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Short Communication

New insights on assessing cancer risk of exposure to carcinogens from tobacco smoke inhalation

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Tobacco products is still the leading cause of deaths worldwide. 80% of lung cancer is attributed to tobacco smoking [1-3]. It has been found that the exposure to tobacco smoke is the primary etiologic factor responsible for lung cancer; and that the decline in the incidence and the mortality of lung cancer is associated with the decline in smoking [3,4]. At the same time, the use of e-cigarette (e-cig) starts to arise rapidly; almost all major tobacco manufacturers are now marketing e-cigarette [2]. However, e-cigarette (e-cig), another tobacco product that was considered for regulation by the U.S. Food and Drug Administration (FDA), is also another tool that delivers toxicants to e-cig users. Several publications demonstrated the levels of carcinogens found in e-cig aerosols including formaldehyde, acetaldehydes, and acrolein that are formed from thermal decomposition of vegetable glycerin (VG) and propylene glycol (PG), the e-liquid of e-cig [5,6]. Other carcinogens including tobacco specific nitrosamines (TSNAs) that are formed from tobacco alkaloids including nicotine and make biological changes [7,8]. After exposure, these carcinogens can damage cells by binding to DNA and forming carcinogen-DNA adducts which interfere with DNA replication and can lead to mutations that contribute to the initiation and development of cancerous tumors [8, 9]. However, the carcinogenic effect of these compounds depends on their reactivity and the time of exposure to these carcinogens (the accumulation effect). In order to better predict whether a specific level of exposure to carcinogen can make biological changes or not, we need to precisely estimate the exposure level. One fast and cost-effective approach is the use of computational modeling of health risk [10,11]. Several agencies including U.S. Environmental Protection Agency (US EPA) through its Integrated Risk Information System (IRIS), and the Agency for Toxic Substances and Disease Registry (ATSDR), have already established parameters such as reference exposure levels, minimal risk levels and cancer potency factors. These reference doses can aid in estimation of health risk and toxicity thresholds associated with known exposures to individual carcinogen in tobacco smoke. In fact, this approach has been explored previously using the total concentration of toxic compounds in mainstream smoke [12-14]. Although informative, these studies may not provide an accurate risk profile because human behavior and biology modify the actual exposure to carcinogens. In our previous studies of soil contaminants, we demonstrated that the total concentration of toxicants overestimates the risk of exposure, and that the bioavailable fraction of toxicants should be considered for risk assessment [10]. Currently there is a very limited data regarding the inhaled fraction of toxicants, and no data regarding the bioavailability of the inhaled fraction of toxicants. Additionally, very little modeling and risk assessment studies have integrated human behavior into the risk paradigm [15], most studies are relying on standardized smoking machine regimens to generate smoke; therefore, a more accurate approach should incorporate the inhaled fraction of carcinogens and human smoking behavior. Our current work is to establish a new insights on assessing the health risk, especially cancer risk of exposure to carcinogens from tobacco smoke inhalation taking into consideration the actual inhaled and the bioavailable faction of the inhaled carcinogens based on the actual human smoking or vaping behaviors to better estimate the cancer risk of exposure to carcinogens from tobacco smoke.

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