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ORIGINAL ARTICLE

SOCIOECONOMIC PROFILE AND SYMPTOMS ASSOCIATED WITH THE USE OF NON-TRADITIONAL SMOKING DEVICES IN THE STATE OF SÃO PAULO – BRAZIL

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Highlights:
(1) Presence of adverse effects during and/or after the session with non-traditional smoking devices.
(2) Participants are aware of the risks, but attractive features encourage use.
(3) Ease of access is perceived, which reinforces health education practices

ABSTRACT

Introduction: The use of electronic smoking devices (ESDs) exposes the body to chemical components contained in the vapor. These include carcinogens and cytotoxic substances, potentially associated with lung and cardiovascular diseases. In regular hookah users, it is possible to observe elevated levels of carbon monoxide (CO) and carboxyhemoglobin (COHb), both for sessions that use tobacco and nicotine, and for sessions free of these components. *Objective:* To analyze the behavior of young people in the state of São Paulo regarding the use of hookah and ESDs. To verify the frequency of use of these devices, the knowledge of young people about the physiological effects of using these devices and the consequences for health. *Method:* This is a prospective observational study in which a questionnaire was applied to collect information about the use of hookah and ESDs among young people in the state of São Paulo. *Conclusion:* The habit of smoking these devices is frequent and is already present in the daily lives of people, especially young people, as a form of social interaction. Even though they are aware of the health risks posed by these devices and have already experienced some adverse effects during and/or after a smoking session, users continue to use them. This reinforces the need for public health policy campaigns emphasizing the consequences of exposure to smoke from electronic cigarettes and hookahs.

Keywords: water pipes; vaping; signs and symptoms; adult; smoking.

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INTRODUCTION

Non-traditional smoking devices (NTSDs) are not new to human history. Hookahs have been reported since the 17th century in the Middle East.[1] Their structure and smoking method have evolved and changed since then, but the essence of their operation remains the same. Recently, the popularity of these non-traditional smoking devices has been increasing worldwide. Population-based studies have shown alarming data regarding their use.[2-5] Approximately 30% reported concomitant use of electronic cigarettes and traditional cigarettes.[6] Among young people and adolescents, the prevalence of use of these devices was estimated at 7.4%.[7] However, the online sale of ESDs is common and, despite the ban, even large department stores sell them freely to children and adolescents[8] even with RDC 46/2009 from Anvisa (National Health Surveillance Agency) which established the regulation that prohibited the sale, import and advertising of these products since 2009.

The habit of smoking these devices is becoming a public health problem, as it is a legal drug and causes serious harm to health with several health, social and economic consequences. The industry's strategy of including flavorings in tobacco has reduced the bitter taste in the mouth and, unconsciously, the sensation that users are consuming a product that is known to be harmful to health and an organically inert substance, making it pleasant to consume.[8-12] A meta-analysis demonstrated that the use of electronic cigarettes increased the risk of experimenting with conventional cigarettes by almost three and a half times and the risk of current smoking by more than four times.[13]

A study conducted in Brazilian capitals with 52,443 individuals over the age of 18 estimated the prevalence of lifetime use at 6.7% and current use at 2.32%. There are 2.4 million individuals who have used ESD and 835 thousand who currently use it. Approximately 80% of people who have used ESD are between the ages of 18 and 34. The prevalence of daily use and dual use among young people aged 18 to 24 was almost 10 times the prevalence in older age groups.[14]

Currently, the use of NTSD is seen as a form of socialization, becoming a leisure activity among users. Several etiological factors explain the use of hookah, the main one being sociability. Its use is seen as a cultural phenomenon, a fun and exciting activity to engage in, and some users find no alternative to socialize except when using the product.[1]

In this sense, the objective of this study was to investigate the frequency of use of these devices, knowledge about the physiological effects and the health consequences among young adults living in the state of São Paulo.

METHODS

Study design and population

This is an observational cross-sectional study. For this purpose, a questionnaire was prepared containing closed questions regarding demographic characteristics (sex, age, race/color, education level, and region of residence), habits of use of the devices (frequency of use, time of use, place of use, concomitant use of conventional cigarettes, among others), knowledge regarding the harmful effects caused by use, and open questions regarding symptoms possibly experienced during and/or after use of the devices.

The population of interest for the study was hookah and/or e-cigarette users, aged 18 years or older and residing in the state of São Paulo. The questionnaire was formulated on the Google Forms platform and disseminated on social networks such as Facebook, WhatsApp, and Instagram. The link with access to the questionnaire questions was available between March 2022 and August 2022. Individuals aged 18 years or older, of both sexes, NTSD smokers, and residing in the state of São Paulo

were included. “Passive” users of these devices and individuals who regularly used straw cigarettes, pipes or other devices were excluded (Figure 1).

