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A Peer Reviewed & Refereed, International Open Access Journal

Vol.3.Issue.2.2016 (April-June) **ISSN:2455-0221(P), 2394-2606(O)**

EXAMINATION INTO THE USE OF PESTICIDES AND POTENTIAL HEALTH EFFECTS - A CASE STUDY

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ABSTRACT

The harmful effects of pesticides on human health have been documented. However, the information is limited by a series of barriers that make it difficult to obtain statistical evidence to show society the adverse effects of these chemical products. The objective of this study was to analyse the frequency of use, as well as the knowledge that farmers have about the negative effects of the application of pesticides and their possible relationship with damage to the health of inhabitants of the Prakasam District, Andhra Pradesh, India. The data was obtained through surveys carried out on people over 30 years of age, who have lived in the locality throughout their lives. The results showed that 83% of the evaluated population works in agricultural work, the agrochemicals shown as possible carcinogens are applied frequently, the majority of people indicated ignorance of the use and application of agrochemicals, while 73% do not use protection when applies them. Similarly, 55.9% reported having a family member die from some type of cancer; of which the most common were lung and stomach. Long-term studies are necessary to corroborate the relationship of pesticides with damage to health.

Keywords: pesticides, toxicity, farmers, cancer, mortality.

Introduction

Pesticides are substances used to control unwanted organisms, including insects, rodents, fungi and weeds.1 Their classification can occur according to different criteria, such as: origin (organic or inorganic), chemical structure, toxicity and purpose. However, the most common classification considers the type of target organism (algaecide for algae, acaricide for mites, bactericide for bacteria, fungicide for fungi, herbicide for weeds, insecticide for insects, moulded for molluscs, nematicides for nematodes, rodenticide for rodents etc.) Currently, the use of pesticides has been increasing, due to the need to produce a greater amount of food and avoid crop losses, around 2.3 million tons per year being used worldwide. Despite the fact that these products promise greater protection for the plant, the risks associated with the environment and human health have outweighed the benefits, causing chronic and neurodegenerative diseases, cancer, and congenital malformations (Van Mael Fabry et al. 2010; Baldi et al. 2010; Meenakshi et al. 2012; Wickerham et al. 2012). In India, pesticides and fertilizers are used without any type of regulation, monitoring and without the necessary equipment to protect themselves from their toxicity, there are more than 30 pesticides that are allowed for sale

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and have been banned in other countries due to their harmful effects. (SSA, 2012), within these are the families of Triazines, Acetanilides, Phenoxycarboxylic Acids, Ureas and Diphenyl ether that are used as herbicides. For their part, organophosphates, carbamates, organochlorines and pyrethrins with insecticidal action and those corresponding to fungicides, carboxymids, dithiocarbamates and morpholines. However, the pesticide catalogue has not been updated in more than 10 years. Andhra Pradesh is one of the states where these products are most used (SSA, 2012). In addition to this, most farmers are unaware of the possible toxicities of pesticides, the dangers and safety measures that must be taken into account before their use. That is why this information should be disseminated so that they are aware and reduce the use of toxic pesticides (Agrawal et al. 2010). Prakasam district in Andhra Pradesh is a highly productive agricultural region of various crops such as green chili, wheat, potato and peach (SAGARPA, 2015). In this district, a high percentage of people work in the agricultural sector and have contact with agrochemicals.

The objective of this research was to determine the frequency of use, the knowledge about the negative effects of the application of pesticides and its possible relationship with damage to health in inhabitants of the different locations in Prakasam District, Andhra Pradesh, India.

Materials and methods

Sampling

The descriptive study was carried out in 2013-14, with a sample of 58 farmers and producers residing in the town of Ongole and Singarayakonda Prakasam District, Andhra Pradesh, India.

To collect information on occupation, knowledge, uses, protection and possible health effects from pesticide applications; A survey-type instrument was applied with multiple choice questions using the Likert scale and open questions. The key informants were selected by means of purposeful or intentional sampling, the participants being native population, mostly male, aged between 20 and 90 years of age.

Measurements

The survey was designed from the theoretical review on the barriers and strategies in the adoption of knowledge that pesticide applications imply. Also, specialized research instruments in the area of pesticides and their adverse effects on health were reviewed.

