (27.8)		24 (2.1)		21 (1.9)		50 (4.4)		36 (3.2)		6 (0.0)		19 (1.7)		44 (3.9)	

* p-value < 0.05.

Table 2-1. Association between β-adrenergic agonists detection rates and the kinds of intake food (logistics regression)

	Clenbuterol			Terbutaline			Salbutamol			Ractopamine		
Food ingestion frequency	Estimate	Pr(>|z|)	OR (95% CI)	Estimate	Pr(>|z|)	OR (95% CI)	Estimate	Pr(>|z|)	OR (95% CI)	Estimate	Pr(>|z|)	OR (95% CI)
2 feet poultry												
Intercept	0.0762	0.6890	1.079 (0.743-1.568)	-3.0845	*< 0.001	0.019 (0.004-0.060)	-3.5140	*< 0.001	0.030 (0.006-0.120)	-2.3678	*< 0.001	0.092 (0.037-0.215)
Weighted 2 feet poultry intake	0.0512	0.1882	1.011 (0.971-1.052)	-0.1927	0.0711	0.825 (0.653-0.991)	-0.2164	0.0956	0.805 (0.606-0.998)	-0.1084	0.0808	0.897 (0.786-1.003)
4 feet poultry												
Intercept	-0.1358	0.3455	0.801 (0.612-1.296)	-5.1317	*< 0.001	0.006 (0.001-0.021)	-5.9144	*< 0.001	0.020 (0.004-0.081)	-2.7420	*< 0.001	0.064 (0.027-0.140)
Weighted 4 feet poultry intake	0.0526	*0.0164	1.055 (1.006-1.061)	0.6493	0.2045	1.051 (0.569-1.120)	-0.0677	0.2269	0.934 (0.829-1.054)	-0.0170	0.5940	0.583 (0.921-1.046)
Meat product												
Intercept	0.2220	0.2193	1.249 (0.876-1.781)	-4.4265	*< 0.001	0.012 (0.003-0.041)	-4.4994	*< 0.001	0.011 (0.002-0.041)	-2.7312	*< 0.001	0.064 (0.028-0.140)
Weighted meat product intake	-0.0445	0.7670	0.957 (0.883-1.035)	-0.1765	0.3008	0.838 (0.569-1.146)	0.0466	0.7074	1.048 (0.779-1.375)	-0.0611	0.5294	0.541 (0.759-1.112)
Offal												
Intercept	0.1421	0.3678	1.153 (0.835-1.592)	-4.7792	*< 0.001	0.008 (0.002-0.026)	-4.4064	*< 0.001	0.012 (0.003-0.041)	-2.8383	*< 0.001	0.057 (0.026-0.117)
Weighted offal intake	-0.0259	0.7417	0.975 (0.851-1.127)	0.0176	0.9182	1.018 (0.541-1.277)	0.0170	0.9529	1.017 (0.396-1.351)	-0.0299	0.8778	0.571 (0.568-1.236)
Milk												
Intercept	0.1389	0.4493	1.138 (0.814-1.589)	-4.7393	*< 0.001	0.009 (0.002-0.028)	-4.1310	*< 0.001	0.016 (0.004-0.056)	-2.5988	*< 0.001	0.067 (0.030-0.141)
Weighted milk intake	0.0038	0.9371	1.001 (0.972-1.029)	-0.0093	0.8668	0.992 (0.889-1.124)	-0.1830	0.2270	0.930 (0.789-1.057)	-0.1302	0.2190	0.501 (0.874-1.027)
Cheese												
Intercept	0.2154	0.2125	1.240 (0.884-1.742)	-4.6941	*< 0.001	0.010 (0.003-0.032)	-4.5478	*< 0.001	0.011 (0.002-0.037)	-2.5680	*< 0.001	0.602 (0.053-0.147)
Weighted cheese intake	-0.0719	0.1775	0.931 (0.834-1.027)	-0.1614	0.4667	0.851 (0.455-1.132)	0.1066	0.3418	1.112 (0.818-1.366)	-0.2032	0.2287	0.816 (0.554-1.079)
Vegetable												
Intercept	0.3654	0.1562	1.441 (0.871-2.393)	-3.4189	*0.0003	0.033 (0.005-0.181)	-4.3388	*< 0.001	0.013 (0.001-0.085)	-2.5495	*< 0.001	0.078 (0.0034-0.242)
Weighted vegetable intake	0.0030	0.8625	1.003 (0.930-1.012)	-0.0571	*0.0104	0.944 (0.902-0.985)	-0.0167	0.4351	0.983 (0.941-1.024)	-0.0096	0.4607	0.990 (0.9564-1.018)
Fruit												
Intercept	0.0760	0.6503	1.079 (0.776-1.499)	-4.7791	*< 0.001	0.008 (0.002-0.026)	-4.5418	*< 0.001	0.013 (0.003-0.045)	-2.7301	*< 0.001	0.065 (0.029-0.136)
Weighted fruit intake	0.0134	0.6858	1.014 (0.932-1.036)	0.0022	0.9491	1.002 (0.934-1.047)	-0.0147	0.7232	0.985 (0.905-1.002)	-0.0328	0.2490	0.968 (0.9514-1.019)

Table 2-2. Association between β-adrenergic agonists detection rates and the kinds of intake food (logistics regression)

	Zilpaterol			Cimaterol			Tulobuterol			Fenoterol		
Food ingestion frequency	Estimate	Pr(>|z|)	OR (95% CI)	Estimate	Pr(>|z|)	OR (95% CI)	Estimate	Pr(>|z|)	OR (95% CI)	Estimate	Pr(>|z|)	OR (95% CI)
2 feet poultry												
Intercept	-3.8724	*< 0.001	0.021 (0.007-0.060)	-2.66e+01	0.993	-	-3.9282	*< 0.001	0.020 (0.005-0.071)	-3.5546	*< 0.001	0.026 (0.009-0.067)
Weighted 2 feet poultry intake	0.0061	0.9129	1.006 (0.889-1.103)	1.27e-15	1.000	-	0.0085	0.1454	1.093 (0.951-1.213)	0.0244	0.6053	1.025 (0.923-1.113)
4 feet poultry												
Intercept	-3.9618	*< 0.001	0.019 (0.006-0.054)	-2.66e+01	0.993	-	-3.8400	*< 0.001	0.022 (0.005-0.082)	-3.5035	*< 0.001	0.030 (0.0107-0.078)
Weighted 4 feet poultry intake	0.0179	0.6156	1.018 (0.946-1.088)	1.92e-15	1.000	-	0.0434	0.3459	1.044 (0.948-1.157)	-0.0034	0.9212	0.597 (0.928-1.063)
Meat product												
Intercept	-3.3254	*< 0.001	0.036 (0.0117-0.100)	-2.66e+01	0.993	-	-3.5949	*< 0.001	0.018 (0.005-0.061)	-3.5356	*< 0.001	0.028 (0.011-0.072)
Weighted meat product intake	-0.3034	0.0861	0.738 (0.459-0.990)	6.32e-15	1.000	-	0.2350	*0.0210	1.265 (1.001-1.514)	0.0035	0.9717	1.003 (0.805-1.186)
Offal												
Intercept	-3.5828	*< 0.001	0.028 (0.010-0.065)	-2.66e+01	0.993	-	-3.4193	*< 0.001	0.027 (0.007-0.088)	-3.7915	*< 0.001	0.023 (0.0030-0.053)
Weighted offal intake	-0.8463	0.1267	0.429 (0.121-1.025)	1.53e-14	1.000	-	0.2226	*0.0374	1.249 (0.915-1.524)	0.5538	*0.0153	1.427 (1.140-1.913)
Milk												
Intercept	-3.9462	*< 0.001	0.019 (0.007-0.049)	-2.66e+01	0.993	-	-3.5070	*< 0.001	0.030 (0.008-0.093)	-3.4390	*< 0.001	0.032 (0.013-0.073)
Weighted milk intake	0.0286	0.3770	1.029 (0.957-1.088)	-3.69e-15	1.000	-	0.0121	0.7398	1.012 (0.966-1.088)	-0.0268	0.5091	0.574 (0.892-1.045)
Cheese												
Intercept	-3.8955	*< 0.001	0.020 (0.007-0.052)	-2.66e+01	0.993	-	-3.4152	*< 0.001	0.033 (0.009-0.101)	-3.5356	*< 0.001	0.026 (0.010-0.064)
Weighted cheese intake	0.0445	0.6727	1.046 (0.788-1.223)	-9.64e-15	1.000	-	-0.1017	0.7599	0.959 (0.635-1.182)	0.6935	0.2873	1.687 (0.887-1.241)
Vegetable												
Intercept	-4.6331	*< 0.001	0.010 (0.002-0.041)	-2.66e+01	1.000	-	-4.2385	*< 0.001	0.014 (0.002-0.077)	-4.0734	*< 0.001	0.017 (0.004-0.064)
Weighted vegetable intake	0.0076	0.6761	1.008 (0.977-1.053)	-5.27e-16	1.000	-	0.0237	0.2790	1.021 (0.981-1.058)	0.0130	0.3260	1.013 (0.986-1.039)
Fruit												
Intercept	-3.9079	*< 0.001	0.020 (0.007-0.051)	-2.66e+01	0.993	-	-3.4329	*< 0.001	0.032 (0.009-0.098)	-3.5360	*< 0.001	0.026 (0.012-0.067)
Weighted fruit intake	0.0156	0.5035	1.0158 (0.969-1.068)	-3.29e-15	1.000	-	-0.1064	0.8722	0.954 (0.912-1.067)	0.0186	0.9514	1.092 (0.9345-1.053)

OR: odds ratio; * p-value < 0.05
Adjusted for sex, age and area.

Conclusion

We found that the detection rates of β-adrenergic agonists were positively associated with some types of foods such as 4 feet poultry, meat products and offal. However, the nutrition and diet habits questionnaire we used wasn't designed for specific sources of β-adrenergic agonists. Hence, for clenbuterol with a particularly high detection rate, it might need to trace the exposure sources in the future.

Development of Screening Tools for Work-related Lumbar Disc Herniation

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Keywords: Occupational epidemiology, Occupational exposures, Screening tool, Modeling

Introduction

Accurate and timely diagnosis of work-related diseases is crucial for preventing further harm to workers and ensuring appropriate compensation. The referral mechanism from general practitioners to occupational physicians is an essential step in the diagnosis of occupational diseases. This study aimed to develop a screening tool to assist general practitioners in referring cases of work-related lumbar disc herniation (LDH) to occupational physicians.

Methods

We analyzed data from the Network of Occupational Diseases and Injuries Service (NODIS), a surveillance system of occupational diseases in Taiwan. From 2010 to 2018, we identified 1,421 patients diagnosed with LDH, and their diseases were classified by reviewers as having higher or lower probability of work-relatedness. We collected demographic and occupational information from the patients and used logistic regression and machine learning methods to investigate the effect of each factor and to develop the screening tool.

Results

Among the 1,421 confirmed LDH cases, 824 were classified as having a higher probability of work-relatedness, while 597 were lower. Our analysis identified five factors that were statistically significant in favor of higher probability of work-relatedness: female sex, tenure over ten years, never stopped working after symptoms onset, currently working part-time, and working in the manufacturing or construction industry. We developed a screening tool based on these factors, which achieved a sensitivity of 0.90 and a positive predictive value of 0.60.

Conclusion

Our study identified demographic and occupational factors that are indicative of work-related LDH. The proposed screening tool can assist general practitioners in referring suspected work-related LDH cases to occupational physicians for further evaluation.

