ORIGINAL ARTICLE

Knowledge, Attitude and Practice on Electronic Cigarette and their Associated Factors among Undergraduate Students in a Public University

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ABSTRACT

INTRODUCTION: Smoking tobacco has been a longstanding issue worldwide, but the trend of smoking electronic cigarette (e-cigarette) is now on the rise. Many people assume that smoking e-cigarette is safer and less harmful than conventional cigarette smoking, which is worrying. Adolescents and young adults are easily influenced by advertisements on e-cigarette. Thus, this study was conducted to determine the knowledge, attitude and practice on e-cigarette among university students. **MATERIALS AND METHODS:** A cross-sectional study using self-administered questionnaire was carried out among 484 university students in a public university in Negeri Sembilan, Malaysia. **RESULTS**: Respondents were between 19- 25 year-old undergraduates, with the majority being female. 6.6% of the respondents were smokers, with nine having tried e-cigarette, where only one is a regular user. Bivariate analysis was carried out to analyse knowledge, attitude and practice scores on e-cigarette. There was significant association between gender with attitude and practice scores (p<0.001) on e-cigarettes, household income with attitude and practice scores (p=0.013 and p=0.001 respectively) on e-cigarette, as well as smoking status (p<0.001). Multivariate analysis revealed that being female and non-smoker were associated with higher attitude and practice scores on e-cigarette. **CONCLUSION**: In conclusion, the knowledge, attitude and practice on e-cigarette needs to be improved among young adults and a more holistic intervention strategy should be implemented to prevent the rise of e-cigarette smoking.

KEYWORDS: e-cigarette, vape, university students, smoking, tobacco.

INTRODUCTION

In recent years, the usage of electronic cigarette (e-cigarette) or more popularly known as 'vape' has become a trend among young adults in Malaysia. A nationwide study in Malaysia reported that majority of the current e-cigarette users are from the 25-44 year-old age group. Of concern, 86.5% of the respondents started vaping as early as 19 years of age.[1] Similarly, in the United States, a survey among young adults revealed that those aged between 18-24 years old were more likely to try e-cigarette than those of 31-35 years old.[2] Despite the inconclusive health outcomes and forbidden (*haram*) status of vaping from the National Fatwa Council of Malaysia,[3] e-cigarette has remained popular in Malaysia.[3,4]

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Smoking e-cigarette or vaping is the behaviour of inhaling vapourised solution from an electronic device that consists of a battery, automatic or manual switch, heating element and reservoir of flavoured liquid solution.[5] Despite the scarcity of long-term evidence on health from vaping, vapours produced from e-cigarette have been found to trigger similar immune responses caused by conventional cigarette smoking. In a scientific

review, frequent or short-term levels of exposure to fine and ultrafine particles from e-cigarettes can contribute to pulmonary and systemic inflammatory processes.[6] Carcinogenic compounds, such as diethylene glycol, lead, chromium, nickel and tobacco specific N-nitrosamines, have been found in e-cigarette cartridges, solutions and mist in varying amounts.[7,8] Centre for Tobacco Products, Food and Drug Administration (FDA) in the USA stated that from 2008 to 2012, they received 47 adverse events reports on e-cigarettes.[9] Several flavours and concentrations of e-cigarette liquids exist but the sources of ingredients and their manufacturing processes are unclear.[10]

Previous studies reported that many people have false perception towards smoking e-cigarette. In general, people view that vaping is harmless,[11,12] cheaper compared to conventional smoking,[13,14] non-polluting to the public,[11,15,16] and act as an effective smoking cessation tool.[12] However, the FDA has not approved e-cigarette as a smoking cessation tool. Prior studies revealed that more than 70% of their respondents have heard of e-cigarette.[12,17–19] But several studies have reported poor level of knowledge on e-cigarette. A study in the USA reported that almost a quarter of e-cigarette users (23%) were uncertain regarding harmful effects when comparing between e-cigarette and conventional cigarette.[20] Another study revealed that more than half (57.3%) did not know that some e-cigarettes contain nicotine.[21] Findings from a study among undergraduate students in Manila also reported 96.1% of students have poor knowledge with regards to design, chemical content, possible health effects, and regulation of e-cigarettes.[22] There is scarcity of publication regarding knowledge and awareness of vaping in Malaysia. Therefore, this study is aimed to determine the level of knowledge, attitude and practice on e-cigarette, and their associated factors among university students, focusing on students with a background from Islamic secondary school.

