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ORIGINAL RESEARCH

Smoking Cessation Beliefs Among Saudi University Students in Qassim Region, Saudi Arabia

Yasser Almogbel 🔗

Department of Pharmacy Practice,
College of Pharmacy, Qassim University,
Buraidah, Qassim 51452, Saudi Arabia

Introduction: Despite Saudi officials initiating a variety of smoking cessation programs, smoking in the country has not decreased. Thus, the objective of this study was to identify the factors associated with Saudi students' beliefs about available smoking cessation interventions.

Methods: A cross-sectional, pre-tested, and validated paper-based survey was administered to a cohort from a university in the Qassim region. Bivariate analyses and logistic regression were conducted to explore the factors associated with the students' beliefs regarding behavioral and pharmacotherapy interventions for smoking cessation.

Results: Out of 1158 surveys distributed, 958 responses were received (82.7% response rate). Students aged >23 years were more likely to believe in a behavioral intervention (marginal effect = 10.4%; 95% CI, 2.3%–18.6%). However, the respondents who indicated that they had smoked a hookah over the past 30 days were less likely to believe in either the pharmacotherapeutic (marginal effect = -7.9%; 95% CI, −15.6 to −0.3%) or the behavioral (marginal effect = -8.1%; 95% CI, −16.2% to −0.1%) interventions. Students who believed that the hookah was the same as or less harmful than cigarettes (marginal effect = −25.6%; 95% CI, −34.7% to −16.6%) and (marginal effect = −12.3%; 95% CI, −22.3% to −2.3%), respectively, were less likely to believe in pharmacotherapeutic interventions. Multiple logistic regression analyses found that hookah smokers with a willingness to quit smoking were more likely to believe in the effectiveness of cessation medications (marginal effect = 42.9%; 95% CI, 28.2%–57.6%) and behavioral interventions (marginal effect = 28.6%; 95% CI, 9.3%–48.0%).

Conclusion: This study found that smoking a hookah and its harmfulness were negatively associated with smoking cessation medications interventions. Regarding beliefs about behavioral interventions, while age was positively associated, hookah smoking and its harmfulness had a negative association. Willingness to quit smoking was positively associated with both medication and behavioral interventions.

Keywords: behavior, college students, Kingdom of Saudi Arabia, quitting smoking, utilization of services

Introduction

In 2015, the World Health Organization (WHO) estimated that about 20% of the world's population aged 15 years or older could be considered current smokers.[1] Smoking kills more than eight million people every year,[2] and exposure to second-hand smoke causes over 600,000 deaths annually.[3] Additionally, a considerable number of preventable diseases and deaths are caused by tobacco.[4] Life expectancy for regular smokers is at least 7 to 13 years shorter than for nonsmokers.[5] Although smoking is known to have a negative impact on health, the prevalence of smoking

Correspondence: Yasser Almogbel
P. O. Box 6800, Department of
Pharmacy Practice
College of Pharmacy, Qassim University,
Buraidah, Qassim 51452, Saudi Arabia
Tel +966 16 3014601
Email y.almogbel@qu.edu.sa

and tobacco consumption is still high in many countries,[6] and tobacco consumption using cigarettes and hookah continues to rise.[7] Premature deaths due to tobacco smoking increase the economic burden on families and healthcare systems, as well as affecting a country's overall economy.[8]

Since hookahs have been in use for about 400 years in a variety of regions, they have many names in different languages, including hubble-bubble, water pipes, nargeela, argeela, arghileh, shisha, okka, kalian, and gouza.[9] The availability and accessibility of hookahs during familial and social gatherings actively increased its spread throughout societies.[9] Smokers mistakenly perceived hookahs to be less addictive than cigarettes.[10] Hookah smoke contains nicotine and other toxins such as tar and carbon monoxide (CO) connected to smoking-related diseases.[11] In fact, one session smoking a hookah would expose the smoker to higher amounts of nicotine, tar, and other toxins than smoking one cigarette.[12]

