

DOI: <https://doi.org/10.36489/saudecoletiva.2021v11i68p7421-7432>

Incidence of pesticides on human organism: literature review

Incidencia de plaguicidas en el organismo humano: revisión de la literatura

Incidência dos agrotóxicos no organismo humano: revisão de literatura

ABSTRACT

Objective: To show the impacts of the use of pesticides on the human body that cause various health problems and, in some cases, lead to fatalities, bringing methods used to combat intoxication. **Method:** The study was carried out by an integrative bibliographic review, selecting articles from the SciELO, PubMed, MEDLINE databases and the BVS platform, in publications from 2016 to 2021. **Results:** The exposed theme proved to be important and can be used to provide knowledge, especially to rural workers who handle pesticides. **Conclusion:** In this study, a great importance was observed in the subject in question, as it made it possible to observe the harm caused in the lives of farmers who are most affected by having direct contact with agrochemicals, and of the entire population that consumes contaminated food in excess, bringing new knowledge to health professionals, in particular to biomedical scientists.

DESCRIPTORS: Pesticides; Rural workers; Occupational exposure; Intoxication; Biomedic.

RESUMEN

Objetivo: Mostrar los impactos del uso de plaguicidas en el cuerpo humano, que ocasionan diversos problemas de salud y, en algunos casos, conducen a fatalidades, con la intención de acercar los métodos utilizados para combatir las intoxicaciones. **Método:** El estudio se realizó mediante una revisión bibliográfica integradora, seleccionando artículos de las bases de datos SciELO, PubMed, MEDLINE y la plataforma BVS, en publicaciones de 2016 a 2021. **Resultados:** El tema expuesto demostró ser importante y por lo tanto puede utilizarse para brindar conocimientos, especialmente a los trabajadores rurales que manipulan plaguicidas. **Conclusión:** En este estudio se observó gran importancia en el tema en cuestión, ya que permitió observar el daño causado en la vida de los agricultores más afectados, al tener contacto directo con agroquímicos, y de toda la población que consume alimentos contaminados en exceso, aportando nuevos conocimientos a los profesionales de la salud, especialmente a los biomédicos.

DESCRIPTORES: Plaguicidas; Trabajadores rurales; Exposición ocupacional; Intoxicación; Biomédica.

RESUMO

Objetivo: Evidenciar os impactos do uso de agrotóxicos no organismo humano que ocasionam diversos problemas de saúde e, em alguns casos, levam a fatalidade, trazendo métodos utilizados para combater a intoxicação. **Método:** Realizou-se o estudo por revisão bibliográfica integrativa, selecionando artigos pelos bancos de dados SciELO, PubMed, MEDLINE e a plataforma BVS, nos quais foram retiradas publicações de 2016 a 2021. **Resultados:** A temática exposta mostrou-se importante podendo assim ser utilizado com o intuito de proporcionar conhecimento, principalmente aos trabalhadores rurais que fazem o manuseio dos agrotóxicos. **Conclusão:** Neste estudo, foi observado grande importância na temática em questão, uma vez que o mesmo possibilitou observar os malefícios causados na vida dos agricultores que são os mais afetados, por terem um contato direto com os agroquímicos, e de toda a população que consome alimentos contaminados em excesso, trazendo novos conhecimentos aos profissionais de saúde, em especial aos biomédicos.

DESCRIPTORIOS: Agrotóxicos; Trabalhadores rurais; Exposição ocupacional; Intoxicação; Biomédico.

