EXPOSURE TO PESTICIDES IN PREGNANT WOMEN CAN CAUSE REPRODUCTIVE HEALTH PROBLEMS

Enggal Hadi Kurniyawan, Ni Made Galuh Widiyantari, Hayyu Rizqiatul Maula, Rita Wulandari, Ardanny Alfiananto Nugroho, Melinda Nur Pramastuti, Elshinta Dika Maharani
(Faculty of Nursing, Universitas Jember, Indonesia)

Abstract

The use of pesticides has excellent benefits in the agricultural sector. On the other hand, the use of pesticides is also known to have detrimental risks. Prolonged exposure to pesticides is directly related to the possibility of disorders of the female reproductive system. Disorders of the reproductive system health in women are disorders that can lead to infertility, cancer, congenital abnormalities, and several problems during pregnancy and after pregnancy. This study aimed to determine the impact of pesticide exposure on women's reproductive health in agricultural areas. The process of searching for journal articles is carried out in the literature reviews from 3 databases, namely ScienceDirect, PubMed, and Google Scholar, with publication between 2018-2022. Finally, ten articles were determined that matched the research criteria and could proceed to the analysis stage. Excessive exposure to pesticides in pregnant women can cause reproductive system problems and hurt the baby to be born. Nurses can provide comprehensive nursing care so that they can improve the level of public health. Nurses can actively offer health education and promotion regarding women's reproduction in agricultural areas.

Keywords: *farmer; pesticide; reproductive; pregnant women*

INTRODUCTION

Farmers are unofficial workers who are very dependent on the role of the government regarding the safety and security of production in the agricultural sector[1]. Farmers are at risk of experiencing health problems because they often interact with the farm environment, including with high intensity the risk of exposure to pesticides. In addition, it is known that when using pesticides, farmers often do not pay attention to using Personal Protective Equipment (PPE), and farmers do not follow the instructions for using pesticide doses properly [2,3].

Pesticides are chemicals often used to protect against pests or diseases that can attack plants[4]. Plants sprayed with pesticides are known to increase their productivity, which impacts large sales, so the profits obtained have increased due to their use in large quantities[4]. Decreasing crop yields due to fungus is often a problem for farmers. This can be overcome by using pesticides to minimize the risk of crop failure, which can cause many losses [5].

Reproductive organs are individual body parts that are used to carry out reproduction and function as sexual organs for both men and women [6]. Exposure to pesticides allows pesticides to enter the body's organs, including reproduction, so they can interfere with health, one of which is that they can cause health problems in the female reproductive

system [7,8]. Disorders of the reproductive system in women affect the endocrine system and central nervous system, which can also be disrupted. This is because the content of pesticides can attack, mimic, and inhibit the work of these systems in the human body [9].

Prolonged pesticide exposure is directly related to the possibility of disorders of the female reproductive system. Disorders of the reproductive system health in women are disorders that can lead to infertility, cancer, congenital abnormalities, and several problems during pregnancy and after pregnancy[4,10]. Even though the implementation of pesticide spraying activities is not carried out directly by pregnant women, pregnant women are still at risk of being exposed to pesticides through other agricultural activities. These activities include preparing pesticides before they are given to plants, mixing pesticides, washing equipment affected by pesticides, or when pregnant women are close to where pesticides are sprayed [9].

Agronursing is a holistic and comprehensive client-oriented service and management in the agricultural sector [11,12]. The use of pesticides has excellent benefits in the agricultural sector, but on the other hand, the use of pesticides is also known to have risks that have detrimental effects [13]. This loss is caused by the use of chemicals in the composition of the pesticide, which has destructive properties and is difficult to repair as before pesticides[5]. Pesticide exposure has adverse environmental and human health side effects[7]. In an agricultural environment, exposure to pesticides can cause pollution to water, soil, and air [13].

METHOD

This study uses a systematic review of origin from 3 databases, namely ScienceDirect, PubMed, and Google Scholar, with a year publication between 2018 and 2022. Keywords use the boolean operator (AND) in English and Indonesian. In English, use the keywords pesticide AND reproductive health AND women AND farmer, while in Indonesian, use keywords pesticides AND health reproduction AND women AND farmers.

