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Research Article

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Cadmium levels in the urine of cigarette smokers in Bangoan village, Tulungagung district

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ABSTRACT

Cadmium (Cd) which accumulates in the body for a long time can damage human organs such as the respiratory tract, reproductive organs, liver, and kidneys. However, many smokers ignore this, so laboratory evidence is needed to advise smokers. This study analyzed the levels of cadmium (Cd) in the urine of smokers in Bangoan Village, Tulungagung District. The research method used is descriptive analytics. The research sample consisted of 15 smokers obtained through random sampling from 15 cafes in Bangoan Village, Tulungagung Regency. The research instrument was a urine examination result sheet. Urine samples were examined with an Atomic Absorption Spectrophotometer (AAS). The data analysis technique was carried out using quantitative descriptive. The results showed that 8 (53%) smokers had normal cadmium levels, and 7 (47%) other smokers had abnormal cadmium levels with the lowest level being 0.503 µg/L and the highest level being 83.892 µg/L. The community is expected to reduce cigarette consumption and avoid exposure to cigarette smoke in the surrounding environment in order to reduce organ damage.

Keywords: Cadmium levels; cigarette smokers; urine

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INTRODUCTION

Smoking is something that is commonly done by people, it can even become a habit for them, both young and old. The definition of a smoker itself is someone who consumes cigarettes by smoking them (Rosita & Andriyati, 2019). Cigarette packaging is accompanied by a health message about the dangers of smoking to the human body. However, they still actively consume even though they have realized that smoking will harm their bodies (Sari, 2020). Most smokers feel that they have suffered a loss to

themselves because they have smoked, and actually, they do not enjoy it but continue to smoke (West, 2017).

There are various types of smoke that are known to the public, one of which is cigarettes (Lianzi & Pitaloka, 2014). Cigarettes are tobacco products that contain dried and processed tobacco leaves. When smoked, they release nicotine, which is a highly addictive stimulant (Lathifah et al., 2020). Cigarettes are tobacco rolls that are rolled up and wrapped in paper, leaves, or corn husks that are about 8-10cm long. Cigarettes wrapped in cigarettes are the most commonly consumed cigarettes among the public. Cigarettes are also addictive substances because they are addictive to the wearer and lead to dependence on the smoker (Parman et al., 2020). The basic ingredient of cigarettes is tobacco, where tobacco contains harmful substances including nicotine (Sudaryanto, 2016), N-Nitrosamine (Tamala & Hanum, 2022), tar, lead, cyanide, arsenic, polonium, formaldehyde, and cadmium (Huwaida et al., 2016). Smoke from cigarette combustion contains chemicals, namely acetone, arsenic, methanol, hydrogen cyanide, toluene, butane, vinyl chloride, and cadmium (Sari, 2020).

Exposure to cigarette smoke negatively impacts health for all ages (Hidayah et al., 2019). Cigarettes are one of the main sources of exposure to cadmium for the human body (Tucker, 2023). Cadmium (Cd) is one of the metals contained in cigarette tobacco whose biological function is unknown and has high toxicity (Ambarwati et al., 2020). There is about 2.0 µg of cadmium in a cigarette so the cadmium level in the urine of smokers will be higher than non-smokers (Tucker, 2023). The content of cadmium (Cd) allowed in the body is only 40 mg or 40,000 mcg (Ambarwati et al., 2020). Cadmium (Cd) levels in the urine as biological monitoring or biological Tolerance Level (BAT) is 5.6 µg/L (Winata, 2016).

Smoking duration is one of the main factors that can increase cadmium (Cd) levels (Rosita & Andriyati, 2019). Cadmium levels allowed in the human body are only 40 mg or 40,000 mc. If a person consumes 10 cigarettes a day, then within 11 years the cadmium level in the body will exceed this threshold. Cadmium (Cd) that accumulates in the body in the long term can cause damage to human organs, especially the liver and kidneys (Ambarwati et al., 2020). Exposure to cadmium occurs by ingesting contaminated food and water and also through inhalation and smoking. (Genchi et al., 2020). Types of work that are directly exposed to Cd include battery manufacturing, welding or soldering, smelting, mining, textile work, manufacturing of materials containing Cd, jewelry manufacturing, and waste recovery workers (Fatima et al., 2019).

