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**The Exposure of Pesticide to Pregnancy Toward the Occurance of Low Birth Weight  
(LBW) in Metro Selatan District, Metro City.**

**Ayu Tri Darmawati, Onny Setiani, Sulistiyani**

<sup>2</sup> Faculty of Public Health, Diponegoro University of Semarang

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**Abstrak**

**Background:** Metro Selatan district is a rural and agricultural area in Metro city which boasts the thriving production of vegetables. Consequently, the use of pesticide is also very high. The dependency of the farmers on the use of pesticide with the inclusion of high numbers of women in the plantation has taken a toll on their health, particularly in the case of pregnant mothers, who mostly live or work in or around the plantation areas. The exposure of pesticide to pregnant mothers can lead to both reproduction condition or defect as well as the occurrence of Low Birth Weight (LBW) to infants they give birth to. This research aims to find out the extent of the pesticide exposure toward the case of Low Birth Weight in Metro selatan district, Metro city.

**Method:** the method used in this research is analytical observation by using Case Control study design. This data was taken from 99 samples with the ratio of 2 : 1, consisting of 33 cases of the occurrence of Low Birth Weight and 66 number of controls. The data was gathered through interview and observation. The data analysis employs Chi-square test and logistical regression.

**Result:** based on the result of bivariate analysis, it was found that there were 5 independent variables which contribute to risk factors of LBW ; (1).the physical involvement in pesticide spraying activity in the farms/plantations [OR = 3.320 995%CI; 1.309-8.424)], the mixing of pesticide [OR 2.934 (95%CI; 1.208-7.127)], the handling of spraying tools [OR= 5.125 (95%CI; 2.005-13.103), the storing of pesticide [OR= 2.870 (95%CI; 1.207-6.925)], and the using of APD [OR= 3.322 (95%CI; 1.364-8.089)]. The result of multivariate analysis suggests that the subjects who were involved directly in the spraying of pesticide, mishandled the spraying tools, stored the pesticide inside the house and worked without complete APD were more prone to and had higher probability to have cases of Low Birth Weight infants, which is 72.3%.

**Conclusion:** The direct involvement in the spraying of pesticide, mishandling the spraying tools, storing the pesticide inside the house and working without complete APD are all contributing factors for the research subject that cause the occurrences of Low Birth Weight. Additionally, the farmer women who work in areas where pesticide is constantly used is highly recommended to wear the complete APD.

**Keywords:** pesticide exposure, Low Birth Weight (LBW), pregnancy.

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## INTRODUCTION

Low Birth Weight (LBW) is one of the main causes of increased mortality, morbidity, disability in infants, toddlers and children and has a prolonged effect on health.<sup>1</sup> Low Birth Weight (LBW) is one of the indicators that most considered for public health because it is the main indicator that can predict the occurrence of infant mortality during the first month of birth. The low birth weight incidence of the baby will have an impact on the health condition of the newborn baby as well as the future development of the baby

Globally, the prevalence of LBW is currently in the range of 10-20% of cases annually from total live infants. In 2013 the World Health Organization (WHO) reported about 25 million babies born with LBW conditions each year and recorded almost 5% of the cases are in developed countries while about 95% occur in developing countries. The prevalence of LBW incidence in India is about 26%, and in the United States 7%. Conditions around the world indicate that infants born with LBW are counted 20 times more likely to die than infants born without BBLR conditions.<sup>3</sup> Nationally, the incidence of LBW is still a problem in many regions. Basic Health Research Results in 2013 found that infants (0-59 months) who were born with low birth weight infants were around 10.2%.<sup>4</sup>

Metro City is one of the cities in Lampung Province with infant mortality rate (IMR) which always increase. According to the report of the Health Section of the Metro City Health Office, In 2014 there were 16 infant deaths or 4.7 per 1000 live births, by 2015 a slight increase of 17 infant deaths from 2,888 live births or 6 per 1000 live births and in 2016 there was a rebound that there were 20 infant deaths from 3,261 live births or 6 per 1000 live births.