The search process article started with the identified keywords determined. At stage identification, there are 1,427 suitable articles with keywords. The selection stage is done, and there are 118 appropriate articles. Filter customized articles with criteria for study inclusion and exclusion. There are 32 corresponding articles with criteria study inclusion and exclusion. The next step is to filter against the article abstract for the focus article by the criteria appraisal. In this step, there are 12 suitable articles with criteria research. Then, from 12 selected articles, repeat language, design research, output, and some other criteria were determined. Finally, ten suitable articles were determined with criteria research and got next to stage analysis.

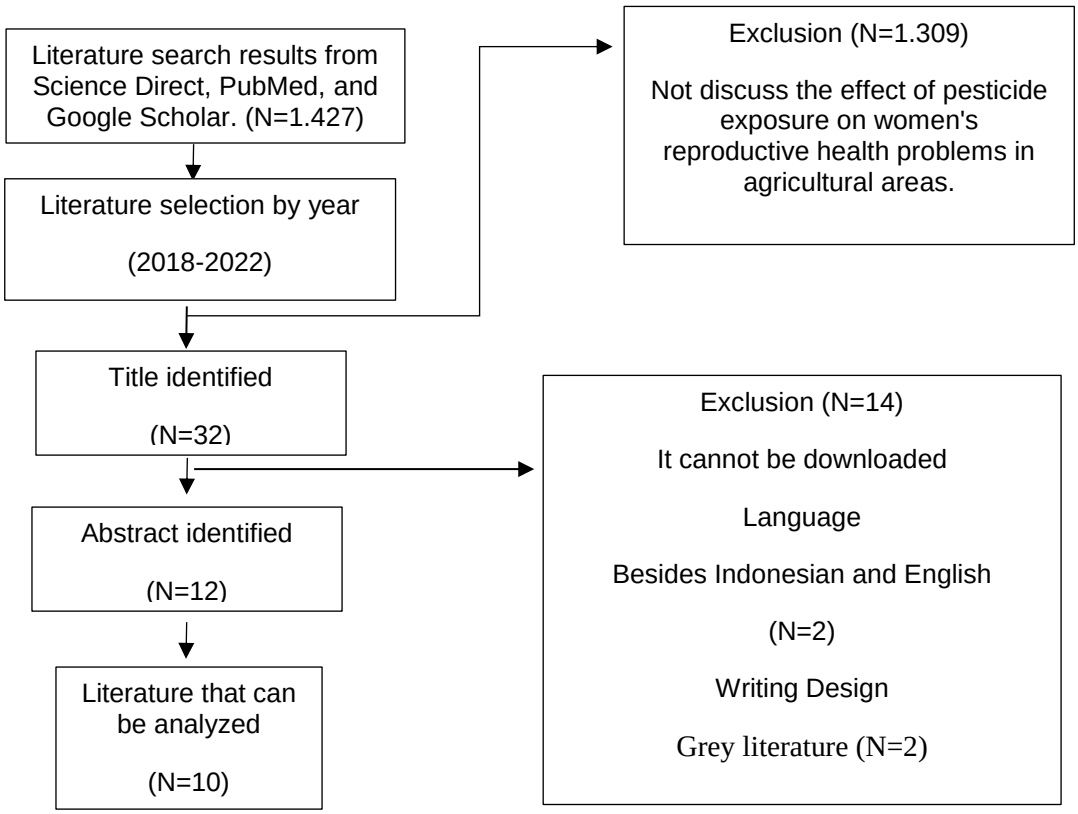

Figure 1. Flow Diagram of Analysis Literature based on PRISMA

RESULTS

A woman's status as a farmer's wife will be directly involved in agricultural activities for quite a long period[14]. Exposure to pesticides directly and over a long period can cause various reproductive problems in women, especially pregnant women. Possible problems that arise are Low Birth Weight (LBW), anemia in pregnancy, disorders development in child preschool, hypertension in pregnancy, and autism in children until miscarriage.

