

## The Usage of E-Cigarette in Curbing Tobacco Addiction: A Baseline Study

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Tobacco cigarette is not the only product that consist of nicotine as the existence of electronic cigarette had been observed as a device that can replace the function of a tobacco cigarette. However, electronic cigarette has caused many controversial issues, especially as an intervention for tobacco cigarette's cessation. For that reason, this study was conducted as the baseline study to find the effectiveness of electronic cigarettes in curbing the tobacco cigarette's addiction and the existence of dual-use. Ten subjects went through the screening test, using the Fagerstrom Test for Nicotine Dependence (FTND) to join this experiment for 40 days. The research used to pretest and posttest design. The baseline results showed that the electronic cigarette is effective in curbing tobacco cigarette addiction as the percentage of the consumed tobacco cigarette was decreased; 87.93% on min value to 35.38% on the maximum value. The existence of dual-use also has been proved. In which, all subjects showed an increase in the usage of an electronic cigarette. Despite the usage of tobacco, cigarettes decreased. Moreover, the baseline results showed that the dependence of nicotine is also decreased significantly ( $t = 22.481, p < 0.05$ ) in paired t-test.

*Keywords:* effectiveness, dual-use, electronic cigarette, tobacco cigarette, addiction

World Health Organization (2017) stated that approximately 6 million people all around the world died every year caused by smoking tobacco, while another 1 million people killed by being secondhand smokers. In Malaysia, the prevalence of tobacco cigarette's user was 4.7 million, which equals to 23.1% from all Malaysian and rose every year (Global Adult Tobacco Survey, 2011).

In the early existence of electronic cigarettes, which also known as e-cigar, it was expected to be the best intervention for the stoppage of tobacco addiction, as stated by Public Health England (2015), that e-cigar was 95% safer than any tobacco cigarette. However, the existence of the e-cig seems to create much polemics upon Malaysian – is it suits as tobacco cigarette's addiction cessation, or only created a new culture that involved the usage of e-cig in

religion's perspective, norms, economy and the effects towards user itself.

The usage of the e-cigar seems to bring a new type of dual addiction, which is referring to a person who used both e-cigar and tobacco use in time (DeAngelis, 2015). While Farsalinos (2015) stated that the e-cigar is the perfect 'medicine' to substitute and cure tobacco cigarette addiction, this incongruity of perspectives creates more curiosity in an empirical study of e-cigar and tobacco addiction.

Thus, this research aimed to examine:

1. The existence of dual-use among students who use e-cigs.
2. The effectiveness of the e-cig as an intervention of tobacco addiction cessation among students.

Significantly, this research would affect the subjects in terms of psychological wellbeing and healthiness if only they changed their habit and routine from consuming tobacco cigarettes into an electronic cigarette (Farsalinos, 2015). Economically, participants would also know the margin of difference in their daily expenses on tobacco, as according to The Public Health of England, that the usage of e-cigar was 40% saver than daily usage of a tobacco cigarette.

Besides that, families, friends, and societies also felt the positive differences as the 'smokes' or vapor that made by the e-cigar were not harmed and 95% safer than tobacco cigarette (Public Health of England, 2015).

Further, the e-cigar consumer around the nation would also benefit from the research results in which the findings would have a positive impact on the perception towards e-cigar usage and consumption, thus lead to behavioral modification towards e-cigar than traditional tobacco usage. Consequently, it would clear up the negatives polemic towards the usage of e-cigar in Malaysia.

## Literature review

### Tobacco Cigarette's Effects

Globally, people already knew the effects of tobacco cigarettes on the human body. Shaharuddin (1992), in a study of 516 patients (both men and women included), stated that 23% of the patients who were smokers or ex-smokers from samples had a higher tendency to get bronchitis. Likewise, Armen (2011) also stated that smoking tobacco cigarettes were caused by much chronic illness such as lung cancer, heart, and liver complication, stroke, neck cancer, and others.

