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A study of pyrazines in cigarettes and how additives might be used to enhance tobacco addiction

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Abstract

Background: Nicotine is known as the drug that is responsible for the addicted behaviour of tobacco users, but it has poor reinforcing effects when administered alone. Tobacco product design features enhance abuse liability by (A) optimising the dynamic delivery of nicotine to

central nervous system receptors, and affecting smokers' withdrawal symptoms, mood and behaviour; and (B) effecting conditioned learning, through sensory cues, including aroma, touch and visual stimulation, to create perceptions of pending nicotine reward. This study examines the use of additives called 'pyrazines', which may enhance abuse potential, their introduction in 'lights' and subsequently in the highly market successful Marlboro Lights (Gold) cigarettes and eventually many major brands.

Methods: We conducted internal tobacco industry research using online databases in conjunction with published scientific literature research, based on an iterative feedback process.

Results: Tobacco manufacturers developed the use of a range of compounds, including pyrazines, in order to enhance 'light' cigarette products' acceptance and sales. Pyrazines with chemosensory and pharmacological effects were incorporated in the first 'full-flavour, low-tar' product achieving high market success. Such additives may enhance dependence by helping to optimise nicotine delivery and dosing and through cueing and learned behaviour.

Conclusions: Cigarette additives and ingredients with chemosensory effects that promote addiction by acting synergistically with nicotine, increasing product appeal, easing smoking initiation, discouraging cessation or promoting relapse should be regulated by the US Food and Drug Administration. Current models of tobacco abuse liability could be revised to include more explicit roles with regard to non-nicotine constituents that enhance abuse potential.

Keywords: Addiction; Electronic nicotine delivery devices; Nicotine; Tobacco industry documents.

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Figures



Figure 1 Advertisement for new 'Enriched Flavor'...



Pyrazines are yielded under pyrolytic conditions, mostly via the Maillard decomposition of Amino-acids at temperatures > 100°C. Shown is the laboratory version.

Figure 2 Graphic representation of the Maillard...

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