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The Relationship Between E-Cigarette Use and Propylene Glycol Content in Women Aged 17–25 Years with the FEV1 and FVC Ratios in Relation to Copd in South Jakarta and its Analysis from an Islamic Perspective

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KEYWORDS
e-cigarettes; propylene glycol; FEV1/FVC ratio; lung function; COPD; Islamic perspective

ABSTRACT
This research aims to investigate the relationship between e-cigarette use, propylene glycol content, and the FEV1/FVC ratio in women aged 17–25 years in South Jakarta, as well as to analyze the findings from an Islamic health ethics perspective. A cross-sectional analytical study was conducted involving 40 female e-cigarette users aged 17–25 years in South Jakarta. Data were collected using spirometry to measure FEV1 and FVC, and a structured questionnaire to assess e-cigarette usage patterns and PG exposure. Purposive sampling was applied, and data were analyzed using descriptive and correlational statistics. All respondents showed FEV1/FVC ratios within normal limits (>75%), with no significant correlation found between the duration or intensity of e-cigarette use and lung function decline. Variations in usage patterns (puffs per day, liquid consumption) did not demonstrate a clear association with FEV1/FVC outcomes. Additionally, no meaningful relationship was observed between e-cigarette use and menstrual pain history. Although e-cigarette use among young women in this sample did not show immediate adverse effects on lung function as measured by FEV1/FVC, potential long-term risks remain a concern. From an Islamic perspective, e-cigarette use may be considered makruh or even haram if proven harmful to health, aligning with the principle of preserving well-being (hifz al-nafs) and avoiding harm (darar). These findings highlight the need for continuous health monitoring and religiously informed public health messaging regarding e-cigarette use.

INTRODUCTION

The rise of smoking is common in the lifestyles of today's smokers (Mahajaya et al., 2023). E-cigarettes or vapes first arrived in Jakarta in 2010. However, their development was not immediately recognized because many people in Jakarta were unaware of them at the time; it was only around 2013–2014 that vaping began to increase (Febrina et al., 2021). In Jakarta, smoking often begins during adolescence. In the current era, conventional cigarettes have largely been replaced by e-cigarettes, which are widely used by teenagers. E-cigarettes appear more attractive than conventional cigarettes, prompting teenagers to switch so they do not feel left behind (Mahajaya et al., 2023).

In Jakarta, data from the Global Adult Tobacco Survey (2021) show that the number of e-cigarette users aged 15 years and older rose from 0.3% (480,000) in 2011 to 3.0% (6.6 million) in 2021. Among these users, 2.8% are young people working as students, with relatively high education levels, living in urban areas, and showing similar prevalence between

men and women. The five provinces with the highest number of e-cigarette users are Jakarta (7.4%), East Java (6.0%), DKI Jakarta (5.9%), South Sulawesi (4.9%), and Bali (4.2%) (Sheliasih et al., 2022). According to the Central Statistics Agency (BPS) in its 2021 survey results, DKI Jakarta has 10,605,437 residents, of whom 5.9% (625,721 people) are e-cigarette users.

According to the Central Statistics Agency (BPS) in its 2021 survey results, South Jakarta has 2,232,442 residents, of whom 4.9% (approximately 109,390 people) are e-cigarette users (BPS, 2021). According to BPS in its 2023 survey results, South Jakarta has 175,884 residents aged 20–24 years. Assuming a 50% male and 50% female distribution, there are 87,942 males and 87,942 females (BPS, 2023). South Jakarta comprises 10 sub-districts, so we estimate approximately 8,794 individuals aged 20–24 per sub-district. To determine the minimum sample size, researchers applied the Slovin formula based on this population data. Factors influencing e-cigarette use among Jakarta adolescents include knowledge, perception, peer and family support, advertising, accessibility, price, and lifestyle (Wirajaya et al., 2024).

E-cigarette use among women of childbearing age continues to rise, despite their better toxic profile compared to conventional cigarettes. However, e-cigarettes still contain harmful substances such as lead, tobacco-specific nitrosamines, and volatile organic compounds, at higher levels in users than in non-users (Perez et al., 2021). Many misconceptions among young people and pregnant women portray e-cigarettes as harmless, contributing to increased prevalence in this vulnerable group (Virgili et al., 2022). E-cigarettes consist of three main parts: a battery, an atomizer, and a cartridge containing a nicotine solution. Initially considered safer due to lower nicotine content, they were found by the FDA in 2009 to contain toxins such as tobacco-specific nitrosamines (TSNAs) and diethylene glycol (DEG), both carcinogens (Rohmani et al., 2018).

E-cigarettes contain humectants such as propylene glycol and glycerol, along with nicotine and various flavors. The WHO notes that more than 8,000 types of flavors are used, but their safety remains untested scientifically (Tayyarah & Long, 2014). Primary ingredients like propylene glycol (PG) can cause acute and chronic health issues, including asthma, shortness of breath, and decreased lung function (Lukito et al., 2017). Tobacco products such as e-cigarettes can also cause respiratory distress, including EVALI (e-cigarette or vaping product use-associated lung injury) in healthy young people (Indriyawati & Martha, 2024). E-cigarette use affects lung function, measurable via spirometry parameters such as FEV1 and FVC, which often decline in obstructive or restrictive conditions (Wen Sewa & How Ong, 2014).

According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD), COPD severity is classified based on post-bronchodilator FEV1 in patients with an FEV1/FVC ratio <0.70: GOLD 1 (mild; FEV1 ≥80% predicted), GOLD 2 (moderate; FEV1 50%–79% predicted), GOLD 3 (severe; FEV1 30%–49% predicted), and GOLD 4 (very severe; FEV1 <30% predicted) (Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease, 2020).