Previous research conducted by Mayaserli & Rahayu (2018) focused on differences in cadmium (Cd) levels in the urine of active smokers and passive smokers using a descriptive observational method with a sample of 10 smokers in the terminal city of Padang. However, in this study, the researchers focused on analyzing the levels of cadmium (Cd) in the urine of cigarette smokers using descriptive-analytic research methods through surveys. The sample used was 15 cigarette smokers from 15 coffee shops in Bangoan village, Tulungagung district. The survey results at the coffee shop showed that almost every visitor to the coffee shop smoked, especially cigarettes. Based on the description above, the research aims to analyze the levels of cadmium (Cd) in cigarette smokers in Bangaon Village, Tulungagung Regency.

RESEARCH METHODS

This type of research is descriptive-analytic, where this research describes real and natural phenomena and describes conditions as they are without change (Surahman et al., 2016). Samples taken in this study were urine from 15 smokers in Bangoan Village, Tulungagung District. The sampling technique used is random sampling. The research instrument was a urine examination result sheet. Urine

samples were examined with an Atomic Absorption Spectrophotometer (AAS). This technique is done by taking a sample of members of the population at random without regard to strata in a population (Surahman et al., 2016). Samples were taken as many as 15 because in Bangoan village there are 15 coffee shops, so in 1 coffee shop taken as many as 1 respondent randomly. The tools used to check cadmium (Cd) levels include urine pots, cool boxes, measuring cups, Kjeldahl flasks, funnels, dropper pipettes, and Atomic Absorption spectrophotometers. The materials used were urine, HNO3, H2SO4, H2O2, and 5% acetic acid.

The procedure for checking cadmium (Cd) levels starts with sample preparation, whereby preparing a clean, dry, and tightly closed urine container and then giving 5% acetic acid urine preservative as much as 10 drops and giving labels and sample codes on urine containers so that they are not confused samples of each other. Furthermore, the sample was destroyed by inserting 20 ml of urine into the Kjeldahl flask and adding a solution of HNO3 and H2SO4 in a ratio of 3:1. The mixture is allowed to stand for 24 hours and then slowly heated at 1000C for 10 minutes. After that, it is cooled for 10 minutes and H2O2 30% is added dropwise. Further heated the mixture at a temperature of 2000C. If the desoldering solution has dried, 20 ml is added and heated again until a clear yellow solution is obtained.

Measurement of cadmium (Cd) levels is done by turning on the Atomic Absorption Spectrophotometry (SSA) device. Then opened the program on the computer, and it will display "Do you want to replace the cathode lamp?". Pressed the YES button and then selected the select element and working mode menu. Selected element cadmium (Cd), and press OK. After that, the condition setting will appear, where it is asked to set the parameters to be analyzed. When you're done, press OK and set up to finish warming up. Blank inserted and allowed to stand until the line is formed, then sucked the sample by pressing F.5. Last clicked the print icon to get the data or clicked file on the menu line and print.

The Data obtained were then analyzed descriptively quantitatively and compared with the value of biological monitoring of cadmium levels (Cd) in the urine or Biological Tolerance Level (BAT) is 5.6 µg/L. If the urine cadmium (Cd) level is <5.6 µg/L, it is included in the normal category, but if the cadmium (Cd) level is >5.6 µg/L, it is included in the abnormal category. The results of research that has been obtained analyzed the percentage of normal and abnormal levels.

FINDING AND DISCUSSION

The results of an examination of cadmium (Cd) levels in the urine samples of cigarette smokers in Bangoan Village, Tulungagung Regency, showed that they all contained cadmium. The results of these examinations can be seen in Table 1 and Figure 1.

Table 1. Results of Examination of Cadmium (Cd) Levels in Cigarette Smokers in Bangoan Village

Sample Code	Cadmium Rate Yield (µg/L)	Categories
D01	1,664	Normal
D02	1,133	Normal
D03	13,391	Abnormal
D04	83,392	Abnormal
D05	42,353	Abnormal
D06	0,503	Normal
D07	0,676	Normal
D08	13,669	Abnormal
D09	12,147	Abnormal
D10	4,931	Normal
D11	6,409	Abnormal
D12	2,183	Normal
D13	2,333	Normal

Sample Code	Cadmium Rate Yield (µg/L)	Categories
D14	2,110	Normal
D15	6,766	Abnormal

