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The Effect of Consumption Patterns and Sanitation of Vegetables and Fruits on Pesticide Residues in Mothers of Under-Two Years Short Toddlers in the City of Malang

Destycia Kusumastuti*, Dwi Wahyuni, Erma Sulistyaningsih
Jember University, Jember, Indonesia
**Corresponding Author: cia.kusuma@gmail.com*

ABSTRACT

Studies in Malang and Cianjur reported that there are pesticide residues from organochlorine, organophosphate and carbamate in agricultural products such as cabbage, carrots and tomatoes. A preliminary study on vegetable and fruit in the Malang City area described that 18 out of 25 mothers with under-two years toddlers did not sanitize vegetables and fruits properly. The study's purpose was to analyze the effect of consumption patterns and sanitation of vegetables and fruits on pesticide residues in mothers of under-two years stunted toddlers in the Malang City area. This was analytical research with a case-control approach. The population of study is all mothers of under-two years children in Malang City area. The respondents are 10 mothers which consist of 5 mothers of case and 5 mothers of control group. Data were collected by documentation and interviews; the pesticide's residue was measured by Gas Chromatography-Mass Spectrophotometry method. As many as 40% of respondent had moderate consumption pattern, and 50% did moderate vegetables and fruits sanitation. There were pesticide residues in 50% of respondents. Data analysis using logistic regression tests showed a significant association between pesticide residue and stunting (p=0.022).

Keywords: pesticides, sanitation, stunting under-two years toddlers

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BACKGROUND

The incidence of under-two years short toddlers or called stunting is one of the nutritional problems experienced by toddlers in the world today. Indonesia ranks third in the country with the highest number of stunting cases in Southeast Asia, after Timor Leste and India. Based on Nutritional Status Monitoring data for the past three years, short toddlers have the highest prevalence compared to other nutritional problems such as malnutrition, thinness, and fatness. The prevalence of short toddlers has increased from 2016, namely 27.5% to 29.6% in 2017 (BKKBN, 2019).

Stunting is a form of growth and development failure due to the accumulation of nutrient deficiencies that lasts from pregnancy to 24 months, where children experience growth disorders so that children are shorter than children of their age(Maulid et al., 2018). The Malang City Health Office showed that the prevalence of stunting in Malang City was 17.48% in under-two years toddlers and 20.68% in under-five years toddlers. The data was obtained from the weighing month program with the number of examinations, namely under-two years toddlers as many as 15,685 examined and 42,531 under-five years toddlers examined (Malang City Health Office, 2019)

Research conducted by Munarso et al on agricultural products in the Malang and Cianjur regions showed that there were pesticide residues from organochlorine, organophosphate and carbamate types in agricultural products in the form of cabbage, carrots and tomatoes with amounts below the normal allowable limit (Munarso et al., 2016). Along with changes in healthy lifestyles in the community, people's consumption patterns have also changed by consuming more vegetables and fruits because they contain vitamins and minerals needed by the human body(Permatasari et al., 2018). The results of a preliminary study on vegetable and fruit sanitation that had been carried out in the Malang City area, found that 18 out of 25 mothers of under-two years toddlers did not sanitize vegetables and fruits properly.

Based on the introduction that has been described, the researchers want to find out whether consumption patterns and sanitation of vegetables and fruits affect pesticide residues on the body of mothers of under-two years short toddlers in the Malang City area. The purpose of this study was to analyze the effect of consumption patterns and sanitation of vegetables and fruits on pesticide residues in mothers of under-two years short toddlers in the Malang City area.

METHODS

Analytical research uses a case-control design where mothers of under-two years short toddlers as a case and mothers of under-two years not-short toddlers as control (Notoadmojo, 2013). The independent variables in this study are consumption patterns and sanitation of vegetables and fruits. The dependent variable in this study was the level of pesticide residues in the mother of under-two years short toddlers. This research used data collection techniques through documentation studies and interviews. The instrument used in this study was to use a questionnaire sheet consisting of consumption patterns and sanitation of vegetables and fruits. Measurement of pesticide residues was carried out by the Gas Chromatography-Mass Spectrophotometry (GC-MS) method in the laboratory. The data were statistically analyzed using linear regression tests.

Approval for this study was obtained from Ethics Comission of Faculty of Dentistry, University of Jember No.1267/UN25.8/KEPK /DL/2021.

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RESULTS

Characteristics of respondents include age, gender of respondents, respondent's education, respondent's occupation, and respondent's employment status.