Previous studies have examined e-cigarette use and its health impacts. For instance, Perez et al. (2021) identified elevated biomarkers of inflammation and toxicant exposure among women of reproductive age who use e-cigarettes. Lukito et al. (2017) highlighted propylene

glycol's role in respiratory irritation and decreased lung function. Rowell and Tarran (2015) raised concerns about long-term pulmonary effects, suggesting risks for obstructive lung diseases. However, most studies focus on general or mixed-gender populations, with limited attention to young women in urban Indonesian contexts. Few integrate spirometric measurements (FEV1/FVC ratios) with behavioral data (e.g., usage frequency, propylene glycol exposure) among young female users. Moreover, scarce research incorporates an Islamic ethical perspective, emphasizing health preservation (*hifz al-nafs*) and the prohibition of harm (*darar*).

The background reveals a correlation between e-cigarettes and impaired lung function, assessable via spirometry. Thus, this study examines the relationship between e-cigarette use by female users and lung function. Its main purpose is to investigate how e-cigarette use contributes to chronic obstructive pulmonary disease (COPD) and affects lung function. Specifically, it determines the relationship between e-cigarette use, COPD, and FEV1/FVC ratios in women aged 17–25 years in South Jakarta. Theoretically, the study aims to enhance understanding of e-cigarette–COPD links and FEV1/FVC ratios in this context. Practically, it benefits researchers by fostering critical, analytical, and systematic skills to identify community health issues and apply medical knowledge from studies at the Faculty of Medicine, Yarsi University. For the public, it provides information on e-cigarette dangers, their impact on lung function, and FEV1/FVC effects. For the university, it supports the Tri Dharma of Higher Education through education, research, and service, while strengthening collaboration among students, faculty, and leadership.

METHOD

This study aims to determine the relationship between e-cigarette use and lung function, especially in the FEV1/FVC ratio, in women aged 17-25 years in the South Jakarta area. The type of research is analytics with a cross-sectional design, which studies risks and effects through simultaneous observation (Abduh et al., 2022). Data were collected using spirometers to measure FEV1 and FVC as well as questionnaires to measure the amount of propylene glycol based on the duration of e-cigarette use. The population in this study was 40 women who used e-cigarettes, with purposive sampling techniques (Lenaini, 2021), and sample calculation using the Slovin formula (Sinaga, D., 2014). This study also combines quantitative and qualitative data to understand the impact of e-cigarette use on lung function.

RESULTS AND DISCUSSIONS

Respondent Overview

This study was conducted on 40 female respondents aged 17-25 years who live in the South Jakarta area and are active users of e-cigarettes. All respondents had a history of e-cigarette use of at least 6 months to 6 years, with variations in the frequency of inhalation per day as well as variations in drops Liquid used per day. The analyzed parameters include:

a. Age
b. Weight, Height, Body Mass Index (BMI)
c. Duration of e-cigarette use
d. Number of suctions per day (N/day)

e. Number of liquid drops per day (n/day)
f. Rated FEV1/FVC ratio
g. History of menstrual pain (assessment of VAS and its categories)

Age Distribution of Respondents

From the data results, 7.5% of respondents aged 17-19 years, 57.5% of respondents aged 20-22 years, and 35% of respondents aged 23-25 years old. This distribution shows that the majority of respondents are in the age group of 20-22 years.

Distribution of Body Mass Index (BMI) of Respondents

From the data results, 10% of respondents were underweight i.e. BMI <18.5 kg/m^2, 37.5% of respondents had a normal body weight, namely BMI of 18.5-22.9 kg/m^2, 22.5% are overweight i.e. BMI 23-24.9 kg/m^2, 25% of respondents had a type I obesity weight, namely BMI of 25-29.9 kg/m^2, and 5% of respondents had a type II obesity weight, namely BMI ≥30 kg/m2. This distribution showed that most respondents were in the normal weight range to type I obsessiveness. *overweight* to obesity.

Distribution of Respondents' E-Cigarette Use Time

From the data results, respondents obtained the most duration of e-cigarette use, which was 32.5% for 24 months. Then, followed by a duration of 12 months and 36 months, which is 20%.

Distribution N/day (number of suctions per day) Respondents

Based on the distribution of the number of e-cigarette puffs per day (N/day), out of a total of 40 respondents, the frequency of e-cigarette puffs per day varies greatly, ranging from 30 to 1000 puffs per day. The number of respondents was the most in the categories of 50 inhalations per day and 100 inhalations per day, each as many as 9 people (22.5%), so that these two categories became the most dominant.

Distribution n/day (number of liquid drops per day) Respondents

From the data results, 22.5% of respondents used <3 drops Liquid per day, 55% of respondents use 3-11 drops Liquid per day, 15% of respondents use 12-20 drops Liquid per day, and 7.5% of respondents used >20 drops Liquid per day. This distribution shows that most respondents are in the light-use category, which is 3-11 drops of liquid per day, which covers more than half of the total respondents.

The variation in the number of liquid drops per day in respondents illustrates the difference in habits and frequency in e-cigarette use in the respondents of this study. Users with the number of drops Liquid which is very mild (<3 drops per day) may reflect less intense or only occasional use behavior. In contrast, respondents with a higher amount of use, especially respondents who used >20 drops per day, showed a very heavy and more consistent pattern of use.

Distribution of Menstrual History with Respondents' E-Cigarette Use

From the data results, 70% of respondents did not experience menstrual pain since the use of e-cigarettes, 22.5% experienced mild menstrual pain with a VAS scale of 5-44 mm, 2.5% of respondents experienced moderate menstrual pain with a scale of 45-74 mm, and 2.5% of respondents experienced severe menstrual pain with a scale of 75-100 mm. This distribution showed that most respondents did not report an increase in menstrual pain complaints, while some still experienced symptoms of varying intensity.

Variations in the level of menstrual pain in respondents can be influenced by various factors, such as hormonal differences, physical activity, sleep patterns, stress levels, nutrient consumption, and reproductive health conditions. Although the study looked at the relationship between menstrual history and e-cigarette use, the results showed that most respondents did not experience significant changes in menstrual pain complaints. This may indicate that since the use of e-cigarettes in this group of respondents was not directly related to the increase in pain intensity.

