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Knowledge, Awareness, Beliefs and Prevalence of E–Cigarettes Usage Among Undergraduate Students in a Private Medical College in Malaysia

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Abstract

It known that 13.8% undergraduate students in Malaysia are using E-cigarettes and they have different views and perceptions regarding this issue. Our objective is to determine the knowledge, awareness, beliefs and prevalence of the use of Electronic cigarettes among undergraduate students in Malaysia and to determine the factors associated with knowledge, awareness, beliefs and prevalence of the use of Electronic cigarettes among undergraduate students in Malaysia. A cross-sectional study was conducted from September 2019 to October 2019 in Melaka-Manipal Medical College (MMMC). Data were collected using self-administered questionnaire and online questionnaires designed in English. Chi square test and logistic regression analysis were used. Level of significance was set at $P < 0.05$ and Odds ratio (OR) was calculated. 8.46% of undergraduate students practice smoking E-cigarettes. In multiple logistic regression analysis, knowledge was the only significant association with the practice of E-cigarettes (OR: 0.96; 95%CI 0.94-0.99; *p*-value 0.003). Younger aged students had a significant association with knowledge on E-cigarettes compared to older aged students (OR: 0.05; 95%CI 0.01-0.47; p-value 0.024). There was a significant association between students living in hostels and their belief towards E-cigarettes and students living outside hostels (OR: 0.47; 95% CI 0.23-0.97; x^2: 4.25; p-value 0.039). Foundation in Science students were significantly aware of E-cigarettes (OR: 0.45; 95%CI 0.21-0.96; x^2: 4.45; p-value 0.035). There was a significant association between male gender and E-cigarette smoking compared to females (OR: 7.29; 95% CI: 2.00-26.47, p value: <0.001). Based on our study, knowledge, male gender, family members who smoke and friends who smoke has an impact on E-cigarette smoking among undergraduate students.

Keywords

E-cigarettes, Medical Students, Knowledge, Attitude, Beliefs, Prevalence, Cross-sectional

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1. Introduction

Electronic cigarettes are part of Electronic nicotine delivery systems (ENDS) and electronic non-nicotine delivery systems (ENNDS) which are battery operated devices that have similar functions as traditional tobacco cigarettes. It is commonly available with nicotine although some may be non-nicotinic and obtainable in a variety of flavours and contains other harmful chemicals. [1] The chemical mixture in E-cigarettes contain nicotine, propylene glycol, glycerine, and flavouring agents which are aerosolized, inhaled and transported to the lungs. [2] Currently, it is actively used as a smoking cessation aid and a substitute to conventional cigarette smoking in many countries. [3]

E-cigarette are commonly used in young adults, smokers, and people who have recently quit smoking, according to reports from centre of disease control and prevention [4] and it is also noted to be common in older teens and college students

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who are trying it on experimental basis. [5, 6] The universality of flavourings appears to be an attraction to the teens and with poor enforcement of the law and restrictions of the usage of E-cigarettes in social venues have led to the rising popularity of E-cigarettes. [7] The use of E- cigarettes in adolescents have been associated with older age, the male gender, a higher income, addiction to smoking and having friends who smoke, and despite the rampancy among the users, they were awareness was unanimous. [8, 9]

According to a survey conducted from 2009 to 2013 in 10 countries by the International Tobacco Control Policy Evaluation Project [ITC Project] the country with the highest prevalence was Malaysia with a 14% usage. Reports also revealed countries like the Republic of Korea and Australia were at 7%, United States at 6%, United Kingdom at 4%, Netherlands at 3%, Canada at 1% and lastly the least was China with 0.05% [1]. The usages of these devices have been banned in other countries such as India [10], Singapore, Brazil and Uruguay [11]. Since E-cigarette have been around for nearly a decade, the long-term side effects are undetermined [12] however, according to the American Thoracic Society, various motifs of pulmonary damage have been reported and they are termed as vaping Associated Pulmonary Illness (VAPI). These VAPI include acute eosinophilic pneumonia, lipoid pneumonia, acute respiratory distress syndrome and acute lung injury, acute and sub-acute hypersensitivity pneumonitis, respiratory bronchiolitis-associated pneumonitis and a few others. [13] The use of ENNDS in healthy young non-smokers has also shown to precipitate a transient impairment of vascular reactivity and endothelial function. [14] This is suggestive of the need of more studies to ensure the safety of the use of E-cigarettes and the need for immediate regulations on its use.

The prevalence in adults engaged in the use of E-cigarettes in Malaysia is 14% according to a cohort study done by the International Tobacco Control (ITC) policy evaluation project from 2009 to 2013 in adults aged 18 and above.[15] In Malaysia, initially, a few states implemented the law to ban the practice of E-cigarettes. [16] Nonetheless, in 2015, there was a decrease in the number of E-cigarette users after the government implemented the law stating that selling of E-cigarette cartridges containing nicotine is strictly regulated under Poison Act (1952) and Dangerous Drugs Act (1952). [17, 18] In 2015 the Higher-Education Minister of Malaysia announced a ban on E-cigarette use and tobacco smoking in universities. [19] In 2017, a survey was conducted among undergraduate students of health science course at International Medical University, Malaysia regarding awareness, perception, and prevalence of E-cigarettes. It was found that 95% of the undergraduate students of health science course at International Medical University, Malaysia were aware and 13.8% had been using E-cigarettes and they have different views and perceptions regarding this issue [19] but to our knowledge there is a lack of understanding regarding the knowledge, awareness, beliefs and the prevalence of the use of E-cigarettes among the undergraduate medical students in Malaysia thus our study focuses on this aspect. It is important that we understand the depth of knowledge, awareness, beliefs and prevalence of the use of E-cigarettes among undergraduate medical students as they are the future of the medical profession and as E-cigarette is a practice commonly observed among the youth population since the younger generation is easily influenced by new technology.

Our objective is to determine the knowledge, awareness, beliefs and prevalence of the use of Electronic cigarettes among undergraduate students in a private medical college in Malaysia and to determine the factors associated with knowledge, awareness, beliefs and prevalence of the use of Electronic cigarettes among undergraduate students in a private medical college in Malaysia.

2. Methodology

2.1. Study Design and Study Population

The study conducted was a cross sectional approach, conducted from September 2019 to October 2019. Undergraduate students of Melaka Manipal Medical College, a private institution located in Malaysia which consists of two campuses, in Muar, Johor and Bukit Baru, Melaka was part of this study. This campus consists of 3 courses, Foundation in Science (FIS), Dentistry (BDS) and Medicine (MBBS). For this study, students of MBBS and FIS are chosen to compare the knowledge, awareness, beliefs and prevalence of the use of e-cigarettes in students with pre-clinical exposure and clinical exposure. There is a total of 4 batches in MBBS course and 2 batches in FIS course. In Muar campus, there is one MBBS batch and the other 3 batches of MBBS are in Melaka campus whereas the FIS students of 2 batches are also studying in Melaka campus.