	Probability of work-relatedness			
	Higher (n = 824)	Lower (n = 597)	Total (n = 1421)	Crude OR (95% CI)
Sex				
Male	688 (83.5%)	468 (78.4%)	1156 (81.4%)	Ref
Female	136 (16.5%)	129 (21.6%)	265 (18.6%)	0.71 (0.55–0.94) *
Age (years)				
(mean ± SD)	48.7 ± 9.0	48.1 ± 9.5	48.5 ± 9.2	
Age ≤ 40	178 (21.6%)	141 (23.6%)	319 (22.4%)	Ref
40 < Age ≤ 55	439 (53.3%)	319 (53.4%)	758 (53.3%)	1.09 (0.84–1.42)
55 < Age	207 (25.1%)	137 (22.9%)	344 (24.2%)	1.20 (0.88–1.63)
Job tenure (years)				
(mean ± SD)	20.6 ± 9.5	19.9 ± 10.0	20.3 ± 9.7	
JT ≤ 10	103 (12.5%)	115 (19.3%)	218 (15.3%)	Ref
10 < JT ≤ 25	492 (59.7%)	327 (54.8%)	819 (57.6%)	1.68 (1.24–2.27) *
25 < JT	229 (27.8%)	155 (26.0%)	384 (27.0%)	1.64 (1.18–2.31) *
Current working status				
Full-time	618 (75.0%)	443 (74.2%)	1061 (74.7%)	Ref
Part-time	72 (8.7%)	23 (3.9%)	95 (6.7%)	2.24 (1.38–3.64) *
Jobless	134 (16.3%)	131 (21.9%)	265 (18.6%)	0.73 (0.56–0.96) *
Ever stopped working				
Yes	355 (43.1%)	295 (49.4%)	650 (45.7%)	Ref
No	469 (56.9%)	302 (50.6%)	771 (54.3%)	1.29 (1.04–1.59) *
Industry classification				
Manufacturing	245 (29.7%)	166 (27.8%)	411 (28.9%)	1.31 (1.02–1.68) *
Construction	245 (29.7%)	135 (22.6%)	380 (26.7%)	1.61 (1.24–2.09) *
Others	334 (40.6%)	296 (49.6%)	630 (44.4%)	Ref
Occupation classification				
Elementary laborers	201 (24.4%)	122 (20.4%)	323 (22.7%)	1.26 (0.97–1.62)
Others	623 (75.6%)	475 (79.6%)	1098 (77.3%)	Ref

SD: standard deviation; JT: job tenure. * p-value < 0.05.

Table 1.
Factors associated with higher probability of work-relatedness for lumbar disc herniation

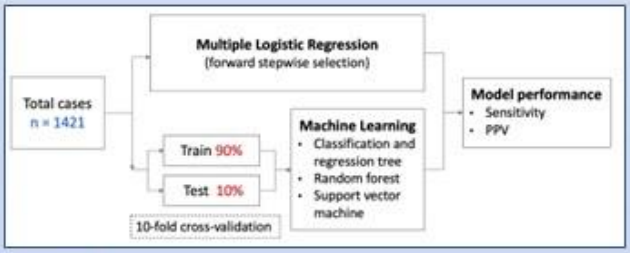

Figure 1.
Flowchart illustrating the data analysis process for developing the screening tool for work-related lumbar disc herniation.

	Sensitivity	PPV
Logistic regression	0.90	0.60
CART	0.78	0.38
Random forest	0.54	0.19
Support vector machine	0.83	0.38

PPV: positive predictive value. CART: classification and regression trees.

Table 2.
Performance of prediction models for work-related lumbar disc herniation. All machine learning methods underwent 10-fold cross-validation, and the mean performance results are shown.

Urinary Phthalates Esters in Nationwide Representative Samples of Taiwan in 2019

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Keywords: phthalate, Chemical exposures, Environmental epidemiology, Exposure assessment

Introduction

Since 2011, there was an incident involving phthalate-tainted food that di-(2-ethylhexyl) phthalate (DEHP) and di-isononyl phthalate (DiNP) were illegally added to foodstuffs and medications. DEHP and DiNP, as widespread plasticizers, are considered endocrine disrupting chemicals (EDCs) with main toxicological effects on reproductive and metabolic systems.

Nationwide human biomonitoring (HBM) surveys have been conducted in many countries long time ago. Like the United States beginning in the early 1960s, which call the National Health and Nutrition Examination Survey (NHANES). However, there is no nationwide human biomonitoring survey had been conducted in Taiwan in recent years. We aimed to establish the urinary levels and reference values (RVs) of phthalate metabolites and identify exposure characteristics among Taiwan's population.

Methods

We enrolled 1748 participants 7 years of age and older from the Nutrition and Health Survey in Taiwan (NAHSIT) conducted in 2019 by using probability proportional to size (PPS) and primary sampling unit (PSU) sampling covering 20 cities or counties of Taiwan. Each township was classified into one of two groups according to its population density and urbanization level. We collected participant's urine, blood, and environmental and lifestyle questionnaires. Levels of 12 different phthalate were determined by Ultra Performance Liquid Chromatography-tandem mass spectrometry (UPLC-MS/MS) for analysis.

Results

When compared directly to adults, children have higher levels of phthalate metabolites. Concentrations of most phthalate metabolites in urine were higher in the 7 to 18-year-old group than in the ≥19-year-old group and exceedances of MnBP (0.4%) and MiBP (0.8%) were higher than other countries.

Conclusion

Compared to adults, children's exposure to phthalates has a relatively low threshold, so more attention should be paid to in this age group, and the government should keep follow up on children's exposure to phthalates continuously.

Table 6.Comparison of 95 percentile levels for urinary phthalate metabolites in 6-19 years old from different countries (μg/L).

Country	TEST, Taiwan [a]		Taiwan		NHANES, USA [b]		CHMS, Canada [c]		KoNEHS, Korea [d]		GerES V, Germany [e]
Year	2013-2016		2019		2017-2018		2018-2019		2015-2017		2014-2017
Age	7-11	12-17	7-12	13-18	6-11	12-19	6-11	12-19	6-11	12-18	3-17
N	336	257	134	125	306	365	498	504	885	901	2256
	P_{95}	P_{95}	P_{95}	P_{95}	P_{95}	P_{95}	P_{95}	P_{95}	P_{95}	P_{95}	P_{95}
MEHP	63.1	54.3	18.9	8.6	6.8	4.1	4.3	5.5	-	-	6.7
MECPP	221.0	139.8	81.1	46.0	61.2	35.7	34.0	26.0	144.0	89.7	46.1
MiBP	140.8	89.5	47.1	21.7	58.5	37.9	65.0	39.0	-	-	110.0
MnBP	218.3	135.6	72.9	49.2	50.9	50.3	72.0	60.0	126.0	168.0	69.6
MEP	168.7	234.8	58.7	71.2	192.0	322.0	130.0	180.0	-	-	219.0
MBzP	15.6	11.7	1.7	1.4	36.2	33.0	46.0	26.0	24.2	25.3	18.7
MnOP	- [f]	-	0.9	0.4	-	-	< LOD [g]	< LOD [g]	-	-	< LOD [g]
MHINP	-	-	26.3	21.1	-	-	7.5	5.5	-	-	30.2
MCINP	-	-	2.2	1.2	15.4	8.6	3.1	2.2	1.5	1.0	30.2
oxo-MPHP	-	-	4.7	3.7	-	-	-	-	-	-	1.8
OH-MINCH	-	-	7.2	5.0	13.1	10.9	1.4	1.5	-	-	15.8
MECPTP	-	-	23.5	29.7	565.0	693.0	-	-	-	-	48.7

a. Taiwan Environmental Survey for Toxicants 2013–2016(Liao, 2021).

Table 6.
Comparison of 95 percentile levels for urinary phthalate metabolites in 6-19 years old from different countries (μg/L).

Table 8. Exceedances of HBM I values or HBM-GVs in Taiwan HBM for DEHP, DBP, BBzP, DPHP, DPHTP and DINCH.

Phthalate metabolites	HBM-I value or HBM-GVs for children (mg/L)	HBM-I value or HBM-GVs for adults (mg/L)	% of Taiwan HBM participants exceeding HBM values in 7–12 years	% of Taiwan HBM participants exceeding HBM values in ≥13 years	Extrapolated for the population in Taiwan aged 7–12 years	Extrapolated for the population in Taiwan aged ≥13 years
MnBP	0.12	0.19	0.4%	0%	~ 5695 persons [a]	0
MiBP	0.16	0.23	0.8%	0%	~ 11390 persons [a]	0
MBzP	2.0	3.0	0%	0%	0	0
oxo-MPHP	0.19	0.29	0%	0%	0	0
5cx-MEPTP	1.8	2.8	0%	0%	0	0
5-cx-MEPP + 5-OHMEHP	0.38	0.57	- [b]	-	-	-
OH-MINCH + cx-MINCH	3.0	4.5	- [c]	-	-	-

a. 2019 demographic data from Dept. of Household Registration in Taiwan.
b. 5-OHMEHP data not analyze in this study.
c. cx-MINCH data not analyze in this study.

Table 8.
Exceedances of HBM I values or HBM-GVs in Taiwan HBM for DEHP, DBP, BBzP, DPHP, DPHTP and DINCH.

Analysis of Urinary Metal Levels in Taiwan's 2019 Human Biomonitoring and Epidemiology Study

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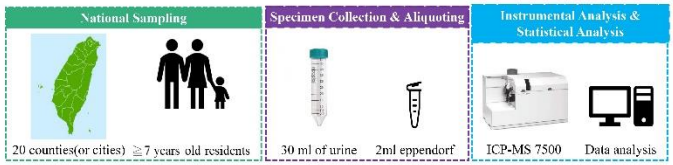
OBJECTIVE

Human beings are often exposed to metals and metalloid elements in our daily life. Human biomonitoring can be used to determine internal aggregate exposures to chemicals from all different sources and through all exposure routes. The aim of this study was to establish the concentration distributions of heavy metals in urine among the general population in Taiwan. Compared with the National Health and Nutrition Examination Survey (NHANES), find out the heavy metals with higher concentration in Taiwan human biomonitoring.

MATERIALS AND METHODS

The research population was collected nationwide in 2019, recruiting a total of 1748 subjects aged 7 and over, collecting urine samples and conducting questionnaire interviews. The study design was a cross-sectional study with a stratified multistage cluster sampling design. 30 ml of urine was collected for each sample and stored in a -20°C freezer. Aliquot 1.5ml of each urine sample into 2ml eppendorf. The concentrations of 20 environmental heavy metals were analyzed by inductively coupled plasma mass spectrometry (ICP-MS). The measured metal concentration was supplemented by LOD/√2, and the adult urine creatinine >300 mg/dL and <30 mg/dL samples were excluded. In this study, the concentration of heavy metals in urine was logarithmically transformed($\log_{10}$), and multivariate regression analysis was used to explore the effect of diet frequency on heavy metal concentrations. The statistical software used for data statistical analysis is SAS 9.4.



RESULTS

Table 1 presents the geometric mean concentration of 20 heavy metals and the 25%, 50%, 75% and 95% concentration value. Table 2 shows the concentration of zinc was higher in men (358.3 μg/g creatinine) than in women (357.0 μg/g creatinine), and the concentrations of other heavy metals were higher in women. The concentration distribution of heavy metals in each age group (07-12 years old, 13-18 years old, 19-39 years old, 40-64 years old, and over 65 years old) showed a U-shaped trend, and the concentration of each age group was significantly different. Figure 1 shows that compared with the NHANES, these 7 heavy metals(including As, Ba, Cd, Cr, Mn, Ni, Pb) were found to be of higher concentration in human biomonitoring in Taiwan.

CONCLUSIONS

1. This study established the distribution of urinary heavy metal concentrations in the Taiwanese population in 2019.
2. Compared with the heavy metal concentrations detected by NHANES, 7 heavy metals were found to have relatively high concentrations in Taiwan.
3. For the effect of diet frequency, fish and seafood were found to have a strong positive correlation with arsenic concentration. Meat products and offal showed a strong negative correlation with the concentration of nickel metal. This phenomenon will be further studied and discussed in the future.

