

An analysis of the reinforcing value of cigarettes and e-cigarettes among nicotine-dependent cigarette smokers using the multiple choice procedure

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BACKGROUND

- Electronic cigarettes (e-cigarettes) have been marketed as an alternative to cigarette smoking; however, there is a paucity of research literature about these devices.
- A laboratory study designed to evaluate the reinforcing value of e-cigarettes is needed.

PURPOSE

- The present study evaluated the reinforcing value of e-cigarettes among nicotine-dependent smokers when compared to money or use of their usual cigarette.
- We also aimed to make subjective effects comparisons between the two smoking vehicles.

METHODS

- Twenty-three e-cigarette naive adults who were not attempting to quit smoking were evaluated
- Participants were randomly assigned to study conditions in order to reduce any carry-over effects in session order (see Table 1)
- Participants were asked to abstain from using any nicotine/tobacco products for 12 hours prior to smoking sessions
- Participants completed two smoking sessions (cigarette, e-cigarette)
 - During cigarette session, participants were provided with usual brand of cigarette and instructed to smoke over a fifteen-minute period
 - During e-cigarette session, participants were shown how to operate e-cigarette and instructed to smoke over a fifteen-minute period
 - After smoking, participants completed subjective effect questionnaires (original and adapted versions of the Direct Effects of Smoking Scale)
- Participants also completed three MCP sessions (cigarette v. money, e-cigarette v. money, cigarette v. e-cigarette v. money)
 - Participants made choices between substance and escalating amounts of monetary compensation (See Figure 1 for sample MCP form)
 - Each item number on the MCP form had a corresponding number in a container, and the number drawn determined the reinforcement received (substance or money).
 - Choices were consequated immediately following the draw
 - MCP results were used to determine and make comparisons between the reinforcing values of substances

RESULTS

- Results indicated significantly higher levels of self-reported direct effects of smoking the cigarette than the e-cigarette when in acute nicotine withdrawal (See Figure 2).
- 74% of participants reported they preferred their regular cigarette brand to the e-cigarette.
- Preliminary results indicated that the crossover value on the MCP was higher for cigarette (M = \$3.45) than e-cigarette (M = \$2.74), suggesting participants found cigarettes to have a higher reinforcing value (See Figure 3).

SIGNIFICANCE AND CONCLUSIONS

- The higher self-report of smoking effects, participant preference, and higher MCP crossover points indicate that cigarettes are a more powerful reinforcer than e-cigarettes.
- This may be due in part to differences in nicotine delivery by smoking vehicle, which is an important area of future research.
- Results of this pilot study will be used to inform future behavioral (e.g. contingency management) and pharmacokinetic studies with e-cigarettes among nicotine-dependent cigarette smokers, cigarette smokers who are currently attempting to stop smoking, and current e-cigarette smokers

