Pesticide Residues in Food and Potential Risk of Health Problems : A Systematic Literature Review

by Elanda Fikri

Pesticide Residues in Food and Potential Risk of Health Problems : A Systematic Literature Review

Yura W F[1*], Muhammad F R[1], Mirza F F[1], Maurend Y L[1], Widyantoro W[1], Farida S S,[1] Aziz Y P[2], Desti A,[3] Edy W[4], Septy M[5], Sutra D[6], Alifia I B[7], Nanda I V M[7], Elanda Fikri[8]

[1] Master Program of Environmental Health, Faculty of Public Health, Diponegoro University, Semarang, Central Java, Indonesia.
[2] Master Program of Electrical Engineering, Faculty of Engineering, Diponegoro University, Semarang, Central Java, Indonesia.
[3] Master Program of Health Promotion, Faculty of Public Health, Diponegoro University, Semarang, Central Java, Indonesia.
[4] Laboratory of Microbiology, Faculty of Medicine, University of Northern Sumatra, Medan, North Sumatra, Indonesia
[5] Master Program of Environmental Science, Gajah Mada University, Yogyakarta, Indonesia
[6] Undergraduate Program of Health Entomology, Faculty of Public Health, Diponegoro University, Semarang, Central Java, Indonesia.
[7] Undergraduate Program of Environmental Health, Faculty of Public Health, Diponegoro University, Semarang, Central Java, Indonesia.
[8] Majoring Environmental Health, Health Polytechnic Ministry of Health, Bandung, West Java, Indonesia.

* Email : firmansyahyura@gmail.com

Abstract. Pesticide residue in food has been investigated since the growing demand of food safe. The determination of pesticides residues in food is becomes an essential requirement for consumers, producers, and authorities responsible for food quality control. Pesticides can poison humans through the mouth, skin, and breathing. Often unwittingly these toxic chemicals enter a person's body without causing sudden pain and causing chronic poisoning. This study aimed to investigate the impact of pesticides residue to health problems from meta-synthesize, sourced from the Scopus and Sinta indexed articles and obtained 12 indexed articles that were used as references. Meta-synthesize result showed that there are some type of pesticide who used by farmers such as chlorphenapir, emamctin benzoate, abamectin, chlorpyrifos, mankozeb, chlorotalonil, and propineb. Continous use of pesticides can cause such as fatigue, excessive saliva, hard breathing, frequent urination, blurred vision, dizzinesss, and fingerpain. At the end, pesticides residue is adverse effect on human health problems.

1. Introduction

Pesticides are nonetheless an essential a part of agricultural sports across the world. Pesticides are broadly used to enhance the productiveness and first-rate of agricultural products. Pesticides are compounds used to shield flora through killing, repelling, or controlling pests earlier than and after harvest. Insecticides will harm the goal organism. However, the mode of motion of pesticides isn't always species-specific. The maximum normally used pesticides are organophosphate, carbamate and pyrethroid pesticides [1]. The outcomes of pesticide publicity have emerge as a international environmental problem, including fatigue, immoderate salivation, trouble breathing, common urination, blurred vision, dizziness and finger pain. The expanded vulnerability of farmers to pesticide poisoning is because of a lack of understanding on a way to use insecticides properly and appropriately [1],[2].

Pesticides in the food chain is one of major human health concern, several studies already analysed pesticide residues content in rice grains [3]. Consuming food contaminated with pesticides poses a potential health risk to the human body. Recently, a cumulative risk assessment study on the possibility of exposure to multiple pesticides may cause unforeseen adverse effects on human health, which is a key issue in many fields [4]. In addition, trying out merchandise infected through insecticides is likewise critical for shielding the ecosystem. One of the bad outcomes of artificial insecticides, particularly organochlorine and organophosphorus (OP) insecticides, is meals contamination. In the Seventies and early 1980s, the excessive toxicity and residue tiers of insecticides utilized in flora had been the principle problems, with organochlorine (OC) and organophosphate dominating (OP) [5],[6]. Organochlorines is a persistent toxic chemical, which is a persistent organic pollutant. Exposure of humans and other life forms to these chemicals is reported to have a variety of carcinogenic, reproductive, neurological, immunological, and other adverse effects [7],[8].