Frieden (2015) further clarify that until now, tobacco cigarette was still leading for the cause of death and disease which more

than 6 million deaths per year and yet the statistics were higher than death caused by HIV, tuberculosis, and malaria. On the contrary, Maulana (2015) said that nicotine and tobacco cigarette can affects the quality and quantity of sperms production caused by the failure to synthesize hormones and affected the spermatogenesis process. All of the chronic illnesses were caused by more than 4000 chemical ingredients of the tobacco cigarette, including 43 carcinogenic chemicals such as arsenic, tar, benzene, acrolein, and more (Armen, 2011).

### The effect of dual-use and its effectiveness as an intervention of tobacco cigarette's addiction cessation

The existence of e-cigar is entirely new to modern days. Therefore, the research about e-cigar is few compared to other nicotine products. Public Health England (2015) stated that the effects of e-cigar were significant, which it can be said to be harmless toward health compared to a tobacco cigarette and potentially high for tobacco cigarette cessation and added that e-cigar was 95% safer than a tobacco cigarette.

Farsalinos (2015) stated that from 19,441 respondents, there are about 3,682 ex-smokers who were dual-user, while two-third of the dual-user was successfully decreased their daily tobacco cigarette consumption from 20 pieces into four pieces only. Then, one-third of the dual-users only smoke once a day. Therefore, Farsalinos (2015) proved that the e-cigar really helped in decreasing tobacco cigarette addiction or dependence amongst e-cigar users but still no assurance that the e-cigar can remove the addiction of tobacco cigarette.

Gonewicz *et al.* (2017) mentioned that there were significant effects of the conditions of health towards their subjects who have initially been smoking tobacco

cigarettes heavily into using the e-cigar in an experiment of 2 weeks duration. The results showed that the subjects were no longer felt heavy breathing and sight disturbance, although some side effects occurred such as cough, difficulty in focusing, and the existence of phlegm. Though Genowicz *et al.* (2017) mentioned that all of the side effects were the positive symptoms for eliminating carcinogenic substances from heavy tobacco cigarette smokers such as NNK, 3-butadiene, benzene, acrolein, toluene, and much more. According to Bullen *et al.* (2013) a total of 657 subjects were divided into three groups – 289 subjects were put into the nicotine e-cigar group, 295 subjects were put into the nicotine patch group, and another 73 subjects were put into the placebo e-cigar (non-nicotine). A Fagerstrom Test for Nicotine Dependence was used all the time for 13 weeks of experiment with six months of follow up studies. The results showed that 7.3% of the subjects from the nicotine e-cigar group were successfully stopped smoking a tobacco cigarette, 5.8% of the subjects from the nicotine patch group successfully stopped smoking a tobacco cigarette. In comparison, another 4.1% of subjects from placebo or non-nicotine e-cigar successfully stopped smoking a tobacco cigarette. It showed that either with nicotine or without nicotine, the e-cigars helped deal with tobacco cigarette cessation.

Adriaens (2014) also stated that in an experiment in which two groups were using e-cigar, while another one was the controlled group (not using any e-cigar). The results showed that the e-cigar effectiveness with 34% of the subjects from both of the experimental groups was successfully stopped smoking a tobacco cigarette, while the controlled group was failed, with 0% of the subjects successfully stopped smoking a tobacco cigarette.

## Theoretical Structure

### Theory of Reinforcement and Punishment

Generally, both the addiction of e-cigar and tobacco cigarettes were classified as substance abuse because both of them contained nicotine, which produced an addiction to their user (Fisher and Harrison, 2013). Thus, the nicotine addiction cessation can be cured by reinforcement theory along with punishment theory. Thorndike (1911) was the early researcher who comes out with the theory of reinforcement, which known as 'Law of Effect, ' which was based on a study of a starved cat in a jail. Skinner (1953) then stated that reinforcement theory was a process where a behavior been strengthened by an effect that shown immediately, then made a behavior is reinforced, and the behavior tends to be repeated. Positive reinforcement was used throughout this study by giving a verbal compliment after the subjects successfully finished up the e-liquid within a specific time-frame.

