THE CHANGES OF ELECTROLYTE (NAK) BLOOD SERUM AND CHOLINESTERASE ACTIVITIES BEFORE AND AFTER THE SPRAY OF ORGANIC PHOSPHATE PESTICIDE ON RED ONION SPRAYER FARMER

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ABSTRACT

The research location in East Java is the centre of red onion producer. The preliminary survey in research location showed that the spraying of pesticide in red onion farm was done three to four times in a week, starting from planting until a week before harvesting. At certain months, the spraying was done intensively, once a day, to avoid pests. Pesticides are hazardous materials that can cause negative impacts on human health and environmental sustainability. This study is aimed at making analysis of the altered activities of cholinesterase activities, sodium and potassium in a serum before and after the spraying on red onion farmers. This was an analytic observational study with cross sectional approach. The study was conducted on March–June 2013. Data retrieval was performed in May–June 2013. Study subject consisted of 17 participants. They were observed before and after the spraying activity. The data collection was done through questionnaires and the examination of the level of cholinesterase and electrolyte serum. Data was analyzed using paired t-test and linear regression. The study showed that there was significant difference between sodium (p = 0.037) and potassium (= < 0.0001) levels before and after spraying, Linear regression indicated a relationship between wearing protective equipment (p = 0.001), length of exposure (p = 0.019) and cholinesterase. There was a significant difference between sodium and potassium before and after the spray, the existence of a meaningful relationship between wearing of protective equipment, length of exposure and cholinesterase.

Keywords: *electrolyte changes, blood serum, sodium and potassium, cholinesterase, organophosphate pesticide*

INTRODUCTION

The agricultural activities in Indonesia nowadays are predominantly agroindustry-oriented in which the use of pesticide as pest control is ubiquitous both in farming and plantation (Depkes RI, 1992). It has been known that some types of pesticides, especially organochlorine, can stays on soil for years, while water resources in the area become susceptible to contamination due to excessive use of pesticide, accidental application of pesticide or external application in the river or in the pool in order to control the growth and spread of weeds (Tugiyo, 2003).

Most cases of accidental pesticide poisoning have been reported to happen among the farmers and their respective families, the exposure of which takes place during the mixing and applying stages. An acute exposure also may take place during its preparation, formulation, packaging, and distribution. The acute effect as a result of pesticide exposure takes various forms ranging from eye burn sensation, skin damage, until neurological one. Cronical exposure, on the other hand, is oftenly linked to reproductive harm, cancer risk, neurological and psychological effects, heart and liver problems besides immunity issue (WHO, 2000).

Table 1. Mean levels of the cholinesterase, sodium and potassium before and after the pesticide application on onion growers in the subdistrict of Sukomoro, Nganjuk 2013.

Variable	Differences				Change pre-post applying pesticide		p
	Pre		Post				
	x	SD	x	SD	x	SD	
Sodium	140,76	3,527	142,47	1,940	–1,706	3,098	0,037
Potassium	4,200	0,4272	3,200	0,2937	1,0000	0,5635	0,000

Aside from its harmful effect on human health, pesticide accounts for enviromental hazard. Pesticide rate in the enviornment shall rise when it stays in the environment, or when biomagnifications tends to occur. With regard to its endurance in the environment (Lu, 1995), pesticide falls into nonpersistent pesticide (less residue) where its persistence rate range from 1–12 weeks in soil and water media; almost persistent (medium residue) with time to breakdown ranges from 1–18 months; and persistent pesticide (high level residue) with persistence rate of 2–5 years (Mukono, 2010).

The purpose of this research is to analyze the change in the activity of cholinesterase, electrolyte (sodium and potassium) in blood serum before and after the pesticide application among onion growers in the sub-district of Sukomoro, Nganjuk Regency.

METHOD

This was an analytic observational study using cross sectional approach, the location of the research is sub-district of Sukomoro in Nganjuk Regency. Date of research started in March and ran until June 2013 while data compilation started in Mei and ended in June 2013. Population was all onion growers in onion fields in subdistrict of Sukomoro, Nganjuk Regency. Sample was the onion growers in the onion field organized in a farmer group in the farming area located in sub-district of Sukomoro in Nganjuk Regency. A total of 17 respondents were analyzed before and after the applying of the pesticide done, all of which were selected using simple random sampling technique.

Table 2. Linear regression analysis on several factors related with cholinestarase, sodium and potassium among the onion growers in Sub-District of Sukomoro, Nganjuk 2013

Variable	Cholinesterase (post)	
		p
High Exposure	-0,462	0,019
Personel Protective Equipment	0,390	0,001

As dependent variables were the cholinesterase activity in blood serum as well as electrolyte (sodium and potassium) of the growers pre and post applying, while the independent variables included pesticide dose response, protective equipment use, hours of exposure, spray frequency. The data collected herein are of primary ones with direct observation of each variable. Secondary data used herein are obtained from geographical data of sub-district office, community health center, and regency agriculture office.