MATERIAL AND METHODS

Study Design

A cross-sectional study among 484 undergraduate students was conducted in Universiti Sains Islam Malaysia (USIM) from June 2016 to December 2016. Since the study was aimed at testing the knowledge on e-cigarette incorporating the knowledge from the Islamic perspective, USIM was chosen because it is the only public university in Malaysia that put formal Islamic education during secondary school as the entry requirement for its undergraduate program. Ethical approval was obtained from USIM ethical committee under the research code PPP/USG-0116/ FPSK/30/11416.

Sample Selection

Respondents were recruited via proportionate simple random sampling method based on the number of students from each faculty. Based on sample size calculation using OpenEpi software version 3.03a, with an additional of 20% anticipated non-responders, the minimum sample size required was 288 respondents. The inclusion criteria were undergraduate students who were willing to participate, have no physical or mental disability, and able to read and understand Bahasa Malaysia.

Study Instrument

A self-constructed questionnaire was used as a measuring tool to collect the data. It was pre-tested among Tamhidi students (Matriculation program in USIM). The questionnaire was constructed by the researchers based on "adapt-and-adopt" method from previous knowledge, attitude & practice (KAP) study on tobacco smoking.[23] A content validation was done and the questionnaire was reviewed by five experts namely public health physician, epidemiologist and family medicine specialist. The reliability of this questionnaire was calculated using Cronbach's Alpha statistical method with a value of 0.74.

The questionnaire was constructed in Bahasa Malaysia and structured into five parts. The first part consists of respondent's socio-demographic background such as age, sex, year of study, parent's monthly income, and marital status. The second section identified the respondents' smoking status regarding e-cigarette, as well as whether they knew anybody around them who smoked e-cigarette. The third, fourth, and fifth parts of the questionnaire examined their knowledge, attitude and practice towards e-cigarette respectively.

The level for each score components (knowledge, attitude, practice) were measured by the accumulated scores obtained. There were 11 questions pertaining to knowledge. The participants need to choose either they agreed or disagreed with the statements given. The questions were then scored 2 for correct answer, 1 for not sure and 0 for wrong answer. As for the attitude part, a total of 4 questions were included and the scoring was based on the 5-point Likert rating scale. For the positive statements, the scores were 5=strongly agreed, 4=agreed, 3=not sure, 2=disagreed, and 1=strongly disagreed. For the negative statements, the scores were 5=strongly disagreed, 4=disagreed, 3=not sure, 2=agreed, and 1=strongly agreed. The last part of the questionnaire was practice, which consisted 4 questions. The scores given were 2=good practice, 1=moderate practice and 0=bad practice. The maximum scores were 22 for knowledge, 20 for attitude and 8 for practice. Data from the questionnaire was coded and entered into SPSS version 23 for statistical analysis.

Data analysis

Descriptive analysis was conducted to determine the prevalence and sociodemographic factors of the study population. Results for continuous data were presented as mean and standard deviation (median and interquartile range for skewed data). For categorical data, the results were presented as frequency and percentage. Bivariate analysis was done to establish any relationship between the exposure variables (sociodemographic factors) with the outcome variables (KAP scores). For bivariate analysis, level of significance was pre-set at 0.05. Independent T-test (Mann-Whitney if the data were skewed) was conducted to determine the association between all the exposure and the outcome variables. Pearson correlation test (Spearman correlation test for skewed data) was used to determine the correlation between age, total knowledge, attitude and practice scores. For multivariate analysis, generalized linear model was used. Variables with significant results in the bivariate analysis were included in the multiple linear regression analysis. For multiple linear regression, significance level was pre-set at 0.05 and variables with *p*-value of <0.05 were then included in the final regression model.

RESULTS

Descriptive Analysis

Socio-demographic Characteristics

Table I shows the distribution of sociodemographic characteristics of the respondents. A total of 484 respondents participated the study, 140 males and 344 females aged between 19-25 years old with mean (SD) age of 20.95 (0.91). All but three were single. Household income ranged between RM 400 and RM 30,000 with a median (IQR) income of RM 4,000 (6,100).

Smoking background

Among the 484 respondents, 32 (6.6%) of them were smokers and all were male. 9 (28.1%) of the smokers have tried e-cigarette. 23 (71.9%) of the smokers smoked conventional cigarette, while only 3 (9.4%), 9

Table I. Distribution of respondents by socio-demographic, smoking backgrounds, knowledge, attitude and practice towards e-cigarette (n= 484).

