Additional file

Supplemental Text 1. Details of urine analysis

In brief, urine was thawed, stirred, allowed to stand for 1 hour at 4°C and the supernatant extracted as follows. One hundred µL of internal standard mixture (each IS at 10 µg/kg) was added to 100 µL of urine samples; and the samples were mixed well. Then 2800 µL of distilled water was added into each sample. Two different types of solid-phase extraction (SPE) cartridges were used for the purification. The first SPE was InertSep Pharma (60 mg/3 ml) (GL Science, Inc, Tokyo, Japan), and was pre-conditioned by 3 mL of acetonitrile/ dichloromethane (1/ 1) reagent followed by 3 ml of distilled water. The second SPE was InertSep PSA (100 mg/1ml) (GL Science), and pre-conditioned with 1 mL of acetonitrile/ dichloromethane (1/ 1) mixture. Prepared samples were loaded to pre-conditioned InertSep Pharma and washed with 0.5 mL of distilled water. The sample-loaded InertSep Pharma (top) was combined with InertSep PSA (bottom) and the target chemicals were eluted with 3 ml of acetonitrile/ dichloromethane (1/ 1) mixture. After concentrating and dry-solidifying with a centrifugal concentrator (CVE-200D with UT-2000, Eyela, Tokyo, Japan), the samples were reconstituted with 100 µL of 3% methanol aqueous solution containing 10 µg/kg of cotinin-d3, and transferred in vials for analysis.

Supplemental Text 2. Details of ion analysis in urine

In brief, urine was thawed, stirred, allowed to stand for 1 hour at 4 °C. 990 µL of distilled water was added to 10 µL of urine samples in 1.5 mL Eppendorf tube, and the samples were mixed well. The diluent was centrifuged at 15000 g for 10 minutes, and the supernatant was transferred to an HPLC vial for analysis. Cation (Na^+, K^+, Ca^{2+}, Mg^{2+}, $NH4^+$) concentrations were measured by ion chromatography using an ion chromatograph (ICS-1500, Dionex), auto-sampler (AS-50, Dionex), IonPac CG12A for guard column, IonPac CS12A for analytical column and CERS-500 for cation suppressor. The degassed 20 mM methanesulfonic acid solution was used for eluent. Anion (Cl^-, NO^{3-}, PO_4^{3-}, SO_4^{2-}) concentrations were measured by ion chromatography using an ion chromatograph (ICS1500, Dionex) and auto-sampler (AS-50, Dionex), IonPac AG12A for guard column, IonPac AS12A for analytical column and AERS-500 for anion suppressor. The degassed 2.7 mM Na_2CO_3 / 0.3 mM $NaHCO_3$ solution was used for eluent.

Supplemental Text 3. Details of hair analysis

Briefly, hair samples were ground to a fine powder in a tissue lyser (Retsch MM 400, Germany) for 2 min at 30 Hz using a 20 mm stainless bead. Twenty-five mg of hair powder was transferred to a 2.0 mL microcentrifuge tube, and 1.5 mL of acetonitrile as well as 10 µL of internal standard solution containing the five isotopically labelled neonicotinoids (125 ng/mL in acetonitrile) were added to the tube. The mixture was shaken in the tissue lyser for 3 min at 30 Hz, centrifuged and the supernatant was reserved. The centrifuged tube containing the hair pellet was re-extracted in 1.5 mL of

acetonitrile; and the second extract was combined with the first one. A QuEChERS (Quick, Efficient, Cheap, Easy, Rugged and Safe) procedure was then applied to the acetonitrile extracts by adding 2 mL of acetonitrile, 5 mL water, and 3.25 g of a mixture of salts composed of anhydrous $MgSO_4$ (2.0 g), NaCl (0.5 g), sodium citrate dehydrate (0.5 g) and sodium citrate sesquihydrate (0.25 g). The tube was vigorously shaken by hand, centrifuged; and the epiphase was recovered and transferred to another tube containing 0.15 g $MgSO_4$, 0.1 g C18 bulk phase, and 0.1 g primary-secondary amine bulk phase for dispersive SPE. After another round of shaking and centrifugation, the supernatant was evaporated, reconstituted in 0.25 mL of methanol 25%, filtered and transferred to an HPLC vial for analysis. Extracts were analysed by ultra-high performance liquid chromatography coupled to tandem mass spectrometry (UHPLC-MS/MS) using a well-established method [1].

1. Bonmatin JM, Mitchell EAD, Glauser G, Lumawig-Heitzman E, Claveria F, Bijleveld van Lexmond M, et al. Residues of neonicotinoids in soil, water and people's hair: A case study from three agricultural regions of the Philippines. Sci Total Environ. 2021; 757:143822.

Supplemental Table 1. Neonicotinoids and metabolites quantification in urine from the general population