The theory of punishment, according to Bandura (1971), happened when a behavior completed joined with effect, then making the behavior become weaker or not going to happen again in the next time. A negative punishment was used throughout this study, as Bandura (1971) stated that negative punishment's consequences would make subjects lost the reinforcement (reinforcement agent) after the unwanted behavior happened. However, there was no negative punishment given to the subjects due to the ethical issue.

## Method

### Participants

The study used to pretest and posttest as the research design. By using the snowball technique, the researcher recruited ten subjects who agreeable to joined the

experiment. Before that, informed consent was distributed to the subjects. All of the ten respondents were fulfilled the criteria determined in the study, which were; 1) aged within 20 – 23 years old, 2) students of under-graduate in UKM, 3) scored moderate or high independence level of nicotine in Fagerstrom Test for Nicotine Dependence (FTND) and 4) never tried or used e-cig before.

The respondents aged between twenty-year-old and twenty-three-year-old were among undergrad students, and they were selected as part of the criteria because they were accessible than post-graduate students. Thus, undergrad students are easily met and communicated with them through 'WhatsApp.'

Twenty-four students did the FTND, but 14 of them got a low score of independence level of nicotine. Therefore, only 10 participants passed the 2nd screening criteria; never tried or consume the e-cigar and must be a heavy tobacco cigarette smoker.

### **Research design and procedure**

The experiment was divided into three phases; 1) pre-baseline, 2) baseline and 3) post-baseline. First, in pre-baseline, all of the ten subjects were contacted and gathered in an experimental room. All of the subjects were given a demography form. The form was contained information about their background, usage time for smoking, and a flavor preferred. Based on the demography information, three situations where all subjects tended to consume tobacco cigarettes daily, which were; before/after meals, boredom situations, and during a hard/distress situation.

Therefore, the researcher decided that these three conditions were the baseline criteria in this study. Thus, all of the subjects must avoid tobacco cigarettes and substituted

with e-cigar. The subjects also were asked to self-monitor by using a Daily Report Form to document their daily intake/usage of tobacco cigarettes for ten days.

In the baseline phase, the researcher split the subjects into two sub-phases. In the first phase of 10-days, subjects were given a set of electronic cigarettes and a bottle of 30ml contained 6mg nicotine e-liquid. They were reminded to finish the e-liquid within ten days. A verbal compliment would be given as reinforcement. The same method was used in the second 10-day phase 2 of the baseline. However, the nicotine level was reduced to 3mg.

In the last phase, all subjects were given the same volume of e-liquid but with different nicotine levels (0mg of nicotine). The same reinforcement was given as in the previous phase two of the baseline. After 10-day, they were all grouped and debriefed on the purpose of the research.

Data from the Fagerstrom Test for Nicotine Dependence (FTND) and Daily Report Form were analyzed with descriptive and inferential analysis by using SPSS23. The descriptive analysis was used to test hypothesis 1, while inferential analysis of paired t-test was used to test hypothesis 2.

## **Result**

### **Demographic analysis**

Table 1 showed that all of the ten subjects (N) were 100% Malay and males. Besides, all the subjects were 30% aged 21 years, 60% aged 22 years, and 10% aged 23 years. It also showed that the frequency of situations of consumption or tobacco cigarette intake. The highest frequency was after/before meals (100%), followed by 80% of them smoked a tobacco cigarette in distressful situations, 50% while boredom, 40% while doing some daily job, 30% while defecated and lastly, only 20% of the

subjects were smoked tobacco cigarette after physical exercised.