Table 1. Distribution of respondents by age, gender, education, and employment status

Variabel	Stunting		Not stunting	
	F	%	F	%
Age				
< 20	3	60	0	0
20 to 30	1	20	1	20
30 to 40	1	20	4	80
Total	5	100	5	100
Education				
Bachelor's degree	1	20	4	80
Senior High School	4	80	1	20
Total	5	100	5	100
Employment status				
Employee	3	60	1	20
Housewife	2	40	4	80
Total	5	100	5	100

Source: Primary Data, 2021

Based on research data, the majority of mothers have children who are not stunted aged 30 to 40 (80%) and respondents with ages under 20 are mothers with the highest stunted children (60%). the majority of respondents had non-stunted children with bachelor's degrees (80%) and respondents with high school degrees became mothers with the highest stunting children (80%). the majority of respondents who had non-stunted children were housewives (80%) and respondents with working mothers with the highest stunted children (60%).

The pattern of vegetable and fruit consumption in respondents is an illustration of the type and frequency of fruits and vegetables consumed in units of time. There are 18 types of vegetables and 15 types of fruits studied in this study. The division of the frequency scale of fruit and vegetable consumption is divided into six scales, namely >1 time / day, 1 time / day, 3 times / week, <3 times / week, <1 time / week (rarely), and never. Then the total score obtained was divided into three categories of vegetable and fruit consumption patterns in respondents, namely bad, sufficient, and good. This study assumes that the less frequent consumption of vegetables and fruits, the better the category. This is because it is assumed with pesticide residues in the body sourced from fruits and vegetables.

Table 2. Frequency Distribution of Vegetable and Fruit Consumption Patterns

Vegetable and Fruit Consumption Patterns	Frequency (N)	Percentage (%)
Bad	3	30,0
Sufficient	4	40,0
Good	3	30,0

Table 2 shows that most respondents have sufficient vegetable and fruit consumption patterns. Then 30% of respondents have a good vegetable and fruit consumption pattern category and the remaining 30% have a bad vegetable and fruit consumption pattern category.

There were six questions about the sanitation of vegetables and fruits consumed by respondents studied in this study. Then the total score obtained was divided into three categories of vegetable and fruit sanitation consumed by respondents, namely bad, sufficient and good. This study assumes that the more complete the sanitation of vegetables and fruits,

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the better the category. This is because it is assumed that sanitation can reduce or remove pesticide residues in vegetables and fruits.

Table 3. Frequency Distribution of Vegetable and Fruit Sanitation

Vegetable and Fruit Sanitation	Frequency (N)	Percentage (%)
Bad	1	10,0
Sufficient	5	50,0
Good	4	40,0

Table 3 shows that most respondents have sufficient vegetable and fruit sanitation categories. Then 40% of respondents have a good vegetable and fruit sanitation category and the remaining 10% have a bad vegetable and fruit sanitation category.

The respondent's pesticide residue level is a description of the level of pesticide residue in the respondent's body. Pesticide residue levels are measured by laboratory tests. The results of the laboratory test were then divided into two categories of pesticide residues in respondents, namely there was residue and no residue. This study assumes that the presence of pesticide residues in the respondent's body is related to the incidence of stunting in the respondent's under-two years toddlers.

Table 4. Frequency Distribution of Pesticide Residue

Pesticide Residue	Frequency (N)	Percentage (%)
There was residue (detected)	5	50,0
No residue (not detected)	5	50,0

Table 4 shows that 5 respondents had pesticide residues in their bodies and the other half of the respondents had no pesticide residues in their bodies.

Linear regression analysis was used as a test method to determine the effect of vegetable and fruit consumption patterns on the presence of pesticide residues in respondents. The cross-tabulation between vegetable and fruit consumption pattern variables and pesticide residue variables as well as significance values and OR values of influence analysis results is presented in the following Table 5.

Table 5. Cross-Tabulation and Significance Value Analysis of the Effect of Vegetable and Fruit Consumption Patterns on Pesticide Residues

Vegetable and Fruit Consumption Patterns	Pesticide Residue				Significance Value (p-value)	OR Value	Std. Error of the Estimates
	There was residue (detected)		No residue (not detected)				
	N	%	N	%			
Bad	3	0,0	0	0,0	0,008	0,56	0,0006813
Sufficient	2	0,0	2	20			
Good	0	0,0	3	30			

The free variable affects the bound variable if the signification value of the influence test $\alpha<0.05$. Table 5 shows that the significance value of the influence between the variables of vegetable and fruit consumption patterns on the pesticide residue variable is 0.008 (< 0.05), indicating the influence of the variable vegetable and fruit consumption patterns on the pesticide residue variable. Table 5 also shows that the OR value of the influence between the variables of vegetable and fruit consumption patterns on the pesticide residue variable is 0.560, meaning that 56% of the variable vegetable and fruit consumption patterns affect the pesticide residue variable. Then, the suitability of the influence model was shown from 100% minus the Std. Error of the Estimate value, which was 99.99%, indicating that vegetable and fruit consumption patterns had an effect on pesticide residues in respondents.