FEV1/FVC Distribution Responders

From the results of the data, it was found that all respondents (100%) had *a FEV1/FVC* ratio in the normal category of >75%. This shows that there are no respondents who experienced a decrease in the FEV1/FVC ratio either in the light (60-75%), medium (40-60%), or severe (<40%) categories. This indicates that the lung function of all respondents is in good condition and shows no signs of airway obstruction.

The Relationship of Respondents' Age with the Respondent's Body Mass Index (BMI)

The graph of the relationship between age and Body Mass Index (BMI) in figure 4.1.1 shows the distribution of respondents' BMI in the age range of 18-25 years with a total of 40 people. On the graph, two boundary lines can be seen that represent the normal BMI value, namely the lower limit of 18.5 and the upper limit of 22.9. The points between the two lines are categorized as normal BMI, while the points below the lower limit line belong to the underweight category, and the points above the upper limit line belong to the overweight to obesity category.

Based on the distribution of data, most respondents were in the BMI category of overweight to obese. However, respondents with BMI are still found to be below normal or normal in almost all age groups. At the age of 18-19 years, BMI variations have been seen with respondents who are in the underweight category and a small percentage are above normal. Ages 20-22 years show the distribution of BMI in the normal range to overweight and obesity. At the age of 23-25 years, the distribution of BMI is quite wide, ranging from underweight to obesity.

Based on the graph of the relationship between age and Body Mass Index (BMI), it can be concluded that the BMI status of respondents in the age range of 18-25 years shows a diverse distribution and does not form a clear pattern of relationship between increasing age and changes in BMI. Most respondents were in the normal BMI category, but in each age group, responses were still found with underweight BMI or overweight to obsessiveness. This suggests that age is not the only factor determining BMI status in young adults.

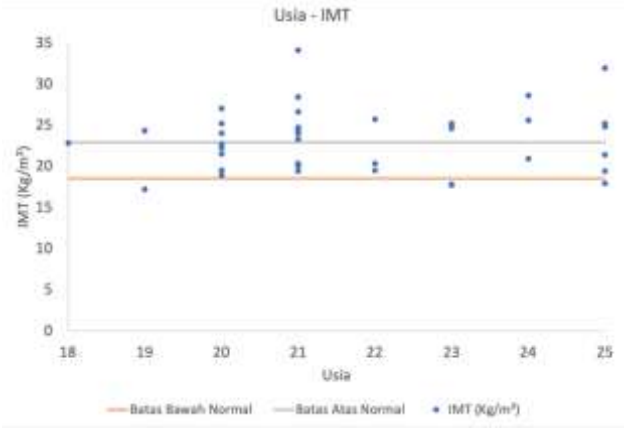


Figure 1. Graph of the Relationship Between Age and Body Mass Index (BMI)
Source: Processed by the author, 2025

The Relationship of Respondents' Age with Respondents' E-Cigarette Use Time

The graph of the relationship between the age of e-cigarette respondents and the time of e-cigarette use shows the long distribution of e-cigarette use (in months) among respondents aged 17-25 years with a total of 40 people. Each point on the graph represents one respondent, so that there is a variation in the time of e-cigarette use in each age group. In general, the time of use of e-cigarettes is quite widespread, ranging from relatively short use to use for a longer period.

At the age of 18-19 years, most respondents have a relatively short to moderate time of e-cigarette use, although there are respondents who have shown a longer duration of use. Ages 20-22 years show a more diverse variety of use times, ranging from 1 year to 5 years of < use. This indicates that in this age range there are respondents who start using e-cigarettes from a younger age and respondents who have just started using them.

At the age of 23-25 years, the duration of e-cigarette use tends to be longer, with some respondents having a duration of use of up to four to six years. However, in this age group, respondents are still found with relatively short usage time.

Overall, Figure 2 shows that the older the respondents, the more likely they are to have a longer period of e-cigarette use. However, the distribution of respondents spread over various durations of use can be stated that the length of use of e-cigarettes is not only determined by age, but also influenced by other factors.

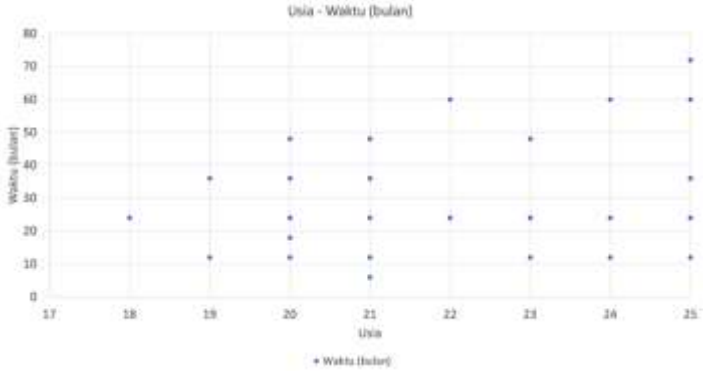


Figure 2. Graph of the Relationship Between Age and Time of Use (months)
Source: Processed by the author, 2025

Respondent's Age Relationship with N/day (number of suctions per day) Respondent

Based on the number of puffs per day varies greatly, ranging from 30 to 1000 puffs per day. In almost all age groups, more than one category of the number of puffs was found, which indicates a difference in the intensity of e-cigarette use between individuals even though they are at the same age. The age group of 20 and 21 years had the most amount of N/day variation, ranging from low to very high suction, and was the group with the largest number of respondents.

The distribution graph in Figure 3 shows that the number of e-cigarette puffs per day in respondents aged 17-25 years shows considerable variation and does not form a clear relationship with age.

