

PESTICIDE POISONING: RECORDS OF A TOXICOLOGICAL ASSISTANCE SENTINEL SERVICE

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ABSTRACT

In surveillance of populations exposed to pesticides is important the role of the national network information centers and toxicological assistance to produce reliable data on poisonings. The aim of the study was to characterize pesticide poisoning reported to a poison control center of Parana, through retrospective analysis of Toxicological Occurrence epidemiological forms of 1240 individuals with diagnosis of acute or chronic intoxication by pesticide from 2003 to 2011. Sex and age of the victims were checked, classification of chemical pesticides, circumstance, severity and outcome of events. Data were tabulated in Excel 2007 software spreadsheet and analyzed by simple descriptive statistics. The average was 138 poisoning/year. The profile of poisonings pointed predominance of working-age male; especially the agricultural professions and the presence of child and elderly labor; high incidence of poisoning by cholinesterase inhibitors insecticides and most cases were reported by hospitals; higher percentage of poisonings deaths in the intentional condition; and high cure proportion. However, high rates of admission to intensive care and lethality indicated severity of the cases.

Keywords: Poisoning. Pesticides. Disease notification.

INTRODUCTION

Brazil, one of the largest agricultural producers in the world, is increasingly dependent on consumption of pesticides for agricultural cultivation, is also one of the world's leader on consumption of pesticides; in the years 1972 to 2000, the amount of active pesticide ingredients marketed increased 4.3 times. Out of the 50 chemicals most used in agriculture in the country, 22 are prohibited by the European Union and in the United States and remain being used in Brazil, despite the risks to human health and to the environment¹.

As a result of this increased consumption and use of highly toxic products, it is observed that, on the country's records systems, poisoning by pesticides of different classes are increasing. This phenomenon brings challenges to the

government, for the implementation of devices focused on coping it, especially health services, rural extension and food security.

The pesticide poisoning is considered a serious public health problem, especially in emerging and developing countries. They are usually conditioned to the chemical structure, action mechanism and active ingredient, type and intensity of exposure to the product, but the inappropriate use of the products, the lack of personal protective equipment use and the precariousness of surveillance mechanisms are factors associated to the occurrence of cases^{2,3}.

According to the National System of Toxic-Pharmacologic Information - SINITOX 7676 cases of poisoning involving agricultural and household pesticides in 2010 occurred; out of these, 203 evolved to death with a mortality rate of 2.64 %⁴. Since the state of Paraná is the third largest consumer of pesticides in Brazil,

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poisoning cases frequently occur and are scattered all over the state⁵.

From the 1990s, there was an increase of Brazilian research on the impact of pesticides on human health, however one of the problems is the lack of reliable data on poisonings, because although intoxication is considered a compulsory notification event, it is estimated that the records represent only 20% of occurred cases¹. Given this underreporting frame and epidemiological emptiness, data from information centers and toxicological assistance - CIAT are considered sentinels of the event and carriers of its social problems.

The CIAT are specialized units with the role of information supply and telephone guidance on diagnosis, prognosis, treatment and prevention of poisoning, personal assistance to the intoxicated at any level of complexity, achievement or viability of toxicological emergency and routine analyzes for the diagnosis and monitoring of poisoning, and record of treatment and availability of data, such as surveillance strategy of poisoning or toxicovigilance⁶.

In this context, the purpose of this study is to characterize the pesticide poisoning reported to an information center and toxicological assistance of Paraná in a period of nine years.

MATERIAL E MÉTODOS

It is a documentary study and quantitative approach, with retrospective analysis of epidemiological forms of Toxicological Occurrence (OT) of pesticide poisoning, filed in the Poison Control Center at the Regional University Hospital of Maringá - CCI / HUM.

The studied population was represented by individuals with a diagnosis of acute or chronic poisoning by pesticides and registered at the CCI/HUM from January 2003 to December 2011. The medical diagnosis was confirmed after reporting exposure to pesticide, laboratory tests or registration of clinical manifestations. For confirmation of the case, they were admitted to clinical and epidemiological criteria - the existence of signs and/or symptoms and history of compatible exposure; or clinical and laboratory - the existence of signs and/or symptoms and results of compatible exams; or

confirmed reports of contact, even without clinical manifestations, considered as exposure^{6,7}.

The data collection was carried out by documentary analysis and the variables compiled from OT forms were: gender - male and female; age - in four age range (zero to 10 years old, 11-19 years old, 20 to 59 years old and 60 years old or more); circumstance of intoxication - suicide attempt, accidental and occupational; classification of pesticides according to the chemical class - pyrethroid insecticide, organophosphate pesticide, carbamate pesticide, herbicide, and others; severity of intoxication, according to the medical care at an emergency room (less than twelve hours of clinical observation), hospitalization (more than twelve hours of clinical observation), and intensive care; and outcome of cases - healing, healing with sequel and death.