The application of the survey to the participants in the study was carried out individually with a duration of approximately 20 minutes. Which was carried out during an ejidal meeting and by visiting their homes.

Some of the questions that were included in the survey were aimed at identifying and understanding the informant's perspective on various aspects of their experience in the field of agricultural work, the application of agrochemicals, the difficulties in their application, the tools of protection, damage to health, cancers and congenital malformations. Questions were included: dichotomous, multiple choice and open. In the case of the question regarding the use of pesticides, it was done personally, mentioning the products according to the trade name; The criterion taken for the response "sometimes" was if the application was made at most three applications a year) and for "almost always" when the application was made four or more times a year. In the case of people who have presented some type of cancer, only first and second-degree relatives were considered.

Analysis of the information

The information from the surveys was retrieved through a database. A descriptive analysis was carried out, using the absolute and relative frequency to characterize the population according to sociodemographic data and contact with pesticides. Likewise, the frequency of use, knowledge of use and application, as well as the cancers presented were analysed.

Crosstab analysis was performed using Pearson's chi^2 test, with IBM SPSS Statistic 25 software, using a 95% confidence level; to identify the association between the variables: knowledge of the use of pesticides and

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the use of protection when applied. Likewise, to identify the level of risk that exists from using pesticides or fertilizers in presenting some type of cancer.

The answers to the open questions were transcribed in their entirety. Subsequently, the paper records were collated to process the information collected. The types of answers were clarified, the most recurring ones were identified and they were organized according to the type of question.

Ethical considerations

It was emphasized to the participants that the information obtained would be strictly confidential, preserving anonymity by assigning a pseudonym to each interviewee. Likewise, in order to obtain their informed consent, the voluntary nature of their participation was reiterated. They were informed of the purpose and use of the information and their permission to publish it.

Results

Of the total number of people interviewed, 33 have worked in agriculture, which corresponds to 56.90%, followed by 16 producers, corresponding to 27.59%. The remaining 9 people who comprised 15% were among housewives and other occupations. Being in its entirety 77.58% of the male gender, with an average age of 56.9 years. Of the people surveyed, 43% have 3-4 members in their family, followed by 29% with 5-6 members, 13.8% with 1-2, 12.1% from 7-8 and 1.7% from 8-9; Of the 49 people who identified themselves as agricultural workers and producers, all apply and have been in direct contact with pesticides (Table 1).

According to the results on the knowledge regarding chemical products, the farmers showed greater ignorance of the commercial names as well as the active ingredients that are applied. For their part, producers have greater knowledge of these products, indicating that Glyphosate, Atrazine, Malathion and Methyl Parathion are always and almost always applied (Table 2). Being these pesticides among the products with the greatest impact, therefore, due to their effects and persistence in the environment, they have been prohibited and eliminated from the catalogue of pesticides in countries of the European Union and the United States.

The results of knowledge about the use and applications of pesticides show that 48% of the total number of people indicated that they knew little and 34% did not know anything. Representing 17% of the population surveyed with responses of enough and a lot (Figure 1).

Below are data that refer to personal protection when using pesticides. The results obtained indicate that the majority of people (91.8%) never make use of protection by calling it; masks, gloves, overalls, rubber boots, among others (Figure 2).

Table 1. Sociodemographic characteristics of the study participants.

Characteristic	**n**	**%**
Age (years)*		56.9±16.3
Gender		
Female	13	22.41
Male	45	77.58
Occupation		
Home	5	8.62
Agricultural worker	33	56.9
Agricultural producer	16	27.59
Unemployed	0	0

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Retiree	1	1.72
Other	3	5.17
Contact with pesticides	49	84.48
Non-contact with pesticides	9	15.52

*Arithmetic means values ± Standard deviation are presented

Table 2. Use of pesticides.

