



UNIVERSIDADE FEDERAL DO MARANHÃO  
CAMPUS UNIVERSITÁRIO DE BALSAS  
BACHARELADO INTERDISCIPLINAR EM CIÊNCIA E TECNOLOGIA

**FATORES DE RISCO RELACIONADOS A TRABALHADORES  
RURAIS EXPOSTOS A AGROTÓXICO NO BRASIL: UMA  
REVISÃO INTEGRATIVA**

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Balsas – MA

2022.2

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# **Fatores de risco relacionados a trabalhadores rurais expostos a agrotóxico no Brasil: uma revisão integrativa**

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## **RESUMO**

O Objetivo desse estudo foi identificar as evidências científicas acerca da exposição ocupacional a agrotóxicos e implicações na saúde do trabalhador rural. A pesquisa foi organizada em três etapas, iniciando com a definição do tema de estudo, trabalhador rural exposto a agrotóxico, seguido pela busca de artigos sobre tema nas bases de dados científicos, posteriormente foram selecionados os estudos que atenderam os critérios de inclusão/exclusão previamente definidos. Os dados foram organizados pelos fatores: perfil sócio-demográfico dos trabalhadores rurais, exposição ocupacional, ocorrência de intoxicação, práticas de segurança e uso de EPI. Vinte e quatro artigos foram elegíveis para inclusão nesta revisão integrativa, os estudos tiveram enfoque em estudos originais sobre saúde ou segurança do trabalhador rural expostos a agrotóxicos no Brasil. O Rio Grande do Sul apresentou o maior número de estudos e a região sudeste foi a região que apresentou estudos de todos os seus quatro estados, Minas Gerais, Espírito Santo, Rio de Janeiro e São Paulo. Trabalhadores do sexo masculino, baixa escolaridade, baixa adesão ao uso de EPIs, práticas inadequadas de segurança e exposição prolongada foram predominantes nas atividades agrícolas com exposição a agrotóxicos e foram identificadas como evidências associadas aos agravos à saúde do trabalhador. Portanto, para mitigar os efeitos adversos dos agrotóxicos, é necessária uma abordagem integrada que envolva programas de vigilância e promoção da saúde, treinamentos e suporte técnico e regulamentação rigorosa, garantindo a proteção dos trabalhadores rurais e suas famílias.

**Palavras-chave:** Intoxicação, exposição ocupacional, trabalhadores rurais, agricultores, agrotóxicos, pesticidas.

## **Risk factors related to rural workers exposed to pesticides in Brazil: an integrative review**

### **ABSTRACT**

The aim of this study was to identify the scientific evidence on occupational exposure to pesticides and the implications for rural workers' health. The research was organized in three stages, beginning with the definition of the study topic, rural workers exposed to pesticides, followed by a search for articles on the subject in scientific databases, after which the studies that met the previously defined inclusion/exclusion criteria were selected. The data was organized by the following factors: socio-demographic profile of rural workers, occupational exposure, occurrence of poisoning, safety practices and use of PPE. Twenty-four articles were eligible for inclusion in this integrative review. The studies focused on original studies on the health or safety of rural workers exposed to pesticides in Brazil. Rio Grande do Sul had the highest number of studies and the southeast was the region that presented studies from all four of its states, Minas Gerais, Espírito Santo, Rio de Janeiro and São Paulo. Male workers, low schooling, low adherence to the use of PPE, inadequate safety practices and prolonged exposure were predominant in agricultural activities with exposure to pesticides and were identified as evidence associated with worker health problems. Therefore, in order to mitigate the adverse effects of pesticides, an integrated approach is needed that involves health surveillance and promotion programs, training and technical support and strict regulation, guaranteeing the protection of rural workers and their families.

**Keywords:** Poisoning, occupational exposure, rural workers, farmers, agrochemicals, pesticides.

## INTRODUCTION

In Brazil, agriculture has reached a level of high productivity, mainly in the production of export-oriented commodities, and consequently the use of pesticides has also increased, placing Brazil among the largest consumers of pesticides in the world<sup>1</sup>. In 2018 alone, the pesticide industry had a turnover of 10.8 billion dollars, an increase of 20% compared to 2017<sup>2</sup>.

According to the IBGE<sup>3</sup>, around 15 million people work on rural properties in the country, of which 1.7 million farmers reported having used pesticides in 2017. This population is the group most at risk of pesticide exposure and poisoning<sup>4</sup>.

The intensive use of pesticides in agriculture has been responsible for damage to the environment and human health<sup>5</sup>. Poisoning due to exposure to pesticides is a common public health problem in developing countries and has a direct impact on farmers' ability to work.<sup>6</sup>

In Brazil, occupational health is monitored by the National Network for Comprehensive Workers' Health Care (Renast), which has the Workers' Health Reference Center (Cerest) as the body responsible for workers' health care and surveillance services within the SUS. Renast and Cerest are part of the National Workers' Health Policy designed to guarantee actions to protect and prevent health problems among workers<sup>7</sup>.

However, access to health facilities in urban areas can be difficult for rural residents, which favors underreporting of poisoning and the emergence of occupational diseases<sup>6</sup>.

Prolonged exposure to pesticides has been linked to chronic pathologies such as cancer, neurological, auditory, respiratory and autoimmune diseases, in addition to the clinical symptoms of acute intoxication<sup>5</sup>.

The aim of this study is to identify the scientific evidence on direct occupational exposure to pesticides and its implications, using data on the socio-demographic profile of rural workers, the characterization of safety practices, the use of PPE as a means of prevention and the risk perceptions of rural workers regarding the use of pesticides. Based on this survey, the aim is to provide guidelines that contribute to health surveillance and the development of public policies to prevent the health of rural workers.

## **METHODOLOGY**

This literature review used the integrative review methodology<sup>8</sup>, which was divided into three stages. Initially, the team limited the object of study to the context of occupational health and safety in agriculture, with a focus on rural workers or farmers with occupational exposure to pesticides. With this, the guiding question was established: "What scientific evidence is related to the health risks of rural workers due to exposure to pesticides in Brazil?".

