

# Association of exposure to neonicotinoid insecticides and oxidative stress in farmworkers in Chiang Mai province, Thailand

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**Abstract:** Systemic neonicotinoid (NEO) have become the most widely used class of insecticide in the world for seed dressing and foliar spraying. Previous animal studies indicated NEO induce oxidative stress leading to reactive oxygen species production related to toxic effects including cell damage; however, human studies are still limited. We conducted a cross-sectional study of 288 reproductive-age farmworkers in Chiang Mai province, Northern Thailand. Demographic data of participants were obtained through face-to-face interview. We evaluated the association between exposure to NEO insecticides and oxidative stress biomarker. Urinary NEO and their metabolites (NEO/m) were measured by liquid chromatography tandem-mass spectrometry whereas urinary oxidative stress biomarker of lipid peroxidation, malondialdehyde (MDA), were measured by high performance liquid chromatography with UV detector. Five NEO/m were detected greater than 50% of samples. The concentration of N-acetyl-acetamidiprid was highest among NEO/m with the geometric mean (GM) of 32.7 ng/mL, followed by imidacloprid (IMI), thiamethoxam, clothianidin and imidacloprid-olefin (Of-IMI) (GM: 25.4, 17.5, 11.3 and 4.4 ng/mL, respectively). The mean concentration of MDA was 1.5  $\mu$ mol/L. Linear regression models showed that IMI and Of-IMI concentrations showed significant positive association with MDA concentrations ( $\beta$ = 0.14; 95% CI: 0.02, 0.26 and  $\beta$ = 0.15; 95% CI: 0.03, 0.27, respectively). These results suggest that NEO insecticides may have an impact on oxidative damage of lipid. However, further studies are warranted for investigation including oxidative stress biomarker of proteins and DNA damage.

**Keywords:** neonicotinoids; insecticides; metabolites; environmental health; oxidative stress; malondialdehyde; biomarker; farmworker



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