RECEIVED ON: 06/09/2021 APPROVED ON: 06/16/2021



Amanda Oliveira Santos

Undergraduate Biomedicine Student, Estacio de Sergipe University Center, Aracaju, Sergipe, Brazil.
ORCID: 0000-0003-3287-7272

Isadora Oliveira de Araújo

Undergraduate Biomedicine Student, Estácio de Sergipe University Center, Aracaju, Sergipe, Brazil.
ORCID: 0000-0001-5920-0750

João Marcos Mendes Bitencourt

Undergraduate Biomedicine Student, Estácio de Sergipe University Center, Aracaju, Sergipe, Brazil.
ORCID: 0000-0002-0199-716X

Victor Hugo Dias Silva Santos

Undergraduate Nursing Student, Estácio de Sergipe University Center, Aracaju, Sergipe, Brazil.
ORCID: 0000-0001-6074-2047

Mayra Morgana Martins de Moura

Graduated in Biomedicine, Lusíada University Center (UNILUS), Santos, São Paulo, Brazil.
ORCID: 0000-0002-4773-1834

Bruno Vieira Humia

Professor at Centro Universitário Estácio de Sergipe, Graduated in Biomedicine from the Bahia School of Medicine and Public Health, Master and Doctor in Industrial Biotechnology from Tiradentes University, Aracaju, Sergipe, Brazil.
ORCID: 0000-0002-4349-6064

Lorena Xavier Conceição Santos

Professor at the Estácio de Sergipe University Center, Graduated in Biological Sciences and Master in Health and Environment from Tiradentes University, Doctor in Development and Environment from the Federal University of Sergipe, Aracaju, Sergipe, Brazil.
ORCID: 0000-0001-5995-2442

Raphaella Ingrid Santana Oliveira

Advisor/Professor at the Estácio University Center of Sergipe, Graduated in Biomedicine and Master in Industrial Biotechnology from Tiradentes University, Aracaju, Sergipe, Brazil.
ORCID: 0000-0002-7027-9049

INTRODUCTION

Pesticides are defined as any substance or mixture of chemical or biological substances used for the purpose of repelling, destroying, controlling pests or regulating plant growth. ⁽¹⁾ However, it is also possible to note that such substances can cause contamination of rivers and lakes, as pesticides deposited in crops penetrate the soil, run off reaching the rivers and end up being a causing agent of pollution. ⁽²⁾

In theory, all people are exposed to the harmful effects of pesticides, however, there are the most vulnerable, such as the elderly, children, pregnant women and people who live in rural areas where it is sprayed, and especially those who deal directly with the products, such as rural workers and family members, due to collective contamination. ⁽³⁾

Exposure to pesticides occurs, main-

ly, in the agricultural sector, in insect control companies, during transport, in the sale and in the production of pesticides. ⁽⁴⁾ In addition to occupational exposure, food and environmental contamination stands out, which puts the health of other population groups at risk, such as farmers' families and the general population that feeds on what is produced in the countryside. ⁽⁵⁾

Pesticides are used on a large scale by various productive sectors, such as treating wood for construction, storing grain and seeds, producing flowers and fighting endemics and epidemics. ⁽⁶⁾ Their classification, according to chemical group, mainly includes organochlorines, chlorophosphates, pyrethroids, organophosphates and carbamates. ⁽⁷⁾ Thus, the negative impact on the health of consumers and workers who frequently handle these toxic products depend

on a series of factors such as (toxicity) of the pesticide used, on the way in which the products are applied; health surveillance mechanisms, lack of non-use or inadequate use of personal and collective protective equipment (PPE's and CPE's); the mode of agricultural production, among others. ⁽⁸⁾ Added to these factors are the low level of education and the precarious socioeconomic and cultural conditions of many rural workers. These, not rare, get sick numerous times, however, these events are not accounted for or not related to agroindustry chemicals. ⁽⁹⁾

Agrochemicals leave a deleterious trail, from their production to their use, including those who transport these products and those who consume contaminated food in regions where this method of pest control is chosen. ⁽³⁾ As pesticides are substances whose

main purpose is to protect agricultural products against the action of harmful living beings and are often not applied using the proper protective equipment, they end up generating risks to human health.⁽¹⁰⁾

In this way, the best study on the subject is relevant in order to explain the harm that pesticides can cause to human health, bringing effective and satisfactory ways to reduce the use and consumption of pesticides, showing that a more sustainable agricultural model, ensuring healthier food, improving the quality of life and, therefore, increasing people's longevity, ensuring healthier soil for planting. Thus, the work aimed to highlight the impacts of the use of pesticides on the human body, to know the pathophysiological consequences of human exposure to pesticide residues, bringing methods used to combat poisoning.

