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Research Article

Comparison of Urine Creatinine Levels between Agricultural Workers and Non-Agricultural Workers in Wuluhan District Jember Regency

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ABSTRACT

Agricultural workers are inseparable from the use of pesticides. Inappropriate use of pesticides causes nephrotoxic effects. Impaired kidney function can be known by measuring creatinine levels excreted through urine. This study aims to determine the difference in urinary creatinine levels between agricultural workers and non-agricultural workers. This study was conducted in October 2022 - April 2023 in Wuluhan District. The data used were primary data obtained from interviews using a questionnaire, while urine creatinine levels were obtained by collecting the middle portion of urine and examined by the Jaffe-Reaction method. The results of the study were 60 male subjects consisting of agricultural workers and non-agricultural workers. Urinary creatinine levels in agricultural and non-agricultural workers were normal. Bivariate analysis showed there was no significant difference in urinary creatinine levels between agricultural workers and non-agricultural workers. The conclusion of this study is that there is no significant difference in urinary creatinine levels between agricultural workers and non-agricultural workers.

Keywords **:** pesticides, urine creatinine, agricultural workers
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INTRODUCTION

Wuluhan District is the fourth largest agricultural center in Jember. The Jember Regency Government stated that in 2021, the number of people in Wuluhan District who earn a living as agricultural workers was approximately 27,734 people (Badan Pusat Statistik, 2021). Agriculture is the most common and easiest sector for people to work in, especially people who live in rural areas. The existence of various pests causes most farmers to finally choose pesticides to control and eradicate these pests (Wudianto, 2011). Behind the positive side given by pesticides, it turns out that pesticides are also toxic and dangerous substances, especially if used in the wrong way. A good and correct use of pesticides should pay attention to the appropriate protocol. This serves to prevent contamination from these chemicals (Pamungkas, 2016).

Pesticides can enter the human body in various ways such as through inhalation, orally, or absorbed through the skin. The impacts that arise can occur in the near future or in the long term (Arif, 2015). Chronic effects that can occur are organ failure in the kidneys. Some studies state that pesticide exposure can cause nephrotoxic effects in humans (Fuentes-Delgado et al., 2018). The mechanism of pesticides in causing nephrotoxicity is thought to be related to oxidative stress, inflammation, and disruption of cellular signaling pathways in the kidney (Silva, 2020). Exposure to pesticides causes accumulation in the kidneys which then causes changes and even damage to the kidney structure (Valcke et al., 2017). If the kidneys are damaged, the filtration of body waste products and urine formation will be disrupted. Urine is one of the important specimens that contains several body waste products and can be used in various examinations. Urine creatinine levels are one of the laboratory tests as a sign of kidney problems (Aryana et al., 2016).

The use of pesticides by the agro-industrial community is difficult to separate. Therefore, this pesticide exposure is an important thing to pay attention to due to the lack of awareness of the dangers of pesticides on kidney health. When the kidneys are damaged, one of the signs that can be seen is a decrease in urine creatinine levels. Even so, there are still not too many journals that discuss pesticides and their relationship with urinary creatinine levels. Based on this description, the researcher is interested in conducting a study on the comparison of creatinine levels between agricultural workers and non-agricultural workers in Wuluhan District, Jember Regency.

METHODS

The type of research is observational analytic with a cross sectional study design. The population used was agricultural workers as the exposure group and non-agricultural workers as the control group in Wuluhan District, Jember Regency. The study sample was obtained from the population who met the inclusion criteria, namely willing and signed the informed consent sheet, earning a living as an agricultural worker, using pesticides in farming, male, and aged 20-70 years. Exclusion criteria in this study, namely having a history of diseases such as kidney stones, kidney failure, hypertension, and diabetes mellitus. The minimum number of research samples was 30 samples.

Data were obtained from structured interviews using a questionnaire for pesticide exposure data. Data on urine creatinine levels were obtained by collecting random urine specimens of the middle portion which were then examined by the Jaffe-reaction method (Maciel, 2016).