Factors that cause LBW are definitely not known, although can be grouped into several general categories of factors that come from the fetus itself and maternal factors. Factors that come from the mother can be a disease that the mother suffered during pregnancy, such as hypertension, heart, lung and infectious diseases.<sup>7</sup> While the fetal factor, caused by multiple pregnancies, hydramnios and chromosomal abnormalities. In addition to maternal factors and fetal factors, factors that influence the occurrence of LBW are environmental factors. One cause of the occurrence of LBW that is influenced by environmental factors is exposure to toxic substances.<sup>6</sup> Toxic substances that enter the mother's body can come from various sources, one of which is the agricultural activities that many use pesticides.<sup>5</sup>

Metro South District is an agricultural area with a large vegetable production in Metro City. The main agricultural commodities in South Metro District are large chili, onion, mustard / caisin, cucumber, lettuce, eggplant, sweet corn, rice, tomato and green onion. The highest agricultural production in the district is large chili, which is 169.04 tons / ha. The agricultural sector is the backbone of the local economy. To keep plants from disturbing organisms, people use pesticides that they find to be efficient, easy and effective in dealing with attack by disturbing organisms.

The dependence of farmers and the involvement of pregnant women in agricultural activities causes them to be exposed to pesticides that have an impact on health, especially reproductive health. Research conducted in Central Poland says that babies born to women exposed to pesticides in the first and second trimesters have a lower body weight of 189 grams than babies born to women who are not exposed to pesticides.<sup>7</sup> Other research conducted in New York City that the majority of pregnant women in African-Americans who use intensive pesticides during pregnancy have an effect on the weight and length of the baby



at birth. It also affects the mental and motor development of children under the age of 3 years.<sup>1</sup> The existence of pest organisms in the land will encourage farmers to use excessive pesticides by increasing the dosage, the type of pesticide mixture used and the frequency of spraying.<sup>9</sup>

Exposure to high pesticides contributes to LBW, but research on the contribution of pesticide pesticides to the occurrence of LBW in the Metro Metro South Metro District has not been done so it is not known for sure. This study aims to determine the exposure of pesticides during pregnancy to the occurrence of LBW in the Metro Metro South Metro.

### **RESEARCH METHODS**

The research design used in this study is Case Control design is an analytical study or survey that reveals how a risk factor is studied by looking retrospectively or backward. The population in this study are all mothers who gave birth and are domiciled in the Metro Metro South Metro subdistrict and recorded in the complete register register public health center Summersari Bantul Metro South. The subjects of the study were mothers who gave birth to LBW and not LBW in South Metro District during the last one year period.

The taking of subjects in the case group was taken using secondary data obtained from the Summersari Bantul Metro Public Health Center, where the data were cases of LBW from January to December 2017 and the subjects in the control group were taken using secondary data obtained from the South Metro Health Center, the mother who gave birth did not experience LBW from January to December 2017 randomly selected based on inclusion and exclusion criteria. There were 33 subjects in the case group (BBLR), the comparison of case and control group subjects was 1:2, so the subjects in the control group were 66 subjects, the number of subjects in this study was 99 subjects. The inclusion criteria in this study were mothers who had a history of LBW during the last one year, productive mothers (25 pregnancies, birth spacing with previous births <1 year -35 years), mothers who gave birth fairly month not premature, mother who has good nutritional status (seen from LILA during pregnancy and weight gain during normal pregnancy), is willing to be a research subject by signing informed consent. Exclusion criteria in this study is twin pregnancy, has a history of disease during

The instruments used in this study were questionnaires used to obtain data on pesticide exposure, LBW occurrence and mother characteristics (education level, parity and chewing tobacco). Analysis of research data was done univariat, bivariat and multivariat. Univariate analysis is performed to describe the characteristics of respondents. Bivariate analyzes were conducted on two variables (independent and dependent variables) suspected to be related. In this study the resulting data are grouped so as to generate categorical data. In bivariate analysis, the data were analyzed using Chi-square test. Multivariate analysis in this study used logistic regression test. The variables included in the multivariate analysis are the variables whose bivariate analysis has p-value  $\leq 0.25$ .



## RESULTS AND DISCUSSION

### Univariate Analysis

The study was conducted on 33 mothers with a history of having LBW or as a case group and 66 mothers with no history of having LBW or as a control group. The univariate analysis can be seen in Table 1.