Table 1. Geometric mean, minimum, maximum, and selected percentiles of urinary heavy metal concentrations (in μg/g of creatinine) in the general population of Taiwan(n=1450)

	MIN	Selected percentiles				MAX	GM(95% CI)
		25th(95% CI)	50th(95% CI)	75th(95% CI)	95th(95% CI)		
As	1.54	27.57(26.03,29.11)	51.66(47.18,54.74)	99.2(91.4,106.99)	304.92(271.71,338.12)	2423.59	54.12(51.44,56.94)
Ba	0.22	1.82(1.69,1.95)	3.24(3.06,3.37)	5.26(4.97,5.55)	10.96(10.13,11.79)	67.65	3.09(2.96,3.22)
Cd	0.01	0.29(0.27,0.31)	0.52(0.49,0.55)	0.87(0.83,0.92)	1.70(1.61,1.79)	7.37	0.48(0.46,0.5)
Co	0.01	0.19(0.18,0.2)	0.29(0.28,0.3)	0.47(0.44,0.5)	1.29(1.13,1.44)	82.92	0.29(0.28,0.31)
Cr	0.03	0.70(0.65,0.74)	1.25(1.19,1.31)	2.16(2.06,2.25)	4.85(4.28,5.42)	86.71	1.20(1.15,1.26)
Cs	0.63	3.49(3.4,3.58)	4.57(4.44,4.67)	6.20(5.95,6.45)	9.85(9.29,10.41)	19.30	4.66(4.55,4.77)
Cu	0.66	5.96(5.71,6.22)	8.76(8.49,9.05)	13.3(12.6,13.99)	27.32(25.04,29.6)	202.96	8.82(8.51,9.15)
Fe	0.54	12.87(12.01,13.73)	23.42(21.83,25.16)	45.28(41.88,48.67)	164.08(139.87,188.3)	4352.24	25.16(23.82,26.58)
Ga	0.02	0.38(0.35,0.41)	0.66(0.62,0.7)	1.14(1.08,1.19)	2.55(2.39,2.71)	15.87	0.63(0.6,0.66)
In	<0.01	0.02(0.02,0.02)	0.03(0.03,0.03)	0.06(0.06,0.07)	0.18(0.17,0.2)	1.43	0.03(0.03,0.04)
Mn	0.03	0.74(0.65,0.83)	1.61(1.52,1.71)	3.15(2.92,3.37)	8.02(7.02,9.01)	159.82	1.41(1.33,1.5)
Ni	0.19	2.46(2.33,2.58)	3.91(3.77,4.05)	6.33(6.06,6.6)	13.3(11.82,14.77)	83.25	3.95(3.8,4.11)
Pb	0.03	0.73(0.7,0.77)	1.18(1.13,1.25)	1.94(1.84,2.04)	4.02(3.62,4.41)	122.06	1.20(1.16,1.25)
Se	4.91	33.73(32.84,34.62)	44.69(43.66,46.09)	59.01(57.41,60.61)	89.80(85.45,94.15)	521.90	44.18(43.17,45.22)
Sn	0.05	0.44(0.42,0.46)	0.75(0.71,0.80)	1.30(1.24,1.36)	2.75(2.58,2.92)	48.86	0.75(0.72,0.79)
Sr	3.38	94.33(90.17,98.49)	145.67(140.68,150.81)	218.87(209.75,227.99)	365.35(347.5,383.21)	925.57	136.1(131.33,141.04)
Ti	4.49	58.65(57.05,60.25)	77.93(75.77,79.33)	102.06(98.93,105.19)	151.91(146.16,157.66)	377.88	76.57(74.84,78.35)
Tl	<0.01	0.12(0.12,0.13)	0.18(0.17,0.19)	0.28(0.26,0.29)	4.38(3.64,5.11)	30.96	0.20(0.19,0.22)
V	0.01	0.21(0.2,0.22)	0.35(0.33,0.37)	0.54(0.51,0.56)	0.96(0.9,1.03)	8.64	0.32(0.31,0.33)
Zn	23.88	256.07(245.45,266.69)	357.02(346.43,368.12)	525.64(507.45,543.84)	863.74(821.04,906.44)	2061.99	357.69(347.4,368.28)

MIN: minimum value; MAX: maximum value; GM: geometric mean; CI: confidence interval

Table 2. Geometric means (95% CI) of urinary heavy metal concentrations (in μg/g of creatinine) among sex and age groups in the general population of Taiwan (n=1450)

	Sex			Age, *P*-value[b]<0.001				
	Male	Female	*P*-value[a]	07-12yrs	13-18yrs	19-39yrs	40-64yrs	≧65yrs
As	52.59(48.93,56.53)	55.86(52.01,59.99)	0.14	51.34(44.82,58.81)	30.59(26.3,35.58)	33.29(29.3,37.82)	58.91(53.09,65.37)	69.27(64.34,74.57)
Ba	2.70(2.55,2.86)	3.57(3.36,3.79)	***	3.76(3.35,4.22)	2.11(1.84,2.4)	2.35(2.11,2.6)	3.42(3.16,3.71)	3.29(3.08,3.52)
Cd	0.40(0.38,0.43)	0.59(0.55,0.63)	***	0.23(0.2,0.26)	0.21(0.19,0.24)	0.29(0.26,0.32)	0.64(0.6,0.69)	0.67(0.64,0.71)
Co	0.23(0.21,0.24)	0.39(0.36,0.41)	***	0.42(0.38,0.46)	0.33(0.28,0.38)	0.26(0.23,0.3)	0.31(0.28,0.34)	0.26(0.25,0.28)
Cr	1.13(1.06,1.2)	1.30(1.21,1.39)	**	1.41(1.24,1.6)	0.76(0.65,0.9)	0.86(0.76,0.98)	1.23(1.12,1.34)	1.42(1.32,1.52)
Cs	4.30(4.16,4.44)	5.09(4.93,5.26)	***	4.99(4.63,5.37)	3.51(3.28,3.77)	3.88(3.69,4.08)	4.86(4.65,5.09)	5.05(4.87,5.23)
Cu	8.35(7.96,8.76)	9.38(8.89,9.9)	**	10.62(9.69,11.64)	6.31(5.67,7.02)	6.86(6.3,7.48)	8.55(7.98,9.16)	10.12(9.55,10.72)
Fe	22.52(20.9,24.26)	28.45(26.28,30.8)	***	25.1(21.09,29.86)	15.45(12.83,18.61)	18.4(16.08,21.04)	26(23.32,28.99)	30.47(28.08,33.07)
Ga	0.55(0.52,0.59)	0.73(0.69,0.79)	***	0.75(0.68,0.84)	0.44(0.38,0.51)	0.48(0.43,0.54)	0.71(0.65,0.78)	0.67(0.62,0.72)
In	0.03(0.03,0.03)	0.04(0.04,0.04)	**	0.03(0.03,0.03)	0.02(0.02,0.03)	0.02(0.02,0.03)	0.04(0.03,0.04)	0.04(0.04,0.05)
Mn	1.21(1.11,1.32)	1.68(1.54,1.83)	***	1.28(1.03,1.58)	0.82(0.69,0.99)	1.09(0.92,1.28)	1.46(1.31,1.64)	1.73(1.57,1.91)
Ni	3.38(3.21,3.57)	4.69(4.44,4.96)	***	4.85(4.32,5.44)	3.01(2.67,3.38)	2.98(2.66,3.34)	3.91(3.63,4.22)	4.43(4.18,4.71)
Pb	1.09(1.03,1.15)	1.34(1.27,1.43)	***	1.02(0.91,1.14)	0.63(0.55,0.72)	0.85(0.77,0.94)	1.37(1.28,1.48)	1.49(1.41,1.58)
Se	40.9(39.64,42.21)	48.12(46.54,49.76)	***	54.89(50.76,59.36)	39.13(36.66,41.77)	38.35(36.45,40.35)	46.43(44.27,48.68)	43.89(42.33,45.5)
Sn	0.69(0.65,0.73)	0.83(0.79,0.88)	***	0.76(0.67,0.86)	0.47(0.42,0.54)	0.52(0.46,0.58)	0.81(0.75,0.88)	0.9(0.85,0.96)
Sr	117.38(111.61,123.44)	160.35(152.91,168.15)	***	163.51(144.31,185.26)	110.03(97.12,124.66)	94.91(86.08,104.64)	150.97(141.9,160.62)	144.68(137.22,152.54)
Tl	0.18(0.17,0.2)	0.22(0.2,0.25)	**	0.3(0.24,0.37)	0.15(0.12,0.18)	0.2(0.17,0.23)	0.22(0.19,0.25)	0.19(0.17,0.21)
Ti	73.29(71.05,75.61)	80.37(77.73,83.11)	***	97.77(90.87,105.19)	69.45(64.79,74.44)	72.24(68.68,75.98)	79.82(76.38,83.41)	73.45(70.78,76.22)
V	0.30(0.29,0.32)	0.34(0.32,0.36)	*	0.37(0.33,0.42)	0.23(0.2,0.26)	0.23(0.21,0.25)	0.32(0.3,0.35)	0.37(0.35,0.39)
Zn	358.31(344.14,373.06)	357(342.22,372.42)	0.62	495.46(456.25,538.04)	348.79(323.67,375.86)	282.14(263.42,302.2)	347.49(327.95,368.19)	369.21(352.37,386.87)

[a] :Comparison of the sex groups by Mann Whitney U test; [b] :Comparison of five age groups by Kruskal Wallis test; *P<0.05,**P<0.01,***P<0.001

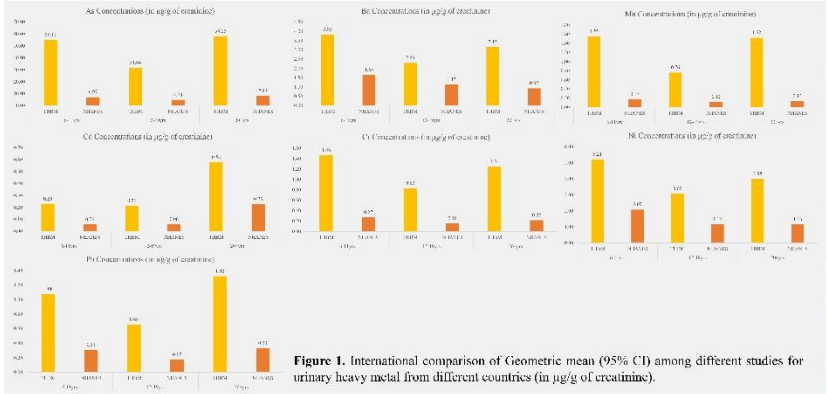


Figure 1. International comparison of Geometric mean (95% CI) among different studies for urinary heavy metal from different countries (in μg/g of creatinine).

