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The Relationship Between Lead (Pb) Levels in Blood and Kidney Function in Farmers in Tanggulangin Subdistrict, Sidoarjo Regency

Khanayah Rahma Sari[1], Lully Hanni Endarini[2*], Ayu Puspitasari[3], Christ Kartika Rahayuningsih[4]
Department of Medical Laboratory, Poltekkes Kemenkes Surabaya, Indonesia
Corresponding author: lullyhanniendarini@gmail.com

ABSTRACT
Lead is one of the heavy metals that can be found in pesticide formulations and has carcinogenic properties. Lead exposure tends to accumulate in the blood after entering the body through various exposure routes, potentially causing proximal tubule damage and leading to chronic kidney disease. The aim of this study is to analyze the relationship between blood lead (Pb) levels and kidney function in farmers in Tanggulangin District, Sidoarjo Regency, using AAS (Atomic Absorption Spectrophotometry) and a photometer. This study is a correlational study conducted at the BSPJI laboratory and the Clinical Chemistry Laboratory of the Medical Laboratory Technology Department at Poltekkes Kemenkes Surabaya from March to May 2024. The population in this study consists of farmers, with a total of 30 blood samples collected using purposive sampling. The results of the study regarding blood lead levels in farmers showed that 29 respondents had normal levels, while 1 respondent had abnormal levels. Meanwhile, 9 respondents had abnormal creatinine and BUN levels, and 21 respondents had normal levels. The conclusion of this study is that there is no relationship between blood lead levels and kidney function in farmers in Tanggulangin District, Sidoarjo Regency.

Keywords: Lead; Creatinine; BUN; Farmers

INTRODUCTION
As an agrarian country with the majority of the population's economy dependent on the agricultural sector, Tanggulangin Subdistrict in Sidoarjo Regency plays an important role in agriculture with a land area of 1,410 hectares, and most of its residents work as farmers. One method used by farmers to prevent pests and plant diseases is the use of pesticides. In 2019, there was a report from residents that a farmer in Tanggulangin Subdistrict was found dead due to pesticide poisoning. It is known that some pesticides contain the heavy metal lead (Pb), which has carcinogenic properties. This can occur because liquid pesticides are produced by dissolving active ingredients such as xylene, naphthalene, and kerosene, which are derived from crude oil distillation, while carriers such as kaolin, lime, sand, and clay are mixed into the pesticide formulation. This formulation may contain the heavy metal lead or plumbum1. Basically, human exposure to lead can occur in two ways: through the respiratory tract or the digestive tract. Most of this substance is then transported by the bloodstream to organs such as the brain, kidneys, musculoskeletal system, and liver. If a person is exposed to lead for a long time, the lead will accumulate in the blood with levels increasing over time and can cause kidney damage, leading to disruption in filtration and reabsorption processes in the proximal tubules. This can cause creatinine and Blood Urea Nitrogen (BUN) levels to increase2. In a study on the Factors Affecting Lead (Pb) Content in Red Onions (Allium Cepa) in Pekalobean Village, Enrekang Regency, it was found that the

pesticide Antracol 70 WP contained lead. This content is not recommended for use in pesticides as it can cause health problems for users and the surrounding environment3. Meanwhile, in a study on The Effect of Pesticide Exposure on Creatinine and Urea Levels in Farmers in Tanjung Village, North Lombok Regency, it was found that there was an increase in creatinine levels by 8.33% and urea levels by 4.1% in the blood of exposed farmers4. Based on a survey of rice farmers in Tanggulangin Subdistrict, Sidoarjo Regency, it was found that farmers did not use complete personal protective equipment (PPE) and used the fungicide Antracol 70 WP, which is suspected to contain lead, thereby increasing the risk of exposure during work. To determine the impact of lead exposure due to pesticide use on kidney function in farmers in Tanggulangin Subdistrict, Sidoarjo Regency, this study was conducted and can provide initial steps for prevention and education on the risks of lead exposure to farmers exposed to pesticides. The type of research used is a correlational study conducted at the BSPJI laboratory and the Clinical Chemistry Laboratory of the Medical Laboratory Technology Department at Poltekkes Kemenkes Surabaya from March to May 2024. This research uses an observational data collection technique obtained from questionnaires used as interview media with the research subjects. The lead levels in the blood were tested in the laboratory using the Atomic Absorption Spectrophotometry method, while creatinine levels were tested using the Jaffe method without deproteinization, and BUN levels were tested using the Enzymatic Colorimetric Berthelot method. The test results will be presented in table form and described descriptively.