### Bivariate Analysis

The bivariate analysis between the variables related to the occurrence of LBW is summarized in table 2. Based on Table 2, it can be seen that there are 5 related variables and the risk factor of LBW occurrence in South Metro sub-district, such as spray involvement (p-value = 0,018) (p-value = 0,027), pesticide storage (p-value = 0,027) and APD usage (p-value = 0.013). The bivariate result was then followed by multivariate analysis which aimed to know the most dominant independent variables to be the risk factor of LBW occurrence. The result of multivariate analysis is shown in table 3.

Table	1.	Univariate Analysis		
Variables	Case	Control	N	%
	n %	n %		
<b>Spraying Involvement</b>				
High (> 2 hours a day)	25 75,8	32 48,5	57	57,6
Low ( $\leq$ 2 hours a day)	8 24,2	34 51,5	42	42,4
<b>Pesticide Mixing</b>				
Not Good	23 69,7	29 43,9	52	52,5
Good	10 30,3	37 56,1	47	47,5
<b>Handling Equipment</b>				
Not Good	25 75,8	25 37,9	50	50,5
Good	24,2	41 62,1	49	49,5
<b>Pesticide Storage</b>				
Inside the house	21 63,6	25 37,9	46	46,5
outdoors	12 36,4	41 62,1	53	53,5
<b>Use of PPE</b>				
incomplete	23 69,7	27 40,9	50	50,5



Complete	10 30,3	39 59,1	49	49,5
<b>Education Mother</b>				
Low	9 27,3	13 19,7	22	22,2
High	24 72,7	53 80,3	77	77,8
<b>Parity</b>				
Risky (> 2 times)	16 48,5	30 45,5	46	46,5
Not at risk ( $\leq$ 2 times)	17 51,5	36 54,5	53	53,5
<b>Chewing Tobacco</b>				
Risky (>3 times)	6 18,2	9 13,6	15	15,2
Not at risk ( $\leq$ 3 times)	27 81,8	57 86,4	84	84,8

Table 2. Recapitulation of Bivariate Analysis

No	Variables	P	OR	95% CI		Information
				Lower	Upper	
1	Involvement In Spraying	0,01 8	3,320	1,309	8,424	significant
2	Pesticide Mixing	0,02 7	2,934	1,208	7,127	significant
3	Handling Equipment Spraying	0,00 1	2,870	1,207	6,825	significant
4	Pesticide Storage	0,02 7	2,870	1,207	6,825	Significant
5	Use of PPE	0,01 3	3,322	1,364	8,089	Significant
6	Amount of Parity	0,94 3	1,129	0,489	2,609	Not significant
7	Chewing Tobacco	0,76 6	1,407	0,455	4,357	Not significant
8	Level of education	0,55 0	1,529	0,575	4,062	Not significant



### **Risk Factors for LBW**

The variables of pesticide exposure that are significantly related to the occurrence of LBW in Metro Metro Selatan Metro City are bivariate involvement in spraying, pesticide mixing, spraying equipment handling, pesticide storage and PPE usage. Based on Table 1 it can be seen that during pregnancy the mothers involved in spraying activity more than 2 hours in a day equal to 57,6%, mother who do not good mixing of pesticide equal to 52,5%, mother do less good pesticide handling equal to 50,5% , mothers who keep pesticides inside the house as much as 46,5% and during pregnancy mothers who work using PPE is not complete equal to 50,5%.

The involvement of pregnant women in agricultural activities consists of various types of work and among them directly involved with pesticides that is preparing equipment, mixing pesticides and spraying. Exposure to pesticides accumulated in the body of pregnant women as a result of involvement in spraying activities may interfere with the development and growth of the fetus in the womb which in turn causes the baby to be born with LBW.<sup>10</sup>