Table 3. Regression coefficients(β) of multivariable regression model of dietary frequency and urinary heavy metal concentrations (in μg/g of creatinine)(heavy metal concentrations have been log-transformed)

Dietary Frequency	As, β	Ba, β	Cd, β	Cr, β	Mn, β	Ni, β	Pb, β
Vegetable							
Midden	0.022	-0.011	-0.014	-0.022	0.096*	-0.018	-0.004
High	0.022	0.04	0.049	-0.005	0.151*	-0.033	0.056
Rice							
Midden	0.013	0.043	-0.015	0.008	0.008	-0.017	0.029
High	0.017	0.024	-0.021	-0.011	-0.044	-0.014	-0.015
Soymilk							
Midden	-0.029	0.018	0.004	-0.007	-0.034	-0.05*	-0.012
High	-0.041	0.017	-0.007	-0.003	0.005	-0.006	0.002
Soy_product							
Midden	-0.056	0.006	-0.015	0.01	0.047	-0.019	0.006
High	-0.156**	0.027	0.003	0.074*	-0.035	-0.058*	0.019
Nut							
Midden	-0.053*	0.008	-0.023	0.016	-0.02	-0.048*	0.015
High	-0.04	-0.002	-0.024	0.044	0.009	-0.028	0.011
Fish							
Midden	0.25**	-0.03	-0.004	-0.025	-0.001	-0.039*	-0.014
High	0.398**	0.022	0.031	-0.018	-0.001	-0.102*	-0.009
Seafood							
Midden	0.148**	-0.023	<0.001	-0.028	0.006	-0.038	-0.034
High	0.249**	-0.024	0.005	-0.01	-0.073	-0.052*	-0.038
Aquatic_product							
Midden	0.086*	0.012	-0.012	-0.013	-0.025	-0.053*	-0.011
High	0.1*	0.005	-0.022	-0.039	-0.016	-0.066*	0.001
Egg							
Midden	0.023	-0.032	-0.021	-0.003	-0.012	-0.02	-0.042*
High	0.007	0.02	0.012	0.029	0.008	0.007	-0.03
Milk							
Midden	-0.004	0.032	-0.008	-0.01	0.029	-0.006	-0.027
High	-0.047	0.017	-0.047*	-0.024	0.04	-0.04	-0.053*
Poultry_2feet							
Midden	0.046	-0.018	-0.04*	-0.04	0.028	-0.006	0.007
High	0.003	0.001	-0.054*	-0.085*	0.042	-0.025	-0.011
Poultry_4feet							
Midden	0.001	0.016	0.002	-0.047*	0.033	-0.035	0.018
High	0.028	0.013	0.038	-0.013	0.088*	-0.009	0.051*
Meat_product							
Midden	0.015	-0.033	-0.037	-0.054	-0.018	-0.075**	-0.037
High	-0.019	-0.033	-0.029	-0.016	-0.045	-0.077*	-0.033
Offal							
Midden	0.06211*	0.01	0.001	-0.036	0.003	-0.062*	0.001
High	0.06	-0.014	-0.055*	-0.048	-0.046	-0.133**	<0.001
Fruit							
Midden	0.031	0.006	-0.005	0.021	-0.006	-0.029	-0.025
High	0.045	0.03	0.02	-0.007	0.068	-0.016*	-0.009
Coffee							
Midden	-0.003	-0.023	-0.018	-0.026	-0.088*	-0.032	-0.032
High	-0.055	-0.015	-0.026	-0.017	-0.065	-0.044	-0.044
Tea							
Midden	-0.016	-0.005	-0.005	0.019	0.019	0.016	-0.01
High	-0.044	-0.005	-0.002	0.001	0.07	0.046	0.024
Sugar_drink							
Midden	-0.03	0.004	0.006	-0.016	-0.013	-0.042	-0.019
High	-0.1*	0.013	-0.031	-0.03	0.01	-0.049	<0.001

Reference group: low frequency group of dietary frequency;
Model: adjusted for sex, age, income, BMI, smoke, house age, burn incense; *P<0.05,**P<0.001

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Childhood Exposure to Perfluoroalkyl Substances in relation to Child Adiposity

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Introduction: Per- and polyfluoroalkyl substances (PFAS) have been used in industrial and consumer products since the 1950s. While epidemiological studies have found associations between some harmful health effects and PFAS exposure, including increased serum lipids and decreased infant birth weight, the evidence linking PFAS to obesity remains unclear. Furthermore, most studies have focused on long-chain PFAS, which have been prohibited, rather than emerging PFAS used by recent manufacturers. In this cross-sectional study, we aim to evaluate the associations between childhood PFAS exposures and health effects related to obesity.

Methods: 17 different PFAS were measured in 595 children aged 6 to 9 in 2018. Various biomarkers were also measured, including lipid profiles, fasting insulin, fasting glucose, adiponectin, leptin, and insulin growth factor-1. We also recorded their BMI, body fat percentage, and waist-height ratio. One-way ANOVA was used to analyze the difference in serum biomarkers linked to metabolic dysfunction among different PFAS concentration quantiles. Spline regression was used to analyze the association between PFAS and findings in physical examination.

Results: Among the participants, 99 children were classified as underweight, and 103 as overweight or obese. 13 of the 17 PFAS were detected in over 70% of the participants. ANOVA analysis revealed an association between increased long-chain PFAS levels and increased serum lipids, consistent with previous research. We also found a difference in adiponectin and homeostatic model assessment insulin resistance (HOMA-IR) in both long- and short-chain PFAS exposure, indicating an increased risk for future metabolic diseases. However, no clear trend was observed between any specific PFAS and obesity.

Conclusion: Our study shows potential associations between specific PFAS exposure and biomarkers linked to metabolic dysfunction in children. However, given the complex mixture of PFAS that humans are exposed to, further investigation is crucial to determine the contribution of the entire mixture and the different PFAS.

Keywords: children, obesity, perfluoroalkyl substances

Legacy and Alternative *Per*- and Polyfluoroalkyl Substances in Paired Serum-Urine Data from the 2009-2012 Taiwan Birth Panel Study

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Introduction

Scientists have discovered possible relationships between levels of per- and polyfluoroalkyl substances (PFAS) in blood and harmful health effects in people. Research involving humans suggests that high levels of certain PFAS may lead to the following: increased cholesterol levels, decreased vaccine response in children, changes in liver enzymes, small decrease infant birth weights, increased risk of high blood pressure or pre-eclampsia in pregnant women and increased risk of kidney or testicular cancer.[1] Because of the health concern of PFAS, manufacturers have replaced select chemistries ("legacy" PFAS) with PFAS with shorter biological half-lives (e.g., perfluorobutanoate [PFBA]). However, knowledge regarding exposure to these compounds is limited.[2] Most of the studies mentioned above use serum concentration of PFAS for assessment of PFAS exposure. Yet, information on urinary concentrations of PFAS is limited. It may be important topic since current studies show that short-chain PFAS mainly eliminate through kidney.[3] We hope to evaluate the relationship between urine and serum concentration of PFOS and the possibility to us urine as a biomonitoring matrix for assessment of PFAS exposure.

Material and Method

We use the urinary and serum concentrations of 17 legacy and alternative short-chain PFAS in 595 children in Taiwan Birth Panel Study (TBPS) II. The R software version 4.2.2 was used for statistical analysis. Concentration below LOD was replaced by LOD/2 and urine concentration was adjust by urine creatinine. We use Pearson correlation test to evaluated the relationship between log serum and log urine PFAS concentration when the detection rate is above 70%.

Results

In 2018, 632 participants with 632 urine and 595 serum sample were collected. 17 kinds of PFAS were elevated. (See Table1) Concentrations of PFBS in serum and urine were median correlated (r = 0.45) with p-value<0.05. Concentrations of PFOA in serum and urine were median correlated (r = 0.41) in male with p-value<0.05. Other PFAS did not show low positive or negative correlation between urine and serum concentration. (see Table2)

Conclusion

It seems that there is no strong linear correlation between PFAS urine and serum concentration. It may because there is other pathway to eliminate PFAS in human body. Serum may still be a more appropriate way to measure the exposure of PFAS. But urine concentration of PFAS is still important since it will give us more information to elimination half-life and the metabolic pathway.

Table 1. Concentration of child serum and urine PFAS (ng/mL)

	Number		Detection Rate (%)		Mean		SD*	
	Serum	Urine	Serum	Urine	Serum	Urine*	Serum	Urine*
Serum perfluoroalkyl substances (ng/mL)								
PFBA	595	632	93	92	4.42	107.03	7.07	1009.20
PFPeA	595	632	60	97	-	4.54	-	33.20
PFHxA	595	632	65	96	-	4.08	-	14.69
PFOA	595	632	100	100	3.34	0.21	1.56	0.53
PFNA	595	632	100	84	3.26	0.13	3.03	0.28
PFDA	595	632	95	47	1.02	-	11.63	-
PFUnDA	595	632	100	90	1.44	0.20	0.96	0.74
PFDoDA	595	632	89	28	0.08	-	0.19	-
PFBS	595	632	92	98	14.61	36.76	28.31	134.00
PFHxS	595	632	100	94	2.14	4.29	1.70	19.29
PFOS	595	632	100	99	6.07	0.86	4.51	2.09
HFPO-DA	259	296	88	94	0.32	0.72	0.15	1.20
PFOSA	259	296	89	94	0.04	0.05	0.21	0.17
6:2 PAP	259	296	71	94	0.30	58.59	0.25	142.60
8:2 PAP	259	296	63	94	-	1.54	-	4.78
6:2 diPAP	259	296	66	81	-	0.64	-	2.38
8:2 diPAP	259	296	100	41	89.55	-	43.72	-

*SD: Standard deviation
*Urine concentrations are adjusted with urine creatinine

Table2. Probability of Significant Correlations between PFAS concentrations in serum and urine normalized by urinary creatinine

	All			Female			Male		
	Coefficient	P-value	N	Coefficient	P-value	N	Coefficient	P-value	N
PFBA	0.21	<0.05	595	0.29	<0.05	263	0.22	<0.05	296
PFBS	0.45	<0.05	595	0.41	<0.05	263	0.46	<0.05	296
PFOA	0.38	<0.05	595	0.35	<0.05	263	0.41	<0.05	296
PFOS	0.18	<0.05	595	0.21	<0.05	263	0.19	<0.05	296
PFNA	-0.31	<0.05	595	-0.18	<0.05	263	-0.33	<0.05	296
PFHxS	-0.16	<0.05	595	-0.13	<0.05	263	-0.19	<0.05	296
PFUnDA	-0.15	<0.05	595	-0.093	0.16	263	-0.18	<0.05	296
HFPO-DA (GenX)	-0.08	0.2	259	-0.045	0.64	106	-0.024	0.8	117
PFOSA	0.055	0.38	259	0.047	0.63	106	0.077	0.41	117
6:2 PAP	-0.053	0.4	259	-0.06	0.54	106	-0.093	0.32	117

Anemia Prevalence and Ambient Air Lead Levels in Taiwan: A Before and After Comparison of the Leaded Gasoline Ban

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Keywords: air pollution, heavy metals, policy and practice

Introduction

Lead exposure can adversely affect many physiologic functions of human, and it was associated with anemia risk. Due to the adverse health effects of lead exposure, the governments worldwide put forward the regulation to decrease lead emissions. Therefore, the leaded gasoline was banned in Taiwan in 2000. The introduction of lead-free gasoline resulted in a decrease in air lead levels and a decrease in average blood lead levels consequently. My study aimed to investigate the differences of prevalence of anemia and ambient air lead level before and after the ban of leaded gasoline in Taiwan.

Methods

The study population would be adults aged from 19 to 64. Data of hematological indicators, such as hemoglobin level, was obtained from Nutrition and Health Survey in Taiwan during 1993-1996 and 2004-2008. Anemia was defined using a strict cut-off of <13.0 g/dl in men and <12.0 g/dl in women. And the ambient air lead levels of years were extracted from Environmental Protection Administration in Taiwan.

Results

The ambient air lead levels in Taiwan have been decreasing from 1998 to 2021. Furthermore, among adults aged from 19 to 64 that included in this study, prevalence of anemia (12.4%) in 2005-2008 was lower than the prevalence (13.5%) in 1993-1996.

Conclusion

The prevalence of anemia was decreased among adults aged from 19 to 64 included in this study after the ban of leaded gasoline. The potential confounding variables are considered and the further analysis will be conducted. The results of this study can provide evidence of the improvement of anemia risk after the ban of leaded gasoline and help the authorities to evaluate the impact of the environmental regulations.

	1993-1996 NAHSIT (%, n = 9961)	2005-2008 NAHSIT (%, n = 6189)
Sex		
Male	4963 (49.8)	3086 (49.9)
Female	4998 (50.2)	3103 (50.1)
Age, years old		
<=18	4930 (49.5)	1524 (24.6)
19-64	4019 (40.3)	3118 (50.4)
>=65	1012 (10.2)	1547 (25.0)
Body mass index (BMI)		
Underweight	488 (4.9)	129 (2.1)
Normal weight	3872 (38.9)	1703 (27.5)
Overweight	1137 (11.4)	872 (14.1)
Obese	825 (8.3)	760 (12.3)
Educational level		
Primary school and below	5725 (57.5)	3376 (54.5)
Junior high school	1960 (19.7)	618 (10.0)
Senior high school	1708 (17.1)	1195 (19.3)
University and graduate school	565 (5.7)	996 (16.1)
Behavior		
Smoking	2541 (25.5)	1029 (16.6)
Alcohol drinking	925 (9.3)	1648 (26.6)
Disease		
Cancer	33 (0.3)	81 (1.3)
Kidney disease	158 (1.6)	90 (1.5)
Peptic Ulcer	534 (5.4)	520 (8.4)

Table 1. Basic information of the 1993-1996 and 2005-2008 Nutrition and Health Surveys in Taiwan (NAHSIT)

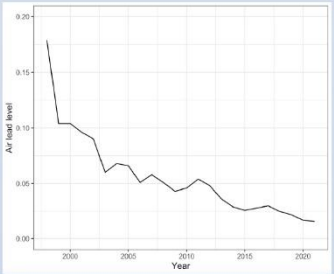

Figure 1. The trend of air lead concentration in Taiwan, 1998-2021.