Saudi Arabia, which is considered a high-income country, was found to have had a significant increase in smoking consumption between 1980 and 2012.[13] Although the country does not produce tobacco, it is one of the top importers of tobacco products.[14] Between 2010 and 2014, it imported tobacco products worth more than US $3.4 billion.[15] The WHO reported that the adjusted crude prevalence in both sexes in Saudi Arabia was 15.9% (with lower and upper limits of 11% and 20.9%, respectively).[1] Different studies have reported on the prevalence of hookah smoking among Saudis. This variation may have been affected by the different types of sampling based on characteristics such as age, gender, and/or level of social acceptance among different parts of the population. A study conducted in 2010 of 500 male students from three colleges in the eastern region found that 12.6% of the sample were hookah smokers.[16] Another study conducted in 2011 with male Saudi university students found that about 40% of the respondents had tried water pipes at least once.[17] A study conducted in 2016 on male university students in Qassim found that 32.9% were shisha smokers.[18] Heavy smoking was found to be responsible for 28,000 premature deaths, and cost around US$20 billion (excluding smuggled products) between 2001 and 2010.[19] This is despite the Islamic religion prohibiting any act, behavior, or practice that could affect health, including smoking;[20] and the fact that at the social level, smoking is considered a shameful behavior, especially for females.[20,21] Over the last 30 years, Saudi Arabia

has launched several policies to decrease the consumption of tobacco, including increasing the price of tobacco in June 2017, banning smoking, and declaring smoke-free zones in government service office locations, educational institutions, and places of public gathering such as malls and parks.[22–24] The government of Saudi Arabia also initiated nonprofit government tobacco cessation centers to run programs that would help smokers quit.[22]

Despite old and new treatments being applied, the failure to quit smoking has persisted, and the physiological withdrawal symptoms due to dependence on and craving for nicotine might be a significant reason for relapse.[25] A pilot study conducted among adult smokers in the United States found that 80% had tried to quit without professional intervention, but only about 10% succeeded.[26] In previously published studies, the reasons given for failing to quit included stress in daily life, inability to control withdrawal, and the belief that quitting had no value.[27] It has been found that the life expectancy of tobacco smokers who quit smoking before the age of 30 was similar to those who had never smoked.[28]

Smoking cessation guidelines advocate strategies ranging from medical treatment to behavioral interventions,[29] which can be categorized as (1) pharmacological interventions, or (2) behavioral (physiological) interventions.[30] Pharmacological interventions can be further divided into nicotine replacement therapy, nicotinic receptor agonists, Varenicline, and antidepressants.[31,32] Physiological interventions include educational programs for smoking cessation.[33] Studies in the literature have revealed that advice and psychological support for tobacco smokers from healthcare providers would increase levels of cessation.[34]

Performing an action or the intention to perform an action (eg utilization of smoking cessation interventions) starts with a behavioral belief about the effect (effectiveness of smoking cessation intervention services). The health belief model (HBM) was developed to explain health-related behaviors and the uptake of healthcare services.[35,36] The HBM states that prior to engaged in a behavior, it is mandatory to have a belief about the value of this behavior, such as the use of smoking cessation intervention services.[36] Furthermore, in the theory of planned behavior (TPB), belief is the starting point for forming an attitude, followed by the intention to perform a behavior.[36,37] The first of two studies to evaluate smoking interventions was conducted in 2010 among adult smokers from China, found that they had limited beliefs regarding behavioral and pharmacological interventions.[38]

The second study, performed in 2013 among Jordanian adults, reported that males were more likely to believe in the effectiveness of pharmacotherapy for smoking cessation. However, older respondents did not believe in the effectiveness of the medication and behavioral interventions for smoking cessation.[39] Furthermore, respondents whose father was a smoker were less likely to believe in the behavioral interventions; and males who used other forms of tobacco were less likely to believe in the effectiveness of pharmacotherapy interventions.

The objectives of this study were to explore the beliefs of Saudi students in the Qassim region about the effectiveness of smoking cessation medications and behavioral interventions currently available, and to understand the factors that influence smokers' beliefs about such services. The perspectives of young adults, especially smokers, are crucial for designing and tailoring effective interventions to meet the needs of smokers to succeed in quitting smoking.