In the second stage, a literature search was carried out during the months of May and June 2024 in the following databases: Scientific Electronic Library Online (SciELO), Science Direct, *Literatura Latino-Americana e do Caribe em Ciências da Saúde* (LILACS) and PubMed. The search was carried out in Portuguese and English respectively, using the previously defined descriptors intersected with the Boolean markers "AND" and "OR: (intoxicação OR “exposição ocupacional”) AND (agroquímicos OR agrotóxicos) AND (“trabalhadores rurais” OR agricultores OR “trabalhadores agrícolas”) AND Brasil. (Poisoning OR “Occupational exposure”) AND (Agrochemicals OR Pesticides) AND (“Rural workers” OR Farmers OR “agricultural

workers") AND Brazil.



In the third stage, the inclusion and exclusion criteria to be used in data selection were defined. The articles selected were original studies on the health or safety of rural workers exposed to pesticides, articles in English and Portuguese and without delimiting the period of publication. This stage used the title of the publication and the abstract for selection. Repeated articles, non-original articles (review articles, book chapters and critical notes) were excluded. After reading the title and abstract, articles outside the context of rural workers exposed to pesticides, studies not carried out in Brazil, studies without data on socio-demographic profiles, occupational exposures, occurrences of poisoning, safety practices, including the use of PPE, and studies on tobacco growing, in which the risk agent was nicotine, were excluded. The articles selected after applying the inclusion/exclusion criteria were read in full and those that answered the guiding question were included in this review.

## RESULTS AND DISCUSSION

This integrative literature review used a search strategy to select 549 articles from six electronic databases. After applying the inclusion and exclusion criteria, 32 articles were selected for full reading, of which only 24 answered the guiding question and were included in this review. The study selection process was carried out in accordance with the *Preferred Reporting Items for Systematic review and Meta-Analysis Protocols* (PRISMA)<sup>9</sup> and is shown in Figure 1.

**Figure 1.** Flowchart for selecting the articles included in the study.

The data sample for this review includes 16 Brazilian states in the south (41.6%), southeast (29.2%) and midwest (12.5%), north (4.2%) and northeast (12.6%) regions of the country. Rio Grande do Sul had the highest number of studies and the southeast was

the region that had studies in all its states, Minas Gerias, Espirito Santo, Rio de Janeiro and São Paulo. The percentages are shown in Figure 2.

**Figure 2:** Percentage of studies carried out by Brazilian states.

The North (4.2%), Northeast (12.6%) and Midwest (12.5%) were the least represented regions in this survey. The reasons for this may be related to the lack of studies on occupational health and safety in these regions or the fact that these studies were published in journals not indexed on the scientific platforms used in this research. According to Moreira et al.<sup>10</sup> in their study of morbidities related to rural work, 47.7% of Brazilian farmers with occupational morbidities are in the northeast, followed by 21.7% in the southeast. This information reflects the lack of data on occupational health in the north and northeast of Brazil. Schmitd and Godinho<sup>4</sup> mention the underreporting of pesticide poisoning incidents, since workers do not seek medical attention to treat the symptoms. This situation may be related to social, economic and political factors.

The studies compiled in this review were evaluated in terms of the scientific evidence characterizing the risks of pesticide poisoning/harm to the health of farmers/rural workers in relation to their socio-demographic profile, occupational exposures, occurrences of poisoning, safety practices and, among these, the use of PPE. The results are shown in Table 1, in chronological order of the studies.

## **Socio-demographic profile**

The socio-demographic profile of the individuals in the articles studied was similar in terms of age, gender and education level of the rural workers. Of the 24 articles compiled, 75% had male farmers or rural workers, with a predominance of activities involving direct exposure to pesticides. The age range of 30 to 49 years was the most frequently reported, as was the low level of education, with many workers having only primary schooling.

This profile has been identified in national and international studies, since the division of labor in rural areas remains traditional, with men carrying out economic activities and women raising children and doing household chores<sup>11</sup>.

The exceptions to this profile are studies aimed at individuals with neoplasms, such as children<sup>12</sup> and adult men<sup>13</sup> living in rural areas, other studies with elderly people with Parkinson's disease<sup>14</sup> and elderly people with hearing disorders<sup>15</sup> who have been involved in agricultural activities with exposure to pesticides.

Only three studies showed that women participated in agricultural activities with a percentage above 50%<sup>16,17,18</sup>. They also helped with pesticide application alongside their husbands, in addition to the cleaning activities commonly attributed to them.

It is worth noting that in the study carried out by Camponogara et al<sup>12</sup>, all the interviewees were female, since the participants were, in most cases, the mothers of children with cancer. It cannot be said that the onset of the disease in children is due to direct or indirect exposure to pesticides. However, there is scientific confirmation of the harmful effects of women's exposure to pesticides, which include reproductive problems, infertility, spontaneous abortions and congenital malformations, while in children it can affect development and favor the appearance of neoplasms<sup>12,19</sup>.

## **Occupational Exposure**

The texts illustrate a scenario of high exposure to pesticides for rural workers, with various factors contributing to the risk of poisoning and health problems. These factors include long working hours, intensive use of highly toxic products, inadequate handling methods, application and storage conditions, as well as unsafe practices, such as not using PPE.

Evidence from studies in the literature indicates that the main routes of exposure are cutaneous and respiratory<sup>4</sup>. Direct exposure was the most frequent in the studies, where the individual is involved in the activities of application, preparation of the product, transportation, storage and cleaning of the clothes and equipment used. Indirect exposure can affect anyone who is close to the individuals during direct exposure<sup>20</sup>.