Various analytical strategies had been used to evaluate the ability dangers of insecticides to human fitness and the surroundings. Reducing using insecticides for useful functions and minimizing the dangers to human fitness and the surroundings is a project and a intention really well worth pursuing [9]. It is important to see the correlation of reducing pesticide with reduction of the possible adverse effects of pesticides on human health and the environment [10].

Due to the full-size use of insecticides in agricultural practices, this has turn out to be a meals protection issue. Research on pesticide residues in rice could be very critical to shield the fitness of consumers. This have a look at evaluated the evaluation of pesticide publicity in meals. The file goals to show records approximately insecticides used, pesticide residues, the effect of number one processing on pesticide residues, human fitness threat assessment, and focus of pesticide infection in meals. This records allows keep away from terrible results on humans.

2. Method

Metasynthesis is a technique of reading facts accrued from preceding studies articles as a way to draw new conclusions or bridge the distance among preceding studies. Meta-synthesis includes collecting, summarizing, reading, and reviewing facts from preceding studies literature. Meta-synthesis is a part of the systematic literature studies method. This article makes use of 15 studies articles to check the capability dangers of pesticide residues and fitness troubles in food. The article choice procedure is primarily based totally on the subsequent inclusion criteria:

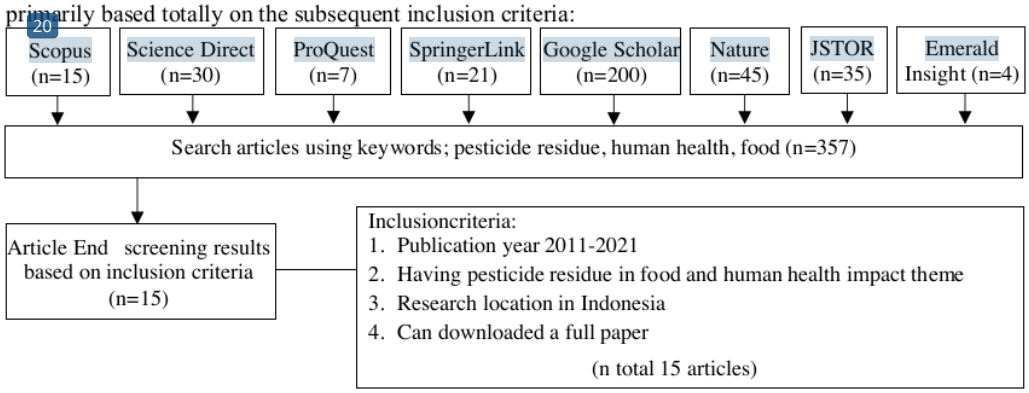

Figure no 1 Article Screening Chart

3. Result and Discussion

Table 1. Result Synthesis of Article

No	Author	Findings	Impact on Human Health
1	Tri Joko[1], Nikie A. Y. Dewanti, Hanan L. Dangiran. [11]	1. Conduct health checks on 100 indonesian farmers who use pesticides, checks such as headaches, dizziness, burning sensation in the esophagus, body cramps, difficulty breathing, coughing, and easily tired. 2. Conducting Focus Group Discussions with farmers regarding excessive use of pesticides. 3. It was found that excessive pesticide use was associated with headaches, difficulty breathing, excessive salivation, blurred vision, body aches, and excessive dizziness. 4. The types of pesticides used are organophosphates and chlorphyropos.	Symptoms appear in farmers such as headaches, dizziness, sensation in the esophagus, body cramps, difficulty breathing, coughing, and easily tired
2	Hestin A[1], Amin Leksono, Zulfaidah Gama. [12]	Conducting open interviews with farmers using the pitfall trap method. The pitfall trap used is 7 cm in size and crammed with 50mL 70% alcohol. Placed 2 days before spraying and a couple of days after spraying. Research locstion in Malang Regency, East Java, Indonesia	The occurrence of resistance, secondary pest outbreaks, and potential to environmental pollution
3	Andria M C, Abee L B, Kristina A T, Melissa JP. [2]	OP pesticides are harmful to the environment, and lots of developed and developing countries have monitored their residue levels in food. Although OP pesticide residues in white rice pose a possible risk to certain groups of individuals, many countries currently don't implement national white rice safety standards. It is necessary to conduct annual monitoring of OP pesticide residues in white rice. It should even be noted that the present research is merely focused on white rice, which has led to underestimation of the entire exposure to surgical pesticides. the continued monitoring plan should be extended to other plants treated with OP pesticides. apart from children aged 2-4 years (119% of ADI) and 4-7 years old (104.3% of ADI), the daily intake of P99.9 of surgical pesticides altogether age groups is less than that of ADI (52-94.5% of ADI). it's also necessary to show other crops that are treated with AChE inhibitory pesticides to know the role of dietary intake in	Fatalities, Tetralogy of Fallot, Anencephaly, Autism Spectrum Disorder, Memory Loss, Finger Tremor

