

# The Correlation of Acute Pesticide Exposure with Urinary Arsenic at Onion Sprayer Farmers in Brebes

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# The Correlation of Acute Pesticide Exposure with Urinary Arsenic at Onion Sprayer Farmers in Brebes

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## ABSTRACT

**Background:** Brebes is one of regencies in Central Java which produces onion. The high production of onion is followed by the high use of pesticides as spraying material in order to eradicate the pest. One of the active ingredients of the pesticide is arsenic, which is a highly toxic metal to humans. The pesticide exposures can cause poisoning and negative impacts on health. Exposure to pesticides can be detected by the presence of urinary arsenic. Therefore, this study aims to determine the correlation of pesticide exposure with urinary arsenic level at spraying onion farmers in Brebes.

**Methods:** This study was an observational study using cross-sectional design. The research subjects were 32 people who are volunteer themselves. The variables examined in were urinary arsenic and pesticide exposure factors include: knowledge, behavior, practice, year of work, the pesticide dose, the wind direction, the use of masks, smoking habits, frequency and duration of spraying. Data were collected by interview, observation, and laboratory examination of urine samples. Data were analyzed using correlation test at level of significance 5%.

**Results:** The results showed that average level of urinary arsenic at farmers is 5.12 mg / l. Most respondents didn't know what they should do in case of poisoning. In general, The farmers had relatively good behavior. In reality, they practice in the handling of pesticides and spraying is relatively poor. Statistical analysis showed that there was no correlation between year of work, frequency and duration of work with urinary arsenic level ( $p$ -value > 0.05).

**Conclusion:** The study concluded that there is no strong evidence about the factors associated with the urinary arsenic

**Keyword:** Urinary arsenic, onion farmer, Brebes

## Introduction

Indonesia is an agricultural country with most of its population work as farmers. Data from the Central Bureau of Statistics in August 2010 showed that the number of agricultural workers was recorded at 41.49 million people. The number of sectors making agriculture as the largest contributor to employment in Indonesia with a share of 38.4% of the total working population of 108.2 million people.<sup>1)</sup> Fulfillment of needs for foodstuffs in large quantities is not possible without the addition of pesticides, that the exterminator weeds, fungicides, rodenticides and insecticides. Also the artificial fertilizers must be mentioned in this topic. Although it was in this case does not involve pesticides in the narrow meaning<sup>2)</sup>, mostly agriculture and plantations in a professional and large-scale use of organophosphates as pesticides. So that the use of pesticides not to cause health problems, then the user must follow a predetermined dose. But apparently Indonesian agricultural products such as potatoes, cabbage, beans, onions and a variety of vegetables returned after being sent because the pesticide exceeded safe levels set.<sup>3)</sup>

Pesticides or Pest Killing Agent is chemical compounds that are generally toxic, is used to eradicate pests of plants, diseases of plants and weeds. Pesticides are all substances or mixtures of substances that are used to regulate the growth or drying plant.<sup>4)</sup> The use of pesticides is usually done because of the fears of the pests that can reduce their crops. But in fact, now, the use of pesticides not only in the presence of pests, but also at times absolutely no pests. So the use of pesticides can now be said to be "blanket cover system" that can lead to resistance to pests.<sup>4)</sup>

The entry path of human exposure to pesticides is through the mouth (orally), through respiration (inhalation), and through the skin (dermal).<sup>4)</sup> The negative impact of exposure to pesticides can contaminate workers directly resulting in poisoning. In Indonesia many cases of poisoning among others in Kulon Progo there were 210 cases of poisoning by physical examination and clinical, laboratory examined 50 of them with the results of 15 people (30%) poisoning. In Sleman reported 30 officers pest eradication, 14 (46.66%) experienced symptoms of poisoning.<sup>3)</sup>

One of the parameters the occurrence of acute exposure to pesticides is the concentration of arsenic (As) in the urine. The entry of arsenic in large quantities into the body suddenly causes acute attacks of abdominal pain in the form of flavor is very damaged as a result of the digestive system, vomiting, diarrhea, intense thirst, abdominal cramps, and finally shock, coma, and death. In addition, arsenic also causes physiological disorders, such as gastrointestinal and liver disorders, cardiovascular disorders, neurological disorders, respiratory disorders, and reproductive disorders can even cause carcinogenic effects. Parts of the body that are usually affected are skin and lung. There are two kinds of arsenic exposure on the human body, those are acute exposure and chronic exposure.<sup>5)</sup>

