Comparing Users of Ice and Non-Ice E-cigarette Flavors: Device Characteristics, Puffing Topography, Nicotine Intake, Pulmonary Functions, and Biomarkers of Potential Harm

Nicholas Felicione,[1] Lisa Kaiser,[1] Connor Martin,[1] Michelle Page,[1] Bradley Schurr,[1] Noel Leigh,[1] Stephanie Podguski,[2] Shikha Sharma,[2] Qixin Wang,[2] Gagandeep Kaur,[2] Irfan Rahman,[2] Richard O'Connor,[1] Maciej Goniewicz[1]

[1]Department of Health Behavior, Roswell Park Comprehensive Cancer Center; [2]Department of Environmental Medicine, University of Rochester Medical Center, School of Medicine & Dentistry

Background

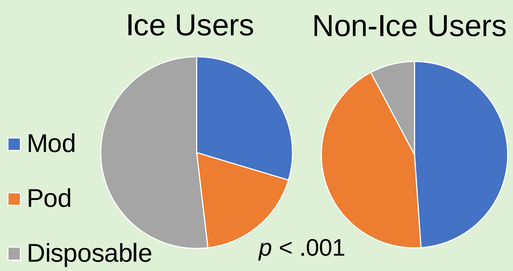
- Flavors are a driver of e-cigarette use (1-2)
- E-cigarette flavors are a potential target for regulation, such as the NY flavor ban and federal ban on flavors in cartridge-based e-cigarettes
- "Ice" e-cigarette flavors, or combinations of fruit/sweet and cooling attributes, have gained prominence among young adults (3)
  - 48.8% reported using ice flavors most often
- Young adult ice-flavor users are more likely to use disposable e-cigarettes and have greater odds of e-cigarette dependence (3)
- Little is known about this emerging flavor category, particularly regarding use patterns and health effects
- **Purpose**: Compare adult users of ice and non-ice flavors on e-cigarette characteristics, pulmonary function, nicotine intake, puffing topography, and biomarkers of potential harm

Methods

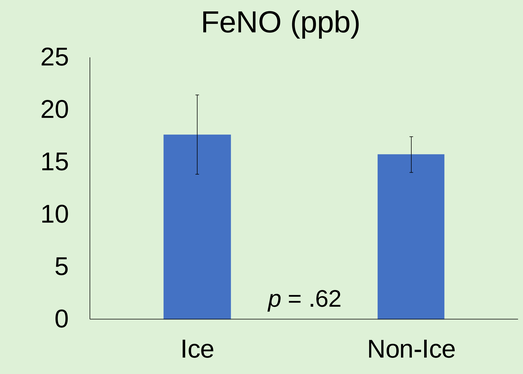
- 114 adult e-cigarette users
  - 26 ice flavors users (menthol + fruit/sweet combination)
  - 88 non-ice flavor users
- Data from initial visit of ongoing cohort study
- Participants self-reported demographics, cigarette/e-cigarette history, and daily use patterns
- Tests of pulmonary function:
  - Spirometry – Forced expiratory volume in 1 second / forced vital capacity (FEV1/FVC)
  - Fractional exhaled nitric oxide (FeNO)
- Puff topography captured via CReSS Micro during *ad lib* puffing at end of session
- Biomarkers of nicotine exposure (cotinine) and inflammation (pro-inflammatory cytokines) quantified from urine (cotinine), blood (IL-6, IL-8), and saliva (IL-1β)

