The Relationship between Pesticide Exposure in Pregnant Women and the Incidence of LBW at the Sawangan 1 Public Health Centre, Magelang Regency

Arifah Rahmawati[1*], Heni Setyowati Esti Rahayu[2], Rohmayanti[2]

[1]*Nursing Science Study Program, Universitas Muhammadiyah Magelang, 56172, Indonesia*
[2]*Faculty of Health Sciences, Universitas Muhammadiyah Magelang, 56172, Indonesia*
Corresponding author's email: kairifahrahmawati@gmail.com

ABSTRACT
Low birth weight (LBW) or babies less than 2,500 grams is the basic cause of neonatal death. The risk factors for LBW are influenced by maternal, fetal, and environmental factors. One of the environmental factors is a history of exposure to pesticides during pregnancy. Exposure to pesticides received by pregnant women can affect fetal growth. The purpose to determine the relationship between pesticide exposure in pregnant women and the incidence of LBW. This research is an analytic observational quantitative research with a case control approach. The study population was all mothers with live births in the last 1 year at the Sawangan 1 Health Centre. The sampling technique used was purposive sampling with a sample of 50 respondents. The data was processed using the Chi-Square statistical test. Exposure to pesticides in the exposed category was 22 respondents (66.7%) in the case group and 11 respondents (33.3%) in the control group. Unexposed category was 3 respondents (17.6%) in the case group and 14 respondents (82.4%) in the control group. The results of statistical tests using Chi-Square in this study showed p value = 0.001 ($p < 0.05$). There is a significant relationship between pesticide exposure and the incidence of LBW. Farming women are expected to minimize the use of pesticides during pregnancy and when working, use complete personal protective equipment to avoid exposure.

Keywords: *LBW; Pesticide Exposure*

1. INTRODUCTION

Low birth weight (LBW) is the underlying cause of neonatal death, more than 20 million babies in the world, namely 15.5% of all births experience LBW and 95% of them occur in developing countries including Indonesia [1]. According to the *World Health Organization* (WHO) all new born with a birth weight of less than 2,500 grams are called Low Birth Weight Infants (LBW). The 2018 Basic Health Research shows the prevalence of LBW at the national level, which is in the range of 6.2%. Based on 2016 Central Java Health Profile data, the percentage of LBW in Central Java in 2016 was 4.4% [2]. Data from the Central Statistics Agency (BPS) of Central Java, babies born with LBW in Magelang Regency in 2019 totalled 953 cases. The danger of LBW if not prevented, the baby will be at risk of experiencing many health problems such as falling sick in the first six days of life or experiencing infections, and can also suffer from long-term problems such as delayed motor and social development or learning disabilities [3]. A history of babies with LBW can have an impact on child stunting [4]. The Magelang District Health Office shows data that in 2017 there were 205 children experiencing stunting and placing Magelang District in the second rank of stunting cases in Central Java. The highest number occurred in Soronalan Village, Sawangan District, where 49 children under five (37.6%) suffered from stunting and made the village the second locus (cases above 30%) in Magelang Regency [5].

Risk factors for LBW are influenced by, among others, maternal factors, fetal factors, and environmental factors. Environmental factors that can affect the occurrence of low birth weight, such as living in the highlands, radiation, and exposure to toxic substances. History of exposure to pesticides during pregnancy is a risk factor for LBW [2]. The high intensity of the use of environmental chemicals *(xenobiotics)* in various sub-districts in the Magelang Regency is one of the causes of the incidence of LBW [6]. Based on data from the Department of Population and Civil Registration of Magelang Regency in 2021, the majority of people in

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Sawangan sub-district work as farmers, the total number of farmers is 21,657 people (35.3%) male farmers are 11,018 people (50.9%) and female farmers are 10,639 people (49.1%). In the working area of the Sawangan 1 Health Centre, the majority of women work as farmers, especially horticultural farmers, so the population is at risk due to exposure to pesticides. Exposure to pesticides, especially during pregnancy can affect fetal growth [6]. Several types of pesticides, known as thyroid disrupting chemicals (TDCs), can interfere with the structure and function of the thyroid gland, interfere with the synthesis, secretion, transport, binding and elimination of thyroid hormones, resulting in hypothyroidism. Hypothyroidism in pregnant women causes disturbances in the growth and development of the fetus or child that is born [7].

