Use of pesticides in the sub-medium São Francisco Valley: Knowledge of rural workers in irrigated fruit cultivation

Uso de Agrotóxicos no Submédio do Vale do São Francisco: conhecimento dos trabalhadores rurais da fruticultura irrigada

Uso de plaguicidas en el submedio del Valle de São Francisco: Conocimientos de los trabajadores rurales en el cultivo frutífico de Riego

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RESUMO

Objetivo: Desvelar o conhecimento dos trabalhadores rurais da fruticultura irrigada do Vale do São Francisco sobre interações entre agrotóxicos e seus riscos à saúde. Método: Pesquisa qualitativa, descritiva e exploratória, realizada com trabalhadores da fruticultura irrigada de agosto a dezembro de 2023. Os instrumentos utilizados na coleta de dados foram as entrevistas semiestruturadas e questionários. As entrevistas foram submetidas à análise de conteúdo, resultando nas categorias temáticas: conhecimento sobre os agrotóxicos e classificação de risco, o uso dos equipamentos de proteção individual e a exposição aos agrotóxicos e efeitos na saúde Resultados: Os participantes eram majoritariamente do sexo masculino, jovens, pardos, com baixas renda e escolaridade, conhecem o conceito de agrotóxicos, porém desconhecem a classificação de risco e prejuízos gerados à saúde ao longo prazo, enfatizando somente efeitos agudos. Percebeu-se também o uso inadequado dos equipamentos de proteção individual e desconhecimento dos prejuízos de saúde advindos dessa prática. Conclusãos: Evidencia-se a necessidade de estratégias de capacitação, além de políticas de promoção e proteção de saúde dessa população.

Descritores: Agrotóxicos; Exposição ocupacional; Saúde do trabalhador rural; Saúde ocupacional.

ABSTRACT

Objective: to reveal rural workers' knowledge about complex interactions between pesticides and their health risks. Method: qualitative, descriptive and exploratory research, carried out with irrigated fruit farming workers from August to December 2023. The instruments used in data collection were semi-structured interviews and questionnaires. In the socioeconomic-demographic analysis, descriptive statistics were used. The interviews were transcribed and subjected to content analysis, resulting in thematic categories: knowledge about pesticides and risk classification, the use of personal protective equipment and exposure to pesticides and health effects. Results: The participants were mostly male, young, brown people, with low income and education, know the concept of pesticides, but are unaware of the risk classification and damage caused to health in the long term, emphasizing only acute effects, the inadequate use of personal protective equipment and lack of knowledge of the health damage resulting from this practice. Conclusions: The need for training strategies is evident, in addition to promoting and protecting the health of this population.

Descriptors: Pesticides; Occupational exposure; Rural worker health; Occupational health.

RESUMEN

Objetivo: revelar el conocimiento de los trabajadores rurales sobre las interacciones complejas entre los pesticidas y sus riesgos para la salud. Método: investigación cualitativa, descriptiva y exploratoria, realizada con trabajadores frutícolas de riego de agosto a diciembre de 2023. Los instrumentos utilizados en la recolección de datos fueron entrevistas semiestructuradas y cuestionarios. En el análisis socioeconómico-demográfico se utilizó estadística descriptiva. Las entrevistas fueron transcritas y sometidas a análisis de contenido, resultando en categorías temáticas: conocimientos sobre plaguicidas y clasificación de riesgo, uso de equipos de protección personal y exposición a plaguicidas y efectos en la salud.Resultados: Los participantes fueron en su mayoría hombres, jóvenes, morenos, con bajos ingresos y educación, conocen el concepto de plaguicidas, pero desconocen la clasificación de riesgo y los daños que causan a la salud a largo plazo, destacando sólo los efectos agudos, el uso inadecuado de equipos de protección personal y el desconocimiento de los daños a la salud resultantes de su uso. esta práctica. Conclusiones: Es evidente la necesidad de estrategias de capacitación, además de promover y proteger la salud de esta población.

Descriptores: Pesticidas; exposición ocupacional; Salud de los trabajadores rurales.

