SOCIAL RESEARCH REPORTS

ISSN: 2066-6861 (print), ISSN: 2067-5941 (electronic)

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Social Research Reports, 2019, Vol. 11, Issue 1, pp. 78-97

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<https://doi.org/10.33788/srr11.1.6>

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WHO ARE THE HOOKAH SMOKERS AMONG THE ISRAELI YOUNG ADULTS POPULATION? ASSOCIATED SOCIO- DEMOGRAPHIC AND HEALTH RELATED FACTORS

Noit KAROLINSKY^{1,2}

Abstract

Contrary to cigarette smoking trends, hookah smoking is on the rise, and is now widely acceptable among various origins and cultures, with estimates ranging around 100 million hookah smokers worldwide, most of them adolescents. However, this phenomenon is not extensively researched, since until recent years it was perceived as marginal. The current study is based on a health-related cross-sectional survey conducted in Israel among young adults aged 21-44. A logistic regression model was used to identify socio-demographic and health-related factors that predicted hookah smoking. The current study included 1,976 interviewees, of which 884 (44.7%) Jews and 1,155 (55.3%) Arabs. The rate of hookah smoking in the sample was 9.5%, 3.5% among Jews and 14.4% among Arabs. The likelihood of being a hookah smoker (95% CI) was higher among Arabs (OR=5.09, $p<.001$), men (OR=3.46, $p<.001$), non-religious respondents (OR=1.68, $p=.004$), respondents with low education level (<12 years) (OR=1.81, $p=.003$), non-parents (OR=1.92, $p<.001$), respondents with poor mental health status (OR=1.56, $p=.003$) and those who did not comply with strict consumption of fruit and vegetables (OR=1.43, $p=.012$). This study has identified the profile of the individual with the highest likelihood of being a hookah smoker. These findings, along with the prevalence of hookah smoking among the young adult population in Israel, call for a need to promote a systematic approach. Based on such profiling it is possible to build designated intervention programs, which will provide health education guidance as well as rehabilitation services. Such programs may contribute to the prevention and reduction of smoking in the young adult population and to improving their health.

Keywords: hookah, smoking, young adults, socio-demographic characteristics, health factors, culture.

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Introduction

Smoking tobacco as a phenomenon began roughly 400 years ago in multiple regions, mainly in the east, and was carried out through various means, one of which is the hookah (Water Pipe Tobacco-WPT), a traditional smoking device (Knishkowsky & Amitai, 2005). Hookah tobacco mixtures typically contain chemical flavoring agents, as well as tar which is a known carcinogen (Klem, 2006). In addition to pre-existing substances, in the process of smoking hookah, coal burning products such as benzene – another known carcinogen, are added to the inhaled smoke, along with other substances produced in the burning process of the tobacco (Shihadeh, Azar, Antonios, & Haddad, 2004; Kassem, 2014).

According to data from the World Health Organization, more than 1.1 billion individuals from the adult population worldwide smoked tobacco products in 2015 (World Health Organization, 2015). This is particularly disturbing as tobacco products consumption is one of the leading causes of morbidity and mortality worldwide, and it is forecasted to be attributed to a third of death cases by 2020 (Momenabadi, *et al.*, 2016). However, in the last decade there seems to be an increase in awareness levels among the public, as cigarette smoking rates in the general adult population in western countries decreased significantly (e.g. from 20.9% to 15.5% in the US, 16.1% to 14.5% in Australia and 19.8% to 14.9% in the UK) (Jamal *et al.*, 2018; Australian Bureau of Statistics, 2015; UK National Health Services, 2018).

Contrary to cigarette smoking trends, hookah smoking is on the rise since the early 1990's when it became prevalent among young people, especially in the middle east (Maziak *et al.*, 2014), and is now widely acceptable among various origins and cultures, with estimates ranging around 100 million hookah smokers worldwide, most of them adolescents (Krenik-Matejcek *et al.*, 2017; Awan *et al.*, 2017). In spite of that, only few countries have carried out routine monitoring of the tendencies of hookah smoking, since until recent years the phenomenon was perceived as marginal (Maziak *et al.*, 2014; Akl *et al.*, 2010). In the countries where there have been collected data about the phenomenon there have been revealed worrying tendencies, particularly in relation to the prevalence and patterns of hookah smoking which have been increased among young adults (Maziak *et al.*, 2014; El-Awa, Warren, & Jones, 2010). However, most of the research works on this issue have focused on the population of youth and students, without giving adequate representation for the entire young adult population (Young adults) (Maziak *et al.*, 2014).