METHODS

The study was based on a bibliographic research of the integrative review type, ie, Evidence-Based Practice (EBP). The integrative review consists of completing the following steps: identification of the theme and selection of the research question; establishing eligibility; identification of studies in scientific bases; evaluation of selected studies and

critical analysis; classification of studies; evaluation and interpretation of results and presentation of data in the structure of the study presented.⁽¹¹⁾

When measuring the approach regarding the incidence of pesticides on human health, we developed the following guiding questions: What are the methods to reduce the aggression of pesticides in food, so that it is less harmful to the health of agricultural workers and consumers of products? How can the biomedical respond to this problem?

The bibliographic survey of this study was carried out from February to April 2021. In the framework described for the research, a bibliographic review of international and national articles was carried out, in summary, selected by: Scientific Electronic Library Online (SciELO), Virtual Health Library (VHL), National Library of Medicine (PubMed) and Online Medical Literature Analysis and Retrieval System (MEDLINE).

For the inclusion criteria, articles published in the last 5 years (2016 to 2020) were included, available on search platforms, in English and Portuguese, involving four words with great meaning for the subject: "Pesticides", "Rural Workers", "Occupational Exposure", "Intoxication" and "Biomedical". The exclusion criterion was supported

by articles that did not present a direct synthesis of the subject and some were repeated, thus, did not meet the legal and objective bases of the research.

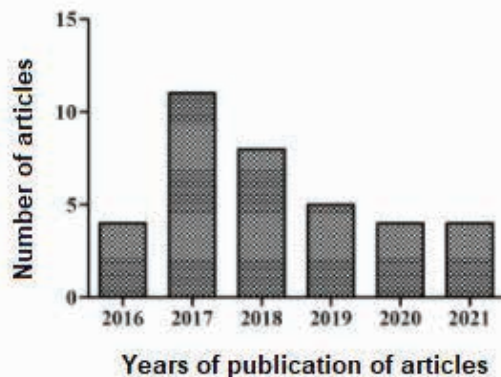
The evaluation of the results took place through graphs executed in the GraphPad PRISM® version 5.00 program. and a table with the following information: Author, Magazine/Year, Title, Method and Result. Thus, it was possible to observe, classify and discuss the data obtained.

RESULTS

The search allowed to find 2.856 articles using the words selected in the methodology, but only 36 articles were used in this study, within the established search parameter (2016-2021). After analyzing and evaluating the selected studies, 2.820 articles were excluded. Therefore, Graph 1 shows the distribution of years of publication of articles, in relation to the quantity of publication. According to⁽¹²⁾, the historical series of reported cases of pesticide poisoning in the Notifiable Diseases Information System (SINAN), between 2007 and 2015, was reported in Brazil in a total of 84.206 cases and, with this, enabled the emergence of new published studies, especially in the year 2017 where it had more relevance in this article. After 2017, the most relevant years in this study were 2018, 2019, 2020, 2016, in that order, with the lowest number being in 2021, perhaps because we are still in the current year.

Graph 2 shows the number of articles per database, highlighting most articles on the SciELO platform, followed by the VHL, PubMed and MEDLINE platforms, according to the descriptors used for the search. According to Spinak⁽¹³⁾, the SciELO platform comprises more than 1.200 active, open access and full-text journals from 17 countries, it also has more than 900.000 articles and SciELO Books, providing 1.300 books. Therefore, the result suggests that SciELO was more relevant in this study be-

GRAPH 1 – Distribution of years of publication of articles (2016-2021).



Source: Authors (2021)

cause it is more comprehensive and easier to access.

DISCUSSION

According to ^(14,15), the plantation area in Brazil made the country the largest consumer of pesticides in the world, as the imposition of the Green Revolution Policy, transgenic crops, the increase in "pests" on crops, subsidized agricultural credits and exemption from tax, are factors that contributed to the increase in the consumption of pesticides in agriculture. According to ⁽¹⁶⁾, population growth, together with food scarcity, made the use of pesticides increase more and more, with the aim of obtaining a more accelerated production method and, therefore, also obtaining good results in production.