Most of the pesticides reported in the studies are classified as highly toxic<sup>21, 22</sup>. In the study by Magalhaes et. al<sup>4</sup> it is clear that the use of more pesticides by farmers is associated with the idea of exterminating the pest more quickly. Several articles also address farmers' perception of the risk of health and environmental problems caused by these substances<sup>23,4,24</sup>. In the study by Pasiani et. al.<sup>23</sup> it was found that more than 95% of farmers considered pesticides to be necessary in the field and 77.7% said that working in the field could harm their health<sup>23</sup>. Almost 90% of farmers considered pesticides to be harmful to their health, especially those who apply them or handle or prepare them (81.3 and 70.5%, respectively). In another survey farmers reported recognizing the possibility of poisoning for individuals who work directly with pesticides, as well as the consequences of chronic exposure<sup>24</sup>. Bortolloto<sup>16</sup> points out that individuals with less schooling may be the ones assigned to the most unhealthy jobs, such as helping to apply pesticides, or even applying them.

In family farming, exposure comes from the whole family, from women to children. Schmitd and Godinho<sup>4</sup> point out in interviews with farmers that the replacement

of the "Passadô de Veneno", in the family sphere, happens immediately after an intoxication event, with the youngest individuals being chosen for the task.

The participation of women in pesticide application activities alongside their husbands is also reported, and even in the gestational period most of them did not avoid exposure, only a few moved away in the first months of pregnancy<sup>25</sup>.

Other evidence of health problems identified in the studies refers to the length of time rural workers have been exposed to pesticides, a factor that increases the risk of health problems. Most of the workers had been exposed to pesticides for between 5 and 30 years, i.e. the same amount of time they had worked in rural areas<sup>17,26,27</sup>. Other farmers in the south of the country who grow citrus fruits reported that they had contact with pesticides at least once a month<sup>28</sup>.

In other studies, fruit growers in Bento Gonçalves used more than 30 types of pesticides, a situation that increases the prevalence of occupational diseases due to exposure to these products<sup>29</sup>. A similar situation was also identified with vegetable farmers in Nova Friburgo<sup>25</sup> and tomato producers in São José de Ubá, both in the state of Rio de Janeiro.<sup>30</sup>

### **Occurrence of poisoning**

The health and well-being of farmers and rural workers are aspects discussed in the articles involved in this study. Cases of pesticide poisoning were found in 87.5% of the studies. 62.5% of the cases were identified by farmers' reports, while 25% of the cases were confirmed by clinical examinations and medical notification.

In a study carried out in the Federal District, 85.9% of the farmers who sought medical attention at the Occupational Toxicology Outpatient Clinic were considered intoxicated, according to clinical and laboratory criteria<sup>4</sup>. Studies carried out in the north

and northeast also showed a high percentage of intoxications, 69% in the São Francisco valley region<sup>13</sup> and 49% in the state of Tocantins .<sup>31</sup>

Confirmation of intoxication by clinical examinations was carried out by determining biomarkers of pesticide intoxication. The most commonly used enzymatic biomarkers were aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma-glutamyltransferase (GGT), plasma cholinesterase cholinesterases (BChE), as well as the metabolites urea and creatinine<sup>25,30,28,4,20,23,32</sup> . In addition, a study carried out in Rio Grande do Sul identified, through clinical examinations, that 50.3% of individuals were at least moderately intoxicated<sup>33</sup> .

Acute pesticide poisoning causes changes in the liver and nervous system, leading to various symptoms such as headache, dizziness, nausea, vomiting, excessive salivation, tremors, tachycardia, blurred vision, weakness, skin irritation, tearing, among others<sup>34</sup> .

Many of these symptoms were reported by farmers in the interior of Rio de Janeiro in a study carried out by Burali et al.<sup>30</sup> where 60% of the participants reported more than four acute symptoms suggestive of pesticide poisoning.

In the study by Bortolotto et al.<sup>16</sup> 6% reported having had symptoms typical of pesticide poisoning, such as headaches, nausea, vomiting, cramps and abdominal pain, generalized weakness, among others. These types of symptoms were also reported by Campos et al.<sup>17</sup> with a prevalence of headaches, nausea, dizziness and weakness.

The consequences of exposure to pesticides can lead to long-term health problems, with diseases arising from prolonged exposure to pesticides. Chronic problems associated with exposure to pesticides include musculoskeletal, respiratory, cardiovascular, gastrointestinal and neurological diseases, as well as anxiety and depression<sup>10,21,30</sup> .

The studies investigating chronic diseases caused by occupational exposure to pesticides included in this review refer to patients with neoplasms<sup>12,13</sup> , Parkinson's disease<sup>14</sup> , hearing loss<sup>15,26</sup> and immune depression<sup>17</sup> . A study by Moura et al.<sup>13</sup> found a prevalence of hematological and prostate neoplasms among rural workers.

Damage to the auditory system also affects workers exposed to pesticides, due to the ototoxic substances present in these products<sup>15</sup> . Frank et al.<sup>15</sup> and Noronha and Almeida<sup>26</sup> report in their studies the need for actions to promote the health of rural workers in order to reduce damage to the auditory system of this population.

Parkinson's disease has been linked to exposure to pesticides, among its possible causes, with scientific confirmation<sup>14</sup> . A study carried out in the west of Paraná found a high number of patients with Parkinson's disease, all of whom had exposure to pesticides as a result of rural work<sup>14</sup> .

A study on the morbidities associated with agricultural activity in Brazil, with no direct link to pesticide exposure, identified the main morbidities in rural workers, which were back diseases, rheumatism, hypertension, heart disease, bronchitis and depression<sup>10</sup> .

Depression has been investigated as a consequence of occupational exposure to pesticides<sup>10</sup> . In a study by Campos et al.<sup>17</sup> a positive association was identified between individuals with depression and about 15 years of occupational exposure.

As for deaths from pesticides, the study by Okuyama et al.<sup>35</sup> shows a percentage of 3.8% nationwide based on data from Brazil's toxicological assistance centers obtained in 2017. Of this percentage, it is estimated that 6.2% correspond to individuals with accidental poisoning, i.e. not suicide attempts.