Socio-demographic characteristics associated to hookah smoking

A wide study that was conducted in the United States examined the socio-demographic characteristics that are associated with hookah smoking during the lifetime among young adults. The likelihood of hookah smoking during the lifetime was higher among males compared to females (1.5 - 1.8, OR = 1.61, 95%

CI), respondents who had an academic education (4.6 - 7.1, OR = 5.7, 95% CI) or secondary education (2.7 - 4.1, OR = 3.3, 95% CI) (both compared to respondents who had less than 12 years of schooling), singles (1.3 - 1.6, OR = 1.45, 95% CI), without children (3.3 - 5.9, OR = 4.5, 95% CI), low-income (1.4 - 1.8, OR = 1.6, 95% CI) and students (1.3 - 1.7, OR = 1.5, 95% CI) (Grinberg & Goodwin, 2016). Unexpectedly, it was found that the rates of smoking were higher for those with higher education (over 12 years of study). Authors have suggested the hypothesis that these individuals were more likely to have experienced hookah smoking due to the greater accessibility for smoking and drug products during their studies in the academic institutions (Grinberg & Goodwin, 2016). These findings are supported by previous studies among students that reported about high usage rates, and a tendency to try various types of smoking products and drugs (Grinberg & Goodwin, 2016; Cho *et al.*, 2015; Botvin & Griffin, 2007).

Other studies also confirm that hookah smoking is mainly associated to the population of students in colleges and universities (Krenik-Matejcek *et al.*, 2017; Awan *et al.*, 2017), as around 32% of students reported on smoking, with a similar rate found between male and female students (33% and 34%, respectively) (Krenik-Matejcek *et al.*, 2017; Fevrier *et al.*, 2018). In addition, findings from the research of Salloum *et al.* (2017) that reported on hookah usage rates in all demographic segments among young adults (18-24), show that the rates of hookah smoking were lower among M.A. students compared to B.A. students (33.4% and 55%, respectively).

A study that has been conducted in the UK and focused on the general adult population (aged 18+) has found an inverse relation between socio-economic status and rates of hookah smoking. In this study the socio-economic status of each participant is determined by the field of employment and the wage levels of the main provider in the same household. The likelihood of hookah smoking during the lifetime among individuals who belonged to the top quintile (defined as AB) of the socio-economic status compared to individuals who belonged to the bottom quintile (defined as E) was 2.5 times higher (1.9 - 2.9, OR = 2.3, 95% CI) (Grant, Morrison, & Dockrell, 2014). Compared to the study that has been conducted in the United States, this finding is in contradiction with respect to the negative relation between income and hookah smoking, but supports a positive relation that was found between education level and hookah smoking (Grant, Morrison, & Dockrell, 2014; Grinberg & Goodwin, 2016).

In addition, the British study has found that compared with white individuals who are the majority group in the UK, minority groups are more likely to report about hookah smoking during the lifetime, such as individuals of mixed origin (1.6 - 3.4, OR = 2.4, 95% CI) and individuals of Asian origin (1.4 - 2.5, OR = 1.8, 95% CI) (Grant, Morrison, & Dockrell, 2014). Similarly, other studies have found that in western countries including the United States, men of non-white or Arab origin show slightly higher use of hookah than white men (70% and 68%, respectively) (Krenik-Matejcek *et al.*, 2017; Awan *et al.*, 2017).

Hookah smoking is a deeply rooted custom in Middle Eastern and Arabic cultures for hundreds of years and has been considered a cultural activity in the Middle East for more than 500 years (Jamil, Geeso, Arnetz, & Arnetz, 2014). Thus, hookah smoking in the Arab population is considered as one of the social

habits with a role in shaping its culture and is even perceived as common among Arab women (Dar-Odeh & Abu-Hammad, 2011).