	1993-1996 NAHSIT		2005-2008 NAHSIT		P-value	
	Hgb (g/dl) Mean (SE)	Prevalence of Anemia (%)	Hgb (g/dl) Mean (SE)	Prevalence of Anemia (%)	Hgb	Prevalence of Anemia
Adults age19-64 (n = 2284)	14.0 (0.04)	12.9	**Adults age19-64** (n = 1684)	13.8 (0.04)	12.4	0.008	0.631
Male (n = 1069)	15.0 (0.04)	7.0	**Male** (n = 808)	14.9 (0.04)	6.3	0.068	0.610
Female (n = 1215)	13.1 (0.04)	18.1	**Female** (n = 876)	12.9 (0.04)	17.9	< 0.001	0.960

Table 2. Hemoglobin (Hgb) level and prevalence of anemia among adults aged 19-64 from the 1993-1996 and 2005-2008 NAHSIT.

Assessing the Relationship Between Persistent Organic Pollutants in Adipose Tissue and Female Breast Cancer Risk: A Machine Learning Prioritization Study

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Keywords: breast cancer, persistent organic pollutants, random forest machine learning, Taiwan

Introduction

Polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and certain pesticides are persistent organic pollutants (POPs) known to cause adverse effects on humans and the ecosystem. They easily enter the food chain and accumulate in fatty tissues. Breast cancer (BC) is the most common cancer among women worldwide, and environmental exposure has been shown to increase its incidence. Hormone-dependent exposure to POPs has raised concerns. Previous studies have only explored single pollutants and not considered the exposure scenario of mixed chemicals. This study aims to identify priority chemicals that may affect BC risk.

Methods

A case-control study was conducted to evaluate the associations between environmental pollutants and breast cancer risk in Taiwanese women. Samples were collected from breast cancer patients, women without malignancy history, or women with biopsy-proven benign breast disease. A total of 73 BC patients and 27 women with benign breast disease were enrolled. Analysis of persistent organic pollutants (POPs) of breast adipose tissue was performed. Statistical analysis was performed using SAS software, and a random forest machine learning method was used to predict the risk of BC. The SHapley Additive exPlanations (SHAP) framework was used to interpret the predictions of complex machine models.

Results

Table1. Demographic characteristics of breast cancer case and control.

		Control (n=27)		Case (n=73)		
		Mean	SD	Mean	SD	P value[a]
Age		48.89	10.42	49.63	12.90	0.5307
BMI (kg/m^2)		23.72	2.76	23.67	3.79	0.9493
Age at menarche		13.63	1.64	13.74	1.50	0.7516
		n	%	n	%	
Education level	<=12 yrs	15	55.56	47	64.38	0.4194
	> 12 yrs	12	44.44	26	35.62	
Cigarette smoking	NO	24	88.89	67	91.78	0.6994
	YES	3	11.11	6	8.22	
Alcohol drinking	NO	26	96.30	64	87.67	0.2795
	YES	1	3.70	9	12.33	
Pregnant	NO	6	22.22	20	27.4	0.6004
	YES	21	77.78	53	72.6	
Oral contraception use	NO	21	77.78	68	93.15	0.0644
	YES	6	22.22	5	6.85	
Abortion	NO	11	52.38	43	81.13	**0.0120**
	YES	10	47.62	10	18.87	
Parity	0	6	22.22	23	31.51	0.2550
	1	4	14.81	4	5.48	
	>=2	17	62.96	46	63.01	
Breastfeeding	NO	16	76.19	25	50.00	**0.0415**
	YES	5	23.81	25	50.00	
Family history of BC	NO	25	92.59	64	87.67	0.7224
	YES	2	7.41	9	12.33	

[a]*t* test for continuous variables and Chi-square tests or Fisher's exact tests to compare groups for categorical variables. Body mass index, BMI; breast cancer, BC. Bold represented significance (p<0.05).

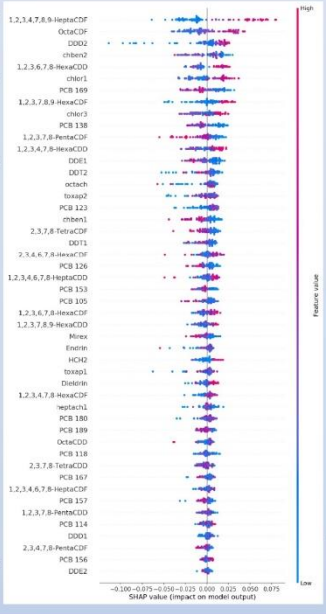

Figure 1. SHAP (SHapley Additive exPlanation) value of persistent organic pollutants (POPs) feature estimates predicted to breast cancer. Adjusted variables in table 1. X axis: The samples were sorted by SHAP value; Y axis: POPs were sorted by SHAP value. The color represented the concentration of the POPs.
DDT1, 2,4´-DDT (o,p'-DDT); DDT2, 4,4´-DDT (p,p'-DDT); DDE1, 2,4´-DDE (o,p'-DDE); DDE2, 4,4´-DDE (p,p'-DDE); DDD1, 2,4´-DDD (o,p'-DDD); DDD2, 4,4´-DDD (p,p'-DDD); Chlor1, cis-chlordane; Chlor3, oxy-chlordane; Chben1, pentachlorbenzene; Chben2, hexachlorbenzene; octach, octachlorstyrene; toxap1, toxaphene parlar 26; toxap2, toxaphene parlar 50; HCH2, beta-hexachlorocyclohexane.

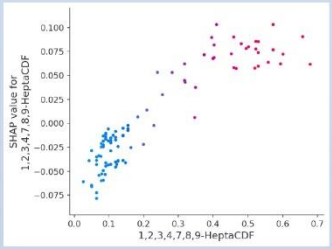

Figure 2. SHAP (SHapley Additive exPlanation) value of 1,2,3,4,7,8,9-HeptaCDF predicted to breast cancer.

Conclusion

The study highlights the importance of considering mixtures of chemicals in understanding the relationship between POPs and BC risk. This information could then be used to inform public health policies and interventions aimed at reducing the risk of breast cancer associated with POP exposure.

Aristolochic Acid and the Risk of Female Lung Cancer: Population-Based Case-Control Study

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Keywords: Aristolochic acid; Female lung cancer; Case-control study

Introduction

AA, a group 1 human carcinogen found in certain herbs, is linked to kidney disease, urinary tract cancer, and other cancers in Taiwan's general population and herbalists. Liver cancer risks are higher in HBV/HCV carriers and diabetic patients. AA induces DNA adducts in lung tissue and tumors in rodents. From 1997-2003, one-third of Taiwan's population, particularly women, consumed AA-containing herbs. This study aims to investigate the potential risk of lung cancer in women consuming AA-containing herbs, as smoking prevalence among women in Taiwan is low.

Methods

This population-based case-control study examined the lung cancer risk associated with exposure to Chinese herbal products containing Aristolochic Acid (AA). Cases were newly diagnosed with lung cancer from January 1, 1999, to December 31, 2013. Controls were matched in age, monthly income, and township. The cumulative dose of each AA-containing herb prescribed up to one year before lung cancer diagnosis was calculated, while potential confounders such as medication use were considered. Logistic regression analysis was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs).

Conclusion

The study found that consuming herbs containing AA is associated with a slightly higher risk of developing lung cancer in women. However, the risk does not seem to be strongly related to the amount of AA consumed. This suggests that even a small amount of AA-containing herbs may pose a risk to women.

Abbreviations: CI, confidence interval; OR, odds ratio.
*Adjusted for age, monthly income, urbanization level, chronic obstructive pulmonary disease, tuberculosis, pneumococcal pneumonia, human papillomavirus infection, alcohol-related disease, hypertension, diabetes, hyperlipidemia, hormone replacement therapy, aspirin, NSAIDs, ACE inhibitors, metformin, and statins.

Results

TABLE 1: Characteristics of Female Lung Cancers and Controls

Characteristics	Lung Cancers (n = 27,167) No.	%	Controls (n = 27,167) No.	%
Age, year				
18-39	3755	13.8	3896	14.3
40-49	5960	21.9	5862	21.6
50-59	6370	23.5	6487	23.9
60-69	7107	26.2	6940	25.6
>=70	3975	14.6	3982	14.7
Monthly income, NT$				
0	6835	25.2	6835	25.2
1-15,840	3304	12.2	3304	12.2
15,841-25,000	13812	50.8	13812	50.8
>25,000	3216	11.8	3216	11.8
Urbanization level				
I	8346	30.7	8313	30.6
II	11760	43.3	11625	42.8
III	4795	17.7	4754	17.5
IV (rural area)	2266	8.3	2475	9.1
Disease				
Chronic obstructive pulmonary disease	4580	16.9	3611	13.3
Tuberculosis	578	2.1	373	1.4
Pneumococcal pneumonia	38	0.1	14	0.1
Human papillomavirus infection	854	3.1	728	2.7
Alcohol-related disease	131	0.5	95	0.4
Hypertension	12184	44.9	12097	44.5
Diabetes	5396	19.9	5888	21.7
Hyperlipidemia	7109	26.2	6896	25.4
Medication				
Hormone replacement therapy	6781	25.0	6071	22.4
Aspirin	5200	19.1	5115	18.8
NSAIDs	16890	62.2	16083	59.2
ACE inhibitors	5333	19.6	5481	20.2
Metformin	2707	10.0	3021	11.1
Statins	3204	11.8	3119	11.5

Abbreviations: ACE, angiotensin-converting enzyme; NSAIDs, nonsteroidal anti-inflammatory drugs.

