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Exogenous poisoning by pesticides in rural workers and relationship with local productive aggregates in Pernambuco

Intoxicación exógena por pesticidas en trabajadores rurales y relación con agregados productivos locales en Pernambuco

Intoxicação exógena por agrotóxicos em trabalhadores rurais e relação com agregados produtivos locais em Pernambuco

ABSTRACT

Objective: To describe the epidemiological profile of rural workers intoxicated by pesticides in the state of Pernambuco, identifying the correspondence with local productive clusters. **Method:** A descriptive cross-sectional study was performed, using data on intoxications recorded in the National System of Notifiable Diseases, from 2007 to 2013. Data were categorized according to individual, social, and occupational variables, occurrence of intoxication and distribution of cases according to Health Regions. The case records were compared with local productive clusters to verify the relationship with economic activities. **Results:** There was a predominance of oral acute case records in men of productive age, brown, informal, with low schooling. The highest number of notifications was observed in the regions that presented productive aggregates related to the subsectors of extraction and production of non-metallic minerals, agriculture, and textile industry. **Conclusion:** It was highlighted the high underreporting and failures in the records, impairing the development of actions to rural workers who use pesticides.

DESCRIPTORS: Agrochemicals; Poisoning; Rural Health.

RESUMEN

Objetivo: Describir el perfil epidemiológico de los trabajadores rurales intoxicados por pesticidas en el estado de Pernambuco, identificando la correspondencia con los agregados productivos locales. **Método:** Se realizó un estudio descriptivo transversal, utilizando datos sobre intoxicaciones registrados en el Sistema Nacional de Enfermedades Notificables, de 2007 a 2013. Los datos fueron categorizados según variables individuales, sociales y ocupacionales, relacionados con la ocurrencia de intoxicación y distribución de casos según regiones de salud. Se compararon los casos con agregados productivos locales, para verificar la relación con actividades económicas. **Resultados:** Hubo un predominio de registros de casos de exposición oral, agudos, en hombres en edad productiva, marrones, informales, con baja escolaridad. Se observó el mayor número de notificaciones en las regiones que presentaron agregados productivos relacionados con los subsectores de la extracción y producción de minerales no metálicos, la agricultura y la industria textil. **Conclusión:** Se destaca el alta subregistro y las deficiencias en los registros, lo que dificulta el desarrollo de acciones dirigidas a los trabajadores rurales involucrados en el uso de plaguicidas.

DESCRIPTORES: Agroquímicos; Envenenamiento; Salud Rural.

RESUMO

Objetivo: Descrever o perfil epidemiológico dos trabalhadores rurais intoxicados por agrotóxicos em Pernambuco, verificando a correspondência com os agregados produtivos locais. **Método:** Realizou-se um estudo descritivo transversal, com dados de intoxicações disponíveis no Sistema Nacional de Agravos de Notificação (Sinan) de 2007 a 2013. Os dados foram categorizados segundo variáveis individuais, sociais, ocupacionais, da ocorrência da intoxicação e distribuição dos casos segundo Regiões de Saúde. Os casos foram comparados com os agregados produtivos locais, para verificar a relação com atividades econômicas. **Resultados:** Observou-se predominância de registros de casos agudos, de exposição oral, em homens em idade produtiva, pardos, informais, com baixa escolaridade. O maior número de notificações foi observado nas regionais que apresentaram agregados produtivos relacionados aos subsetores de extração e produção de minerais não metálicos, agricultura e indústria têxtil. **Conclusão:** Destacam-se elevada subnotificação e as falhas nos registros, dificultando o desenvolvimento de ações direcionadas aos trabalhadores que usam agrotóxicos.

DESCRIPTORES: Agrotóxicos; Intoxicações; Saúde da População Rural.