Country of residence of participants	n	Quantified neonicotinoids/metabolites	Ref.
Japan	33	6CNA	1
Japan	3	DMAP	2
Japan	147	6CNA, 2TCA, 3FA	3
Japan	52	IMI, ACE, THI, NIT, TMX, CLO, DIN	4
China	295	IMI, 6CNA	5
Japan	85	DMAP, THI, NIT, TMX, CLO	6
Japan	20	IMI, ACE, THI, NIT, CLO, TMX	7
Japan	373	IMI, ACE, DMAP, THI, TMX, CLO, DIN	8
Japan	223	IMI, ACE, NIT, TMX, CLO,	9
Sri Lanka	40	IMI, DMAP, TMX, CLO,	10
USA	60	IMI, 5OH-IMI, ACE,DMAP, THI, CLO	11
China	275	IMI, 6CNA	12
US	3038	IMI, 5OH-IMI, DMAP, CLO	13
Japan	46	IMI, ACE, DMAP, THI, NIT, TMX, CLO, DIN	14
Japan	57	DMAP, DIN,	15
China	324	IMI, ACE, THI, TMX, CLO, DIN	16
USA	20	IMI, 6CNA , ACE, DMAP, TMX, DMTX, CLO, IMZ, SFO	17
Japan	50	IMI, ACE, DMAP, THI, TMX, CLO, DIN	18
Korea, Japan, Vietnam, Kuwait, Saudi Arabia, India, China, Greece, US	566	IMI, 6CNA, ACE, DMAP, THI, TA, NIT, TMX, CLO, DIN	19
China	275	5OH-IMI, Of-IMI, DMAP, DIN-G, DIN-U	20
China	129	IMI, IMI-ole, DN-IMI, ACE, DMAP, TMX, CLO, DIN	21
China	289	IMI, ACE, DMAP, NIT, TMX, DMTX, CLO, DIN	22
Thai	100	IMI, IMI-ole, ACE, DMAP, THI, TMX, CLO, DIN, SFO	23
Japan	1036	IMI, ACE, DMAP, THI, TMX, CLO, DIN	24
Japan	109	IMI, ACE, DMAP, TMX, CLO, DIN	25
China	408	IMI, 5OH-IMI, IMI-ole, DN-IMI, ACE, DMAP, TMX, CLO	26
Ghana	75	IMI, ACE, DMAP, THI, NIT, TMX, CLO, DIN	27
Thailand	143	IMI, IMI-ole, ACE, DMAP, THI, TA, NIT, TMX, CLO, DM-CLO, DIN	28
China	40	IMI, 5OH-IMI , ACE, DMAP, THI, TMX, CLO, DIN	29
China	386	IMI, ACE, DMAP, THI, NIT, CLO, DIN, SFO, IMZ	30
Sri Lanka	92	IMI, ACE, DMAP, THI, TMX, CLO, DIN	31
China	25	IMI, ACE, 6CNA	32
China	20	IMI, IMI-ole, IMI-guanidine, IMI-urea, ACE, THI, TMX, CLO, DIN, THI-amide, 6CNA	33
Switzerland	14	IMI, IMI-ole, DMAP, SFO	34
China	305	IMI, ACE, ,THI, TMX, CLO, DIN	35
USA	1381	IMI, 5OH-IMI, ACE, DMAP, THI, CLO	36
China	20	IMI, 6CNA, IMI-ole, IMI-G, IMI-urea, ACE, DMAP, THI, THI-amide, NIT, TMX, DM-TMX, CLO	37
Japan	68	IMI, ACE, DMAP, THI, TMX, CLO, DIN	38
USA	171	ACE, CLO, IMI, DMAP, 6-CNA, NIT, TMX, SFO,	39
China	774	IMI, ACE, DMAP, THI, NIT, TMX, CLO, DIN, SFO,I MZ	40
China	296	IMI, ACE, DMAP, 6CNA, 2TCA	41
Germany	77	IMI, ACE, THI, TIMX, 5OH-IMI, IMI-ole	42
China	151	IMI, ACE, CLO, THI, TMX, NIT, IMZ, DMAP, TA	43
China	118	IMI, 5OH-IMI, ACE, DMAP, THI, NIT, TMX, CLO, DM-CLO, DIN, IMZ	44
USA	1397	5OH-IMI, DMAP, CLO	45

USA	47	CLO, NIT, TMX, 6CNA, THI-amide, DIN, IMZ, DMAP, DM-TMX,	46
Germany	38	6CNA-glycine	47
China	8	IMI, ACE, CLO, THI, TMX, DIN, 5-OH-IMI, IMI-ole, DMAP	48
China	380	IMI, ACE, CLO, THI, TMX, NIT, DMAP, 6-CNA	49
China	500	IMI, IMI-ole, IMI-dn, DMAP, CLO, THI, TMX, 6-CNA	50
Japan	8538	IMI, IMI-ole, ACE, DMAP, THI, THI-amide, NIT, TMX, CLO, CLO-dm, DIN, SULA, SULB	51
China	35	IMI, ACE, CLO, DIN, IMZ	52
China	3123	IMI, IMI-ole, 5OH-IMI, DN-IMI, DMAP, TMX, CLO, DM-CLO	53
USA	21	5OH-IMI	54
China	442	IMI, ACE, DMAP, THI, NIT, TMX, CLO, DIN, IMZ, DMAP, DM-CLO, DMTX, 5OH-IMI	55
USA	1192	IMI, 5OH-IMI, ACE, DMAP, THI, CLO	56
Philippines	99	IMI, ACE, DMAP, THI, NIT, TMX, CLO, DIN	Current study

Abbreviations: IMI, imidacloprid; 6-chloro-nicotinic acid; 5OH-IMI, 5-hydroxy-imidacloprid; IMI-ole, imidacloprid-olefin; IMI-urea, imidacloprid-urea; IMI-G, imidacloprid-guanidine; DN-IMI, desnitro-imidacloprid; 6CNA, ACE, acetamiprid; DMAP, *N*-desmethyl-acetamiprid; THI, thiacloprid; TA, thiacloprid-amide; NIT, nitenpyram; TMX, thiamethoxam; DMTX, *N*-desmethyl-thiamethoxam; CLO, clothianidin; DM-CLO, *N*-desmethyl-clothianidin; DIN, dinotefuran; 2TCA, 2-chloro-1,3-thiazole-5-carboxylic acid; 3FA, 3- furoic acid; DIN-G, 1-methyl-3-(tetrahydro-3-furylmethyl) guanidine; DIN-U, 1-methyl-3-(tetrahydro-3-furylmethyl) urea; SFO, sulfoxaflor; SUL.A, sulfoxaflor A; SUL.B, sulfoxaflor B; IMZ, imidaclothiz; FLU, flupyradifurone; 5OH-FLU, 5-hydroxy- flupyradifurone; df-FLU; 4OH-THI, 4-hydroxy-thiacloprid; 4/5OH-IMI, 4-hydroxy-/5-hydroxy-imidacloprid;

References:

1. Taira K, Aoyama Y, Kawakami T, Kamata M, Aoi T. [Detection of chloropyridinyl neonicotinoid insecticide metabolite 6-chloronicotinic acid in the urine: six cases with subacute nicotinic symptoms: *Chudoku Kenkyu* 2011, 24:222-30. *Japanese.*
2. Taira K, Fujioka K, Aoyama Y. Qualitative profiling and quantification of neonicotinoid metabolites in human urine by liquid chromatography coupled with mass spectrometry: *PLoS One* 2013, 8:e80332. Doi: 10.1371/journal.pone.0080332.
3. Nomura H, Ueyama J, Kondo T, Saito I, Murata K, Iwata T, Wakusawa S, Kamijima M. Quantitation of neonicotinoid metabolites in human urine using GC-MS: *J Chromatogr B Analyt Technol Biomed Life Sci* 2013, 941:109-15. Doi: 10.1016/j.jchromb.2013.10.012.
4. Ueyama J, Nomura H, Kondo T, Saito I, Ito Y, Osaka A, Kamijima M. Biological monitoring method for urinary neonicotinoid insecticides using LC-MS/MS and its application to Japanese adults: *J Occup Health* 2014, 56:461-8. Doi: 10.1539/joh.14-0077-OA.
5. Wang L, Liu T, Liu F, Zhang J, Wu Y, Sun H. Occurrence and Profile Characteristics of the Pesticide Imidacloprid, Preservative Parabens, and Their Metabolites in Human Urine from Rural and Urban China: *Environ. Sci. Technol* 2015, 49:14633－14640. Doi: 10.1021/acs.est.5b04037
6. Marfo JT, Fujioka K, Ikenaka Y, Nakayama SMM, Mizukawa H, Aoyama Y, Ishizuka M, Taira K. Relationship between Urinary N-Desmethyl-Acetamiprid and Typical Symptoms including Neurological Findings: A Prevalence Case-Control Study: *PloS ONE* 2015,10: e0142172. Doi: 10.1371/journal.pone.0142172.
7. Ueyama J, Harada KH, Koizumi A, Sugiura Y, Kondo T, Saito I, Kamijima M. Temporal Levels of Urinary Neonicotinoid and Dialkylphosphate Concentrations in Japanese Women Between 1994 and 2011: *Environ Sci Technol* 2015, 49:14522-8. Doi: 10.1021/acs.est.5b03062.
8. Harada KH, Tanaka K, Sakamoto H, Imanaka M, Niisoe T, Hitomi T, Kobayashi H, Okuda H, Inoue S, Kusakawa K, Oshima M, Watanabe K, Yasojima M, Takasuga T, Koizumi A. Biological Monitoring of Human Exposure to Neonicotinoids Using Urine Samples, and Neonicotinoid Excretion Kinetics: *PloS One* 2016, 11:e0146335. Doi: 10.1371/journal.pone.0146335.
9. Osaka A, Ueyama J, Kondo T, Nomura H, Sugiura Y, Saito I, Nakane K, Takaishi A, Ogi H, Wakusawa S, Ito Y, Kamijima M. Exposure characterization of three major insecticide lines in urine of young children in Japan-neonicotinoids, organophosphates, and pyrethroids: *Environ Res* 2016, 47:89-96. Doi: 10.1016/j.envres.2016.01.028.
10. Kabata R, Nanayakkara S, Senevirathna S, Harada KH, Chandrajith R, Hitomi T, Abeysekera T, Takasuga T, Koizumi A. Neonicotinoid concentrations in urine from chronic kidney disease patients in the North Central Region of Sri Lanka: *J Occup Health* 2016, 58:128-33. Doi: 10.1539/joh.15-0140-BR.
11. Baker SE, Serafim AB, Morales-Agudelo P, Vidal M, Calafat AM, Ospina M. Quantification of DEET and neonicotinoid pesticide biomarkers in human urine by online solid-phase extraction high-performance liquid chromatography-tandem mass spectrometry: *Anal Bioanal Chem* 2019, 411:669-678. Doi: 10.1007/s00216-018-1481-0.
12. Tao Y, Dong F, Xu J, Phung D, Liu Q, Li R, Liu X, Wu X, He M, Zheng Y. Characteristics of neonicotinoid imidacloprid in urine following exposure of humans to orchards in China: *Environ Int* 2019, 132:105079. Doi: 10.1016/j.envint.2019.105079.
13. Ospina M, Wong LY, Baker SE, Serafim AB, Morales-Agudelo P, Calafat AM. Exposure to neonicotinoid insecticides in the U.S. general population: Data from the 2015-2016 national health and nutrition examination survey: *Environ Res* 2019, 176:108555. 10.1016/j.envres.2019.108555.
14. Ikenaka Y, Miyabara Y, Ichise T, Nakayama S, Nimako C, Ishizuka M, Tohyama C. Exposures of children to neonicotinoids in pine wilt disease control areas: *Environ Toxicol Chem* 2019, 38:71-79. Doi: 10.1002/etc.4316.