The results of research conducted by Lentho show that there is a significant relationship between the history of maternal involvement during pregnancy in agricultural activities, the level of involvement in agricultural activities, years of service in agricultural activities and the completeness of PPE when carrying out agricultural activities with the incidence of LBW in Blado Subdistrict, Kabupaten Blado. Previous research by Nurrohmah concluded that there is a relationship between the involvement of mothers during pregnancy in agricultural activities, the completeness of PPE when working in agricultural areas and the incidence of stunting in children aged 2-5 years. There is no relationship between the duration of work and the presence of pesticides in the house with the incidence of stunting in children aged 2-5 years. In addition, Septiana shows that there is a significant relationship between work related to pesticides, period of pesticide exposure, duration of pesticide exposure, frequency of pesticide exposure, and the practice of mixing pesticides with the incidence of hypertension in pregnant women. There is no significant relationship between the use of agricultural PPE with the incidence of hypertension in pregnant women.

From the description above, LBW is still a health problem in Indonesia and a history of babies born with LBW will cause stunting compared to babies born with normal weight. The incidence of stunting in Sawangan District is high because it is the second locus (cases above 30%) in Magelang District. Environmental sanitation in the form of pesticide exposure is one of the risk factors for pregnant women with low birth weight. However, research on the relationship between pesticide exposure and LBW is still limited. Therefore, researchers are interested in conducting research with the title "Relationship of Pesticide Exposure in Pregnant Women with LBW Incidence in Sawangan 1 Health Center, Magelang Regency" with the aim of the study identifying the characteristics of respondents, identifying pesticide exposure to pregnant women in agricultural activities, identifying the incidence of LBW in Sawangan District Magelang Regency, analysing the relationship between pesticide exposure in pregnant women and the incidence of LBW at the Sawangan 1 Health Centre, Magelang Regency.

2. METHOD

This research is a quantitative research with analytical observational character with a case control approach. In this study, there were 2 groups the case group was mothers with LBW babies and the control group was mothers with normal babies. In this study, the independent variable is pesticide exposure and the dependent variable is LBW. The population in this study were 366 mothers with live births in the last 1 year in the work area of the Sawangan 1 Health Centre. The samples needed in this study were 25 people for the case group and 25 people for the control group. So, the total needed is 50 people. This study used a purposive sampling technique with inclusion criteria and exclusion criteria. The inclusion criteria for the case group were mothers with LBW babies at the Sawangan Health Centre, mothers of babies who worked as farmers, LBW babies born alive aged 0-12 months. The inclusion criteria of this study were mothers with LBW and non-LBW babies at the Sawangan Health Centre, mothers of babies who worked as farmers, LBW babies born alive aged 0-12 months. The exclusion criteria for the study were mothers who moved their domiciles, mothers who during pregnancy had pulmonary TB and KEK, and maternal age <20 years and >30 years. The instruments used are medical records, baby birth weight data at the Sawangan 1 Health Centre and a pesticide exposure questionnaire that has been tested by experts. Univariate analysis was carried out to determine the characteristics of the respondents while bivariate analysis was carried out using the Chi-Square test.

3. RESULT AND DISCUSSION

3.1. Result

The results of the research will be described through two stages of data analysis, namely univariate and bivariate analysis. The results of the univariate analysis aim to describe the characteristics of respondents in the case group and control group. While the results of the bivariate analysis aimed to prove the relationship between pesticide exposure and the incidence of LBW. Statistical analysis of research data is described as follows:

Table 1 Frequency Distribution of Mother's Characteristics

No	Respondent Characteristics		Group				P value
			Case		Control		
			n	%	n	%	
1.	Age	(20-35)	25	50.0	25	50.0	0.700
2.	Parity	Primipara	11	57.9	8	42.1	0.120
		Multipara	14	45.2	17	54.8	
3.	Length of service as farmers	≤1 year	0	0.0	4	100.0	0.394
		>1 year	25	53.2	21	45.7	

Based on table 1. can be concluded that the age range of all respondents in the case group and control group is 20-35 years with the percentage of the case group being 50% and the control group being 50%. The majority of parity respondents were parity multipara with the percentage of case group was 45.2% and control group was 54.8%. The duration of working as a farmer was more than one year in the case group with a percentage of 53.2% and 45.7% in the control group.