All participants signed an informed consent form prior to participating in the study. The research project was approved by the Research Ethics Committee of the Pontifical Catholic University of São Paulo - PUC/SP, under opinion number 5,348,858.

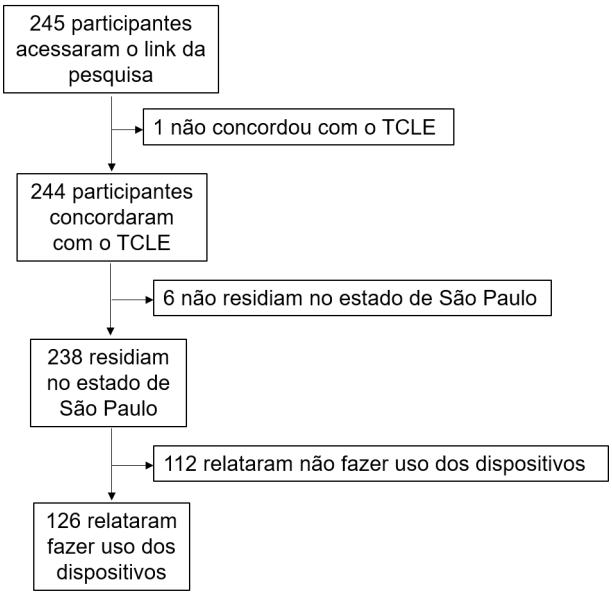

Figure 1 – Flowchart of participants included in the study.

Source: Study data.

Statistical analysis

Data were presented as means and standard deviations (SD) or as medians and interquartile ranges. Visual inspection of the normal curve and the Kruskal-Wallis test were used to test the normality of continuous variables. Categorical variables were presented as absolute and relative frequency distributions (N and % respectively). The free software R version 4.0.2 (www.r-project.org) was used in the analyses.

RESULTS

During the six-month study period, 245 participants accessed the survey link. Of these, 119 participants did not meet the study inclusion and exclusion criteria. Thus, the final sample consisted of 126 participants.

Demographic characteristics

Demographic, clinical, and smoking-device use characteristics are detailed in Table 1. Overall, more than half of the participants reported identifying as female, with a mean age of 24 years, white race/color and residing in the countryside of the state of São Paulo. Surprisingly, more than 70% of the participants were currently attending or had already completed university education.

Table 1 – Absolute and relative frequency distribution (n and %) or main summary measures of participants' demographic characteristics

Characteristic	
Gender	
Female	74 (58.7)
Male	52 (41.3)
Age	
mean (sd)	24 (5)
median (Q1-Q3)	23 (21 - 25)
Education	
*elementary/high school	24 (19)
**university	102 (81)
Race/Color	
White	89 (70.6)
[&]Others	37 (29.4)
Region	
Countryside	70 (55.6)
[$]RMSP	56 (44.4)

Source: Study data. *completed elementary school/attending high school/incomplete high school/completed high school; **completed or attending [&]yellow/multiracial/mixed race/prefer not to say/black; $RMSP: greater São Paulo and capital; sd: standard deviation; Q1: first quartile; Q3: third quartile.

Device usage habits

Table 2 shows the distribution of characteristics related to the use of both electronic cigarette and hookah smoking devices. Almost half of the participants (48%) reported using both electronic cigarettes and hookahs. Two facts drew attention in relation to the burden of exposure to NTSD: the recent adoption of the use of these devices and the relatively low weekly frequency, where more than half of the interviewees reported using them for less than 3 years and 57% reported using them up to twice a week. In addition, approximately two-thirds of the participants reported not using them concomitantly with conventional cigarettes.

Table 2 – Absolute and relative frequency distribution (n and %) of device usage habits

Usage habits		**n (%)**
Device	Both	61 (48.4)
	Electronic cigarette	42 (33.3)
	Hookah	23 (18.3)
Do you use conventional cigarettes (tobacco)?	No	82 (65.1)
	Yes	44 (34.9)
How long have you been using these devices?	Less than a year	26 (20.8)
	More than a year	27 (21.6)
	More than two years	16 (12.8)
	More than three years	56 (44.8)
How often do you consume it?	Once a week	45 (36.6)
	Twice a week	26 (21.1)
	3 times a week	13 (10.6)
	4 times a week	10 (8.1)
	5 times a week	2 (1.6)
	Every day of the week	27 (22)
Does hookah and/or electronic cigarettes help you socialize?	No	51 (40.8)
	I don't know	13 (10.4)
	Yes	61 (48.8)
When you smoke, is it usually at home?	No	57 (45.2)
	Yes	69 (54.8)
When you smoke, is it usually at a friend's house?	No	41 (32.5)
	Yes	85 (67.5)
When you smoke, is it usually in public places?	No	30 (23.8)
	Yes	96 (76.2)

Users demonstrated high diversity in terms of consumption locations, with over 60% of respondents reporting using the devices in two or three locations listed in the questionnaire. Thus, 76%, 68% and 55% of participants reported using the devices in public places, at friends' houses and in their own homes, respectively. These percentages add up to more than 100%, as participants were able to indicate more than one consumption location. Specifically regarding the substances present in the devices, half of the e-cigarette users reported opting for a juice with nicotine, while 61% of hookah users in general reported choosing a charcoal without ignition agents. Fifty-eight percent reported choosing a tobacco juice.