Variables	N	%
AGE (YEARS OLD)		
19	5	(1.1)
20	165	(34.1)
21	189	(39.0)
22	104	(21.5)
23	17	(3.5)
24 and 25	4	(0.9)
MARITAL STATUS		
Single	481	(99.4)
Married	3	(0.6)
GENDER		
Male	140	(28.9)
Female	344	(71.1)
MONTHLY HOUSEHOLD INCOME (RM) (N= 463)		
< 3000	170	(36.7)
3000 - 5000	128	(27.7)
>5000	165	(35.6)
SMOKING STATUS		
Yes	32	(6.6)
No	452	(93.4)
EVER TRIED E-CIGARETTE (N=30)		
Yes	9	(30.0)
No	21	(70.0)
AGE OF SMOKING INITIATION (N=27)		
6 – 12 years old	4	(14.8)
13 – 15 years old	12	(44.4)
16 – 17 years old	5	(18.5)
18 years and above	6	(22.3)
RELATIVES/ FRIENDS USING E-CIGARETTE		
Close family	73	(16.2)
members	40	(8.8)
Relatives	220	(48.7)
Friends	119	(26.3)

(28.1%) and 15 (46.9%) have tried cigar, hand-rolled, and shisha respectively. Despite 452 (93.4%) respondents being non- smoker themselves, it is possible that they are passive smokers as they might be surrounded by smokers. 16.2% (n=73) and 8.8% (n=40) of non-smoker respondents have close family members and relatives respectively who used e-cigarette, almost half (n= 220, 48.7%) have friends, and about a quarter of them (n=119, 26.3%) have neighbours who smoked e -cigarette.

Knowledge, Attitude, and Practice related to e-cigarette

From a total of 22 marks in the knowledge section, more than half of the respondents (n=271, 56.0%) obtained a score of more than 50% with a mean (SD) score of 5.80 (2.04), a minimum score of zero was obtained by three respondents (0.6%), and a maximum of 22 were scored by three respondents.

The respondent's attitude score on e-cigarette had a total score of 20 with a median (IQR) score of 18.0 (4.0). As for the practice related to e-cigarette smoking, the median score (IQR) laid at 7.0 (1.0).

For the knowledge part, most of the respondents answered correctly for questions 1, 2, 4, 5, 8, 9 and 11 (marks ranging from 1.46 to 1.84). However, majority of them were unsure whether i) e-cigarette contained nicotine, ii) nicotine content has been standardized by Ministry of Health (MOH), iii) National Fatwa Council had declared that e-cigarette is forbidden in Islam. However, they agreed that e-cigarette is one of the ways to stop smoking.

For attitude, majority of the respondents strongly agreed that the selling of e-cigarette should be banned (n=302, 62.4%) and Muslim should not use e-cigarette (n= 371, 76.7%). Majority of the respondents also disagreed (n= 166, 34.3%) and strongly disagreed (n=199, 41.1%) that e-cigarette will not cause addiction to the users.

For practice, majority of the respondents cannot stay near to the individuals who is using e-cigarette (n= 377, 77.9%) and will be not be influenced by their friends who used e-cigarette (n=453, 93.6%). Most of the respondents will also advice their family members to stop using e-cigarette (n = 379, 78.3%).

Bivariate Analysis

Bivariate analysis (Table II) found that no factors had significant association with knowledge scores. As for attitude and practice, gender ($p<0.001$), household income ($p=0.02$ and $p=0.013$) and smoking status ($p<0.001$) were found to be significantly associated with both attitude and practice scores towards e-cigarette. Between knowledge, attitude, and practice towards e-cigarette, significant positive correlations were seen between attitude and practice scores, but the correlations were weak and moderate respectively ($r=0.333$, $p<0.001$). There was also significant correlation found between knowledge and practice scores towards e-cigarette ($p=0.029$), however the relationship found was a weak negative correlation ($r= -0.100$).

Table IIa. Results of bivariate analysis between age, gender, household income, smoking status with knowledge, attitude and practice towards e-cigarette (n=484).

Variables	N	%	Knowledge score			Attitude score			Practice score		
			Mean	SD	*p*-value	Mean	SD	*p*-value	Mean	SD	*p*-value
GENDER											
Male	140	28.9	15.7	2.39	0.498	16.1	3.04	<0.001	5.3	1.82	<0.001
Female	344	71.1	15.3	2.25		17.9	2.09		6.7	1.18	
SMOKING STATUS											
Smoker	32	6.6	15.2	2.52	0.67	14.1	2.81	<0.001	3.8	2.02	<0.001
Non-smoker	452	93.4	15.5	2.28		17.7	2.35		6.5	1.34	

Table IIb. Results of bivariate analysis between age, gender, household income, smoking status with knowledge, attitude and practice towards e-cigarette (n=484).

