

## Analysis Of Urine Nicotine In Electronic Cigarette Smokers and Regular Cigarette Smokers

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### ABSTRACT

**Background:** The use of cigarettes, both conventional and electronic, is a growing public health problem in Indonesia. Exposure to nicotine in electronic and conventional cigarettes can have adverse effects on health. Nicotine, the main addictive substance in cigarettes, is metabolized into cotinine, which can be detected in urine as an important biomarker for assessing exposure levels and health risks.

**Objective:** To analyze nicotine in the urine of electronic cigarette and conventional cigarette users.

**Research Methods:** This study used a descriptive observational method with a cross-sectional research design. A total of 30 subjects who met the inclusion and exclusion criteria were selected using purposive sampling. Sample processing was performed using descriptive methods.

**Research Results:** The results showed that 15 samples from electronic cigarette users and 15 samples from conventional cigarette users tested positive for nicotine in urine.

**Conclusion:** The results showed that 15 samples from electronic cigarette users and 15 samples from conventional cigarette users tested positive for nicotine in urine.

**Keywords:** Electronic cigarette users, conventional cigarette users, nicotine in urine.

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### ABSTRAK

**Latar Belakang:** Penggunaan rokok, baik konvensional maupun elektrik, merupakan masalah kesehatan masyarakat yang semakin meningkat di Indonesia. Paparan nikotin yang terdapat pada rokok elektrik dan konvensional dapat berdampak buruk bagi kesehatan. Nikotin, sebagai zat adiktif utama dalam rokok, akan dimetabolisme menjadi cotinine yang dapat dideteksi dalam urine sebagai biomarker penting untuk menilai tingkat paparan dan risiko kesehatan.

**Tujuan:** Menganalisis nikotin dalam urine pada pengguna rokok elektrik dan rokok konvensional.

**Metode:** Penelitian ini menggunakan metode observasional deskriptif dengan rancangan penelitian cross sectional. Sebanyak 30 subjek yang memenuhi kriteria inklusi dan eksklusi dengan teknik pengambilan sampel purposive sampling. Pengolahan sampel dilakukan dengan metode deskriptif.

**Hasil Penelitian:** Hasil penelitian menunjukkan bahwa 15 sampel perokok elektrik dan 15

sampel dari perokok konvensional menunjukkan hasil positif nikotin dalam urine. **Kesimpulan:** Ditemukan positif nikotin urine pada perokok elektrik dan konvensional dengan pemeriksaan RDT. Kesimpulan: Hasil penelitian menunjukkan bahwa 15 sampel dari pengguna rokok elektronik dan 15 sampel dari pengguna rokok konvensional dinyatakan positif mengandung nikotin dalam urin.

Kata Kunci: Perokok elektrik, perokok konvensional, nikotin urine.

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## INTRODUCTION

Cigarettes are one type of product produced by the tobacco plants *Nicotin tabakum* and *Nicotin rustica* (Isnaeni et al. 2024). The World Health Organization (WHO) reports that tobacco use among adolescents increased from 13% in 2015 to 23% in 2023. According to the 2021 *Global Adult Tobacco Survey* (GATS) in Indonesia, exposure to cigarette smoke in public places remains high. As many as 74.2% of adults are exposed to cigarette smoke in eating places, and 44.8% in workplaces. Smoking can cause several diseases such as lung disease, heart disease, and cancer, and it can also reduce quality of life. Cigarette smoke contains 4,000 chemicals, including nicotine, tar, carbon monoxide (CO), and *polycyclic aromatic hydrocarbons* (PAHs) (Hermawati and Lathifah 2023). Cigarettes come in two types: regular cigarettes and electronic cigarettes, commonly referred to as vapes or vaporizers (Isnaeni et al. 2024).

Vaping is a form of change from conventional cigarettes to electronic cigarettes, which convert liquid into vapor through a suction device. The circulation of electronic cigarettes throughout the world has become a trend and has reached various consumer groups. Since 2014, the use of electronic cigarettes in Indonesia has continued to increase every year. According to GATS in 2021, the population using electronic cigarettes increased tenfold compared to the previous survey, from 0.3% to 3%. The use of electronic cigarettes has also increased worldwide, especially among teenagers. Electronic cigarettes are essentially used as a way to reduce addiction to conventional cigarettes. This situation makes electronic cigarettes seem like a solution and a health innovation for tobacco cigarette addicts, given the various dangers posed by conventional cigarettes. (et al. 2024).

## METHODS

This study is a descriptive observational study that describes a problem and the characteristics of a population or individual. This study obtained data through direct observation and conducted interviews using questionnaires and sampling conducted at the same time. The research design used a cross-sectional approach, which aims to determine the relationship between independent and dependent variables in the research subjects. The independent variable in this study was the type of cigarette used, namely electronic cigarettes and conventional cigarettes. The dependent variable in this study was the analysis of nicotine in urine, which was measured using the *Rapid Diagnostic Test* (RDT) method.

## RESULTS AND DISCUSSION

The table above shows that urine tests on electronic and conventional smokers showed positive results for nicotine. There were 28 male smokers and 2 female smokers. The average age of respondents in this study was

20 to 40 years old.