Table 2 Frequency Distribution of Baby Characteristics

Baby Characteristics	Group				P value
	Case (n=25)		Control (n-25)		
	n	%	n	%	
Gender					0.777
a. Man	13	50.0	12	48.0	
b. Woman	12	48.0	13	50.0	

Based on table 2. can be concluded that the majority of infants in the case group were male with a percentage of 50%. While in the control group the majority were female with a percentage of 50%.

Table 3 Distribution of Respondents Based on Pesticide Exposure to Mother During Pregnancy

		Exposed	Not Exposed
Weight	Case Group LBW (n=25)	22	3
		66.7%	17.6%
	Control Group Not LBW (n=25)	11	14
		33.3%	82.4%

Based on table 3. be concluded that the exposure to pesticides in pregnant women at the Sawangan 1 Public Health Centre, Magelang Regency, was exposed to more in the case group, with a percentage of 66.7%. While the category is not exposed to the majority in the control group with a percentage of 82.4%.

Table 4 Distribution of Respondents Based on the Relationship between Pesticide Exposure and LBW at Sawangan Health Centre 1

Pesticide Exposure	Weight				P-*value*	OR
	LBW		Not LBW			
	n	%	n	%		
Exposed	22	66.7	11	33.3	0.001	2.471
Not Exposed	3	17.6	14	82.4		

**Chi-Square Test*

Based on table 4. it shows that the majority of exposure to pesticides in the exposed category is the case group with a percentage of 66.7%. While the category not exposed to the majority is the control group with a percentage of 82.4%. The results of the study were statistically tested using the Chi-Square test showing p value = 0.001 so that $p < 0.05$, which means that there is a statistically significant or significant relationship between pesticide exposure and the incidence of LBW. The OR value shows 2,471 which means that mothers who are exposed to pesticides during pregnancy are twice as likely to give birth to babies with low birth weight compared to pregnant women who are not exposed to pesticides.

3.2. Discussion

3.2.1. Age

In this study, the results showed that the age range of the respondents was 20-35 years with a total of 50 respondents. The case group and the control group had the same percentage, each of which was 50%. The results of the homogeneity test of the characteristics of respondents based on age showed homogeneity between the case group and the control group with a significance value of 0.700.

According to Nappu the safe age for pregnancy and childbirth is 20-35 years or known as healthy reproduction. Pregnancy under the age of 20 can affect organs such as the uterus, and even babies can be born prematurely and have low birth weight. This is because women who are pregnant at a young age have not provided a good supply of food to the fetus they contain. While pregnancy in old age, namely in women aged more than or equal to 35 years from a biological point of view, the development of reproductive organs has experienced a setback which can cause abnormal complications, including pregnancy and childbirth with serotonin.

In this study, the age of the respondents was the age that was not at risk, but there were respondents who gave birth to LBW and were not exposed to pesticides. This happens because there are several other factors that affect LBW, namely maternal factors such as parity, maternal nutrition and maternal illness during pregnancy [10]. This is similar to the results of research conducted by Salam (2021) which states that there is no relationship between maternal age and the incidence of LBW.

3.2.2. Parity

This study obtained the results of primipara parity and multipara parity categories. The primipara parity of the case group was 57.9% and the control group was 52.1%. The multipara parity of the case group was 45.2% and the control group was 54.8%. The results of the homogeneity test of respondents' characteristics based on parity showed a p value of 0.120, which means the variance is the same or homogeneous between the case group and the control group. In this study, there were still many mothers who had primiparous and multiparous parity who gave birth to LBW. This is because mothers with primiparous parity have not optimal organ functions in maintaining pregnancy and accepting the presence of the fetus. Meanwhile, mothers with multiparity parity will cause disruption of the uterus, especially in the blood vessels and damage to the walls of blood vessels in the uterus which can affect the nutrition of the fetus. So that the occurrence of disturbances in fetal growth and giving birth to babies with LBW [11].