Product Name	Never		Sometimes		Almost always		Always	
	n	%	n	%	n	%	n	%
Glyphosate	16	27.59	1	1.72	13	22.4	18	31.03
Atrazine	10	17.24	7	12.07	15	25.9	7	12.07
Malathion	7	12.07	4	6.9	12	20.7	16	27.59
Paraquat	16	27.59	14	24.14	6	10.3	3	5.17
Furadan	11	18.97	17	29.31	4	6.9	7	12.07
Captan Fungicide	2	3.45	0	0	17	29.3	19	32.76
Azinphos Methyl	24	41.38	0	0	8	13.8	7	12.07
2,4-D	22	37.93	11	18.97	6	10.3	0	0
Diuron	35	60.34	14	24.14	0	0	0	0
carbofuran	11	18.97	13	22.41	9	15.5	6	10.34
endolsufuran	11	18.97	13	22.41	9	15.5	6	10.34
phorate	35	60.34	4	6.9	0	0	0	0
methyl parathion	30	51.72	0	0	6	10.3	13	22.41
Sulprofos	28	48.28	0	0	7	12.1	4	6.9
triazophos	31	53.45	0	0	5	8.62	3	5.17
Sulfur	0	0	0	0	0	0	3	5.17
Ammonium sulphate	0	0	0	0	0	0	1	1.72
Arsenite	0	0	0	0	0	0	1	1.72
edena	0	0	0	0	1	1.72	0	0
Zinc	0	0	0	0	0	0	1	1.72
organic	0	0	0	0	0	0	1	1.72
Others	32	55.17	0	0	0	0	8	13.79

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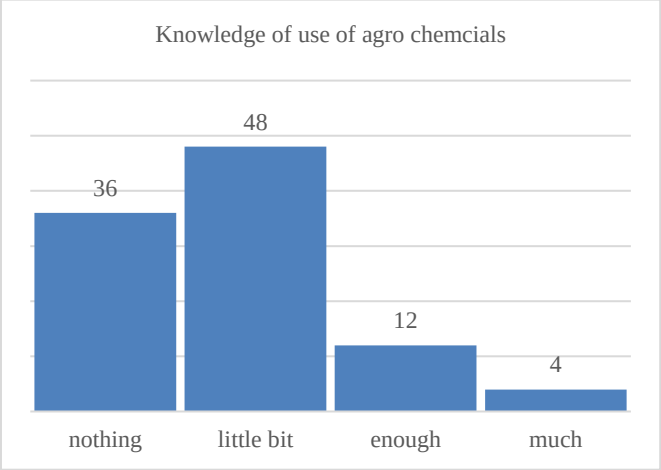

Figure 1: Knowledge of pesticide use.

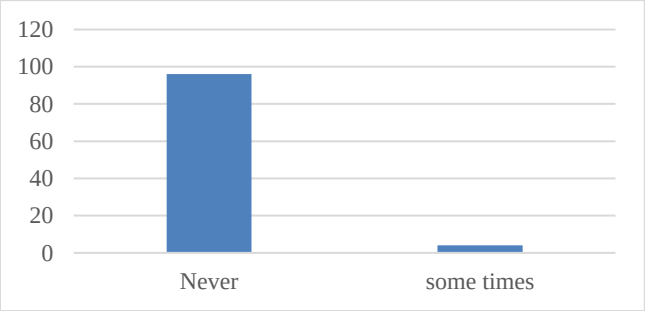

Figure 2: Knowledge of Personal protection when applying pesticides.

According to the Chi-square test, it was found that there is no association between the variables of knowledge of the use of pesticides and the use of protection when they are applied. Which means that although people are aware of the possible risks that exist when applying agrochemicals, they do not protect themselves.

The data on health effects, specifically cancer, indicated alarming results. Of the 58 respondents, 55.9% have a relative who died of some type of cancer, highlighting stomach cancer with 20.3%, followed by lung cancer with 18.6% (Table 3).

Table 3. Types of cancer presented.

Type of Cancer	N	%
Lung cancer	11	18.97
Colon cancer	1	1.72
breast cancer	2	3.45
lymphomas	2	3.45
Leukaemia	4	6.9
Stomach cancer	12	20.69
testicular cancer	1	1.72

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Table 4. Pesticides and fertilizers and their relationship with cancer.