According to ⁽¹⁷⁾, as quoted by ⁽¹⁸⁾, this large consumption has had a negative impact on human health and the environment caused by acute and chronic exposure to pesticides, which is already well known in the literature and, despite this, contradictorily, Brazil consumes immense amounts of these poisons.

As per ^(19,20), the use of synthetic chemical compounds to control pests has negative points, as they affect flora, fauna, soil, animals, microorganisms, rural workers and members of the consumer market. According to ^(21,22), the

use of these compounds has been causing effects that reflect not only social benefits, but environmental and public health problems, being responsible for complex chemical contaminations, especially in rural areas.

It is noteworthy that chemical pollution of an organic or inorganic nature causes one of the serious problems to the environment, arising from the introduction of pesticides, fertilizers and chemical products in general. ^(23,24) Also, the use of fertilizers and pesticides in crops can cause soil contamination, since many fertilizers have heavy metals in their composition, contributing to the toxic content of the place. ^(25,24)

Some questions have been raised regarding the possibility of an increased risk of microbiological and parasitic contamination in the food produced, mainly due to the type of fertilization, from animal manure and the prohibition of the use of pesticides, thus making the food inappropriate for human consumption. ⁽¹⁶⁾

In a study by ^(26,27), it is noteworthy that 52% do not wear waterproof clothing and 44% do not wear gloves. The use of PPE, such as a filter mask, long-sleeved overalls, goggles or a visor, gloves and boots, although uncomfortable, should be considered as an available and indispensable protection technology within an approach to occupational problems, in the case of

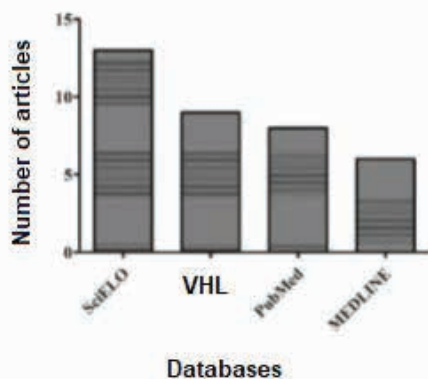
agrochemicals, where PPE's are designed to ensure protection against external chemical agents, that is, that these agents do not come into contact with the body. ⁽²²⁾

Also ^(28,29), also carried out a study where they found as the main symptoms presented by farmers, after exposure, dizziness (present in 22% of the workers interviewed), headache (16%), blurred vision (11%), nausea (11%), diarrhea (8%), sweating (8%) and abdominal cramps (8%). Therefore, in view of these studies available in the literature, it is possible to characterize pesticide poisoning reported to a toxicological assistance center, through a retrospective analysis of epidemiological records of toxicological occurrence, with a medical diagnosis of acute or chronic pesticide poisoning. ⁽³⁰⁾

The occurrence analysis is carried out through the Information System for Notifiable Diseases (SINAN) after medical care, with the objective of recording the processing of data on notifiable diseases throughout the national territory, providing information for analyzing the profile of individuals with exposure and/or poisoning by pesticides in Brazil. ⁽³¹⁾ For this, it is pertinent that the population is educated and that professional training programs for assistance to these patients occur continuously so that retrospective monitoring of these affected patients is feasible, as well as the survey of cases in the country. ⁽³²⁾

In a case study, carried out by ^(33,34), after signing the consent form, 62 participants answered a questionnaire about the process and labor relations in tobacco farming, insertion in production and consumption, as well as health problems perceived as arising from this activity. Of this total, 46 people participated in the second phase, consisting of anamnesis and physical examination, application of the Self-Reporting Questionnaire (SRQ-20), validated in the country for users of primary care health services, in addition to blood collection to perform exams of: erythrocyte and plasma cholinesterase, blood count with reticulocyte counts, urea, creatinine, total proteins and fractions, total

GRAPH 2 – Distribution of the quantity of articles used by database.