2.2. Sample Size

In Malaysia, 14% of prevalence was recorded among the adults for usage of the e-cigarettes [14]. The estimated total population was 600 students. The number of samples taken was n= 203 from the MBBS batch and FIS batch by using the formula in the figure below:

$$n(calculated) = \frac{N * X}{X + N - 1}$$

$$X = \frac{\mathrm{Z}^2 * \mathrm{P}(1 - \mathrm{P})}{\mathrm{E}^2}$$

Where;

Z: 95% confidence level (1.96)

P: expected prevalence or proportion (14%)

E: desired width of the confidence interval (5%)

$$n(final) = \frac{n\ (calculated)}{1 - (non - response)}$$

$$n(final) = \frac{142}{1 - 0.30}$$

Non-response: 30%

A total of 203 participants were chosen from a population of 600 MBBS and FIS student in Melaka Manipal Medical College, they were chosen via purposive sampling, a non-probability method.

Inclusive criteria of this study were 1) undergraduate students 2) willing to provide informed consent 3) students of Melaka Manipal Medical College. Exclusive criteria were 1) students on leave and/or not attending classes. 2) students suspended by the university 3) students who do not wish to participate in the study 4) incomplete questionnaire.

2.3. Data Collection

The data was collected by the distribution of questionnaires during a lecture class to the targeted undergraduate students in Melaka Manipal Medical College which involved students from MBBS and an online questionnaire was used to collect data from FIS. Students were given 30 minutes to read the participant information and voluntarily participate in the study and complete the informed consent and the questionnaire.

This study investigates the association between the independent and dependent variables. Independent variables of this study were age, gender, ethnicity, nationality, semester, living arrangement, socioeconomic status, monthly allowance, smoking status of the student and smoking status of his/ her family and/ or friends. Dependent variables were as follows; knowledge, awareness, beliefs, and prevalence of use. Data were collected using self-administered questionnaire, designed in English and consists of open-ended, close-ended and multiple-choice questions. Survey items were formulated based on previously published articles. [20-25]

The questionnaire was divided into 6 parts: 1) demographic profile, 2) smoking status of participants, 3) knowledge, 4) awareness, 5) beliefs and 6) prevalence of smoking E-cigarettes by participants. Demographic profile includes age, gender, nationality, ethnicity, living arrangement, semester of study, socioeconomic status. Smoking status, knowledge, awareness and belief section were designed as close-ended questions. Smoking status of participants was identified by a close-ended question with the choice of non-smoker, ex-smoker and current smoker. Both ex and current smoker choices were followed up by another close- ended question with the choices of cigarettes used; E-cigarettes, tobacco or both. Cronbach's alpha coefficient was done and for knowledge questions it was 0.454, awareness questions 0.543, belief questions 0.279 and prevalence questions 0.862. For the knowledge section of the questionnaire, there were 7 statements regarding E-cigarette. Examples were "Electronic cigarettes contain toxic chemicals", "Nicotine in Electronic cigarettes is extracted from tobacco". For each statement, participants can choose either "True", "False" or "Not sure". Every "True'' answer was given a score of 1, and for every "False" and "Not sure" answer, a score of 0. The awareness section of the questionnaire was made up of 8 questions. Examples of questions were, "Have you heard of Electronic cigarettes?", and "Are you aware that e- cigarette is a nicotine delivery system?" Participants were given the choice of "Yes" and "No". Participants' beliefs regarding E cigarettes were identified by 6 questions and statements, for example, "E- cigarettes can help smokers to quit" and "Do you think E cigarettes should be prohibited?" Each answer was noted. Prevalence of smoking E-cigarettes were designed as a multiple-choice question. It starts with the question "Have you personally tried an E- cigarette?" Participants can either choose "Yes "or "No". Then, an instruction was given to participants who were currently smoking to answer 3 follow up questions. First question, "When did you start using E- cigarettes?" Participants can choose from 4 choices ranging from "During the last 30 days" to "More than a year ago". Second question was "On average how frequently?" There were 4 choices ranging from "Less than once per month" to "Daily". The last question was "Which is the main reason why you use E- cigarettes?" Participants were given 8 choices to choose from. For example, "To completely stop smoking" and "To replace tobacco use with E-cigarettes use".

2.4. Data Processing and Data Analysis

Data collected was entered into Microsoft Excel. Data was then analysed using Epi Info version 7.1.5.0

In the study, qualitative data such as gender, nationality, ethnicity, and residence, semester of study, monthly household income, and monthly allowance, and smoking status, questions on awareness, beliefs and prevalence were analysed to derive frequency and percentage. For quantitative data, like age, and knowledge, was analysed to derive mean and range. Standard deviation (SD) was then calculated from mean.

Level of significance was set at P = 0.05 multivariable

analyses were carried out to calculate Odds Ratio (OR) for the association between independent and dependent variables.

Following statistical test was used in our study:

Table 1. Independent and dependent variables with statistical test.

Independent Variable	Dependent Variable	Statistical Test
Age	Knowledge	Chi Square test
Gender	Knowledge	Chi Square test
Ethnicity	Knowledge	Chi Square test
Nationality	Knowledge	Chi Square test
Monthly household income	Knowledge	Chi Square test
Monthly allowance	Knowledge	Chi Square test
Accommodation	Knowledge	Chi Square test
Semester	Knowledge	Chi Square test
Smoking status	Knowledge	Chi Square test
Family members smoking	Knowledge	Chi Square test
Friends smoking	Knowledge	Chi Square test

Independent Variable	Dependent Variable	Statistical Test
Age	Awareness	Chi Square test
Gender	Awareness	Chi Square test
Ethnicity	Awareness	Chi Square test
Nationality	Awareness	Chi Square test
Monthly household income	Awareness	Chi Square test
Monthly allowance	Awareness	Chi Square test
Accommodation	Awareness	Chi Square test
Semester	Awareness	Chi Square test
Smoking status	Awareness	Chi Square test
Family members smoking	Awareness	Chi Square test
Friends smoking	Awareness	Chi Square test

Independent Variable	Dependent Variable	Statistical Test
Age	Beliefs	Chi Square test
Gender	Beliefs	Chi Square test
Ethnicity	Beliefs	Chi Square test
Nationality	Beliefs	Chi Square test
Monthly household income	Beliefs	Chi Square test
Monthly allowance	Beliefs	Chi Square test
Accommodation	Beliefs	Chi Square test
Semester	Beliefs	Chi Square test
Smoking status	Beliefs	Chi Square test
Family members smoking	Beliefs	Chi Square test
Friends smoking	Beliefs	Chi Square test

Independent Variable	Dependent Variable	Statistical Test
Knowledge Awareness Beliefs	Practice	Logistic Regression

2.5. Ethical Consideration

Participants were made aware by the informed consent that entering the research study was completely voluntary. They were able to withdraw at any time without any reason. All information obtained was anonymous and confidentiality was maintained by omitting participants roll number in the analysis. This research was approved by the Research Ethics Committee, Faculty of Medicine, Melaka-Manipal Medical College, Malaysia.

