

Review: Tinjauan Hubungan Antara Paparan Pestisida dan Risiko Penyakit Gagal Ginjal

Review: Review of the Relationship Between Pesticide Exposure and Risk of Renal Failure Disease

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Abstrak. Pestisida, meskipun berfungsi untuk mengendalikan hama, dapat menimbulkan dampak negatif yang signifikan terhadap kesehatan, khususnya terkait dengan penyakit gagal ginjal. Review jurnal ini bertujuan untuk mengeksplorasi hubungan antara paparan pestisida dan gangguan fungsi ginjal pada petani. Dalam artikel ini, kami menyelidiki berbagai penelitian yang menunjukkan hubungan antara paparan pestisida, terutama golongan organofosfat, dan peningkatan kadar kreatinin dan urea, yang merupakan indikator kerusakan ginjal. Analisis sampel darah dan urin dengan teknik Kromatografi Cair Kinerja Tinggi (HPLC) digunakan dalam studi ini. Selain itu, dilakukan penilaian hubungan antara paparan pestisida dan gangguan fungsi ginjal. Hasil yang di dapat pada 5 jurnal dari 12 jurnal menunjukkan bahwa 24,9% petani di Indonesia mengalami penyakit ginjal kronis (CKD), dengan faktor risiko seperti penggunaan alat pelindung diri (APD) yang tidak memadai dan kebersihan pribadi yang kurang berkontribusi terhadap kerusakan ginjal. Diskusi tentang mekanisme patofisiologis mengungkapkan bahwa pestisida dapat menyebabkan stres oksidatif dan peradangan pada jaringan ginjal. Review jurnal ini menekankan pentingnya pemantauan kesehatan rutin dan edukasi tentang penggunaan pestisida yang aman untuk melindungi kesehatan ginjal petani. Diperlukan penelitian lebih lanjut untuk memahami mekanisme yang mendasari kerusakan ginjal akibat paparan pestisida dan untuk mengembangkan strategi pencegahan yang efektif.

Kata kunci: Pestisida, Laboratorium, Gagal Ginjal

Abstract. Even though pesticides are used to keep pests under control, they can have serious health effects, namely kidney failure. Examining the connection between farmers' compromised kidney function and pesticide exposure is the goal of this literature review. In this study, we examined research that demonstrated a correlation between increased levels of creatinine and urea, markers of kidney injury, and exposure to pesticides, particularly organophosphates. In the present investigation, blood and urine samples were analyzed using the high-performance liquid chromatography (HPLC) technology. Also evaluated was the connection between exposure to pesticides and compromised renal function. According to data from five out of twelve publications, 24.9% of Indonesian farmers suffer from chronic kidney disease (CKD), and risk factors for kidney damage include poor personal hygiene and insufficient usage of personal protective equipment (PPE). According to a discussion of pathophysiological mechanisms, pesticides may induce inflammation and oxidative stress in renal tissues. In order to safeguard farmers' kidney health, this journal review highlights the significance of routine health monitoring and instruction on safe pesticide use. To comprehend the fundamental mechanisms of kidney damage caused by pesticide exposure and to create efficient preventative measures, more research is required.

Keywords: Pesticides, Laboratory, Renal Failure

INTRODUCTION

Pesticides are hazardous and toxic chemicals that have the potential to cause negative impacts on the environment and can cause health problems, so they must be managed with great care. Pesticides that enter the body continuously can cause toxicity and reduce the function of the agricultural workers has been around 18.2 per 100,000 workers (Prajawahyudo et al., 2022).

body's organs (Aminudin et al., 2024). Poisoning due to pesticide exposure threatens agricultural workers in various regions of the world. Based on information from the World Health Organization (WHO), the cause of death reaches 12.6 million people per year, one of which is caused by this chemical. Studies in developed countries show that the incidence rate of poisoning among
Examining the relationship between pesticide exposure and renal failure disease is



important because pesticides can have toxic effects on various organs, including the kidneys. Exposure to pesticides, especially organophosphates, can cause cell damage and impaired kidney function (Zahrox et al., 2021). Pesticides, especially organophosphates, can cause chronic poisoning that is difficult to detect in the short term but can have a serious impact on kidney health in the long term (Marisa & Pratuna, 2018). Long-term exposure to pesticides can result in the accumulation of toxins in the body, which can potentially damage the kidney organs (Andini et al., 2024).

Pesticides control pests, but can also pose significant health risks, particularly about kidney failure disease. These gaps include a lack of comprehensive epidemiological data on the prevalence of kidney disease among pesticide-exposed populations, as well as a lack of understanding of the pathophysiological mechanisms underlying kidney damage from pesticide exposure. Although many studies have shown that pesticide exposure can increase the risk of impaired renal function, there remains a lack of understanding of the specific mechanisms involved and the factors that influence individual susceptibility to such effects. Other factors that may influence kidney damage due to pesticide exposure, such as personal hygiene and spray duration, also need to be investigated further to gain a more comprehensive understanding of this relationship.