TABLE 2: Association Between Female Lung Cancer and Chinese Herbal Products Containing Aristolochic Acid

Chinese Herbal Products Containing Aristolochic Acid	Lung Cancers (n = 27,167) No.	%	Controls (n = 27,167) No.	%	Crude OR	95% CI	Adjusted OR*	95% CI
Use								
Never	8208	30.2	8764	32.3	1.00		1.00	
Ever	18959	69.8	18403	67.7	1.10	1.06 to 1.14	1.08	1.04 to 1.12
Duration of use, day								
0	8208	30.2	8764	32.3				
1-30	10846	39.9	10689	39.4	1.08	1.04 to 1.13	1.07	1.03 to 1.12
31-90	4882	18.0	4630	17.0	1.13	1.07 to 1.18	1.10	1.05 to 1.16
91-180	1862	6.9	1783	6.6	1.12	1.04 to 1.20	1.08	1.01 to 1.16
181-365	977	3.6	927	3.4	1.13	1.02 to 1.24	1.08	0.98 to 1.19
>365	392	1.4	374	1.4	1.12	0.97 to 1.29	1.07	0.92 to 1.23
Mu Tong, g								
0	20243	74.5	20558	75.7	1.00		1.00	
1-30	5050	18.6	4800	17.7	1.07	1.02 to 1.12	1.06	1.01 to 1.11
31-60	994	3.7	987	3.6	1.02	0.94 to 1.12	1.01	0.92 to 1.10
61-100	438	1.6	386	1.4	1.15	1.00 to 1.32	1.14	0.99 to 1.31
>100	442	1.6	436	1.6	1.03	0.90 to 1.18	1.01	0.88 to 1.15
Fang Ji, g								
0	17646	65.0	18024	66.4	1.00		1.00	
1-30	8295	30.5	7919	29.2	1.07	1.03 to 1.11	1.06	1.02 to 1.10
31-60	737	2.7	700	2.6	1.08	0.97 to 1.20	1.06	0.95 to 1.18
61-100	252	0.9	284	1.1	0.91	0.76 to 1.08	0.89	0.75 to 1.06
>100	237	0.9	240	0.9	1.01	0.84 to 1.21	1.00	0.84 to 1.20
Ma Dou Ling, g								
0	27002	99.4	27022	99.5	1.00		1.00	
>0	165	0.6	145	0.5	1.14	0.91 to 1.42	1.09	0.87 to 1.37
Mu Xiang, g								
0	19657	72.4	20013	73.7	1.00		1.00	
1-30	6081	22.4	5759	21.2	1.08	1.03 to 1.12	1.06	1.02 to 1.10
31-60	808	3.0	796	2.9	1.03	0.94 to 1.14	1.01	0.91 to 1.11
61-100	318	1.2	303	1.1	1.07	0.91 to 1.25	1.04	0.88 to 1.21
>100	303	1.1	296	1.1	1.04	0.89 to 1.23	1.03	0.88 to 1.21
Tian Xian Teng, g								
0	27128	99.9	27132	99.9	1.00		1.00	
>0	39	0.1	35	0.1	1.11	0.71 to 1.76	1.10	0.69 to 1.73
Xi Xin, g								
0	13039	48.0	13589	50.0	1.00		1.00	
1-30	9066	33.4	8648	31.8	1.09	1.05 to 1.14	1.08	1.04 to 1.12
31-60	2188	8.1	2180	8.0	1.05	0.98 to 1.12	1.02	0.95 to 1.08
61-100	1234	4.5	1162	4.3	1.11	1.02 to 1.20	1.07	0.99 to 1.17
>100	1640	6.0	1588	5.9	1.08	1.00 to 1.16	1.03	0.96 to 1.11
Estimated aristolochic acid, mg								
0	8208	30.2	8764	32.3	1.00		1.00	
1-125	17112	63.0	16569	61.0	1.10	1.06 to 1.14	1.09	1.05 to 1.13
126-250	1077	4.0	1077	4.0	1.07	0.98 to 1.17	1.04	0.95 to 1.14
251-500	527	1.9	514	1.9	1.10	0.97 to 1.24	1.07	0.94 to 1.21
>500	243	0.9	243	0.9	1.07	0.89 to 1.28	1.03	0.86 to 1.24
Each 100-mg increase					1.01	1.00 to 1.03	1.01	0.99 to 1.02

Comparison of Risks of Major Adverse Cardiovascular Events and mortality in patients with Deep Vein Thrombosis or Pulmonary Embolism

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Keywords: Deep vein thrombosis, Pulmonary embolism, Major adverse cardiovascular event

Introduction

This study aimed to evaluate the subsequent major adverse cardiovascular events (MACEs) and mortality after patients with a new diagnosis of deep vein thrombosis (DVT) or pulmonary embolism (PE).

Methods

We conducted a nationwide, population-based, frequency-matching cohort study using Taiwan's National Health Insurance Research Database. The study cohort comprised 693 newly diagnosed DVT patients (without PE) or PE patients (without DVT) who were frequency-matching by age, sex, and index year without a diagnosis of DVT and PE in the comparison cohort. We evaluate the subsequent major adverse cardiovascular events and mortality. Each patient case was followed from 2000 to 2012. We constructed a Cox proportional hazard model and plotted Kaplan-Meier curves to evaluate the association between DVT, PE, MACEs, and mortality.

Results

We identified 75, 67, and 51 MACEs cases in the study (DVT, PE) and comparison cohorts during the mean follow-up period of 5.78, 5.06, and 7.18 years, respectively. After adjusting for potential confounders, the adjusted hazard ratio (HR) for DVT was 1.48 (95% confidence interval [CI] 1.01–2.16), and PE was 1.44 (95% [CI] 0.97–2.14). The mortality cases were 106, 121, and 28 in the study (DVT, PE) and comparison cohorts, respectively. The adjusted HR for DVT was 2.91 (95% [CI] 1.88– 4.5), and PE was 4.29 (95% [CI] 2.8–6.58). The survival analysis curve demonstrated that both DVT and PE impacted the deaths.

Conclusion

Patients with DVT have a higher incidence of MACE. However, patients with PE have a higher incidence of mortality. Either DVT or PE may increase the risk of MACE and mortality.

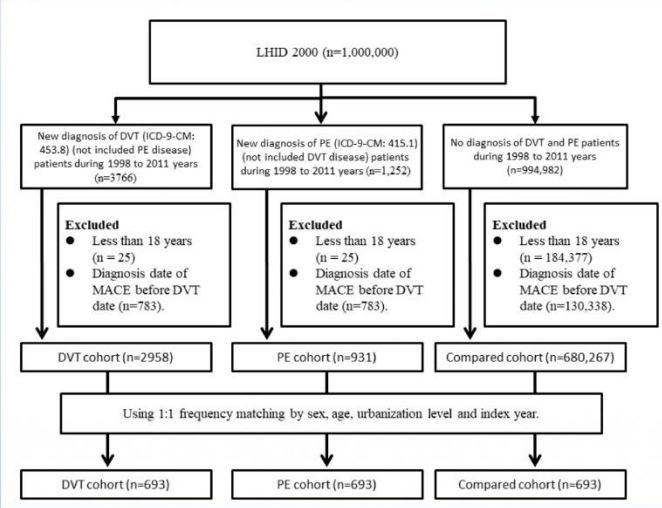

Figure 1. Patient selection flowchart

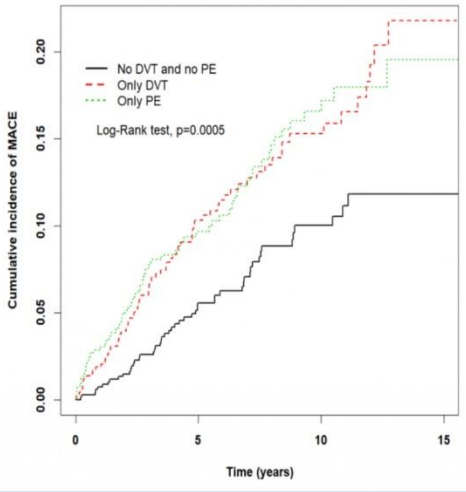

Figure 2. Cumulative incidence of MACE

Association Between Parabens Exposure and Thyroid Hormones in Children

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Keywords: Endocrine disrupting chemicals, Exposure assessment-biomarkers of exposure, Children's health

Introduction

Parabens, commonly used as preservatives, may have harmful effects on the endocrine system, including the thyroid gland, leading to changes in hormone levels. The study aims to examine the relationship between paraben exposure and thyroid hormone development in children.

Methods

The Taiwan Birth Panel Study II (TBPS II) is a cohort study that tracks the health and development of a group of children in Taiwan. By recruiting children between the ages of 6-9 years old, the study can evaluate the potential effects of environmental exposures on their health outcomes. We measured four kinds of parabens including methylparaben (MP), ethylparaben (EP), propylparaben (PP) and butylparaben (BP), and assessed several different thyroid hormones, including Triiodothyronine (T3), Thyroxine (T4), Thyroid-stimulating hormone (TSH), Free T3, and Free T4 to obtain a comprehensive understanding of thyroid function. We utilized a multivariate linear regression model to investigate the relationship between parabens and thyroid hormone concentrations.

Results

The total number of participants in this study was approximately 595, with about 318 (53.45%) boys. The concentrations (in μg/g) of MP, EP, PP, and BP were 78.5, 1.57, 1.58, and 0.54, respectively. The mean concentrations of thyroid hormones T3, T4, TSH, Free T3, and Free T4 were 153.37 ng/dl, 8.55 ug/dl, 2.94 uIU/ml, 4.31 pg/ml, and 1.42 ng/dl, respectively. After adjusting for confounding factors using a linear model, we observed that girls exposed to MP had [β=2.369 (95% CI=0.479 to 4.258)] and [β=0.057 (95% CI=0.021 to 0.094)] for T3 and Free T3, respectively. Additionally, girls exposed to BP had [β=0.02 (95% CI=0.003 to 0.037)] for Free T4.

Conclusion

The study indicates that paraben exposure could affect children's thyroid hormone levels, particularly in the cases of MP and BP. Further research is necessary, and it's crucial to be aware of these chemicals in everyday products.

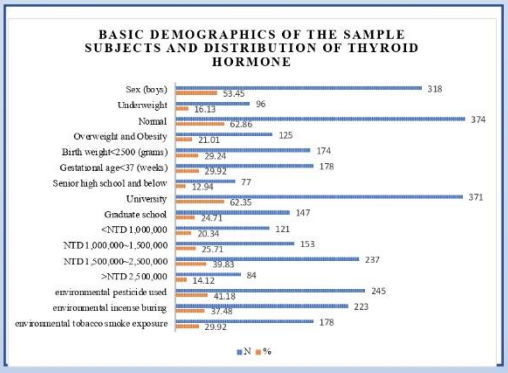

Figure 1.

Basic demographics of the sample subjects and distribution of thyroid hormone

				MP		EP		PP		BP	
		Sex	N	Bata	CI	Bata	CI	Bata	CI	Bata	CI
T3	Crude	M	318	-0.308	(-1.815,1.198)	0.089	(-1.296,1.473)	0.436	(-1.148,2.020)	-0.878	(-2.793,1.038)
		F	277	2.403	(0.516,4.289)*	0.519	(-1.178,2.215)	-0.255	(-1.965,1.454)	-0.433	(-2.808,1.941)
	Model[a]	M	318	-0.334	(-1.862,1.194)	-0.11	(-1.510,1.290)	0.199	(-1.417,1.816)	-0.994	(-2.939,0.951)
		F	277	2.369	(0.479,4.258)*	0.211	(-1.514,1.936)	-0.254	(-1.959,1.450)	-0.271	(-2.720,2.178)
T4	Crude	M	318	0.006	(-0.084,0.097)	-0.035	(-0.118,0.049)	-0.041	(-0.136,0.055)	-0.028	(-0.144,0.087)
		F	277	0.069	(-0.032,0.169)	0.022	(-0.067,0.112)	-0.023	(-0.113,0.067)	0.064	(-0.061,0.189)
	Model[a]	M	318	-0.005	(-0.096,0.086)	-0.046	(-0.129,0.037)	-0.046	(-0.142,0.051)	-0.034	(-0.150,0.082)
		F	277	0.041	(-0.059,0.141)	0.019	(-0.071,0.109)	-0.039	(-0.129,0.050)	0.088	(-0.040,0.216)
TSH	Crude	M	318	-0.017	(-0.108,0.074)	-0.029	(-0.112,0.054)	0.046	(-0.049,0.141)	-0.034	(-0.150,0.081)
		F	277	0.047	(-0.067,0.160)	0.029	(-0.072,0.130)	-0.005	(-0.107,0.097)	0.043	(-0.099,0.185)
	Model[a]	M	318	-0.014	(-0.107,0.079)	-0.024	(-0.110,0.061)	0.046	(-0.053,0.144)	-0.031	(-0.150,0.087)
		F	277	0.026	(-0.088,0.140)	0.036	(-0.067,0.139)	-0.015	(-0.117,0.087)	0.077	(-0.068,0.223)
FT3	Crude	M	318	0.0003	(-0.033,0.034)	-0.002	(-0.033,0.029)	0.019	(-0.016,0.055)	0.009	(-0.033,0.052)
		F	277	0.057	(0.020,0.095)*	-0.013	(-0.046,0.021)	-0.017	(-0.051,0.016)	-0.014	(-0.061,0.033)
	Model[a]	M	318	0.002	(-0.032,0.036)	-0.006	(-0.037,0.025)	0.018	(-0.018,0.054)	0.007	(-0.037,0.050)
		F	277	0.057	(0.021,0.094)*	-0.013	(-0.047,0.021)	-0.015	(-0.048,0.019)	-0.006	(-0.054,0.042)
FT4	Crude	M	318	-0.002	(-0.013,0.009)	0.004	(-0.006,0.014)	0.002	(-0.010,0.013)	0.008	(-0.006,0.022)
		F	277	0.012	(-0.001,0.026)	-0.005	(-0.016,0.007)	0.003	(-0.009,0.015)	0.015	(-0.001,0.032)
	Model[a]	M	318	-0.005	(-0.015,0.006)	0.003	(-0.007,0.012)	0.0003	(-0.011,0.012)	0.007	(-0.006,0.021)
		F	277	0.009	(-0.004,0.022)	-0.003	(-0.015,0.009)	0.0003	(-0.011,0.012)	0.02	(0.003,0.037)*

Model[a] the model adjusted children's sex, BMI, birth weight, family income, mother education, incense buring, pesticide used, smoke.
*p < 0.05.