ORIGINAL

Introduction

Modern agriculture is one of the fundamental pillars of the global economy, responsible for the food supply of the world's ever-growing population. However, this increasing productivity is intrinsically related to the intensive use of pesticides, chemical substances used to mitigate disease-causing pests that affect crops.[1]

Although pesticides have been shown to be effective in protecting agricultural production, their indiscriminate use raises concerns in the areas of public health, environmental and social issues. In Brazil, the indiscriminate use of pesticides finds fertile ground, given the intensification of the agrarian structure, directed to export monocultures, which require large-scale production.[2]

Both acute and chronic exposure to pesticides culminate in overwhelming adverse effects on human health, including: immunotoxic, nephrotoxic, neurotoxic, carcinogenic, teratogenic, mutagenic effects, in addition to leading to endocrine disruption, impairment of fertility and development, among others.[3,4] Rural workers, who play an essential role in agricultural production, are constantly exposed and vulnerable to the risks and effects of a range of substances present in pesticides.[2,3]

Risk perception is a multifaceted construct that reflects workers' subjective assessment of the dangers associated with pesticide use, as well as their beliefs about the benefits and negative impacts of these products. This perception is influenced by a variety of factors, including education level, experience in the field, risk communication, and the availability of information. In the national context, there is little technical support offered to farmers, which results in the adoption of improper rural practices and, consequently, greater exposure to pesticides.[5,6]

Understanding the aspects that involve this practice is essential for the elaboration and improvement of public policies, as well as for the proposition of safer, more sustainable and adequate alternatives to the demands of the communities.[7] Thus, the guiding question of this research is: What is the knowledge of rural workers about pesticides and their implications on health?

Thus, the present study aims to unveil the knowledge of rural workers in irrigated fruit growing in the sub-middle of the São Francisco Valley about complex interactions between pesticides and their health risks.

Method

This is a descriptive and exploratory research, with a qualitative approach, carried out in a Rural Workers Union in the municipality of Petrolina-PE, located in the sub-middle of the São Francisco Valley. The study participants were rural workers of irrigated fruit growing, who use pesticides in their work activities.

The São Francisco Valley is a developed region on the banks of the São Francisco River and its tributaries. It is located in the states of Minas Gerais, Bahia, Pernambuco, Sergipe and Alagoas. The region of the Submedian of the São Francisco Valley, which has as cities Petrolina (PE) and Juazeiro (BA), has about 120 thousand irrigated hectares. It is considered an important region

because it encompasses one of the main irrigated horticultural areas in the country. Today, it is one of the country's agricultural production regions that achieves the highest export rates.[8]

For data collection, a semi-structured interview was used, in which a script of questions was elaborated, based on the guiding question of the research. The following inclusion criteria were considered: rural workers in irrigated fruit farming, over 18 years of age, of both sexes, who work with pesticides, unionized, all participants in this research signed the Free and Informed Consent Form (ICF). Workers under 18 years of age were excluded, as well as those who were not union members. For the socioeconomic and demographic characterization, a specific questionnaire was developed.

The workers were contacted while waiting for periodic health care at the Union's headquarters and invited to participate in the study. After acceptance and signing of the informed consent form, the interviews were conducted individually, in a private place, on a day and time, according to the worker's availability.

The interviews took place between August and December 2023, totaling 20 interviewees. After each recorded interview, the speeches were transcribed in full, and the letter T was assigned followed by the number in ascending order of the participants, ensuring confidentiality and anonymity. The definition of this sample met the criteria of information saturation, which was identified by the repetition and homogeneity of the answers, and was soon interrupted when the conceptions, explanations and meanings attributed by the participants began to have similarity and regularity of presentation.[9]

Socioeconomic and demographic information were consolidated and tabulated in Excel 2010®. Data were presented and analyzed using descriptive statistics. The interviews were transcribed and organized in tables in the Microsoft Word® program and submitted to content analysis, a method in which the following steps are performed: Pre-analysis, exploration of the material, treatment of the results obtained.[10]

After the individual analysis, the transcription of the interviews allowed a dive into the experience of rural workers, from which emerged the thematic categories of analysis that made up the corpus of discussion of this work: "Knowledge about pesticides and risk classification", "Use of personal protective equipment" and "Relationship between exposure to pesticides and health".