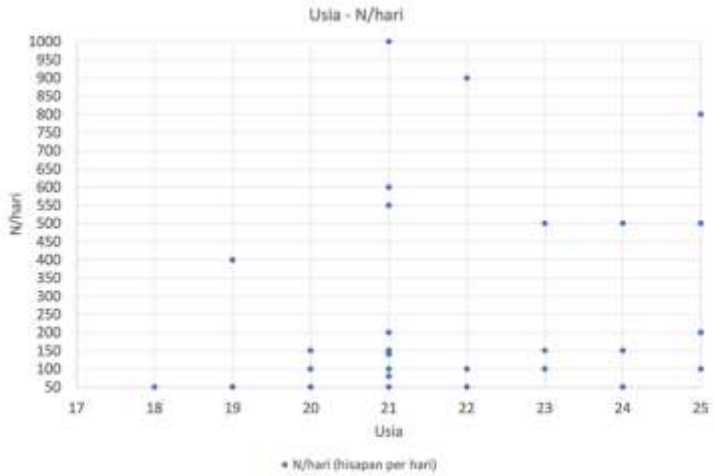


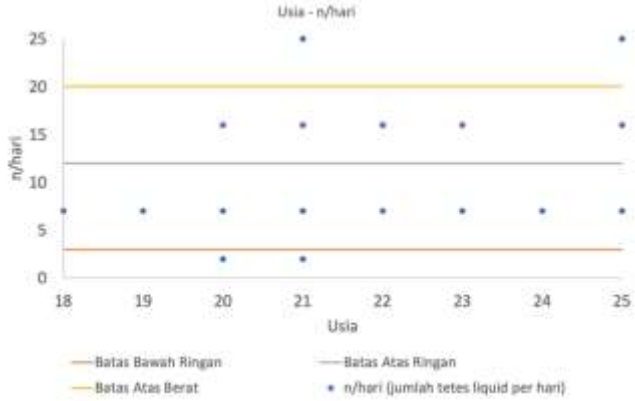
Figure 3. Graph of the Relationship Between Respondent Age and N/day (number of suctions per day) of Respondents

Source: Processed by the author, 2025

Respondent's Age Relationship with n/day (number of liquid drops per day) Respondent

Based on the number of drops of liquid per day used, respondents ranged from 2 to 25 drops per day. The highest found n/day value was 7 drops per day (included in the mild category), which was spread almost across all age groups and was the category with the highest number of respondents. In addition, the use of 16 drops per day is also quite frequent, especially in respondents aged 20-25 years. The use of very light liquid drops, i.e. 2 drops per day, was mostly found at the age of 20 and 21 years, while very heavy use, i.e. 25 drops per day, was only found in a small percentage of respondents aged 21 and 25 years.

The distribution graph in Figure 4.1.4 shows that most of the points are in the range of light to heavy use, which is 3-11 drops/day and 12-20 drops/day. The boundary line on the graph shows the classification of usage levels. No clear relationship was found between increasing age and increasing the number of drops of liquid used per day.



*n/day = number of liquid drops per day

Figure 4. Graph of the Relationship Between Respondent Age and n/day (number of liquid drops per day) Respondent

Source: Processed by the author, 2025

Respondents' Age Relationship with Menstrual History (*Visual Analogue Scale*, VAS (mm)) Respondents

Based on most of the respondents had a VAS value of 0 mm, which indicates that they did not feel menstrual pain since the use of e-cigarettes. This condition is found in almost all age groups. However, there are still respondents who feel pain with varying intensity, ranging from mild pain to severe pain.

Graph 5 shows that the majority are in the category of no pain to mild pain. In each age group, there was a variation in pain intensity, but there was no pattern of increasing pain intensity with age. There was no clear relationship between age and menstrual pain intensity in the e-cigarette respondents in this study.

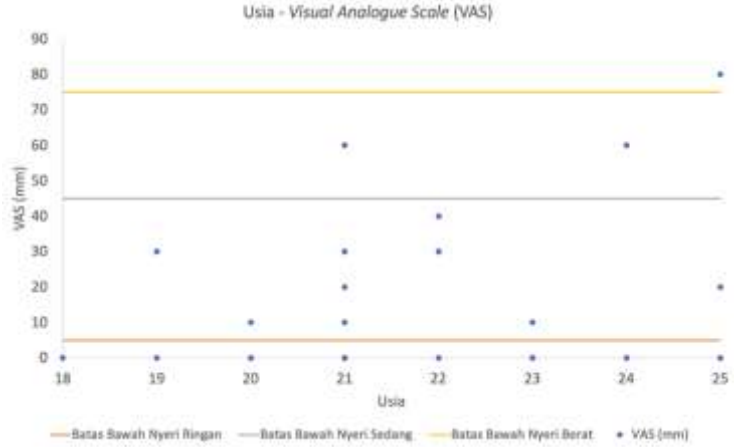


Figure 5. Graph of the Relationship Between Respondents' Age and Menstrual History on the Visual Analogue Scale (VAS)

Source: Processed by the author, 2025

Respondents' Age Relationship with FEV1/FVC MEAS and FEV1/FVC PRED Respondents

Based on all respondents, the values of FEV1/FVC MEAS and FEV1/FVC PRED were above the normal limit of 75%. The FEV1/FVC value of MEAS ranges from 90.7% to 100%,

while the FEV1/FVC value of PRED ranges from 85.6% to 93.4%. In general, FEV1/FVC MEAS values in all age groups tend to be higher than FEV1/FVC PRED values.

The graph in Figure 6 shows that FEV1/FVC MEAS points are located at high and relatively stable values across the age range, while FEV1/FVC PRED values are slightly lower but remain within normal limits. No clear relationship was found between increasing age and decreased FEV1/FVC values in respondents in this study.