Source: Authors (2021)

bilirubins and fractions, alkaline phosphatase, Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT), Gamma-Glutamyl Transferase (GGT), thyrostimulating hormone (TSH), fasting blood glucose, total cholesterol and fractions, triglycerides, Venereal Disease Research Laboratory (VDRL).⁽³³⁾ These tests were performed to define the intoxication/poisoning according to the exposure to the chemical agent that resulted in clinical and/or laboratory changes compatible with the toxic exposure picture, which could be acute (single exposure for up to 24 hours, or repeated for up to 15 days), subchronic (repeated between 15 days and three months) and chronic (over three months).⁽³⁵⁾

Thus, it is clear that the assessment of patients who have a history of pesticides is also done through clinical and laboratory tests. Thus, the biomedical health model with its focus on the etiology, diagnosis and treatment of diseases has made an important contribution to the development of medical care. However, this reductionist approach, in general, does not take into account factors that influence health, such as the physical and social environment where health problems occur.⁽³⁶⁾

The National Policy on Agroecology of Organic Production (PNAPO - Política Nacional de Agroecologia de Produção Orgânica) is a model of sustainable agriculture that applies ecological concepts and principles for the study and management of agricultural systems, generating a scientific basis for developing a more sustainable agriculture, based on the appreciation of cultural and biological diversity.⁽³⁷⁾ This practice seeks to conserve and rescue landraces and traditional knowledge of local populations, unlike the form of dissemination used in conventional agriculture, promoted through technological packages, generating knowledge through socialization and exchange of knowledge between agricultural and urban communities.⁽³⁸⁾

In this way, it is possible to understand that pesticides are present in the population as a way to increase the production and income of farmers and to encourage the export agro-industry. However, over time, it has often caused irreversible damage to the population, especially to producers because they have direct contact.⁽³⁹⁾ Thus, we saw the importance of monitoring aimed at the reduction and control of pesticides in food production, making it noticeable

and also, of paramount importance, the use of (PPE's) during the application of poisons in crops, avoiding contact directly to agrochemicals. The risk of contamination and damage to exposure are notorious, thus, it is possible to understand that pesticides are causing damage to the health of the population and the environment.⁽⁴⁰⁾

CONCLUSION

The work dealt with the harm that pesticides can cause to human health, presenting satisfactory paths for the proper use and reduction in the use of pesticides, aiming to ensure a healthier diet, thus enabling the improvement in people's quality of life. He also highlighted the importance of the biomedicine in diagnosing poisoning, performing laboratory tests after medical care. Lectures and advertisements also show the population the dangers of exposure to these substances and the importance of adequate PPE, having these as one of the main methods that influence the decrease in the incidence of contamination with pesticides. Thus, it is expected that this study will favor a future discussion for further research. ■

REFERENCES

1. Nogueira FAM. Exposição a agrotóxicos e agravos à saúde em trabalhadores agrícolas: o que revela a literatura? *Rev Bras Saude Ocup* 2020; 45(36).
2. Lopes CVA, Albuquerque GSC. Agrotóxicos e seus impactos na saúde humana e ambiental: uma revisão sistemática. *Saúde debate* 2018; 42(117).
3. Agrotóxicos e as repercussões na saúde dos trabalhadores rurais: revisão de literatura [Mestrado]. Pombal/PB: Universidade Federal de Campina Grande – UFCG; 2018.
4. Silva JM, Silva EN, Faria HP, Pinheiro TMM. Agrotóxico e trabalho: uma combinação perigosa para a saúde do trabalhador rural. *Ciência & saúde coletiva* 2005; 10(4).
5. Almeida MD, Cavendish TA, Bueno PC, Ervilha IC, Gregório LS, Kanashiro NBO, et al. A flexibilização da legislação brasileira de agrotóxicos e os riscos à saúde humana: análise do Projeto de Lei no 3.200/2015. *Cadernos de Saúde Pública* 2017; 33(7).
6. Ministério da Saúde (BR). Documento Orientador para a Implementação da Vigilância em Saúde de Populações Expostas a Agrotóxicos. Brasília/DF: Ministério da Saúde; 2013.
7. Santana CM, Costa AR, Nunes RMP, Nunes NMF, Peron AP, Cavalcante AACM et al. Exposição ocupacional de trabalhadores rurais a agrotóxicos. *Cadernos Saúde Coletiva* 2016; 24(3).
8. Carneiro FF, Rigotto RM, Augusto LGS, Pignati W, Rizzolo A, Alexandre VP, et al. Dossiê ABRASCO: um alerta sobre os impactos dos agrotóxicos na saúde, 1ª parte, Rio de Janeiro; 2012.
9. Borges LD. Agrotóxicos e seus efeitos na saúde pública: um panorama evolutivo. Caderno de pós-graduação em análise ambiental e desenvolvimento sustentável: legislação ambiental. Centro Universitário de Brasília – UniCEUB; 2016.
10. Gomes ACS, Moraes LGS, Moraes CRS. O uso de agrotóxicos e a saúde do trabalhador rural no Brasil. *ARIGÓ - Revista do Grupo PET e Acadêmicos de Geografia da Ufac* 2018; 1(1).
11. Ercole, FF, Melo SL, Alcoforado CLGC. Revisão Integrativa versus Revisão Sistemática. *Revista Mineira de Enfermagem*