This study was approved by the Human Research Ethics Committee of the State University of Bahia, under CAAE opinion: 66049822.4.0000.0057, and strictly followed the ethical guidelines for research involving human beings, obtaining the informed consent of all participants and ensuring their confidentiality and anonymity.

Results

Table 1 shows the socioeconomic characterization of the study participants. of study participants. Of the 20 participants, 11 (55%) were male and 9 (45%) were female. The age range of the patients who participated in the study ranged from 23 to 54 years and most lived in the rural area of the municipality where the study scenario is located. Regarding self-reported skin color, 14 (70%) said they were brown (70%), 3 (15%) were black, and 3 people

(15%) said they were white. The workers' ages ranged from 23 to 54 years, with a mean age of 39 years.

Of the participants in this study, 50% were married or in a stable union, 8 (40%) were single, 1 (5%) was widowed, and 1 (5%) was divorced. Regarding schooling, 11 (55%) participants had not completed elementary school, 1 (5%) had completed elementary school, 6 participants (30%) had completed high school, and 2 (10%) workers reported not being literate. Family income ranged from one to two minimum wages, and 90% of them received one minimum wage.

As for the length of time working in agriculture, it was found that this period ranged from 2 to 35 years. In relation to working hours, there was a variation of 8 to 10 hours per day.

Table 1 – Socioeconomic characterization of rural workers in irrigated fruit growing in Petrolina, PE.

Socioeconomic Characteristics	**N**	**(%)**
Gender		
Male	11	55%
Female	9	45%
Self-reported color		
White	3	15%
Black	3	15%
Brown	14	70%
Monthly income		
Up to 1 salt. Minimum	18	90%
Between 1 and 2 Salt. Minimum	2	10%
Marital Status		
Married	10	50%
Divorced	1	5%
Single	8	40%
Widower	1	5%
Education		
Incomplete Elementary School	11	55%
Complete Elementary	1	5%
Complete High School	6	30%
Illiterate	2	10%

From the content analysis based on Bardim (2011) model, the thematic categories that made up the corpus of discussion of this work emerged. 3 categories were identified and analyzed, represented through the fragments of the interviewed workers' speeches:

Category 1: pesticide use: the knowledge of rural workers

During the interviews, when asked about what pesticides are, it is clearly observed that there is a consensus, pesticides are known as "poison", as observed in the following statements:

> *T1: What we understand is that pesticides are poisons that are used to apply to insects, they are fertilizers to kill pests.*

> *T3: Pesticides are poisons that we use in the plantation to avoid pests in the fruits. We use it to control and produce well.*
> *T7: Pesticide is a poison that is applied to plants against pests, but that harms the health of every living being, both the pests and the worker who uses it or who eats the fruit and that greatly harms health*

Grape monoculture (70%) and mango (30%) are the main cultivars in the region where the rural workers interviewed work.

The most frequently mentioned class of pesticides was organophosphates. Among the commercial names of pesticides mentioned, Dormex (cyanamide) stands out, followed by Ethrel (2-chloroethylphosphonic acid - ETEFOM) and Vertimec (abamectin), in addition, the workers stated that they practice the mixture of several of these chemical compounds.