Duration contact with women with pesticides causes a more risk problem of reproduction. About 44% of women exposed to pesticides for ≥ 11 years (Widyawati et al., 2018). Based on the data obtained from the study that is as much as 75% of 25 respondents give birth to a child with birth weight low birth weight (LBW), and 44% of 25 respondents follow as well in activity agriculture[15]. Most women who used complete PPE obtained research data, and as much as 66% of 50 respondents did not wear PPE, and 34% of 50 respondents did not wear full PPE[9].

Study state that the prevalence of anemia in farmers women working in the horticulture area by 27.5%, with factor risk including poor nutritional status well, lack of protein consumption, and lack of consumption containing vegetable substance iron[16]. Which mentions a connection between farmer women with long spray pesticides and the amount

and type of pesticides that can cause anemia. Besides that, exposure to pesticides in pregnant women can cause hypertension[17]. Who stated that incident hypertension has a percentage of 55.8%, and for those who do not have hypertension, as much as 44.2% of the total respondents, 77 people[18]. Incident hypertension relates to exposure to pesticides in pregnant women, mixing pesticides, and inappropriate use of PPE[13].

In his research also yielded that of 63 respondents children aged 3-5 years; there were 65.1% or 41 children experienced disturbance development with aspect communication (44.4%), motor gross (50.8%), motor smooth (52.4%), splitting problems (55.6%), and personal social (60.3%)[3]. It can happen Because of exposure to long enough pesticides for detected pregnancy in the urine at the time age ± 17 weeks of gestation. Related research by Thistle et al. (2022) with distracted child preschool, consequence exposure to Pesticides is too long to mention that the prevalence of incident disturbance development in preschool more Lots happens to children Women compared to men with a percentage of 56%. Besides that, research by Juanda (2021) mentions that exposure to pesticides can cause autism in newborns because pesticides that affect endocrine disruptors chemical or bully system can inhibit the receptor thyroid that causes hypothyroid[19]. Neuroanatomy and neurochemistry of neurotransmitters in the brain will disturbed because of the decline of dendrites in cells Purkinje in the cerebellum, causing autism in newborns. Character autism among 11-year-old children associated with exposure to chlorpyrifos and diazinon (including in organophosphate) in prenatal mothers will increase if exposed too long[20].

Table 1. Results of Literature Review

No	Author and Journal Identity	Journal Titles	objective	Population and Sample	method	Summary of Results
1	**Author:** Widyawati , S. A, Yuliaji , S., and Puji , P. **Journal Identity:** Journal Knowledge Nursing Maternity Volume 1, No. 1 . 31-38 2018	Potency Exposure Pesticides and Impacts on Female Farmer Reproductive Health Study in the District Brebes	Identification of potency exposure and impact on health reproduction of farmer women.	Women working in agricultural areas.	Study descriptive use method study *cross-sectional*.	Women who have status as wife farmers will be directly involved with activity agriculture with relatively long pesticide exposure. So, there is a connection between exposure times to pesticides with healthy reproduction of female farmers, like LBW and abortion.
2	**Author:** Lentho, JN, Suhartono, and Dharminto	Analysis Factor Risk Exposure Pesticides In	Know factor risk exposure related to	Fifty women who have or are Still	history. The quantitative study	There is a significant relationship between the history