RESULT AND DISCUSSION

Based on research conducted from March to May 2024 on farmers in Tanggulangin District, Sidoarjo Regency, lead levels were tested at the BSPJI laboratory, and creatinine and BUN levels were tested at the Clinical Chemistry Laboratory, Department of Medical Laboratory Technology, Poltekkes Kemenkes Surabaya. The results of the study will be presented below:

Table 1. Frequency Distribution of Respondents Based on Age Category, Use of PPE, Pesticide Dosage, Lead Levels, Creatinine Levels, and BUN Levels in Farmers in Tanggulangin Subdistrict, Sidoarjo Regency.

No	Variabel	*f*	%
	Age Category		
	45-55 years	9	30%
	56-65 years	14	47%
	66-75 years	7	23%
	Use of PPE		
	Wearing a PPE	3	10%
	Not Wearing a PPE	27	90%
	Pesticide Dosage Usage		
	Correct Dosage	28	93%
	Incorrect Dosage	2	7%
	Lead Levels		
	Normal (≤ 10 µg/L)	29	97%
	Abnormal (≥ 10 µg/L)	1	3%
	Creatinine Levels		
	Normal (0,7-1,2 mg/dL)	21	70%
	Abnormal (≥1,2 mg/dL)	9	30%
	BUN Levels		

Normal (7-20 mg/dL)	21	70%
Abnormal (≥20 mg/dL)	9	30%
Total	30 respondents	

Table 1 shows that the majority of respondents who participated in this study were in the age range of 56-65 years, indicating that most of the farmers are of advanced age. Based on the category of personal protective equipment (PPE) usage, 27 farmers (90%) did not use PPE, indicating that the majority of farmers do not use personal protective equipment. Regarding the category of pesticide dosage, 28 farmers (93%) used the recommended dosage, showing that most farmers follow the dosage instructions on the packaging. Based on laboratory test results, 29 respondents (97%) had lead levels within the normal range. Most farmers have lead levels within the normal limit, which is < 10 μg/dL. The recommended use of personal protective equipment can reduce the risk of lead exposure in farmers. By wearing appropriate PPE such as masks, gloves, long-sleeved clothing, and shoes, the risk of direct contact with lead can be minimized, thus maintaining health and safety while working in the fields. Additionally, using the correct pesticide dosage minimizes the risk of lead exposure to minimal levels. This is important to prevent lead accumulation in the body, which can lead to poisoning[5].

The lead study was conducted on 30 EDTA blood samples from farmers in Tanggulangin Subdistrict, Sidoarjo Regency, who met the criteria and were willing to participate as respondents in the research. Lead levels were measured using EDTA blood specimens. Blood is often used because it reflects lead exposure over a relatively short period and provides an accurate picture, as lead tends to accumulate in the blood after entering the body through various exposure routes. Additionally, lead can accumulate and remain in the blood for up to 128 days.

If a person is exposed to lead for a long period, lead will accumulate in the blood, with levels increasing over time. Based on the questionnaire and interviews, respondents used masks, gloves, and applied pesticides at the correct dosage. One farmer had a lead level above the normal limit (< 10 μg/dL), though the pesticide used contained lead. However, most farmers exposed to pesticides had lead levels within the normal range. The use of masks, gloves, and correct pesticide dosages helps reduce the risk of heavy metal poisoning from pesticides.

This accumulation can cause kidney damage, particularly in the proximal tubules, which play an important role in the reabsorption of electrolytes, nutrients, and the excretion of waste products from the blood into the urine. Such damage results in several consequences, such as the inability of the damaged proximal tubules to reabsorb substances that should be reabsorbed into the blood6. In the examination of creatinine and BUN levels in farmers in Tanggulangin Subdistrict, Sidoarjo Regency, 21 respondents (70%) were within the normal range, while 9 respondents (30%) had abnormal levels. Based on interviews, respondents with creatinine and BUN values exceeding the normal limits had a history of cholesterol and uric acid diseases. Atherosclerosis can cause plaque buildup in the arteries that supply blood to the kidneys, reducing blood flow and potentially leading to impaired kidney function. Additionally, uric acid crystals can lead to kidney stones7. The results of the statistical test using Spearman's correlation between blood lead levels and creatinine levels and BUN levels in farmers in Tanggulangin District, Sidoarjo Regency showed no significant results, indicating that there is no significant relationship between lead levels and kidney function in farmers in Tanggulangin District, Sidoarjo Regency.

CONCLUSION

There is no significant relationship between blood lead levels and kidney function in farmers in Tanggulangin Subdistrict, Sidoarjo Regency.

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