



Safety of Electronic Cigarettes as an Alternative to Conventional Cigarettes

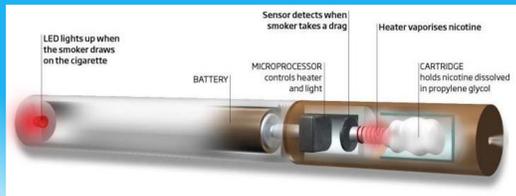
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Introduction

For the past four decades, cigarettes have been shown to cause adverse health effects and premature death in smokers²

- An estimated 42.1 million US adults currently smoke cigarettes⁶
- More than 480,000 Americans die each year from smoking⁶
 - Over 41,000 deaths are attributable to secondhand smoke exposure⁶
- Smoking kills about 6 million people worldwide every year despite smoke-free programs²
- Tobacco cessation results in the best health outcomes for smokers, however this option is difficult and not always successful¹
 - Alternative sources of nicotine, such as electronic cigarettes may be a safer route towards smoking cessation and enhancing public health¹
- Electronic cigarette use has greatly increased in the past five years¹
 - Electronic cigarettes are nicotine releasing devices designed for tobacco harm reduction invented in 2003¹
 - Components include a battery and an atomizer¹
 - Liquid is stored in the atomizer and aerosolized using energy and heat¹
 - Aerosolized liquid is made up of propylene glycol, glycerol, distilled water, flavorings, and nicotine¹
 - Consumers can choose the nicotine strength and flavor¹
- There is a current lack of published research on the toxic effects of electronic cigarettes and their potential role in public health²
- Opponents of electronic cigarettes argue that electronic cigarettes still pose a significant health risk by releasing chemicals¹

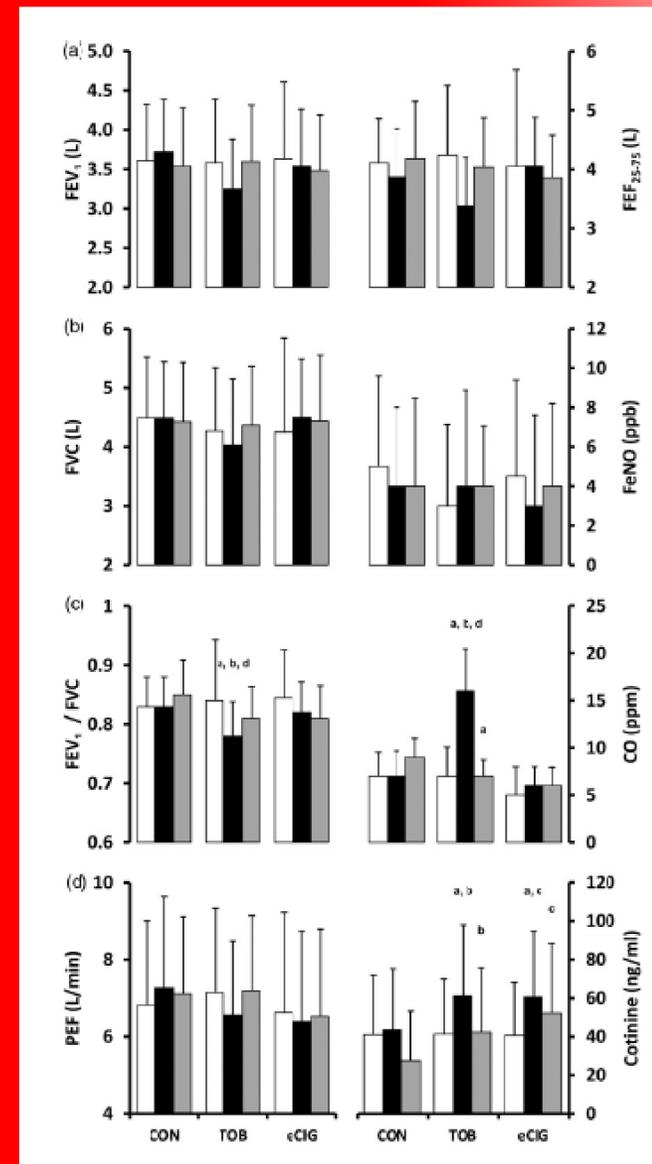


Methods

- Study question:** Are electronic cigarettes a safe alternative to conventional cigarettes for smokers?
- Database:** NCBI PubMed
- Search terms:** "e-cigarette," "electronic cigarette," and "safety"
- Filters:** Article type: "clinical trial," "review," or "systematic review"; Publication date: last 5 years
- Results:** The combination of the above search terms and filter yielded 34 articles. The articles were perused for relevance to our study question and 5 were selected as these specifically addressed safety concerns with electronic cigarette usage