	Journal Identity: Journal of Public Health Volume 6, No. 4 Matter. 453-462 Year: 2018	Pregnancy With Incident Low Birth Weight (LBW) in Padangsidimpuan City 2019 year	pesticides with LBW events.	involved in activity agriculture with a pregnancy	uses an analytic observational approach and the design studies *case control.*	of women moment pregnant in activities on the farm, the level of involvement in the activity of the farmer, and the long time Working with LBW incidence. However, No found connection between intensity exposure to pesticides and LBW events
3	**Author:** Lubis, FH, and Titin, AN **Journal Identity:** Journal of Public Health and Nutrition volumes 3, No. 1 Matter. 39-47 Year: 2019	Analysis Factor Risk Exposure Pesticides In Pregnancy With Incident Low Birth Weight (LBW) in Padangsidimpuan City 2019 year	Know factor risk exposure related to pesticides with LBW events.	Twenty-five farmers with a history of giving birth to LBW and cases without a history gave birth to LBW, and as many as 25 people.	*Cross-sectional design.*	There is a connection between work Mother-related pregnancy with pesticides and LBW events.
4	**Author:** Yushanant, P., Yetty AMA, and Iwan, S. **Journal Identity:** Journal: Journal Health Sciences Volume 6, Issue 2 Matter. 317-325 Year: 2021	Anemia and its Associated Factors Among Women of Reproductive Age in Horticulture Areas	Analyze the risk of anemia in fertile women who do activities such as farming and horticulture.	One hundred sixty women age fertile.	*cross-sectional design*	The prevalence of anemia in women who work in agriculture is high, with 27.5% of reported cases, namely 22.7%, as well as found three factors of risk of anemia: dissatisfaction, nutritional status, and lack of consumption of vegetable substance iron.
5	**Author:** Kartini , S., Onny S., and Tri, J. **Journal Identity:** International Journal of English, Literature and Social Science (IJELS) Volume 4 Issue-4	Association of Pesticides Exposure with Anemia in Women Farmers in Bandungan Village, Semarang District	Analyze the connection between exposure to pesticides and the incidence of anemia in farmers women in the District Bandungan Semarang Regency.	Fifty farmers and women who were taking samples used the approach *of nonprobability sampling* with *purposive sampling*.	Observational analytic with *cross-sectional design.*	There is a connection between exposure to pesticides and anemia in farmers women in the Village Bandung Semarang Regency based on the duration of spraying pesticides, amount, and type of pesticide, as well as No There is a

	Matter. 1079-1081 Year: 2019					connection between rate cholinesterization and anemia in farmers women in the village.
6	**Author:** Thistle, JE, Amanda, R., Kyle, RR, Giehae, C., Cherrel, K., Manley, Amber, MH, Gro, DV, Enrique, C., Amrit, KS, Cathrine, T., Pål, Z ., Ted, RK, Kristin R. Ø ., Amy, H ., Heidi, A., and Stephanie, ME **Journal Identity:** Journal Environmental Research Volume 212 Part D Matter. 1-26 Year: 2022	Prenatal Organophosphorus Pesticide Exposure and Executive Function in Preschool-Aged Children in The Norwegian Mother, Father and Child Cohort Study (MoBa)	Evaluate the connection between exposure to the pesticide Organophosphorus in preschool children by considering the role of alleles in metabolic genes.	Two hundred sixty-two children with *attention-deficit/hyperactivity disorder* (ADHD) and 78 children in development as well as a mother giving birth between 2004-2008.	*Behavior Rating Inventory of Executive Function-Preschool* (BRIEF-P) and three evaluation-based performance in parents and teachers.	Concentration metabolites High prenatal organophosphorus, control emotions, inhibitions and work on age child pre-measured school using parents and teachers with BRIEF-P. Invention That proves deficit development system nerves exist in children's age preschool. Studies also support global regulations and restrictions on Organophosphate To limit exposure during pregnancy.
7	**Author:** Kurniawati , DY, Suhartono , and Nikie , AYD **Journal Identity:** Journal of Indonesian Public Health Media Vol. 18 No. 3 (2019)	Exposure History Relationship Pesticides in Pregnant and Breastfeeding Women with Disturbance Development of Children Aged 3-5 Years in Candi Village District Bandung Semarang Regency	Know the connection between exposure to pesticides in the mother pregnant and breastfeeding with disturbance development child 3-5 years old.	Children aged 3-5 years, a total of 75 people, responded to his research, and that is mothers who had children 3-5 years old, a total of 63 people.	*Simple random sampling* with an observational-analytic *cross-sectional* approach.	From 63 respondents there were 41 children (65.1%) who experienced it disturbance development with aspect communication (44.4%), motor gross (50.8%), motor smooth (52.4%), splitting problems (55.6%), and personal social (60.3%).
8	**Author:** Septiana , D., Suhartono , and Nikie , AYD **Journal Identity:** Journal of	Connection Exposure to Pesticide Before Pregnancy With Incident Hypertension in	Analyze the connection between exposure to pesticides before pregnancy and	pregnant women, as many as 492 people.	Studies *case controls* with approach *retrospective .*	There is a linkage between the use of pesticide with case happening hypertension in the mother pregnant with p-value = 0.011 and OR