		total OP pesticides exposure in china.	
4	Chen C, Li Y, Chen M, Chen Z and Qian Y. [13]	This examine attempted to get the residues of precise pesticides (organophosphorus and pyrethroids) and fungicides (triazole and chloronitrile) withinside the amassed culmination and vegetables. The Electron Capture Detector Gas Chromatograph (ECDGC) is employed to make a decision the notice of twenty-two pesticide residues utilized in pest management. Among the utmost regularly detected pesticide residues, cypermethrin became detected in 18.7% of the analyzed samples.	Immaturity, Fatigue, Fingerpain
5	Anna H, Jane, James, etc. [5]	We discovered that corporations of farmers are at better threat of reporting signs of poisoning . This locating became unexpected, however it might be thanks to the very fact participants of the agricultural network are greater aware about the power dangers of insecticides and consequently file greater signs. However, withinside the absence of farmers' expertise and practice, citizenry have discovered the usage of WHO Class II insecticides and insecticides with decrease toxicity. they're susceptible to acute poisoning, persistent fitness troubles and environmental pollution.	Headache, Fatigue, Vomit, Skin Irritation, Excessive Sweating, Blurred Vision, Dizzines
6	Pornpimol Kongtip, Noppanum Nankongab, Mathuros Tipayamongkholgul, Ariya Bunngamchairat, Jutharak Yimsabai, Aranya P, Susan Wokie. [7]	The Thai foodstuff has found high levels of pesticide residues in fruits and vegetables, which has become a current public ill health . Therefore, many Thais are increasingly choosing organic foods. Thailand Pestiicide Early Warning Network (ThaiPAN) tested 296 fruit and vegetable samples from five regions in Thailand in 2016, and located that 51.4% of the fruit and vegetable had obtained the "Q (Quality) Mark" standard issued by the National Agricultural and Food Administration of Thailand, and therefore the contamination by pesticide residues exceeded the utmost . Residue Limit (MRL). Most organic farmers during this study (86.9%) had used pesticides before they realized the toxicity of the pesticides they used and switched to organic farming. Therefore, they're older than traditional farmers on the average and have a better level of education. About 35% of traditional and organic farmers are in debt, and 57% of organic farmers have part-time	Low Body Mass Index, Stunting, Heavy Breathing