The characteristics were defined as in the Guide for Notification and Service Form of Toxicological Assistance Centers which establishes guidelines for standardization of concepts and registration forms nationally, with categorization of ten epidemiological and clinical parameters for data collection. In this research, we selected defining parameters for patient identification, the type of care, toxic agent, treatment and outcome⁴.

The degree of poisoning severity was established from the attention level used to treat the intoxicated: understanding the gravity of the event implies the complexity of care. Three levels of care were established for treatment - clinical observation, ward hospitalization and intensive care hospitalization, relating them to three degrees of severity - mild, moderate and severe^{8,9}. (Table 1)

Table 1. Graduation system of pesticide poisoning severity.

| Intoxication gravity degree | Level of attention |
|-----------------------------|--|
| Mild | Clinical observation for a period ≤ 12 hours |
| Moderate | Hospitalization for a period ≤ 12 hours |
| Severe | Intensive care hospitalization |

Adapted from BURIOLA, OLIVEIRA (2009).

The data were transferred, coded and plotted in Excel Software 2007 spreadsheet, with subsequent descriptive analysis (average, absolute and relative frequencies) and discussion with the relevant scientific literature.

In the case of secondary data, the release for public use of epidemiological data from the records of the CCI/HUM was requested, and the study was approved by the Ethics Committee on Human Research of the State University of Maringá (COPEP/UEM) opinion number 78630/2012.

RESULTS AND DISCUSSION

Pesticides can cause; a) acute poisoning, in which the signs and symptoms appear suddenly; b) chronic poisoning, characterized by late manifestation, from small, moderate and continuous exposure, with association to chronic diseases; c) and subacute toxicity associated to moderate exposure, with subjective and vague signs and symptoms - headache, stomach pain, muscle weakness and drowsiness, among others^{3,10}.

Considering that most of pesticide poisoning are detected after continuous exposure, classified as chronic or subacute, the workers do not know the risks of exposure and, usually do not relate the use of products to the clinical sign and symptoms presented, mostly diffuse and nonspecific¹. Intoxicated, then, constitute a population of difficult access and/or occult (hidden population)², and, since it is not a countable population, cannot get/produce a registration of intoxicated by pesticides in a given location.

In the investigated period, were notified to the CCI/HUM 1240 cases of pesticide poisoning, with an annual average of 138 cases and one case every three days. Regarding gender and age range of intoxicated, the poisonings stood out in males, 827 cases (67%), aged between 20-59 years old, 854 cases (68%). However, considered high rates were found in the age groups from zero to 10 years (151-12 %) and over 60 (73-6 %). (Table 1)

Agricultural work is usually linked to social relations that structure the family, involving values and differentiation of roles and hierarchies, designating to males the task of

caring the soil directly, exposing men to greater risk of poisoning by pesticide use. Rural salaried or temporary workers, regardless of gender, presented higher probability for pesticide poisoning¹. Tasks as the tank filling and mixing the substance, typically associated with females, have contributed to the explanation of the female findings.

Also, the literature reveals wide variations in the age groups of people poisoned by pesticides, demonstrating that all ages are susceptible to poisoning, which occurs more frequently in the productive age and economically active population, justified by the greater access of workers to the product^{1,5}.

Regarding intoxication in adolescence and childhood, it shows an increase in this type of occurrence, presented as cause of attendance in emergency room, hospitalizations and increase in morbidity and mortality rates. One of the reasons pointed to raise these occurrences is the easy access and inappropriate storage of the products in a general way, and the consequent accidental exposure, but the involvement of children and teenagers in dangerous and unhealthy activities should serve as a warning for actions in the field of Worker's Health and Child Labor^{5,8,11}.

Regardless of intoxication in childhood, this question must be enhanced in future studies, because the state of Paraná has a predominantly agricultural economy. It is believed that teenagers are entering prematurely in activities related to the use and application of pesticides^{2,11}.

Regarding the elderly, the distribution of cases showed little variation between occupational circumstances, accidental and suicide attempt (Table 1). Population aging is one of the greatest triumphs of humanity and also a major challenge for society, for the decline of cognitive function compromises the security of individuals, leaving them more susceptible to many situations of risk to health. In Brazil, between 1980 and 2005, the average rate of intoxication was 4,12/100,000 elderly, with a tendency to rise among men and decline among women, and progressive increase with advancing age in both gender^{1,12}.