METHODS

The study's technique included gathering information on the connection between pesticides, labs, and renal failure. The inclusion and exclusion criteria had to be decided upon initially. Studies that used blood or urine samples to investigate the impact of pesticide exposure on kidney function in a lab setting met the inclusion criteria. The exclusion criteria also applied to studies that did not use laboratory data or that did not concentrate on the connection between pesticides and renal problems. These papers were chosen because they included laboratory investigations that used biochemical analysis, such as measuring the levels of creatinine or urea or testing blood or urine samples to determine the presence of pesticides. In order to evaluate clear picture of how exposure to pesticides affects farmers' kidney health (Agustin et al., 2019).

pesticide levels and their effects on organs, especially the kidneys, these research employed laboratory analytical techniques. Both "Laboratory" and "Pesticide Renal Failure" were utilized as individual search phrases and in combination in two research database systems, PubMed and Google Scholar. Based on the data search results, five journals had references that were pertinent to the subject.

RESULTS AND DISCUSSION

A study published in five of the twelve journals on laboratory analysis of pesticides regarding renal failure found a strong link between farmers' exposure to pesticides and lower kidney function. According to this study, both blood and urine levels of pesticides were higher in those who were exposed to pesticides—farmers in particular—than in those who were not. A higher chance of kidney disease was linked to this. Proteinuria in the urine and elevated blood levels of creatinine and urea were found in kidney function tests, suggesting that exposure to pesticides had harmed the kidney nephrons (Pamungkas, 2016).

In addition, the pathophysiological mechanisms found in this study suggest that pesticides may cause inflammation and oxidative stress in kidney tissue. Certain pesticides, such as organophosphates, have neurotoxic effects that may aggravate kidney conditions. Although ureum and creatinine levels in farmers who use pesticides regularly are usually within normal limits, it is important to note that incomplete use of personal protective equipment (PPE) and poor personal hygiene increase the risk of poisoning and kidney damage (Zahrox et al., 2021).

Additionally, the study found that prolonged exposure to pesticides, water consumption of less than two liters per day, and insufficient usage of personal protective equipment (PPE) during spraying are some of the factors that contribute to higher creatinine levels. These findings highlight the significance of wearing personal protective equipment (PPE) and leading a healthy lifestyle in order to avoid kidney damage brought on by pesticide exposure. Overall, this research highlights the need for improved pesticide use safeguards and paints a

Epidemiological studies conducted show that kidney disease is more common among

people exposed to pesticides. The study found that 24.9% of farmers in Indonesia suffer from chronic kidney disease (CKD). In the United States, the study also found 320 cases of end-stage renal disease among licensed pesticide applicators, a finding that suggests a significant association between pesticide exposure and kidney disorders. However, although some studies did not find a significant association, these findings suggest that further research is needed to understand the

mechanisms that lead to kidney damage caused by pesticide exposure (Dewi et al., 2021).

Overall, this study provides a clear picture of how pesticide exposure affects farmers' kidney health. To protect farmers' kidney health, better health monitoring and preventive measures are essential. To prevent kidney damage and improve the quality of life of farmers exposed to pesticides, the use of adequate PPE, training in safe agricultural practices, and regular health checks are necessary (Andini et al., 2024).

Tabel 1. Research conducted in several journals about relationship between pesticide exposure and risk of renal failure disease

No.	Author	Year	Title	Methods	Research Results
1.	Iin Fatimatus Zahrox	2021	Hubungan Paparan Pestisida Dengan Kadar SGOT Dan SGPT Petani di Desa Pakis Kabupaten Jember	Accidental Sampling	Farmers in Pakis Village, Jember Regency, showed no discernible correlation between their SGOT and SGPT levels and pesticide exposure. According to this study, there was no correlation between elevated SGOT and SGPT levels and low acetylcholinesterase levels, which indicate pesticide exposure (p-values of 0.320 and 0.604, respectively).
2.	Poppi Nastasia Yunita Dewi	2021	Studi Literatur: Paparan Pestisida Dan Kejadian Gangguan Fungsi Ginjal Pada Petani	Uji Nefrotoksisitas	Pesticides, particularly those that contain heavy metals, have been shown in numerous studies to induce kidney damage. However, little is known about the precise mechanisms that underlie this harm.
3.	Fitria Andini	2023	Gambaran Kadar Ereum Dan Kreatinin Pada Petani Yang Menggunakan Pestisida di Desa Loa Janan Ulu	Enzimatik dan Jaffe Reaction	Farmers who regularly use pesticides have urea and creatinine levels that are within normal ranges. But it's crucial to remember that using personal protective equipment (PPE) completely and in compliance with pesticide use guidelines is strongly advised in order to avoid potential kidney damage from extended pesticide exposure.
4.	Oktofa Setia Pamungkas	2016	Bahaya Paparan Pestisida Terhadap Kesehatan Manusia	Analisis Biomonitoring dan Pengujian Spesifik Terhadap Enzim Kolinesterase dalam darah	There is a correlation between acute and chronic kidney illness and pesticide exposure. The levels of urea and creatinine among farmers exposed to pesticides were elevated, although they were still within normal ranges. Although there are signs of kidney damage from pesticide exposure, the study comes to the conclusion that there isn't enough epidemiologic data to establish that pesticides are a