Several Studies that have been conducted in Israel examined smoking related socio-demographic characteristics. Baron-Epel and colleagues (2015) have found that gender-wise, men with less than 12 years of education were more likely to smoke hookah (1.2 - 5.3, OR = 2.6, 95% CI) compared to men with an academic education, and among women, those who were single were more likely to report about smoking (1.01 - 11.1, OR = 3.3, 95% CI) than those who were married. They also found that secular individuals were more likely to smoke hookah compared with traditional individuals (1.3 - 16.7, OR = 4.5, 95% CI) or religious (1.1 - 6.7, OR = 2.7, 95% CI) (Baron-Epel *et al.*, 2015). Harel-Fish (2017) has found that the prominent population groups in smoking hookah are young people aged 18-24; Men; Muslim Arabs; unmarried; those with partial academic education; those with a partial secondary school education (Harel-Fish, 2017). Similar findings were also observed in a study conducted in Israel at the Ariel University Center among B.A. students, as hookah smoking was found to be more common among men than women, singles versus married, and secular versus religious (Koren, 2011). In summary, studies in recent years worldwide, as well as in Israel and the middle east, show a pattern of increase in positive replies about hookah usage compared with past studies, indicating on a steady rise in global hookah usage rates (Chaouachi, 2007; Krenik-Matejcek *et al.*, 2017).

Health characteristics and health behaviors associated to cigarette and hookah smoking

As the phenomena of smoking widened – mainly cigarettes and hookah, and medical research started showing the adverse health effects of smoking on the human body, research efforts have also been directed towards identifying health behaviors and activities attributed with smoking. Several studies have found that smoking was related to unhealthy dietary habits such as increased consumption of calories, sugars, total fats, saturated fats, cholesterol, alcohol, and inversely related to healthy dietary habits such as consumption of vitamins, anti-oxidants and dietary fibers commonly found in fruits and vegetables, sea food, dairy products, etc. The unhealthy dietary profile found among smokers could increase the risk for cardiovascular and cancer diseases related to smoking (Dallongeville, Marécaux, Fruchart, & Amouyel, 1998; Suh *et al.*, 2013).

Similar findings were observed in a cross-sectional study conducted in Iran, which found that smokers consumed significantly more fast food and white meat but less dairy products and less fruit and vegetables, as smokers were 1.83 times more likely to consume an unhealthy diet compared to non-smokers (Heydari *et al.*, 2014). These findings are also supported by a study that was conducted in Israel, which found that smoking hookah was negatively associated with healthy eating habits (Korn & Billig, 2013). The consumption of fruits and vegetables was also studied by McClure *et al.* (2009) who examined the dietary habits – particularly consumption of fruits and vegetables - and psychosocial factors among

smokers and non-smokers, and found that smokers reported on low self-efficacy and low levels of motivation to meet the recommended daily intake of fruits and vegetables. Smokers were less likely to keep with the general daily recommendation of 5 combined servings of fruits and vegetables, with only 20% reaching this goal compared to 35% among non-smokers. The average daily consumption of combined daily servings of fruits and vegetables among smokers was also lower compared to non-smokers, 3.7 and 4.5 respectively (McClure *et al.*, 2009). Supporting evidence was also observed among college students, as those who have not consumed fruits and vegetables at all were likely to smoke over 2 days more per month than those who consumed 5 or more daily servings of fruits and vegetables (Mitchell, 2014). The appropriate consumption of fruit and vegetables is associated with decreasing various health risks including some types of cancer, diabetes, cardiovascular diseases, etc. (Bazzano, 2006), and was found to have a positive effect among smokers against lung cancer (Skuladottir *et al.*, 2004) and cardiovascular diseases (Hung *et al.*, 2004).

Another health aspect studied in the context of smoking is physical health status. Researchers have found that poor physical health status as self-rated by participants was directly related to smoking (Nouran, 2011; Gritz *et al.*, 2003; Cott, Gignac, & Badley, 1999; Komar *et al.*, 2006; Lim *et al.*, 2007), unlike positive health behaviors such as healthy diet and regular physical activity which have been found related to a good self-rated health status (Khalaila, 2014). Similarly, poor self-perception of mental health status was found to be more common among smokers than non-smokers (Ahmad, Jhajj, Stewart, Burghardt, & Bierman, 2014). With regard to mental health, in the US individuals with mental illness are among the largest sub-groups of smokers, accounting for over 44% of all cigarettes sold in the country (Smith, Mazure, & McKee, 2014). In a study that was conducted in France, smoking was significantly more common among psychiatric patients compared to the entire population, and smoking was found to be particularly prevalent among individuals who were diagnosed with schizophrenia and substance-related disorders (Poirier *et al.*, 2002).

