



Analysis of Pesticide Exposure Factors During Pregnancy on Low Birth Weight Incidence

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Abstract

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Pesticide exposure is one of the environmental risk factors that can affect the health of pregnant women and fetal development. Uncontrolled pesticide use has the potential to increase the risk of pregnancy complications, including low birth weight (LBW). This study aims to analyze factors associated with pesticide exposure in pregnant women and their association with LBW. The method used was a Systematic Literature Review (SLR) by reviewing scientific articles published in the last five years and obtained through Google Scholar. Inclusion criteria included articles discussing pesticide exposure, pregnancy, and infant health outcomes. The review results indicate that pesticide exposure can occur through inhalation, skin contact, and consumption of contaminated materials, and is influenced by factors such as exposure intensity, duration of work, use of personal protective equipment, and socioeconomic conditions. Pesticide exposure during pregnancy has the potential to disrupt the hormonal system and fetal growth, thereby increasing the risk of LBW. Although there is variation in results across studies, the majority indicate an association between pesticide exposure and the occurrence of LBW. Therefore, preventive efforts are needed through increased awareness, safe work practices, and environmental health policies.



1. Introduction

The agricultural sector is one of the important sectors in supporting human life needs, especially in the provision of food and industrial raw materials. Along with the increasing need for agricultural production, the use of pesticides is one of the strategies that are widely applied to control pests and increase crop yields. However, improper and uncontrolled use of pesticides can have various negative impacts on the environment and human health (Kim et al., 2017). Long-term exposure to pesticides is known to be associated with a variety of health disorders, including nervous system, endocrine, and other chronic diseases (Hoppin, & LePrevost., 2017).

Exposure to pesticides not only impacts agricultural workers in general, but is also of particular concern for vulnerable groups, such as women, especially during pregnancy. Pregnant women have physiological characteristics that allow the accumulation of chemical substances in the body, thereby increasing the risk of negative impacts on the fetus conceived. Some studies suggest that exposure to environmental chemicals, including pesticides, during the prenatal period can affect fetal development and increase the risk of developing health problems in the baby (Gómez-Roig et al., 2021). This condition is becoming increasingly important considering that the pregnancy period is a critical phase in determining the quality of an individual's health in the future.

One of the important indicators in assessing the health of a newborn is birth weight. Low birth weight (LBW) is a condition in which babies are born weighing less than 2500 grams and are still a global health problem today. Global data show

that the prevalence of LBW is still quite high and is closely related to an increased risk of infant morbidity and mortality, as well as impaired cognitive and physical development later in life (Blencowe et al., 2019). In addition, various environmental factors, including exposure to harmful chemicals during pregnancy, have been identified as one of the important determinants in the occurrence of LBW (WHO, 2018).

Exposure to pesticides during pregnancy can occur through various pathways, such as inhalation, skin contact, and consumption of contaminated food. Previous research has shown that there is a relationship between pesticide exposure and various adverse pregnancy outcomes, including LBW, preterm birth, and fetal developmental disorders (Eskenazi et al., 2018). In addition, the level of exposure to pesticides in individuals is also influenced by various factors, such as the duration of exposure, the intensity of use, and the use of personal protective equipment in daily activities (Damalas & Koutroubas, 2017).

Although various studies have examined the relationship between pesticide exposure and health impacts, the results still show variation, especially regarding the factors that most affect the occurrence of LBW. Some studies emphasize the importance of environmental and behavioral factors in determining exposure levels, while other studies show an equally significant role of biological and social factors. Therefore, a more comprehensive study is needed to identify and analyze the factors that play a role in pesticide exposure, especially in women during pregnancy.

Based on this background, this study aims to analyze various factors related to pesticide exposure in pregnant women and their relationship with the incidence

of low birth weight. By understanding these factors, it is hoped that a clearer picture can be obtained about the mechanism of exposure and preventive efforts that can be carried out to improve maternal and infant health.

2. Literature Review

Exposure to pesticides has become a major concern in environmental health studies, especially because of their far-reaching impact on human health. Pesticides contain a variety of chemical compounds that are designed to kill or control disruptive organisms, but at the same time can have toxic effects on humans. Exposure to pesticides can occur through a variety of pathways, such as inhalation, dermal contact, and consumption of contaminated food. The health effects can be acute or chronic, depending on the type of chemical, dosage, and duration of exposure (Kim et al., 2017).