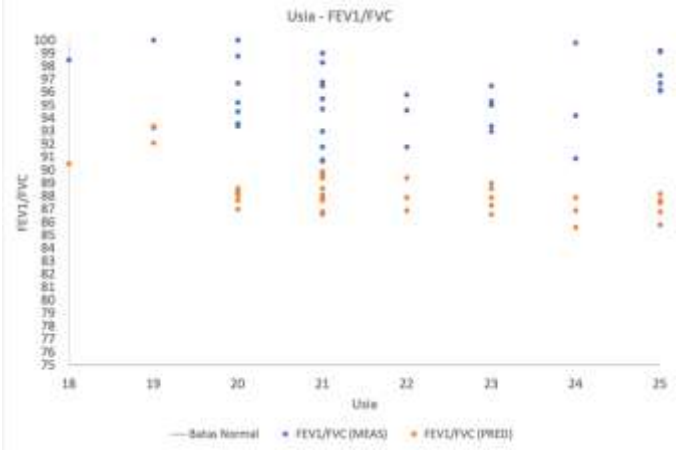


Figure 6. Graph of the Relationship between Respondents' Age and FEV1/FVC (PRED and MEAS) Respondents

Source: Processed by the author, 2025

Relationship of Respondents' E-cigarette Use Time with N/day (number of puffs per day)

The distribution of the number of respondents was based on the time of use of e-cigarettes with the number of e-cigarette puffs per day (N/day). Based on the most diverse variations based on the time with the number of suctions, namely 12 months, 24 months, and 36 months.

The graph in figure 7 shows the relationship between the time of e-cigarette use and the number of puffs per day (N/day). The graph depicts the distribution of the intensity of e-cigarette use among 40 respondents with a duration of use ranging from 6 months to 72 months. Each point on the graph represents one respondent, so that there is a variation in the number of suction per day in each group of long use. Based on the graph, there is no clear relationship between the time of e-cigarette use and the number of puffs per day (N/day).

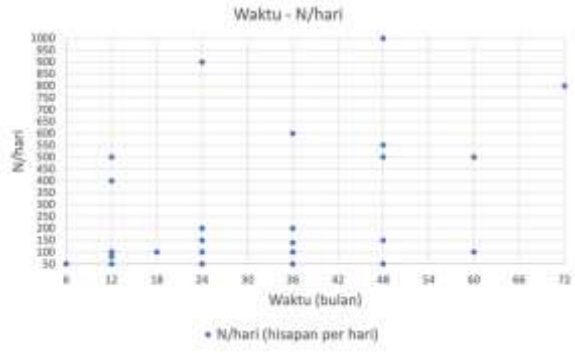


Figure 7. Graph of the Relationship between Respondents' E-cigarette Usage Time and N/day (number of puffs per day)

Source: Processed by the author, 2025

The relationship between the time of use of E-cigarettes of the Respondents and n/day (number of drops of liquid per day)

Total respondents were based on time and n/day (number of liquid drops per day). At each time of e-cigarette use, the dominant respondent was the number of drops of liquid per day in the light category, which was 3-11 drops per day.

The graph in figure 8 shows the relationship between the time of the respondent's e-cigarette use and the number of liquid drops per day (n/day). The graph shows the distribution of liquid usage patterns in 40 respondents with a duration of use of 6 to 72 months. Each point on the graph represents one respondent, so there is a variation in the number of drops of liquid used per day in each time group of use. The number of liquid drops can be categorized into very light (<3 drops), light (3-11 drops), heavy (12-20 drops), and very heavy (>20 drops). Based on the graph, there is no clear relationship between the time of e-cigarette use and the number of drops of liquid used per day. The number of liquid drops per day in respondents varied with each duration of use and did not show a tendency to increase with the increasing duration of use.

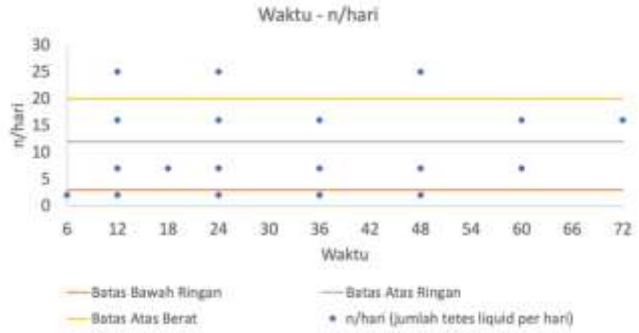


Figure 8. Graph of the relationship between the time of use of E-cigarettes Respondents with n/day (number of drops of liquid per day)

Source: Processed by the author, 2025

The Relationship between Respondents' E-Cigarette Time and Body Mass Index (BMI)

Based on the distribution of data, the duration of e-cigarette use was found to be 24 months, with most respondents in the overweight to obese category, followed by the normal BMI category.

The graph in figure 9 shows the relationship between the time of e-cigarette use and the Body Mass Index (BMI) in 40 respondents. The horizontal axis depicts the length of e-cigarette use in the month, while the vertical axis shows the respondent's BMI value. The graph also shows two boundary lines that mark the normal BMI range, namely the lower limit and the upper boundary. The dots on the graph represent the BMI value of each respondent at a given duration of use. Based on the graph, there is no clear relationship between the time of e-cigarette use and the respondents' BMI value. Respondents' BMI status at different durations of use showed wide variation and did not form a specific pattern.

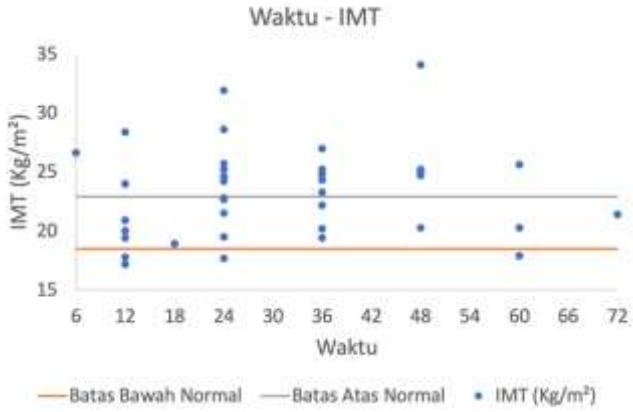


Figure 9. Graph of the Relationship Between Respondents' E-Cigarette Consumption Time and Body Mass Index (BMI)

Source: Processed by the author, 2025

Relationship of Respondents' E-cigarette Use Time with Menstrual Pain History (Visual Analogue Scale, VAS (mm))

At each time of e-cigarette use, the dominant respondent was the number of drops of liquid per day in the light category, which was 3-11 drops per day. At each time of e-cigarette use, the dominant respondents in the category had no pain (0-4 mm).