In summary, tobacco smoking in general, including hookah smoking, is related to unhealthy lifestyle, including high stress levels, unhealthy dietary habits, lack of physical activity, etc. (Sarrafzadegan *et al.*, 2010). Hookah smoking was also related to various health effects, such as post-use increased heart rate and blood pressure, higher CO levels, metabolic syndromes, etc. (Aslam, Saleem, German, & Qureshi, 2014). It appears that most studies have not well distinguished hookah usage from cigarettes or other tobacco products, thus compared to cigarettes, relatively few data exist in the scientific literature regarding hookah smoking. In the current study, evaluations of the different characteristics and factors specific to hookah smoking will be evaluated and presented.

Methodology

This study is based on a cross-sectional survey, the 2013 knowledge, attitudes and practices survey, which was carried out by the Israel Center for Disease Control in 2013.

Study participants

Participants in this survey were young Jewish and Arab Israeli residents aged 21 or older. A random sample of landline telephone numbers households was drawn from a comprehensive list of the national telephone company. Fax numbers, disconnected numbers, commercial and business numbers and households without a resident 21 years and older were ineligible and thus excluded from the sample.

The sample that was derived for the purposes of the current study included young adults (aged 21-44). In order to identify the unique characteristics of hookah smokers, all the participants that reported on cigarette smoking were excluded from this study. Overall, 1,976 young interviewees (884 from Jewish households and 1,092 interviewees from Arab households) completed the interview and were included in this study.

The questionnaire

Self-reported data were collected by telephone interviews. The interview was conducted in Hebrew among the Jewish population and in Arabic among the Arab population. The interviews were conducted by trained interviewers, native speakers of Hebrew or Arabic. The current research is based on the information that was collected as part of this survey. The questionnaire in this survey included issues related to socio-demographic factors, health status and health-related behaviors and practices in diverse domains, such as compliance with flu vaccine, nutrition habits etc.

Study Variables

Dependent Variable

Hookah smoking: the interviewees were asked: “Do you smoke hookah?” those who answered positively to this question were defined as “hookah smokers”. Otherwise, they were defined “non-smokers”.

Main Independent Variables

Population Group: [the classification was done on the basis of nationality and reported religion. The interviewees were defined as “Jews or others” if they reported that they are Jews or a non-Arab Christians. They were defined as “Ar-

abs” if they reported on being Muslim Arabs, Christian Arabs, Bedouins, Druze, Circassians or

Armenians; *Gender*: The gender of the interviewees was identified by the interviewers and documented; *Religiosity*: It was determined according to the religious level of the interviewees: secular, traditional, religious, or very religious. Secular and traditional interviewees were defined as “non-religious”, and the rest were defined as “religious”; *Education level*: It was determined according to the number of years of schooling the interviewee has reported on, and accordingly was classified as having either a higher education (12 years of schooling or more) or a low level of education (less than 12 years of schooling); *Parenthood*: The interviewees were asked if they have children or do not have and accordingly were classified as “non-parents” or “parents”; *Physical health status*: The interviewees were asked “In general, how is your physical health?”, and possible answers were “Very good”, “Good”, “Not so good” or “Not good at all”. Interviewees who reported that their physical health was generally “Very good” or “Good” were classified as having “Good” physical health status. Otherwise, they classified as having “poor” physical health status; *Mental health status*: The interviewees were asked “In general, how is your mental health?”, and possible answers were “Very good”, “Good”, “Not so good” or “Not good at all”. Interviewees who reported that their mental health was generally “Very good” or “Good” were classified as having a “Good” mental health status. Otherwise, they were classified as having a “Not good” mental health status; *Influenza vaccine*: The interviewees were classified as “Responding to vaccination against influenza” if they reported on complying with this vaccination during the past year; *Maintaining low-calorie diet*: The interviewees who responded positively to the declaration “Trying to decrease the amount of consumed calories” were classified as “Maintaining low-calorie diet”; *Strict consumption of fruits and vegetables*: The interviewees who responded positively to the declaration “Trying to increase the amount of vegetables and fruits” were considered as “strictly consuming vegetables and fruits”; *Consumption of sweet foods*: The interviewees who reported that they are used to eat “Every day” or “Almost every day” cakes/cookies/sweet pastries/sweet snacks, were classified as “Consuming sweet foods”; *Consumption of sweet soft drinks*: The interviewees who reported that they drink “Every day” or “Almost every day” sweetened soft drinks was classified as “Consuming sweet soft drinks”.