According to Casarett and Doull's (1986), determining the biological indicators of arsenic poisoning is a very important thing. Arsenic has a short half-life time (a few days), so it can be found in the blood only at the time of acute exposure. For chronic exposure of arsenic is not commonly done assessment. To determine the presence of arsenic in the body, it is necessary laboratory examination. There are two kinds of laboratory tests that can be used is by checking levels of arsenic in urine and hair. Arsenic in urine is an indicator of arsenic poisoning is the best for workers exposed by arsenic. Normal levels of arsenic in the urine is less than 50 ug/L.<sup>6)</sup> According to the United States Department of Health and Human Services, the initial clinical diagnosis of arsenic poisoning is often difficult, the key laboratory tests in exposure to arsenic is arsenic excretion in the urine. The best specimens are 24-hour urine, although the urine as it can also help in urgency.<sup>5)</sup> In addition, according to the report Pollution in People, Toxic Chemicals in Washingtonians that the arsenic found in some pesticides and arsenic was found in urine samples at four of the 10 workers in Washingtonians.<sup>7)</sup>

Furthermore, case studies were carried EPA (Environmental Protection Agency) explains that arsenic is organic form (containing carbon), such as monosodium methanearsonate and disodium methanearsonate used in pesticides for agricultural applications. The concentration of arsenic in the urine is an indication of exposure to arsenic were measured within 24 hours after exposure. This was also expressed by the experts that the arsenic concentration in urine is the best indicator of the current poisoning indicator (1-2 days).<sup>8)</sup>

Brebes regency is one of regencies in Central Java, which has a high onion production. The high product of shallots/onion followed by the high use of pesticides by farmers to eradicate the pest. This condition is very risky cause of pesticide poisoning in farmers. Study the impact of pesticides on farmers has often been done with cholinesterase parameter. Besides cholinesterase, there are other biological indicators that can be used to look at the incidence of pesticide poisoning, the content of arsenic in the urine. Research exposure to

pesticides with biological indicator which is arsenic in urine has never been done in Brebes. Therefore, this study aims to look at the effects of exposure to pesticides with arsenic levels in the urine of onion farmers in Brebes.

## Methods

This study was an observational study with cross-sectional design. This design studied the dynamics of the correlation between risk factors with effects, with the approach of observation or the collection of data at a time (point time approach). The population of this study were sprayer farmers of onion in Brebes. The sample size are 50 people. Variables examined included doses of pesticides, the number of combinations of pesticides, use of PPE, long workday, the intensity of spraying and spraying action downwind, and arsenic levels in the urine. All data is taken from survey respondents (sprayer farmers of onion in Brebes). Data was collected through interviews and observations. Being the data content of arsenic in urine taken from urine spraying onion farmers by conducting laboratory tests. Data analysis was performed by descriptive and analytic.

## Results and Discussion

The results of the examination of urine arsenic levels at onion sprayer farmers in the district Kersana obtained average 5.1137 mg/l (range 1.40 to 4.45 ug/l). According to the American Conference of Governmental Industrial Hygienists in 2001, the levels of arsenic in the urine is still below the threshold value. Although the levels of arsenic in the urine is still at a safe level according to these standards, but still requires attention by the parties concerned, such as agriculture and health sectors. This is because regardless of the size of pesticides that enter into the human body will still be injurious, because pesticides are toxic. In addition, exposure to arsenic at low levels for a long time will give harmful health effects, one of which is anemia. This is according to the results of research which stated that anemia is an important determinant of outcome of arsenic exposure. The higher the average levels of arsenic, the lower the Hb.<sup>9</sup>

Pesticides are alternative materials which are used by farmers to kill pests communities of plants (including onion). Based on the existing references, one of the materials used for the production of pesticides is arsenic is a poison that is very dangerous (can kill humans). Therefore, although the levels of arsenic in the urine of farmers still below the safe threshold value, this condition needs attention. Agricultural bureau expected role in order to increase public knowledge of farmers in order to apply pesticides correctly and rationally. This knowledge is important so that farmers can spray to prevent pesticide exposure, so it does not get into the human body. Health Department is also expected to increase the role in farmers' knowledge about the symptoms and dangers of pesticide poisoning. This is important to increase their awareness in order to be able to apply the principles of personal hygiene in the handling of pesticides from preparation through spraying.