Presence of symptoms and participants' knowledge about the effects caused by the use of devices

Most participants (85%) stated that using the devices is equally or less harmful than using conventional cigarettes. More than half of the respondents reported being aware of the physiological effects that were exposed in the questionnaire: transmission of Covid-19 by sharing the devices (94%), risk of viral infections such as cold sores, influenza and hepatitis C (89%), effects on heart rate, blood pressure, tissue oxygenation and vascular function (73%), development of Chronic Obstructive Pulmonary Disease (COPD) (67%) and transmission of tuberculosis by sharing the devices (57%) (Table 3).

Table 3 – Absolute and relative frequency distribution (n and %) of questions related to respondents' knowledge about the physiological effects caused by the use of devices

Knowledge		**n (%)**
*Compared to conventional cigarettes, how much harm do you think hookah and/or e-cigarettes cause?	Less harmful	51 (40.8)
	Equally harmful	55 (44)
	More harmful	19 (15.2)
Did you know that the use of these devices affects heart rate, blood pressure, tissue oxygenation and vascular function?	No	34 (27)
	Yes	92 (73)
Did you know that in the long term, hookah and e-cigarette smokers may have a higher risk of developing hypertension and coronary artery disease?	No	60 (47.6)
	Yes	66 (52.4)
Did you know that the use of these devices can cause COPD (chronic obstructive pulmonary disease)?	No	42 (33.3)
	Yes	84 (66.7)
In addition to what has already been mentioned, did you know that sharing the hose of a hookah and/or e-cigarette promotes the risk of viral infections such as cold sores, influenza and hepatitis C?	No	14 (11.1)
	Yes	112 (88.9)
Are you aware that sharing electronic cigarettes and hookahs can be a gateway for the transmission of tuberculosis?	No	54 (42.9)
	Yes	72 (57.1)
Thinking about COVID-19, did you know that hookahs and electronic cigarettes can be gateways for infection if they are used in shared form?	No	7 (5.6)
	Yes	119 (94.4)

Only 14.1% declared themselves asymptomatic. Among those with symptoms, complaints were multiple and many participants presented more than one complaint, with cough, dizziness and headache (54%, 46% and 37.1% respectively) being the most prevalent. In addition, more than half of the participants presented 3 or more symptoms (Table 4).

Table 4 – Absolute and relative frequency distribution (n and %) of symptoms presented during and/or after the use of devices

Symptoms	**n (%)**
Cough	68 (54)
Dizziness	59 (46.8)
Headache	47 (37.3)
Shortness of breath	26 (20.6)
Sudden weakness	26 (20.6)
Nausea	24 (19)
Rapid heartbeat	20 (15.9)
Blurred vision	20 (15.9)
Tingling	6 (4.8)
Fainting	2 (1.6)

Discussion

This study used a consecutive sample of participants who answered a questionnaire distributed through social networks. The responses served as a basis for describing demographic and socioeconomic characteristics and the presence of symptoms among NTSD users in the state of São

Paulo. The results regarding the profile of users in this study were consistent and in line with a recent population-based epidemiological study[14,15] in our country: the majority were young adults, females, and highly educated. Some factors may potentially explain the attraction of this public to these types of devices, such as the fact that they are consumed quickly, the multiplicity of flavors, the portable characteristic (and in most cases, rechargeable) and, for almost half of our sample, the aid in group socialization.

Although approximately two-thirds of the participants reported concomitant use with conventional cigarettes, we observed that the burden of exposure to NTSD was not high, since more than half of the respondents had used hookah and/or electronic cigarettes for less than three years with a frequency of no more than twice a week. Therefore, at least in theory, it would be expected that the reduced exposure load of the sample would not be capable of producing symptoms. However, this was not what we observed in our sample, since our findings demonstrated a low frequency of asymptomatic individuals (less than 15%) and the presence of more than one symptom in the same individual. Recent data from North American studies involving more than ten thousand adolescents and young adults showed that the use of any type of electronic cigarette more than 5 times per month was associated with a 56% increased risk of presenting symptoms such as cough, increased mucus production and a 36% increase in the risk of developing increased respiratory rate.[16] From an epidemiological point of view, a population-based study in the United States recently showed an independent positive association between the use of electronic cigarettes and the presence of wheezing.[17]