Statistical analysis

The rates of hookah smoking among Israeli young adults were calculated for the entire sample and by population group and by the other socio-demographic characteristics mentioned above. Bivariate analyses were done by χ^2 test for examining associations between socio-demographic and health-related variables and hookah smoking. The significant variables that were found in the bivariate analyses among the study population were included in multivariable model of logistic regression. This model was used for detecting predictors for hookah smoking among Israeli young adults. SPSS software (version 24) was employed and statistical significance was determined at $p < 0.05$.

Results

The current study included 1,976 interviewees. Table 1 presents the socio-demographic characteristics of the study population group. 884 were Jewish respondents and 1,155 were Arab respondents. Around 40% were men and around 60% were females. Most of the interviewees defined themselves as “non-religious” (60%), reported on >12 years of schooling (89.5%) and that they are parents (80.8%).

The rate of hookah smoking in the sample was 9.5%. Table 2 presents the rates of hookah smoking among the study population groups by socio-demographic and health-related characteristics. Higher rates of hookah smoking were found among Arabs, males, non-religious respondents, among those who have high education level, among parents, among those who had poor mental health status, among those that did not comply with strict consumption of vegetables and fruits, among those that consumed sweet foods and among those that consumed sweet soft drinks.

Table 3 presents a logistic regression model that identified socio-demographic and health-related factors that predicted hookah smoking. Arabs, men, non-religious respondents, respondents with low education level, non-parents, respondents with poor mental health status and those who did not comply with strict consumption of vegetables and fruits were more likely to be hookah smokers.

Discussion

This research examines the rates of hookah smoking among young adults (aged 21-44) in the State of Israel, the patterns of smoking, its characteristics and the factors that can predict it. All this is done by looking at the Israeli society through examination of factors such as socio-demographic characteristics, health characteristics and health behaviors. These examinations are aimed at assessing, first of all, the rates of hookah smoking in the Israeli population; second, examining the differences in smoking between different socio-demographic characteristics and health related factors; third, trying to identify the predictors of hookah smoking.

In the current research it was found that the rate of current hookah smoking in the research population was 9.5%, whereas current rates of hookah smoking among young adults in the US and in the UK ranged between 0.5% - 2% (Grant, Morrison, & Dockrell, 2014; Grinberg & Goodwin, 2016; Salloum *et al.*, 2014).

Socio-Demographic Characteristics and Smoking among the Entire Population

In the current research it was found that the likelihood of hookah smoking was higher among Arabs than among Jews, 14.4% and 3.5%, respectively. A distinct feature of the Israeli society is the combination of Jews and Arabs, as also reflected in this study's population. Hookah smoking is intertwined with Arab culture, and may be crossing sectors and socioeconomic classes in the Arab society in Israel (Dar-Odeh & Abu-Hammad, 2011). The fact that for many years this custom was

prevalent mainly among Arab populations may explain the gaps in smoking rates between Arab and non-Arab populations in Israel and around the world.

In this research, the likelihood of hookah smoking was higher among men than among women. A similar trend has also been reported in previous as well as recent large-scale studies (Jamal *et al.*, 2018; Australian Bureau of Statistics, 2015; Israel Ministry of Health, 2011). The scientific literature offers several explanations that may account for this gap in smoking rates between men and women. Studies have found that when men smoke (both cigarettes and hookahs), higher activation is triggered in the reward and pleasure center in their brains compared to women (Al'Absi *et al.*, 2015), so the incentive for smoking is higher among men than it is among women. In a large meta-analysis it was found that men were significantly more involved than women in a very wide range of risk behaviors, including smoking. A series of studies show that there is a gap between men and women in the perception of risk behaviors, such as health-related and recreational behaviors; these risks may be perceived by women as dangerous and therefore not attractive or less enjoyable, while among men they may be perceived as harmless or rather attractive because of its inherent risk. Moreover, even when taking the assumption that the risk will not occur, women expected these behaviors to be less enjoyable than men did. (Hudgens & Torsani-Fatkin, 1980; Byrnes, Miller, & Schafer, 1999; Harris, Jenkins, & Glaser, 2006). In addition, in most cases the awareness and compliance with health behaviors (including essential uses of health services) is lower among men compared to women. In fact, studies show that in the western world in general, men's health tends to be less good than women's health (Tudiver & Talbot, 1999).