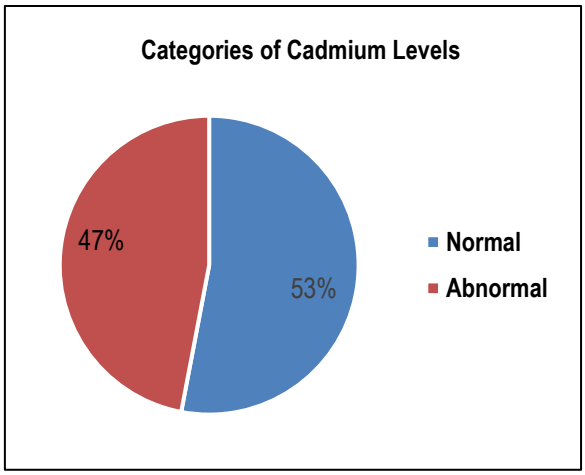

Figure 1. Category of Cadmium Levels in the Urine of Cigarette Smokers in Bangoan Village

Based on Table 1, it is known that the highest cadmium (Cd) level is 83.392 µg/L and the lowest cadmium (Cd) level is 0.503 µg/L. The permissible level of cadmium in urine is 5.6 µg/L (Winata, 2016). the majority of cadmium levels in the urine of respondents who were cigarette smokers in Bangoan Village, Tulungagung Regency were normal, namely 8 people (53%) can be seen in Figure 1. This is in line with the research result of Sari (2020) about the profile of cadmium (Cd) levels in urine in active smokers, which states that the results of cadmium (Cd) levels in urine are normal because the cigarettes consumed in his research are filtered. Based on observations made on smokers in Bangoan Village, Tulungagung Regency, it was found that the cigarettes consumed by the 8 people were filtered cigarettes. Filtered cigarettes are cigarettes that have cork or synthetic fiber foam at the end of the suction which is useful for filtering harmful substances contained in cigarettes so as to reduce the entry of toxic substances produced by cigarette smoke (Faslah et al., 2013). When smokers consume cigarettes with the filter, toxic substances contained in cigarettes, one of which is cadmium, will be filtered in the cork, although not completely filtered, which can reduce the entry of toxic substances into the body (Schulz et al., 2016). The existence of a filter in cigarettes allows the content of cadmium (Cd) that enters the body to decrease so that in the urine the levels are low and difficult to detect (Sari, 2020).

In respondents whose cadmium levels exceed normal values, most consume more than 10 cigarettes daily and have smoked for 33-40 years. This is in line with research which is conducted by Rosita & Andriyati, (2019) showed that the respondents whose cadmium levels exceeded the threshold value were caused by the length of time they were exposed to cigarettes, namely the smoking duration of 30-55 years. Cadmium (Cd) is free to be in the air and the environment is very influential on the pollution of cigarette smoke containing cadmium (Cd) so that it can be inhaled by others or yourself which can make the accumulation of harmful heavy metals in the body. In the body, about 5% to 10% of exposed cadmium will be absorbed. Absorption most of which occurs in the intestine (Rosmiati et al., 2022). After the absorption process occurs, heavy metals will bind to proteins through sulfur and nitrogen elements found in protein structures, thus forming metal interactions with proteins called metallothionein (Widowati et al., 2019) then distributed throughout the body, especially in the liver and kidneys. Cadmium (Cd) accumulates in the liver and kidneys about 30% each with a half-life of 7-30 years (Bernhoft, 2013). Cadmium (Cd) poisoning is very harmful to the human body because it can cause respiratory disorders,

blood circulation disorders, damage to the reproductive glands, and damage to the heart, kidneys, and bone fragility (Agustina, 2014).

CONCLUSION

There were 8 (53%) smokers who had normal cadmium levels, and 7 (47%) other smokers had abnormal cadmium levels with the lowest level being 0.503 µg/L and the highest level being 83.892 µg/L. The high level of cadmium (Cd) in the urine of a smoker is influenced by the presence or absence of cigarette filters, the number of cigarettes, age, and duration of cigarette consumption. Most of the smokers in Bangoan Village, Tulungagung Regency, have normal cadmium levels. The community is expected to reduce cigarette consumption and avoid exposure to cigarette smoke in the surrounding environment in order to reduce organ damage.

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