15. Ichikawa G, Kuribayashi R, Ikenaka Y, Ichise T, Nakayama SMM, Ishizuka M, Taira K, Fujioka K, Sairenchi T, Kobashi G, Bonmatin JM, Yoshihara S: LC-ESI/MS/MS analysis of neonicotinoids in urine of very low birth weight infants at birth. *PloS ONE* 2019, 14: e0219208.
16. Zhang T, Song S, Bai X, He Y, Zhang B, Gui M, Kannan K, Lu S, Huang Y, Sun H. A nationwide survey of urinary concentrations of neonicotinoid insecticides in China: *Environ Int* 2019, 132:105114. Doi: 10.1016/j.envint.2019.105114.
17. Honda M, Robinson AM and Kannan K. A simple method for the analysis of neonicotinoids and their metabolites in human urine: *Environ Chem* 2019, 16: 171-178 https://doi.org/10.1071/EN18240
18. Ueyama J, Aoi A, Ueda Y, Oya N, Sugiura Y, Ito Y, Ebara T, Kamijima M. Biomonitoring method for neonicotinoid insecticides in urine of non-toilet-trained children using LC-MS/MS: *Food Addit Contam Part A Chem Anal Control Expo Risk Assess* 2020, 37:304-315. Doi: 10.1080/19440049.2019.1696020.
19. Li AJ, Kannan K. Profiles of urinary neonicotinoids and dialkylphosphates in populations in nine countries: *Environ Int* 2020, 145:106120. Doi: 10.1016/j.envint.2020.106120.
20. Song S, Zhang T, Huang Y, Zhang B, Guo Y, He Y, Huang X, Bai X, Kannan K. Urinary Metabolites of Neonicotinoid Insecticides: Levels and Recommendations for Future Biomonitoring Studies in China: *Environ Sci Technol* 2020, 54:8210-8220. Doi: 10.1021/acs.est.0c01227. Erratum in: Environ Sci Technol. 2021 May 4;55(9):6521-6523.
21. Wang A, Mahai G, Wan Y, et al. Assessment of imidacloprid related exposure using imidacloprid-olefin and desnitro-imidacloprid: Neonicotinoid insecticides in human urine in Wuhan, China: *Environ Int* 2020, 141:105785. Doi:10.1016/j.envint.2020.105785
22. Hexing Wang, Dongjian Yang, Hongji Fang, Minghui Han, Chuanxi Tang, Jingui Wu, Yue Chen, Qingwu Jiang, Predictors, sources, and health risk of exposure to neonicotinoids in Chinese school children: A biomonitoring-based study: *Environment International* 2020,143:05918. https://doi.org/10.1016/j.envint.2020.105918.
23. Suwannarin N, Prapamontol T, Isobe T, Nishihama Y, Nakayama SF. Characteristics of Exposure of Reproductive-Age Farmworkers in Chiang Mai Province, Thailand, to Organophosphate and Neonicotinoid Insecticides: A Pilot Study: *Int J Environ Res Public Health* 2020, 17:7871. Doi: 10.3390/ijerph17217871.
24. Oya N, Ito Y, Ebara T, Kato S, Ueyama J, Aoi A, Nomasa K, Sato H, Matsuki T, Sugiura-Ogasawara M, Saitoh S, Kamijima M. Cumulative exposure assessment of neonicotinoids and an investigation into their intake-related factors in young children in Japan: *Sci Total Environ* 2021, 750:141630. Doi: 10.1016/j.scitotenv.2020.141630.
25. Anai A, Hisada A, Yunohara T, Iwasaki M, Arizono K, Katoh T. Urinary neonicotinoids level among pregnant women in Japan: *Int J Hyg Environ Health* 2021, 236:113797. Doi: 10.1016/j.ijheh.2021.113797.
26. Mahai G, Wan Y, Xia W, Wang A, Qian X, Li Y, He Z, Li Y, Xu S. Exposure assessment of neonicotinoid insecticides and their metabolites in Chinese women during pregnancy: A longitudinal study: *Sci Total Environ* 2021, 151806. Doi: 10.1016/j.scitotenv.2021.151806.
27. Nimako C, Ikenaka Y, Akoto O, Bortey-Sam N, Ichise T, Nakayama SMM, Asante KA, Fujioka K, Taira K, Ishizuka M. Human Exposures to Neonicotinoids in Kumasi, Ghana: *Environ Toxicol Chem* 2021, 40:2306-2318. Doi: 10.1002/etc.5065.
28. Suwannarin N, Prapamontol T, Isobe T, Nishihama Y, Hashimoto Y, Mangklabruks A, Pantasri T, Chantara S, Naksen W, Nakayama SF. Exposure to Organophosphate and Neonicotinoid Insecticides and Its Association with Steroid Hormones among Male Reproductive-Age Farmworkers in Northern Thailand: *Int J Environ Res Public Health* 2021, 18:5599. Doi: 10.3390/ijerph18115599.
29. Zhang H, Shen K, Wu R, Li Z, Wang X, Wang D, Zhan M, Xu W, Gao Y, Lu L. Occurrence and distribution of neonicotinoids and characteristic metabolites in paired urine and indoor dust from young adults: Implications for human exposure: *Environ Res* 2021, 199:111175. Doi: 10.1016/j.envres.2021.111175.
30. Zhou W, Yue M, Liu Q, Wang F, Liu L, Wang L, Liu X, Zheng M, Xiao H, Bai Q, Gao J. Measuring urinary concentrations of neonicotinoid insecticides by modified solid-phase extraction-ultrahigh performance liquid chromatography-tandem mass spectrometry: Application to human exposure and risk assessment: *Chemosphere* 2021, 273:129714. Doi: 10.1016/j.chemosphere.2021.129714.
31. Taira K, Kawakami T, Weragoda SK, Herath HMAS, Ikenaka Y, Fujioka K, Hemachandra M, Pallewatta N, Aoyama Y, Ishizuka M, Bonmatin JM, Komori M. Urinary concentrations of neonicotinoid insecticides were related to renal tubular dysfunction and neuropsychological complaints in Dry-zone of Sri Lanka: *Sci Rep* 2021, 11:22484. https://doi.org/10.1038/s41598-021-01732-2
32. Gao B, Poma G, Malarvannan G, Dumitrascu C, Bastiaensen M, Wang M, Covaci A.Development of an analytical method based on solid-phase extraction and LC-MS/MS for the monitoring of current-use pesticides and their metabolites in human urine. J Environ Sci (China). 2022 Jan;111:153-163. Doi:10.1016/j.jes.2021.03.029.
33. Huang Z, Li H, Xiong J, You J. Target and Suspect Screening of Urinary Biomarkers for Current-use Pesticides: Application of a Simple Extraction Method. Environ Toxicol Chem. 2022 Jan;41(1):73-80. Doi: 10.1002/etc.5234.
34. Laubscher, B., Diezi, M., Renella, R. et al. Multiple neonicotinoids in children's cerebrospinal fluid, plasma, and urine: *Environ Health* 2022, 21:10. https://doi.org/10.1186/s12940-021-00821-z
35. Zhao Y, Zhu Z, Xiao Q, Li Z, Jia X, Hu W, Liu K, Lu S. Urinary neonicotinoid insecticides in children from South China: Concentrations, profiles and influencing factors: *Chemosphere* 2022, 291:132937. Doi: 10.1016/j.chemosphere.2021.132937.
36. Vuong AM, Zhang C, Chen A. Associations of neonicotinoids with insulin and glucose homeostasis parameters in US adults: NHANES 2015-2016: *Chemosphere* 2022, 286:131642. Doi: 10.1016/j.chemosphere.2021.131642.
37. Huang Z, Li H, Xiong J, You J. Target and Suspect Screening of Urinary Biomarkers for Current-use Pesticides: Application of a Simple Extraction Method: *Environ Toxicol Chem* 2022, 41:73-80. Doi: 10.1002/etc.5234.
38. Nimako C, Ichise T, Hasegawa H, Akoto O, Boadi NO, Taira K, Fujioka K, Isoda N, Nakayama SMM, Ishizuka M, Ikenaka Y. Assessment of ameliorative effects of organic dietary interventions on neonicotinoid exposure rates in a Japanese population. Environ Int. 2022 Apr;162:107169. Doi: 10.1016/j.envint.2022.107169.
39. Buckley JP, Kuiper JR, Bennett DH, Barrett ES, Bastain T, Breton CV, Chinthakindi S, Dunlop AL, Farzan SF, Herbstman JB, Karagas MR, Marsit CJ, Meeker JD, Morello-Frosch R, O'Connor TG, Romano ME, Schantz S, Schmidt RJ, Watkins DJ, Zhu H, Pellizzari ED, Kannan K, Woodruff TJ. Exposure to Contemporary and Emerging Chemicals in Commerce among Pregnant Women in the United States: The Environmental influences on Child Health Outcome (ECHO) Program. Environ Sci Technol. 2022 May 17;56(10):6560-6573. Doi: 10.1021/acs.est.1c08942.
40. Yue M, Liu Q, Wang F, Zhou W, Liu L, Wang L, Zou Y, Zhang L, Zheng M, Zeng S, Gao J. Urinary neonicotinoid concentrations and pubertal development in Chinese adolescents: A cross-sectional study. *Environ Int.* 2022, 163:107186. Doi: 10.1016/j.envint.2022.107186.