3. Results

Table 2. Sociodemographic characteristics of undergraduates' students (n=).

Variable	n (%)
Age	
<22	65(32.34)
22-25	4(1.99)
>25	132(65.67)
Mean (SD)	21.65(2.14)
Gender	
Male	82(40.80)
Female	119(59.20)
Nationality	
Malaysian	159(79.10)
Non-Malaysian	42(20.90)
Ethnicity	
Malay	37(18.41)
Chinese	50(24.88)
Indian	67(33.33)
Others	47(23.38)
Residence	
Hostel	160(79.60)
Non-Hostel	41(20.40)
Monthly household Income	
< 3000	35(17.41)
3001-6500	41(20.40)
6501-13000	68(33.83)
>13000	57(28.36)
Monthly Allowance	
<1000	145(72.14)
1000-3000	52(25.87)
>3000	4(1.99)

Table 2 shows the sociodemographic characteristics of undergraduate students. Age of the students were divided into 3 groups in this study, 32.34% were less than 22 years, 1.99% were between the ages of 22 to 25, and the highest percentage was 65.67% from ages more than 25. The mean age was 21.65 years with a standard deviation of 2.14. Majority of the students were females, 59.2% compared to males, and 40.8%. 79.1% of students were Malaysians and 20.90% were non-Malaysians. The percentage of Indians students in this study was 33.33%, followed by 24.88% Chinese students, 23.38% of other ethnicity, and 18.41% Malay students. A high percentage of students, 79.6% were living in the hostels compared to the students not living in the hostels 20.4%. About 33.83% students had a monthly household income of 6501-13000, followed by more than 13000 which were 28.36%, 3001-6500 with a percentage of 20.4% and lastly 17.41% students with less than 3000 as their monthly household income. Monthly allowance for the majority of our students were less than 1000 ringgit, which was 72.14% followed by 1000 to 3000 ringgit, 25.87% and more than 3000 ringgit which was 1.99%.

Table 3. Prevalence of E-cigarette among undergraduate students.

Variables	n (%)
Smoking status	
Non smoker	178(88.56)
Current smoker	
Electronic cigarettes	5(2.49)
Tobacco	1(0.50)
Both	12(5.97)
Ex-smoker	
Electronic cigarettes	1(0.50)
Tobacco	3(1.49)
Both	1(0.50)
Family members smoking	
Non smoker	143(71.14)
Electronic cigarettes	6(2.99)
Tobacco	34(16.92)
Both	18(8.96)
Friends smoking	
Non smoker	41(20.40)
Electronic cigarettes	21(10.45)
Tobacco	11(15.92)
Both	128(79.60)
Personally tried e cigarettes	
Yes	44(22.0)
No	156(78.0)
Smoking e cigarettes	17(8.46)
Start using e- cigarettes	
Last 30 days	2(11.76)
More than one month ago but <6 months	2(11.76)
More than 6 months but <1 year ago	5(29.41)
More than 1 year ago	8(47.6)
Frequency of using e-cigarettes	
Less than once per month	1(5.88)
Monthly	3(17.65)
Weekly	2(11.76)
Daily	11(64.71)
Reasons of using e cigarettes	
To completely stop smoking	7(43.75)
To reduce tobacco consumption without completely stop smoking	7(43.75)
To replace tobacco use with e- cigarettes use	8(50.0)
To reduce the amount of money spent on tobacco	8(50.0)
To have convenience smoking wherever place	12(75.0)
To reduce troubles related to tobacco use	0(0)
To reduce health risks without stopping smoking tobacco	0(0)
To stop being nicotine addicted/ progressively reduce nicotine addiction	9(56.25)

Table 3 shows the prevalence of E-cigarette among undergraduate students. The smoking status among undergraduate student, 88.56% were non-smokers, current smokers who smoke E-cigarettes were 2.49%, current tobacco smoker was 0.5% and both tobacco as well as E-cigarette smokers were 5.97%. For Ex E-cigarette smoker it was 0.5%, ex tobacco smoker was 1.49% and ex-smoker for both tobacco and E-cigarettes were 0.5%. There were 71.14% of non-smokers in family members whereas those who smoke E-cigarette were 2.99%, tobacco smoker was 16.92%, both tobacco and e-cigarette smoker was 8.96%. Among friends, 20.40% were non-smokers, 10.45% were E-cigarette smokers, and 15.92% were tobacco smokers and 79.6% were practicing for both tobacco and e-cigarette smoking. 22% had personally tried E-cigarette and 78% had never tried an e-cigarette. There was a total of 8.46% undergraduate students who smoke E-cigarettes.

For descriptive purposes, we have divided the point of initiating E-cigarette use amongst current smokers: 11% last 30 days, 11.76% more than one month ago but less than 6 months, 29.41% more than 6 months ago but less than 1 year ago and 47.6% started using more than 1 year ago. Of the 17 participants who were using E cigarettes, 5.88% uses it less than once per month, 17.65% uses it monthly, 11.76% weekly and 64.71% daily. Amongst participants who were smoking E- cigarettes, more than half (75%), have chosen “to have convenience smoking wherever place” as a reason to smoke. This was followed 56.25% who smoke e cigarettes to stop being addicted to nicotine/ progressively reduce nicotine addiction, 50% to replace tobacco use with E-cigarettes use, and 50% to reduce the amount of money spent on tobacco. 43.75% to completely stop smoking and to reduce tobacco

consumption without completely stop smoking. None of the current smokers have chosen "to reduce troubles related to tobacco use" and "to reduce health risk without smoking tobacco" as a reason to start using E cigarettes.

Table 4. Frequency of Knowledge, Awareness and Belief in undergraduate students.

Variable	n (%)
Knowledge	
Good	22(10.95)
Need to improve	179(89.5)
Awareness	
Good	83(41.29)
Need to improve	118(58.71)
Beliefs	
Good	53(26.37)
Need to improve	148(73.63)

Table 4 shows 10.95% of participants had good knowledge while 89.5% needed to improve their knowledge; each represents 22 and 179 participants respectively. 83 participants had good awareness with percentage of 41.29% while 118 participants with 58.71% needed to improve their awareness. Next, 53 participants equal to 26.37% had good beliefs as the other 73.63% needed to improve their beliefs that was corresponding to 148 participants.

Table 5. Frequency of knowledge of E-cigarette in undergraduate students.

