

Compensatory puffing behaviour in e-cigarette users: Blood nicotine delivery and subjective effects

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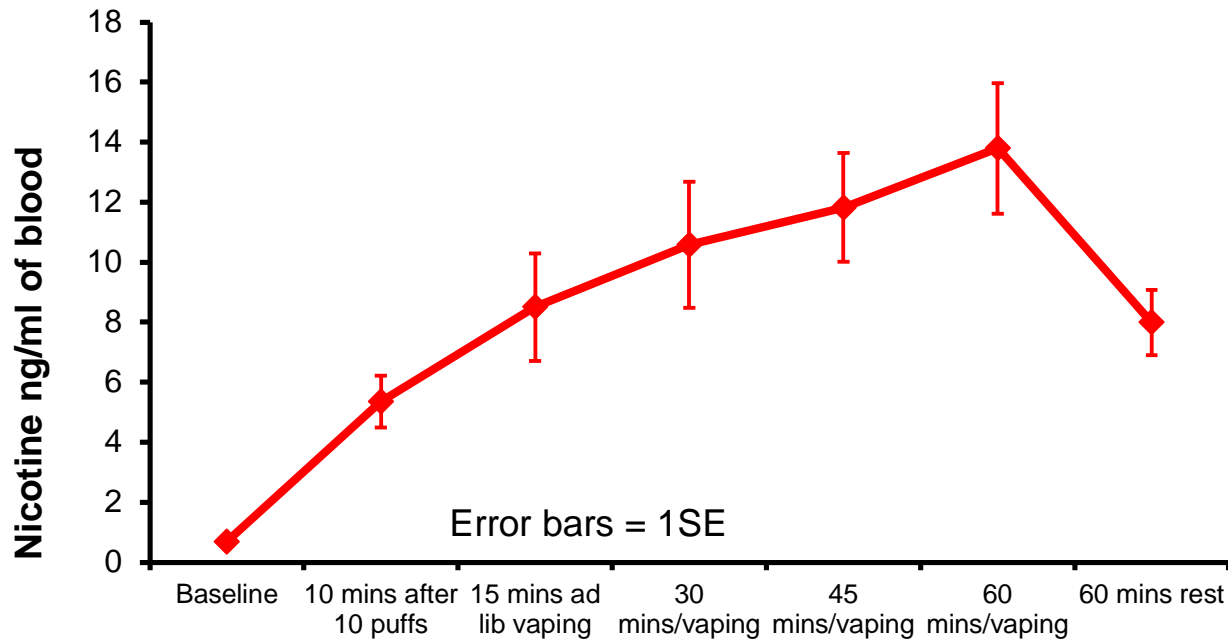
Declarations

- Conducted research for e-cigarette companies (2010-2013)
- Consultant for pharmaceutical industry (2014)
- Expert witness in e-cigarette patent infringement case (2014)
- No funding from tobacco industry

Self-Titration in Smokers

- Smokers adjust their nicotine intake to maintain a personal optimal level
- Smokers can achieve approx. 60-80% of their ordinary nicotine intake (Scherer & Lee, 2014)
- Mainly via taking longer, harder drags and more frequent puffs
- Switching to 'light' or reduced nicotine containing cigs doesn't appear to reduce toxicant exposure and may even increase it.