*Table 1*  
Results for demographic analysis

| Categories   |                               | n  | %   |
|--|-------------------------------|----|-----|
| <b>Gender</b>  | Male                          | 10 | 100 |
|  | Female                        | -  | -   |
| <b>Race</b>  | Malay                         | 10 | 100 |
|  | Others                        | -  | -   |
| <b>Age</b>   | 20                            | -  | -   |
|  | 21                            | 3  | 30  |
|  | 22                            | 6  | 60  |
|  | 23                            | 1  | 10  |
| <b>Situations where the tobacco cigarette was smoked</b> | After physical exercised      | 2  | 20  |
|  | Before/after meals            | 10 | 100 |
|  | While/after doing a daily job | 4  | 20  |
|  | In distressful situations     | 8  | 80  |
|  | Boredom                       | 5  | 50  |
|  | Defecate                      | 3  | 30  |

**Descriptive analysis**

Table 2 showed the results of dual-use for three-phases, which is, pre-baseline, baseline, and post-baseline based on the sum of tobacco cigarette consumption. On the pre-baseline, all of the subjects have not given the electronic cigarettes yet, so the mean of tobacco cigarettes consumption was 157.50, with minimum and maximum value all of the subjects were 58.00 and 260.00, respectively. The standard deviation and the variance of this phase were 70.17 and 4924.06, respectively.

The electronic cigarettes were initially given in the baseline sub-phase 1, so the tobacco cigarette consumption by all subjects also started to show some reduction in its sums. The mean of all subjects was 125.90, with the min and max value showed were 33.00 and 227.00, respectively. The standard deviation of

sums of the tobacco cigarette consumption was 60.00, while the variance was 4356.32.

Next, in the baseline sub-phase 2, the mean of tobacco cigarettes consumed by all subjects was 96.70, with the min and max value were 16.00 and 188.00, respectively. The standard deviations for this phase were 58.76, while the variance was 3452.90. Table 2 also showed the mean of sums of the tobacco cigarette consumed were 78.50, with the min and max value were 7.00 and 168.00, respectively. Then, the standard deviation and the variance were 54.55 and 2976.72, respectively.

Furthermore, table 2 showed the decreased percentage of tobacco cigarette consumption from the pre-baseline until the post-baseline. The decreased percentage in the minimum value was 87.93% while in the maximum value, the decreased percentage was 35.38%. Then, the decreased percentage of mean was 50.16%.

Table 2

Results for dual-use in pre-baseline, baseline, and post-baseline based on the amount of tobacco cigarette

| Phase                                | n  | SD    | Variance | Mean   | Min   | Max    |
|--------------------------------------|----|-------|----------|--------|-------|--------|
| Pre-baseline                         | 10 | 70.17 | 4924.06  | 157.50 | 58.00 | 260.00 |
| Baseline (1 <sup>st</sup> sub-phase) | 10 | 66.00 | 4356.32  | 125.90 | 33.00 | 227.00 |
| Baseline (2 <sup>nd</sup> sub-phase) | 10 | 58.76 | 3452.90  | 96.70  | 16.00 | 188.00 |
| Post-baseline                        | 10 | 54.55 | 2976.72  | 78.50  | 7.00  | 168.00 |

In table 3, it showed the result of dual-use based on the consumption of e-liquid of electronic cigarettes. There were only 2 phases that involved which were the baseline phase (1 and 2) and post-baseline. In the baseline phase 1, there were only 40% out of 10 subjects finished all of 30ml of e-liquid within the time given. The percentage kept increasing in the baseline phase 2, to 70%. Finally, the percentage

was at the peak as the subjects who finished the e-liquid was 90% out of 10 subjects. These results were proved that hypothesis 1 was accepted because all of the subjects were using both tobacco cigarettes and electronic cigarettes simultaneously. However, as a decrease in tobacco cigarettes, the usage of electronic cigarettes also increased.