The graph shows the relationship between the time of e-cigarette use and the history of menstrual pain (Visual Analogue Scale) in 40 respondents. The horizontal axis depicts the length of e-cigarette use in the month, while the vertical axis shows the VAS value. The horizontal lines on the graph mark the classification of menstrual pain intensity, i.e. no pain (0-4 mm), mild pain (5-44 mm), moderate pain (45-74 mm), and severe pain (75-100 mm). The graph points represent each respondent at a given duration of use.

Based on the graph, most of the respondents were in the no-pain to mild pain category. At a duration of use of 6-18 months, the majority of respondents felt the absence of menstrual pain. At the duration of 24-36 months, a more diverse variation in pain intensity begins to be seen. Meanwhile, severe pain was only found in respondents with a duration of use of 72 months. Based on the graph, the length of time of e-cigarette use does not indicate a clear association with increased menstrual pain intensity based on VAS.

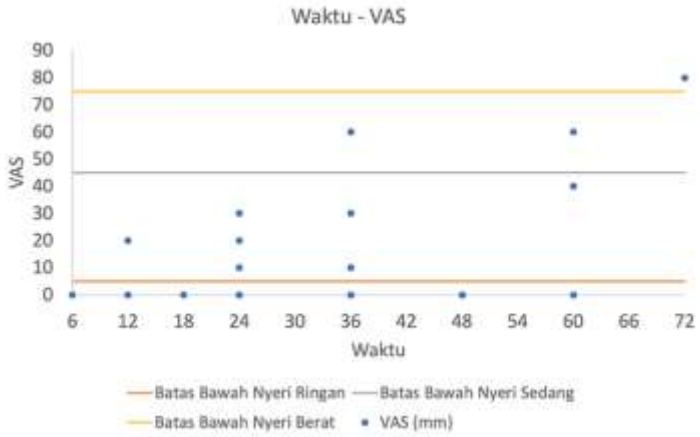


Figure 10. Graph of the Relationship of Respondents' E-Cigarette Use Time with Menstrual Pain History VAS (*Visual Analogue Scale*)

Source: Processed by the author, 2025

Relationship of Respondents' E-Cigarette Time with FEV1/FVC MEAS and FEV1/FVC PRED

Based on all respondents, the values of FEV1/FVC MEAS and FEV1/FVC PRED were above the normal limit of 75%. The FEV1/FVC value of MEAS ranges from 90.7% to 100%, while the FEV1/FVC value of PRED ranges from 85.6% to 93.4%. In general, the FEV1/FVC MEAS value in all e-cigarette use time groups tends to be higher than the FEV1/FVC PED value.

The graph in figure 11 shows the relationship between the duration of e-cigarette use and the FEV1/FVC ratio, both based on direct measurement results (FEV1/FVC MEAS) and predictive values (FEV1/FVC PRED), in 40 respondents. The horizontal axis depicts the length of e-cigarette use in the month, while the vertical axis shows the value of the FEV1/FVC ratio. The horizontal line on the chart marks the normal limit of the FEV1/FVC ratio of 75%. The dots on the graph represent the FEV1/FVC value of each respondent at a given duration of use.

Based on the graph, all FEV1/FVC MEAS and FEV1/FVC PRED values were above normal limits, both at short and longer durations of use. The FEV1/FVC value of MEAS was consistently higher than the FEV1/FVC value of PRED in almost all respondents. Based on the graph, the length of e-cigarette use did not show a clear relationship with the FEV1/FVC ratio in respondents. All respondents had FEV1/FVC values that were still within normal limits, both based on measurement results and prediction values.

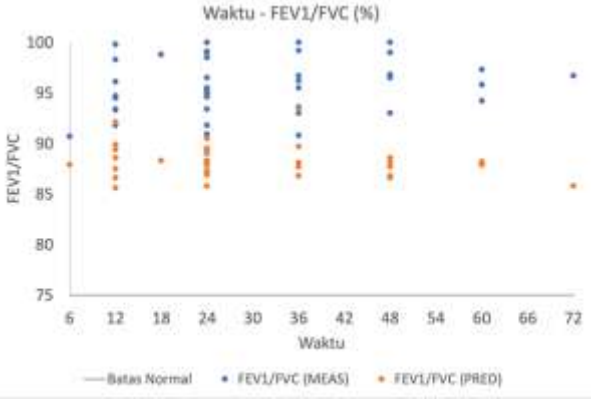


Figure 11. Graph of the Relationship of Respondents' E-Cigarette Usage Time with FEV1/FVC MEAS and FEV1/FVC PRED

Source: Processed by the author, 2025

Data Results and Interpretation of Results

From a total of 40 respondents whose data were collected in this study, it was found that all respondents had a FEV1/FVC ratio value above 75%, which indicates lung function within normal limits. This indicates that in general, no airway obstruction was found in the study samples, although there were variations in individual characteristics such as age, body mass, e-cigarette habits, and history of menstrual pain. Thus, from these results, it can be interpreted that there is no meaningful relationship between the history of e-cigarette use and the FEV1/FVC ratio value in the respondents of this study.

In addition, the characteristics of the respondents showed that some participants were e-cigarette users with varying durations of use, ranging from six months to six years. The

frequency of use per day also varied, but the variation did not show a significant effect on FEV1/FVC values remaining within the normal range.

The variation in the BMI (Body Mass Index) value of the respondents ranging from underweight to type II obesity did not show a significant interaction with the FEV1/FVC ratio value. It can be concluded that anthropometric factors also did not appear to contribute to changes in the FEV1/FVC ratio in these respondents.

In the menstrual pain history section, some respondents reported pain complaints of varying severity. However, the complaint has no direct relationship with pulmonary function parameters, so it does not affect the FEV1/FVC ratio value. Overall, the data illustrates that the variability of respondent characteristics did not have a significant impact on basic lung function as measured through the FEV1/FVC ratio.