E-cigs and nicotine delivery

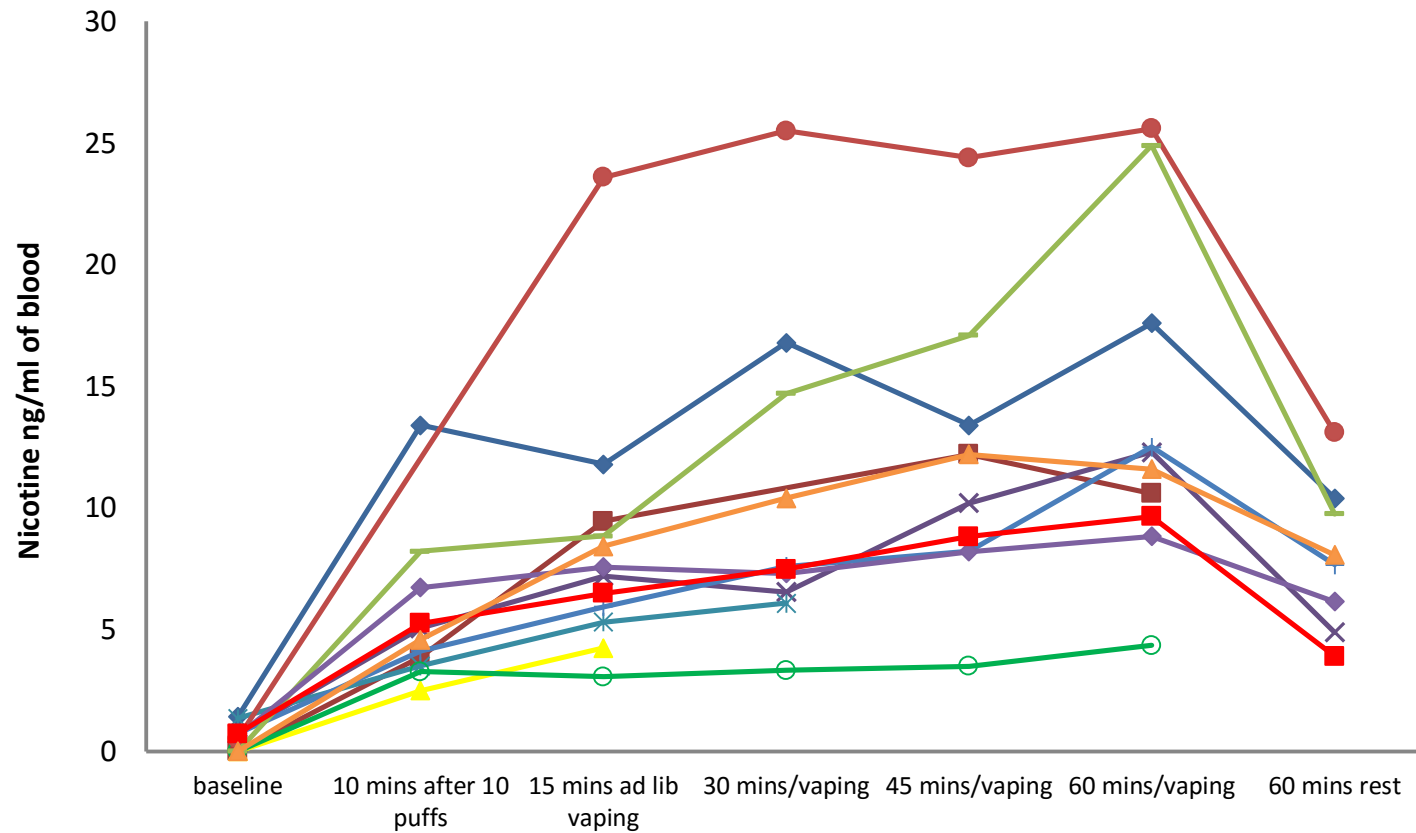


Nicotine boost of 4.7ng/mL after 10 mins (10 puffs).
Cmax = 13.9ng/mL at 60 mins.

Dawkins & Corcoran (2014)



Individual nicotine levels



TPD Article 20

- Limit on nicotine concentrations > 20mg/mL
- 9% use above 20mg/mL (ASH, 2016)
- 1/5th of e-cig users *initiated* vaping with >20mg/mL nicotine concentration (Farsalinos et al., 2013)

Aims

To explore:

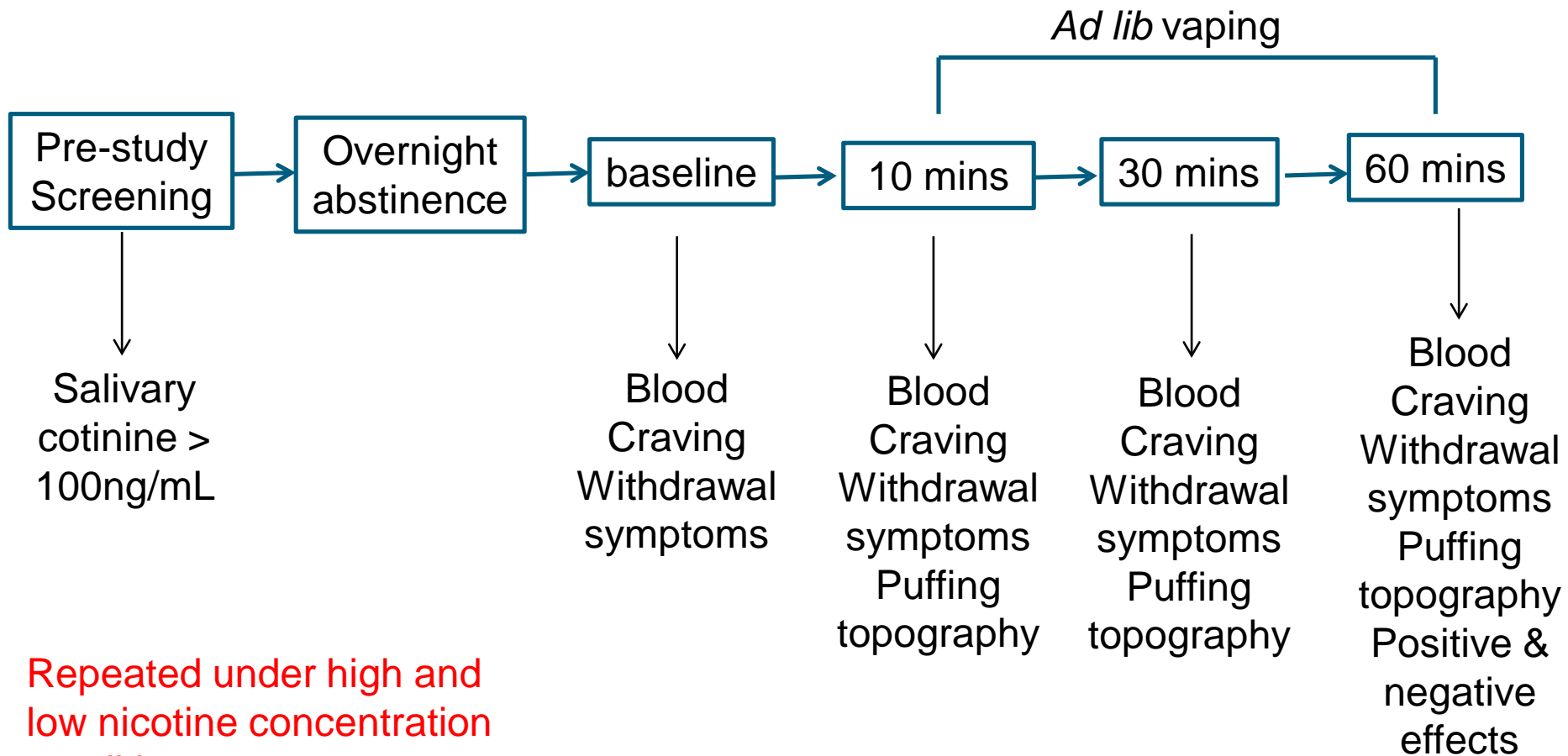
1. the extent to which e-cigarette users self-titrate when given a lower nicotine concentration liquid
2. subjective effects (craving, withdrawal symptoms, positive and negative effects) and plasma nicotine concentrations between conditions (high vs. low nicotine concentration liquid)

Methods

- Participants: 11 male experienced e-cig users
- E-cigarette: eVic Supreme (Joyetech) with Aspire tank (Nautilus)
- E-liquid: 6 & 24mg/mL tobacco flavour (Halo Smokers' Angels)
- Double-blind, counterbalanced