In the context of reproductive health, pesticide exposure is an increasingly important issue because it has the potential to affect fetal development during pregnancy. Studies show that the chemicals in pesticides can act as endocrine disruptors that disrupt the hormonal system, thus impacting the growth and development process of the fetus. In addition, exposure during the prenatal period can lead to long-term biological changes, including disturbances in the child's nervous system and metabolism (Maitre et al., 2018). This shows that the prenatal environment has an important role in determining future health outcomes.

A number of studies have also examined the relationship between pesticide exposure and adverse pregnancy outcomes, including low birth weight (LBW). LBW

is one of the important indicators that reflects the health condition of the baby at birth. Babies with LBW have a higher risk of developing health complications, both in the short and long term. Epidemiological research suggests an association between exposure to environmental chemicals, including pesticides, and an increased risk of LBW, although the strength of the association may vary between studies (Jedrychowski et al., 2017).

In addition to direct exposure factors, the level of risk experienced by individuals is also influenced by various other factors, such as work behavior, use of personal protective equipment, and environmental conditions. In the context of work in the agricultural sector, the intensity of pesticide exposure is often influenced by the frequency and duration of use, as well as the level of compliance with occupational safety practices. The use of non-optimal personal protective equipment can increase the risk of pesticides entering the body, thereby increasing the potential health impact (Damalas & Koutroubas, 2017).

Based on these findings, it can be concluded that pesticide exposure is a complex risk factor and is influenced by the interaction between environmental, behavioral, and biological factors. Therefore, a comprehensive approach is needed in understanding the relationship between pesticide exposure and health outcomes, especially in vulnerable groups such as pregnant women. A systematic review of the literature is important to identify consistent relationship patterns and factors that play a role in increasing the risk of LBW.

3. Methods

This study uses a *Systematic Literature Review* (SLR) approach which aims to identify, evaluate, and synthesize relevant research results related to factors related to pesticide exposure in pregnant women as well as their relationship with the incidence of low birth weight. This approach was chosen because it is able to provide a comprehensive and structured picture of the topic being researched based on previously published scientific evidence. The research process is carried out through several systematic stages, starting from the formulation of research questions, determination of literature search strategies, to the analysis and synthesis of the data obtained.

Literature searches are conducted online through commonly used scientific databases, such as Google Scholar, using a combination of keywords relevant to the research topic, including "pesticide exposure", "pregnancy", "low birth weight", and "maternal health". These keywords are combined using Boolean operators such as AND and OR to obtain more specific and targeted search results. The inclusion criteria in this study include articles published in the range of 2017 to 2021, available in *full-text* form, written in English or Indonesian, and directly discussing the relationship between pesticide exposure and pregnancy outcomes, especially low birth weight. In addition, the selected articles are empirical research and systematic reviews that have high relevance to the topic being studied.

In contrast, exclusion criteria include articles that do not have full access, articles with years of publication outside the predetermined range, as well as studies that do not specifically address pesticide exposure in pregnant women or do not

examine the health outcomes of the baby. After the initial search process, a screening stage is carried out based on titles and abstracts to identify articles that meet the inclusion criteria. Articles that pass this stage are then further reviewed in the full text section to ensure fit for the purpose of the study.

Furthermore, a data extraction process was carried out from the selected articles, which included important information such as authors, year of publication, research objectives, study design, variables studied, and main findings. The data that has been collected is then analyzed qualitatively by grouping findings based on relevant themes, such as exposure factors, respondent characteristics, and the relationship between pesticide exposure and the incidence of low birth weight. The synthesis process is carried out by comparing and integrating the results of various studies to gain a deeper understanding of the patterns of existing relationships.

To maintain the quality and validity of the results, each article analyzed has gone through a rigorous selection process based on the relevance and credibility of the source. Using a systematic literature review approach, this study is expected to be able to provide a comprehensive and evidence-based picture of the factors that play a role in pesticide exposure in pregnant women and their implications for the health of the unborn baby.

4. Results and Discussion

The results of the literature review show that pesticide exposure in pregnant women is a complex issue and is influenced by various interrelated factors. Based on an analysis of a number of relevant studies, it was found that exposure to pesticides

can have a significant impact on maternal and fetal health, especially in increasing the risk of low birth weight (LBW). This exposure generally occurs through various pathways, such as inhalation, skin contact, and consumption of contaminated foodstuffs, thus allowing harmful chemicals to enter the body and accumulate in biological tissues (Kim et al., 2017).

In general, pesticides contain toxic compounds that can disrupt the human biological system, including the endocrine system. This disorder has the potential to affect the hormonal balance that plays an important role in the pregnancy process and fetal development. Studies show that exposure to pesticides during the prenatal period can cause changes in the hormonal system, which ultimately impacts fetal growth and increases the risk of birth weight (Hoppin & LePrevost, 2017). This is in line with findings that environmental chemicals can act as *endocrine disruptors* that affect intrauterine development (Maitre et al., 2018).