REFERENCES

- 2014; 18(1).
12. Ministério da Saúde (BR). Relatório Nacional de Vigilância em Saúde de Populações Expostas a Agrotóxicos. Brasília/DF: Ministério da Saúde; 2018.
13. Spinak E. Integração de bases de dados nacionais acadêmicas na Europa. SciELO em Perspectiva 2021.
14. Carneiro FF, Augusto LGS, Rigotto RM, Friedrich K, Búrigo AC. Dossiê ABRASCO: um alerta sobre os impactos dos agrotóxicos na saúde. Rio de Janeiro: EPSJV; São Paulo: Expressão Popular; 2015.
15. Pignati WA, Lima FANS, Lara SS, Correa MLM, Barbosa JR, Leão LHC, et al. Distribuição espacial do uso de agrotóxicos no Brasil: uma ferramenta para a Vigilância em Saúde. *Ciência & Saúde Coletiva* 2017; 22(10).
16. Fidelis RA, Gonçalves AV, Santos FAL. Contaminação, por agrotóxicos, bactérias, protozoários, helmintos e artrópodes, nas hortaliças orgânicas e convencionais comumente relatados na literatura. [Resumo]. Centro Universitário de Várzea Grande UNIVAG 2017.
17. Rigotto RM, Vasconcelos DP, Rocha MM. Uso de agrotóxicos no Brasil e problemas para a saúde pública. *Caderno de Saúde Pública* 2014; 30(7).
18. Lopes CVA, Albuquerque GSC. Desafios e avanços no controle de resíduos de agrotóxicos no Brasil: 15 anos do Programa de Análise de Resíduos de Agrotóxicos em Alimentos. *Caderno de Saúde Pública* 2021; 37(2).
19. Martins, MAR. O trabalhador rural e os agrotóxicos. *Revista Direito, Trabalho e Política Social* 2015; 1(1).
20. Coutinho, KA. Intoxicações relacionadas a exposição por agrotóxicos [Monografia]. Brasília/DF: Centro Universitário de Brasília – UniCEUB; 2017.
21. Vieira MG, Steinke G, Arias JLO, Primel EG, Cabrera LCC. Avaliação da Contaminação por Agrotóxicos em Mananciais de Municípios da Região Sudoeste do Paraná. *Revista Virtual de Química* 2017; 9(5).
22. Martins DE. Impactos ambientais da utilização de agrotóxicos: percepção dos trabalhadores rurais e adesão a métodos alternativos [Mestrado] Chapecó/SC: Universidade Federal da Fronteira Sul; 2019.
23. Aguiar MRMP, Novaes AC, Guarino AWS. Remoção de metais pesados de efluentes industriais por aluminossilicatos. *Química Nova* 2015; 25(6b):1145-54.
24. Oliveira RIS, Araújo SS, Lisboa CLS, Resende AF, Santos TS, Alves LL, Alves LL, Lima Silva W. Análise comparativa de elementos físico-químicos e contaminantes em corpo d'água do Riacho Grilo no estado de Sergipe. *Saúde Coletiva* 2020; 10(59).
25. Silva ES, Jesus RS. Caracterização Geoambientais do Rio Machado na área do bairro Matinha em Lagarto/SE. [Monografia]. Lagarto/SE: Universidade Federal de Sergipe; 2012.
26. Pacheco FP, Vasconcelos HL. Saúde e segurança do trabalho: agentes químicos e equipamentos de proteção individual utilizados no tratamento e manuseio de sementes tratadas. *Revista Varia Scientia Agrárias* 2013; 3(2).