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INTRODUCTION

The productive model of Brazilian agribusiness has driven the expansion of agricultural commodities and pressed for a reduction in the size of the State, making State control over the regulated sector more flexible. This model is highly dependent on chemical inputs such as pesticides, the consumption of which has intensified in recent years, resulting in damage to health and the environment.^{1,2}

Agricultural workers are one of the groups that suffer most from the impacts of pesticides, having contact with these agents during the preparation, handling, application, storage and disposal of packaging.^{3,4} Intoxications are considered an important public health problem due to high treatment costs, years of life lost and number of deaths. Worldwide, it is estimated that about one million unintentional poisonings by pesticides occur annually, leading to approximately 20.000 deaths⁵, especially in rural workers.⁶

In Brazil, according to data from the National System of Notifiable Diseases (Sinan), in the period from 2007 to 2017, 107,535 cases of pesticide poisoning were reported. Of these, 39.698 records corresponded to poisoning by pesticides for agricultural use, which represented 52,8% of the total deaths related to pesticide poisoning in the country, revealing a serious public health problem.⁷ From 2007 to 2014, Pernambuco was the 4th state with the highest number of cases of exogenous intoxication, with 5.734 cases.⁸ Thus,

the objective of this study was to describe the epidemiological profile of rural workers intoxicated by pesticides in Pernambuco, verifying the correspondence with the local productive aggregates.

METHOD

This is a descriptive and cross-sectional study, based on secondary data recorded at Sinan from January 2007 to December 2013, in the state of Pernambuco. Data were collected on June 25, 2015, including cases of exogenous intoxication in rural workers according to the municipality of occurrence, whose final classification was "confirmed intoxication" and "only exposure".⁹ The cases of intoxication by other chemical agents and those of workers not linked to agriculture were excluded from the analysis.

The data were extracted from the Tabnet and organized by grouping the variables into the categories: I individual (sex, race, age group), II social (education), III occupational (occupation, situation in the labor market), IV related to the occurrence of intoxication (route of exposure, relationship between poisoning and work, acute/chronic cases).

The distribution of case records was analyzed according to the 12 Health Regions of the state, and then compared with the Locational Quotient (LQ) of each region, determined in a previous study.¹⁰ The LQ determines the concentration of an economic activity in a given territory, identifying clusters of local productive activities.¹¹ The eight

existing productive sectors were considered (mineral extraction; transformation industry; industrial services of public utility; civil construction; commerce; services; public administration; agriculture, vegetal extraction, hunting and fishing) and the breakdown of IBGE's economic activity sub-sectors is used. In order to ensure the grouping of municipalities with high specializations and levels of productive concentration, conforming local production systems, it was adopted as a cutoff point $QL \geq 4$. The intoxication data were compared with regions with productive specialization, to verify the existence of a relationship with activities related to agriculture and livestock.

The study was approved by the Ethics and Research Committee, CAAE number: 37977914.3.0000.5201.

RESULTS

From 2007 to 2013, 4.468 cases of exogenous poisoning were reported in Sinan. The "occupation" field was filled in 15,2% of the records (678 cases), 46 of which were marked as "ignored". Data analysis was performed with 203 cases of rural workers, who met the inclusion criteria established for this study.

Most cases of poisoning by exposure to pesticides recorded in agriculture occurred among male individuals (71%), browns (67%) and with a concentration of cases in the range of 20 to 49 years of age (77%). The occurrence of cases of intoxication in children and adolescents stands out, with 8,38% of notifications

Table 1 - Pesticide poisoning cases reported in Sinan among rural workers according to sociodemographic, occupational and exposure characteristics. Pernambuco, 2007 a 2013.

VARIABLES	DISTRIBUTION OF CASES	
	N	%
Sex		
Male	145	71,4
Female	58	28,6
Ethnicity	N	%
Ign/Null	32	15,8
Brown	136	67
Black	15	7,4
White	14	6,9
Yellow/Indigenous	6	3
Age group		
<1 to 9	2	0,99
10 to 19	15	7,39
20 to 29	72	35,47
30 to 39	52	25,62
40 to 49	32	15,76
50 to 59	18	8,87
> 60	12	5,91
Education		
Ignored/Null	92	45,3
Illiterate	14	6,9
1st to 4th grade of elementary school incomplete	28	13,8
Full 4th grade of elementary school	17	8,4
5th to 8th grade of elementary school incomplete	25	12,3
Complete primary education	6	3
Incomplete high school	5	2,5
Complete High School	13	6,4
Não se aplica	3	1,5
Situation in the Labor Market		
Ignored/Null	63	31
Self-employed	43	21,2
Registered employee	36	17,7
Single Worker	16	7,9
Unregistered employee	12	5,9
Unemployed	8	3,9
Temporary Worker	6	3
Retired	3	1,5
Cooperative	1	0,5
Others	15	7,4

in children under 19 years old, and in the elderly (5,91%) (Table 1).