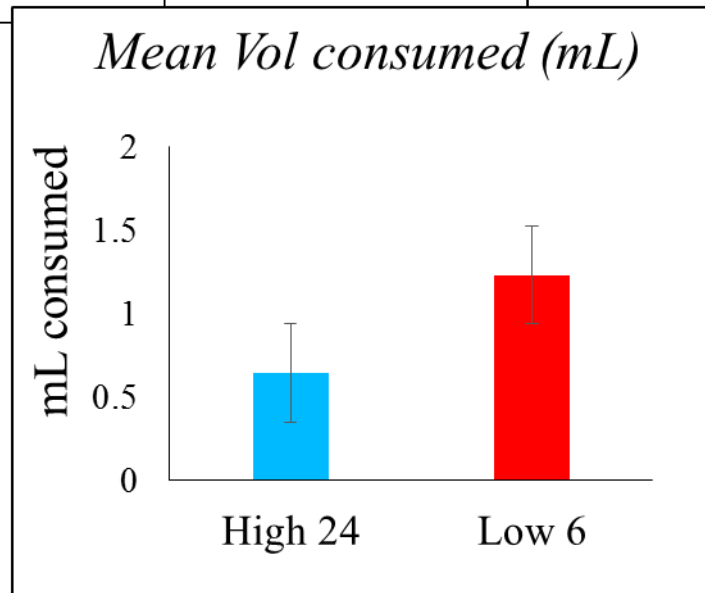
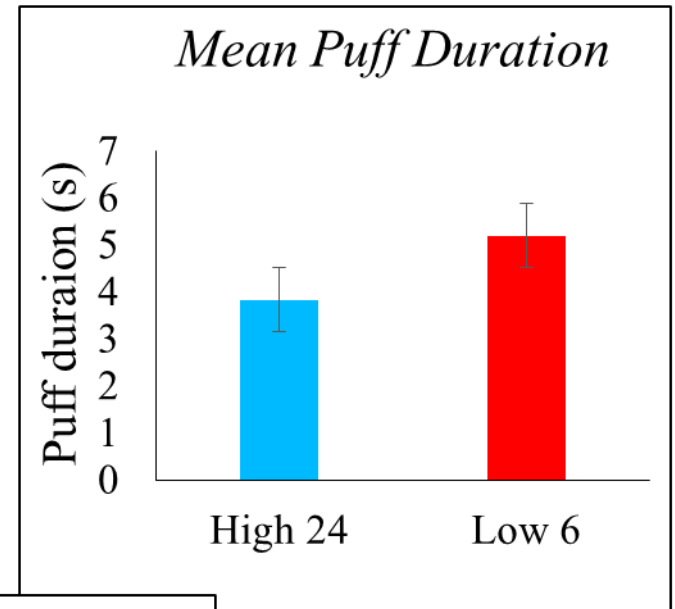
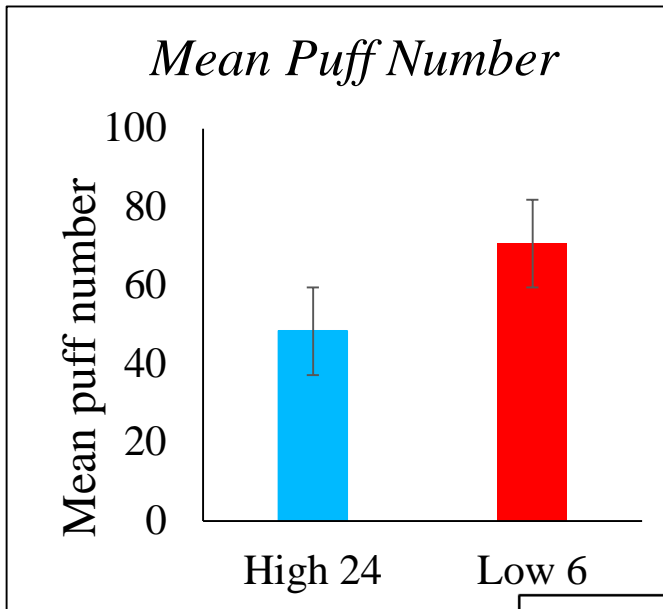