The results of this study showed that all respondents had a FEV1/FVC ratio within normal limits, although there were differences in individual characteristics and variations in e-cigarette use habits. These findings indicate that in a young population (17-25 years) with good general health status, e-cigarette use has not shown a detected effect through basic pulmonary function parameters measured by the FEV1/FVC ratio using a spirometry instrument.

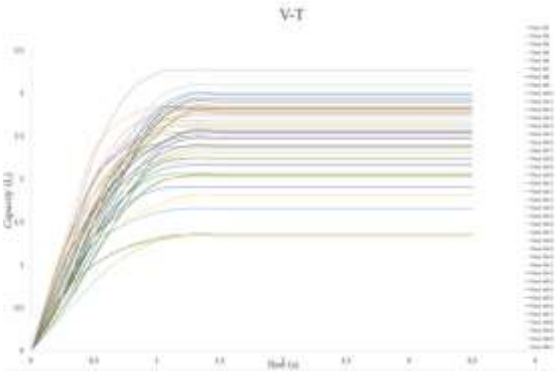


Figure 12. Graph of 40 Respondents
Source: Processed by the author, 2025

The data in the graph in Figure 12, shows the relationship between time (horizontal axis, in units of seconds) and lung capacity (vertical axis, in units of liters) in 40 respondents. This graph shows the volume of air expelled by 40 respondents, i.e. women aged 17-25 years, during forced expiration measured through a spirometry curve. The curve shows the process of expelling air from the lungs at its maximum after full inspiration, so it can be used to assess lung ventilation function.

In general, the curve shown shows a very rapid increase in volume in the first second of expiration, which illustrates the respondent's ability to expel air vigorously. This initial phase shows the achievement of the FEV1 (Forced Expiratory Volume in 1 Second) value, which is the volume of air that can be expelled in the first second of forced expiration. After the initial phase, the increase in air volume takes place more slowly until it reaches the maximum capacity, namely FVC (Forced Vital Capacity).

Based on the curve pattern, respondents showed a consistent increase in air volume and achieved FVC optically Number of Age-Appropriate Respondents with mal BMI, with no indication of airflow resistance during the expiratory process. The rapidly rising curve at the beginning of expiration indicates that most respondents have good ventilation function. There

is no curve showing slow or inhibited air excretion, which is usually found in individuals with obstructive disorders.

The comparison between FEV1 and FVC is an important indicator to identify the possibility of obstructive or restrictive pulmonary function impairment in the respiratory tract. This graph provides a visual picture that reinforces the interpretation that the respondents in this study generally have lung function that is within normal limits.

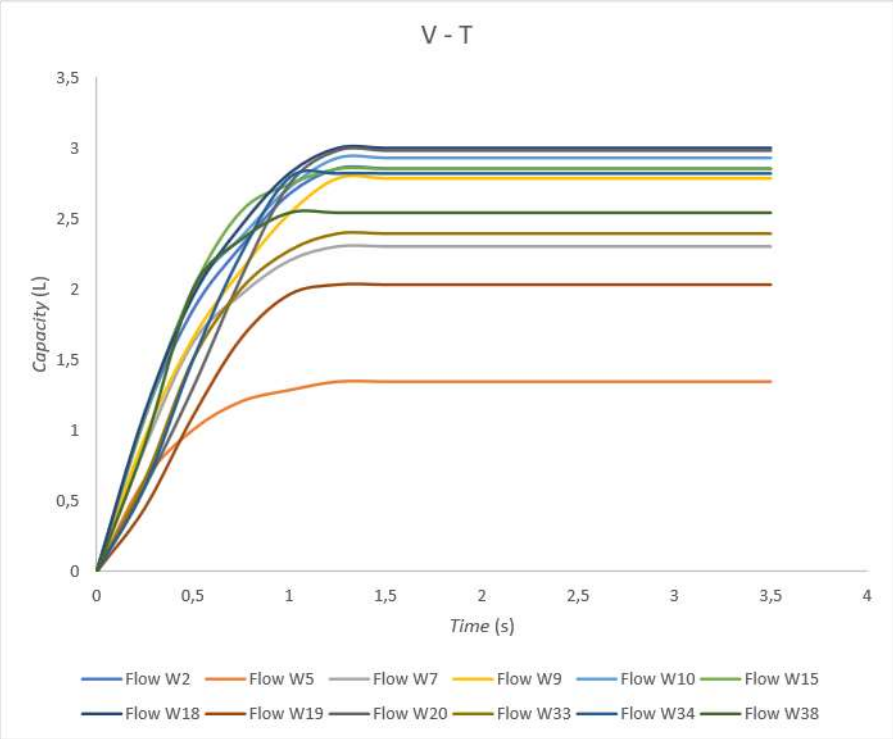


Figure 13. Graph of Respondents with a History of Menstrual Pain
Source: Processed by the author, 2025

The data in the graph in figure 13, shows the relationship between time (horizontal axis, in units of seconds) and lung capacity (vertical axis, in units of liters) in respondents who have a history of menstrual pain. This graph represents the forced expiration process in each respondent after maximum inspiration. Through this graph, it can be seen how the air volume increases over time until it reaches the forced vital capacity (FVC) in each respondent.

In general, the entire curve showed a pattern of rapid increase in air volume in the first second of expiration, which illustrates the respondent's ability to expel air strongly and effectively. This achievement illustrates the value of FEV1 (Forced Expiratory Volume in 1 Second). After the initial phase, the volume increase took place more slowly until the maximum volume that respondents could achieve.

Although the respondents in this graph had a history of menstrual pain, the curves shown showed no airflow obstruction or abnormal expiratory patterns. All respondents seemed to perform forced expiratory maneuvers well and reached their maximum capacity. This indicates that the menstrual pain experienced by the respondents did not affect the forced expiratory pattern through the V-T curve.

Overall, figure 4.2.2 shows that respondents with a history of menstrual pain still had an expiratory process that was within the normal range based on the V-T curve picture.