Knowledge	Correct answer n (%)
Electronic Cigarettes contain toxic chemicals.	165(82.09)
Electronic cigarettes contribute to the development of smoking- related disease.	139(69.15)
Electronic cigarettes are cheaper than spending on normal tobacco.	93(46.27)
Electronic cigarettes are banned in certain states in Malaysia.	87(43.28)
Dependence potential of Electronic cigarettes is lower than tobacco smoking.	83(41.29)
The harmful effect of electronic cigarettes is due to diethylene glycol.	75(37.31)
Nicotine in Electronic cigarettes is extracted from tobacco.	74(36.82)

Table 5 shows 165 participants with percentage 82.09% knew that E-cigarettes contain toxic chemicals. 75 participants that were equal to 37.31% knew the harmful effects of E-cigarettes are due to diethylene glycol. 43.28% representing 87 participants knew that E-cigarettes were banned in certain states in Malaysia. For knowing that E-cigarettes are cheaper than spending on normal tobacco, 93 participants equal to 69.15% answered correctly. 74 participants with percentage of 36.82% knew that nicotine in E-cigarettes was extracted from tobacco. 41.29% from total sample representing 83 participants knew that dependence potential of E-cigarettes was lower than tobacco smoking.

Table 6. Frequency of awareness of E-cigarette in undergraduate students.

Awareness	Yes n (%)
Have you heard of electronic cigarettes (E-cigarette)?	195(97.01)
Are you aware that an e-cigarette can be inhaled with different flavors (i.e. Peach)?	190(94.53)
Do e-cigarettes come with cartridges/tanks of different volumes/capacity?	182(90.55)
Are you aware that an e-cigarette can be inhaled with different additives (i.e. Nicotine)?	162(80.60)
Are you aware that an e-cigarette is nicotine delivery system?	155(77.11)
Are you aware that e-cigarette do not present with signs related to tobacco use (bad breath, yellow teeth, tobacco smell)?	134(66.67)
Are there electronic cigarettes which are nicotine free?	114(56.72)
Is there no combustion in an e-cigarette?	68(33.83)

Table 6 highlights one of the 4 main parts of our questionnaire containing 8 questions on awareness. The highest awareness amongst 201 participants was 97.01% for "Have you heard of electronic cigarettes (E-cigarette)?" and the lowest awareness rate was 33.83% for "Is there no combustion in an e-cigarette?" The remaining questions had a good awareness rate, over 50%, with 77.11% aware that an e-cigarette is a nicotine delivery system, 80.60% aware that an e-cigarette can be inhaled with different additives (i.e. Nicotine), 56.72% aware that there are electronic cigarettes which are nicotine free, 94.53% aware that an e-cigarette can be inhaled with different flavors (i.e. Peach), 90.55% aware that e-cigarettes come with cartridges/tanks of different volumes/capacity and 66.67% aware that e-cigarette do not present with signs related to tobacco use (bad breath, yellow teeth, tobacco smell).

Table 7. Frequency of belief on E-cigarette in undergraduate students.

Belief	Yes n (%)
It is important for physicians to be educated about e-cigarettes.	190 (94.53)
Electronic cigarettes can generate addiction.	182 (90.55)
Do you think that electronic cigarettes should be prohibited?	129 (64.18)
E-cigarettes are less dangerous than traditional cigarettes.	100 (49.75)
E-cigarettes can help smokers to quit.	93 (46.27)
Would you recommend the electronic cigarette as smoking cessation aid to anyone?	64 (31.84)

Table 7 this part of our questionnaire contained 6 questions on beliefs in regards to e-cigarettes. Among 201 participants 94.53% believe that it is important for physicians to be educated about e-cigarettes, 90.55% believe electronic cigarettes can generate addiction, 64.18% believe that electronic cigarettes should be prohibited, 49.75% believe e-cigarettes are less dangerous than traditional cigarettes, 46.27% believe e-cigarettes can help smokers to quit and 31.84% would recommend electronic cigarettes as smoking cessation aid to anyone.

Table 8. Association between age, gender, nationality, ethnicity, residence, batch, socioeconomic status, smoking status among family and friends toward knowledge on E-cigarettes among undergraduate students.

Independent Variables	Knowledge		OR (95% CI)	Chi-Square	P value
	Good n (%)	Need to improve n (%)			
Age					
22	3(4.62)	62(95.38)	0.05(0.05-0.47)	-	0.024
22-25	17(12.88)	115(87.12)	0.15(0.02-1.12)	-	0.093
>25	2(50)	2(50)	1(Reference)		
Gender					
Male	11(13.41)	71(86.59)	1.52(1.63-3.70)	0.87	0.352
Female	11(9.24)	108(90.76)	1(Reference)		
Nationality					
Malaysian	17(10.69)	142(89.31)	1.52(0.63-3.70)	0.87	0.352
International	5(11.90)	37(88.10)	1(Reference)	-	
Ethnicity					
Malay	3(8.11)	34(91.89)	0.94(0.20-4.53)	-	>0.999
Chinese	10(20.00)	40(80.00)	2.69(0.78-9.26)	2.59	0.108
Indian	5(7.46)	62(92.54)	0.87(0.22-3.42)	-	>0.999
Others	4(8.51)	43(91.49)	1(Reference)		
Residence					
Hostel	18(11.25)	142(88.75)	1.17(0.37-3.67)	-	0.099
Non-hostel	4(9.76)	37(90.24)	1(Reference)		
Batch					
FIS	3(7.32)	38(92.68)	0.59(0.16-2.08)	-	0.577
MBBS	19(11.88)	141(88.13)	1(Reference)		
Monthly household income					
<RM3000	5(14.29)	30(85.71)	1.42(0.40-5.04)	-	0.742
RM3001-RM6500	6(14.63)	35(85.37)	1.46(0.43-4.89)	-	0.550
RM6501-RM13000	5(7.3)	63(92.65)	0.67(0.19-2.34)	-	0.546
>RM13001	6(10.53)	51(89.47)	1(Reference)		
Monthly allowance					
<RM1000	13(8.97)	132(91.03)	0.30(0.03-3.05)	-	0.329
RM1000-RM3000	8(15.38)	44(84.62)	0.54(0.05-5.92)	-	0.514
>RM3000	1(25.00)	3(75.00)	1(Reference)		
Family members smoking					
Smoker	4(6.90)	54(93.10)	0.51(0.17-1.59)	1.37	0.242
Non smoker	18(12.59)	125(87.41)	1(Reference)		
Friends smoking					
Smoker	16(10.00)	144(90.00)	0.65(0.24-1.78)	-	0.405
Non smoker	6(14.63)	35(85.37)	1(Reference)		