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Linear regression analysis was used as a test method to determine whether there was an influence between vegetable and fruit sanitation on the presence of pesticide residues in respondents. Cross-tabulation between vegetable and fruit sanitation variables and pesticide residue variables as well as significance values and OR values from the influence analysis results are presented in Table 6.

Table 6. Cross-Tabulation and Significance Value Analysis of the Effect of Vegetable and Fruit Sanitation on Pesticide Residues

Vegetable and Fruit Sanitation	Pesticide Residue				Significance Value (p-value)	OR Value	Std. Error of the Estimates
	There was residue (detected)		No residue (not detected)				
	N	%	N	%			
Bad	1	0,0	0	0,0	0,005	0,604	0,0006461
Sufficient	4	0,0	1	10,0			
Good	0	0,0	4	40,0			

Table 6 shows that the significance value of the influence between vegetable and fruit sanitation variables on pesticide residue variables is 0.005 (<0.05), so it can be assumed that vegetable and fruit sanitation variables affect pesticide residue variables. Table 5 also shows that the OR value of the influence between vegetable and fruit sanitation variables on pesticide residue variables is 0.604, meaning that 60.4% of vegetable and fruit sanitation variables affect pesticide residue variables. The suitability of this variable influence model was 99.99%, indicating that vegetable and fruit sanitation had an effect on pesticide residues in respondents.

The effect between pesticide residues on respondents on stunting Incidence was analyzed by linear regression tests. Cross-tabulation between pesticide residue variables and stunting incident variables, OR values and significance values is presented in Table 7.

Table 7. Cross-Tabulation and Significance Value Analysis of the Effect of Pesticide Residues on Stunting Incidence

Pesticide Residue	Stunting Incidence				Significance Value (p-value)	OR Value	Std. Error of the Estimates
	Stunting		Not Stunting				
	n	%	n	%			
There was residue (detected)	4	40,0	1	10,0	0,022	0,437	0,65706
No residue (not detected)	1	10,0	4	40,0			

Table 7 shows that the significance value of the influence between pesticide residue variables on stunting incident variables is 0.022 (<0.05), so it is assumed that pesticide residues affect stunting incident variables. This table also shows that the OR value between the pesticide residue variable and the stunting incident variable is 0.437, meaning that 43.7% of the pesticide residue variable affects the stunting event variable. The suitability of the influence model, which was 99.34%, indicated that vegetable and fruit sanitation had an effect on pesticide residues in respondents.

The frequency of vegetable and fruit consumption patterns shows that most respondents have sufficient vegetable and fruit consumption patterns categories. Then 30% of respondents have a good vegetable and fruit consumption pattern category and the remaining 30% have a bad vegetable and fruit consumption pattern category. The FFQ Semi-Quantitative Method not only looks at the foodstuffs consumed by the sample, but also looks at the size of the portion or the number of foodstuffs consumed by the sample (Septamarini et al., 2019). The SQ-FFQ (Semi-Quantitative Food Frequency) method is a method used to obtain data on the frequency

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of consumption of a number of foodstuffs consumed during a certain period such as every day, week, month and year (Palupi & Dodik Arso Wibowo, 2017).

DISCUSSION

This study tried to measure the frequency of consumption of vegetables and fruits with assumptions with pesticide residues in the body sourced from fruits and vegetables. Thus, the increasing consumption of vegetables and fruits increases the risk of pesticide residues. Short-term mild exposure may only cause irritation to the eye membranes or skin, but long-term mild exposure has the potential to cause various health impacts, such as disruption of the hormonal system, organ failure and death (Widyawati et al., 2018).

The frequency of Vegetable and Fruit Sanitation showed that most respondents had sufficient vegetable and fruit sanitation categories. Then 40% of respondents have a good vegetable and fruit sanitation category and the remaining 10% have a bad vegetable and fruit sanitation category. Sanitation of respondents in an effort to prevent disease by eliminating or regulating environmental factors related to the chain of disease transfer is not optimal, evidenced in the interview of the main informant 10 (IU10) explained that managing vegetables from the market by washing but only by pouring water without washing with soap.

Poor food sanitation is caused by physical, chemical and biological factors due to contamination by bacteria, viruses, fungi, and parasites. Poor food sanitation can cause health problems in people who consume the food The good quality of food ingredients can be seen through physical characteristics and their quality in this case shape, color, freshness, smell and others (Mokodongan et al., 2021). One of the contaminants that can explain the chemical aspect is pesticides. Good foodstuffs are free from damage and pollution including pollution by kima materials such as pesticides (Kurnia et al., 2019).