Regarding the circumstances of poisoning, 566 cases (46%) originate from suicide attempts,

352 (28%) of individual accidents and 322 (26%) occupational accidents, with male predominance in all circumstances, and for accidental circumstance, children from zero to 10 years of age. Suicide with these products is

considered an important cause of mortality in Brazil, and it is considered by the World Health Organization as a growing public health problem¹³. (Table 1)

Table 1. Distribution of poisoning by pesticides according to patient's age and gender and circumstance of intoxication. CCI/HUM, 2003-2011.

| AGE (years) | GENDER | | CIRCUMSTANCES | | | | |
|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|------------------|--------------------|
| | | | SA ^A | | AP ^B | | OP ^C |
| | | | n (%) | | n (%) | | n (%) |
| | M | F | M | F | M | F | TOTAL n (%) |
| 0-10 | - | - | 82(36,8) | 67(51,9) | 2(0,7) | - | 151(12,2) |
| 11-19 | 38(11,9) | 63(39,5) | 24(10,8) | 15(11,7) | 20(7,0) | 2(5,7) | 162(13,0) |
| 20-59 | 261(82,4) | 185(74,3) | 94(42,1) | 41(31,8) | 248(86,4) | 25(71,4) | 854(68,9) |
| >60 | 18(5,7) | 1(0,4) | 23(10,3) | 6(4,6) | 17(5,9) | 8(22,9) | 73(5,9) |
| TOTAL | 317(100,0) | 249(100,0) | 223(100,0) | 129(100,0) | 287(100,0) | 35(100,0) | 1240(100,0) |

Subtitle: A: Suicide attempt; B: Accidental poisoning; C: Ocupacional poisoning.

This may be associated with the population knowledge about the high toxic power of these substances associated with easy access, making them a dangerous weapon for those who attempt suicide. Pesticides are the most common means of intentional intoxication in most rural areas and are associated with high rate of mortality⁸.

Among the suicide attempts, 317 (56%) were male. Suicidal behavior between men and women differs in choice and way to reach death; men generally prefer to commit suicide using more aggressive methods such as hanging, firearms, while women prefer slow methods such as suffocation and poisoning. However, male behavior can vary in pesticide poisoning, since these agents are considered "strong" and lethal^{1,14}.

In Brazil, rates of people over 45 years of age who kill themselves are higher than in younger and older people, and the elderly attempt suicide less often than young people, but succeed more often, accounting for over 25% of suicides¹⁴.

Occupational poisonings involving farm workers, exposed to higher risk of intoxication because of intense contact with pesticides in activities, such as transportation, storage, preparation of mixtures, application, equipment cleaning and the disposal of empty containers. The exposure among farm workers is actually high, and the literature is full with studies that corroborate to the existence of the risk to become ill because of this scenery^{1,15}.

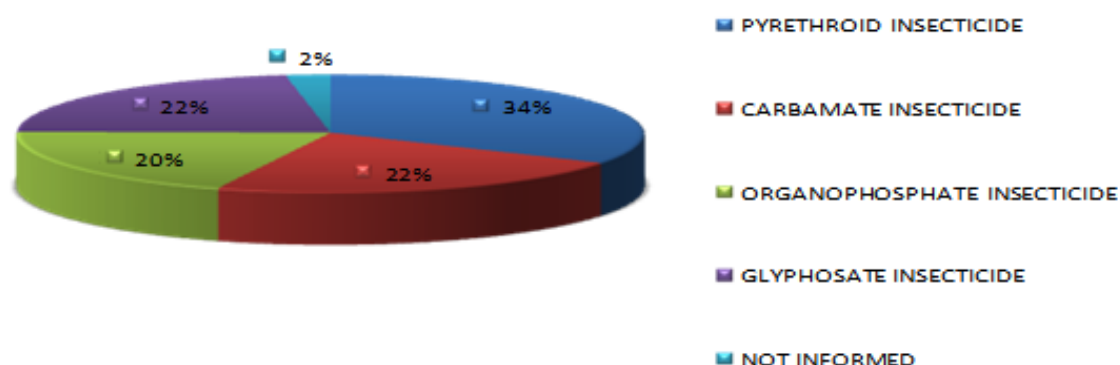


Figure 1. Distribution of pesticide poisoning according to toxic agent. CCI/HUM, 2003-2011.

