The Cardiovascular Effects of Electronic Cigarette Components on Daphnia magna: An Investigation into Decreased Heart Elasticity

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Vaping and the use of e-cigarettes have major public health implications. E- cigarettes are abused by teens and used by adults seeking a “safer” alternative to smoking. However, e-cigarettes can cause problems, affecting immunity, metabolism, respiration, neurology, and cardiology. E-cigarettes stiffen arteries and nearly double the chance of a heart attack. Using Daphnia magna, I tested the effect of two e-cigarette fluid components on cardiac function. E-cigarette fluid can be broken down into four key components: propylene glycol, glycerin, nicotine, and proprietary flavoring chemicals. The effects of nicotine on the heart have been well-documented, while the effects of propylene glycol and glycerin are less understood. D. magna were exposed to varying concentrations of these chemicals and video was recorded under a microscope. D. magna was chosen because it is a standard model organism for studies of the cardiac effects of chemicals. Stills were taken from the video, and the perimeter and area of the heart were measured using a computer program. The variations in heart area and perimeter during the contraction-relaxation cycle decreased significantly (p-value < 1.0 × 10^-4), in inverse proportion to increased concentrations of propylene glycol and glycerin; this shows a decrease in heart elasticity. In humans, decreased heart elasticity is a cause of heart failure. This study showed that two of the key components of e-cigarette fluid, propylene glycol and glycerin, caused a statistically significant decrease in heart elasticity in D. magna.

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