In addition to biological factors, environmental and behavioral factors also have an important role in determining the level of pesticide exposure. In the context of agricultural activities, the intensity of exposure is strongly influenced by the frequency of pesticide use as well as the duration of an individual's involvement in activities related to the substance. The more often and for longer a person is exposed to pesticides, the greater the possibility of accumulating harmful substances in the body. This condition increases the risk of adverse health impacts, including in pregnant women (Abdollahdokht et al., 2021). Therefore, exposure management is an important aspect of prevention efforts.

The factor of using personal protective equipment (PPE) is also one of the important determinants in reducing the level of pesticide exposure. The use of non-optimal PPE can increase the risk of chemical substances entering the body through the skin or respiratory system. On the other hand, the implementation of good occupational safety practices, including the complete and correct use of PPE, can significantly reduce the risk of exposure (Damalas & Koutroubas, 2017). This shows that individual behavioral factors have a major contribution in determining the level of risk faced.

Furthermore, several studies have shown a relationship between pesticide exposure and various adverse pregnancy outcomes, including LBW. Exposure to chemicals during pregnancy can interfere with the fetal growth process through various mechanisms, such as disruption of nutrient flow, oxidative stress, and hormonal dysfunction. This condition can cause the fetus to not develop optimally, thus increasing the likelihood of being born with low body weight (Eskenazi et al., 2018). In addition, long-term exposure can also trigger biological changes that are permanent in the fetus.

In the context of epidemiology, LBW is an important indicator that reflects the health condition of the mother and baby. The high incidence of LBW globally shows that the underlying risk factors are still a challenge in the field of public health. One of the factors that contribute to this condition is exposure to unhealthy environments, including pesticides (Blencowe et al., 2019). Therefore, understanding risk factors is key in prevention efforts.

In addition, the results of the study also show that social and economic factors can affect the level of pesticide exposure. Individuals with lower levels of education tend to have a limited understanding of the risks of pesticides and how they are safe to use. This can increase the likelihood of accidental exposure. On the other hand, economic factors can also affect access to personal protective equipment and safer work practices (Kangkhetkron & Juntarawijit, 2021). Thus, the intervention approach needs to consider the socio-economic aspects of the community.

Other findings suggest that pesticide exposure not only impacts physical health, but can also affect overall quality of life. The long-term effects of exposure to chemicals can increase the risk of chronic disease, ultimately impacting an individual's productivity and well-being. This reinforces the importance of pesticide exposure control as part of a sustainable public health strategy (Hernández et al., 2020).

Although most studies show a link between pesticide exposure and LBW, there are also variations in results that suggest that the relationship is not always consistent. These differences can be due to variations in the study design, exposure measurement methods, as well as the characteristics of the population studied. In addition, other factors such as maternal nutritional status, health conditions, and access to health services can also affect the results of the study (Jedrychowski et al., 2017). Therefore, a more comprehensive approach is needed in analyzing the factors that contribute to LBW.

Overall, the results of this study show that pesticide exposure is a significant risk factor for the occurrence of LBW, but its effect is influenced by various other

factors that interact with each other. Therefore, prevention efforts focus not only on reducing the use of pesticides, but also on increasing public awareness, implementing safe work practices, and strengthening environmental health policies. An integrated approach is expected to reduce the risk of exposure and improve the quality of health of the mother and the baby who are born.

5. Conclusion

Based on the findings of a systematic literature review, it can be concluded that pesticide exposure is a significant risk factor contributing to low birth weight (LBW). This exposure can occur through various routes, such as inhalation, direct skin contact, or consumption of contaminated substances, allowing harmful chemicals to enter and accumulate in the body, particularly in pregnant women. This condition has the potential to disrupt hormonal balance and fetal growth processes, which ultimately impacts pregnancy outcomes. Furthermore, the level of pesticide exposure is influenced not only by environmental factors but also by behavioral and socioeconomic factors. The use of personal protective equipment, the duration and intensity of exposure, and an individual's level of knowledge regarding pesticide risks are key factors determining the magnitude of the risk faced.

On the other hand, factors such as education and access to information also play a role in fostering safer pesticide usage practices. Although there is variation in results across studies, they generally indicate an association between pesticide exposure and the incidence of low birth weight. Therefore, comprehensive prevention efforts are needed through increased awareness, the implementation of

safe work practices, and the strengthening of environmental health policies to protect the health of mothers and infants. An integrated approach is expected to reduce exposure risks and improve overall public health.

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