Data were processed univariate and bivariate analyses were conducted using Independent T-Test to determine urinary creatinine levels between agricultural workers and non-agricultural workers in Wuluhan District. This study was approved by the Ethics Committee of the Faculty of Medicine, University of Jember with number 1.750/H25.1.11/KE/2023.

RESULTS

Table 1. Sample characteristics

Characteristic	Exposure		Control	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Sex				
Male	30	100	30	100
Female	0	0	0	0
Age				
21-30	1	3,3	4	13,2
31-40	5	16,7	7	23,3
41-50	11	36,7	15	50
51-60	10	33,3	2	6,7
61-70	3	10	2	6,7
Education Level				
Elementary	13	43,3	11	36,7
Junior	7	23,3	7	23,3
Senior	10	33,3	7	23,3
College	0	0	5	16,7

The majority of the agricultural worker sample had an age range of around 41-50 years, as many as 11 people (36.7%). The sample of agricultural workers also had a majority age range of around 41-50 years, as many as 15 people (50%). The education of agricultural workers is mostly at the elementary school level, as many as 13 people (43.3%) and the majority of education in non-agricultural workers is also at the elementary school level, as many as 11 people (36.7%).

Table 2. Urine creatinine levels

Sample	Frequency (n)	*Minimum*	*Maximum*	*Mean*
Agricultural workers	30	24,15	199,30	107,0367
Non-agricultural workers	30	24,15	271,80	122,4267

Urinary creatinine levels in agricultural worker subjects have an average of 107.0367 mg/dL. Urine creatinine levels in non-agricultural subjects have an average of 122.4267 mg/dL. Based on these data, it can be seen that the average urinary creatinine level in agricultural worker subjects is lower.

Table 3. Characteristics of pesticide exposure

Variable	Frequency (n)	Percentage (%)
Working Period		
1-5 years	2	6,7
5-10 years	3	10
>10 years	25	83,3
Frequency of Pesticide Spray		
1-3 times/month	8	26,7
4-6 times/month	14	46,7
>6 times/month	8	26,7
Duration of Pesticide Spray		
<1 hours	8	26,7
1-3 hours	20	66,7
>3 hours	2	6,7

The majority of agricultural workers have a working period of >10 years, as many as 25 subjects (83.3%). In addition, the frequency of pesticide use by the research subjects was mostly 4-6 times/month, as many as 14 subjects (46.7%). Based on pesticide exposure duration data, as many as 20 subjects (66.7%) used pesticides for 1-3 hours in one spraying.

Table 4. Independent T-Test

Variable	*p-value*	*Confidence Interval 95%*	
		Lower	***Upper***
Urine Creatinine Levels	0,352	-48,19354	17,41354

From the results of the t-test, a p value of 0.352 was obtained, which means p>0.05.This means that there is no significant difference in urinary creatinine levels between agricultural workers and non-agricultural workers.

DISCUSSION

The research conducted in Wuluhan District, Jember Regency consisted of 30 agricultural workers and 30 non-agricultural workers with male gender. Based on age, the majority of the samples, both agricultural workers and non-agricultural workers, ranged in age from 41-50 years old. As age increases, kidney function can decrease. This is related to glomerular excretion and decreased tubular function. Decreased kidney function is a normal process when you get older, but it does not cause any abnormalities because it is still within reasonable limits that can be tolerated by the kidneys and the body (Pranandari and Woro, 2015). The majority of education of agricultural workers and non-agricultural workers is at the elementary school level. The level of education is one of the standards of a person in responding to everything from outside. The higher the level of education, the more logical the responses and perceptions given and the wider the knowledge possessed when compared to those with lower levels of education (Kurniasih et al., 2013). The lower the knowledge of agricultural workers, the use of pesticides will be less good so that it is likely to result in farmers being exposed to greater pesticides. Knowledge of agricultural workers about the use of pesticides can be in the form of selecting the type, storage, and use of pesticides (Indrianti et al., 2021).