		jobs additionally to agricultural work. In 2013, among the 4.8 million people living in rural areas, most of them were engaged in agricultural work, of which 10.9% lived in poverty. 4,444. Because there are greater guys in the conventional farmer organization and male muscular tissues has a tendency to be better, your BMI might also additionally even His frame fats percent or waist circumference isn't , however better and falls into the “abnormal” range. Another reason behind the distinction in BMI may also be that natural farming is greater labor-intensive, at the same time as chemical farmers use greater agricultural equipment of their operations.	
7	Damalas C A and Eleftherohorinos I G. [10]	Pesticides have performed a key function in ensuring dependable deliver of agricultural merchandise at lower priced prices, enhancing product high-satisfactory and ensuring excessive income for farmers. Although insecticides are designed to paintings with affordable protection and minimum dangers to human fitness and therefore the environment, many research are involved approximately the fitness dangers resulting from non-occupational publicity of farmers (or different quit customers of insecticides) and therefore the public. However, their use shows decreased protection, which shows that chance signs want to be evolved to reinforce the accuracy and reliability of pesticide hazard assessment, thereby assisting to reduce the viable dangerous outcomes of insecticides on human health and therefore the environment.	Skin irritation, Eye Irritation, Oral Irritation, Dizzines, Vomit, Headache
8	Vu N Huyen, Nguyen S, Nguyen Thuy, Le Dung, Luong Khanh. [14]	This study conducted interviews with 300 farmer households randomly selected from 3 studies villages. This observe extensively utilized the fee of disease (COI) approach to degree the effect of crop safety merchandise on farmers' fitness costs. Formula for estimating fitness care costs.	Otorhinolaryngologic diseases, Eye diseases, Nervous system diseases, Dermatological diseases, Musculoskeletal diseases, Digestive diseases, Urologic diseases, Teeth - jaw – face diseases, cancer
9	Oluwatoyin T.	Analyze organophosphate and carbamate	Does not pose a

	Fatunsin, Aderonke O. Oyeyiola, Muyideen O. Moshood, etc.[15]	pesticide residues on a fueloline chromatograph (Agilent 7890A) including a spectrometer (GC-MS). The sensitivity of the tool is likewise decided with the help of using calculating the restrict of detection (LOD) (signal-to-noise ratio of 3:1) and therefore the restrict of quantification (LOQ) (awareness with a signal-to-noise of 10:1).	health threat
10	G Bhandari, Kishor Atreya, Paul T.J. Scheepers, Violette G. [16]	The soil samples had been gathered according with the concepts of EU guidelines. that they had been marked as easy soil samples through Wageningen Food Safety research facility and did now not include any of the 23 insecticides tested. Chemical evaluation and fine manage had been according with the ecu Commission Conduct Guide (SANTE / 11813/2017)	Cancer and non-cancer health problems Skin disease disorders due to direct contact
11	Michiel A. Mònica Guxensc,d,e,f, Suzanne Spaanb, Trudy Voortmana,g, Vincent W. Jaddoea,g,h, Todd A. Juskoi, Matthew P. Longneckerj,Henning Tiemeierd.[17]	Concentration of six dialkyl phosphate in urine	not explained, only measuring the concentration of pesticide residues in the urine
12	Haji Mwevura, Henrik Kylin, Tash Vogt, Hindrik Bouwman. [18]	Use the Agilent GC 6890 and Varian 3400 series for fuel chromatographic (GC) quantification of pesticide residues. The fuel oil chromatograph is equipped with thermionic detectors for the selective detection of nitrogen and phosphorus compounds for the investigation of degradation products; Organochlorine pesticides (OCP) contain hexachlorobenzene (HCB), hexachlorocyclohexane (HCH), DDT and its decomposition products, cyclodiene (aldrine, dieldrin, heptachlor, heptachlorobenzene, gammachloride, endrin, and Ken's agent); and organophosphate (OP) pesticides (chlorpyrifos, diazinon, fenthion, oxon and malathion). The herbicide thiobendazim was also tested.	Only describes biota impacts where toxins accumulate biologically and possible food webs may be affected.

13	Norsita Agustina, Norfai. [19]	1. Conducted research on 50 horticultural farmers 2.The variable that features a significant relationship with pesticide exposure to anemia in horticultural farmers 3.There are 11 respondents with mild poisoning thanks to exposure to pesticides 4.There are 4 respondents who experience anemia	Pesticides decrease the production or increase the destruction of red blood cells. This causes hemoglobin to become abnormal resulting in hemolytic anemia
14	Siti A K, Onny S, Sri A N. [20]	1. Conducted on 40 respondents 2. The results of the Binary Logistics Regression test show that exposure to pesticides features a tendency of 5,333 times greater influence on the incidence of anemia compared to respondents who aren't exposed to pesticides. 3. Types of pesticides used by organophosphates	Causes anemia with symptoms of dizziness, weakness, if you get up from sitting, your eyes feel dizzy

The Presence of Food Pesticide Residues

The use of pesticides basically serves to control plant pests. Pesticides such as insecticides for insect pest control, fungicides for fungal pest control, and herbicides for weed pest control [21]. The active ingredients of pesticides that are often found are the organophosphate group (chlorpyrifos, paration, profenofos, diazinon, phenitrotion, metidation and malation), pesticide group IA and IB, insecticide (deltamethrin), organochlorine group consisting of lindane, heptachlor, DDT, aldrin, dieldrin, endrin and endosulfan [12][2].