Variables		Knowledge score	Attitude score	Practice score
AGE	r	-0.04	-0.014	0.082
	p-value	0.385	0.753	0.07
HOUSEHOLD INCOME	r	0.071	-0.108	-0.116
	p-value	0.126	**0.02**	**0.013**
KNOWLEDGE	r	1	-0.026	0.054
	p-value	.	0.571	0.233
ATTITUDE	r	-0.026	1	0.333
	p-value	0.571	.	**<0.001**
PRACTICE	r	0.054	0.333	1
	p-value	0.233	**<0.001**	.

Multivariate Analysis

Significant bivariate results were included in the multivariate analysis. These include gender, household income and smoking status. The results for final regression model for multivariate analysis using generalized linear model showed that gender and smoking were significantly associated with attitude. Female students and non-smokers have better attitude scores. The mean attitude score among males is 1.231 units lower compared to females, and 2.631 units higher among non-smokers compared to smokers (Table III). Similar results were obtained for factors associated with practice (Table IV), whereby gender and smoking status were found to be significantly associated with higher practice scores. The mean practice score among the males is 1.033 units lower compared to female, and 1.925 units higher among non-smokers compared to smokers. The results for final regression model were summarized in Table III for attitude and Table IV for practice.

Table III. Final regression model of factors associated with attitude score towards e-cigarette smoking.

Variables	B	*p* value	95% CI	
			Lower	Upper
(Intercept)	15.318		14.38	16.255
Male	-1.231	<0.001	-1.728	-0.734
Female	1			
Non-smoker	2.632	<0.001	1.725	3.539
Smoker	1			

DISCUSSION AND CONCLUSION

Many studies found that smoking habits start during the adolescent years.[24–26] In this study, the prevalence was low possibly due to the higher number of female respondents participating in the study, nevertheless, it may not be the only reason as the number of female adolescent smokers has doubled within five years from 2.1% in 2012 to 5.3% in 2017.[27,28] Approximately 1 in 4 male respondents in our study smoked cigarette, which corresponds to the statistics of adult smokers in Malaysia.[27] When we examined the age of smoking initiation, it did not differ from previous studies, whereby the initial age of smoking was as early as six years old. This was supported by the findings of a local study, which found that smoking habits among Malaysians began as early as pre-school age.[29] Similar to other local and abroad surveys, the majority of the respondents started their habits during their early secondary school ages.[29–31]

Table IV. Final regression model of factors associated with practice score towards e-cigarette smoking.

Variables	B	*p* value	95% CI	
			Lower	Upper
(Intercept)	4.814		4.281	5.347
Male	-1.033	<0.001	-1.316	-0.751
Female	1			
Non-smoker	1.925	<0.001	1.409	2.44
Smoker	1			

The prevalence of e-cigarette smoking in this study was quite low compared to the national Tobacco & E-cigarette Survey Among Malaysian Adolescents (TECMA) which found that 9.1% of adolescent were e-cigarette users.[32] Despite that, the issue of e-cigarette is undeniably an important issue among university students, since the use of these smokeless tobacco among Malaysian adults has tremendously increased from 0.8% in 2011 to 11.5% in 2015.[27,33] Despite not being smokers themselves, the students are exposed to

the dangers of e-cigarette from surrounding people or even family members. In this study, the overall knowledge on e-cigarette is considerably low among the students. However, in a study conducted in another local university with Islamic education, the level of knowledge on smoking among their students and workers was found to be high.[23] Given that half of the participants in that study were university staff, it is possible that they have more knowledge on e-cigarette compared to students. The percentage of respondents in our study who were unsure of the contents inside the cigarette was similar to the findings in a study in Pakistan.[34] When asked whether it contained nicotine, slightly more than half (53.1%) answered 'yes' and only 28.5% respondents answered that it does not contain tar.

Regarding the Islamic knowledge on e-cigarette, despite having Islamic education embedded into the undergraduate syllabus, not all participants knew the Islamic ruling on e-cigarette. Only 54.5% were certain that smoking e-cigarette posed the same rule of being impermissible as regular cigarette, and only 43.0% were aware that it has been declared as such by National Fatwa Council, Malaysia.[3]

The overall attitude scores in the present study showed that many of the respondents are opposed to e-cigarette smoking. This concurs with two other studies among university students in Philippines as well as adults in Hong Kong, but the opposite was found in a study among adolescents in California.[22,35,36] This suggests that the attitude towards e-cigarette varies across communities and countries, most likely due to the difference in culture and lifestyle.