The findings of this research show that the likelihood of hookah smoking is higher among non-religious individuals compared to religious individuals. These findings are also supported in the research literature, including in Israel (Israel Ministry of Health, 2012; Korn & Billig, 2013; Primack *et al.*, 2014; Baron-Epel *et al.*, 2015; Jawad *et al.*, 2015). Apparently, an explanation for this difference lies in the value of the sanctity of life in the various religions, which leads to avoidance of behaviors that may endanger the life and health of the individual in those religions (Judaism, Islam and Christianity) (Garrusi & Nakhaee, 2012). Accordingly, religious individuals may refrain from smoking following the compliance to the religious way of life and adherence to the commandments.

The current research has found that the likelihood of hookah smoking was higher among individuals with lower education (education level under 12 years) compared to individuals with higher education levels (education level of 12 years and more). Jawad and colleagues (2014) have also established this connection in their research that included data from 13 developing countries (Jawad *et al.*, 2014). Similar trends have been reported on hookah and cigarettes in the research literature (Jamal *et al.*, 2018; Drope *et al.*, 2018; Israel Ministry of Health, 2012). Another interesting finding was observed in a wide survey that included about 18000 participants, where among ever users of hookah a higher education level was related to lower intent to use hookah again (Cavazos-Rehg *et al.*, 2015). Usually, the level of education reflects the individual's level of knowledge and skills that are important for making decisions about health behaviors (Muller, 2002), and a person with a low level of education may be more exposed to smoking and

less aware to its damages than a person with a higher education (Hiscock, Bauld, & Amos, 2011). An alternative explanation to the relation between smoking and level of education may be socioeconomic background. On the one hand, the level of education usually indicates the individual's socioeconomic status - through employment status and income level (Muller, 2002), and on the other hand, low socioeconomic status is a known predictor of smoking, because of exposure to a smoking supportive environment, including family members who smoke and serve as their role models, social norms, and a high availability of tobacco products. as well as emotional factors that inhibit quitting attempts such as low self-confidence, lack of motivation and social support and difficulties in funding nicotine replacements. All of these can encourage the individual to experience with smoking tobacco products and adopt this negative behavior (Hiscock, Bauld, & Amos, 2011; Pärna *et al.*, 2014). In contrast, several studies have found the opposite relation as higher hookah use was correlated with higher education levels. However, these studies focused on student populations, and explained their findings by the growing popularity of hookah shops and smoking venues located in attractive urban areas, including close to university campuses (Sutfin *et al.*, 2011; Pandey, 2017).

This research has found that the likelihood to smoke hookah was higher among non-parents compared with parents. These findings are consistent with observations from previous studies (Child Trends Databank, 2014; Koren, 2011; Grinberg & Goodwin, 2016). A possible explanation is that individuals who are parents are concerned about the risk of endangering the health of their children and thus avoid smoking, or are more motivated to turn to smoking cessation services. Contrary, this motivation does not exist among non-parents - having no children they feel ought to protect against the health consequences of smoking (Kalter-Leibovici *et al.*, 2016). In addition, the parent may have a spouse and children who may provide social support for making a decision to quit smoking, and during the process itself (Watt *et al.*, 2014).

Health Characteristics and Smoking among the Entire Population, among Jews and among Arabs

In this research, no significant connection was found between hookah smoking and poor physical health status (self-rating: "Not so good" or "Not good at all"). Similarly, in the research literature there are contradictory evidence about this connection (Kawachi, Kennedy, & Glass, 1999; Manderbacka, Lundberg, & Martikainen, 1999; Chen, Cohen, & Kasen, 2007; Wang *et al.*, 2005; Bobak *et al.*, 1998). A possible explanation for the lack of connection with hookah smoking is that interviewees were aware of the health-related focus of the survey prior to taking it, and therefore might have been prone to report less about unhealthy habits. Another possibility is a sample size limitation due to the limited number of hookah smokers who reported on poor physical health.

In the current research, it has been found that the likelihood to smoke hookah was higher among individuals who ranked their mental health situation as poor ("Not so good" or "Not good at all") than those who ranked their mental health situation as good ("Very good" or "Good"). Many studies indicate about the connection between mental health and tobacco smoking – cigarettes as well