Methods
Study Design and Data Sources
A cross-sectional cohort study was conducted to explore factors affecting beliefs about hookah smoking cessation interventions using a paper-based survey. Data were collected between November 2018 and April 2019 at a higher education institute in Qassim province.

Participants
The research was conducted in colleges that agreed to participate, including health sciences, humanities, and social science colleges. All colleges in the Saudi educational system admit students after they have completed their secondary school degree (18 years and above).

Each of the participating teaching faculties were asked to distribute the survey and consent forms to students and to allot 20 minutes for students to complete the survey. Participation was anonymous and voluntary. Each student was asked to drop the completed survey in a box; they were allowed to stop at any time without providing a reason.

Survey Design
This study was conducted using a pre-tested, validated, paper-based survey that was used previously in two studies.[38–41] The back-translation method was used by two independent translators for translating the survey, which was developed initially in English.[40,42] Two public health specialists checked the survey. Furthermore, an interview was conducted with five students and they were asked to think aloud to check the clarity and understandability of the survey. Before distributing the survey, reliability was tested with ten students using test–retest reliability and allowing two weeks between the two tests ($r = 0.92$).

Variables
Outcome variables
Several variables were included in this study. Two main dependent variables regarding beliefs were measured: (1) smoking cessation medications and (2) behavioral interventions. Both were measured as a dichotomous variable (believe about the effect = 1, do not believe about the effect = 0). The question that was asked was "Which of the following strategies would be effective in helping you or others quit smoking?"

Independent Variables
The covariates considered included demographics, academic performance, current hookah smokers, harmful effects of the hookah, and social acceptance. These variables were selected from a 44-question survey. In the first section, a question was asked, please specify socio-demographic information for the following (1) age, (2) gender, and (3) monthly income. Age was collected as a continuous variable that was subcategorized into two groups (18–23 and >23 years). The reason for subcategorization was to evaluate whether being an overaged student had an effect on the student's beliefs. Gender was categorized into male or female. Details of income were collected and then divided into two categories based on regular Saudi students' financial aid (Saudi riyals 990/month = US$264/month) to assess the effect of receiving more money than students on financial aid. Also, participants were asked to indicate their marital status with four responses choices (married, single, divorced, or widowed). The marital status covariate was recoded to married and non-married (single, divorced, or widowed) because some response choices were not chosen. Academic performance was ascertained by asking the students to report the grade they had most frequently received during their education, with two possible responses: excellent to good and poor to fail. Current hookah smokers were defined as those who had smoked a hookahs one or more times within the past 30 days, and the answer choice was yes or no. Harmfulness of smoking hookah was assessed as: "Do you think the hookah is harmful?" with the responses being that it is less harmful than cigarettes, or the same or more harmful than cigarettes. Students were asked to assess social acceptability: "What is

the social acceptability of using hookah among your peers," and the response was none, low, medium, or high. One question asked smokers about their willingness to quit smoking; the response was yes or no—another question asked how often they smoked a hookah (three days or less, or more than three days). Finally, they were asked whether or not they own a hookah.

Statistical Analysis

Descriptive statistics and chi-square analyses were performed to explore the frequencies and associations between the dependent and independent variables. All covariates with a p-value ≤ 0.2 in the chi-square analysis were included in the multiple logistic regression to control for covariates that are not statistically significant.[43] Also, age and income were added for their importance as well as indicators of face validity.[44] Both inferential statistics (bivariate and multiple logistic regression) were conducted twice for each intervention. Thereafter, a simple logistic regression was conducted for a subset of the sample (hookah smokers). All data collected were coded and entered using Microsoft Excel 2016, and statistical analyses were performed using Stata 16.

Results

Out of the 1158 surveys distributed, 958 were received, for a response rate of 82.7%. The mean age of the participants was 22.1 ± 2.5 years. About 20% of the respondents reported that they had smoked a hookah within the past 30 days. The average age of the participants when they starting hookah smoking was 16.9 ± 4.4 years.