Procedure



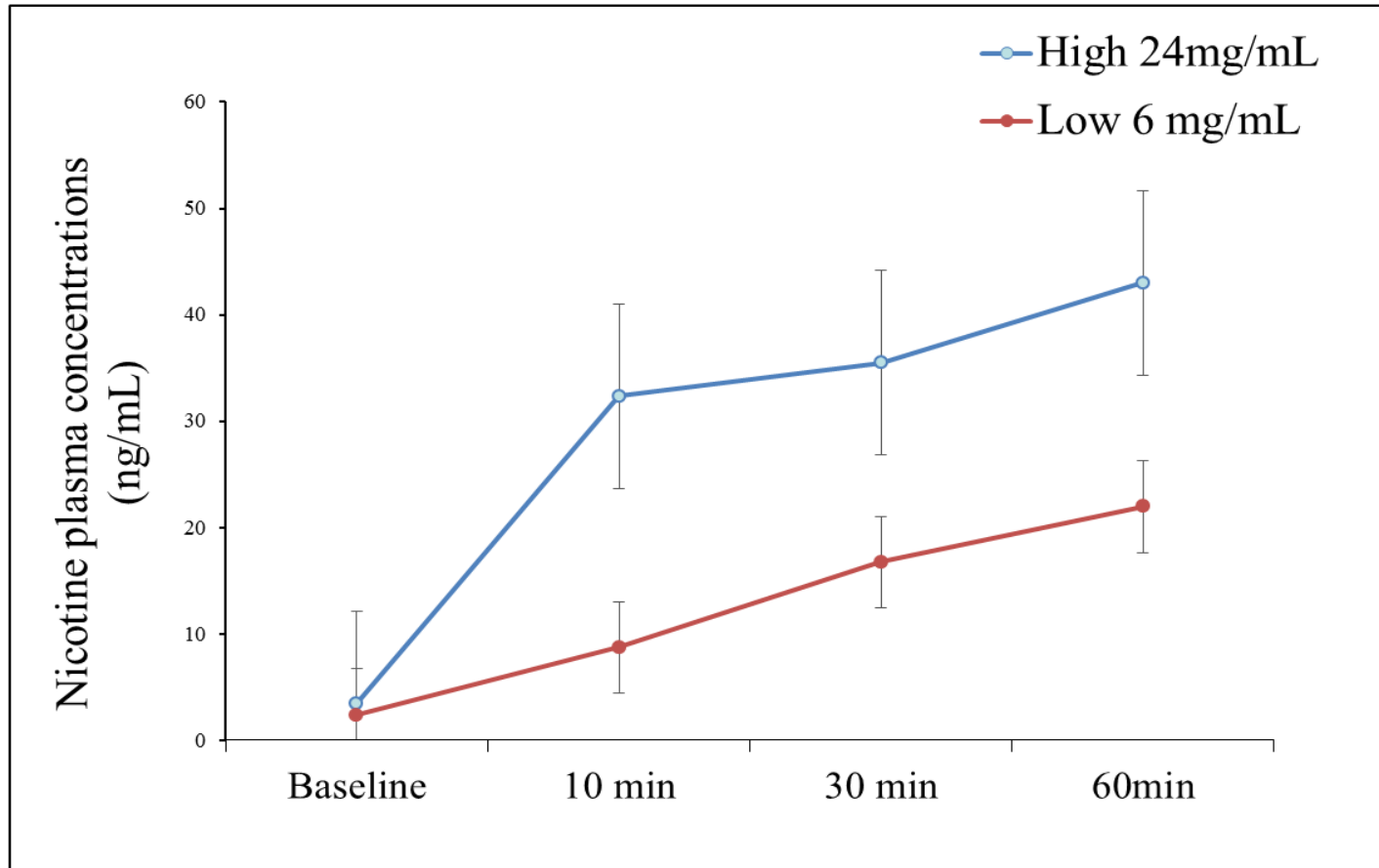
Repeated under high and low nicotine concentration conditions

