Acrolein Carcinogenic Potential in Dual Betel Quid and Cigarette Users and the Toxic Potential of Acrolein from Heated Tobacco Products

Tsung-Jung LIU
Institute of Food Safety and Health Risk Assessment, National Yang Ming Chiao Tung University

Betel quid with tobacco has been classified as Group 1 carcinogen by IARC (1985). In Taiwan, almost all betel quid chewers are also cigarette smokers. We have demonstrated that the oral alkaline environment following chewing betel quid facilitates the absorption and enhance the carcinogenic potential of nicotine, NNK and cigarette smoke in vitro and in vivo. Acrolein is a major cigarette-related carcinogen that preferentially causes p53 mutations and inhibits DNA repair function in lung cancer. To test the hypothesis that acrolein is associated with oral carcinogenesis. In healthy volunteers, we have further demonstrated that urinary 3-HPMA (acrolein GSH conjugates) levels in betel quid and cigarette dual user are significantly higher than that in cigarette and betel quid solo users. This correlates well with buccal acrolein adduct levels. The alkaline oral environment (pH 8-11) following the chewing of betel quid containing slake lime might facilitate the absorption of acrolein (pKa 9.6) during cigarette smoking. Heated tobacco products (HTPs) are applying for marketing authorization in Taiwan. To test the toxic and carcinogenic potential of HTPs, we collected the aerosols from HTPs and conventional cigarettes (CCs), and demonstrated that aerosols from CCs caused higher cytotoxicity and oxidative stress levels than similarly collected aerosols from HTPs. The acrolein content in HTPs (2.34 $\pm$ 0.41 g/stick) was significantly less ($p<0.01$) than that from CCs (18.45 $\pm$ 1.08 g/stick). We conclude that HTPs generate less acrolein than from conventional cigarettes; however, the combined use of HTPs and betel quid might still pose a risk for oral carcinogenesis.