However, the results of this study also showed that there were still mothers who gave birth to non-LBW babies and had more multiparity parity than mothers who gave birth to LBW. This happens because there are other factors that trigger the occurrence of LBW, namely the nutritional status of pre-pregnant mothers and when pregnant are marked by socioeconomic status which includes education, occupation, family economic status, history of maternal illness, birth history and pregnancy services which include how much mothers often check for pregnancy, health workers who examine them, gestational age at the beginning of pregnancy checks [12]. The results of this study are in line with the results of research conducted by Putri (2019) which stated that there was no significant relationship between parity and LBW infants in RSUDZA Banda Aceh with p value = 0.085 (> 0.05).

3.2.3. Occupation

This study obtained the results of the occupation categories of respondents from both groups, namely the case group and the control group, on average working as farmers. Of the 50 respondents, each group has the same percentage, namely 50% of the respondents work as farmers. According to Hardiana & Setiani (2021) women who are involved in agricultural activities are at risk of being exposed to pesticides. The fat content of women during pregnancy is higher than women who are not pregnant, so pesticides are more easily absorbed by the body. Pesticides that enter the body will undergo a process of accumulation in body tissues, bones, fats and proteins. Fat-soluble pesticides are stored for a long time in the body. The high fat content in pregnant women makes it easier for pesticides to accumulate in the body, resulting in disruption of the growth of the fetus being conceived. In addition, the lack of thyroid hormone intake is also a trigger for the disruption of the growth process in the fetus. Lack of thyroid hormone intake due to exposure to pesticides in women during pregnancy causes thyroid dysfunction, namely hypothyroidism and hyperthyroidism, resulting in low-birth-weight babies.

This is similar to the results of Lentho which shows that there is a significant relationship between the history of the respondent's involvement during pregnancy in agricultural activities and the incidence of Low Birth Weight (LBW) in Blado District, Batang Regency. This is based on the obtained p *value* of 0.043 which is smaller than the value of (0.05).

3.2.4. Length of service as farmers

This study obtained the results of the old category of being a farmer, namely less than 1 year and more than 1 year. Of the 50 research respondents, the majority of respondents worked as farmers for more than 1 year. The case group with a percentage of 53.2% and the control group with a percentage of 45.7%. The results of the homogeneity test of the characteristics of the respondents based on the length of time they worked as farmers showed that they were homogeneous or had the same variance between the two groups, namely the case group and the control group by showing the results of p value = 0.394 > 0.05.

Working period is one of the factors that can affect pesticide exposure into a person's body and poses a risk to health, the longer the working period as a farmer and the more frequent agricultural activities that involve the use of pesticides, the easier it is for exposure to occur and

the more frequent contact with pesticides, the risk higher pesticide exposure [15]. This is similar to Luthfiya that years of service as farmers were shown to have a relationship with the incidence of LBW with a p value = 0.012 < (0.05) and an OR value of 6.500 (95% CI = 1.640-25.759) which means that the longer The working period of being a farmer is 6,500 times more at risk of giving birth to LBW compared to farmers whose working period is less than 5 years.

3.2.5. Baby's Gender

In this study, the majority of infants born with LBW were male and the majority of non-LBW infants were female. According to [17] male babies have a higher LBW tendency than female babies. Research conducted in Sub-Saharan Africa reported that the prevalence of low birth weight was high and female infants had no effect on the incidence of LBW. Boys are born with smaller sources of iron and are more at risk of iron deficiency than female babies. The results of this study are similar to the research conducted by [18] the results of the study found that the incidence of Low Birth Weight Babies (LBW) based on the Gender of Babies at the Kota Pinang Hospital, Labuhan Batu Selatan Regency in 2021, the majority were male.

3.2.6. Relationship between Pesticide Exposure and LBW

The results of this study were statistically tested using the chi-square test which showed p value = 0.001 so that p <0.05, which means that there is a statistically significant relationship between pesticide exposure and low birth weight. The OR value shows 2,471 which means that mothers who are exposed to pesticides during pregnancy are 2 times more likely to give birth to babies with low birth weight compared to pregnant women who are not exposed to pesticides.

Babies with low birth weight (LBW) are babies weighing less than 2,500 grams regardless of gestational age. The baby's weight is weighed within one hour after birth and is a very sensitive indicator to monitor the degree or status of the baby's health since birth [19]. The World Health Organization (WHO) states, birth weight less than 2500 grams has always been a significant problem globally and is associated with various short-term and long-term consequences. Overall, it is estimated that 15% - 20% of all births in the world experience low birth weight, which represents more than 20 million births per year [20]. In this study, the instrument used on the baby's weight variable was in the form of medical records obtained directly from the Sawangan 1 Health Center as the research location. The results of this study indicate that exposure to pesticides can cause low birth weight. This is supported by the results of Hardiana's that pesticide exposure to pregnant women in agricultural activities can increase the risk of low birth weight in Sembalun District by showing a significant relationship based on the probability value of p value = 0.003 or p < 0.05.