With regard to chemical classification of pesticides, cholinesterase inhibitors insecticide -

carbamates and organophosphates - accounted for 519 cases of poisoning (42%), followed by

pyrethroid insecticides, with 416 cases (34%), and glyphosate herbicide, with 278 cases (22%), different from national casuistry. (Graph 1)

The cholinesterase inhibitors pesticides are compounds that inactivate plasma and erythrocyte acetylcholinesterase, enzymes responsible for the neurotransmitter degradation of acetylcholine in the synaptic gap, increasing acetylcholine levels and consequently causing acute cholinergic syndrome, whose severity depends on the toxicity of the compound, the dose and the route of exposure involved in the occurrence^{10,16}.

Organophosphate pesticides contain the phosphorus group in the molecule, and, therefore, are absorbed quickly by all routes (oral, dermal and respiratory). Additionally, cholinesterase inhibitors are irreversible, but do not accumulate in the human body, being easily degraded and excreted. Cause certain symptoms, such as bradycardia, hypotension, diarrhea, muscle fasciculation, respiratory failure, seizures, miosis, salivation, always at high risk of death^{10,16,17}.

A second group of insecticides agents was the pyrethroid class; natural insecticide obtained from crushing flowers of some plants belonging to the *Compositae* family. After the exposure of individuals to these products, hypersensitivity reactions are detected, neurological effects, and cardiovascular manifestations. These substances when continually used and by chronic exposure, alter the balance of endocrine functions and may interfere in the development of organs and tissues during the prenatal period, blocking or mimicking the action of endogenous hormones, and the fetal and neonatal periods are considered particularly susceptible to the toxic effects^{18,19}.

Herbicides are the most used group of pesticides in the world and are used extensively in agriculture to control weeds. Stands out the Glyphosate, which accounts for about one third of the total volume of pesticides sold in Brazil, with an estimated consumption of 200 million liters per year. It is used in a wide variety of crops such as soybean, wheat, corn, cotton, beans and rice²⁰.

Regarding the severity of cases, it was found that 611 cases (43%) needed

hospitalization for more than 12 hours and 116 (9%) were admitted to intensive care units (ICU). Of these, 101 (87%) occurred in suicide attempts, and 19 of them (16%) died. (Table 2)

From these parameters, the poisoning is classified into *fatal* when the patient progresses to death; *severe* when the patient remains hospitalized in highly complex units - emergency or intensive care, and evolves with critical symptoms and risk of death; *moderate*, with hospitalization in average complexity units, wards and emergency care; and *mild* when they are treated in primary care settings or when the family only receives guidance for symptomatic and household measures, since the intoxicated shows symptoms that resolve spontaneously⁹.

Considering the complexity level of care required after the poisoning, there were a significant number of cases that required more complex levels of care and stood out the severity of the cases by the admissions in levels of attention to health of medium and high complexity. The ICU stay, with the use of technology and human resources to treat critically ill patients, is an essential life support to individuals with serious poisoning with imminent risk of death, and can be used alone as an indicator of severity of cases²¹.

Of the 1240 cases studied, 1200 (96.0 %) were discharged and evolved to healing, which may indicate appropriate care to victims and success in the clinical management, including measures of inactivation of the toxic agent in a timely manner, because the initial approach should be quick and proper, and rapid diagnosis and early treatment is crucial in the clinical course and outcome of cases. Pesticides alone are not lethal; the fatality rate is directly proportional to the amount of product consumed, exposure time, frequency of intake, to the composition and the product's mechanism of action, individual susceptibility and early treatment¹³.

Regarding the deaths, the number of victims, confirms that pesticide poisoning are serious events. The deaths also, can be related to late diagnosis, especially in cases of attempted suicide where the patient performs the act alone^{13,21}.

Table 2. Distribution of pesticide poisoning according to circumstances, unit of treatment and outcome of cases. CCI/HUM, 2003-2011. (n = 1232).

| VARIABLES | CIRCUMSTANCES | | | |
|------------------|--------------------------|--------------------------|--------------------------|--------------------|
| | SA ^A n (%) | AP ^B n (%) | OP ^C n (%) | TOTAL n(%) |
| ICU | 101(18,2) | 14(4,0) | 1(3,0) | 116(9,3%) |
| WARD | 336(60,4) | 145(41,2) | 130(39,2) | 611(48,9%) |
| OBSERVATION | 119(21,4) | 193(54,8) | 201(60,5) | 513(41,8%) |
| CURE | 523(94,1) | 348(98,9) | 329(99,1) | 1200(96,7%) |
| DEATH | 19(3,4) | 3(0,8) | - | 22(1,8%) |
| CURE WITH SEQUEL | 10(1,8) | - | - | 10(0,8%) |
| NOT INFORMED | 4(0,7) | 1(0,3) | 3(0,9) | 8(0,7%) |
| TOTAL | 556(100,0%) | 352(100,0%) | 332(100,0%) | 1240(100%) |

Subtitle: A: Suicide attempt; B: Accidental poisoning; C: Ocupacional poisoning.