**Table 4. 1** Results of Nicotine Testing in Electric and Conventional Cigarette Smokers.

No	Responden	Umur	Jenis Kelamin	Hasil RDT	Keterangan
1	R 1	25	L	Positive	PK
2	R 2	22	L	Positive	PK
3	R 3	25	L	Positive	PK
4	R 4	21	L	Positive	PK
5	R 5	23	L	Positive	PK
6	R 6	22	L	Positive	PK
7	R 7	26	L	Positive	PK
8	R 8	30	L	Positive	PK
9	R 9	22	L	Positive	PK
10	R 10	25	L	Positive	PK
11	R 11	23	L	Positive	PK
12	R 12	40	L	Positive	PK
13	R 13	29	L	Positive	PK
14	R 14	22	L	Positive	PK
15	R 15	33	L	Positive	PK
16	R 16	21	L	Positive	PE
17	R 17	23	L	Positive	PE
18	R 18	20	L	Positive	PE
19	R 19	22	P	Positive	PE
20	R 20	22	L	Positive	PE
21	R 21	23	L	Positive	PE
22	R 22	24	L	Positive	PE
23	R 23	20	L	Positive	PE
24	R 24	21	L	Positive	PE
25	R 25	26	P	Positive	PE
26	R 26	22	L	Positive	PE
27	R 27	19	L	Positive	PE
28	R 28	21	L	Positive	PE
29	R 29	23	L	Positive	PE
30	R 30	22	P	Positive	PE

Respondent

M: Male

P: Female

PK: Conventional Smoker

PE: Electronic cigarette smoker

This study aims to observe the difference in nicotine positivity in urine between electronic cigarette smokers and conventional cigarette smokers, measured using the Rapid Diagnostic Test (RDT) method in a rural area, namely Bunut Baok Village, with a population of approximately 9,444, consisting of 4,601 women and 4,843 men. The variables in this study include independent

variables, namely the type of cigarette used (electronic and conventional), and dependent variables, namely the level of nicotine positivity measured through the detection of the main metabolite of nicotine, namely cotinine, which is the main biomarker for nicotine exposure in the body. How Rapid Diagnostic Tests (RDTs) Work. RDTs work by detecting the presence of cotinine in urine using a highly sensitive and rapid antigen-antibody reaction. This method detects the main metabolite of nicotine, cotinine, which has a fairly long half-life (15-20 hours), making it a more accurate biomarker of nicotine exposure in the body. According to Schidweiler et al. (2015), RDT performs detection quickly and cost-effectively, with the main advantages being high sensitivity and specificity, 99.5% and 92.0% respectively, and 99.4% accuracy. These advantages make RDT suitable for use in epidemiological studies and large-scale population screening. The structure of nicotine intake from cigarettes into the human body, both in conventional and electronic smokers.

How Nicotine Enters the Body:

#### 1. Inhalation

When someone inhales a cigarette (conventional or electronic), the smoke or vapor containing nicotine enters the respiratory tract

#### 2. Enters the Lungs

Nicotine from cigarette smoke enters the bronchi → bronchioles → alveoli (air sacs). In the alveoli, gas exchange occurs between the air and the blood.

#### 3. Absorption into the Bloodstream

Nicotine is absorbed very quickly by the blood capillaries in the alveoli and immediately enters: Pulmonary blood circulation → pulmonary veins → left heart → aorta → entire body, including the brain. It takes only about 7–10 seconds for nicotine to reach the brain after inhalation

#### 4. Distribution to the Brain and Other Organs

Nicotine crosses the blood-brain barrier and:

- a. Binds to nicotinic acetylcholine receptors in the brain.
  - b. Stimulates the release of dopamine, causing feelings of pleasure (addictive effect).
  - c. Nicotine also spreads to: The liver, kidneys, muscles, adrenal glands (increasing adrenaline)
5. Metabolism in the Liver Nicotine is metabolized in the liver, primarily by the CYP2A6 enzyme, into: Cotinine (the primary and more stable metabolite). This substance is then carried by the blood to the kidneys for excretion through urine.

#### 6. Excretion (Elimination)

Remaining nicotine and its metabolites (primarily cotinine) are excreted through:

- a. Urine
- b. Small amounts through sweat, saliva, and breast milk (in breastfeeding mothers)
- c. Brief Overview of Nicotine Pathway: Cigarettes → Inhalation → Lungs (alveoli) → Blood → Brain & organs → Metabolism in the liver → Cotinine → Urine

d. Nicotine is absorbed very quickly, so its effects are felt immediately.

e. Because cotinine is more stable (half-life of 15–20 hours), it is used as a biomarker in urine testing via RDT.

Differences in Nicotine Levels Between Electronic and Conventional Smokers Electronic and conventional smokers have different patterns of nicotine exposure. According to Nabilatus Sholikah et al. (2022), cotinine levels in the urine of e-cigarette users can be predicted from the level of nicotine consumption, but in general, both groups show significantly higher levels of nicotine exposure compared to non-smokers. However, this study aims to determine whether there is a significant difference in cotinine antibody levels in the urine between the two groups. Since cotinine has a high concentration in urine (10-15%) and a longer half-life (15-20 hours), even can be 2-4 days and in heavy smokers can reach 2-3 weeks in urine compared to nicotine, positive detection and positivity levels in urine are important indicators for assessing nicotine exposure.

## **CONCLUSION**

Based on the results of a study conducted on 30 respondents who smoke electronic and conventional cigarettes in Bunut Baok Village using the nicotine strip test method, the following results were obtained:

1. Positive nicotine results were found in the urine of smokers of both electronic and conventional cigarettes who had been smoking for a long period of time, ranging from 6 months to 1 year, with ages ranging from 18 to 40 years for both male and female smokers.
2. Positive Positive nicotine results in all urine samples from respondents who were e-cigarette and conventional cigarette smoke.

## **RECOMMENDATIONS**

1. For the public: The public is advised to understand the health risks associated with the consumption of electronic and conventional cigarettes, as well as the importance of limiting or quitting smoking, whether electronic or conventional cigarettes, and using nicotine-containing products.
2. For future researchers: To obtain more representative results, it is recommended to use more sensitive testing techniques such as immunoassay or chromatography, expand the number and variety of samples, and add other parameter tests that may be affected by nicotine from smoking.

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