Table 3

Results for dual-use based on e-liquid intake

| Categories                           | n  | (%) |
|--------------------------------------|----|-----|
| Baseline (1 <sup>st</sup> sub-phase) | 10 | 40  |
| Baseline (2 <sup>nd</sup> sub-phase) | 10 | 70  |
| Post-baseline                        | 10 | 90  |

Table 4 showed the results of the score obtained in the Fagerstrom Dependence of Nicotine Test of all ten subjects in the pre-baseline and post-baseline. The score for

pre-baseline (M = 8.200, SD = 1.476) were higher than post-baseline (M = 4.100, SD = 1.595).

Table 4

Results of scored in FTDN by participants

| Phase         | Mean  | n  | SD    |
|---------------|-------|----|-------|
| Pre-baseline  | 8.200 | 10 | 1.476 |
| Post-baseline | 4.100 | 10 | 1.595 |

**Inferential Analysis**

Table 5 showed the results of the correlation between the score of the Fagerstrom Test for Nicotine Dependence

in Pre-baseline and Post-baseline. It showed that both of the scores have

significantly high in correlation ( $r = 0.935$ ,  $p < 0.01$ ).

Table 5

Results for correlation between pre-baseline and post-baseline score

|        |                                | n  | Correlation | Sig.  |
|--------|--------------------------------|----|-------------|-------|
| Pair 1 | pre-baseline and post-baseline | 10 | 0.935       | 0.000 |

Table 6 showed the results for paired t-test of the mean score between Pre-baseline and Post-baseline with a significant decreased

(0.000) and valued ( $t = 22.481$ ,  $p < 0.05$ ). It means that hypothesis 2 was also accepted because the result showed a decrease in the dependence of nicotine significantly.

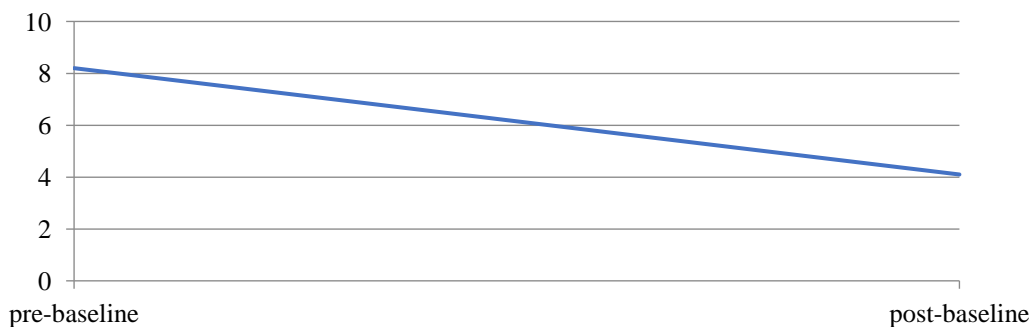
Table 6

Results for paired t-test

| Pair 1                       | m     | SD    | t      | Sig.  |
|------------------------------|-------|-------|--------|-------|
| Pre-baseline – Post-baseline | 4.100 | 0.568 | 22.841 | 0.000 |

Graph 1 showed the results for the mean score of the Fagerstrom Test for Nicotine Dependence for both Pre-baseline and Post-baseline. It showed that the mean score in Pre-baseline ( $M = 8.200$ ) significantly

decreased to the Post-baseline phase ( $M = 4.100$ ). While graph 2 showed the result for the usage of Dual-use based on e-liquid consumption for ten subjects, was significantly rise.



Graph 1 Graph of the difference between pre-baseline and post-baseline based on the mean of the score in FTND

## DISCUSSIONS

Hypothesis 1: The Existence of Dual-use among UKM Students

Dual-use is a state in which people used both electronic cigarettes and tobacco

cigarettes in a time (DeAngelis, 2014). It also can be defined as a non-permanent or permanent state for tobacco cigarettes' users who wanted to stop smoking (DeAngelis, 2014).