## **Security practices**

The chemical substances present in pesticides, which are essential for controlling pests and diseases in crops, pose a health risk when not handled with due care. Safety practices include preventive actions for workers with direct exposure to pesticides, among them the agronomic prescription made by a qualified professional, which provides information on the dosage against a given pest, the equipment indicated for the application, which PPE should be used, among others<sup>11</sup>. In Brazil, an agronomic prescription is a legal requirement for the purchase of pesticides<sup>36</sup>, but in many studies farmers report that they do not receive technical guidance or use an agronomic prescription for the application of pesticides.

Farias et al.<sup>29</sup> reported that only 17.2% of the farmers interviewed in Bento Gonçalves received technical guidance on pesticide use. Similar results were identified, where only 26% of the farmers interviewed in Minas Gerais received guidance from a professional<sup>33</sup>.

The majority of those interviewed (55.3%) said they received information about pesticides from extension workers, technicians and/or pesticide sellers and 19.6% from cooperatives. More than half of the farmers (54.5%) reported following the agronomic prescription<sup>23</sup>.

In a study conducted in Mato Grosso, 73.5% of farmers confirmed that they followed the instructions on the product's package leaflet, but they only read the information on pests and dosages, but not on care and safety when handling the products<sup>24</sup>. This reality is also reported by other authors<sup>21,23</sup>.

Inadequate safety practices (not washing hands or showering after application) can increase the risk of poisoning. In addition, not respecting the time to re-enter the field, the grace period for re-applying the pesticide and the grace period for harvesting are risk factors for the individual and the environment<sup>22</sup>.



In the same vein, a study by Nerilo et al.<sup>20</sup> found that many rural fruit workers do not follow technical guidelines by choice, while others prefer to rely on advice from neighbors or family members regarding the handling and dosage of pesticides<sup>29</sup>.

Buralli et al.<sup>30</sup> mentions in their study the lack of understanding of pesticide leaflets by farmers, which can compromise the farmer's ability to reduce exposure and protect their health.

This survey identified many actions by rural workers that pose a high occupational risk, such as applying products against the wind, mixing pesticides, unclogging product pump nozzles with their mouths, using tools to open product bottles for other purposes, lack of personal hygiene, using equipment contaminated with pesticides more than once, storing products or empty containers near their homes, among others<sup>4</sup>.

However, these actions may be related to a lack of training on how to use chemical products, a low level of education which makes it difficult to understand the safety information on both product labels and agronomic prescriptions, as well as financial conditions which can limit access to PPE, safer equipment and safe storage facilities.

More health promotion and surveillance actions are needed for family and small-scale farmers, as they are more susceptible to occupational exposure. Medium and large producers, due to their higher incomes, opt for agricultural machinery and equipment with cabs, both for comfort and safety when applying chemical products<sup>21</sup>.

### **Use of PPE**

The use of PPE is aimed at reducing or eliminating health risks, provided it is done properly, since incorrect or incomplete use does not guarantee protection against the risk agent.

In a study of farmers in the northwest of Rio Grande do Sul, it was found that 70% of the workers used PPE, but all of them had altered levels of the enzyme cholinesterase as a result of exposure to pesticides and some degree of intoxication<sup>37</sup>.

Similar results were also observed by Farias et al<sup>29</sup>, where 94% of workers used all PPE and 27.9% of those involved in the study showed a 20% reduction in acetylcholinesterase levels.

On the other hand, the reality of the Brazilian countryside presents various challenges that make it difficult for rural workers to use PPE. PPE is not well accepted by farmers due to the discomfort it causes when carrying out work activities, such as a feeling of suffocation, intense heat and lack of air<sup>6</sup>.

In the Federal District, 44.4% of farmers said they wore full PPE<sup>23</sup>. While more than 80% of farmers in Mato Grosso do Sul said they didn't wear PPE, although they were aware of it and thought they should wear it, they cited discomfort and their own "sloppiness" for not doing so.<sup>24</sup>

Irregular use of PPE was also identified by 70% of the agricultural workers assessed in Nova Friburgo, RJ<sup>25</sup>, 40% of farmers in Paraná<sup>20</sup>, and by 10% of family fruit growers in Rio Grande do Sul<sup>29</sup>. It is presumable that in regions with higher temperatures, the use of PPE becomes an additional challenge. The intense heat can generate significant discomfort, especially when you consider the need to wear boots, a visor, a mask, a shirt, pants and a waterproof apron. This information is in line with studies carried out in other countries<sup>11</sup>.

Rural workers' low adherence to this equipment increases their vulnerability to the harmful effects of pesticides. Various factors, including socio-demographic and economic factors, have been associated with refusal of PPE, including: female workers, those with low levels of education or those belonging to lower economic classes, such as

D or E<sup>22</sup> . Corroborating the literature, Naidoo et al.<sup>38</sup> states that in places with precarious economic conditions, farmers would give preference to basic needs, such as food, clothing and transportation, rather than acquiring safety equipment.

Factors aggravated by the intense exposure to the sun and the high physical effort involved in working in the fields lead to a consequent rise in the worker's body temperature, making the use of PPE uncomfortable and risking damage to health as a result of heat stress<sup>29</sup> .

In this case, it is extremely important to develop strategies to prevent and correct workers' exposure to pesticide use.

## **CONCLUSION**

The analysis of the studies compiled in this review made it possible to identify the most relevant scientific evidence associated with the health risks of workers exposed to pesticides, which include: male workers, low levels of education, low adherence to the use of PPE, inadequate safety practices and prolonged exposure. In this study, it was possible to identify the lack of education among farmers and rural workers as one of the factors that most affects their health and safety and that of their families. It should be emphasized that education is not restricted to the level of schooling, but also to training for the activities carried out with agrochemicals. Incomplete use of the PPE recommended for pesticide handlers or even refusal to use it is serious evidence, which can also be corrected with health promotion actions and training courses to raise workers' awareness. The development of PPE suitable for rural activities and the climatic characteristics of a given region are factors to be considered by PPE manufacturers in Brazil. Finally, prolonged exposure to harmful agents, responsible for the onset of chronic diseases, requires the use of safe application technologies, work organization standards to reduce exposure time and periodic health checks for pesticide handlers. In addition, it is

necessary to intensify health promotion programs in the field and environmental education as mechanisms to prevent direct and indirect exposure to pesticides. As well as public policies and strict regulations aimed at the health and safety of rural workers.