The proportion of respondents involved in spraying activities during pregnancy over 2 hours a day was greater in the case group (75.8%) than in the control group (48.5%), Table 2, Chi-square test results explained that there was a significant relationship between involvement in spraying with the occurrence of LBW (p-value = 0.018) and the value of Odds Ratio (OR) = 3.320. This result is enough to prove that involvement in spraying is one of the factors causing LBW incidence. The results of this study are in line with the results of a study conducted in Shenyang, China which states that exposure to pesticides during pregnancy has a strong relationship to the adverse effects of newborns.<sup>11</sup> In addition, pesticide exposure in the third trimester associated with the birth of LBW infants, head circumference small and long stunting babies.<sup>12</sup> The results of this study are also in line with Dayu Yunita Putri's research in 2014, which states that the involvement of pregnant women in agricultural activities has a 4.318 times greater chance of giving birth to LBW).<sup>13</sup>

The longer pregnant women work or are in the agricultural field, increasing the risk of exposure to the negative effects of pesticides. Pesticide exposure disrupts the maternal body's metabolic system so that it interferes with the nutritional intake to the fetus which can inhibit growth and development of body size at birth.<sup>14</sup> Pesticide exposure causes endocrine dysfunction ie synthetic disorders, metabolic secretion, binding and elimination of hormones in the body that keep balance, reproduction and growth process where the hormone endoktrin thyroid hormone dysfunction. Pesticide exposure in pregnant women can cause thyroid hormone dysfunction that can cause fetal growth disorders and one of the manifestations is BBLR.<sup>15</sup>

The proportion of respondents who did poor pesticide was higher in case group (69,7%) than control group (43,9%). Table 2, Chi-square test results explain that there is a significant relationship between pesticide mixing with the occurrence of LBW (p-value = 0,027) and Odds Ratio (OR) = 2,934, meaning that respondent by mixing the pesticide is not good having risk 2,9 times more likely to give birth to LBW than the respondents who did the pesticide mixing well.

The process of mixing pesticides into one of the risk factors of exposure to pesticides in pregnant women. Exposure to pesticides can occur if mixing is done inside the house so that people living in the house may be exposed to pesticides, mixing pesticides using no special bucket and mixing is done near a water source that allows pesticides to contaminate the water present in the event of a spill. The results of this study are in line with the results of research



conducted by Farhang et al (2005) which states there is a relationship between pesticide mixing with the occurrence of LBW (p-value = 0.001) .<sup>16</sup> The results of this study also supported by Eka Lestari Mahyuni research, the farmers in Berastagi sub-district made the pesticide mixing process inadequate.<sup>17</sup> However, this result is not in line with Fatmawati (2016) which states that there is no correlation between pesticide mixing and the occurrence of LBW (p-value = 0.490) .<sup>18</sup> The proportion of respondents who handled the spraying equipment was less good was higher in the case group (78.5%) than the control group (37.9%). Table 2, Chi-square test results explain that there is a significant relationship between handling spraying equipment with the occurrence of BBLR (p-value = 0.001) and Odds Ratio (OR) = 5.125.

Handling of spraying equipment is one of the important things to be aware of after spraying. If the handling of the equipment is not done well then the pesticide will remain attached to the equipment resulting in the occurrence of exposure to pesticides.

Berkowits et al (2012) states that pregnant women who perform poor handling equipment have an opportunity of 2.46 times LBW delivery compared to pregnant women who handled the spraying equipment well and pregnant women who handled poor spraying equipment increased the risk of 1, 41 times to 4.30 times.<sup>15</sup>

The proportion of respondents who store pesticides inside the house was higher in case group (63,6%) than control group (37,9%). Table 2, Chi-square test results explain that there is a significant relationship between pesticide storage with the occurrence of BBLR (p-value = 0,027) and Odds Ratio (OR) = 2,870. This proves that the storage of pesticides is also one of the risk factors causing the occurrence of LBW.