Descriptive statistics were calculated for the smoking cessation medication cohort and the behavioral intervention cohort. Participants were grouped into two age categories (Tables 1 and 2). In both cohorts, around 78% of the respondents were in the 18–23 age group. Moreover, ≈95%, of the sample were unmarried, ≈96% had an income of more than US$264/month, ≈95% had good to excellent academic performance, and ≈80% were not hookah smokers. Furthermore, ≈70% of the respondents thought that hookah smoking was less harmful than cigarette smoking. When asked to assess the social acceptability of hookah smoking, ≈46% of the students answered "none" suggesting that hookah smoking is not socially acceptable.

The results of the bivariate analyses of the demographic covariates (eg age, gender, income) as well as the other smoking-related variables are shown in Tables 1 and 2. Table 1 shows the association between these variables and

participants' belief in the effectiveness of the medication intervention for smoking cessation. The demographic covariates did not show any significant association with their beliefs regarding the medication intervention. A significantly greater number of participants who believed in the effectiveness of the medication intervention did not smoke a hookah (p <0.001). However, the belief in the harmful effects of smoking a hookah was significant, with most of the respondents who believed in the effectiveness of the smoking cessation medication intervention indicating that they believe that hookah smoking was less harmful than cigarette smoking (p < 0.001).

Table 2 shows the bivariate analysis results based on participants' beliefs in the effectiveness of behavioral interventions. There was a significantly greater number of students in the 18–23 age group (p = 0.007) viewing the behavioral intervention favorably. While gender did not have a significant association with beliefs regarding medication cessation, more males believed in the effectiveness of the behavioral interventions (p = 0.022). There was a significantly greater number of hookah nonsmokers who believed in the effectiveness of behavioral interventions (p = 0.005). Moreover, students who believe in the effects of a behavioral intervention also tended to think of hookah smoking as less harmful than cigarettes (p < 0.001).

Two multiple logistic regression analyses were conducted: one for smoking cessation medication (Table 3) and one for behavioral intervention (Table 4). In Table 3, the total sample size excluding missing values was 878 students. Smoking a hookah within the past 30 days was associated with less likelihood of believing in the effectiveness of smoking cessation medication interventions (marginal effect = -7.9%; 95% CI, −15.6 to −0.3%). In addition, respondents who thought that hookahs are the same as or less harmful than cigarettes were less likely to believe in the effects of medication interventions compared to the reference group respondents (more harmful than cigarettes), (marginal effect = -25.6%; 95% CI, −34.7% to −16.6%) and (marginal effect = -12.3%; 95% CI, −22.3% to −2.3%), respectively. The Hosmer−Lemeshow goodness of fit test was conducted to identify the model fit and it indicated a good fit for the model (p = 0.370).

Table 4 shows the results of the multiple logistic regression on the factors associated with beliefs in the behavioral intervention. This analysis included 885 participants. Students aged >23 years were 10.4% more likely to believe in the effectiveness of a behavioral intervention

Table 1 Demographic Characteristics and Bivariate Analysis of Factors Associated with Beliefs Among College Students in Saudi Arabia About Using Cessation Medications in the Qassim Region

Characteristics	Total (n = 958)[a]		Smoking Cessation Medications				P-value
			Believed in the Effects (n = 607)		Did Not Believe in the Effects (n = 308)		
	No.	%	No.	%	No.	%	
Age group (years)							
18–23	719	78.6	478	78.7	241	78.3	0.861
>23	196	21.4	129	21.3	67	21.7	
Gender							
Male	807	88.5	527	87.1	280	91.2	0.067
Female	105	11.5	78	12.9	27	8.8	
Marital status							
Married	47	5.2	34	5.6	13	4.2	0.371
Unmarried	862	94.8	569	94.4	293	95.8	
Income (US$/month)							
≤990 SR ($264)	29	3.2	15	2.5	14	4.6	0.091
>990 SR ($264)	886	96.8	592	97.5	294	95.4	
Academic performance							
Excellent to good	862	94.7	567	93.9	295	96.4	0.107
Poor to fail	48	5.3	37	6.1	11	3.6	
Past 30 uses smoke hookah							
Yes	179	20	99	16.7	80	27	<0.001*
No	712	79.9	495	83.3	217	73	
Harmfulness of hookah							
More harmful than cigarettes	121	13.3	70	11.6	51	16.6	<0.001*
Same harmfulness as cigarettes	147	16.1	70	11.6	77	25.1	
Less harmful than cigarettes	644	70.6	465	76.86	179	58.3	
Social acceptability							
None	418	45.9	287	47.5	131	42.7	0.281
Low	262	28.7	175	29	87	28.3	
Medium	181	19.9	113	18.7	68	22.2	
High	50	5.5	29	4.8	21	6.8	