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Table 1. Study Design

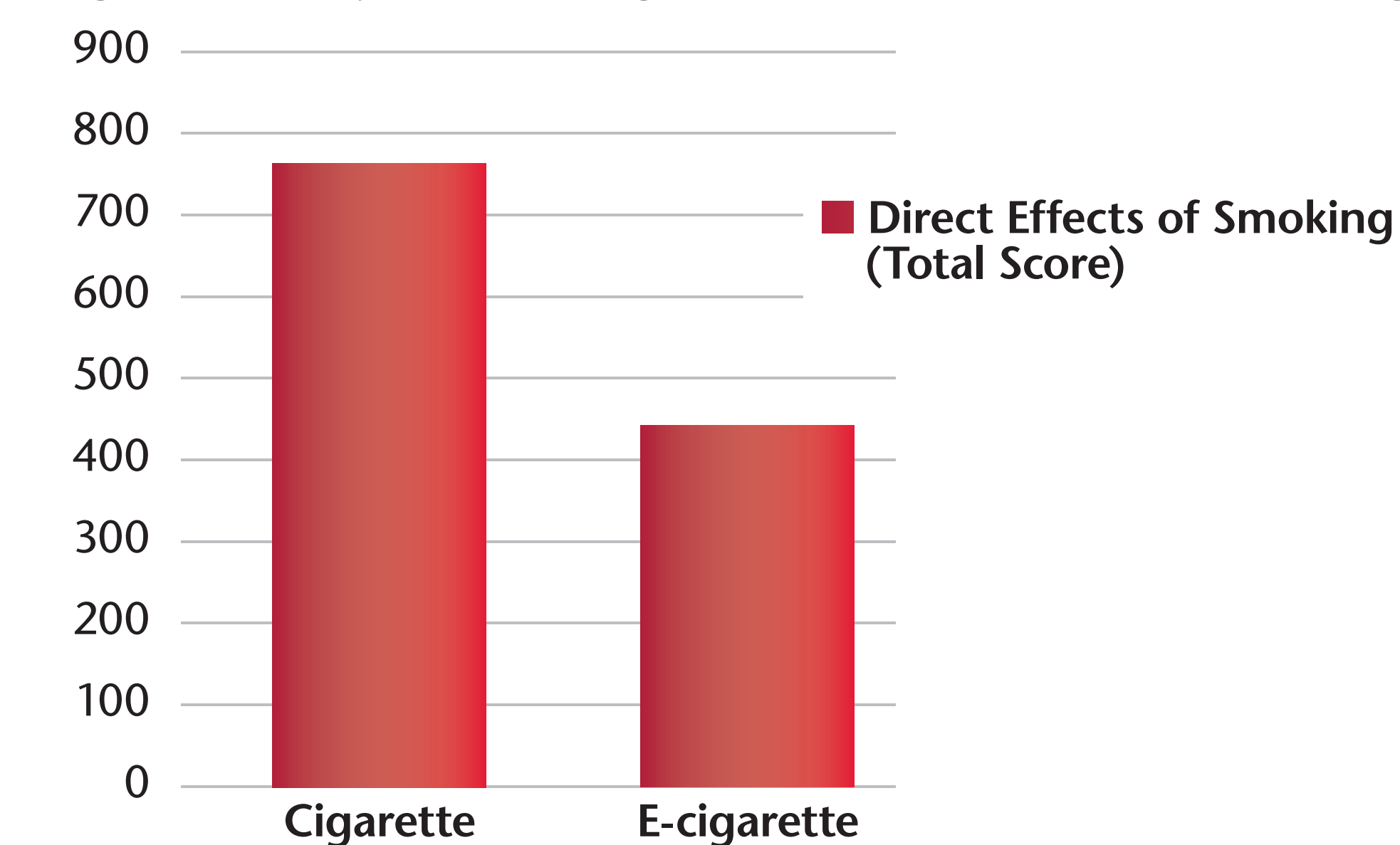
Study Conditions	Exposure Sessions (Randomized)		MCP Sessions Drug v. Money (Randomized)		MCP Final Session
	Cigarette	E-cigarette	Cigarette v. Money	E-cigarette v. Money	Cigarette v. E-cigarette v. Money
	1	2	3	4	5

Figure 1. Sample MCP Items

2	e-cigarette	\$0.25
3	e-cigarette	\$0.50
4	e-cigarette	\$0.75
...
40	e-cigarette	\$9.75
41	e-cigarette	\$10.00
42	e-cigarette	\$10.75
...
79	e-cigarette	\$19.50
80	e-cigarette	\$19.75
81	e-cigarette	\$20.00