					significant contributor to both acute and chronic renal failure.
5.	Marlina Dwi Agustin	2019	Gambaran Kreatinin Pada Petani Bawang Merah Yang Terpapar Pestisida	Purposive Sampling	The majority of onion growers who were exposed to pesticides had normal creatinine levels; 8 respondents (42.1%) had abnormal creatinine levels, whereas 11 respondents (57.9%) had normal creatinine levels. Additionally, this study suggests that exposure to pesticides may be a factor in declining kidney function, as evidenced by higher creatinine levels.

A significant link between pesticide exposure and its impact on kidney health was revealed in a discussion about laboratory tests for pesticides associated with kidney failure disease. Studies show that people exposed to pesticides, especially farmers, have a higher risk of kidney problems. Pesticide levels in their blood and urine are often associated with elevated creatinine and urea, which are important indicators of kidney damage. While these levels are usually below normal limits, a significant increase may indicate a more serious problem that needs to be addressed (Pamungkas, 2016).

Exposure to pesticides, especially organophosphates, which are neurotoxic, causes kidney damage through oxidative stress and inflammation. The nephrons, the parts responsible for kidney function, can be damaged during this process, potentially leading to kidney failure. New studies show that long-term exposure to kidney tissue can lead to morphological changes that can be identified through histopathology. Therefore, it is important to understand that, even if laboratory results show normal levels, there is a possibility of kidney damage, especially for people who are continuously exposed (Zahrox et al., 2021).

Laboratory screening methods to identify pesticide concentrations and evaluate kidney function include chromatographic measurements to evaluate pesticide concentrations and measurement of biomarkers such as creatinine and proteinuria. However, the development of more sensitive and specialized techniques is needed to identify kidney disorders at an early stage. Research on specific types of pesticides and the severity of kidney disease is still needed. To understand the basic pathophysiological mechanisms and find effective prevention

methods, further research is needed (Pamungkas, 2016).

Several factors need to be considered, although ureum and creatinine levels in farmers who are regularly exposed to pesticides are generally within normal limits. Farmers' characteristics, such as age, gender, and length of work, may affect their health risks, according to research conducted in Loa Janan Ulu Village. Key risk factors that can increase the likelihood of pesticide poisoning include incomplete use of personal protective equipment (PPE) and poor personal hygiene. This shows how important it is to use proper PPE and maintain personal hygiene to prevent the accumulation of toxins in the body that can damage kidney function (Andini et al., 2024).

In addition, spraying that lasts more than three hours each day can also increase the risk of poisoning, which can have an impact on kidney health. Therefore, it is important for farmers to continuously check their kidney health and take better precautions, even if laboratory results show normal values. To protect farmers' health from the hazards associated with pesticide exposure, education on the safe use of pesticides and the use of complete PPE is essential (Andini et al., 2024).

In addition, this study showed that exposure to pesticides, especially those containing heavy metals and nephrotoxic chemicals, can damage renal proximal tubular cells. During long-term exposure to these substances, the kidneys may be impaired in their reabsorption and secretion processes. As a result, kidney function may be impaired. Although there are studies showing that pesticide exposure can cause kidney damage, some studies did not find a significant correlation. This suggests that further research is

needed to understand the underlying mechanisms and to find additional components that may cause kidney disease (Dewi et al., 2021).

This discussion emphasizes how important it is for farmers to be better monitored and educated about health to prevent the negative effects of pesticide exposure on their kidney health. To fully understand the relationship between pesticide exposure and kidney disease, more comprehensive and systematic research is needed. In addition, it is necessary to create guidelines for safer pesticide use by raising awareness about the risks it can pose to kidney health (Andini et al., 2024).

CONCLUSIONS

Laboratory pesticide testing results show a significant association between pesticide exposure and an increased risk of kidney failure disease, especially among farmers. There is a correlation between high levels of pesticides in blood and urine and impaired kidney function, which can be indicated by elevated creatinine and urea levels.

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