Notes: [a]The numbers may not total 958 for some variables due to missing values; *p<0.05.

(marginal effect = 10.4%; 95% CI, 2.3%–18.6%). Smoking a hookah within the past 30 days was associated with less likelihood of believing in behavioral interventions (marginal effect = -8.1%; 95% CI, −16.2% to −0.1%). Furthermore, students who thought that hookahs were less harmful than cigarettes were less likely to believe in the positive effects of behavioral interventions (marginal effect = −15.9%; 95% CI, −25.9% to −5.9%). Regarding model fit, the Hosmer−Lemeshow goodness of fit test showed the model fit the data well ($p = 0.274$).

A third multiple logistic regression was conducted for the 70 participants who indicated that they were hookah smokers to explore factors associated with their beliefs regarding medication interventions (Table 5). Those with a willingness to quit smoking a hookah were more likely to believe in smoking cessation medications (marginal effect = 42.9%; 95% CI, 28.2%–57.6%). The Hosmer−Lemeshow goodness of fit test for this model showed the model fit the data well ($p = 0.1210$).

Table 6 shows the last multiple logistic regression performed for factors associated with beliefs among smokers about behavioral interventions. When the same independent variable was tested on the sample sub-population (hookah smokers) to evaluate

Table 2 Demographic Characteristics and Bivariate Analysis of Factors Associated with Beliefs Among College Students in Saudi Arabia About Using Behavioral Interventions in the Qassim Region

	Characteristics Total (n = 958)[a]		Behavioral Intervention				P-value
			Believed in the Effects (n = 591)		Did Not Believe in the Effects (n = 333)		
	No.	%	No.	%	No.	%	
Age group (years)							
18–23	727	78.7	449	76	278	83.5	0.007*
>23	197	21.3	142	24	55	16.5	
Gender							
Male	817	88.7	511	86.9	306	91.9	0.022*
Female	104	11.3	77	13.1	27	8.1	
Marital status							
Married	47	5.1	33	5.6	14	4.2	0.342
Unmarried	871	94.9	552	94.4	319	95.8	
Income (US$/month)							
≤990 SR ($264)	29	3.1	17	2.9	12	3.6	0.543
>990 SR ($264)	895	96.9	574	97.1	321	96.4	
Academic performance							
Excellent to good	871	94.8	550	93.9	321	96.4	0.096
Poor to fail	48	5.2	36	6.1	12	3.6	
Past 30 uses smoke hookah							
Yes	181	20.2	100	17.3	81	25.2	0.005*
No	717	79.8	477	82.7	240	74.8	
Harmfulness of hookah							
More harmful than cigarettes	127	13.8	63	10.7	64	19.5	<0.001*
Same harmfulness as cigarettes	147	16	87	14.7	60	18.2	
Less harmful than cigarettes	645	70.2	440	74.6	205	62.3	
Social acceptability							
None	418	45.9	287	47.5	131	42.7	0.281
Low	262	28.7	175	29	68	28.3	
Medium	181	19.9	113	18.7	68	22.2	
High	50	5.5	29	4.8	21	6.8	

Notes: [a]The numbers may not total 958 for some variables due to missing values; *p<0.05.

its association with the behavioral intervention, a significant positive association was found. Students who were more willing to quit smoking a hookah were more likely to believe in a behavioral intervention (marginal effect = 28.6%; 95% CI, 9.3%–48.0%). The Hosmer–Lemeshow goodness of fit test reflected that this model fit the data well (p = 0.1142).