The negative effects of NTSDs on health are multiple and include the deposition of ultra-fine particles, heavy metals and carcinogenic compounds in the respiratory epithelium, cytotoxicity, increased release of inflammatory markers, hemodynamic repercussions and even dependence on their use.[18,19] Unfortunately, due to many methodological problems, serious conflicts of interest, inconsistencies and contradictions in the results and the lack of long-term follow-up, the relatively few and often small studies are not able to offer definitive evidence on the effects harmful to health.[18]

Due to the recent increase in the number of NTSD users, there is a lack of specific studies on lung function, since at least in theory a certain amount of time of exposure to inhaled gases from these devices is expected for symptoms to appear. Thus, studies with animal models have demonstrated an association with reduced lung function. Glynos et al. 2019 observed a significant reduction in static compliance and increased airway resistance in rodents, suggesting that exposure to e-cigarette vapor was responsible for triggering inflammatory processes and thus adversely affecting the mechanics of the respiratory system. Furthermore, when flavor was added to e-cigarettes, the negative effects were exacerbated.[20]

Evali, the acronym for e-cigarette-induced lung injury, is a lung disease related to the use of NTSD, first described in 2019 in the United States. This lung injury was initially attributed to some solvents and additives used in these devices, causing a type of inflammatory reaction in the organ, which can cause pulmonary fibrosis, pneumonia, and respiratory failure. As of January 2020, the Center for Disease Control and Prevention (CDC) in the United States had recorded 2,711 hospitalized cases of Evali, and as of February of the same year, 68 deaths had been confirmed. The mean age group was 24 years, 66% of those affected were male, and the mean duration of use was 12 months.[7]

Frequent inhalation of its smoke contributes to the deterioration of respiratory and hemodynamic function, and the degree of damage is related to time and intensity.[21] In an attempt to demonstrate the effects of chronic exposure to NTSD smoke, Olfert et al. 2018 demonstrated signs of endothelial dysfunction in rodents. After exposing the animals to e-cigarette smoke for 4 hours a day, five days a week, for 8 months, the authors found a 2.5-fold increase in arterial stiffness.[22]

Even with information about the harmful effects of nicotine, we found that more than half of the participants in this study still opted for an essence with added nicotine and tobacco. Nicotine is a drug found in tobacco leaves and is a stimulant that causes addiction, as it stimulates brain cells, causing (hyper) excitation. Nicotinic receptors mediate the systemic actions of nicotine and are found in the Central Nervous System (CNS), specifically in the peripheral autonomic ganglia, sensory nerves, adrenal glands, and smooth, striated skeletal and cardiac muscles.[17-19]

It is possible to observe that the respondents have an affinity regarding the health risks caused by the use of devices and the results reaffirm this affinity, since 81% of the participants are studying or have already completed university education, which indicates a higher level of knowledge and information reach. In all questions, the percentage of responses in the "knowledge" section was higher in the "yes" option. Given this, we can emphasize that the potential attractions that the practice of smoking brings to the individual outweigh the harmful consequences to health that can occur.

Salicio et al.[22] proved that hookah smoke contains higher amounts of nicotine, carbon monoxide, tobacco, heavy metals and carcinogenic substances compared to conventional cigarette smoke. The duration of a hookah session exposes the smoker to smoke inhalation for a much longer period than when smoking a cigarette. The volume of puffs from a hookah can reach 1,000 ml in one hour. The volume of cigarette puffs reaches 30 to 50 ml in five to seven minutes. Like any other tobacco product, hookah contains nicotine and the same 4,700 toxic substances as conventional cigarettes. The burning of charcoal produces carcinogenic substances, including carbon monoxide, increasing the risks for its users.[22] Non-smokers rarely have COHb values above 1.5%, while levels in smokers can reach 5%. COHb results above 10-15% are consistent with CO poisoning.[23] Hookah use on the respiratory system can lead to a 25-40% increase in CO in hemoglobin and a reduction in oxygen consumption.[24]

Internet advertisements use images and videos that attract the attention of young people, influencing the use and experimentation of these devices even by minors. There are many videos posted on social media that, in addition to promoting websites selling these products, teach how to use them and techniques for "playing" with smoke. It is worth noting that even though the sale of electronic cigarettes is banned by Anvisa throughout Brazil, these products can easily be found in physical and virtual stores. In addition to maintaining the definitive ban on these devices in Brazil, it is necessary to start routine and effective monitoring of the sale of these products, as well as finding ways to prevent large retail conglomerates from continuing to defy health authorities.[25]

CONCLUSION

The habit of using NTSD is common and frequent among young people in the state of São Paulo. Despite the low exposure load, the symptoms were exuberant. Even though they are aware of the health risks posed by these devices and have already experienced some adverse effect during and/or after a smoking session, users continue to use them. This reinforces the need for public health policy campaigns emphasizing the consequences of exposure to smoke from electronic cigarettes and hookahs.

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