Table 8 describes the association between the sociodemographic profiles toward knowledge on E-cigarettes among undergraduate students in a private medical college. According to our study, the odds of having good knowledge is less likely in the less than 22 years old age group compared to the more than 25 years old group. Findings were significant (95%CI 0.01-0.47; p-value 0.024). In comparison to 22-25 years age group, it was found that the odds of having good knowledge were 0.15 times more compared to the students above 25 years of age. Findings were not significant (95%CI 0.02-1.12; p-value 0.093). As for gender, it was found that the odds of a male having good knowledge was 1.52 times more likely than females. However, findings were not significant (95%CI 0.63-3.70; $x^2$0.87; p-value 0.352). The data showed that the odds of having good knowledge are 0.89 times less likely in Malaysian students as compared to International students. Findings were not significant (95%CI 0.31-2.56; x^2 0.05; p-value 0.823). The odds of having good knowledge were 0.94 times less likely in Malays than Others. Findings were not significant (95%CI 0.20-4.53; p-value >0.999). In comparison with Chinese, the odds of having good knowledge were 2.69 times more likely in Chinese compared to others. The findings were not significant (95%CI 0.78-9.26; x^2 2.59; p-value 0.108,). The odds of having good knowledge were 0.87 times less likely in Indians compared to others. However, findings were not significant (95%CI 0.22-3.42; p-value: >0.999). Participants were categorized based on their residence: Hostel and Non- hostel. The odds of having good

knowledge were 1.17 times more likely in participants staying in the hostel than those who do not. Findings were not significant (P-value: >0.999, 95%CI: 0.37-3.67). The odds of having good knowledge in FIS students are 0.59 times less likely than MBBS. However, findings were not significant (95%CI 0.16-2.08; p-value 0.578). The odds of having good knowledge was 1.42 times more in the <RM3000 monthly income group than the >RM13000 monthly income group. Findings were not significant (95%CI: 0.43-4.89; p- value 0.550). The odds of having good knowledge were 1.46 times more likely in the income group of RM 3001 to RM 6500. However, findings were not significant (95%CI: 0.19-2.34; p-value 0.546). As for the income group of RM6501 to RM13000, the odds of having good knowledge is 0.67 times less likely compared to the >RM13000 income group and this finding is not significant as well (95% CI 0.19-2.34; p-value 0.564). It was found that the odds of having good knowledge was 0.30 times less likely in <RM1000 monthly allowance group than >RM13000. Findings were not significant (95%CI 0.03-3.05; p- value 0.329). The odds of having good knowledge was 0.54 times less likely in the RM1000 to RM3000 allowance group compared to the >RM3000. However, findings were not significant (95%CI: 0.05 to 5.92; p- value 0.514). The odds of having good knowledge were 0.51 times less likely in family who smoke than those who do not. However, findings were not significant (95%CI 0.17-0.242; x^2 1.37; p-value: 6.90). The odds of having good knowledge were 0.65 times less likely in participants with friends who smoke than those who do not. However, findings were not significant (95%CI 0.24-1.78; p-value 0.405).

Table 9. Association between age, gender, nationality, ethnicity, residence, batch, socioeconomic status, smoking status among family and friends toward beliefs on E-cigarettes among undergraduate students.

Independent Variables	Beliefs		OR (95% CI)	Chi-Square	P value
	Good n (%)	Need to Improve n (%)			
Age					
<22	16(24.62)	49(75.38)	0.91(0.46-1.79)	0.08	0.775
22-25	2(50.00)	2(50.00)	2.77(0.38-20.43)		0.298
>25	35(26.52)	97(73.48)	1(Reference)		
Gender					
Male	26(32.93)	93(67.07)	0.57(0.30-1.07)	3.07	0.080
Female	27(21.85)	55(78.15)	1(Reference)		
Nationality					
Malaysian	43(27.04)	116(72.96)	1.19(0.54-2.62)	0.18	0.672
International	10(23.81)	32(76.19)	1(Reference)		
Ethnicity					
Malay	16(43.24)	21(56.76)	2.49(0.98-6.37)	3.74	0.053
Chinese	10(20.00)	40(80.00)	1.02(0.38-2.72)	0.00	0.964
Indian	16(23.88)	51(76.12)	1.03(0.43-2.47)	0.00	0.953
Others	11(23.40)	36(76.60)	1(Reference)		
Residence					
Hostel	37(23.13)	123(76.88)	0.47(0.23-0.97)	4.25	0.039
Non-hostel	16(39.02)	25(60.98)	1(Reference)		
Batch					
FIS	10(24.39)	31(75.61)	0.88(0.40-1.94)	0.10	0.747
MBBS	43(26.88)	117(73.13)	1(Reference)		
Monthly household income					
< 3000	13(37.14)	22(62.86)	1.28(0.53-3.10)	0.30	0.584
3001-6500	6(14.63)	35(85.37)	0.37(0.13-1.04)	3.70	0.054
6501-13000	16(23.53)	52(76.47)	0.67(0.30-1.47)	1.01	0.314
>13000	18(31.58)	39(68.42)	1(Reference)		
Monthly Allowance					
<1000	39(26.90)	106(73.10)	1.10(0.11-10.93)		0.999
1000-3000	13(25.00)	39(75.00)	1.00(0.10-10.47)		0.999
>3000	1(25.00)	3(75.00)	1(Reference)		
Family members smoking					
Smoker	14(24.14)	44(75.86)	0.85(0.42-1.72)	0.21	0.648
Non smoker	39(27.27)	104(72.73)	1(Reference)		
Friends smoking					
Smoker	43(26.88)	117(73.13)	1.14(0.52-2.52)	0.10	0.747
Non smoker	10(24.39)	31(75.61)	1(Reference)		

Table 9 showing the association between age, gender, nationality, ethnicity, residence, batch, socioeconomic status, smoking status among family and friends towards beliefs on E-cigarette among undergraduate students. In participants <22 years compared to > 25 years participants; it was 0.91 times more likely to have correct beliefs but with no significant association (95% CI 0.46-1.79; x^2 0.08; p-value 0.775). Compared to >25 years participants, 22-25 years participants were 2.77 times more likely to have correct beliefs also with no significant association (95% CI 0.38-20.43; p-value 0.298).