Knowledge of safety of using pesticide is essential for farmers spraying. This is because most of them (62.5%) graduated from elementary school only. A person with low education are generally less knowledge of safety and not able to think rationally, so that it can lead to a tendency to use pesticides for spraying according to his own perception. Thus, the party who has the authority to develop the farmers should always improve their knowledge in order to know, understand, have a good attitude in applying pesticides. This advice is important because it is supported by the facts in field that as many as 46.9% of the farmers in the spraying onion applied pesticide dose not comply with the rules on the label. In addition to not see the rules of the dose on the label, most of them (34.4%) use a combination

of all four types of pesticides for spraying activities and most are using 7 different combinations of pesticides. Table 1 provides an analysis of the factors of exposure to pesticides with arsenic urine of respondents.

Table 1. Analysis of exposure factors and urinary arsenic at onion spayer farmers in the district of Brebes

Independent Variable	N	Arsenic ( $\mu\text{g/l}$ )		U-test	p-value
		Average	Std dev		
1. Did doses used the correct amount?					
Yes	17	5.9047	3.93	99.500	0.290
No	15	4.2173	2.10		
2. Pay attention to the wind direction:					
No	6	4.5667	1.98	73.500	0.828
Yes	26	5.2400	3.52		
3. Wear gloves when mixing pesticides:					
No	27	4.7763	3.04	45.500	0.276
Yes	5	6.9360	4.20		
4. Wear masks when using pesticide:					
No	12	4.4017	2.14	108.00	0.640
Yes	20	5.5410	3.77		
5. Smoking while spraying pesticide:					
Yes	17	5.5188	3.08	101.00	0.317
No	15	4.6547	3.51		
6. Combine pesticide :					
Sufficient (2 variants)	2	4.0000	3.04	24.500	0.668
Excess (more than 2 variants)	30	5.1880	3.32		
7. Spraying frequency in a week:					
Twice	9	5.8689	4.81	102.500	0.967
Three times or more	23	4.8183	2.51		

The behavior of spraying farmers also is a concern. This problem is demonstrated by the fact such as not using gloves when dispensing pesticides (84.37%), excessive pesticide combination (93.75%), smoking while spraying (53.12%). Smoking habits also affect the increase in arsenic levels in the urine. Especially in combination with the eating habits of sea fish meal will increase the levels of arsenic in the urine. This is consistent with the results of research said that both smoking and consumption of sea fish provide significant effects on the metabolite of inorganic arsenic ( $\text{AS}^{3+}$ ,  $\text{AS}^{5+}$ , MMA and DMA).<sup>10</sup>

Increased of knowledge indispensable for farmers spraying. This knowledge will underpin the growth of a good attitude for farmers, which will foster an attitude oriented spraying for good practice. Knowledge about the symptoms, the action in the event of poisoning, mix the right pesticide and spraying were both still very limited. Most respondents (59.4%) have a good knowledge about the symptoms of pesticide poisoning (find out more 2 symptoms). However, when viewed from the knowledge of what they should do in case of poisoning, most of them (87.5%) had knowledge that is mediocre, likewise knowledge about the right mix of pesticides (56.3%).

Another fact that was found in this study is that most (37.5%) respondents have a good attitude. They disagreed that the need to use excessive doses (beyond measure) to increase better results. Another showed a good attitude is to spray the onions should be done when the plants attacked by pests alone. Most respondents (71.9%) agreed when spraying is only done when the plants are attacked by pests. This attitude was necessary to prevent exposure to arsenic decreases in their activities. Nonetheless, other studies have shown that family members are not exposed to arsenic within 24 hours, but have a history of exposure to arsenic before, they had higher levels of serum arsenic inhibitor higher than that had no previous history.<sup>11</sup>

## Conclusion

The average of urinary arsenic at onion sprayer farmer is 5.1157 mg/l. Urinary arsenic level are still far below the threshold value of arsenic poisoning (50 ug/l). The number of combinations of pesticides used by farmers of onion quite a lot with a mean 4 types (a maximum of 7 types). This research has not been able to prove the variable that acts as a risk factor for urinary arsenic at onion sprayer farmers in the district of Kersana, Brebes Regency.

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