Excessive use of pesticides, inappropriate doses, frequency of spraying will cause pesticides to leave residues. Pesticide residues can be found in plant products such as chili, rice, shallot, tomato, eggplant, lettuce, apple, orange, corn, papaya, banana, pumpkin, mustard greens, cauliflower, beans, dragon fruit, bitter melon, pear, grapes, longan, strawberries, cabbage and leeks [22][10]. It is also possible for pesticide residues to be present on the soil, due to the spraying process carried out the residue will fall to the surface of the soil. Pesticide residues found in groundwater occur because residues that start on the surface of the soil will seep and enter the pores of the soil to contaminate resistant water. Pesticide residues found in the air occur due to the spraying process that is not in accordance with the direction of the wind, the suitability of the plant height when spraying, and wind speed [14][15].

Measurement of food residues can be identified using gas chromatography is a type of chromatography that is commonly used in chemical analysis for the separation and analysis of compounds that can evaporate without undergoing decompos [17][18] Common uses of GC include testing the purity of a particular compound, or separating the different components in a mixture. Measurement of other pesticide residues can use the G9 Fast Pesticide Test Kit, which is a pesticide test tool to detect pesticide residues in the Organophosphate, Carbamate and Cholinesterase inhibitor sample groups which are very sensitive with qualitative results. QuEChERS Method (Quick, Easy, Cheap, Effective, Rugged and Safe) can be used in multi-analysis pesticide residues on various sample matrices [19] . The pesticide residue left on pepper can be harmful to human health. Therefore, the FAO/WHO Codex The Alimentarious Commission has established Maximum Residue Limit (BMR) of pesticides at pepper is 1 mg/kg for DDT; 0.5 mg/kg for -cyhalothrin, fenvalerate, deltamethrin; 0.1 mg/kg for permethrin, cyfluthrin, cypermethrin, heptachlor and 5 mg/kg for endosulfan [23].

The Pesticide Exposure on Human Health

Table 2. Exposure of Active Pesticide Ingredients to Human Health

No	Active Pesticide Ingredients	Symptom on Human Health
1	Organophosphates and chlorphyropos	Symptoms appear in farmers such as headaches, eye irritation, itchy skin, excessive saliva, dizziness, vomiting, burning sensation in the esophagus, body cramps, difficulty breathing, coughing, and easily tired
2	Organochlorine pesticides (OCPs) include hexachlorobenzene (HCB), hexachlorocyclohexanes (HCHs), DDT and its decomposition products, cyclodiene (Aldrin, Dieldrin, heptachlor, heptachlor epoxide, Gamma Chlordane, Endrin, and Ken's Agent); and organophosphorus pesticides (OPP) (chlorpyrifos, diazinon, fenthion, oxon, and malathion).	Dermatological diseases, Musculoskeletal diseases, Otorhinolaryngologic diseases, Eye diseases, Nervous system diseases, Digestive diseases, Urologic diseases, Teeth - jaw – face diseases, cancer
3	OP (Organophosphates) pesticides	Fatigue, headache, dizziness, loss of appetite, nausea, stomach cramps, diarrhea, blurred vision, tearing, sweating, excessive salivation, tremor, pupil constriction, slow heart rate, muscle spasms (twitching), inability to walk, discomfort and tightness, uncontrolled defecation and urination, incontinence, unconsciousness and convulsions. Complications that can occur include pulmonary edema, respiratory arrest, atrioventricular block, and convulsions.
4	Residues of selected insecticides (organophosphorus and pyrethroids) and fungicides (triazoles and chloronitrile) in the collected fruits and vegetables. Most frequently detected pesticide residues, cypermethrin was found.	Symptoms that arise are fatigue, headache, dizziness, loss of appetite, nausea, skin stomach cramps, asthma, allergies, irritation to hearing and taste where the effects of pyrethroids pesticides generally appear 1-2 hours after exposure and disappear within 24 hours.[23]
5	Organophosphate and carbamate pesticide residues	Nervous, diaphoresis (cold sweat), shortness of breath, rapid processive circulatory collapse or shock which will lead to anemia Symptoms of carbamate poisoning appear quickly but disappear quickly when compared to organophosphates [23]