Males were 0.57 times more likely to have better beliefs compared to female with no significant association (95% CI 0.30-1.07; x² 3.07; p-value 0.080). Malaysians were 1.19 times more likely to have correct beliefs compared to International students however there was no significant association (95% CI 0.54-2.62; x² 0.18; p-value 0.775). Compared to Other ethnicities, Malays are 2.49 times more likely to have good beliefs (95% CI 0.98-6.37; x² 3.74; p-value 0.053), Chinese were 1.02 times more likely to have good in beliefs (95% CI 0.38-2.72; x² 0.00; p-value 0.964), and Indians were 1.03 times more likely to have good beliefs (95% CI 0.43-2.47; x² 0.00; p-value 0.953) however none of these associations were significant. Students living in hostels were 0.47 times more likely to have good beliefs compared to students living outside the hostels (95% CI 0.23-0.97; x² 4.25; p-value 0.039) moreover, this association was significant. Compared to students studying MBBS, FIS students were 0.88 times more likely to have better beliefs (95% CI 0.4-1.94; x² 0.10; p-value 0.747) however this association wasn't significant. Compared to the highest monthly household income (> RM 13001), families earning <RM 3000 were 1.28 times more likely to have good beliefs (95% CI 0.53-3.10; x² 0.30; p-value 0.584), families earning RM 3001-6500 were 0.37 times more likely to have good beliefs (95% CI 0.13-1.04; x² 3.70; p-value 0.054) and families earning RM 6501-RM 13000 were 0.67 times more likely to have good beliefs (95% CI 0.3-1.47; x² 1.01; p-value 0.314) however none of these associations were significant. As compared to highest monthly allowance category (> RM 3000), <RM 1000 category were 1.1 times more likely to have good beliefs (95% CI 0.11-10.93; p-value 0.999) whereas RM 1000-RM 3000 category were 1 times more likely to have good beliefs (95% CI 0.10-10.47; p-value 0.999) but none of these associations were significant. Students who had family members who smoke were 0.85 times more likely to have good beliefs compared to those with no members in the family who smoke (95% CI 0.42-1.72; x² 0.21; p-value 0.648) but this association was not significant. Students with friends who smoke were 1.14 times more likely to have good beliefs compared to students with no friends who smoke (95% CI 0.52-2.52; x² 0.10; p-value 0.747) but neither was this a significant association.

Table 10. Association between age, gender, nationality, ethnicity, residence, batch, socioeconomic status, smoking status among family and friends toward awareness on E-cigarettes among undergraduate students.

Independent Variables	Awareness		OR (95% CI)	Chi-Square	P value
	Good n (%)	Need to Improve n (%)			
Age					
<22	20(30.77)	45(69.23)	0.44(0.06-3.38)	0.64	0.423
22-25	61(46.21)	71(53.79)	0.86(0.12-6.28)	0.02	0.881
>25	2(50.00)	2(50.00)	1(Reference)		
Gender					
Male	47(57.32)	35(42.68)	3.096(1.72-5.57)	0.88	0.349
Female	36(30.25)	83(69.75)	1(Reference)		
Nationality					
Malaysian	63(39.62)	96(60.38)	0.72(0.36-1.43)	0.88	0.349
International	20(47.62)	22(52.38)	1(Reference)		
Ethnicity					
Malay	18(48.65)	19(51.35)	1.17(0.49-2.78)	0.13	0.717
Chinese	15(30.00)	35(70.00)	0.53(0.23-1.22)	2.24	0.13
Indian	29(43.28)	38(56.72)	0.94(0.45-2.00)	0.02	0.882
Other	21(44.68)	26(55.32)	1(Reference)		
Residence					
Hostel	64(40.00)	96(60.00)	0.77(0.39-1.54)	0.54	0.462
Non-Hostel	19(46.34)	22(53.66)	1(Reference)		
Batch					
FIS	11(26.83)	30(73.17)	0.45(0.21-0.96)	4.45	0.035
MBBS	72(45.00)	88(55.00)	1(Reference)		
Monthly household income					
<RM3000	17(48.57)	18(51.43)	1.13(0.48-2.62)	0.08	0.782
RM3001-RM6500	16(39.02)	25(60.98)	0.76(0.34-1.73)	0.42	0.516
RM6501-RM13000	24(35.29)	44(64.71)	0.65(0.32-1.34)	1.38	0.241
>RM13001	26(45.61)	31(54.39)	1(Reference)		
Monthly allowance					
<RM1000	57(39.31)	88(60.69)	0.65(0.09-4.73)	0.19	0.666
RM1000-RM3000	24(46.15)	28(53.85)	0.86(0.11-6.56)	0.02	0.882
>RM3000	2(50.00)	2(50.00)	1(Reference)		
Family members smoking					
Smoker	23(39.66)	35(60.34)	0.91(0.49-1.69)	0.09	0.764
Non smoker	60(41.96)	83(58.04)	1(Reference)		
Friends smoking					
Smoker	69(43.13)	91(56.88)	1.46(0.71-3.00)	1.085	0.298
Non smoker	14(34.15)	27(65.85)	1(Reference)		

Table 10 shows the association between social demographic profile of participants and their awareness on E-cigarettes. It was seen that students less than 22 years of age were 0.44 times less likely to be aware of E-cigarettes compared to students over 25 years of age but this association was not significant (95%CI 0.06-3.38, x^2 0.64; p-value 0.423). Students between the ages 22 and 25 years were 0.86 times less likely to be aware of E-cigarettes also with no significant association (95%CI 0.12-6.28, x^2 0.02; p-value 0.881). Males were 3.10 times more likely to be aware of E-cigarettes compared to females but this was of no significant association (95%CI 1.72-5.57; x^2 0.88; p-value 0.349). Malaysians were 0.72 times less likely to be aware of E-cigarettes compared to International students but there was no significant association (95%CI 0.12-6.28; x^2 0.88; p-value 0.349). Malay students were 1.17 times more likely to be aware of E-cigarettes compared to Other students with no significant association (95%CI 0.49-2.78; x^2 0.13; p-value 0.717) while Chinese students were 0.53 times less likely to be aware of E-cigarettes compared to Other students with no significant association (95%CI 0.23-1.22; x^2 2.24; p-value 0.13) and Indian students were 0.94 times less likely to be aware of e-cigarettes compared to Other students but there was no significant association (95%CI 0.45-2.00; x^2 0.02; p-value 0.882). Students residing in the hostel were 0.77 times less likely to be aware of E-cigarettes compared to students not residing in the hostel but there was no significant association (95%CI 0.39-1.54; x^2 0.54; p-value 0.462). Students of FIS were 0.45 times less likely to be aware of E-cigarettes compared to MBBS students with a significant association (95%CI 0.21-0.96; x^2 4.45; p-value 0.035). Students with a household income of less than RM 3000 were 1.13 times more likely to be aware of E-cigarettes compared to a student with a household income greater than 13001, a household income between RM 3001 to RM 6500 were 0.76 times less likely to be aware of E-cigarettes compared to a house with an income greater than RM 13001, and a household income between RM 6501 and RM 13000 were 0.65 times more likely to be aware of E-cigarettes compared to household with an income more than RM 13001 but none of these associations were significant (95%CI 0.48-2.62; x^2 0.08; p-value 0.782)(95%CI 0.34-1.73; $x^2$0.42; p-value 0.516)(95%CI 0.32-1.34; x^2 1.38; p-value 0.241) respectively. Students receiving a monthly allowance less than RM 1000 were 0.65 times less likely to be aware of E-cigarettes compared to those with an allowance greater than RM 3000 and students with an allowance between RM 1000 and RM 3000 were 0.86 times less likely to be aware of E-cigarettes but these associations were not significant (95%CI 0.09-4.73; x^2 0.19; p-value 0.666) (95%CI 0.11-.6.56; $x^2$0.02; p-value 0.882). Students who have family members who smoke were 0.91 times less likely to be aware of E-cigarettes compared to students who have no family members who smoke but this association was not significant (95%CI 0.49-1.69; x^2 0.09; p-value 0.764) and students with friends who smoke were 1.46 times more likely to be aware of E-cigarettes compared to students with friends who were non-smokers, but there was no significant association (95%CI 0.71-3.00; x^2 1.085; p-value 0.298).