Puffing topography



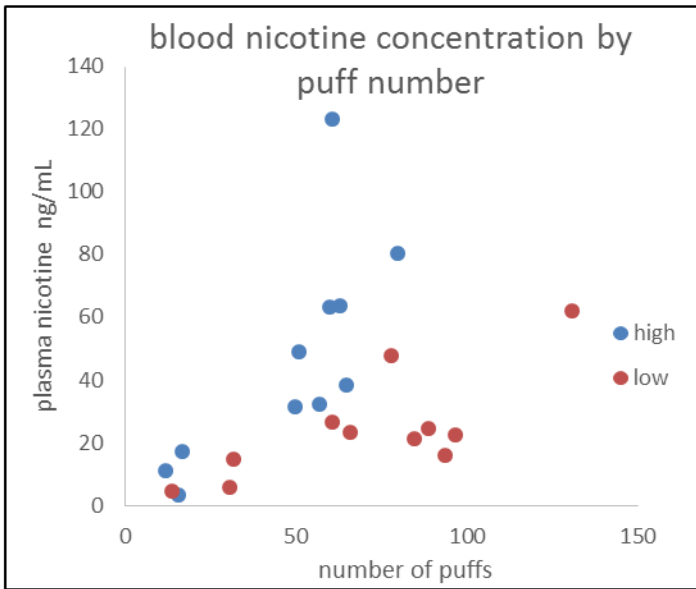
More puffs, longer puffs and more liquid consumed in the low (6mg/mL condition ($p < 0.05$))

Blood nicotine delivery

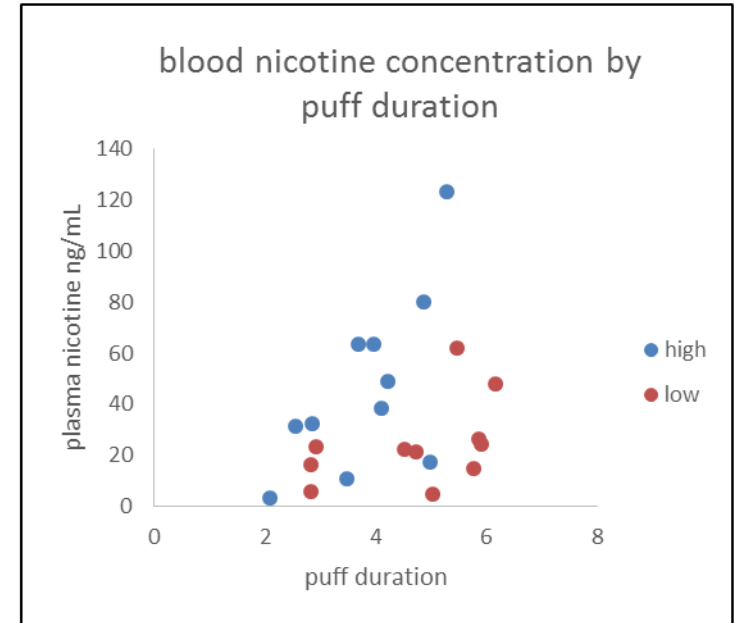


Incomplete self-titration from compensatory puffing

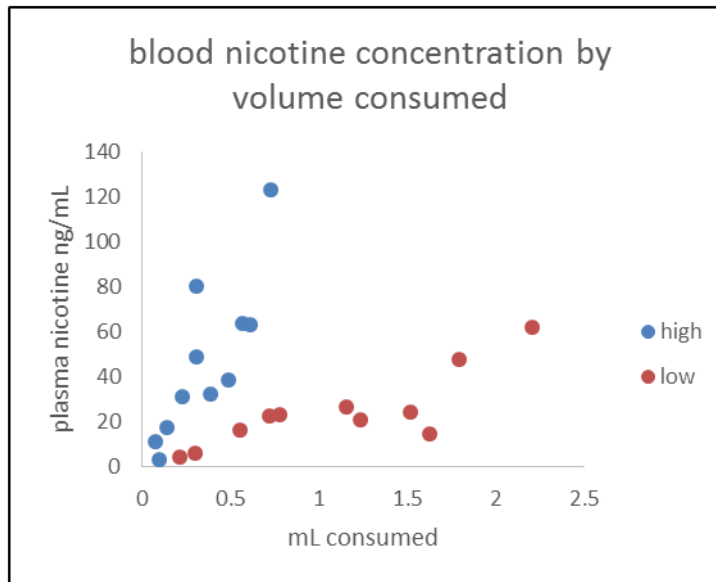
Blood nicotine/puffing topography correlations



