

# Electronic Cigarette and Cardiovascular Disease

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*Cigarro Eletrônico e Doenças Cardiovasculares*

*Cigarrillo Electronico y Enfermedad Cardiovascular*

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## INTRODUCTION

The USA and Europe started to use electronic cigarette between 2006 and 2007<sup>1</sup> and ever since, its dissemination is continuously growing and new products are launched successively in the market. The popularity of electronic cigarettes is increasing exponentially amidst USA adolescents. From 2011 to 2018, there was a raise of nearly 13 times of the consumption in youngster, jumping from 1.5% to 20.8%<sup>2</sup>. At the start, the *design* of the electronic cigarette reminded the conventional cigarette, but it is widely disclosed that it is a product without combustion to release nicotine, attempting to widen the concept of being safer than the conventional. As time went by, these devices grew robust, with enhanced storage capacity and more vaporization, extended capacity and nicotine release and boosting the consumption even more as much as it approached the conventional cigarette to satisfy the nicotine intake the smoker needs for its satisfaction<sup>1</sup>. In 2017, it appeared the JUUL<sup>®</sup>, electronic cigarette in the format of “mod-pods”, small, similar to the USB device, easy to be transported and concealed with innumerable options of flavor and high concentration nicotine release capacity, speeding up the addiction to the product. Its wide disclosure at the Internet draw adolescents and youngster to try it (new users) and, today, is the electronic cigarette most consumed amidst Americans youngsters. For the smokers, these new products were initially disseminated as they were “a safer alternative” in comparison to the conventional cigarette, a fact not ever proved<sup>1</sup>. Even because tobacco addiction cessation is understood as complete interruption of the regular consumption of any product containing nicotine, either electronic or conventional.

The makers of electronic cigarette are, today, the same of the conventional cigarette and insist that their

product is safer than the conventional, grounded in the argument that the electronic has less toxic substances than the conventional. For this, they use scientific studies that compare the quantity of substances present in the conventional cigarettes *versus* the quantity existing in the electronic cigarettes. The serious fact to emphasize is that a recent systematic review of the literature showed that tobacco industry-funded studies have much more chance to demonstrate positive results (in favor of the electronic cigarette with less adverse effects from its use) than unfunded studies or whose authors hold no financial conflict with the tobacco industry<sup>3</sup>. According to this study, 95% of the researches with unfunded tobacco industry studies reported some effect or harming substances in the electronic cigarette, while only 39% of the funded studies boasted about the risks related to the use of electronic cigarette. The presence of moderate to strong conflict of interests was associated to 91.5% odds of not finding any warning to the use of electronic cigarette.

## DEVELOPMENT

Conventional cigarette causes innumerable health damages, as well established in the literature. Tobacco addiction is the main cause of avoidable death in the world and of the tobacco-addiction caused diseases, cardiovascular diseases stand out, as acute myocardial infarction, brain stroke and peripheral vascular diseases. Tobacco addiction compromises the endothelial function and increases the release of oxygen free radicals, in addition to accelerating the atherosclerotic process, even in individuals with low consumption of cigarettes and passive chain-smokers<sup>4-6</sup>.

The damages caused by electronic cigarette are less known, as they are devices that are in continuous change and development and due to the short period they are

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being traded, it is not possible to determine the damages in the long term, not to speak of many users that smoke conventional and electronic cigarettes concomitantly. Electronic cigarette does not expose the user to carbon monoxide because there is no combustion; nonetheless, elements like nicotine, knowingly the cause of damaging effects to the cardiovascular system are present. Other chemicals that are inhaled by the electronic cigarette smoker vary according to the brand and with the “e-liquid” utilized; among the components, however, chemical solvents, volatile and aldehyde organic compounds, heavy metals, polycyclic aromatic hydrocarbons, ultrafine particulate material stand out, in addition to compounds that produce flavor<sup>7-8</sup>. Therefore, electronic cigarettes cause increase of oxidative stress and liberation of inflammatory mediators<sup>9-10</sup> and modification of the endothelial function, leading to an increase of risk of cardiovascular diseases.

A recent study by Bhatta et al<sup>11</sup>. concluded that both the occasional and the daily consumption of electronic cigarette are associated with the increase of risk of acute myocardial infarction, even after adjustment to concomitant consumption of conventional cigarette (OR 2.25 – daily consumption; OR 1.99 – occasional consumption). The use of electronic cigarette had a similar effect of the conventional cigarette in relation to risk of myocardial infarction. In this same study, the combined use of conventional and electronic cigarette had a worse outcome than the isolated use of one of the forms (OR 6.64)<sup>11</sup>. Another study by Alzahrani et al.<sup>12</sup> had already demonstrated that the daily consumption of electronic cigarette is associated to the increase of risk of infarction (OR 1.79).

Lee et al.<sup>13</sup>, evaluated the impact of the principal components of electronic cigarettes consumed in the USA on the epithelial function and integrity, in the result of the interaction between endothelial and macrophage cells. These changes are part of the physiopathology of the fatal and non-fatal cardiovascular diseases. In this study, the authors evaluated the effect of the e-liquids of electronic cigarettes in the feasibility of endothelial cells derived from human pluripotent stem cells of healthy individuals, showing an increase of the quantity of H<sub>2</sub>O<sub>2</sub> in the stem cells, increase of interleukins and other inflammatory cytokines after 48 hours of exposure for the majority of e-liquids tested<sup>13</sup>.

## CONCLUSION

Electronic cigarette was launched in the market as a likely minimizer of health damages and boasted as a possible therapeutic for the cessation of conventional tobacco addiction. Initial cigarette industry-sponsored

studies corroborate these finalities. Nevertheless, with the development of new unfunded studies, it was perceived that the potential of damages generated by the consumption of electronic cigarette is quite bigger than what was initially believed and, as far as cessation of tobacco addiction is concerned, the partial or total shift of the conventional by the electronic cigarette is occurring, but the smoker continues to suffer the damaging effects of nicotine intake and other toxic compounds of the electronic cigarette and the generating aerosols while using electronic cigarette, creating the category of “passive tobacco addiction of electronic cigarette”, consisting, most of all, of ultrafine particulate material.

Similar to the conventional cigarette, there is no safe level for the consumption of electronic cigarette – the safe thing to do is not to smoke.

## CONTRIBUTIONS

Both the authors participated of all the stages of the manuscript and final approval for publication.

## DECLARATION OF CONFLICT OF INTERESTS

There are no conflict of interests to declare.

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