41. Pan C, Yu J, Yao Q, Lin N, Lu Z, Zhang Y, Zhao S, Wang Z, Lei X, Tian Y, Gao Y. Prenatal neonicotinoid insecticides Exposure, oxidative Stress, and birth outcomes. Environ Int. 2022 May;163:107180. Doi: 10.1016/j.envint.2022.107180.
42. Wrobel SA, Bury D, Belov VN, Klenk JM, Hauer B, Hayen H, Martino-Andrade AJ, Koch HM, Brüning T, Käfferlein HU. Rapid quantification of seven major neonicotinoids and neonicotinoid-like compounds and their key metabolites in human urine. Anal Chim Acta. 2023 Jan 25;1239:340680. Doi: 10.1016/j.aca.2022.340680.
43. Li F, Lin X, Liu J. Variability of urinary biomarkers of neonicotinoid insecticides in Chinese population: Implications for human exposure assessment. Chemosphere. 2022 Nov;307(Pt 1):135705. Doi: 10.1016/j.chemosphere.2022.135705.
44. Xu ZR, Yuan XX, Chen RM, wie HY, Chen LQ, Du HW, Li GM, Yang Y, Chen XJ, Fang X, Luo FH. Association between new onset type 1 diabetes and real-world antibiotics and neonicotino'ds' exposure-related gut microbiota perturbation. World J Pediatr. 2022 Oct;18(10):671-679. doi: 10.1007/s12519-022-00589-3.
45. Yang C, Liang J. Associations between neonicotinoids metabolites and hematologic parameters among US adults in NHANES 2015-2016. Environ Sci Pollut Res Int. 2023 Feb;30(10):26327-26337. doi: 10.1007/s11356-022-23997-4.
46. Thompson DA, Kolpin DW, Hladik ML, Lehmler HJ, Meppelink SM, Poch MC, Vargo JD, Soupene VA, Irfan NM, Robinson M, Kannan K, Beane Freeman LE, Hofmann JN, Cwiertny DM, Field RW. Prevalence of neonicotinoid insecticides in paired private-well tap water and human urine samples in a region of intense agriculture overlying vulnerable aquifers in eastern Iowa. Chemosphere. 2023 Apr;319:137904. doi: 10.1016/j.chemosphere.2023.137904.
47. Wrobel SA, Koslitz S, Belov VN, Bury D, Hayen H, Brüning T, Koch HM, Käfferlein HU. Quantitation of 6-chloronicotinic acid and 2-chloro-1,3-thiazole-5-carboxylic acid and their glycine conjugates in human urine to assess neonicotinoid exposure. Environ Res. 2023 Jun 1;226:115609. doi: 10.1016/j.envres.2023.115609.
48. Gao Y, Lu S, Zhao Q, Zhang B, Song S, Gui M, Wang Y, Sun H, Zhang T. Within-person variability of urinary neonicotinoids and their metabolites and recommendation for sampling strategy. Sci Total Environ. 2023 Aug 10;885:163898. doi: 10.1016/j.scitotenv.2023.163898.
49. Lu Z, Hu Y, Tse LA, Yu J, Xia Z, Lei X, Zhang Y, Shi R, Tian Y, Gao Y. Urinary neonicotinoid insecticides and adiposity measures among 7-year-old children in northern China: A cross-sectional study. Int J Hyg Environ Health. 2023 Jun;251:114188. doi: 10.1016/j.ijheh.2023.114188.
50. Sun J, He P, Wang R, Zhang ZY, Dai YQ, Li XY, Duan SY, Liu CP, Hu H, Wang GJ, Zhang YP, Xu F, Zhang R, Zhao Y, Yang HF. Association between urinary neonicotinoid insecticide levels and dyslipidemia risk: A cross-sectional study in Chinese community-dwelling elderly. J Hazard Mater. 2023 Jul 26;459:132159. doi: 10.1016/j.jhazmat.2023.132159.
51. Nishihama Y, Nakayama SF, Isobe T, Kamijima M; Japan Environment Child'en's StudyGroup. Association between maternal urinary neonicotinoid concentrations and child development in the Japan Environment and Child'en's Study. Environ Int. 2023 Nov;181:108267. doi: 10.1016/j.envint.2023.108267.
52. Gu S, Fu L, Wang J, Sun X, Wang X, Lou J, Zhao M, Wang C, Zhang Q. MtDNA Copy Number in Oral Epithelial Cells Serves as a Potential Biomarker of Mitochondrial Damage by Neonicotinoid Exposure: A Cross-Sectional Study. Environ Sci Technol. 2023 Oct 24;57(42):15816-15824. doi: 10.1021/acs.est.3c03835.
53. Wang A, Wan Y, Mahai G, Qian X, Li Y, Xu S, Xia W. Association of Prenatal Exposure to Organophosphate, Pyrethroid, and Neonicotinoid Insecticides with Child Neurodevelopment at 2 Years of Age: A Prospective Cohort Study. Environ Health Perspect. 2023 Oct;131(10):107011. doi: 10.1289/EHP12097.
54. Zahid M, Taiba J, Cox K, Khan AS, Uhing T, Rogan E. Pesticide residues in adults living near a bioenergy plant with 85,000 tons of contaminated wetcake. Chemosphere. 2023 Dec 11;349:140941. doi: 10.1016/j.chemosphere.2023.140941.
55. Yang Z, Wang Y, Tang C, Han M, Wang Y, Zhao K, Liu J, Tian J, Wang H, Chen Y, Jiang Q. Urinary neonicotinoids and metabolites are associated with obesity risk in Chinese school children. Environ Int. 2023 Dec 2;183:108366. doi: 10.1016/j.envint.2023.108366.
56. Zhao H, Gui W, Tan X, Chen Y, Ning Y, Wang X. Exploratory analysis of the associations between neonicotinoids insecticides and serum lipid profiles among US adults: A cross-sectional, population-based study. Ecotoxicol Environ Saf. 2023 Dec;268:115724. doi: 10.1016/j.ecoenv.2023.115724. Epub 2023 Nov 22. PMID: 37992647.

Supplemental Table 2. Neonicotinoids and metabolites quantification in body fluid except urine and in hair from the general population.