	Public Health Volume 9 No. 2 Matter. 187-194 Year: 2021	Pregnant Women in Agricultural Areas District Sumowono Kab. Semarang	hypertension in the mother pregnant in the agricultural area Subdistrict Sumowono Semarang Regency			(95% CI) = (3.125 (1.272 - 7.674), and there is a connection between ever-exposed pesticide with incident hypertension in the mother pregnant with p-value = 0.008 and t count = 2.689.
9	**Author:** Nikmah , SS, and Eram, TP **Journal Identity:** HIGEIA Journal of Public Health Research and Development Volume 4, Special 2, Matter. 381-391 Year: 2020	Factor Incident Hypertension in Farmers Flower Sprayer	Know the factors related to incident hypertension in farmers' sprayer flowers.	77 farmers sprayer flowers.	*Simple random sampling* design *cross-sectional*	Factors related to hypertension in flower spraying farmers in Kenteng Village, Bandung District: knowledge, length of service, type of pesticide, spraying time, and completeness of PPE. Meanwhile, factors unrelated to incident hypertension include spraying technique, spraying duration, spraying frequency, and storage.
10	**Author:** Lize, M., Christine, M., Florence, R., Gwendolin, L., Gael, D., Helene, T., and Cecile, C. **Journal Identity:** Environmental Research Volumes 212, Part C, Year: 2022	Prenatal Exposure to Organophosphate Pesticides and Autism Spectrum Disorders in 11-year-old Children in French PELAGIE Cohort	Analyze the connection between prenatal exposure to organophosphate pesticides with characteristic *Autism Spectrum Disorder* (ASD) in children 11 years old.	Seven hundred ninety-two children from the French PELAGIE cohort.	Questionnaire parents "Childhood Autism Spectrum Test with a negative binomial regression model.	There is an increase in autistic traits among children aged 11 years related to prenatal exposure to chlorpyrifos and diazinone in mothers. Chlorpyrifos and diazinone are pesticide types of organophosphate.

DISCUSSION

The use of pesticides today is increasingly intensive to increase agricultural yields. Pesticide users are not only male farmers but also female farmers, so they have the potential to interfere with their reproductive health. This study aims to identify the potential for pesticide exposure and the impact on the reproductive health of female farmers [14]. Farm women have been involved and assisted in farming activities, including using pesticides, for

a long time. The findings in this study indicate that 44.0% of female farmers are exposed to pesticides ≥ 11 years. Mother's work before pregnancy related to pesticides can have a high chance of causing poisoning. Pesticide exposure also negatively affects thyroid hormones, essential hormones in babies' growth and development[15]. Therefore, pesticides can cause miscarriages and premature births and increase the number of congenital disabilities.

Pregnant women with jobs that are at risk of exposure to pesticides are more likely to give birth to babies with LBW 6.769 times than pregnant women with jobs that are less at risk of exposure to pesticides. Breastfeeding mothers who work in agricultural areas for more than 7 hours per day allow for greater exposure and will eventually accumulate in the body. After doing agricultural activities, mothers do not immediately wash their hands, take a shower, or wash clothes. Some mothers hang up their clothes and use them again the next day. Some women eat or drink in the farming area without washing their hands, which causes exposure by ingestion through the mouth. The exposure in mothers can be transferred to children and will impact their development. Involvement of mothers during pregnancy in agriculture is associated with impaired development of children aged 3-5 years. Three-year-old children with high prenatal blood plasma chlorpyrifos levels (> 6.17 pg /g plasma) showed significantly more delays in mental and psychomotor development, and their mothers reported more attention problems and pervasive developmental disorder symptoms at age 3. year. High prenatal exposure to organophosphates and metabolites has been associated with decreased attention/hyperactivity disorder in children at the age of 5 years[3].