Regarding the risk classification of the pesticides handled, there is insufficient knowledge of the workers, described in the following statements:

> *T15: It's because there isn't just one, there's a mixture of three or four, as far as I can remember there's dormex, sulfur and... oh, there's also vermitec (Vertimec)... Now I don't remember all of them, there's a risk, but I don't know what it is, it's that paper with the colors, isn't it?*
> *T10: There are several, we use many at once, it's never just one... I don't remember the risk, I don't know the risk.*
> *T8: There are many, there's Dormex, Etrhel, we use more of those, with the mixtures.*
> *S19 So, we don't use just one there, in my head so I remember dormex, sulfur, vermitex, it's a lot, they're all high risk I think.*

Category 2: Use of personal protective equipment (PPE)

Regarding the mandatory use of PPE, it was possible to observe that most workers use this protection minimally, especially when there is supervision by the company. Three interviewees reported partially using PPE, because its use causes discomfort, especially in the region where the climate is typically hot, according to the discourses:

> *T20: We wear boots, hats and glasses, but sometimes because the heat here no one can stand it.*

> *T4: I wear a cap, boots, gloves, that's all. I sometimes wear the mask when the person in charge comes.*

> *T6: Glove, glasses, hat, it's very rigid, if you don't wear it, you get a warning, from time to time we take it off because it bothers you, but the right thing is not to take it off, most of them take it off, it's difficult to find everyone (workers) wearing it.*

> *T12: It's mandatory to wear them, the company gives them, it's a hat, boots, overalls and gloves, they also give me glasses and a mask, but I don't use them all, only when the inspection comes there you have to put it on.*

Category 3: Relationship between pesticide exposure and health

Regarding the symptoms of poisoning due to direct exposure to pesticides, it was questioned whether the worker had manifested any specific physical symptoms immediately during the manipulation and/or application,

during the performance of the work or later up to 48 hours. Acute symptoms such as headache (headache), itchy skin (pruritus), dizziness (vertigo), sneezing, nausea and vomiting were mentioned, as shown in Table 2.

Table 2. Symptoms reported by rural workers exposed to pesticides in irrigated fruit growing in Petrolina – PE, 2023.

REPORTED SYMPTOMS	N (%)
Headache	17 (85)
Itchy skin	14 (70)
Dizziness	12 (60)
Sneezing	15 (75)
Nausea and vomiting	8(40)

With regard to knowledge about the risks of pesticide use to health, there was a unanimous conception that they cause harm to health, but they did not know how to discuss the chronic effects of long-term use, addressing in most of the statements about symptoms of acute intoxication, as shown in the following statements:

> *S1: It's bad, my daughter! I know it does, not now, but we're still going to reach a lot of people with cancer, skin problems, kidney and liver problems, it's very bad... We work because it's the way to do it, don't we?*
>
> *T17: The health of those who work here, you know, you can look for it that it's bad, there are a lot of people with back pain, headaches, our lungs are weaker, you know? When we get the flu we realize it and the doctor has also told me to get out, I'm going to see something else for me to do, health first.*
>
> *T14: People who work in the fields don't have good health, poison is bad, who doesn't know that? I've been in this life for many years, we spend a lot of time in the sun, all day long, it's a lot of poison too, when you're applying another area, the wind brings you all over, there's no way not to feel it, it's sneezing, headache, even vomiting.*
>
> *T3: When you apply it's at night, but in the morning when you arrive you still feel it, it's bad, the smell doesn't, but the itching on the skin says it all, it gives you a headache, dizziness. There were some colleagues from the village (Agrovila) who left because they had a kidney problem, then they are out of work because they have to undergo treatment.*

Discussion

The socioeconomic and demographic profile of the participants in this study is similar to other national and international studies,[11,12,13] which denote a prevalence of males, low schooling and low income. It is notorious that the level of education of the study participants is unsatisfactory, this situation implies a worsening of critical judgment and perception of risks, since low education can hinder the understanding of the importance and care needed in the handling of pesticides, making this population vulnerable and susceptible to the indiscriminate use of pesticides and greater human exposure.

Regarding self-reported skin color, the predominance of brown skin color corroborates a previous study that reported a prevalence of 65% of brown color among rural workers in the northern region of Brazil.[14]

Regarding income, the data are similar to a survey conducted in the same study region, in which 85.4% of rural workers only receive up to 2 minimum wages. Low income has repercussions on the quality of life of rural workers, as well as on their access to goods and services and health care.[15]

Regarding the length of time working in agriculture, a study conducted by Pessoa et al.[16] showed that 15.9% of the workers reported applying pesticides between 6 and 10 years, and 21.8% reported having applied pesticides for 16 years or more. In a study conducted by Buralli et al.[17], it was reported that more than 70% of rural workers had been working with crops for 27 years. These findings are feasible with what the present study shows, with regard to the time that these workers have been working in agriculture.