The relationship between cases of intoxication and level of education proved to be unrepresentative due to the high frequency of filling in this field as ignored/white (45,3%). In the records in which the field was filled out, schooling was considered low, where 63,06% (n=70) of the workers did not complete elementary school and 12,61 (n=14) were illiterate (Table 1).

As for the labor market, most workers were registered as self-employed (21,2%). There was also a large percentage of notifications in the field Situation in the Labor Market with registration as ignored/white (31,0%) (Table 1).

The main route of intoxication recorded was oral (61,1%), usually in acute-single exposures (73,9%). As for the circumstance of exposure related to work, 36% were exposed at work and 56% were not related to their work activity. The majority (56%) of the registered cases of poisoning in rural workers by pesticides were not related to work activity (Tabela 1).

Among the Health Regions, the highest number of notifications was observed in Regions IX (26,1%), VIII (21,2%) and IV (20,7%), which presented productive aggregates related to the mineral extraction/industry subsectors production of non-metallic minerals, agriculture and textile industry, respectively (Table 2). In the other Health Regions, where no productive aggregates were observed, the percentage of registered poisoning cases was 6,9% (I Region), 3,4% (7 Region), 3% (V, VI and XI Regions) and 0,5% (X Region) (data not shown in table).

An important problem identified was the low quality of the record, with a high prevalence of ignored/blank fields for different variables.

DISCUSSION

As for sex, similar results have been observed in other studies¹²⁻¹⁴, which can be

Exposure route		
Ignored/Null	15	7,4
Oral / Digestive	124	61,1
Inhalation/Respiratory	40	19,7
Dermal/Skin	21	10,3
Ocular	2	1
Other	1	0,5
Exposure type		
Ignored/Null	39	19,2
Acute-single	150	73,9
Acute-repeated	12	5,9
Chronic	2	1
Exposure at work		
Ignored/Null	16	7,9
No	114	56,2
Yes	73	36
Total	203	100%

Source: Information System for Notifiable Diseases. Pernambuco, 2007-2013.

structural and functional development of the brain, such as in childhood and adolescence, can result in severe damage to health, with changes that can manifest even during adulthood.²⁶ The record of intoxication in the elderly is also worrying, and the existence of cases of occupational exposure in this group represents a violation of the law.^{24,25}

Low education among rural workers has been observed in several studies.^{20,27-29} Individuals with low schooling and little technical qualification are more likely to come into contact with pesticides, as these are normally assigned to the most unhealthy jobs, which involve applying pesticides, preparing the syrup, washing contaminated packaging and equipment or washing clothes used in the application, increasing contact with the products.^{27,28} The presence of illiterates among intoxicated workers is very worrying and reveals a failure to comply with legislation, which prohibits them from manipulating pesticides of any nature.^{24,25}

In addition, having a low level of education makes access to information on pesticides difficult, such as that related to the instructions for use, safety recommendations and technical information about the product.^{22,27,28} It is noteworthy that, in July 2020, there was a change in the risk communication of pesticides, with the removal of the skull pictogram with two crossed tibias of labels and product inserts that have less potential to cause immediate death after acute exposure. With the removal of the universal poison symbol, which communicates toxicity/danger, workers with lower levels of education will be less able to understand the dangers related to the products to which they are exposed, which may have high potential and chronic health damage, despite less acute toxicity.³⁰

With regard to the situation in the labor market, informality in the field still stands out in relation to other sectors. The predominance of self-employed workers points to a greater precariousness of work, without the social protec-

Table 2 - Frequency of pesticide poisoning cases reported in Sinan among rural workers according to Health Regions. Pernambuco, 2007 a 2013.