### **Authorship contribution**

E.C. Santos contributed to the research, analysis and interpretation of data, writing, drawing up figures, critical review and approved the final version; G.S. Brito contributed to the conception and planning of the study, critical review and approved the final version; Q.C. Fidelis contributed to the conception and planning of the study, writing, critical review and approved the final version.

### **Declaration of Competing Interest**

The authors declare no competing interest.

### **Acknowledgments**

The authors gratefully acknowledge the financial support of the Fundação de Amparo à Pesquisa e ao Desenvolvimento Científico e Tecnológico do Maranhão (FAPEMA) and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

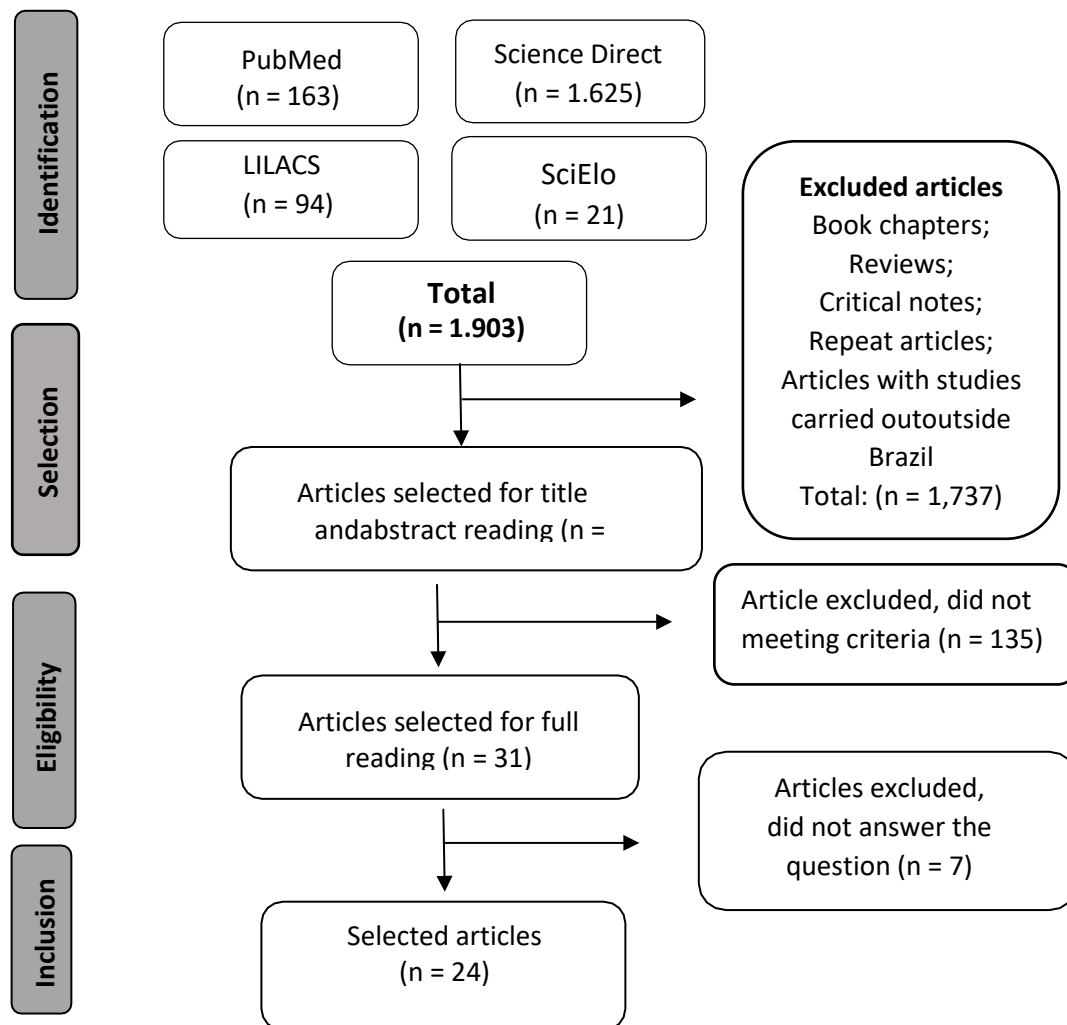
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**Figure 1.** Flowchart for selecting the articles included in the study.