The frequency of pesticide residues in Table 3 shows that 5 respondents have pesticide residues in their bodies and the other half of the respondents have no pesticide residues in their bodies. Respondents did not really understand the existence of pesticides because they did not have a direct effect that could be suffered due to pesticide residues.

Some of the pesticides contained in vegetables and fruits are organochlorine, which is a chemically chlorinated hydrocarbon insecticide classified as a relatively stable and less effective insecticide, characterized by the impact of its residue that has long decomposed in the environment. One of the well-known organochlorine insecticides is DDT (Siti Alfiah, 2013). The organochlorine group is a poison against the nervous system in both insects and mammals. Poisoning can be acute or chronic poisoning is carcinogenic (cancer). Organophosphate, this insecticide is an ester of phosphoric acid or thiophosphate acid. This pesticide has the effect of blockading the distribution of nerve impulses by binding to the enzyme acetylcholinesterase. Chronic poisoning of pesticides of the organophosphate group is potentially carcinogenic (Malini et al., 2017).

Carbamate, this group is an ester of H-methylcarbamate acid. Works inhibit acetylcholinesterase. But its effect on such enzymes does not last long, since the process is quickly reversible. Pyrethroids and those derived from other plants pyrethroids derived from pyrethrum are obtained from the flowers of Chrysanthemun cinerariaefolum. Another plant insecticide is nicotine which is acutely highly toxic and acts on the nervous system. Pyrethrum has low toxicity in humans but causes allergies in sensitive people (Fitri et al., 2019).

Vegetable and fruit consumption patterns with sufficient categories. The results of the repondent interview showed that respondents and their families consumed vegetables and fruits every day. Statistical analysis reinforces the findings of an influence between vegetable and fruit consumption patterns on pesticide residue variables. This is in line with the research of Julio et al., (2020) states that diet is the most important behavior that can affect the nutritional state of individuals. This is because the quantity and quality of food and drinks consumed will

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affect the intake of nutrients so that it will affect the health of individuals and the community. Lack of consumption of vegetables and fruits as a source of fiber, vitamins and minerals can trigger obesity and the incidence of non-communicable diseases such as heart and blood vessel diseases, colon cancer, diabetes, hypertension and stroke. Sufficient consumption of vegetables and fruits, is one of the simple indicators of a healthy diet with balanced nutrition.

Vegetable and fruit sanitation has been done with a fairly good category. Based on the interview results, most respondents cleaned vegetables and fruits before consumption. Statistical tests showed the effect of vegetable and fruit sanitation on pesticide residues in respondents with a significance value of 0.005. This is in line with research of Ardiwinata (2020) which reported the poisoning of pesticide residues derived from agricultural products. Poisoning occurs directly due to eating agricultural products contaminated with pesticides or through the food chain. Although respondents are likely to suffer from acute poisoning, but generally pesticide residue poisoning occurs chronically, imperceptibly, and in the long run can cause health problems.

Pesticide residues affect the variable incidence of stunting. The results of this study are in line with the research of Apriningtyas & Kristini (2019) that there is a relationship between exposure to chemical substances and the incidence of stunting. The types of chemical substances used are mostly pesticides and agricultural insecticides used to eradicate plant insects. According to Suntari et al. (2020) one of the factors causing stunting is the additional/complementary food factor that is not adequate. The quality of food will determine the nutrients it contains and absorbs the body. Poor food quality, namely low/poor quality of micronutrients, low consumption of diverse foods and animal proteins, anti-nutrient levels, low energy levels in supplementary foods. In addition, unsafe foods such as contaminated food and beverages, poor conditions of clean and healthy living behavior, unsafe food storage and preparation also result in low quality food.

One of the hormones that is at risk of negative impacts due to pesticide exposure is thyroid hormone. Pesticide active ingredients including TDCs (Thyroid Disrupting Chemicals) can cause the thyroid gland to be unable to produce enough hormones (T4 and T3) to meet the body's needs. This condition is called hypothyroidism. When it occurs in pregnant women, it can cause disturbances in the growth and development of the fetus. Babies who have experienced previous growth disorders, namely during pregnancy, are at greater risk of developing growth disorders (Jasmadi & Kurniati, 2020).

CONCLUSION

Most of the respondents (30%) had the category of vegetable and fruit consumption patterns in the sufficient category and 50% of respondents had vegetable and fruit sanitation in the sufficient category. Laboratory examinations found that 50% of respondents had pesticide residues. Statistical analysis showed that vegetable and fruit consumption patterns and vegetable and fruit sanitation had an influence on the presence of pesticides in the respondent's body, as well as pesticide residues in the mother's body affected the incidence of stunting on under-two years toddlers. The results of this study can be considered by the government through related agencies to provide education to the public about the use of pesticides and their impact on health and become information for the public to always be aware of pesticide contamination in food by implementing proper sanitation for the food to be consumed.

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