	Country	n	Detected neonicotinoids/metabolites	Ref.
Blood	Pakistan	109	IMI	1
	Pakistan	184	6CNA	2
	China	196	IMI, IMI-ole, ACE, DMAP, THI, TMX, CLO, DIN, DIN-U	3
	China	374	IMI, IMI-ole, ACE, DMAP, THI, TMX, CLO, DIN, DIN-U	4
Serum	China	200	IMI, IMI-ole, ACE, DMAP, THI, TMX, CLO, DIN, DIN-U	5
	China	120	IMI, ACE, THI, NIT, TMX, CLO	6
	Saudi Arabia	25	IMI, 6CNA, ACE, DMAP, TA ,TMX, CLO, DIN, SFO	7
	China	1483	IMI, ACE, CLO, THI, TMX, NIT, DIN, FLU, SUL, DMAP	8
Umbilical cord serum	China	95	IMI, IMI-ole, ACE, DMAP, CLO, THI, TMX	9
Plasma	Switzerland	14	IMI, DMAP, TMX, SFX	10
	China	2525	IMI, ACE, CLO, THI, TMX, NIT, IMZ, DMAP, THI-amid	11
Cerebrospinal fluid	Switzerland	14	IMI, DMAP, TMX, SFX	10
Saliva	China	188	IMI, 5OH-IMI, ACE, DMAP, THI, TMX, CLO, DIN, DIN-U	12
Semen	China	191	IMI-ole, DMAP, DM-CLO.	13
Breast milk	China	80	IMI, ACE, DMAP, THI, NIT, CLO	14
	China	32	IMI, TMX	15
	China	137	IMI, ACE, CLO, NIT, TMX, DIN	16
Bile	China	201	IMI, ACE, IMZ, CLO, THI, NIT, TMX, DIN	17
Tooth	China	127	IMI, 5OH-IMI, ACE, DMAP, THI, TMX, CLO, DIN, DIN-U	18
Hair	Greece	32	IMI	19
	Burkina Faso	101	IMI, ACE,	20
	China	204	IMI, ACE, THI, TMX, CLO	21
	Philippines	100	IMI, ACE, THI, TMX, CLO	22

Abbreviations: IMI, imidacloprid; 5OH-IMI, 5-hydroxy imidacloprid; IMI-ole, imidacloprid-olefin; ACE, acetamiprid; DMAP, *N*-desmethyl acetamiprid; THI, thiacloprid; NIT, nitenpyram; TMX, thiamethoxam; CLO, clothianidin; DM-CLO, desmethyl clothianidin; DIN, dinotefuran; DIN-U, 1-methyl-3-(tetrahydro-3-furylmethyl) urea; SFO, sulfoxaflor; IMZ, imidaclothiz; THI-amid, thiacloprid-amid

References:

1. Khan DA, Bhatti MM, Khan FA, Naqvi ST, Karam A. Adverse Effects of Pesticides Residues on Biochemical Markers in Pakistani Tobacco Farmers: *Int J Clin Exp Med* 2008, 1:274-282. www.ijcem.com/IJCEM806001
2. Khan DA, Hashmi I , Mahjabeen W, Naqvi TA. Monitoring health implications of pesticide exposure in factory workers in Pakistan: *Environ Monit Assess* 2010, 168:231–240. doi: 10.1007/s10661-009-1107-2
3. Xu M, Zhang Z, Li Z, Kan S, Liu Z, Wang D, Liu Q, Zhang H. Profiles of neonicotinoid insecticides and characteristic metabolites in paired urine and blood samples: Partitioning between urine and blood and implications for human exposure: *Sci Total Environ* 2021, 773:145582. doi: 10.1016/j.scitotenv.2021.145582.
4. Zhang H, Zhang R, Zeng X, Wang X, Wang D, Jia H, Xu W, Gao Y. Exposure to neonicotinoid insecticides and their characteristic metabolites: Association with human liver cancer: *Environ Res* 2022, 208:112703. doi: 10.1016/j.envres.2022.112703.
5. Zhang H, Zhu K, Du J, Ou M, Hou J, Wang D, Wang J, Zhang W, Sun G. Serum concentrations of neonicotinoids and their characteristic metabolites in elderly population from South China: Association with osteoporosis: *Environ Res* 2022, 203:111772. doi: 10.1016/j.envres.2021.111772.
6. Chen Q, Zhang Y, Li J, Su G, Chen Q, Ding Z, Sun H. Serum concentrations of neonicotinoids, and their associations with lipid molecules of the general residents in Wuxi City, Eastern China: *J Hazard Mater* 2021, 413:125235. doi: 10.1016/j.jhazmat.2021.125235.
7. Li AJ, Banjabi AA, Takazawa M, Kumosani TA, Yousef JM, Kannan K: Serum concentrations of pesticides including organophosphates, pyrethroids and neonicotinoids in a population with osteoarthritis in Saudi Arabia: *Sci Total Environ* 2020, 737:139706. doi: 10.1016/j.scitotenv.2020.139706.
8. Pan D, Lin M, Mu C, Yu C, Ye B, Liang J, Sheng Y, Huang D, Liu S, Zeng X, Jennifer Tan HJ, Chongsuvivatwong V, Qiu X. Maternal exposure to neonicotinoid insecticides and fetal growth restriction: A nested case-control study in the guangxi Zhuang birth cohort. Chemosphere. 2023 Sep;336:139217. doi: 10.1016/j.chemosphere.2023.139217.
9. Zhang H, Bai X, Zhang T, Song S, Zhu H, Lu S, Kannan K, Sun H. Neonicotinoid Insecticides and Their Metabolites Can Pass through the Human Placenta Unimpeded. Environ Sci Technol. 2022 Dec 6;56(23):17143-17152. doi: 10.1021/acs.est.2c06091.
10. Laubscher, B., Diezi, M., Renella, R. et al. Multiple neonicotinoids in children's cerebrospinal fluid, plasma, and urine: *Environ Health* 2022, 21:10. https://doi.org/10.1186/s12940-021-00821-z