This research uses paired-samples t-test for analyzing the change in cholinestarase, sodium and potassium prior to the spray and afterward. Linear regression test is employed to analyze the correlation among the variables in the test.

RESULT

Based on paired-samples t-test shown in table 1 it is safe to conclude that there is no significant change of pre- and post applying, in contrast to sodium and potassium which evidently shows significant change. Table 2 shows that risk factor related with cholinesterase level among onion growers in sub-district of Sukomoro, Nganjuk Regency is the most highly exposed ($p = 0.019$; $\beta = -0.462$), so that the longer respondents exposure to pesticide the lower their cholinesterase level, with the highest cholinesterase risk occurs among respondents who use improper protective equipment ($p = 0.001$; $\beta = 0.390$).

DISCUSSION

Cholinesterase level in blood samples taken from respondents after a short break from spraying may rise to some extent (table 1). The finding is in contrast to another study on workers of pesticide formulation at PT. Bina Guna Kimia Klepu Ungaran that recorded a change in cholinesterase activity before and after their work done ($p < 0.0001$) (Kartikarini, 2002). due to long exposure, approximately 8 hours/ day, to pesticide, where the amount of pesticide sucked in became greater. Another study confirms that the discrepency in cholinesterase level before and after applying pesticide returns to baseline level after two week break (Raini et al., 2004).

The research result concerning sodium level in blood serum before and after the application of pesticide using paired samples t-test shows a significant rise, not with standing its normal change, reveals that some amount of pesticide has been absorbed by the kidneys through inhalation, skin as well as gastrointestinal system during eating or drinking right after applying pesticide causing it to build up in larger quantities in the kidneys leading to nephrotoxicity and harms the kidneys, especially the tubules, which is susceptible to hazardous chemicals or drugs (Kerem, et al, 2007., Singh, 2012). A study on goldfish and rat exposed to organophosphate pesticides has confirmed such as damage on proximal tubules. Hispathology of the kidneys was observed under a microscope after pesticide injected in the kidneys of the goldfish and of the rat (Kerem, et al., 2007, Singh, 2012).

The significant change, a decline, in potassium level in blood serum before and after the applying of the pesticide using paired-samples t-test reveals that pesticide deposited in the kidneys builds up so that decreases potassium level in blood serum which in turn can damage the tubules, the reason why electrolyte test confirms the changes in both sodium and potassium levels. The previous experiment cited on the goldfish and the rat has evidently confirmed the conclusion (Kerem, et al., 2007., Singh, 2012., Baldatina, 2008).

Table 2 shows a correlation between hours of exposure and the decline in cholinesterase level in the blood serum of onion growers. It is safe to say that the longer the exposure, the lesser the cholinesterase level. It happens due to excessive applying of pesticide, namely more than five hours/ day so that the poison absorbed by the body is higher than that among respondents who work ≤ 5 hours/day. The result is in line with another study confirming that respondents who are exposed to pesticide > 5 hours/ day are more risky of pesticide poisoning compared to those who are exposed ≤ 5 hours/day Tugiyo (2003), due to the higher amount of the pesticide sucked in by the body. Another study finds that fertile women with high exposure level to pesticide are 2.5 times more susceptible to declining of cholinesterase level compared to fertile women with low exposure to pesticide, not to mention the fertile women working, mostly clearing weed, with no protective equipment on, while their husbands apply the pesticide, the risk of exposure is evidently higher compared to fertile women with protective equipment on (Purba, 2009).

The analysis result shows that there is a correlation between the improper use of protective equipment and pesticide poisoning in the body, in this case is the rise in cholinesterase level in blood serum among onion growers, most probably due to ± 30 minute-break after the applying of the pesticide prior to blood sampling. Another factor involved is the pesticide mixture where the higher its concentration the faster the decline of cholinesterase level and vice versa (Gossel, 1990). The proper use of protective equipment can reduce direct exposure of pesticide toward the body of the appliers so that reduce the risk of pesticide poisoning which occur through inhalation, swallowing, or skin contact (Djojosumarto, 2008). The result is in contrast with another study who shows that protective equipment use is linked to pesticide poisoning in blood serum considering the improper use of protective equipment among the respondents in the study (Afriyanto and Budiyono, 2009). As stated earlier, improper use of protective equipment among pesticide sprayers is more susceptible to harmful exposure and poisoning compared to proper use of protective equipment. Another study confirms that pesticide appliers with improper use of protective equipment face the risk of poisoning 5.9 times higher compared to those with proper use of protective equipment. The reason is obvious, the improper use of protective equipment allows pesticide exposure to happen in high degree, and vice versa (Yuantari, 2012).

CONCLUSION

There was a significant difference between sodium and potassium before and after the spray, the existence of a meaningful relationship between wearing of protective equipment, length of exposure and cholinesterase.

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