Results

Author	Study Design	Population	Key Findings
Caponnetto P, et al. (2013)	Clinical trial	300 smokers who did not intend to quit	Significant reductions in cig/day ($p < 0.0001$), exhaled CO ($p < 0.0001$), and reported symptoms such as cough, dry mouth, dyspnea, throat irritation, and headache were observed
Farsalinos KE and Polosa R. (2014)	Systematic review	N/A	Significant health benefits are expected in smokers switching from traditional to electronic cigarettes. Levels of toxic chemicals in electronic cigarette vapor are much lower than in tobacco smoke. The potential for harm from e-cigarettes has largely been exaggerated.
Farsalinos KE, et al. (2014)	Clinical trial	36	Systolic BP and heart rate were significantly elevated after smoking conventional cigarettes ($p < 0.001$) but not after smoking electronic cigarettes (comparison $p < 0.001$). The diastolic BP increased in both groups ($p < 0.001$) and there was no significant difference between the groups ($p > 0.05$)
Flouris AD, et al. (2013)	Clinical trial	15 smokers, 15 nonsmokers	When used short-term, electronic cigarettes have a similar ($p > 0.001$) nicotinic impact to conventional cigarettes. Additionally they generate smaller changes ($p < 0.001$) in lung function compared to conventional cigarettes.
Flouris AD, et al. (2012)	Clinical trial	15 smokers, 15 never-smokers	With tobacco cigarettes, WBC count ($p < 0.001$), lymphocyte count ($p < 0.022$), and granulocyte count ($p < 0.001$) increased significantly. E-cigarettes did not significantly affect these indices ($p > 0.05$)



Conclusions

- Current research supports that electronic cigarettes are a less harmful alternative to traditional cigarettes²
 - Electronic cigarette vapor contains some toxic chemicals but their levels are considerably lower when compared with tobacco smoke²
 - CBC acute inflammatory proteins are not increased⁵
 - No immediate effects on myocardial relaxation³
 - Smaller changes in lung function⁴
- An additional benefit of electronic cigarettes is their role in smoking cessation.
 - Simulate the visual, sensory, and behavioral aspects of smoking traditional cigarettes¹
 - E-cigarettes appear to improve cognitive effects during tobacco abstinence¹
 - The use of e-Cigarette substantially decreased cigarette consumption without causing significant side effects in smokers not intending to quit¹
- Limitations
 - Possible residual unforeseen risk with e-cigarettes²
 - The clinical trials we reviewed focused mainly on acute markers of risk, further research is necessary to evaluate long-term risk⁵
 - Individually, the trials were mostly limited to one e-cigarette device and liquid⁴

Intervention

- Electronic cigarettes should be recommended to cigarette smokers because evidence shows that electronic cigarettes are a cleaner form of nicotine intake that can satisfy nicotine cravings²
- Quitting is still the most effective option for health benefits in smokers²
- Nicotine is still addicting and may be a gateway to smoking and any form of nicotine should not be recommended to nonsmokers²
- More research is necessary to further evaluate health safety with electronic cigarette use⁵
- Regulation of electronic cigarette nicotine content and usage will be necessary to ensure product safety⁵

1. Caponnetto P, et al. (2013) Efficacy and Safety of an Electronic Cigarette (ECLAT) as Tobacco Cigarette Substitute: A Prospective 12-Week Randomized Controlled Design Study. PLoS One 8: e63317.
 2. Farsalinos KE and Polosa R. (2014) Safety evaluation and risk assessment of electronic cigarettes as tobacco cigarette substitutes: a systematic review. Ther Adv Drug Saf 5: 67-86.
 3. Farsalinos KE, et al. (2014) Acute effects of using an electronic nicotine-delivery device (electronic cigarette) on myocardial function: comparison with the effects of regular cigarettes. BMC Cardiovasc Disord 14: 72.
 4. Flouris AD, et al. (2013) Acute impact of active and passive electronic cigarette smoking on serum cotinine and lung function. Inhal Toxicol 25: 91-101.
 5. Flouris AD, et al. (2012) Acute effects of electronic and tobacco cigarette smoking on complete blood count. Food Chem Toxicol 50: 3600-3.
 6. http://www.cdc.gov/tobacco/campaign/tips/resources/data/cigarette-smoking-in-united-states.html