A significant relationship between maternal involvement during pregnancy and child development disorders can occur due to direct exposure to pesticides to the mother. Most mothers spend ≥ 7 hours daily and do not use complete PPE. The longer a person is in contact with pesticides daily, the greater the decrease in the cholinesterase enzyme activity. Therefore, the maximum contact time with pesticides should not be more than 5 hours per day; even the Environmental Protection Agency (EPA) has a maximum threshold for contact with pesticides of 4 hours per day. Children are generally exposed to organophosphates from the womb, after birth, from breast milk, food residue, and through ingestion (such as through the habit of putting your hands in your mouth), inhalation, and absorption of pesticides in the environment. Direct exposure can occur, either through inhalation of pesticide residues in the air, skin contact with pesticides or equipment contaminated with pesticides, or through ingestion due to poor hygiene (not immediately cleaning oneself, changing clothes and washing clothes or equipment contaminated with pesticides)[13].

In addition, exposure to pesticides can lead to an increased risk of hypertension in pregnant women. This study illustrates that the risk of hypertension in pregnancy and preeclampsia is experienced by women who have risky activities exposed to pesticides

before pregnancy or during the first trimester of pregnancy. The entry of active chemical pesticides into the body through the skin, respiratory tract, and mouth. Pesticide chemicals in the body can interfere with enzymes and blood cholinesterase performance. The cholinesterase enzyme in the blood functions to maintain a balance of motion between tissues and nerve cells by decomposing acetylcholine found in human body tissues so that they continue to work normally. The active chemical substances contained in pesticides can inhibit and interfere with the decomposition process of acetylcholine; this occurs as a result of the enzyme cholinesterase, which binds to the active chemicals of pesticides, resulting in the accumulation of acetylcholine in the body. The accumulation of acetylcholine in blood vessels causes irregular movements between tissues and nerve cells, resulting in an imbalance of movement in blood vessels and high blood pressure[13].

Improper use of pesticides is one of the causes of anemia. The body exposed to pesticides causes blood profile abnormalities because pesticides interfere with the organs of blood cell formation and the immune system. Aplastic anemia has been reported following exposure to various pesticides, particularly to organochlorine compounds, such as lindane, DDT, chlordane, and heptachlor, as well as some organophosphate insecticides. Analysis of complete blood tests showed that the use of pesticides during the previous three days had a significant effect on the most selected health indicators, such as monocytes, monocyte percentage, red blood cell percentage, hemoglobin, hematocrit, mean blood cell volume, mean live cell hemoglobin, mean red blood cell hemoglobin concentration, variation in the coefficient of red blood cell distribution width, platelet count, and platelet distribution width[17].

CONCLUSION

Excessive exposure to pesticides in pregnant women can cause reproductive system problems and hurt the baby to be born. The impacts include anemia, hypertension, LBW, developmental disorders of pre-school children, autism, and the risk of abortion. Farm women often do not wash their hands after using pesticides, so they are exposed to pesticides while eating. Exposure to these pesticides can affect child development and there is a significant relationship between the involvement of pregnant women and the development of children due to direct exposure to pesticides. Factors influencing this relationship are the mother's time working with pesticides for more than 7 hours per day and the lack of proper use of PPE.

Nurses are essential in overcoming this problem, especially in agricultural areas. They become caregivers who provide comprehensive nursing care to improve public health. As educators, nurses counsel and promote women's reproductive health in agricultural areas. In addition, nurses also act as counselors or give guidance to the community in finding solutions related to women's reproductive health problems in agrarian areas. Nurses have

an essential role in maintaining health and protecting pregnant women and children regarding pesticide exposure.

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