The existence of dual-use was proved with all of 10 subjects used both electronic cigarettes and tobacco cigarettes during this research occurred. The dual-use also has been proved by Farsalinos (2015), who stated that out of 19,441 who were ex-smoker, 3,682 were dual-user. Two third of dual-user was successfully decreased their tobacco cigarette consumption from 20 to 4 cigarettes per day, while the others were only smoke for sometimes a day. The experiment by Farsalinos (2015) concludes that the e-cigar was not only useful in dealing with tobacco cigarette addiction, but it was proven that the e-cigar could make the dual-use addiction existed.

Although there was a significant difference in the pre-baseline and post-baseline score in Graph 1 and Graph 2. The results showed that the subjects still used both the e-cigar and tobacco cigarettes simultaneously. Therefore, hypothesis 1 is accepted.

#### Hypothesis 2: The Effectiveness of Electronic Cigarettes as an Intervention for Tobacco Cigarette Addiction Cessation

Based on the results, the researcher noticed that the e-cigar was effective in decreasing the dependence of nicotine among subjects as the mean score for the Fagerstrom Test for Nicotine Dependence were significantly different in both Pre-baseline and Post-baseline were respectively, ( $m = 8.200$  and  $m = 4.100$ ) with value ( $t = 22.481$  and  $p < 0.05$ ). Jorenby (2016) was made a research that ran for 26 days, a group of tobacco cigarette user and a group of dual-user were formed. Results showed that the dual-user group successfully decreased the usage of tobacco cigarettes compared to the group of tobacco cigarettes only.

In table 2, the results showed that the decrease of the percentage of tobacco cigarette consumptions was higher on the subjects who less dependence on nicotine rather than the subjects who depends more on nicotine in daily intake. As an example, subject nine was successfully decreased in the percentage of tobacco cigarette intake, which started with 58 pieces of tobacco cigarettes at the pre-baseline phase, then decreased into seven pieces only throughout the post-baseline phase with 87%. Compared to subject 4, which started with 239 pieces of tobacco cigarettes in the pre-intervention phase, then decreased to 168 pieces in the post-baseline phase, with a percentage, only 29%. It proved that e-cigar effectiveness was more comfortable to trace on the person who has a lower dependence on a tobacco cigarette.

Moreover, the results in Table 2 showed that the subjects were experienced a decreased amount of tobacco cigarette intake from the pre-baseline until the end of the study. It proved that no subjects were failed to decrease their tobacco cigarette intake throughout this study. Therefore, this study rejects the experiment by McQueen *at all*. (2016) which stated that the e-cigar did not effectively decrease for tobacco cigarette cessation.

The results showed in Table 3, apparently proved that the dependence of nicotine amongst subjects was decreased significantly. The decrease in the dependence on nicotine was stated in the results. The mean of the FTND as the mean score in the pre-baseline was also decreased in the post-baseline. Therefore, both of these results proved that the e-cigar was effective in dealing with tobacco cigarette addiction. These also supported by Etter and Eisenberg (2014), stated that the ex-smoker (tobacco cigarette) who changed into using e-cigar was having a very low dependence of nicotine, yet stated that the e-cigar also have the same/lower addictions compared to the usage of nicotine gum for



the tobacco cigarette cessation. Therefore, hypothesis 2 is accepted.

### Conclusions

In conclusion, the baseline study was successfully done and achieved its' objectives and hypothesis. First, e-cigar was existed along with the existence of dual-use. It is a state where a person used both e-cigar and a tobacco cigarette. It was also shown in the results that dual-use not only existed. It also has a relationship with the amount of the tobacco cigarette consumed and the percentage of the e-liquid used. Therefore, the higher the percentage of the e-liquid, the lesser the value of the mean score in the FTND. It is much related to the number of tobacco cigarettes consumed by the subjects). Second, e-cigar helped deal with the addiction of the tobacco cigarette, proved by the mean score of the FTND in both pre-baseline and post-baseline, and the amount (pieces) of the tobacco cigarette intake by all subjects throughout the study. Therefore, the e-cigar was helpful for tobacco cigarette cessation.

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