The characteristics of pesticide exposure related to working period in this study showed that most agricultural workers in Wuluhan District had a working period of more than 10 years, as many as 25 subjects. This is in line with research in Pakis and Kadirejo which showed that 88.2% of agricultural workers sprayed pesticides for more than 10 years (Amalia, 2020). In addition, this study is also in line with research in Chitwan, where 60% of farmers have used pesticides for more than 10 years (Kafle et al., 2021). This working period of more than 10 years provides a high risk of pesticide poisoning. This can occur due to continuous exposure to pesticides over a long period of time (Suparyanto and Rosad, 2020). Besides the working period, there are other factors that influence pesticide exposure. These factors include the dose of pesticide application, spraying time,

spraying frequency, spraying action against the wind direction, and also the use of personal protective equipment (Octiara et al., 2021).

The results of this study indicate that the majority of the frequency of pesticide use by agricultural workers is 4-6 times / month, namely there are 14 agricultural worker subjects.The frequency of pesticide use will vary depending on the crop to be sprayed.Most of the agricultural commodities grown in Wuluhan District are chili peppers.The recommended frequency of pesticide use on chili plants is about 1-2 times/week (Hendra et al., 2021). This is still in accordance with the government's recommendation, which is no more than 2 times/week. If agricultural workers spray pesticides more often, it can also increase the risk of pesticide poisoning (Tutu et al., 2020).

Based on the length of pesticide use, 20 (66.7%) subjects used pesticides for 1-3 hours in one spraying.The duration of pesticide use in this study is still in accordance with the recommendation according to Permenaker No.Per-03/Men/1986, which is for agricultural workers not to use pesticides> 4 hours per day or 30 hours a week.In addition, WHO assumes the duration of exposure to insecticides is about 6 hours per day (World Health Organization, 2018).The duration of pesticide spraying depends on the area used by agricultural workers.The area of the field that is sprayed can affect the incidence of pesticide poisoning.This means that the longer the spraying takes place, the more pesticides enter the body. This can affect the body's health against pesticide exposure and cause poisoning (Sodikin et al., 2020).

The human kidney is one of the organs that plays an important role in maintaining water and electrolyte balance and plays a role in regulating the body's metabolism.The presence of disturbances in kidney function can be known through laboratory examinations, one of which is by measuring the body's metabolic waste materials such as creatinine (Verdiansah, 2016).Urine creatinine examination can be used to monitor the progression of kidney disease (Maciel, 2016).The results of this study indicate that urine creatinine levels in agricultural worker subjects have an average of 107.0367 mg/dL.In addition, it was also found that urine creatinine levels in non-agricultural subjects had an average of 122.4267 mg/dL.Based on the minimum maximum level, the value of urine creatinine levels in both agricultural workers and non-agricultural workers is still within normal limits, which is in the range of 20-320 mg/dL in adult men (Van Leeuwen et al., 2017).Urinary creatinine levels that are still within normal limits indicate that the kidneys still have good working functions and are able to effectively filter body waste products from the blood.

The results of the analysis using independent t-test in this study obtained a p-value of 0.352 ($p>0.05$), which means that there is no significant difference in urinary creatinine levels between agricultural workers and non-agricultural workers.The absence of significant differences can be influenced by several factors.These factors include the same

living environment between agricultural and non-agricultural workers.In addition, lifestyles such as smoking activity, daily physical activity, the amount of fluid entering the body, diet, and also health status are also factors that affect urinary creatinine levels (Johnson et al., 2021).