High: $r = 0.85^{**}$; Low: $r = 0.75^{**}$



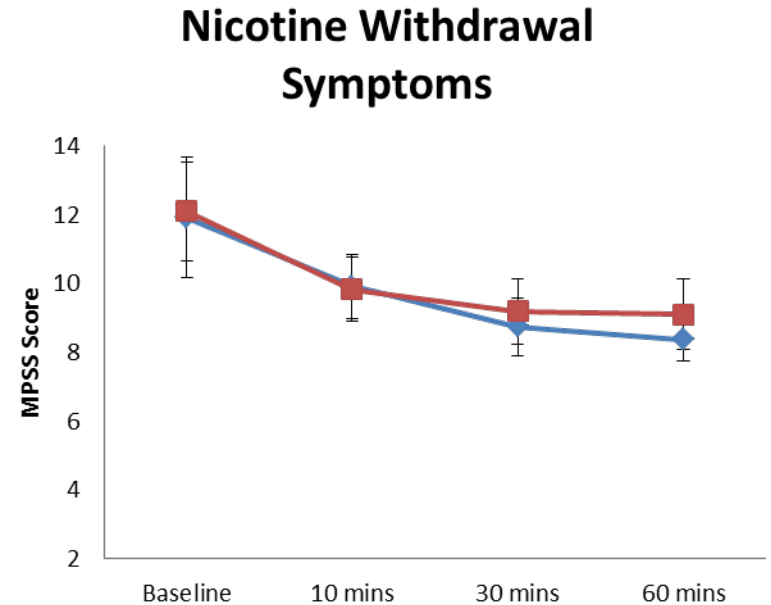
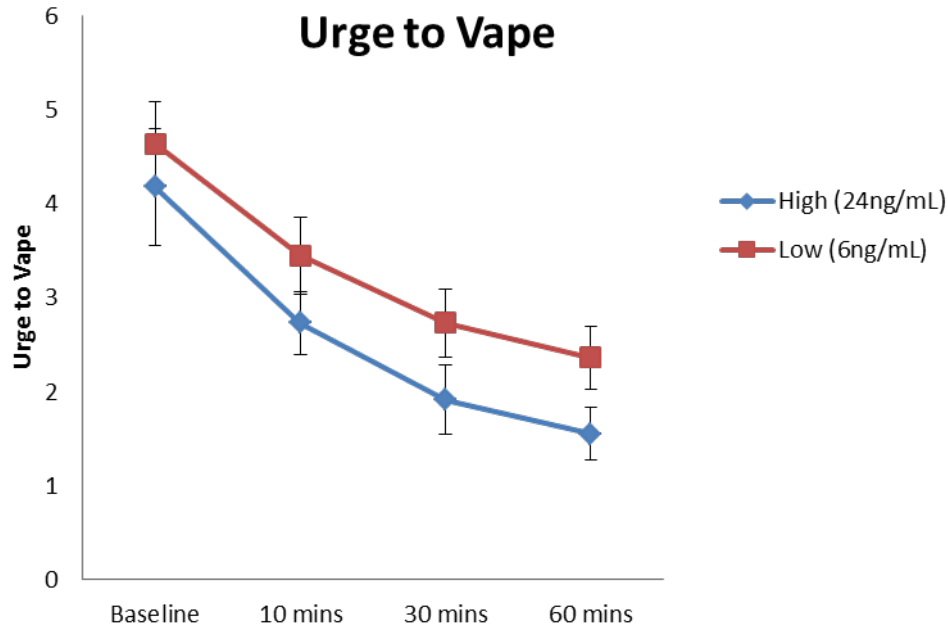
High: $r = 0.56^*$; Low: $r = 0.22$