Source: prepared by the author according to PRISMA principles<sup>9</sup>



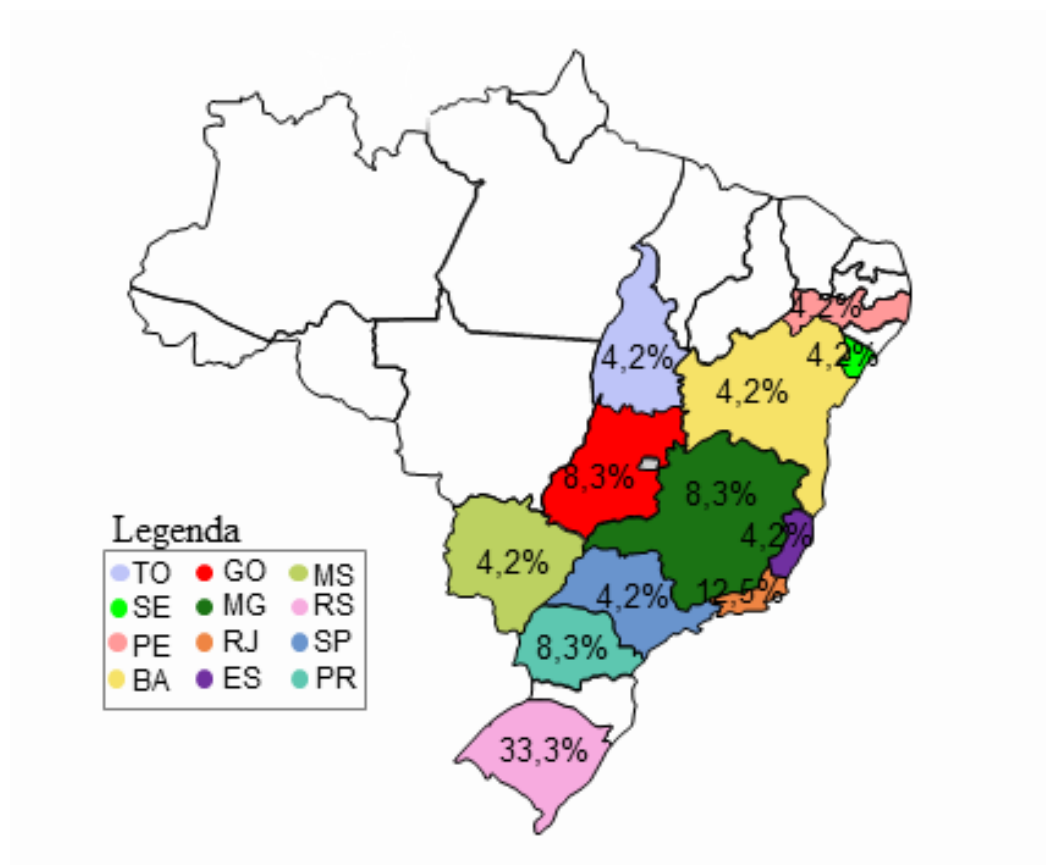


Figure 2: Percentage of studies carried out by Brazilian states.

**Table 1.** Scientific evidence from studies in the literature on risk factors in rural workers (RW) exposed to pesticides in Brazil.

Authors/Year	Title	Socio-demographic profile	Occupational exposure	Occurrence of poisoning	Security practices	Use of PPE
<b>Soares et al., 2003</b>	Rural work and risk factors associated with pesticide use in Minas Gerais, Brazil	94.2% of those interviewed were men; 90.7% were aged ≤49 years; 87.5% had completed elementary school; 45% had direct contact with pesticides.	Average exposure of 3.5 hours/day and 6.7 days/month to highly toxic pesticides	50.3% of individuals were moderately intoxicated	26% of workers had received professional advice on the use of pesticides; 55% reported reading product labels	86.3% use some kind of PPE
<b>Schmidt, Godinho, 2006</b>	A brief study of the day-to-day work of rural producers: pesticide poisoning and underreporting	98% of the survey subjects were men; Age group 33-63; More than 50% with incomplete primary education.	Small producers had greater chemical exposure due to less access to agricultural equipment	Underreported cases of poisoning; Identification by typical symptoms of intoxication: headaches, eye irritation, dizziness, nausea, excessive saliva, inattention.	Use of tractors with cabs to improve safety in the use of agrochemicals; Applications at less hot times and on less windy days	The study presents farmers' perceptions of the use of PPE; Low adherence to use because it is uncomfortable, inefficient and expensive;
<b>Araújo et al., 2007</b>	Multiple exposure to pesticides and health effects: cross-sectional study in a sample of 102 rural workers, Nova Friburgo, RJ	74.5% of the workers were men; 92% aged between 20 and 49; 61% had less than 7 years of schooling	Farmers and family members exposed to pesticides during application, handling and transportation; 73% had direct contact with pesticides; Pregnant women did not avoid activities involving pesticides; Average exposure time of 20 years.	7.8% of cases of mild and moderate acute poisoning; 5.9% of subacute cases; 11.8% of acute intoxication.	-	9.4% used a respirator; 30% boots; 7% apron; 69% did not wear PPE
<b>Recena, Caldas, 2008</b>	Risk perception, attitudes and practices in the use of pesticides among farmers in Culturama, MS	The participants were farmers, landowners, all men, aged 30-60	All participants had been exposed to pesticides for at least a year	Cases of poisoning identified by farmers' reports; Typical symptoms of poisoning reported: headache, dizziness and vomiting.	74.1% of farmers have received advice on use from sellers; 12% of government programs; 11.5% have never received external guidance 54.4% stored empty containers at home;	Most commonly used PPE: hat and leather boots; Less commonly used PPE: gloves, masks or waterproof clothing