Discussion

This study explored the beliefs about using either cessation medications or behavioral interventions to quit smoking a hookah. The multiple logistic regression models included both hookah smokers and nonsmokers. Negative associations were found between smoking a hookah, opinion of its harmfulness and both interventions. Conversely, a positive association was found between the respondent's age and their belief in behavioral interventions. Another multiple logistic regression found statistically significant positive associations between respondents' willingness to quit smoking and their belief in the effectiveness of both cessation medications and behavioral interventions.

This sample prevalence did not match other reported studies, particularly the two that were conducted with Saudi college students in the Qassim region.[17,18] This

Table 3 Multiple Logistic Regression Results of Factors Associated with Beliefs Among College Students in Saudi Arabia About Using Cessation Medications in the Qassim Region (n=878)

Characteristics	Smoking Cessation Medications					
	Odds Ratio	95% Confidence Level	P-value	Marginal Effects	95% Confidence Level	P-value
Age group (years) 18–23 >23	Ref. 1.070	0.795–1.551	0.719	Ref. 0. 014	−0.063 to 0.091	0.719
Gender Male Female	0.707 Ref.	0 0.4377–1.145	0.159	−0.072 Ref.	−0.171 to 0.028	0.157
Income (US$/month) ≤990 SR ($264) >990 SR ($264)	Ref. 1.276	0.568–2.864	0.555	Ref. 0.505	−0.117 to 0.218	0.555
Academic performance Excellent to good Poor to fail	Ref. 1.496	0.733–3.055	0.269	Ref. 0.084	−0.064 to 0.231	0.269
Past 30 uses smoke a hookah Yes No	0. 681 Ref.	0.469–0.989	0.044*	−0.079 Ref.	−0.156 to −0.003	0.042*
Harmfulness of hookah More harmful than cigarettes Same harmfulness as cigarettes Less harmful than cigarettes	Ref. 0.328 0.567	0. 223–0.482 0.368–0.877	<0.001* 0.011*	Ref. −0.256 −0.123	−0.347 to −0.166 −0.223 to −0.023	<0.001* 0.016*
Social acceptability None Low Medium High	Ref. 0. 914 0.760 0.654	0.638–1.305 0. 517–1.118 0.331–1.291	0.622 0.163 0.221	Ref. −0.0184 −0.057 −0.091	−0.092 to 0.055 −0.140 to 0.024 −0.244 to 0.061	0.624 0.169 0.240

Note: *p<0.05.

lack of concordance could be related to a convenience sampling technique that was used for data collection. However, the current sample included twice the number of respondents as the prior two studies, both males and females, and was representative of more colleges. Thus, this study is more representative and generalizable for Saudi university students in the Qassim province compared to the previous studies.

In this study, there was a significant association between increasing age and beliefs in the effectiveness of behavioral interventions. Middle-aged individuals were more willing to attend an educational health session and a nonmandatory annual health checkup than younger participants.[45] Thus, middle-aged adults would be less likely to engage in risky behaviors than younger adults. In addition to smoking and drinking alcohol, risky

activities include sunbathing without sunscreen, driving without wearing a seat belt, and engaging in unprotected sex.[46] This highlights that as age increases, respondents' awareness and concern about their health increases. However, no association was found between age and belief in the effectiveness of smoking cessation medications. In two studies, conducted in Jordan and China, researchers found that smokers age was negatively associated with beliefs about both medication and behavioral interventions. Those studies only selected smokers older than the participants in the current study which may explain the reasoning behind this belief.[38,39] A study conducted in 2007 on Native Americans regarding beliefs about smoking cessation found that most respondents had a negative attitude toward smoking cessation pharmacotherapy. This included fear of side effects, suspicion about the effects of

Table 4 Multiple Logistic Regression Results of Factors Associated with Beliefs Among College Students in Saudi Arabia About Using Behavioral Interventions in the Qassim Region (N=885)