High: $r = 0.85^{**}$; Low: $r = 0.75^{**}$

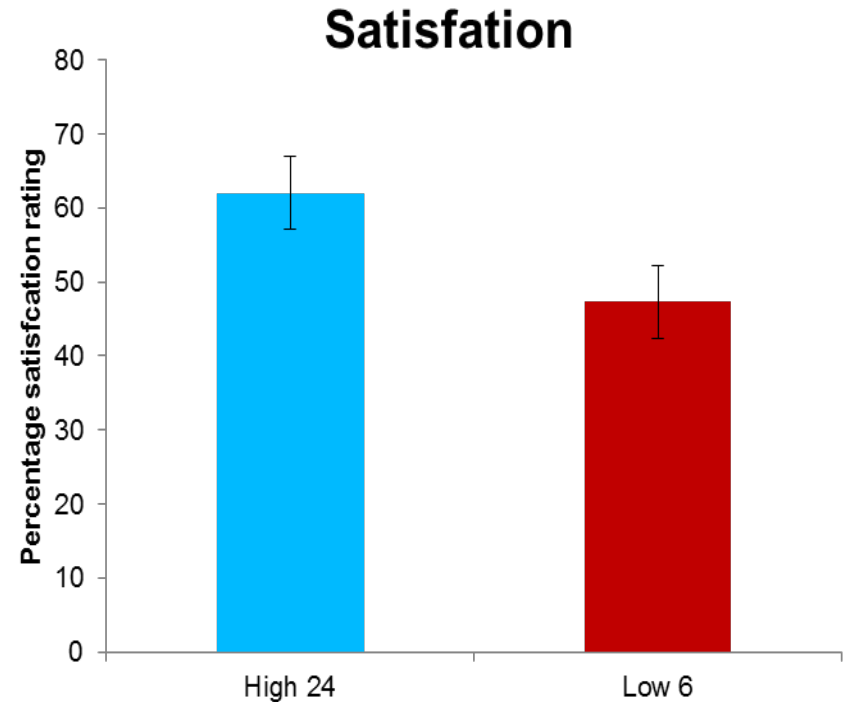
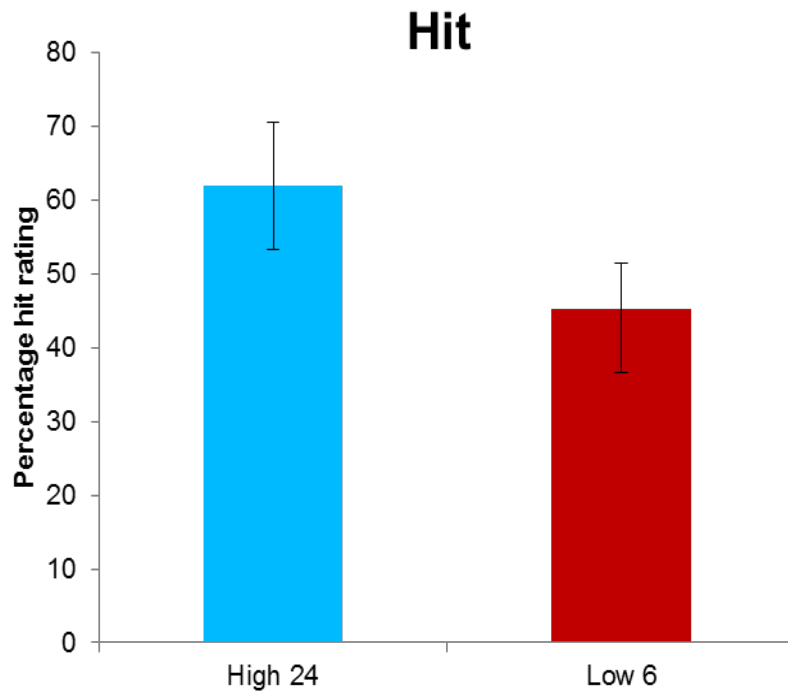
** $p < 0.01$; * $p < 0.05$

Subjective effects



No significant differences between conditions in urge to vape or withdrawal symptoms

Positive Effects



Trend for higher ratings of hit and satisfaction in the high nicotine condition ($p = 0.11$ & $p = 0.09$)

Conclusions

- Clear evidence of compensatory puffing with lower nicotine concentration e-liquid
- Self-titration was partially effective...
- ... equivalent reduction in urge to vape and withdrawal symptoms across conditions...
- ...but significantly higher levels of blood nicotine in the high condition
- Very high levels of nicotine can be achieved very quickly (equivalent to smoking) under certain conditions

Implications

- Self-titration – another attractive feature of vaping?
- More e-liquid consumed = higher cost (Kimber et al., 2016)
- Advise smokers to use a higher nicotine strength liquid?
- Limiting nicotine concentrations in e-liquid (TPD; May 2016) not necessarily the best option.
- Blood nicotine levels akin to smoking may improve smoking cessation rates but prolong nicotine addiction



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