Exposure to pesticides in the home can occur if there is food contaminated by pesticides because of its storage close to the kitchen and the presence of special accidents such as pesticides placed in beverage packaging without any warning sign. This is in accordance with the results of research conducted by Harley et al (2011) which mentions there is a relationship between storage of pesticides around the house with the incidence of BBLR (p-value = 0.05) and Odds Ratio (OR) = 2.870, meaning that the storage of pesticides around the house is a risk factor for the occurrence of BBLR.<sup>19</sup> This study is also in line with the study of Noni Kartika Sari (2012) which explains that there is a relationship between pesticide storage in the house with the incidence of BBLR (p-value = 0.044).<sup>20</sup>

The proportion of respondents working with incomplete PPE was higher in case group (69,7%) than control group (40,9%). Table 2, Chi-square test results show that there is a relationship between the completeness of PPE used when working in agricultural areas with the incidence of BBLR (p-value = 0.013) and the value of Odds Ratio (OR) = 3.322, meaning that pregnant women who work do not use Complete APD has a chance of 3,322 times LBW delivery compared with pregnant women who work using APD in full.

Pesticide poisoning can occur due to excessive pesticide entry or due to neglect of safety procedures. Pesticides that enter the body will be absorbed by the body organs and can cause the production of thyroid hormone to be adequate (hypothyroidism) which if it occurs in pregnant women can disrupt the growth and development of the fetus dikandungannya. In accordance with research conducted by Harley (2011), pregnant women who work in agriculture using incomplete PPE have a risk of 5.4 times to give birth to LBW compared with mothers working in agricultural areas using full PPE.<sup>19</sup>



Table 3. Results of Logistic Regression Analysis Risk Factors of LBW

No	Variables	B	P	Exp (OR)	95% CI	
					Lower	Upper
1	Involvement In Spraying	1,620	0,006	5,055	1,601	15,960
2	Handling Equipment Spraying	2,015	0,001	7,503	2,394	23,514
3	Pesticide Storage	1,301	0,016	4,184	1,412	12,403
4	Use of PPE	1,431	0,010	3,673	1,276	10,578

Constanta:-4,302

The result of multivariate can be seen in Table 3, it can be seen that statistically spray involvement (p-value = 0,006), p-value = 0,001, pesticide storage = 0.010). Mothers involved in agricultural activities during pregnancy at risk 2,178 times (2,064-11,552) to give birth to LBW, mothers handling spraying during pregnancy at risk 4,169 times (2,056-15,454) to give birth to LBW, mothers holding pesticides at home at risk 7,332 times (2,133- 21,895) to give birth to LBW and mothers who work with incomplete PPE during pregnancy at risk 5,239 times (2,081-20,708) to give birth to LBW.

The probability of LBW occurrence based on involvement in spraying, handling of spraying equipment, pesticide storage and use of PPE is as follows

:

$$P(x) = \frac{1}{1 + e^{-y}}$$

$$P(x) = \frac{1}{1 + 2,718^{-(2,335)}}$$

$$P(x) = 0,723$$

$$P(x) = 72,3\%$$

Thus, pregnant women involved in spraying activities, handling unsuitable spraying equipment, storing pesticides inside the house and while working in agriculture using incomplete PPE have a probability of getting LBW at 72.3%.



### CONCLUSION

This study concludes:

1. Involvement in spraying is a risk factor for the occurrence of LBW (p-value = 0.018), [OR = 3,320 (95% CI; 1,309-8,424)],
2. Pesticide mixing is a risk factor for the occurrence of LBW (p-value = 0.027), [OR = 2,934 (95% CI; 1,208-7,127)],
3. Pesticide storage is a risk factor for the occurrence of LBW (p-value = 0.027), [OR = 2.870 (95% CI, 1.207-6.925)],
4. Equipment handling is a risk factor for the occurrence of LBW (p-value = 0.001), [OR = 5.125 (95% CI, 2.005-13.103)],
5. The use of PPE is a risk factor for the occurrence of BBLR p-value = 0, 013 [OR = 3.322 (95% CI, 1.364-8.089)],
6. Number of parity is not a risk factor for the occurrence of BBLR p-value = 0.943,
7. The level of education is not a risk factor for the occurrence of BBLR p-value = 0.550.
8. Chewing tobacco is a risk factor for the occurrence of BBLR p-value = 0.766.
9. From multivariate analysis results, variables involvement in spraying, handling spraying equipment, pesticide storage and use of PPE are the most risky variables of LBW occurrence Probability of mother giving birth to LBW if involved in spraying activity, handling poor spraying equipment, storing pesticide inside home and work with incomplete PPD is 72,3%.

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