According to Setia pesticide exposure is an experience gained by a population or organism as a result of being exposed to or in direct contact with pesticides as potential agents originating from the environment. This happens because pesticides contain active ingredients but do not have a specific toxic effect so that they can affect target, non-target organisms, humans and the environment. The danger of pesticide exposure to women of childbearing age, including pregnant women, can cause reproductive problems. Pesticides known as thyroid disrupting chemicals (TDCs) can interfere with the structure and function of the thyroid gland, interfere with the transport, secretion, synthesis, binding and elimination of thyroid hormones, resulting in hypothyroidism. Pregnant women who experience hypothyroidism will cause impaired growth and development of the baby they are born with, resulting in low birth weight and even stunting [6].

In Lentho's research, it is stated that pesticide exposure to the incidence of LBW is caused by pregnant women who carry out agricultural activities. The involvement of pregnant women in agriculture consists of various types of work and some of them are directly involved with pesticides, for example when mothers prepare and mix pesticides or spray crops in the fields. The involvement of pregnant women can cause exposure to pesticides that accumulate in the body so that it interferes with the growth and development of the fetus in the womb and can cause babies to be born with low birth weight. Some agricultural activities that involve women include working to find pests, pulling grass from plants, harvesting and cutting plant stalks and spraying pesticides. These activities can trigger the occurrence of pesticide exposure in women which is harmful to health. The involvement of women during pregnancy in agricultural activities can lead to exposure to pesticides, pesticides enter and will accumulate in the body which can interfere with the growth and development of the fetus being conceived, so that when giving birth, the baby's birth weight is less than normal or is said to have low birth weight [14].

Although seen from the statistical data, the results of this study were significant because the p value < 0.05. However, there are still some respondents who gave birth to LBW and were not exposed to pesticides. This is possible due to factors other than environmental factors. Other factors such as maternal and infant factors. According to Ajul maternal age is the main factor in the incidence of LBW. The age of a woman has a direct influence on reproductive function. Sasmita apart from maternal age, parity can cause babies to be born with low birth weight. The condition of giving birth too often can cause uterine disorders. According to Sundani (2020) fetal factors that cause low birth weight include hydramnios or amniotic fluid, multiple pregnancies, and chromosomal abnormalities.

In addition to the factors that cause LBW mentioned above, another thing that allows respondents with LBW not to be exposed to pesticides is because respondents when working as farmers wear full PPE so as to minimize the risk of being exposed to pesticides directly. Based on

the results of this study indicate that the majority of research respondents use complete PPE. According to [24] the complete use of PPE can reduce the risk of exposure to and poisoning from pesticides. The use of PPE can prevent the absorption of pesticides into the body.

4. CONCLUSION

The characteristics of the respondents in this study were identified, which included maternal age in both groups, namely 20-35. Most of the parity respondents are multipara parity, the job of the respondents from each group is to be a farmer. Most of the respondents in the case and control groups worked as farmers for more than 1 year. Identified pesticide exposure to pregnant women in agricultural activities at the Sawangan 1 Health Centre, Magelang Regency, namely the results of the most exposed category were the case group and the most unexposed category was the control group. The exposed category is the case group with a percentage of 66.7% and the control group 33.3%. While the category is not exposed to the case group with a percentage of 17.6% and the control group 82.4%. Identified the incidence of LBW in Sawangan District, especially in the work area of the Sawangan 1 Health Center, Magelang Regency of the 366 total births, there were 25 (6.83%) babies born with low birth weight. There is a relationship between pesticide exposure in pregnant women and the incidence of LBW at the Sawangan 1 Public Health Centre, Magelang Regency. The results showed $p = 0.001 < 0.05$ and an OR value of 2.471, which means that pregnant women who are exposed to pesticides are at risk of giving birth to LBW twice compared to pregnant women who are not exposed to pesticides.

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