Graphic Data

Based on the FEV1/FVC PRAISED graph, the prediction curve pattern shows a relatively uniform shape and follows a trajectory that should correspond to individual characteristics, such as age, gender, height, and weight. This prediction curve describes the physiologically expected condition of lung function in each respondent. Visually, most of the prediction graphs appear stable and in the normal range, indicating that theoretically the respondents have a lung capacity that should still be good if not influenced by external factors. This shows that the calculation of the prediction value is appropriate and can be used as a comparative reference for the actual measurement results.

The FEV1/FVC MEAS graph shows more pronounced variations than the prediction graph. The actual measurement lines in some respondents did not appear to fully follow the predictive curve pattern and showed certain deviations, either in the form of a decrease or a shift in the shape of the curve. Although most of the values were still above the normal limit, there was a visual difference in FVC and FEV1 in some respondents. This variation reflects the condition of lung function that is influenced by external factors, such as e-cigarette habits, duration of use, daily inhalation, and other factors, so measurements are not always ideal with predicted values.

Comparisons between the FEV1/FVC PRED and FEV1/FVC MEAS graphs show a relationship, but they are not fully aligned. In some respondents, the actual measurement curve was still close to the prediction pattern, indicating that lung function was relatively in line with the expected conditions. However, in other respondents, there was a fairly clear difference between the two graphs, indicating a decrease or change in lung function compared to the predicted value. Overall, the graph shows that although the predictive values provide an ideal picture of lung function, the actual measurement results reflect actual physiological conditions that are influenced by external factors. Thus, there is a relationship between FEV1/FVC PRED and FEV1/FVC MEAS, but the relationship is not always linear or identical in every respondent.

Comprehensive analysis

The respondents in this study were all in the young adult age group, namely 17-25 years, so the variation in characteristics that emerged more reflects differences in behavior and use of e-cigarettes than differences in biological age. The length of e-cigarette uses in respondents varied from short-term to long-term use, indicating a difference in the duration of exposure in a relatively homogeneous age group. In addition, the intensity of use, both based on the number of puffs and the number of drops of liquid per day, also indicates anything that is not uniform. This pattern indicates that e-cigarette use habits in young adults are more influenced by individual behavioral factors and preferences than by age factors themselves.

Judging from the respondents' Body Mass Index (BMI) profile, the distribution of respondents' BMI was spread across the underweight, normal, to overweight-obese categories, with dominance in the normal and overweight-obese categories. The distribution of BMI over different durations of e-cigarette use did not show a consistent pattern of change. Respondents with longer durations of use did not necessarily have higher BMI compared to users with shorter durations. This suggests that BMI in young adult respondents may be more influenced by other factors than by the duration of e-cigarette use.

In the aspect of menstrual pain history assessed using the Visual Analogue Scale (VAS), most of the respondents were in the category of no pain to mild pain. Although it was found

that several respondents had moderate to severe pain intensity, the distribution of VAS values did not show a tendency to increase with the increase in the length of e-cigarette use. Variations in pain intensity that appear at a given duration of use appear to be individual and do not form a systematic pattern. These findings indicate that other factors may have a more dominant role in menstrual pain compared to e-cigarette use factors.

Analysis of lung function based on the FEV1/FVC ratio, both predictive values (PRED) and actual measurement results (MEAS), showed that all respondents were within the normal value range. The FEV1/FVC PRED graph showed a relatively uniform pattern according to the expected physiological conditions, while the FEV1/FVC MEAS graph showed more pronounced variation between respondents. A comparison of the two graphs shows a similarity, but not completely alignment, where in some respondents the actual measurement graph is below or shifts from the predicted value. However, there was no tendency to decrease the FEV1/FVC ratio related to the length of use of e-cigarettes, so visually the lung function of the respondents was still in good condition in this study population.

This study examines the law on the use of cigarettes in the Islamic view, the majority of which consider cigarettes not to be absolutely *haram*, but *makruh*, and some even consider it *makruh tahrim* (*makruh* that is close to haram). This is because tobacco cigarettes were not known in the time of the Prophet, so there is no explicit evidence in the Qur'an or hadith regarding its legal status. However, smoking can be a risk to health, and in Islam, anything that is harmful can be forbidden if it is proven to cause harm. In addition, cigarettes are categorized as a waste of wealth, which is contrary to the teachings of Islam which teaches to avoid waste (QS. Al-Isra [17]: 26-27). Smoking is also considered an act that wastes wealth and has the potential to harm the body, which is contrary to Islamic principles that prohibit any form of harm.

While there are some social and economic benefits from the cigarette industry, such as labor absorption and state revenue, the harm posed by cigarettes is much greater. Tobacco is known to be the leading cause of death due to lung disease, cancer, and other organ damage. In the sharia view, smoking is not only harmful for active smokers, but also risky for passive smokers, which causes greater harm to society. In the hadith of the Prophet PBUH, it is emphasized that everything that damages the body and property, as well as that can cause harm to oneself and others, is something that must be avoided (Kamilia, T.N., 2023; Rezi, M. and Sasmiarti, S., 2018). Therefore, smoking is included in the category of acts that Muslims should avoid because they can cause damage both physically and financially.

CONCLUSION

In this study, most respondents were women aged 17–25 years, predominantly 20–22 years old, with varied BMI statuses (majority overweight) showing no clear link to age; e-cigarette use intensity (puffs and liquid drops per day) varied widely without patterns tied to duration; and most reported no menstrual pain post-use, unrelated to age or duration. Lung function remained normal among all participants, with no significant FEV1/FVC ratio decline or COPD indications despite usage. From an Islamic perspective, cigarettes are deemed *makruh* (disliked) and potentially *haram* (forbidden) if they harm health, intellect, or property, violating Sharia principles against self-endangerment, harm to others, and redundancy, thus opposing the

maqasid al-Sharia of preserving life and wealth. For future research, longitudinal studies tracking propylene glycol exposure, FEV1/FVC changes, and menstrual health over years in larger South Jakarta samples could clarify subtle long-term risks and strengthen Islamic ethical interventions.

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