HEALTH REGIONS	SUBSECTOR	LQ	CASES OF INTOXICATION	
			N	%
IX	Extraction of minerals	19,32	53	26,1
IX	Non-metallic mineral production industry	12,57	53	26,1
II	Footwear industry	12,48	2	1,0
VIII	Agriculture	6,71	43	21,2
IV	Textile industry	6,18	42	20,7
III	Food and beverage industry	5,35	4	2,0
XII	Food and beverage industry	4,92	19	9,4

Source: Notifiable Diseases Information System. Pernambuco, 2007-2013;¹⁰

explained by the fact that the functions in which there is greater contact with pesticides in agricultural work are performed mainly by men.^{15,16}

In relation to ethnicity, it is known that blacks and browns generally occupy precarious jobs and have lower pay, exercising primarily activities in the sectors of agriculture and livestock (60,8%), construction (63%) and domestic services (65,9%).¹⁷

The predominance of young adults of working age is similar to the findings of other studies^{14,18-21} in which a higher percentage of exogenous intoxications was observed in the age group between 20 and 39 years. The record of cases in adolescents indicates that there is work involving the handling of pesticides by children under 18 years of age^{22,23}, not complying with the current legislation.^{24,25} Exposure in critical periods for the

tion devices provided to salaried workers. The mechanization of agricultural production driven by agribusiness has affected family farmers, reducing the number of jobs and leaving several families without jobs, affecting adults and young people.^{28,31}

The present study revealed a prevalence of acute cases, in which the most important routes of exposure were oral and inhalation, in line with the findings of other studies.^{19,32} The dermal route is more important in chronic intoxication³² and in cases of occupational exposure.³³

The fact that 56% of the cases of pesticide poisoning in rural workers in this study do not have a direct relationship with work activity may suggest other types of exposure, such as environmental exposure. However, it is possible that there are also problems in the quality of the record, considering mainly: i) the high number of ignored and blank fields; ii) that the majority of workers are not formally inserted in the labor market, implying that, due to the precarious working conditions in the field, they may be exposed to pesticides in the domestic environment, often used as a storage place for chemical inputs. However, at the time of registration, the relationship with the job is not established. The presence of pesticides in the domestic environment can cause poisoning due to improper storage, reuse of pesticide packaging, spillage when transporting the product, or by ingesting accidentally contaminated food and water.³⁴

Only the VIII Health Region showed compatibility between the main productive aggregate of the territory (agriculture) and the highest proportion of intoxication records. However, it is important to consider that this apparent inconsistency can have several justifications: i) only the absolute number of cases was considered, which can be relativized considering the population differences between the Health Regions; ii) the determination of the QL is made considering only jobs in the formal sec-

tor, which does not represent the reality of work in the field, particularly in the cases analyzed in the present study, where the self-employed predominate; iii) the high underreporting of intoxication cases makes it difficult to delineate the profile from the productive aggregates.

The present study revealed a prevalence of acute cases, in which the most important routes of exposure were oral and inhalation, in line with the findings of other studies. The dermal route is more important in chronic intoxication and in cases of occupational exposure.

It is worth mentioning that the IX and IV Regions have agriculture as an important productive activity in the territory and production is highly dependent on chemical inputs. However, due to the high informality in the sector, the

analysis of productive aggregates based on the calculation of the QL shows discrepancies. In fact, work in agriculture presents several dangers, and serious accidents often affect workers in this sector, whether due to exposure to pesticides or the use of dangerous tools as basic work tools.¹⁰

It is also observed the underreporting of cases, because considering the precariousness of work in the field and the vulnerability of rural workers in the state, the expected number of records should probably be higher. This indicates the need to look carefully at these data, which can overestimate acute cases, whose signs and symptoms of intoxication are in general much more prominent and inflame the records in systems like Sinan, in comparison to chronic cases, and which did not have a relationship with work.²⁰

To improve the quality of exogenous intoxication notifications, one must invest in the permanent training and qualification of health professionals, at all levels, complexity of care services, considering the deficiency in investigations of human exposures, outbreaks of poisoning, in addition to the diagnosis of acute and chronic pesticide poisoning.²⁸

CONCLUSION

In Pernambuco, pesticide poisoning represents a serious public health problem, which impacts more severely those in greater vulnerability, such as rural workers, with low schooling, mixed race and informal.

The great underreporting and the low quality of the record, with a large number of blank and ignored fields in the exogenous poisoning notification forms, compromise both the quality of the information and the planning and execution of promotion, assistance and surveillance actions. Therefore, it is essential to make efforts to promote both the improvement of the identification and diagnosis of suspected cases and the improvement of the quality of data recording. ■

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