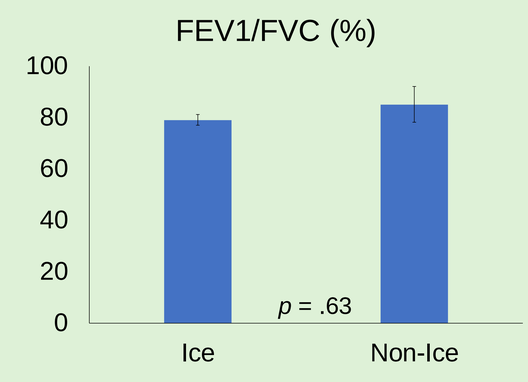
Results

E-cigarette Device Type



Pulmonary Function



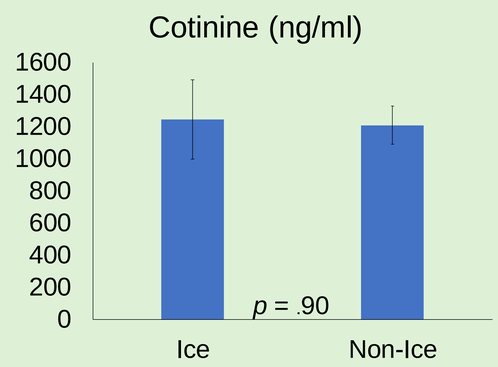


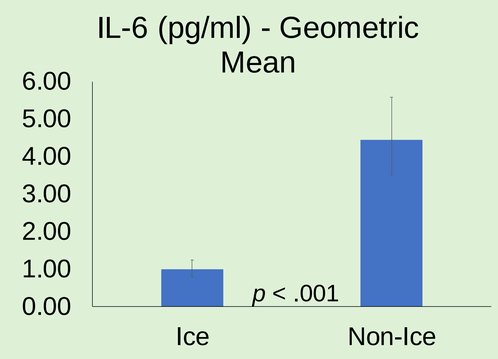
Puff Topography

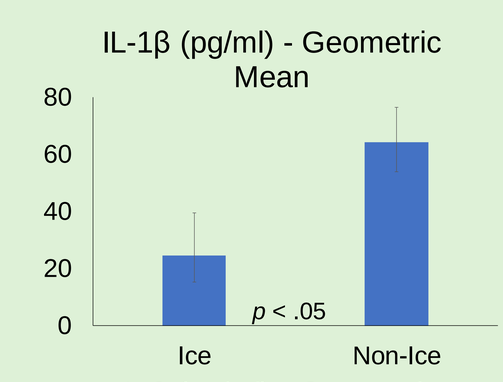
	Ice	Non-Ice	*p*
Puff Count	7.69 (1.04)	7.41 (0.67)	0.83
Duration (s)	1.66 (0.20)	1.95 (0.15)	0.34
Volume (ml)	135.91 (14.65)	138.62 (10.52)	0.89
Flow Rate (ml/s)	80.68 (3.91)	70.37 (3.06)	0.08
IPI (s)[1]	10.41 (1.48)	13.81 (1.55)	0.23

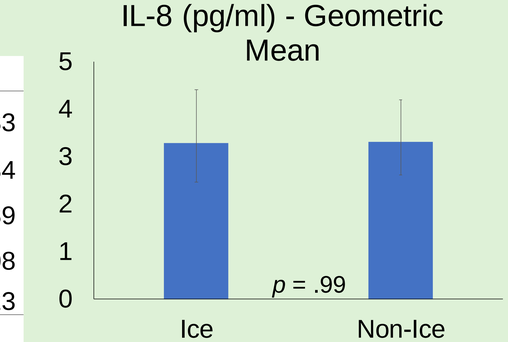
1. Interpuff Interval

Biomarkers of Exposure and Harm









Participant Characteristics

		Ice	Non-Ice
Demographics			
Age		26.54 (1.51)	28.44 (0.86)
% Male		69.2%	55.7%
% White		92.3%	89.8%
Education			
% High School Grad		61.5%	60.2%
% College Degree		34.6%	36.0%
Cigarette History			
Cigs Lifetime			
	Never	3.8%	3.6%
	< 100	23.1%	23.8%
	100+	73.1%	72.6%
Months SmokeFree		35.15 (6.26)	40.10 (4.12)
E-cigarette History			
Months Used E-cig		61.58 (6.25)	55.16 (3.70)
ml purchased		83.50 (17.45)	105.29 (17.09)
E-cigarette Characteristics			
Nicotine (mg/ml, self-report)		34.72 (4.44)	25.04 (2.33)
Adjustable Voltage		42.30%	50%
Rechargeable[1]		69.2%	93.2%

1. p = .001

Conclusions

- Users did not differ on demographics, smoking history, nicotine intake, puffing patterns, or pulmonary function
- Ice and non-ice users differ in e-cigarette device types (3)
  - Ice flavors associated with disposable e-cigarettes
- Marginally higher nicotine content among ice-flavors (32.74±4.44 mg/ml) than non-ice (25.04±2.33 mg/ml; *p*=.053)
- Some evidence of reduced inflammation among ice users
  - Effects remained significant when controlling for device type
  - Cooling agents may activate TRPM8 receptors (4), which may reduce systemic inflammation (5-6)

References

1. Baker et al. *Sci Rep*. 2021;11:4689
2. Audrain-McGovern et al. *Drug Alcohol Depend*. 2016;166:263-267
3. Leventhal et al. *Tob Control*. doi: 10.1136/tobaccocontrol-2020-056416
4. Jabba et al. *bioRxiv*. doi: 10.1101/2021.06.09.446946
5. Ramachandran et al. *PNAS*. 2013;110:7476-7481
6. Silverman et al. *Front Immunol*. 2020;11:590261.