	Characteristics Behavioral Interventions					
	Odds Ratio	95% Confidence Level	P-value	Marginal Effects	95% Confidence Level	P-value
Age group (years)						
18–23	Ref.			Ref.		
>23	1.605	1.105–2.333	0.013*	0.104	0.023 to 0.186	0.012*
Gender						
Male	0.623	0.387–1.003	0.052	−0.104	−0.209 to 0.001	0.051
Female	Ref.			Ref.		
Income (US$/month)						
≤990 SR ($264)	Ref.			Ref.		
>990 SR ($264)	0 0.937	0.414–2.117	0.876	−0.014	−0.19 to 0.166	0.876
Academic performance						
Excellent to good	Ref.			Ref.		
Poor to fail	1.465	0.7030–2.940	0.282	0.084	−0.069 to 0.237	0.281
Past 30 use smoke hookah						
Yes	0.691	0.479–0.996	0.048*	−0.081	−0.162 to −0.001	0.046*
No	Ref.			Ref.		
Harmfulness of hookah						
More harmful than cigarettes	Ref.			Ref.		
Same harmfulness as cigarettes	0.681	0.463–1.000	0.050	−0.087	−0.176 to 0.002	0.056
Less harmful than cigarettes	0.503	0.331–0.765	0.001*	−0.159	−0.259to −0.059	0.002*
Social acceptability						
None	Ref.			Ref.		
Low	1.317	0.933–1.859	0.118	0.061	−0.015 to 0.136	0.114
Medium	1.156	0.794–1.682	0.449	0.033	−0.051 to 0.116	0.446
High	1.746	0.848–3.595	0.130	0.118	−0.022 to 0.258	0.099

Note: *p<0.05.

such medications, and displeasure with using medications in general.[47] In the current study, the average age difference was very slight (mean = 22 ± 2.2) because this study was conducted among college students (studying for their bachelor's degrees). This might have resulted in a more narrow view of the association between age-related beliefs about medication and how it varies with age.

In addition, hookah smokers were less likely to believe in the effectiveness of both interventions. It could be assumed that they continue to smoke due to the effects of addiction, lack of willpower, and force of habit.[48] It is known that quitting smoking can be difficult because of the addictive effect of nicotine.[49] A pilot study conducted with 26 smokers in the United States found that most smokers who had tried to quit smoking without professional help had failed.[26] It is likely that hookah smokers

who are addicted to nicotine will not be willing to quit.[39] A subgroup analysis was performed with only the hookah smokers and found that only those smokers who were willing to quit had positive beliefs about the effects of the two interventions. Perceived causes are crucial because they influence the desire to seek treatment.[50] In contrast, in a Canadian study of youths showed that even those who were interested in quitting may have had negative beliefs about cessation programs.[51]

Furthermore, a negative association was found between participants who thought that hookahs are less harmful than cigarettes and a belief in the effectiveness of behavioral interventions. Some studies have found that hookah smokers thought the waterpipe was less harmful than cigarettes because of the filtering by bubbling in the water.[52] It has been found that hookahs contain significant

Table 5 Multiple Logistic Regression Results of Factors Associated with Beliefs Among Smoking College Students in Saudi Arabia Regarding the Use of Cessation Medications in the Qassim Region (n=70)

Characteristics	Smoking Cessation Medications					
	Odds Ratio	95% Confidence Level	P-value	Marginal Effects	95% Confidence Level	P-value

Age group (years)
  18–23
  >23
	Ref.
	2.609
		
		0. 804–8.467
			
			0.110
				Ref.
				0.174
					
					−0.023 to 0.703
						
						0.409

Income (US$/month) ≤990 SR ($264) >990 SR ($264)	Ref. 6.522	 0.0752–56.511	 0.089	Ref. 0.340	 −0.023 to −0.703	 0.066

Harmfulness of hookah
  More harmful than cigarettes
  Same harmfulness as cigarettes
  Less harmful than cigarettes
	Ref.
	0.272
	1.685
		
		0.054– 1.362
		0. 377–7.518
			
			0.113
			0.494
				Ref.
				−0.211
				0.095
					
					−0.441 to 0.020
					−0.175 to 0.366
						
						0.074
						0.489

Willingness to quit hookah smoking
  Yes
  No
	10.700
	Ref.
		2.882–39.724	<0.001*	0.429
				Ref.
					0.282 to 0. 576	<0.001*

How often do you smoke the hookah?
  1–3 times per week
  >3 times per week
	Ref.
	0.933
		
		0. 254–3.428
			
			0. 917
				Ref.
				−0.012
					
					−0. 248 to 0.223
						
						0.824

Owns hookah
  Yes
  No
	0.530
	Ref.
		0 0.154–2.821	0.314	−0.115	−0.332 to 0.103	0.301

Note: *p<0.05.