As for the practice against e-cigarette smoking, most of them (78.3%) will and have advised family members to stop smoking e-cigarette. This is much higher than what was found in a study on practices regarding smoking cessation in Hong Kong.[36] On the other hand, although many of them (77.9%) preferred not to sit or be around people who smoke e-cigarettes, only 27.7% of the respondents are willing to lodge a report to authorities regarding knowledge of any premises involved in an illegal e-cigarette business.

Association between socio-demographic factors and knowledge, attitude and practice

Although household income was found to have significant association with tobacco use among adults in Malaysia,[37] the association with attitude and practice opposing e-cigarette behaviour among the students had only weak correlations ($r = -0.115$ and $r = 0.153$ respectively). No significant association was seen with knowledge. Similarly, a study by Lozano et al. (2015) found that among university students in Philippines, socio-economic status did not contribute to any differences in the knowledge, attitude and practice towards opposing e-cigarette smoking.[22]

Gender differences were found in the knowledge, attitude and practice scores towards opposing e-cigarette. Male students were found to have higher knowledge scores (mean (SD) = 6.31 (2.06)) compared to female (mean (SD) = 5.60 (2.00)). The finding was in line with another study that reported young women have relatively poor knowledge on smoking behavior.[34,38,39] This is probably due to the differences in their risk perception and risk-taking behaviour, which may influence the male participants to explore more information on risk-taking behaviour.[40] Our results however differs from another study which emphasized that female participants have higher knowledge on smoking than the male, but their finding was not significant.[23] Despite the higher knowledge among male students in this study, their mean scores for attitude and practice were lower than the female students. This is further supported by a study among teenagers, where they noticed female had less positive outlooks and perception towards e-cigarette compared to male.[34] This could also be attributed to the differences between gender in perceiving and practicing risk-taking behavior.[40]

Another factor associated with better attitude and practice was smoking status. Smokers were found to have lower scores for attitude and practice. Attitude against tobacco use among non-smokers was also observed to be prevalent in a study conducted among 2489 adults.[41] It is not surprising that those who have tried e-cigarette have more positive perceptions towards e-cigarette.[42] Perhaps, because they have tried themselves and felt no difference in health or other

effects. In another study, adolescents who smoked cigarettes were identified to have more positive believe towards e-cigarette and were more willing to try e-cigarette compared to non-smoking adolescents.[43] The differences in practice were also prominent between smokers and non-smokers. Although knowledge was found not to have significant association with smoking status, the mean score of knowledge on e-cigarette was higher among smokers compared to non-smokers. This shows that smokers have more awareness and knowledge on e-cigarette, which is in agreement with a study conducted in Pakistan.[39]

Association between Knowledge, Attitude and Practice

In our study, we found that having high knowledge on e -cigarette was associated with higher attitude score. A study conducted in the United States reported that having high knowledge on smoking was associated with better attitude, thus leading to effective tobacco control.[41] This association also concurs with a local study among university staff and workers.[23] The association between knowledge and practice was found to have a negative relationship. Students with higher knowledge on e-cigarettes had lower practice scores. When analysed according to smoking status, smokers were found to have similar knowledge scores compared to non-smokers but their practice scores were significantly lower compared to the same group. Thus, having more knowledge about e-cigarette does not translate into practices that is opposed to the behaviour. A positive relationship was seen between attitude and practice. Students having higher attitude scores were found to have higher practice scores. Therefore, instituting a more negative perception on e-cigarette smoking would improve the community awareness and culture.

Limitation of study

Despite the increasing trend in vape use based on the national evidence, our study noted a very low prevalence of vape use among the students, which the inconsistencies could be due to the limitation in this study. Given the sensitive nature of smoking issues especially among religious background students, under reporting might have contributed to the low prevalence. On top of that, in general, university students have just surpassed the legal age of smoking. They might still have the 'guilt' insight of smoking as what they perceived during their school days, which could influence their willingness to disclose their smoking status. Furthermore, this study was participated by female students as majority of respondents. We have tried selecting the students in random manner, however, many male participants refused to join probably due to the sensitive issues which might create discomfort among the students although anonymity of respondents were assured.

CONCLUSION

Our study revealed that the prevalence of vape use is low among the participants. Despite that, as cigarette and e-cigarette smoking are crucial issues in the societies, they should have a good knowledge regarding the matter. However, our study has revealed that university students, who were still young, were insufficiently exposed to the knowledge on e-cigarette smoking. Knowledge on tobacco smoking and its health effect including on e-cigarette and other forms of tobacco consumption should be instilled in schools as many of them had started their habits since then. Community awareness towards e-cigarette should be improved to create a healthier culture. Lastly, government should implement policies with regard to controlling the impact of e-cigarette.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

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