Table 1. Adjusted a regression coefficients (95th CI) for change in serum thyroid measure in relation to a unit increase in ln-transformed paraben concentration among children stratified by gender.

The association between dietary intake, indoor environmental status, and urinary cadmium levels in a nationwide representative sample in Taiwan

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Introduction: Cadmium (Cd) is a toxic heavy metal that can accumulate in the human body through various environmental exposures, including dietary intake. In Taiwan, higher urinary cadmium concentrations among the general population compared with the Human Biomonitoring Guidance value (HBM-GVs) for Cd have been observed, but the primary source has not been identified.

Methods: This study aimed to investigate the association between dietary intake, indoor environmental status, and urinary cadmium levels in a nationwide representative sample in Taiwan. This study collected 1,566 human urine samples from the Taiwan Human Biomonitoring program in 2019. Individual urinary cadmium concentrations were measured and adjusted by urinary creatinine levels. The study also used questionnaires to collect information on individuals' dietary habits (e.g., vegetarian, lacto-ovo-vegetarian, and general population), dietary frequency, and indoor environmental conditions (e.g., household incense burning and use of air purifiers).

Results: The results showed that 35.82% of participants (n = 561) had urinary Cd concentrations exceeding the HBM-GVs. Additionally, 4.21% of participants (n = 66) were vegetarians, and 64.43% (n = 1009) burned incense at home, while 23.40% (n = 365) used air purifiers at home. Logistic regression analysis, adjusted for gender, age, BMI, and other confounding factors, revealed that the odds ratio (OR) for elevated urinary Cd concentrations was 1.80 (95% CI: 1.02–3.19) for participants who were vegetarian or lacto-ovo-vegetarian.

Conclusion: These findings suggest that the consumption of certain foods may increase the risk of heavy metal exposure and toxicity. The results also highlight the need for public health interventions to raise awareness of the potential health risks associated with certain dietary habits and to promote healthy and balanced diets.

Keywords: dietary intake, indoor environmental status, urinary cadmium, human biomonitoring

Citywide Wastewater SARS-CoV-2 Concentration Predicts the Epidemic Curve in Taipei City, Taiwan

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Keywords: Infectious diseases, Modeling, Policy and practice, Risk assessment , Science communication

Introduction

During the pandemic, over 70 countries have incorporated wastewater surveillance as a novel public health tool to detect unidentified cases and monitor epidemic curves. However, it remains unresolved whether the surveillance serves as a leading, lagging, or concurrent indicator. The aim of this study was to establish a citywide wastewater surveillance system and a COVID-19 epidemic prediction model in Taiwan.

Methods

Over a period of 90 days from May to August 2022, wastewater sampling, preparation, and qRT-PCR analysis were carried out daily in the Xinyi and Neihu districts and twice a week in the other 10 districts in Taipei City. Epidemic statistics were obtained from the Taiwan Centers for Disease Control database, and daily epidemiological indicators were computed, including new case rates and last and future x-days moving averages. Simple linear regression analysis, with and without logarithmic transformation, was performed based on daily wastewater surveillance data in the two districts to predict the epidemic curve. The prediction model was validated by comparing reported epidemic indicators and model estimates for the other 10 districts with a paired sample t-test.

Results

All wastewater samples from all districts were positive, with an average viral concentration of 1,829.0±2,237.7 copies/L and an average relative signal of 17.1±16.7. Wastewater virus could be well identified when new case rates exceeded 59.08 new cases per 100,000 population. The best-fitting model, with an R-squared value of 0.43, was a log-log model predicting future 5-day moving average new cases with relative signals of the E gene. An increase of 1% in the latter was associated with an increase of about 0.53% in the former (Fig.1). There was no significant difference between reported and predicted epidemic indicators for the other 10 districts.

Conclusion

Modelling with wastewater viral surveillance data is a useful supplement to forecast epidemic trends.

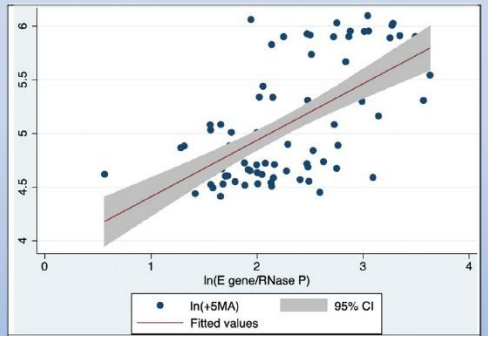

Figure 1.
The Taipei City Wastewater Epidemic Prediction Model

COVID-19 Infection Risk Assessment in a Kindergarten Utilizing Continuous Air Quality Monitoring Data

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Keywords: COVID-19, Modeling, Occupational exposures, Policy and practice, Science communication

Introduction

Researchers and transnational public health organizations have recognized aerosol transmission as an essential route of COVID-19 transmission. Therefore, improving ventilation systems is now adopted as a core preventive measure. As young children aged 2-6 in kindergartens generally lack vaccine protection and multiple infection clusters have been identified during the pandemic, we aimed to evaluate the effectiveness of ventilation systems and the risk of aerosol transmission in kindergartens in Taiwan.

Methods

From August to November 2021, we conducted on-site visits and continuously monitored indoor air quality indicators, such as PM2.5, carbon dioxide (CO_2), relative humidity, and temperature, in a kindergarten located in northern Taiwan. We utilized the Wells-Riley model to estimate the basic reproduction number (R0) of each classroom and staff office, with input parameters including the number of occupants, duration of their stay, and indoor/outdoor carbon dioxide concentration. Contagious settings were defined as those where the R0 estimates exceeded 1. We conducted a scenario and sensitivity analysis to assess the effect of simulated improvement measures.

Results

During school hours, the average concentration of CO_2 in each classroom and staff office exceeded 900 ppm. The R0 estimates gradually increased from Monday to Friday and throughout school hours, corresponding to the hourly and daily distribution of the CO_2 concentration (Fig.1), which could not dissipate completely during off-duty time. The R0 estimates during school hours ranged from 3.01 to 3.12 in classrooms with a maximum of 30 occupants. To lower the R0 estimates, a substantial reduction in the number of occupants, the duration of their stay, and/or indoor CO_2 concentration is needed.

Conclusion

The risk of outbreaks of cluster infections in kindergartens should not be underestimated. Feasible strategies to mitigate this risk include improving ventilation systems through engineering controls and limiting the number of indoor occupants and their residence time through administrative controls.

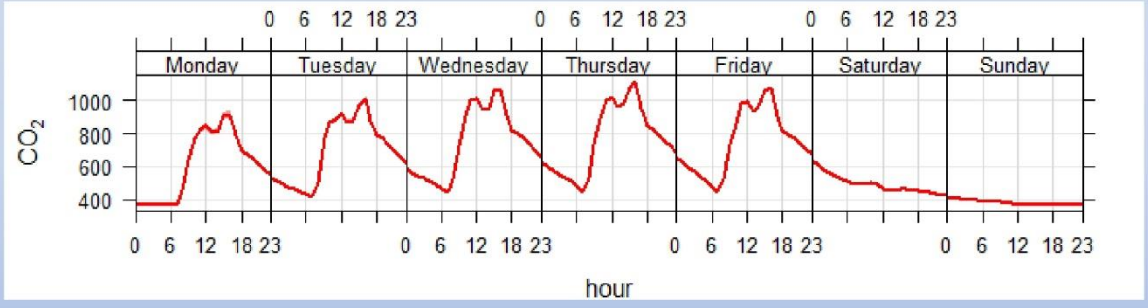

Figure 1.
Hourly and daily distribution of the CO2 concentration in the Class A

The Association Between Birth Weight and Childhood Cancer Risk in Taiwan

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Keywords: birth weight, childhood cancer,

Introduction

Previous studies have attempted to establish a link between birth weight and childhood cancer, but research among Asian populations is limited. In the present study, we aimed to investigate the relationship between birth weight and childhood cancer in Taiwan using nationwide population data.

Methods

We utilized data from two large national databases – the Taiwan Birth Registration database and the Taiwan Cancer Registration database – to conduct our analysis. Our study comprised 7,857,354 infants born between 1978-2000; we excluded 451,434 premature and post-term births. Of these, 7,281 children were diagnosed with childhood cancer from 1979-2001. We divided newborns into five weight groups and used Cox proportional hazards model to investigate the association between birth weight and cancer risk, while controlling for variables such as gender, maternal age, and socioeconomic status.

Results

After a follow-up period of 20 years and one hundred million person-years, we observed that birth weight between 3500-3999 gm was associated with a slight increase in hazard ratios (HRs) for certain childhood cancers, such as soft tissue sarcoma ([HR] =1.30, 95% CI=1.03-1.65) and germ cell tumors ([HR]=1.52, 95% CI=1.24-1.86). Additionally, birth weight over 4000 gm increased the risk of soft tissue sarcoma ([HR] =1.55, 95% CI=1.06-2.26) and bone tumor ([HR] =2.40, 95% CI=1.46-3.96), but decreased for leukemia ([HR] =0.82, 95% CI=0.68-0.99) and renal tumors ([HR] =0.53, 95% CI=0.29-0.99). Furthermore, large gestational age (LGA) was also associated with an increased risk of cancer ([HR] =1.30-1.56, 95% CI=1.03-2.57).

Conclusion

Our study suggests that higher birth weight and large gestational age may increase the risk of childhood cancer. Our findings add to the current knowledge on the association between birth weight and childhood cancer and highlight the importance of early life factors in the development of pediatric malignancies. Further research is needed to better understand the underlying mechanisms and to develop preventive strategies.