Table 11. Association between age, gender, nationality, ethnicity, residence, batch, socioeconomic status, smoking status among family and friends toward current smoking of E-cigarettes among undergraduate students.

Independent Variables	Smoking E cigarettes		OR (95% CI)	Chi-Square	P value
	Yes n (%)	No n (%)			
Age					
<22	5(7.69)	60(92.31)	0.25(0.02-2.87)	-	0.311
22-25	10(7.58)	122(92.42)	0.25(0.02-2.59)	-	0.289
>25	1(25)	3(75)	1(Reference)		
Gender					
Male	13(15.85)	69(84.15)	7.29(2.00-6.47)	-	<0.001
Female	3(2.52)	116(97.48)	1(Reference)		
Nationality					
Malaysian	10(6.29)	149(93.71)	0.40(0.14-1.18)	2.90	0.089
International	6(14.29)	36(85.71)	1(Reference)		
Ethnicity					
Malay	3(8.11)	34(91.89)	0.74(0.16-3.33)	0.15	0.695
Chinese	1(2)	49(98)	0.17(0.02-1.53)	-	0.105
Indian	7(10.45)	60(89.55)	0.98(0.29-3.30)	0.00	0.974
Others	5(10.64)	42(89.36)	1(Reference)		
Accommodation					
Hostel	15(9.38)	145(90.63)	4.14(0.53-32.28)	-	0.202
Non-hostel	1(2.44)	40(97.56)	1(Reference)		
Batch					
FIS	2(4.88)	39(95.12)	0.53(0.12-2.45)	-	0.534
MBBS	14(8.75)	146(91.25)	1(Reference)		
Monthly household income					

Independent Variables	Smoking E cigarettes		OR (95% CI)	Chi-Square	P value
	Yes n (%)	No n (%)			
<RM3000	4(11.43)	31(88.57)	1.10 (0.29-4.20)	-	0.099
RM 3001- RM 6500	0	41(100)	0(Uncertain)	-	0.039
RM 6501- RM 13000	6(8.82)	62(91.18)	0.82(0.25-2.71)	0.10	0.748
RM >13001	6(10.53)	51(89.47)	1(Reference)		
Monthly allowance					
<RM 1000	10(6.9)	135(93.1)	0.22(0.02-2.34)	-	0.267
RM 1000- RM 3000	5(9.62)	47(90.38)	0.32(0.03-3.68)	-	0.373
>RM 3000	1(25)	3(75)	1(Reference)		
Family members smoking					
Smoker	6(10.34)	52(89.66)	1.53(0.53-4.44)	0.63	0.426
Non smoker	10(6.99)	133(93.01)	1(Reference)		
Friends smoking					
Smoker	16(10.00)	144(90.00)	uncertain	-	0.046
Non smoker	0	41(100.00)	1(Reference)		

Table 11 shows the association of sociodemographic profile and the practice of e- cigarettes in undergraduate students. Students aged less than 22 years and between 22 to 25 years were 0.25 times less likely to smoke e-cigarette compared to those who were more than 25 years of age. However, this association was not significant as the p value of both the associations were 0.311 and 0.289 respectively (95% CI for 22 years: 0.02-2.87; 95% CI for 22-25 years: 0.02-2.59). It is noted that males were 7.29 times more likely to smoke e-cigarettes compared to female students. There was a significant association between male gender and E-cigarette smoking (95% CI: 2.00-26.47, p value: <0.001). Malaysian students were 0.40 times less likely to smoke e-cigarettes compared to international students (95% CI: 0.14-1.18; x2: 2.90; p value: 0.089). This association was not significant. Based on this study, Malay students were 0.74 times less likely to smoke E-cigarette compared to Other ethnicities (95% CI: 0.16-3.33; x2: 0.15; p value: 0.695). There was no significant association between Malay students and smoking E-cigarettes. Next, Chinese students were 0.17 times less likely to smoke e-cigarettes compared to Other ethnicities (95% CI: 0.02-1.53; p value: 0.105). Chinese students were not significantly associated to smoking e-cigarettes. Indian students were 0.98 times less likely to smoke e-cigarettes compared to Other ethnicities (95% CI: 0.29-3.30; x2: 0.00; p value: 0.974). There was no significant association between Indian students and smoking e-cigarette. Students who stay in the hostel were 4.14 times more likely to smoke e-cigarettes (95% CI: 0.53-32.28; p value: 0.202). There was no significant association between students staying in the hostel and smoking e-cigarettes. Furthermore, FIS students were 0.53 times less likely to smoke e-cigarettes compared to MBBS students (95% CI: 0.12-2.45; p value: 0.534). In conclusion, there was no significant association of FIS students and smoking e-cigarettes. Students with monthly household income <RM 3000 were 1.10 times more likely to smoke e-cigarettes compared to those who have a household income >RM 13001 (95% CI: 0.29-4.20; p value: 0.099). However, this association is not significant. Besides, students with monthly household income of RM 3001- 6500 the association was uncertain compared to those who have a household income >RM 13001. Lastly, those with RM 6501-13000 monthly household income, were 0.82 times less likely to smoke E-cigarettes compared to those who have a household income >RM 13001 but this association was not significant (95% CI: 0.25-2.71; p value: 0.748). Students with monthly allowance of <RM 1000 were 0.22 times less likely to smoke E-cigarette compared to those receiving >RM 3000, but this association was not significant (95% CI: 0.02-2.34; p value: 0.267). Moreover, students receiving RM 1000-3000 per month were 0.32 times less likely to smoke E-cigarette compared to those receiving >RM 3000, and this was also not a significant association (95% CI: 0.03-3.68; p value: 0.373). In addition, students with family members who smoke are 1.53 times more likely to smoke E-cigarettes compared to family members who were non-smokers. However, this was not a significant association (95% CI: 0.53-4.44; x2: 0.63; p value: 0.426). Students with friends who smoke had an uncertain association with smoking E-cigarettes.

Table 12. Multiple logistic regression analysis of practice of E-cigarettes between knowledge, awareness and belief.

Independent Variable	OR (95% CI)	Standard Error	P value
Knowledge	0.96(0.94-0.99)	0.01	0.003
Awareness	1.00(0.98-1.2)	0.01	0.764
Beliefs	0.99(0.96-1.00)	0.01	0.175

Table 12 shows an association between knowledge, awareness, and belief towards practice of E cigarettes. There was a significant negative association between knowledge and practice of E cigarettes with odds ratio 0.96 (95%CI 0.94- 0.99) and *p*-value 0.003. Knowledge as a protective factor towards practicing of E cigarettes this was suggestive

of the fact that if students had greater knowledge, they were less likely to practice E-cigarette smoking. Between awareness and practice of E cigarettes, there was no association since the odds ratio value is 1 (95% CI 0.98-1.2) with *p*-value 0.764. However, this association was not significant. There was a negative association between beliefs and practice of E cigarettes, this makes belief a protective factor towards practicing of E cigarettes with odds ratio 0.99 (95% CI: 0.96-1.00) and p-value equal to 0.175. This was a significant association between these two variables. For all the independent variables, the standard error was 0.01.