CONCLUSION

Problems of internal and external matter in studies based on secondary data bank are usual in Brazil. For this study, the sampling process occurred intentionally, with selection of individuals based on criteria considered typical of a studied population. However, it is reiterated that the data from information and toxicological assistance centers are considered sentinels gathering social problems of toxicological events.

The profile of poisonings pointed predominance of cases in males at working-age; stood out the occupations involving agricultural work and presence of child and elderly labor; which has higher risk to intoxication; high incidence of poisoning by cholinesterase inhibitors pesticides; high percentage of poisoning and deaths with intentional condition; high level of cure, although the high rates of

admission to intensive care unit and lethality indicate severity.

The data suggest that there is impact on the use of pesticides in different population groups and not only in those who work directly with the product. In this sense it is necessary that actions be taken to decrease the use and the execution of a control program for the marketing of such products. This profile provides the need for prevention strategies, specific control and intervention, as in every circumstance of intoxication, the action and management measures require differentiated treatment.

Health professionals need to be qualified and seek to develop prevention, a priority for the organization of an information system which allows knowing the profile of health and illness from exposure to pesticides to promote the surveillance of populations exposed to pesticides. It is suggested, yet, more studies of this nature in order to deepen the theme and subsidize health promotion, prevention and treatment.

INTOXICAÇÕES POR AGROTÓXICOS: REGISTROS DE UM SERVIÇO SENTINELA DE ASSISTÊNCIA TOXICOLÓGICA

RESUMO

Na vigilância das populações expostas a agrotóxicos, é relevante o protagonismo da rede nacional de centros de informação e assistência toxicológica para produção de dados confiáveis sobre as intoxicações. O objetivo do estudo foi caracterizar as intoxicações por agrotóxicos reportadas a um centro de assistência toxicológica do Paraná, por meio de análise retrospectiva de fichas epidemiológicas de Ocorrência Toxicológica de 1240 indivíduos com diagnóstico médico de intoxicação aguda ou crônica por agrotóxicos, registrados no período de 2003 a 2011. Foram verificados sexo e idade das vítimas, classificação química dos agrotóxicos, e circunstância,

gravidade e desfecho dos eventos. Os dados foram tabulados em planilha no *Software Excel 2007* e analisados por estatística descritiva simples. A média foi de 138 intoxicações/ano. O perfil das intoxicações apontou predomínio do sexo masculino e em idade produtiva; destaque para as profissões agrícolas e a presença de trabalho infantil e do idoso; alta incidência de intoxicação por inseticidas inibidores das colinesterases e maioria dos casos notificados por unidades hospitalares; maior percentual de intoxicações e óbitos na circunstância intencional; e maior proporção de cura. No entanto, elevadas taxas de internação em terapia intensiva e a letalidade indicaram gravidade dos casos.

Palavras-chave: Envenenamento. Praguicidas. Notificação de doenças.

INTOXICACIÓN POR PLAGUICIDAS: REGISTROS DE UN CENTRO DE SERVICIO CENTINELA

RESUMEN

En el cuidado a los individuos expuestos a los pesticidas, es relevante el protagonismo de la red nacional de centros de información y atención toxicológica para la producción de datos confiables sobre las intoxicaciones. El objetivo del estudio fue caracterizar las intoxicaciones por pesticidas referidas a un centro de atención toxicológica de Paraná, por medio del análisis retrospectivo de fichas epidemiológicas de la Presencia Toxicológica de 1240 individuos con diagnóstico médico de intoxicación aguda o crónica por pesticidas, registrados en el período de 2003 a 2011. Fueron verificados sexo y edad de las víctimas; clasificación química de los pesticidas y circunstancia; gravedad y desenlace de los eventos. Los datos fueron puestos en tablas en la planilla de *Software Excel 2007* y analizados por estadística descriptiva simple. El promedio fue de 138 intoxicaciones/año. El perfil de las intoxicaciones señaló predominio del sexo masculino y en edad productiva; destaque para las profesiones agrícolas y la presencia de trabajo infantil y del anciano; alta incidencia de intoxicación por pesticidas inibidores de las colinesterasas y la mayoría de los casos notificados por unidades hospitalarias; mayor porcentual de intoxicaciones y óbitos en la circunstancia intencional; y mayor proporción de cura. Sin embargo, elevadas tasas de internación en cuidado intensivo y la letalidad indicaron gravedad de los casos.

Palabras clave: Envenenamiento. Pesticidas. Notificación de enfermedades.

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