11. Wang L, Ma C, Wei D, Wang M, Xu Q, Wang J, Song Y, Huo W, Jing T, Wang C, Mao Z. Health risks of neonicotinoids chronic exposure and its association with glucose metabolism: A case-control study in rural China. Environ Pollut. 2023 Jul 17;334:122213. doi: 10.1016/j.envpol.2023.122213.
12. Zhang H, Zhang N, Zhou W, Zeng X, Wang X, Zhan M, Xu W, Huang Y, Lu L, Li Z, Gao Y. Profiles of neonicotinoid insecticides and their metabolites in paired saliva and periodontal blood samples in human from South China: Association with oxidative stress markers: *Ecotoxicol Environ Saf* 2021, 212:112001. doi: 10.1016/j.ecoenv.2021.112001.
13. Wang A, Wan Y, Zhou L, Xia W, Guo Y, Mahai G, Yang Z, Xu S, Zhang R. Neonicotinoid insecticide metabolites in seminal plasma: Associations with semen quality: *Sci Total Environ* 2022, 811:151407. doi: 10.1016/j.scitotenv.2021.151407.
14. Chen D, Liu Z, Barrett H, Han J, Lv B, Li Y, Li J, Zhao Y, Wu Y. Nationwide Biomonitoring of Neonicotinoid Insecticides in Breast Milk and Health Risk Assessment to Nursing Infants in the Chinese Population: *J Agric Food Chem* 2020, 68:13906-13915. doi: 10.1021/acs.jafc.0c05769.
15. Ying Z, Fu L, Gu S, Wang Y, Mo X, Tang T, Jin H, Zhang Q. Development of QuEChERS coupled with UHPLC-MS/MS for simultaneous determination of eight neonicotinoid pesticides in breast milk. Environ Monit Assess. 2023 Apr 20;195(5):597. doi: 10.1007/s10661-023-11185-x.
16. Zhang Q, Mo X, Lou J, Ying Z, Wang Y, Dai W. Occurrence, distribution and potential risk to infants of neonicotinoids in breast milk: A case study in Hangzhou, China. Sci Total Environ. 2023 Jun 20;878:163044. doi: 10.1016/j.scitotenv.2023.163044.
17. Chen Y, Yu W, Zhang L, Cao L, Ling J, Liao K, Shen G, Du W, Chen K, Zhao M, Wu J, Jin H. First evidence of neonicotinoid insecticides in human bile and associated hepatotoxicity risk. J Hazard Mater. 2023 Mar 15;446:130715. doi: 10.1016/j.jhazmat.2022.130715.
18. Zhang N, Wang B, Zhang Z, Chen X, Huang Y, Liu Q, Zhang H. Occurrence of neonicotinoid insecticides and their metabolites in tooth samples collected from south China: Associations with periodontitis: *Chemosphere* 2021, 264:128498. doi: 10.1016/j.chemosphere.2020.128498.
19. Kavvalaskis MP, et.al. Development and application of LC–APCI–MS method for biomonitoring of animal and human exposure to imidacloprid: *Chemosphere* 2013, 93: 2612–2620
20. Lehmann E, Oltramare C, Nfon Dibié JJ, Konaté Y, de Alencastro LF. Assessment of human exposure to pesticides by hair analysis: The case of vegetable-producing areas in Burkina Faso: *Environ Int* 2018, 111:317-331.
21. Peng FJ, Hardy EM, Mezzache S, Bourokba N, Palazzi P, Stojiljkovic N, Bastien P, Li J, Soeur J, Appenzeller BMR. Exposure to multiclass pesticides among female adult population in two Chinese cities revealed by hair analysis: *Environ Int* 2020, 138:105633. doi: 10.1016/j.envint.2020.105633.
22. Bonmatin JM, Mitchell EAD, Glauser G, Lumawig-Heitzman E, Claveria F, Bijleveld van Lexmond M, Taira K, Sánchez-Bayo F. Residues of neonicotinoids in soil, water and people's hair: A case study from three agricultural regions of the Philippines: *Sci Total Environ* 2021, 25;757:143822. doi: 10.1016/j.scitotenv.2020.143822.

Supplemental Table 3. Profiles of two participants urinary natrium were less than 15 mEq/L, and Five Participants Urinary Strong Ion Difference were more than 40 mEq/L

Sampling Area	Age	Gender	Occupational Pesticide exposure	Hair Dye	Neonicotinoids detected in hair	Neonicotinoids detected in urine	Strong Ion Difference in urine (mEq/L)	Na^+ in urine (mEq/L)	Na/K in urine
Mindanao	15	M	No	No	Thiamethoxam Clothianidin Imidacloprid	Imidacloprid Acetamiprid	5.1	**13.6**	2.7
Mindanao	32	M	Yes	No	Thiamethoxam Clothianidin Imidacloprid	none	1.1	**11.8**	3.6
Luzon	47	M	Yes	No	Imidacloprid	thiamethoxam, imidaclorpid	**54.5**	217.0	5.3
Luzon	38	F	No	No	none	imidacloprid	**84.6**	205.6	6.0
Luzon	33	F	No	yes	none	imidacloprid	**43.7**	113.8	5.0
Marinduque	9	F	No	no	Thiamethoxam, Clothianidin, Acetamiprid	DMAP	**45.7**	64.8	4.8
Mindanao	39	M	Yes	yes	Thiamethoxam, Imidacloprid, Thiacloprid	none	**42.1**	95.3	3.6

Supplemental Table 4. Comparison of urine and hair analysis of the three islands

	Luzon (n=31)			**Marinduque (n=31)**			**Mindanao (n=37)**			
	>LOQ	Mean[a]	Max	>LOQ	Mean[a]	Max	>LOQ	Mean[a]	Max	p value[b]
Urine		(μg/L)	(μg/L)		(μg/L)	(μg/L)		(μg/L)	(μg/L)	
Thiamethoxam	12.9%	0.03	0.36	45.1%	0.05	0.15	35.1%	0.05	0.45	N.C.[c]
Clothianidin	0		<LOQ	12.9%	0.03	0.09	27.0%	0.04	0.30	N.C.
Imidacloprid	61.3%	0.06	0.55	41.9%	0.04	0.22	43.2%	0.04	0.19	N.C.
Acetamiprid	3.2%	0.01	0.07	6.5%	0.01	0.09	18.9%	0.01	0.13	N.C.
Thiacloprid	0		<LOQ	0		<LOQ	2.7%	0.01	0.12	N.C.
Σ five NEO	64.5%	0.15	0.55	80.6%	0.16	0.26	67.6%	0.18	0.80	0.35
Nitenpyram	0		<LOQ	3.2%	0.03	0.25	2.7%	0.03	0.66	N.C.
Dinotefuran	19.3%	0.04	0.95	3.2%	0.03	0.20	24.3%	0.04	0.66	N.C.
DMAP	3.2%	0.01	0.27	3.2%	0.01	0.21	10.8%	0.01	0.09	N.C.
Σ NEO	71.0%	0.25	1.1	83.9%	0.24	0.35	78.4%	0.30	1.02	0.19
Hair		(μg/kg)	(μg/kg)		(μg/kg)	(μg/kg)		(μg/kg)	(μg/kg)	
Thiamethoxam	12.9%	0.01	0.25	3.2%	0.01	0.08	67.6%	0.16	129.28	N.C.
Clothianidin	22.6%	0.02	0.33	45.1%	0.03	0.53	64.9%	0.08	6.72	N.C.
Imidacloprid	61.3%	0.06	0.63	25.8%	0.02	0.24	89.2%	0.27	341.40	N.C.
Acetamiprid	12.9%	0.01	0.07	12.9%	0.005	0.06	13.5%	0.01	0.07	N.C.
Thiacloprid	3.2%	0.01	0.01	0		<LOQ	18.9%	0.01	0.02	N.C.
Σ five NEO	77.4%	0.13	0.66	61.3%	0.09	0.53	94.6%	1.03	350.52	**<0.001**