Table 13. Association between knowledge and awareness, and association between knowledge and beliefs.

Variables	Coefficient (r)	P-value
Awareness/ Knowledge	0.26	0.0002
Belief/ Knowledge	0.20	0.0045

Table 13 shows the association between knowledge and awareness and also knowledge with beliefs. The association between knowledge and awareness was a positive one with r value of 0.26. However, the magnitude of correlation is little. This association was significant (P value: < 0.001). The association between knowledge and awareness was also positive with r value of 0.20. The magnitude of correlation was little and findings were significant (P-value: 0.005).

4. Discussion

The study we conducted was a cross-sectional study with the purpose of determining the knowledge, awareness, beliefs and practice of Electronic cigarettes amongst undergraduate medical students in Malaysia. The second objective of this study was to determine the factors associated with knowledge, awareness, beliefs and practice of Electronic cigarettes among our participants.

We found that the majority of our participants (89.5%) have poor knowledge in relation to E-cigarettes. The result was consistent with a study done on health care professionals by Pepper et al which showed that 83% of their participants knew little to nothing about E- cigarettes. [27] We have found 69.15% of our participants agreed that E-cigarettes contributed to the development of smoking- related diseases. This finding could be compared to the result of a study done on public health residents in Europe. In that study, 82.2% of participants associated nicotine with diseases related to smoking; 59.1% believed that it contributes to lung cancer and 72.7% indicated its role in the development of atherosclerosis. [23]

In our study, we found that 8.46% are currently practicing smoking of E-cigarettes and 22% are personally had tried the E-cigarettes. Based on a study conducted in International Medical University, Malaysia they found that 13.8% students of Health Science course were practicing E-cigarette smoking. [19] Besides, another study conducted among adult population in KOSPEN area of Kuching district, Sarawak, Malaysia found that 11.2% were practicing E cigarettes. [28]

Our study has highlighted that 41.29% of respondents had good awareness, which was relatively low to results (65.6%) found by a study done in Pakistan amongst medical students. That study also showed that most participants, who were aware, gained their information from the internet followed by acquaintances. [20] By comparison, our study found that almost all our participants (97.01%) have heard of E-cigarettes and this was consistent with results found in another study done among health science students in International Medical University in Malaysia where 95% of their respondents were aware of the existence of E-cigarettes. [20]

In our study, it was found that only 26.37% of our participants have good beliefs in regards to E- cigarettes. As many as 46.27% participants believed that E-cigarettes can help smokers to quit. In a study done among medical students in Pakistan, only 27.4% of participants believe the same. [29] However, in a study done on medical student, it was found that most of the students who were using E cigarettes (75%) claimed that it had no effect on tobacco addiction. [30] It was found that 49.75% of our participants believed that E-cigarettes were less toxic compared to traditional cigarettes. In a survey conducted online with 3587 participants, it was found that 40% of the participants used E- cigarettes to try safer alternatives to tobacco. [31] In a US study, only 12.4% of the medical students agreed that they were confident enough to talk to patients about E- cigarettes. [27] Therefore it is important for physicians to be educated about E-cigarettes and our study showed that 94.53% of our participants belief the same.

There are many factors that could be associated with the usage of E-cigarettes in undergraduate students such as students who recently quit smoking, trying it on experimental basis, older age, the male gender, a higher income, addiction to smoking and having friends who smoke. [4][5][6][8][9] This study showed that males were significantly more likely to smoke E-cigarettes compared to females. This finding is especially relatable to Malaysia as in the Asian culture, as smoking is considered a taboo for females. It is known that Malaysians are a collective community in which social norms influence the personal choice of an individual. [32] However, the study among university students in Malaysia also stated that males were less likely of using E-cigarettes when compared to females. [19] Based on a study conducted to determine the prevalence and associated factors of ever use of electronic cigarettes in public hospitals and health clinics

in Malaysia, it was found that males of 18–34 years are 4 times more likely to use E-cigarette compared to older males. [19] Other factors associated, according to a study conducted to identify the use of e-cigarettes among university students in Malaysia were, family members and friends who smoke. [19] However, these factors had a non-significant association in our study.

In this research, we studied the association between knowledge, awareness, belief and use of e-cigarettes. Based on our study, there was a significant negative association between knowledge and practice of E cigarettes which indicated that if students have a greater knowledge, they were less likely to use e-cigarette. In a previous study done among adolescent, no significant differences were found between never- and ever-users of e-cigarettes on a composite knowledge score or any of the individual knowledge items. Compared to never-users, e-cigarette users were significantly less likely to worry about the health risks of e-cigarettes, less likely to think that e-cigarettes would cause negative health consequences, and less likely to believe that e-cigarette use would lead to addiction. [9] The study among Healthcare Professionals in Greece also showed that most of the healthcare professional was reluctant to recommend electronic cigarettes to help population of smokers for cessation of tobacco smoking. [22] We found that there was no significant association between belief, awareness towards e-cigarettes and use of e-cigarettes. However, previous study among public in Saudi Arabia showed that 93.6% (vast majority) of the e-cigarette users had awareness toward e-cigarettes. [20]

There were few limitations in our study. We conducted this study in 6 weeks and our study was a cross-sectional study which only allowed us to observe participants at one point in time. Therefore, we were unable to observe the effect of time on the changes in participants' knowledge, awareness, beliefs, and practice. Besides that, our study was only done in one private medical college; hence the findings cannot be generalized to other settings. Furthermore, there was very little participation from final year students in comparison to their junior counterparts. This might affect the results as final year students might have different knowledge, beliefs and awareness.

In this study, most students were having good awareness towards e-cigarettes but had limited knowledge. Hence, education via the media ads, campaign or incorporation of knowledge into the curriculum would be ideal. In general, more studies have to be done to assess knowledge, awareness, beliefs and practice in undergraduate students. Accordingly, researchers could include more final year students and also health professionals to access the same. Qualitative research should be used to explore the reasons as to why people engage in the practice of E- cigarette smoking.

5. Conclusion

Based on our study, the prevalence of E-cigarette among undergraduate students is 8.46%. Only knowledge and the practice of E-cigarette showed a significant association. Males were significantly more likely to practice the use of E-cigarette. Hence, education via the media ads, campaign or incorporation of knowledge into the curriculum would be an ideal method to reach out to the student population and to improve their knowledge and awareness in regards to the E-cigarette.

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