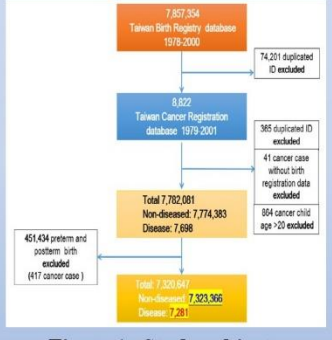

Figure 1. Study subjects

Table 1. Characteristics of study population

		<2500 gm	2500-2999 gm	3000-3499 gm	3500-3999 gm	>=4000 gm
		N=191,267 (2.6%)	N=1,435,394 (19.7%)	N=3,444,036 (47.1%)	N=1,812,694 (24.8%)	N=422,839 (5.8%)
Birthweight	Mean (SD)(gm)	2255.9 (222.2)	2780.5(133.0)	3205.2(143.4)	3656.8(134.9)	4190.0(241.2)
Sex	-Male (%)	42.7	43.8	50.8	58.4	63.9
GA	-37 weeks (%)	19.4	9.0	3.1	1.3	0.9
	-38 weeks (%)	22.4	19.7	12.4	7.7	5.2
	-39 weeks (%)	13.9	19.5	17.6	14.0	9.4
	-40 weeks (%)	41.4	47.0	59.6	67.2	72.8
	-41 weeks (%)	2.0	3.6	5.4	7.2	8.0
	-42 weeks (%)	0.9	1.2	1.9	2.6	3.6
GA type	-SGA (%)	96.4	48.2	0.0	0.0	0.0
	-AGA (%)	3.6	51.8	99.7	77.3	0.5
	-LGA (%)	0.0	0.0	0.3	22.7	99.5
Parity	-Primipara (%)	49.4	48.6	42.1	35.5	28.6
	-Multipara (%)	50.6	51.4	57.9	64.5	71.4
Multiple birth		13.2	2.4	0.4	0.1	0.1
Mother's age	-16-19 (%)	6.2	5.1	4.1	3.3	2.7
	-20-29 (%)	72.1	72.8	72.7	71.3	68.8
	-30-39 (%)	21.0	21.6	22.7	24.8	27.7
	->=40 (%)	0.7	0.5	0.5	0.6	0.8
Father's age	-16-19 (%)	1.4	1.1	0.8	0.6	0.4
	-20-29 (%)	51.7	51.0	49.8	47.4	43.8
	-30-39 (%)	42.4	44.2	45.6	47.8	50.3
	->=40 (%)	4.5	3.7	3.8	4.2	5.5
Education (M)	-College (%)	7.8	10.1	10.0	9.2	7.2
	-Junior high (%)	25.7	29.5	28.9	27.8	29.4
	-Senior high (%)	31.3	31.4	29.2	27.9	26.5
	-Elementary (%)	35.2	29.0	31.9	35.1	41.4
Education (F)	-College (%)	12.5	15.4	15.6	15.1	12.7
	-Junior high (%)	26.7	29.6	29.2	28.4	26.8
	-Senior high (%)	31.4	31.3	29.1	27.8	26.5
	-Elementary (%)	29.4	23.7	26.1	28.7	33.9
Urbanization	-Metropolitan (%)	33.0	34.6	35.3	35.9	35.8
	-City (%)	23.8	24.4	23.7	23.4	23.2
	-Town (%)	26.3	25.6	25.5	25.5	25.5
	-Rural area (%)	16.9	15.4	15.4	15.2	15.5

Table 2. Adjusted HRs of birthweight for different types of childhood cancer (aged 0-19 years old)

	N	<2500 gm HR (95% CI)	2500-2999 gm HR (95% CI)	3000-3499 gm HR (95% CI)	3500-3999 gm HR (95% CI)	>=4000 gm HR (95% CI)
All cancer		0.92(0.78-1.07)	0.97(0.91-1.03)	Ref	1.07(1.01-1.13)*	0.96(0.87-1.06)
Leukemia	2037	0.71(0.53-0.95)*	0.94(0.84-1.06)	Ref	1.01(0.90-1.12)	0.82 (0.68-0.99)*
Lymphomas	698	0.59(0.54-1.84-)	0.97(0.77-1.21)	Ref	0.96(0.80-1.14)	0.98(0.72-1.35)
CNS tumors	993	1.65(0.99-2.73)	1.10 (0.92-1.31)	Ref	1.12(0.96-1.31)	0.98(0.75-1.27)
Neuroblastoma	306	0.73(0.35-1.54)	0.74(0.53-1.05)	Ref	0.92(0.70-1.21)	0.88(0.46-1.70)
Retinoblastoma	184	0.60(0.26-1.33)	1.25(0.81 1.93)	Ref	0.95(0.62-1.47)	1.13(0.55-2.32)
Renal tumors	200	7.42(0.95-58.1)	0.93(0.60-1.35)	Ref	0.86(0.61-1.21)	0.53(0.29-0.99)*
Hepatic tumors	300	0.59(0.26-1.37)	0.82(0.58-1.15)	Ref	1.11(0.83-1.49)	1.49(0.95-2.33)
Bone tumors	383	1.36(0.57-3.21)	0.91(0.67-1.33)	Ref	1.15(0.90-1.46)	2.40(1.46-3.96)*
Soft tissue sarcomas	436	1.38(0.73-2.58)	1.02(0.77-1.35)	Ref	1.30(1.03-1.65)*	1.55 (1.06-2.26)*
Germ cell tumors	623	0.77(0.44-1.38)	1.19(0.94-1.05)	Ref	1.52(1.24-1.86)$	1.14(0.83-1.57)
Other epithelial Neoplasms	632	1.04(0.66-1.63)	0.97(0.77-1.21)	Ref	1.01(0.83-1.22)	1.05(0.77-1.45)
Other malignant Neoplasms	276	2.76(1.20-6.38)*	1.02(0.71-1.46)	Ref	1.00(0.75-1.34)	0.97(0.57-1.64)
Not classified	66	0.50(0.60-4.16)	0.60(0.31-1.17)	Ref	1.29(0.54-3.11)	1.47(0.46-4.64)

*: p<0.05; $: p<0.0001

Table 3. Adjusted HRs of SGA and LGA for different types of childhood cancer

	N	SGA HR (95% CI)	AGA HR (95% CI)	LGA HR (95% CI)
Leukemia	2037	0.81 (0.70-0.93)*	Ref	0.91(0.80-1.04)
Lymphomas	698	0.99(0.77-1.28)	Ref	0.99(0.79-1.24)
CNS tumors	993	1.15(0.94-1.40)	Ref	1.01(0.83-1.23)
Neuroblastoma	306	1.07(0.67-1.70)	Ref	1.31(0.88-1.95)
Retinoblastoma	184	0.79(0.49-1.28)	Ref	0.90(0.55-1.45)
Renal tumors	200	1.23(0.78-1.93)	Ref	0.70(0.46-1.05)
Hepatic tumors	300	0.98(0.69-1.40)	Ref	1.56 (1.11-2.20)*
Bone tumors	383	0.87(0.61-1.23)	Ref	1.86 (1.35-2.57)$
Soft tissue sarcomas	436	1.00(0.73-1.37)	Ref	1.53 (1.13-2.06)*
Germ cell tumors	623	1.01(0.77-1.31)	Ref	1.30 (1.03-1.63)*
Other epithelial Neoplasms	632	0.87(0.69-1.11)	Ref	1.07(0.85-1.36)
Other malignant Neoplasms	276	1.00(0.68-1.49)	Ref	0.85(0.58-1.25)
Not classified	66	0.55(0.27-1.11)	Ref	1.05(0.32-3.50)

*: p<0.05; $: p<0.0001
* adjusted by sex, gestational age, parity, mother's age, father's educational level, and urbanization

Segmentectomy versus Wedge Resection for stage IA Lung Adenocarcinoma – A Population-based Study

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Introduction: Based on the existing studies, sublobar resection for early lung cancer was not inferior to lobectomy with respect to cancer-specific survival. However, the clinical benefits and risks of sublobar resection including segmentectomy and wedge resection have not been investigated comprehensively. The objective of this population-based study was to investigate whether wedge resection is comparable to segmentectomy in patients with stage IA lung adenocarcinoma.

Methods: The clinical stage IA lung adenocarcinoma patients were collected from Taiwan Cancer Registry database between 2011 to 2018. The primary endpoint was lung cancer-specific survival. Further subgroup survival analyses were conducted based on tumor size. Propensity score matching was used to balance the baseline differences between the two groups. Survival predictors other than the surgical procedure were also analyzed using regression model.

Results: Totally, 6598 stage IA lung adenocarcinoma patients who underwent sublobar resection between 2011 and 2018 were enrolled in this study. Of these, 2061 received segmentectomy and 4537 received wedge resection. The mean age was 60.3 ± 11.7, and 66.2% were female. Most (81.5%) were never smokers. After propensity matching, segmentectomy was associated with better lung cancer-specific survival then wedge resection especially for 2 cm or larger in tumor size. Except for the choice of segmentectomy, 75-year-old or less, good differentiation, smaller tumor size and no nodal metastasis were also associated with better lung cancer-specific survival.

Conclusion: Segmentectomy was linked to better lung cancer-specific survival than wedge resection, particularly for tumors 2 cm or larger. Being 75 or younger, having good differentiation, smaller tumor size, and no nodal metastasis were also associated with better survival.

Keywords: lung cancer, segmentectomy

Determinations of Organic Ultraviolet (UV) Filters and Environmental Hormones in Indoor Dusts

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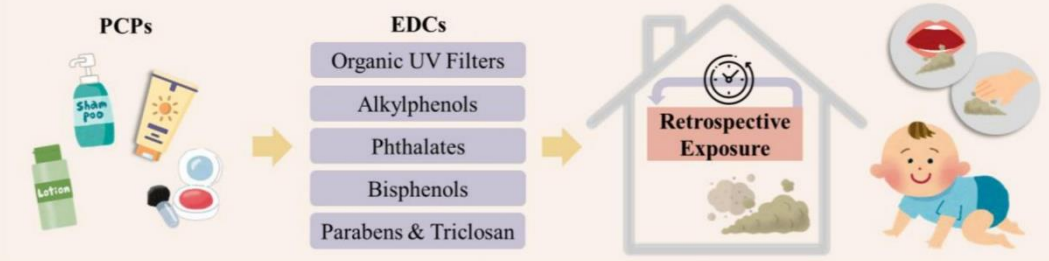
Keywords: endocrine disrupting chemicals (EDCs), personal care products (PCPs), indoor dust, SPME (solid phase microextraction), exposure assessment

Introduction

Background



Study aim: To develop and validate a sensitive and effective pretreatment procedure and an analytical method for simultaneous determinations of different EDCs in indoor dust.

Methods

① **Simultaneous determinations** of different EDCs in indoor dusts:

Method Optimization

✓ Pretreatment ✓ Analytical method

② **Field study**:
analysis of household dusts

③ **Exposure Assessment**
for the vulnerable group (children)

Results

- This study established and optimized analytical methods for measuring organic ultraviolet (UV) filters and environmental hormones in indoor dust.
- The findings found that the procedure performed in this study showed good linearity and precision analyzed with GC-MS.
- Besides, human exposure assessment will be carried out by calculating the estimated daily intakes (EDI) of PCPs through dust ingestion for the vulnerable group, such as toddlers, in this study.

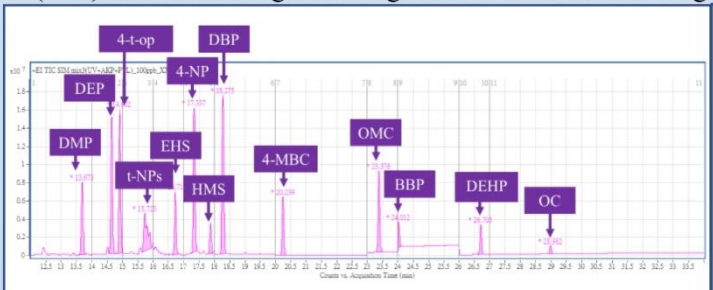


Figure 1. Chromatogram for target compounds

Table 1. Optimization for SPME parameters

types of fiber	PDMS/DVB
Pre-incubation temperature	100°C
Pre-incubation time	5 min
extraction temperature	100°C
extraction time	10, 20, 30, 40 min
stirring velocity	250 rpm
desorption temperature	270°C
desorption time	5, 10, 15, 20 min
Acetic anhydride	100 µL
Potassium carbonate	1%
NaCl	0, 10, 20, 30 % (w/v)

Conclusion

- The established analytical method of this study will be performed to determine the concentration of EDCs in indoor dust in Taiwanese households.
- Moreover, the validated process will be available for conducting exposure assessments to address the health risks posed by exposure to EDCs from indoor dust, especially for the vulnerable group (toddlers).
- Dust samples can also be regarded as reliable samples representing past exposure scenarios.

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	COFFEE BREAK	GOLDSMITH AWARD CEREMONY & LECTURE	AWARDS CEREMONY	AWARDS CEREMONY
INTERMISSION	PARALLEL SYMPOSIA AND ORAL SESSIONS			
		KEYNOTE LECTURES	KEYNOTE LECTURES	KEYNOTE LECTURES
WORKSHOP SESSIONS	LUNCH BREAK			
		KEYNOTE PANEL	KEYNOTE PANEL	KEYNOTE PANEL
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