INTRODUCTION

Smoking is a major and potentially possible to eliminate risk factors for cardiovascular disease. It has been proven that smoking leads to acceleration of atherosclerosis, particularly in coronary arteries and increased incidence of a heart attack or sudden cardiac death. It is also associated with the development of a peripheral vascular disease and cerebral vascular disease, including vascular thrombosis and cerebral haemorrhage (Lukier 1992; Ntikemowicz 2007).

However, there is controversy over whether nicotine itself or other substances contained in tobacco smoke are responsible for these effects. This is crucial for determining the safety of medicinal products (preparations of nicotine replacement therapy such as chewing gum containing nicotine, nicotine patches, nicotine inhaler) or new alternative forms of nicotine delivery (e.g. electronic cigarettes, called an e-cigarettes or ENDS).

Effect of nicotine on arteries

It has been proved that both active and passive smoking also affects the degradation in elastic properties of the arterial wall, which may lead to increased stiffness of arteries, further contributing to an increase in the risk of developing cardiovascular complications.

Mahmoud and Felly (Mahmoud and Felly, 2003) demonstrated that smoking even one cigarette contributes to the sudden increase in arterial stiffness in both smokers and non-smokers. Research conducted by Jatoli et al. (Jatoli et al., 2007) show a significant linear relationship between the duration of addiction and changes in propagation velocity (PWV - pulse wave velocity), even after adjusting the values in relation to age, gender, blood pressure, heart rate and body mass index (BMI - body mass index).

The issue remains nicotine itself effects on arterial stiffness. Recent studies, attended by young, healthy men, showed significant changes in arterial stiffness after a single nicotine sublingual tablet (2mg), and the increase in the concentration of nicotine in the blood corresponded to concentrations achieved after passive exposure to tobacco smoke (Adamopoulos et al., 2008).

Artery stiffness measurement

The digital volume pulse (DVP) analysis is a method allowing for the measurement of arterial stiffness, which may lead to increased stiffness of arteries, further contributing to an increase in the risk of developing cardiovascular complications.

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PRINCIPLES AND AIM OF RESEARCH

The aim of the study was to investigate the acute effect of electronic nicotine delivery systems (ENDS) and conventional cigarettes on arterial stiffness.

CHARACTERISTICS OF STUDIED GROUP

The study was performed using a randomized placebo-controlled double blind cross-over design. Sixteen healthy smokers, 6 men and 10 women, aged 37 ± 11 years, were recruited and studied in the morning on two different days. All subjects were regular smokers who smoked >10 cigarettes per day.

METHODS AND MATERIALS

In each session, participants were randomly provided with an ENDS with a cartridge containing 16 mg nicotine or a cartridge without nicotine (placebo). Subjects were also asked to smoke one cigarette Their regular hour after the use of ENDS.

Measurement of the stiffness index and the reflection index (RI) was performed using 5-fold Track Pulse Monitor:

- at the beginning of the experiment,
- 15 and 60 minutes after the use of the electronic-cigarette (ENDS) (respectively 15 and 60 minutes from the start of the study),
- 15 and 60 minutes after smoking a conventional cigarette (75 and 120 minutes after the start of the study).

The study used two nicotine-containing products: a electronic cigarette (e-cigarette) Mini Cigarette DSE901 and a participant's own cigarette.

The e-cigarette contained a cartridge with a nicotine content of 18 mg and the type and content of nicotine in the participant's cigarette were recorded. The first product administered in the study at the beginning of the experiment, while the second was the conventional cigarette.

RESULTS

The mean values and standard deviation of base values of the analyzed parameters on the day of the experiment (time 0 min.).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>nicotine</th>
<th>placebo</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stiffness index (SI) [m/s]</td>
<td>8.49±1.94</td>
<td>7.94±2.08</td>
<td>0.4507</td>
</tr>
<tr>
<td>Reflection index (RI) [%]</td>
<td>67±13</td>
<td>65±15</td>
<td>0.6519</td>
</tr>
</tbody>
</table>

Changes in arterial stiffness after using the e-cigarette

Analysis of the mean values (Table II) and the relative change compared to initial values of the stiffness index (SI) and the reflection index (RI) with subsequent measurements of time, does not indicate a statistically significant change of the parameters over time (p < 0.05), as well as depending on the type of the e-cigarette cartridge (nicotine vs. placebo).

CONCLUSIONS

The presented data show that there are no significant differences between the effect of both nicotine and placebo for e-cigarette, as well as between the effect of e-cigarettes and conventional cigarettes.