This is of great importance since the health effects due to exposure do not depend only on the toxicity of the active ingredients, but also on the amount of the product absorbed and the exposure time.[18] As for the exposure time in daily hours, 7.01 hours were recorded, similar times were recorded by Martins et al.[19] who found that 52.08% of agricultural workers remain in activity for more than 6 hours a day. To refer to pesticides, the workers attribute the term poison, corroborating previous studies [17, 20].

In Brazil, pesticides are commonly referred to as phytosanitary, agrochemical, pesticide, biocidal and pesticide, the latter being used by the business sector as a rhetorical maneuver, loaded with marketing intentionality to hide their harmful effects, aiming to convince rural workers that these products act only to prevent the action of organisms that could cause economic damage. concealing the risks inherent in the use of these substances to the environment and human health.[17, 20]

The most widely used classes of pesticides in the region are organophosphates, which represent the main class of insecticides involved in cases of poisoning. These substances in contact with workers cause elevated acetylcholine levels, leading to neurotoxicity depending on the dose and route of exposure involved. In Brazil, they are the main responsible for high numbers of acute poisonings and recorded deaths. The participants in this study did not know how to classify the risk of these substances used in their activities. This finding reveals the vulnerability of this population, since they are unaware of the risks, and their protection and self-care practices are neglected.[20,21,22]

The use of pesticides has serious consequences for the environment and health. Studies point to associations of pesticides with various health problems,[13,23,24] with emphasis on countries with agribusiness development, where the economy depends on agricultural production based on the use of pesticides,[16] which has even become a public health problem[12] that mainly affects rural workers.

As in the present study, the research by Viero et al.25 showed that rural workers who handle pesticides generally deny a direct association between these products and health problems, showing that they do not use personal protective equipment properly.

Often, these farmers are in a work environment without the proper use of PPE and exposed to a greater possibility of acute and chronic symptoms resulting from direct or indirect contact with pesticides.[25]

The scientific literature also describes that the acute effects of short-term exposure to pesticides are in the form of poisoning with apparent reactions, perceived in the first 24 to 48 hours after contact. The findings of the research

corroborate other studies that evaluated exposure to pesticides and their effects on human health. These studies found several acute effects, such as: nausea, vomiting, weakness, muscle spasm, tremor, gastrointestinal symptoms, cardiac arrhythmia, convulsion, fainting, shock, coma, and even death. [1,13,22, 25]

In the present study, it was explicit that the workers identified symptoms of acute exposure, but were unable to report the damage caused by long-term exposure. Chronic effects result from long-term exposure to smaller doses of one or more chemicals and appear days, months, years (or even generations) after exposure. Therefore, it is more difficult to perceive and establish a causal relationship between exposure and chronic diseases. [13,22,23, 25]

Conclusion

This study allowed us to identify the knowledge of rural workers about the use of pesticides, in addition, it was possible to know the most common pesticides used in the region, and the description of symptoms of acute poisoning reported by the agricultural workers participating in this study.

In this research, the participation of the subjects in the search for production and knowledge will support the elaboration of alternative management plans capable of transforming the reality presented here. It should also be noted that the data obtained in the present study reflect information provided at a given time, and are subject to temporal and sociocultural factors that may interfere with future observations.

As a limitation of the study, it is important to emphasize that qualitative research, with narrative interviews of experience, can generate rich data, however, the sample is generally limited in size and may not be representative of the entire population of rural workers exposed to pesticides. Therefore, the results should be interpreted considering these limitations.

From this perspective, the realization of educational campaigns in the region and the elaboration of planning policies about the possible effects of pesticides on health are essential, because in addition to reducing the vulnerability of these workers, it aims at prevention, control and quality of life of rural workers.

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