					8.4 % sent to the receiving station	
<b>Farias et al., 2009</b>	Pesticide poisoning among rural fruit-growing workers in Bento Gonçalves, RS	95.2% of the workers were men; 88% were owners, Average age 38.5 years; 39.7% had $\geq 8$ years of schooling.	Exposure to 30 different types of pesticides; Exposure activities: application, preparing the spray, helping with the application, cleaning equipment, veterinary treatment, contaminated clothing, re-entry into the field; Application equipment: tractor, hose and "pen"; knapsack sprayer.	19.4% reported poisoning at some point in their lives.	53.3% of the workers received guidance from the salesperson; 17.2% from the EMATER technician; 20.9% from other people on the property and neighbors; 6.1% agronomists; 8.6% of workers have never received guidance	94% of workers reported using PPE; 98.3% boots; 96.9% hat; 95.5% protective clothing; 94.1% gloves; 95.2% mask.
<b>Pasiane et al., 2012</b>	Knowledge, Attitudes, Practices and Biomonitoring of Farmers and Residents Exposed to Pesticides in Brazil	99.1% of the farmers were male; 54.6% were aged between 20 and 40; 49.1% with incomplete primary education;	27.7% of the workers had been exposed to pesticides for between 10 and 20 years; 81.3% applied pesticides; 4.5% stored the pesticide inside their homes; 40% used a manual sprayer and 36.6% an automatic static sprayer for application; 16.1% buried/burned the empty containers. 26.8% lived near the plantation;	23.4% reported symptoms typical of pesticide poisoning; Seven had a confirmed diagnosis and two were hospitalized;	74% of farmers have received guidance on pesticide use (from the government, technicians, cooperatives or sellers); 65.7% followed the guidelines; 87.5% respected the grace period; 54.5% followed agronomic prescriptions; 58% read the warnings and precautions on product labels;	48.2% did not use PPE properly; 7.2% have never worn them; 18.8% have worn waterproof clothing; 18% did not wear gloves.
<b>Nerilo et al., 2014</b>	Pesticide use and cholinesterase inhibition in small-scale agricultural workers in southern Brazil	60.7% of the farmers were men; 52.6% with primary education. Average time exposed to pesticides, 17.4 years;	89.0% of producers had direct contact with pesticides and 11% indirect contact; 72.3% were applicators; 54.3% prepared the product;	4.6% of workers with poisoning identified by clinical examination	Unfamiliarity with safety practices when using pesticides; They didn't follow the instructions in the prescriptions; 67.7% followed the label instructions for application	39.5% wore boots, gloves and masks; 39.9% have never used PPE;
<b>Campos et al., 2016</b>	Exposure to pesticides and mental disorders in a rural population of Southern Brazil	49.6% of the workers were men; 61.1% were aged between 26 and 55;	71.9% were exposed to activities involving pesticides; 58% in application, 53% in preparation, 48% as application assistants, 53% as transporters,	There are signs of poisoning; 72.3% of workers felt unwell after exposure to pesticides; 23% mentioned common mental disorders;	-	13.5% wore masks, gloves, boots and overalls or pants and long-sleeved shirts.

		83% only had primary education;	39% in farming, 53% in cleaning equipment and 45% in washing clothes; 66.7% had exposure time $\leq$ 15 years	21% reported depression;		
<b>Viero et al. 2016</b>	Society at risk: the use of pesticides and the implications for rural workers' health	Male participants; Age range 37 to 67 years old; All are married and have at least one child involved in farming.	73.3% of the workers had 30 years of rural activities with pesticides; They use various classes of chemical products; They had prolonged exposure. Mechanical application (tractor)	-	All of them used the pesticides as prescribed by the agronomist of the companies supplying these substances;	I didn't use PPE properly.
<b>Noronha, Almeida, 2017</b>	Occupational health and speech therapy: perceptions of irrigation farmers exposed to ototoxic products	96.30% were male; 62.96% had incomplete primary education;	25.93% had been exposed to pesticides for less than 20 years and 59.26% had been exposed for more than 31 years.	Farmers reported symptoms such as: vomiting, headaches, nausea, difficulty breathing, weakness, abdominal cramps, salivation, tremors, mental confusion, convulsions, among others.	The study presents farmers' accounts of the guidance they received from technicians and professionals when using pesticides.	The study does not provide information on the use of PPE by farmers.
<b>Camponogara et al. 2017</b>	Implications of pesticide use: perceptions of family members of children with neoplasms	100% of the participants were female; Age range 22 to 47 years old; All the women were mothers;	Exposure to drying and glyphosate pesticides; Application method: manual and mechanical (tractor).	There are signs of poisoning with symptoms such as headaches, and it is sometimes necessary to go to the doctor;	Workers believe that "pesticides are a necessary evil in rural areas"	30% reported only wearing a mask; 20% applied products manually without using PPE; 20% used some kind of PPE; 20% did not know; 10% wore gloves and masks.
<b>Silva, Costa, 2018</b>	Pesticide poisoning in the state of Tocantins: 2010-2014	43.92% of poisoning cases involved individuals aged between 20 and 39; 69.06% of the reports of occupational pesticide poisoning were from men; 22% of the municipalities in the state of Tocantins were notified of poisoning.	Cases of respiratory poisoning mainly affect rural workers; Cases of ingestion are classified as suicide.	The routes of exposure were digestive (51.66%) and respiratory (35.08%); 49.17% accidental poisoning; 14.64% of environmental poisoning. 13.81% of the poisonings reported were due to pesticide dilution and 25.69% to spraying.	-	-

<b>Magalhães, Caldas, 2018</b>	Occupational exposure and poisoning from chemical products in the Federal District	60% of the individuals in the study were farmers - of these 92.9% were men	Exhibition activities: loading/unloading, product marketing, preparation and application; Most with exposure time $\leq 9$ years	85.9% of farmers had poisoning confirmed by clinical examinations	-	78.7% of the workers did not use any type of PPE; 32.8% wore gloves and masks; 1.4% wore full PPE (boots, hat, apron or waterproof clothing, gloves, mask and goggles).
<b>Lermen et al., 2018</b>	Pesticide exposure and health conditions among orange growers in Southern Brazil	Of the participating rural workers, 62% were male; 28% were aged 29-49 and 35% were aged 50-59; 67% had incomplete primary education;	Exposure activity: preparation, application, washing of packaging and clothing used; 70% had direct contact with pesticides at least once a month.	Cases of poisoning confirmed by reports; Typical symptoms: headache, nausea, dizziness and weakness	-	23% wore overalls; 63% boots; 18% hat; 34% gloves; 48% masks; 30% goggles;
<b>Bortolotto et al., 2018</b>	Exposure to pesticides: a population-based study in a rural area in southern Brazil	51.7% of the participants were women; 66.0% were over 40 years old; 75.5% had up to eight years of schooling;	Exposure activity: application, washing clothes used to prepare the mixture, washing contaminated packaging and equipment.	5% of the participants had already been poisoned by pesticides.	-	-
<b>Klein et al. 2018</b>	Analysis of the impact of the use of organophosphates (OF) and carbamates (CAR) on rural workers in a municipality in the northwestern region of the state of Rio Grande do Sul	Male participants aged between 22 and 50; 44.44% of the individuals had been exposed to pesticides for between 5 and 10 years.	Occurrence of exposure: 88.9% product application; 81.5% product preparation; 40.7% storage; 33.3% supervision of crops; 11.1% disposal of packaging; 7.4% cleaning/maintenance of equipment.	Signs of toxicity identified by clinical examination: cholinesterase enzyme results are significantly low.	-	70.4% say they used safety PPE.
<b>Moura et al. 2018</b>	Epidemiological characterization of workers with cancer in an irrigated fruit-growing region	83% of rural workers were male; 55.5% had incomplete primary education; 30% were illiterate.	50% of the workers had been exposed to pesticides for more than 10 years; 83.3% used a backpack pump for application.	69.4% reported symptoms after handling chemical compounds, such as dizziness, intense itching, headache, tearing, sneezing, eyelid and lip tingling, weakness and blurred vision.	64% reported not receiving guidance on how to use the products; 30% received advice from an agricultural technician, agronomist or salesperson; 30% reported reading product labels;	36.1% did not use PPE; 8.7% wore full PPE.