4. Conlusion

Pesticide residues in food have an effect on human health. The health risks arising from exposure to these pesticides can vary from each type of pesticide. where some pesticides cause acute symptoms and prolonged illness such as organophosphates (OPPs), chlorphyropos, organochlorines (OCPs), cyclodienes, triazoles, and chloronitrile pesticides but some only cause temporary and quickly disappearing effects such as pyrethroids and carbamates.

References

[1] E. D. Okoffo, M. Mensah, and B. Y. Fosu-Mensah, "Pesticides exposure and the use of personal protective equipment by cocoa farmers in Ghana," *Environ. Syst. Res.*, vol. 5, no. 1, 2016.

[2] A. M. Cimino, A. L. Boyles, K. A. Thayer, and M. J. Perry, "Effects of neonicotinoid pesticide exposure on human health: A systematic review," *Environ. Health Perspect.*, vol. 125, no. 2, pp. 155–162, 2017.

[3] G. M. Teló, E. Marchesan, R. Zanella, S. C. Peixoto, O. D. Prestes, and M. L. de Oliveira, "Resíduos de fungicidas e inseticidas em grãos de arroz," *Acta Sci. - Agron.*, vol. 39, no. 1, pp. 9–15, 2017.

[4] C. Chen, Y. Li, M. Chen, Z. Chen, and Y. Qian, "Organophosphorus pesticide residues in milled rice (Oryza sativa) on the Chinese market and dietary risk assessment," *Food Addit. Contam. - Part A Chem. Anal. Control. Expo. Risk Assess.*, vol. 26, no. 3, pp. 340–347, 2009.

[5] A. H. Oesterlund, J. F. Thomsen, D. K. Sekimpi, J. Maziina, A. Racheal, and E. Jørs, "Pesticide knowledge, practice and attitude and how it affects the health of small-scale farmers in Uganda: A cross-sectional study," *Afr. Health Sci.*, vol. 14, no. 2, pp. 420–433, 2014.

[6] and S. R. Jikun Huang, Fangbin Qiao, Linxiu Zhang, *Farm Pesticides, Rice Production and Human Health in China*, vol. 53, no. 9. 2001.

[7] P. Kongtip, N. Nankongnab, M. Tipayamongkholgul, A. Bunngamchairat, J. Yimsabai, A. Pataitiemthong, and S. Woskie, "A cross-sectional investigation of cardiovascular and metabolic biomarkers among conventional and organic farmers in thailand," *Int. J. Environ. Res. Public Health*, vol. 15, no. 11, pp. 1–12, 2018.

[8] S. A. M. A. S. Eqani, R. N. Malik, A. Katsoyiannis, G. Zhang, P. Chakraborty, A. Mohammad, and K. C. Jones, "Distribution and risk assessment of organochlorine contaminants in surface water from River Chenab, Pakistan," *J. Environ. Monit.*, vol. 14, no. 6, pp. 1645–1654, 2012.

[9] S. Rahman and C. D. Chima, "Determinants of pesticide use in food crop production in Southeastern Nigeria," *Agric.*, vol. 8, no. 3, pp. 1–14, 2018.

[10] C. A. Damalas and I. G. Eleftherohorinos, "Pesticide exposure, safety issues, and risk assessment indicators," *Int. J. Environ. Res. Public Health*, vol. 8, no. 5, pp. 1402–1419, 2011.

[11] T. Joko, N. A. Y. Dewanti, and H. L. Dangiran, "Pesticide Poisoning and the Use of Personal Protective Equipment (PPE) in Indonesian Farmers," *J. Environ. Public Health*, vol. 2020, 2020.