In agricultural workers, one of the factors that can influence is seen from pesticide exposure which is also related to the use of complete personal protective equipment and worker compliance in using pesticides as recommended (Octiara et al., 2021).In this study, normal urinary creatinine levels in agricultural workers can be caused by agricultural workers in Wuluhan District who use pesticides in accordance with government recommendations, namely the frequency of use and duration of exposure that does not exceed the recommended limit.This can minimize contact with pesticides, so there is no accumulation of harmful pesticide substances that can cause poisoning and even damage to the kidneys (Tutu et al., 2020). There are other factors that can affect the normal creatinine levels in agricultural workers, namely the use of personal protective equipment when using pesticides. In this study, although personal protective equipment was not studied, based on the results of interviews in the field, it was found that the majority of agricultural workers in Wuluhan District wore complete personal protective equipment at work, such as masks, boots, hats, long-sleeved shirts, and long pants. Personal protective equipment used by agricultural workers can minimize direct contact with pesticides.This can lead to a reduced risk of accumulation of hazardous materials by pesticides in the body so that both acute and chronic poisoning can be avoided (Tutu et al., 2020).

Another factor that can affect pesticide exposure in agricultural workers is related to the position when the pesticide is sprayed. The spraying position can be influenced by several factors such as the type of equipment used, spraying technique, wind direction, and the content of the pesticide used. The closer the sprayer is to the ground, the greater the risk of inhaling pesticide vapors. In addition, direct contact with the sprayed surface increases the potential for skin exposure. Ground level spraying poses a greater risk of pesticide drift, as fine droplets can be carried by wind currents to unauthorized areas and nearby people, increasing the risk of exposure. In addition, spraying can also be done through the air. This covers a larger area, but can allow the pesticide to spread further and potentially affect non-target areas or people. Wind conditions are also influential in aerial spraying, as wind direction can affect the distribution and deposition of pesticide droplets. Farmers who spray downwind are more exposed to pesticides, and thus have a higher risk of poisoning, especially when the crops being sprayed are large (Osang et al., 2016).

The dosage or concentration of pesticides must be in accordance with recommendations because they are known to be effective in controlling pests on a particular crop. The use of inappropriate doses will affect the efficacy of the pesticide and leave residues in the harvest that endanger human health. Information on the recommended dosage for each

type of pesticide can be found on the pesticide label or packaging. In general, concentration is the amount of pesticide that must be mixed into each liter of water. To get the right dosage concentration, it is also necessary to consider the amount of pesticide solution used to spray each unit of land. For example, if a pesticide must be sprayed at a dose of 1 liter per ha with a concentration of 2 ml/liter, the ideal spray volume is 1,000 ml (1 liter) divided by 2, which is 500 liters/ha (Octiara et al., 2021).

The fluid intake consumed by each individual, both in agricultural workers and non-agricultural workers, is also one of the factors that affect the normal level of urinary creatinine. Dehydration can reduce the overall volume of fluid in the body, resulting in a decrease in urine production. Less water availability in urine formation causes urine to become concentrated and to increase creatinine concentration in urine.Conversely, increased fluid intake can make urine thinner and reduce creatinine concentration (Mayasari, 2020).Creatinine levels not only depend on muscle mass, but are also influenced by muscle activity, diet, and health status (Verdiansah, 2016). An increase in muscle mass can lead to higher urinary creatinine levels, and vice versa. This can occur because creatinine is a waste product resulting from the process of breaking down creatinine phosphate into muscle cells and is produced by the body constantly depending on muscle mass (Bansal et al., 2022). Age can affect a person's urine creatinine levels, this is because urine creatinine levels will continue to decline when a person reaches old age (Shen et al., 2022). In addition, increasing age also affects the loss of muscle mass and muscle strength which also affects a person's urinary creatinine levels (Bansal et al., 2022). Lifestyle such as smoking activity can affect urinary creatinine levels by causing disturbances through oxidative stress mechanisms due to the formation of reactive oxygen species (ROS) (Setyawan, 2021).

CONCLUSION

Based on the results of the analysis and discussion that has been carried out, it can be concluded that urinary creatinine levels in agricultural workers and non-agricultural workers are still within the normal range of values and there is no significant difference in urinary creatinine levels between agricultural workers and non-agricultural workers in Wuluhan District, Jember Regency. In addition, the use of pesticides by agricultural workers in Wuluhan District, most of them are still in accordance with the recommended use of pesticides.

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