				25% reported intoxication; 33.3% sought medical attention.	11.1% bought pesticides with a prescription; 30.5% lived within 500 meters of the plantations; 38.9% returned the packaging.	
<b>Petarli et al., 2019</b>	Occupational exposure to pesticides, risks and safety practices in family farming in a municipality in the state of Espírito Santo, Brazil	Farmers aged between 30 and 39;  64.5% were men;  Schooling: 68% with less than 4 years	Exposure activity: use of a hand-held knapsack sprayer; 30% of farmers did not shower immediately after application; 46.2% did not comply with the re-entry period.	-	64.5% of farmers respect the grace period for harvesting; 68% respect the time for reapplying pesticides. 34.2% of farmers sought technical advice when purchasing agrochemicals; 50.6% reported reading the label on pesticides;	28.6% reported using full PPE; 48.7% use incomplete PPE 22.7% do not use PPE due to discomfort
<b>Brust et al. 2019</b>	Epidemiological profile of farmworkers from the state of Rio de Janeiro	54.7% female, aged between 40 and 64; 45.3% were male; 95% family labor	Contact with pesticides during preparation and handling; poisoning in cases of reused packaging and incorrect handling of products.	Symptoms include headaches, allergies and irritated eyes, among others; 15% reported a family history of cancer.	The lack of ability to understand the terms on pesticide packaging; Lack of training and guidance from a qualified professional.	51.8% of the workers did not use PPE during their activities. 3.6% of workers reported always wearing PPE.
<b>Frank et al. 2019</b>	Hearing alterations in farmers exposed to pesticides treated at a specialized rehabilitation center	92.9% of the farmers were men, 85.7% in the 50-79 age group; 95.7% with incomplete primary education;	26.9% of the workers had direct contact with agrochemicals and had worked in the field for between 10 and 20 years.	There are signs of poisoning; Symptoms associated with exposure to pesticides: 17.1% nausea; 14.3% headache; 10% dizziness; 8.6% vomiting; 7.1% diarrhea.	-	20% used PPE during preparation; 58.6% did not use PPE when preparing the food;  21.4% used PPE during application; 55.7% did not wear PPE during application;
<b>Vasconcellos et al. 2019</b>	Conditions of exposure to pesticides of patients with Parkinson's disease followed up at the neurology outpatient clinic of a university hospital and the perception of the relationship between exposure and illness	50% of the workers were male; 87.48% were over 60 years old.	Among the participants, 24 people, or 74.98%, said they had direct or indirect contact with pesticides.	-	Of the participants who used pesticides: minority read the labels; others learned how to use the product from family members; some couldn't read; one ignored the label.	75% said they didn't use any kind of PPE;

<b>Burali et al., 2020</b>	Occupational exposure to pesticides and health symptoms among family farmers in Brazil	83.3% of pesticide applicators were male; Average age 40.3 years; 27 years of rural work.	85.7% of applicators directly handled or sprayed pesticides for 1-3 days/week during the harvest; 11.9% for 4-7 days/week during the harvest season	60% of them had acute symptoms suggestive of pesticide poisoning.	They worked without safety training, technical support and full protective equipment.	67.9% used some kind of PPE; 50% cloth mask; 14% visor; 37.2% hat; 52.6% gloves; 53.8% boots; 39.7% above all
<b>Silvério et al., 2020</b>	Assessment of Primary Health Care for rural workers exposed to pesticides	Average age of men - 43, women - 42; Average schooling of 4 years for both; Men with longer exposure in all age groups;	Activities in which men are exposed: pesticide application by coastal pump; hose; tractor without cab; tractor with cab; Women: cleaning clothes used in pesticide application.	Poisoning by pesticides: 23.48% in men; 7.29% in women	-	The negligence of the use of PPE: 79% of men; 97% of women
<b>Okuyama et al., 2020</b>	Poisoning and factors associated with death from pesticides: case-control study, Brazil, 2017	68.5% men; 68.5% aged between 20 and 59; 8.9% of individuals who died from pesticide poisoning were from the agricultural sector; 9% occupational accident.	Men who are exposed to extremely toxic products.	24.2% gastrointestinal disorders (vomiting, nausea, diarrhea and epigastralgia); 37.4% hypotension; 38.6% coma; 49.4% respiratory failure; 61.4% cardiorespiratory arrest.	-	-





CSP\_1337/24

Arquivos	<a href="#">Versão 1</a> <a href="#">[Resumo]</a>
Seção	Artigo
Data de submissão	19 de Julho de 2024
Título	Risk factors related to rural workers exposed to pesticides in Brazil: an integrative review
Título corrido	Risk factors related to rural workers exposed to pesticides in Brazil
Área de Concentração	Saúde Ocupacional e Ambiental
Palavras-chave	Poisoning, Occupational exposure, Rural workers, Pesticides, Farmers
Fonte de Financiamento	Fapema e Capes
Conflito de Interesse	Nenhum
Condições éticas e legais	Não se aplica (estudo não envolve pesquisa com seres humanos ou animais).
Registro Ensaio Clínico	Nenhum
Sugestão de consultores	Nenhum
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STATUS	Com <i>Secretaria Editorial</i>