[12] H. A. Asih, A. S. Leksono, and Z. P. Gama, "The Impact of Pesticide Use on Chili Plants (Capsicum annum L.) on Soil Arthropod Diversity with Semi-Organic and Conventional Agricultural Systems in Dau District, Malang Regency, Indonesia," *Int. J. Sci. Res. Publ.*, vol. 9, no. 12, p. p9672, 2019.

[13] C. Chen, Y. Qian, Q. Chen, C. Tao, C. Li, and Y. Li, "Evaluation of pesticide residues in fruits and vegetables from Xiamen, China," *Food Control*, vol. 22, no. 7, pp. 1114–1120, 2011.

[14] V. N. Huyen, N. Van Song, N. T. Thuy, L. T. P. Dung, and L. K. Hoan, "Effects of pesticides on farmers' health in Tu Ky district, Hai Duong province, Vietnam," *Sustain. Futur.*, vol. 2, p. 100026, 2020.

[15] O. T. Fatunsin, A. O. Oyeyiola, M. O. Moshood, L. M. Akanbi, and D. E. Fadahunsi, "Dietary risk assessment of organophosphate and carbamate pesticide residues in commonly eaten food crops.," *Sci. African*, vol. 8, p. e00442, 2020.

[16] G. Bhandari, K. Atreya, P. T. J. Scheepers, and V. Geissen, "Concentration and distribution of pesticide residues in soil: Non-dietary human health risk assessment," *Chemosphere*, vol. 253, p. 126594, 2020.

[17] M. A. van den Dries, A. Pronk, M. Guxens, S. Spaan, T. Voortman, V. W. Jaddoe, T. A. Jusko, M. P. Longnecker, and H. Tiemeier, "Determinants of organophosphate pesticide exposure in pregnant women: A population-based cohort study in the Netherlands," *Int. J. Hyg. Environ. Health*, vol. 221, no. 3, pp. 489–501, 2018.

[18] H. Mwevura, H. Kylin, T. Vogt, and H. Bouwman, "Dynamics of organochlorine and organophosphate pesticide residues in soil, water, and sediment from the Rufiji River Delta, Tanzania," *Reg. Stud. Mar. Sci.*, vol. 41, p. 101607, 2021.

[19] N. Agustina and N. Norfai, "Paparan Pestisida terhadap Kejadian Anemia pada Petani Hortikultura," *Maj. Kedokt. Bandung*, vol. 50, no. 4, pp. 215–221, 2018.

[20] S. Aisyah Kurniasih, O. Setiani, and S. Achadi Nugraheni, "Faktor-faktor yang Terkait Paparan Pestisida dan Hubungannya dengan Kejadian Anemia pada Petani Hortikultura di Desa Gombong Kecamatan Belik Kabupaten Pemalang Jawa Tengah Factors Related to Pesticides Exposure and Anemia on Horticultural Farmers In Gombo," vol. 12, no. 2, 2013.

[21] M. Louisa, T. Joko, B. K. Lingkungan, F. K. Masyarakat, and U. Diponegoro, "Hubungan Penggunaan Pestisida Dengan Kejadian Hipertensi Pada Petani Padi Di Desa Gringsing Kecamatan Gringsing Kabupaten Batang," *J. Kesehat. Masy.*, vol. 6, no. 1, pp. 654–661, 2018.

[22] M. T. Mergia, E. D. Weldemariam, O. M. Eklo, and G. T. Yimer, "Small-scale Farmer Pesticide Knowledge and Practice and Impacts on the Environment and Human Health in Ethiopia," *J. Heal. Pollut.*, vol. 11, no. 30, pp. 1–19, 2021.

[23] S. Aisyah Kurniasih, O. Setiani, S. Achadi Nugraheni, B. Pekalongan dr Onny Setiani, P. Magister Kesehatan Lingkungan UNDIP Drdr Sri Achadi Nugraheni, and F. Kesehatan Masyarakat UNDIP, "Faktor-faktor yang Terkait Paparan Pestisida dan Hubungannya dengan Kejadian Anemia pada Petani Hortikultura di Desa Gombong Kecamatan Belik Kabupaten Pemalang Jawa Tengah Factors Related to Pesticides Exposure and Anemia on Horticultural Farmers In Gombong Village Belik Sub District Pemalang Central Java," vol. 12, no. 2, 2013.