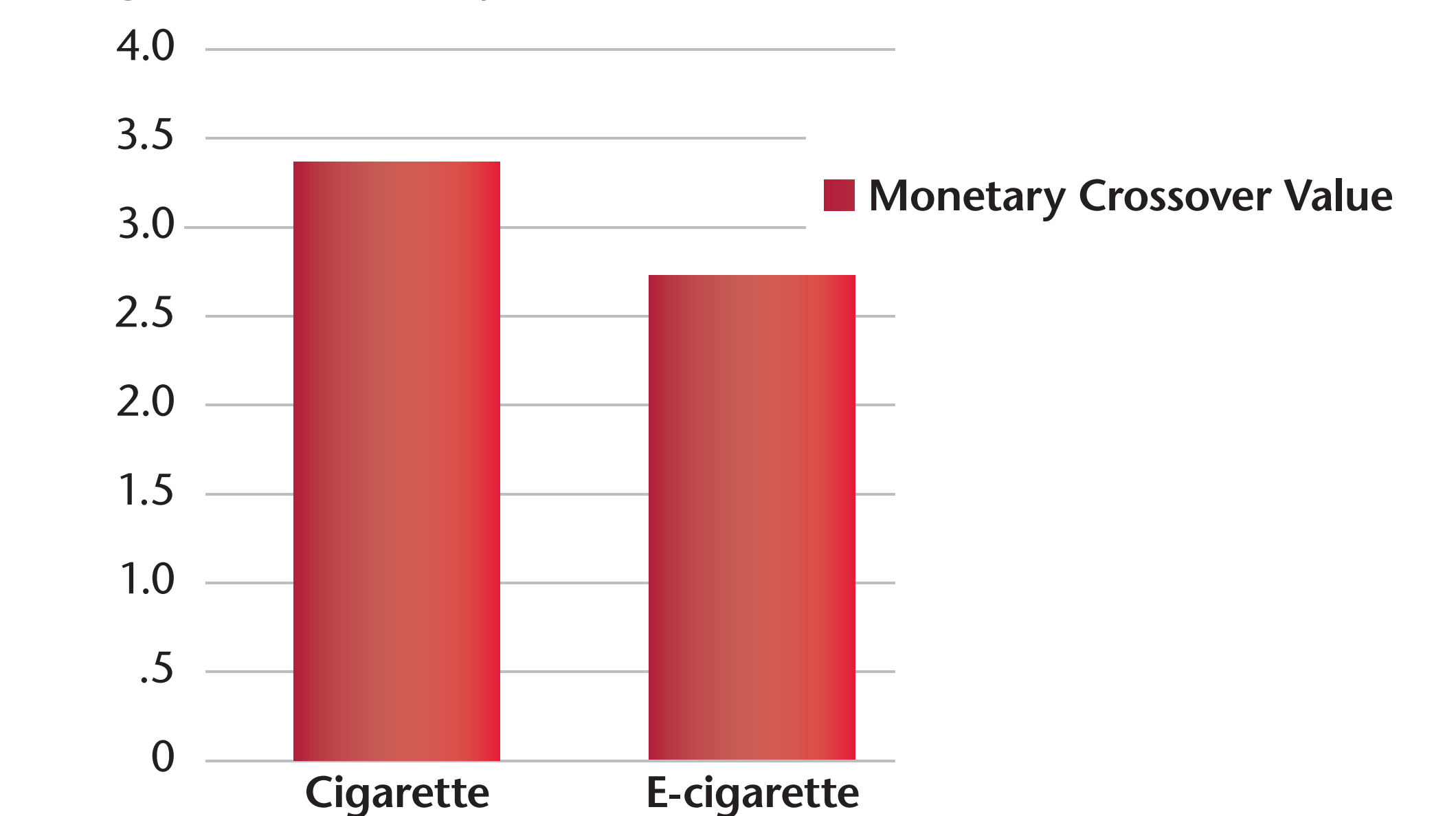
Note. Participants choose substance or money for each item. The point where they begin choosing money over the substance represents the monetary crossover point (\$10.00 in the above example).

Figure 2. Subjective Ratings of the Direct Effects of Smoking



Note. $p < .001$; Direct effects of smoking was measured using the original and adapted versions of the Direct Effects of Smoking Scale (Kleykamp et al., 2008).

Figure 3. Monetary Crossover Values on MCP



Note. $p < .057$; The mean crossover value for cigarette was \$3.45, and the mean crossover value for e-cigarette was \$2.74.