Table 6 Multiple Logistic Regression Results of Factors Associated with Beliefs Among College Smokers Students in Saudi Arabia Using Behavioral Interventions in the Qassim Region (n=78)

Characteristics	Behavioral Interventions					
	Odds Ratio	95% Confidence Level	P-value	Marginal Effects	95% Confidence Level	P-value

Age group (years)
  18–23
  >23
	Ref.
	1.427
		
		0.539–3.774
			
			0.473
				Ref.
				0.079
					
					−0.134 to 0.292
						
						0.468

Income (US$/month) ≤990 SR ($264) >990 SR ($264)	Ref. 4.033	 0.775–20.989	 0.097	Ref. 0. 309	 −0.032 to 0.652	 0.076

Willingness to quit hookah smoking
  Yes
  No
	3.637
	Ref.
		1.297–10.197	0.014*	0.286
				Ref.
					0.093 to 0.480	0.004*

How often do you smoke the hookah?
  1–3 times per week
  >3 times per week
	Ref.
	0. 910
		
		0.303–2.727
			
			0.867
				Ref.
				−0.021
					
					−0.264 to 0.223
						
						0.866

Note: *p<0.05.

levels of tar, nicotine, and heavy metals.[53,54] Participants who did not believe in the effects of behavioral interventions also thought that the hookah was less harmful than cigarettes, which implies that respondents who were aware of their risk were less likely to believe in smoking cessation interventions.

This study had some limitations. First, because a convenience sampling method was used, the possible influence of non-respondents on our study could not be detected. Second, because generalizability is restricted to a similar population, a cross-sectional analysis may raise questions about the causality, but not the associations among variables. Third, even though the identity of the student respondents was protected, they may not have revealed their smoking status for social or religious reasons.[20,21] Thus, the percentage of hookah smokers may be vulnerable to errors. Fourth, this study included 44 questions and was collected using a paper-based method. Thus, missing values may have affected the collected survey responses, especially at the end of the survey.

This study shed light on the importance of population beliefs, especially smokers, regarding smoking cessation interventions. Saudi Arabia is one of the top ten importers and consumers of tobacco worldwide,[14] and deaths caused by smoking negatively affect the country's economy.[8] Despite the negative effects on health, the prevalence of smoking is still high and continues to increase.[6,7] Saudi Arabia has lost 28,000 of its citizens through premature death and incurred costs of around US$20 billion between 2001 and 2010 owing to the smoking of tobacco.[19] If the smoking cessation services are not used, the cost of providing free smoking cessation services will be added to costs with no value. Hence, belief is of crucial importance to facilitate usage based on the HBM and TPB.

Conclusion

This study identified factors associated with belief in the effectiveness of cessation medications or behavioral interventions for quitting hookah smoking. A significant predictor of beliefs in the effectiveness of smoking cessation medications is being a hookah smoker and belief in the harmfulness of hookahs. For behavioral interventions, increasing age was positively associated with behavioral interventions. In contrast, factors negatively associated with beliefs in behavioral interventions are being a current hookah smoker and belief in the harmfulness of

hookahs. Willingness to quit smoking positively influenced belief in both cessation medications and behavioral interventions. Conducting behavioral studies is crucially important to increase the use of free health services, consequently improving health and decreasing the economic burden on individuals, society, and the government.

Abbreviations

HBM, health belief model; TPB, theory of planned behavior.

Ethical Approval

The study was approved by the Subcommittee of Health Research Ethics at the Deanship of Scientific Research at Qassim University (number: 13518). Furthermore, this study was performed according to the Declaration of Helsinki.

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Disclosure

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