Are E-Cigarette Flavors Associated with Exposure to Nicotine and Toxicants? Findings from Wave 2 of the Population Assessment of Tobacco and Health (PATH) Study

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BACKGROUND

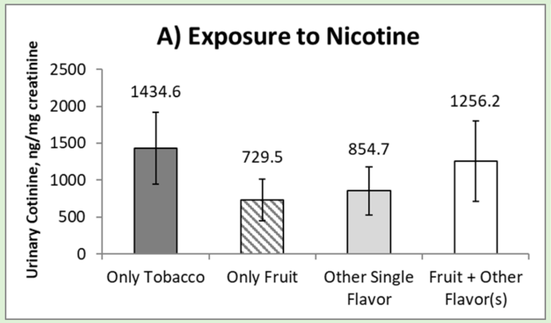
- The availability of e-cigarettes in appealing flavors (e.g. mint, fruit, candy) is often cited as a reason for use, especially among youth and young adults.
- In laboratory studies, one of the most popular classes of e-cigarette flavorings--fruit flavors--has been linked to enhancement of nicotine delivery to users, and potential for increased inflammatory and cytotoxic effects.
- Results from laboratory studies often do not translate to naturalistic settings, which merit the examination of these issues using observational data sources.
- We assessed whether use of specific e-cigarette flavors was associated with select urinary biomarkers of exposure to nicotine and toxicants in regular users of e-cigarettes using population-based data.

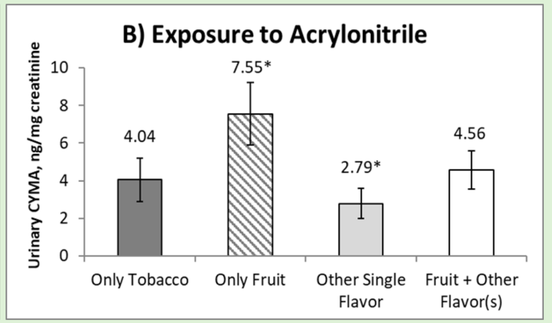
METHODS

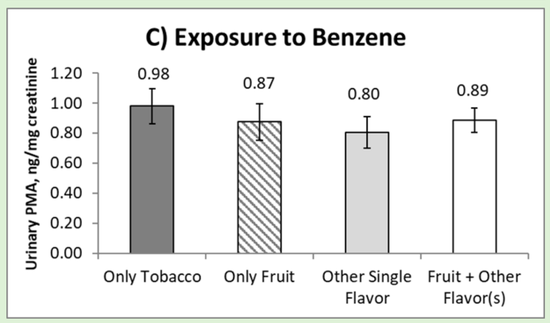
- Data were from Wave 2 of the Population Assessment of Tobacco and Health (PATH) Study Biomarker Restricted Use Files.
- We analyzed biomarker concentrations for nicotine and three tobacco-related toxicants (acrylonitrile, benzene, and acrolein) among exclusive e-cigarette users who used their product within the last 24 hours (n=211).
- Past month use of flavored e-cigarettes was classified into: 1) fruit-only, 2) tobacco-only, 3) single other flavor (including mint, clove, chocolate, and other flavors) and 4) fruit + use of additional flavors.
- Data were log-transformed; creatinine-adjusted geometric means were calculated, and between-flavor differences were compared using weighted simple linear regression models adjusted for multiple comparisons (Sidak) using Stata v. 15.0

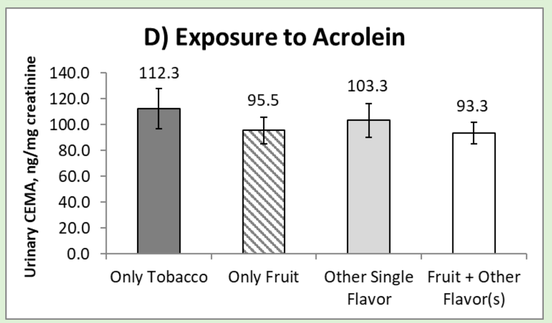
RESULTS

Figure 1. Urinary concentrations of biomarkers of exposure to: (a) nicotine; (b) acrylonitrile; (c) benzene; and (d) acrolein; among exclusive users of flavored e-cigarettes, United States, 2015-2016 (n=211)









- Most exclusive e-cigarette users reported using only mint, clove, chocolate, and other reported flavors (31%), and fruit and additional flavors (31%), followed by tobacco-only (19%), and fruit-only (19%).
- Users of fruit-only flavored e-cigarettes exhibited significantly higher concentrations of the biomarker for acrylonitrile (CYMA) compared to users of a single other flavor (geometric mean ratio=2.71, 95%CI: 1.30-5.62, adjusted *p*-value 0.048).
- Concentrations of biomarkers of exposure to nicotine (cotinine), benzene (PMA), and acrolein (CEMA) did not significantly differ across flavors.

CONCLUSIONS

- Using population-based biomarker data, we did not confirm findings from laboratory studies suggesting that fruit-flavored e-cigarettes contribute to significantly elevated concentrations of nicotine among exclusive e-cigarette users.
- We observed significantly greater concentrations of acrylonitrile among those who only used fruit flavored e-cigarettes compared to other flavors.
- Differences in user behavior, devices, and e-liquids likely play a role in this discrepancy and should be investigated in future studies.
- Future work should continue to investigate the role that e-cigarette flavors may play in affecting nicotine delivery and user health.

CONFLICT OF INTEREST

- MLG receives fees for serving on an advisory board from Johnson & Johnson and grant support from Pfizer. The other authors have no conflicts of interest to declare.

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