27. Silva MBC. Avaliação da exposição a agrotóxicos em pacientes com leucemia [TCC]. Santa Cruz do Sul/RS: Universidade De Santa Cruz Do Sul; 2020.
28. Santos LDC, Oliveira MFF, Rodrigues MA, Barbosa PM, Ser-cundes SP. Investigação sobre o manejo e aplicação de agrotóxicos pelos agricultores da fazenda boa vista, do município de Goioerê – PR e do vilarejo Água Santos Antônio, do município de Janiópolis – PR, 2000. *Arquivos da Apadec* 2001; 5(1).
29. Taveira BLS, Albuquerque GSC. Análise das notificações de intoxicações agudas, por agrotóxicos, em 38 municípios do estado do Paraná. *Saúde Debate* 2018; 42(4).
30. Hungaro AA, Correia LM, Silvino MCS, Rocha SM, Martins BF, Oliveira MLF. Intoxicações por agrotóxicos: registros de um serviço sentinelado de assistência toxicológica. *Ciência, cuidado e saúde* 2015; 14(3).
31. Malaspina FG, ZiniLise ML, Bueno PC. Perfil epidemiológico das intoxicações por agrotóxicos no Brasil, no período de 1995 a 2010. *Caderno de Saúde Coletiva* 2011; 19(4).
32. Ambrosini MB, Witt RR. As intoxicações por agrotóxicos no meio rural e a atuação do enfermeiro. *Revista Gaúcha de Enfermagem* 2000; 21(1).
33. Mari JJ, Williams P. A validity study of a psychiatric screening questionnaire (SRQ-20) in primary care in the city of São Paulo. *British Journal of Psychiatry* 1986.
34. Murakami Y, Pinto NF, Albuquerque GSC, Perna PO, Lacerda A. Intoxicação crônica por agrotóxicos em fumicultores. *Saúde Debate* 2017; 41(113).
35. Germano LC, Alonzo HGA. Estudo descritivo dos atendimentos hospitalares por eventos toxicológicos em um município do estado de São Paulo, 2012. *Epidemiologia e Serviços de Saúde* 2017; 26(3).
36. Souza EM, Grundy E. Promoção da saúde, epidemiologia social e capital social: inter-relações e perspectivas para a saúde pública. *Caderno de Saúde Pública* 2004; 20(5).
37. Moura IF. Agroecologia na agenda governamental brasileira: trajetórias no período 2003-2014 [Tese]. Rio de Janeiro: Universidade Federal Rural Do Rio De Janeiro; 2016.
38. Sambuichi RHR, Oliveira MAC, Silva APM, Luedemann G. A sustentabilidade ambiental da agropecuária brasileira: impactos, políticas públicas e desafios. Rio de Janeiro: IPEA – Instituto de Pesquisa Econômica Aplicada; 2012.
39. Miranda AC, Moreira JC, Carvalho R, Peres F. Neoliberalismo, uso de agrotóxicos e a crise da soberania alimentar no Brasil. *Ciência & Saúde Coletiva* 2007; 12(1).
40. Silva JB, Xavier DS, Barboza MCN, Amestoy SC, Trindade LL, Silva JRS. Fumicultores da zona rural de Pelotas (RS), no Brasil: exposição ocupacional e a utilização de equipamentos de proteção individual (EPI). *Saúde em Debate* 2013; 37(97).