[a] geometric mean on assumption <LOQ data is a half of LOQ; [b] one way ANOVA; [c] not calculable

Supplemental Table 5. Comparison of hair neonicotinoid concentration in adult women between hair dyed and hair un-dyed

	Total (n=26)	Hair dyed (n=9)		Hair un-dyed (n=17)		p value[a]
Age (mean±SD)		37.4 ± 19.3		34.9 ± 9.0		0.64
Pesticide related workers		n=3 (33%)		n=2 (14.8%)		0.22
	>LOQ	>LOQ	Mean	>LOQ	Mean	p value[b]
Urine			(μg/L)		(μg/L)	
Thiamethoxam	50.0%	22.2%	0.038	70.6%	0.089	0.061
Clothianidin	15.4%	0		23.5%	0.036	N.C.
Imidacloprid	38.5%	66.7%	0.076	23.5%	0.036	N.C.
Acetamiprid	0	0		0		N.C.
Thiacloprid	0	0		0		N.C.
Total 5 NEO	80.8%	77.8%	0.178	88.2%	0.205	0.71
Dinotefuran	15.4%	22.2%	0.038	11.1%	0.032	N.C.
Nitenpyram	0	0		0		N.C.
DMAP	3.8%	11.1%	0.008	0		N.C.
Total 8 NEO	84.6%	77.8%	0.277	88.2%	0.290	0.83
Hair			(μg/kg)		(μg/kg)	
Thiamethoxam	15.4%	11.1%	0.006	17.6%	0.008	N.C.[c]
Clothianidin	34.6%	22.2%	0.013	41.2%	0.026	N.C.
Imidacloprid	57.7%	33.3%	0.023	76.5%	0.073	**0.014**
Acetamiprid	7.7%	0%	N.C.	11.8%	0.004	N.C.
Thiacloprid	7.7%	11.1%	0.005	5.9%	0.005	N.C.
Total 5 NEO	73.1%	44.4%	0.061	82.4%	0.144	**0.017**

[a] t-test; [b] Mann-Whitney U test; [c] not calculable

Supplemental Table 6. Relationships between neonicotinoids detection in urine and in hair

	Urine>LOQ	+	+	-	-	Sensitivity	Specificity	Positive Likelihood ratio	Negative Likelihood ratio
	Hair >LOQ	+	-	+	-				
		n	n	n	n				
Total	Thiamethoxam	11	20	19	49	0.35	0.72	1.27	0.90
	Clothianidin	9	5	36	49	0.64	0.58	1.52	0.62
	Imidacloprid	25	22	34	18	0.53	0.35	0.81	1.35
	Acetamiprid	0	10	13	76	0.00	0.85	0.00	1.17
	DMAP/ Acetamiprid [a]	2	4	11	82	0.33	0.88	2.82	0.76
	Thiacloprid	0	1	9	89	0.00	0.91	0.00	1.10
	Total 5 NEO	53	16	24	6	0.77	0.20	0.96	1.16
Category A	Thiamethoxam	0	6	8	14	0.00	0.64	0.00	1.57
	Clothianidin	0	0	18	10	N.C.	0.36	N.C.	N.C.
	Imidacloprid	5	7	12	4	0.42	0.25	0.56	2.33
	Acetamiprid	0	4	2	22	0.00	0.92	0.00	1.09
	DMAP/ Acetamiprid [a]	1	1	1	25	0.50	0.96	**13.00**	0.52
	Thiacloprid	0	0	0	28	N.C.	1.00	N.C.	N.C.
	Total 5 NEO	12	4	11	1	0.75	0.08	0.82	3.00
Category B	Thiamethoxam	3	5	0	5	0.38	1.00	N.C.	0.63
	Clothianidin	2	1	4	6	0.67	0.60	1.67	0.56
	Imidacloprid	1	1	8	3	0.50	0.27	0.69	1.83
	Acetamiprid	0	1	1	11	0.00	0.92	0.00	1.09
	DMAP/ Acetamiprid [a]	0	0	1	12	N.C.	0.92	N.C.	N.C.
	Thiacloprid	0	0	1	12	N.C.	0.92	N.C.	N.C.
	Total 5 NEO	8	3	2	0	0.73	0.00	0.73	N.C.
Category C	Thiamethoxam	7	8	10	19	0.47	0.66	1.35	0.81
	Clothianidin	7	4	12	21	0.64	0.64	1.75	0.57
	Imidacloprid	17	8	11	8	0.68	0.42	1.17	0.76
	Acetamiprid	0	5	10	29	0.00	0.74	0.00	1.34
	DMAP/ Acetamiprid [a]	1	2	9	32	0.33	0.78	1.52	0.85
	Thiacloprid	0	1	5	38	0.00	0.88	0.00	1.13
	Total 5 NEO	28	5	9	2	0.85	0.18	1.04	0.83
Category D	Thiamethoxam	1	1	1	11	0.50	0.92	6.00	0.55
	Clothianidin	0	0	2	12	N.C.	0.86	N.C.	N.C.
	Imidacloprid	2	6	3	3	0.25	0.50	0.50	1.50
	Acetamiprid	0	0	0	14	N.C.	1.00	N.C.	N.C.
	DMAP/ Acetamiprid [a]	0	1	0	13	0.00	1.00	N.C.	1.00
	Thiacloprid	0	0	3	11	N.C.	0.79	N.C.	N.C.
	Total 5 NEO	5	4	2	3	0.56	0.60	1.39	0.74

[a]: Relationship between urine N-desmethyl acetamiprid concentration and hair acetamiprid concentration.