as hookah, as poor mental health is associated with smoking (Chao *et al.*, 2017; Joseph *et al.*, 2003; Gregor *et al.*, 2007; Zvolensky *et al.*, 2009; Ahmad *et al.*, 2014; Hamadeh *et al.*, 2016; Primack *et al.*, 2013). Mental distress, manifested in symptoms of depression and/or anxiety, can increase the risk of dangerous behaviors, such as unprotected sex, and increased use of addictive substances, including tobacco products, among young people. Studies have shown that these symptoms are motivating factors for initiation of smoking or leading to more frequent smoking among smokers, as individuals who cope with emotional distress smoke in order to regulate the symptoms associated with the distress with which they cope (Minichino *et al.*, 2013; Hwang & Yun, 2015). However, this is a poor coping strategy that causes individuals to seek only temporary escape from the stress and emotional distress that they experience (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Brandon & Baker, 1991; Pomerleau & Pomerleau, 1991). In addition, mental distress may be the basis for the adoption of rigid smoking patterns, and consequently increased smoking tolerance - i.e., the individual will experience the need to smoke an increasing amount of a given tobacco product in order to obtain and maintain the “facilitating” effect. These consequences are age-dependent; initiation of tobacco smoking at a later age, compared to younger age groups, reduces the likelihood of developing dependence on tobacco products (Hwang & Yun, 2015). Yet, an addicted person has to meet more than half of the nine diagnostic criteria proposed by APA in DSM-5 (Tudorel *et al.*, 2018).

Moreover, research evidence from recent years suggest that smoking cessation may have a positive contribution to the mental health of individuals (Minichino *et al.*, 2013).

This study has found a relation between strict consumption of vegetables and fruits and hookah smoking. Multiple other studies have also demonstrated a significant relationship between hookah and cigarette smoking and reduced consumption of fruit and vegetables (McPhillips *et al.*, 1994; Chiolo *et al.*, 2006; McClure *et al.*, 2009; Heydari *et al.*, 2014), and similar findings were found in Israel (Korn & Billig, 2013). A possible explanation was given in the study by McClure and colleagues (2009) who suggested that smokers generally tend to adopt other unhealthy behaviors as well. This was in light of their findings that smokers had lower self-efficacy and were less motivated to keep the recommended daily intake of fruit and vegetables, had lower expectations regarding the chances of reduced risk for illness from eating fruit and vegetables, and less viewed healthy eating as a life goal (McClure *et al.*, 2009). Several other explanations have been presented in various studies, including smoking-induced changes to taste which could affect food choices (Palaniappan, Jacobs Starkey, O’Loughlin, & Gray-Donald, 2001; Preston, 1991). In addition, the lower socio-economic status that was associated with smokers was also related to a generally unhealthy diet and lack of nutritional knowledge (Dallongeville *et al.*, 1998). In the context of socio-economic status, this has been shown indirectly in the current study through the finding of lower education levels among smokers.

The relation between consumption of sweet soft drinks and hookah smoking in this study was not significant, however it follows the trend of direct relation reported in the literature. Similar evidence were found in several studies, according to which the consumption of sweet soft drinks was significantly higher among

current smokers, and consumers of sweet drinks also tended towards other negative health habits such as physical inactivity, low consumption of fruit and vegetables, etc. This has been explained by the hypothesis that negative health behaviors tend to be associated and manifest along with other negative health behaviors, and the avoidance of different health risk behaviors seems to be cross-related (Rombaldi, Neutzling, Silva, Azevedo, & Hallal, 2011; Terry-McElrath, O'Malley, & Johnston, 2014; Palmer *et al.*, 2008; Kvaavik, Andersen, & Klepp, 2005; Dhingra *et al.*, 2007). Another evidence for this connection was found in a cohort study, according to which the proportion of current smokers among consumers of sweet drinks increased by the number of glasses consumed (The InterAct consortium, 2013). These findings can also be explained by the reduction in insulin sensitivity levels and the development of insulin resistance among smokers, as a result of modifications to the body's hormonal processes triggered by nicotine or other chemical substances existent in hookah and cigarette smoke (Filozof *et al.*, 2004; Frati *et al.*, 1996; Balhara, 2012). These changes to the insulin release mechanism can explain the need for higher intake of sugars (Balhara, 2012). As to the lack of significant relation in the current study, this may be explained by the prior knowledge of the interviewees about the health-related focus of the survey; therefore interviewees might have been prone to report less about unhealthy habits.

Conclusion

This research shows that about 10% of the young adult population (aged 21-44) in Israel smokes hookah. However, the rate of hookah smoking in the Arab population is more than four times higher than in the Jewish population (14.4% and 3.5%, respectively). These findings show that there is a need to promote a systematic approach towards the hookah smoking phenomenon in Israel. This approach should integrate the different aspects of dealing with this issue, including the therapeutic and educational levels. In addition, there is a need to increase the awareness of the young adult population to the damages of smoking and the implications on their health for short-term and long-term, at older ages. Perhaps it is necessary to consider combining special programs as part of the curriculum in kindergartens and schools in order to reduce the rate of smoking among young adults in the future.