Pesticide Residues in Food and Potential Risk of Health Problems : A Systematic Literature Review

ORIGINALITY REPORT

13%	10%	9%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.hindawi.com Internet Source	1%
2	www.tandfonline.com Internet Source	1%
3	ejournal.undip.ac.id Internet Source	1%
4	Lian-Kuet Chai, Fatimah Elie. "A rapid multi-residue method for pesticide residues determination in white and black pepper (Piper nigrum L.)", Food Control, 2013 Publication	1%
5	Vu Ngoc Huyen, Nguyen Van Song, Nguyen Thi Thuy, Le Thi Phuong Dung, Luong Khanh Hoan. "Effects of pesticides on farmers' health in Tu Ky district, Hai Duong province, Vietnam", Sustainable Futures, 2020 Publication	1%
6	repub.eur.nl Internet Source	1%

7	Haji Mwevura, Henrik Kylin, Tash Vogt, Hindrik Bouwman. "Dynamics of organochlorine and organophosphate pesticide residues in soil, water, and sediment from the Rufiji River Delta, Tanzania", Regional Studies in Marine Science, 2021 Publication	1 %
8	www.ijsrp.org Internet Source	1 %
9	Mahmood, Adeel, Riffat Naseem Malik, Jun Li, and Gan Zhang. "Human health risk assessment and dietary intake of organochlorine pesticides through air, soil and food crops (wheat and rice) along two tributaries of river Chenab, Pakistan", Food and Chemical Toxicology, 2014. Publication	1 %
10	Submitted to Henley College Coventry, Coventry Student Paper	1 %
11	doaj.org Internet Source	<1 %
12	edepot.wur.nl Internet Source	<1 %
13	Duan, Yun, Ni Guan, Pingping Li, Jianguo Li, and Jinhui Luo. "Monitoring and dietary exposure assessment of pesticide residues	<1 %

in cowpea (Vigna unguiculata L. Walp) in Hainan, China", Food Control, 2016.
Publication

14	issuu.com Internet Source	<1 %
15	mafiadoc.com Internet Source	<1 %
16	A. S. Tsagkaris, L. Uttl, Z. Dzuman, J. Pulkrabova, J. Hajslova. "A critical comparison between an ultra-high-performance liquid chromatography triple quadrupole mass spectrometry (UHPLC-QqQ-MS) method and an enzyme assay for anti-cholinesterase pesticide residue detection in cereal matrices", Analytical Methods, 2022 Publication	<1 %
17	Mashura Shammi, Ayesha Sultana, Nazmul Hasan, Md. Mostafizur Rahman, Md. Saiful Islam, Md. Bodrud-Doza, Md. Khabir Uddin. "Pesticide exposures towards health and environmental hazard in Bangladesh: A case study on farmers' perception", Journal of the Saudi Society of Agricultural Sciences, 2020 Publication	<1 %
18	Yasir Mehmood, Muhammad Arshad, Nasir Mahmood, Harald Kächele, Rong Kong. "Occupational hazards, health costs, and pesticide handling practices among vegetable	<1 %

growers in Pakistan", Environmental Research, 2021
Publication

19	en.wikipedia.org Internet Source	<1 %
20	garuda.kemdikbud.go.id Internet Source	<1 %
21	repository.najah.edu Internet Source	<1 %
22	ep.liu.se Internet Source	<1 %
23	turkjphysiotherrehabil.org Internet Source	<1 %
24	eprints.hec.gov.pk Internet Source	<1 %
25	onlinelibrary.wiley.com Internet Source	<1 %
26	Chen Chen, Yun Li, Mingxue Chen, Zhijun Chen, Yongzhong Qian. " Organophosphorus pesticide residues in milled rice ( ) on the Chinese market and dietary risk assessment ", Food Additives & Contaminants: Part A, 2009 Publication	<1 %

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		