Furthermore, this study examined the unique characteristics which are associated with hookah smoking, thus the profile of the individual with the highest likelihood of being a hookah smoker was identified - *a secular Arab man with a low level of education, who is not a parent, has a self-rating of poor mental health, and is not careful to consume adequate amounts of vegetables and fruit.* Based on such profiling it is possible to build designated intervention programs, in which relevant individuals will be identified and directed towards health education guidance (including on the issue of smoking), in integration with rehabilitation services according to their smoking status. In addition, a combination of professional personnel should be considered in order to provide adequate therapeutic aid in the

field of mental health. The priority for inclusion in such intervention programs will be determined by the number of parameters that increase the individual's likelihood of being a hookah smoker. The encouragement for a healthy lifestyle and the psychological support in such a program may contribute to the prevention and reduction of smoking in the young adult population and to improving their health.

Recommendations for Further Studies

In the present research, it was not possible to determine a causal connection between the characteristics which were examined and the initiation of smoking because this was a cross-sectional research. For example, poor mental health may lead the individual to begin smoking; alternatively, smoking may have been the root cause of poor mental health of the individual. Future research could be conducted in which non-smokers will be classified into research groups according to different health variables, and exposure will be examined and followed up. For example, a classification of non-smoking individuals could be made according to the extent to which they keep a strict consumption of vegetables and fruit, with having follow-ups conducted in order to compare the rates of smoking initiation.

This research did not examine the specific patterns of smoking within subgroups of the Israeli society – such as the Jewish and Arab populations. It is advisable to conduct studies in which adequate representation will be given to these subgroups in order to identify the system of factors associated with smoking in these populations. Accordingly, it will be possible to achieve better targeted intervention programs for sub-population groups in Israel.

In the present research, the individuals were classified according to the status of smoking. However, no distinction was made between smokers according to the quantity of smoking. It is possible to consider a research that will collect data about the frequency and quantity of smoking of various tobacco products, and a summary index could be created that will reflect the total level of smoking of all tobacco products. In this way, it will be possible to identify characteristics that distinguish between individuals who smoke, i.e. “heavy” or “light” smokers, and “non-smokers”.

The present research used subjective measures to assess the physical and mental health situations of the interviewees. In future studies about this research issue, it is recommended to include questions in which the interviewee reports about the existence or absence of diseases and various physical health situations (such as diabetes, heart disease, asthma, etc.). In order to assess the situation of mental health, it is recommended to include a designated questionnaire which is dedicated to identifying mental distress or specific mental disorders, such as suspicion of general anxiety. If possible, it is desirable to extract these data from a current medical database that exists in practice. This may improve the validity of health-related information. Thus, in order to understand these implications in one's life, future studies should consider the use of robust and validated instruments (Tudorel *et al.*, 2018; Vintila *et al.*, 2018) and intercultural comparison studies of those instruments that would help specialists develop appropriate interventions for those in need (Swami *et al.*, 2018).

Strengths and Limitations

The current research has several strengths: (a) This research focuses on hookah users, a population of smokers that is not well studied, even more so in Israel. Most of the data on smoking in the scientific literature is about cigarettes only, and among those studies that looked into hookah smoking, very few have isolated hookah smoking entirely; (b) This research provides a wholesome approach to the phenomenon of hookah smoking by exploring health-related factors and behaviors, as well as socio-demographic characteristics.

However, the current research has several limitations: (a) The interviewees self-reported about their smoking patterns, health characteristics and health behaviors. The interviewees were aware that the survey is focused on collecting information about health behaviors. Some may have over-reported about positive health behaviors, and reported about negative health behaviors less than they were actually taken, including smoking. It was not possible to compare the data that were collected against another source of information, such as an existing medical database; (b) As noted in the discussion, there is a connection between socioeconomic status and smoking. Based on the research data, it was not possible to provide a complete picture of the socioeconomic status of the interviewees who participated in the research, so that it was not possible to completely adjust the results of the research at the multi-variable processing stage during examination of the connections between the research variables and smoking. This connection may have been reflected indirectly through other measures (such as level of education and physical health situation).

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