		Family with Cancer		
	Use of pesticides and Fertilizers	Yes	no	Total
Yes	Number of people	27	22	49
	% family member with Cancer	81.80%	88.00%	84.50%
No.	Number of people	600.00%	3	9
	% family with Cancer	18.20%	12.00%	15.50%
Total	Number of people	33	25	58
	% family with Cancer	100.00%	100.00%	100.00%

The results of the cross tables showed that of the 49 people who use pesticides and fertilizers, corresponding to 84.5% of the surveyed population, 27 people reported having a family member with cancer (Table 4). When analyzing the Odds Ratio, it was observed that people who use fertilizers and pesticides have a risk together with their relatives of 1.6% times of presenting some type of cancer. **Discussion**

The data obtained allowed us to meet the objective of identifying the impact of pesticides on health. The research shows the perception of the participants regarding the use of pesticides. Presenting the general population exposure, the above can be affirmed because it was corroborated that the warehouses where the agrochemicals are stored are next to their homes. Likewise, aerial fumigations are implemented in that locality. These conditions negatively affect the population, since the chemical particles are inhaled directly, due to the presence of volatile components of pesticides, their potential for respiratory exposure is excellent (Amaral, 2014). Inhaling sufficient amounts of pesticides can cause serious damage to the nose, throat and lung tissues (Damalas and Eleftherohorinos, 2011). Studies suggest that pesticides may be linked to various diseases, including cancers, leukemia, and asthma.

Stomach cancer was the most frequently reported in this study. Results in other investigations show that manufacturers and applicators of herbicides (phenoxyacid contaminants) present a greater risk of presenting stomach cancer (Armijo et al. 1981; Blair and Hayes, 1982; Blair and Zahm, 1991; 15 Higginson, 1966; Kraus et al., 1957; Repetto and Baliga, 1996). Lung cancer was also one of the main ones that have been presented, this type of cancer is associated with exposure to arsenical compounds (Infante-Rivard et al. 1999). The results of Blair et al. (1983) showed that the risk of lung cancer increased with the number of years licensed to use these products, with a standard mortality rate of 2.89 among those licensed for 20 years or more (Blair et al. 1983). In a survey of 1,600 agricultural product applicators, almost double the mortality from lung cancer, with the risk increasing among those with 20 or more years of exposure (Barthel, 1981). Scientific evidence has shown other affectations, such as bladder cancer, leukemia, breast, lymphoma, and prostate.

In the present investigation, cases of leukemia, lymphomas, breast, colon and testicles were also found. Results from a prospective study of US pesticide applications indicated associations of two imidazolinone herbicides (imazethapyr and imazaquin) with bladder cancer (Koutros et al. 2015). In another case-control study (953 cases and 881 controls) of male farm workers in Egypt, results found an increased risk of bladder cancer when there is pesticide exposure in a dose-dependent manner (Amr et al. 2015). .

A case investigation determined that chronic lymphocytic leukemia (CLL) was associated with pesticide use (Nanni et al. 1996). In France a hospital study found a significant association between exposure to organophosphate insecticides and risk of leukemia (Cavel et al. 1996). An investigation revealed that exposure of leukemic cell lines to increasing doses of an organophosphate insecticide resulted in dose-dependent leukemic cell proliferation (Boros and Williams, 2001). Another study found 162 cases of children exposed to

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Vol.3.Issue.2.2016 (April-June) ISSN:2455-0221(P), 2394-2606(O)

pesticides at home with leukemia, mainly of the acute lymphoblastic type (Ma X et al. 2002). Other publications have shown that the insecticide chlorpyrifos (CPF) induces a redox imbalance that alters the antioxidant defense system in cancerous breast cells (Ventura et al. 2015). In a study covering a female population from Tunisia, possible associations between serum concentrations of organochlorine pesticides and xenoestrogenic effects were investigated; consequently, its positive association with breast cancer risk was observed (Arrebola et al. 2015).

Results have revealed that some phosphate compounds have been associated with prostate cancer, particularly in farm workers exposed to high levels of these compounds (Mills and Yang, 2003). Other researchers cited damage to sperm from domestic mammals, incubated in the presence of Parathion and Paraoxon, affecting the ability at the time of fertilization (Bustos-Obregón et al. 2003). The risk of health hazards from pesticide exposure depends not only on how toxic the ingredients are but also on the level of exposure.

Additionally, certain people such as children, pregnant women, or aging populations may be more sensitive to the effects of pesticides than others. According to a meta-analysis of 13 case-control studies from Pubmed databases published between 1990 and 2005, there was a significantly positive association between occupational pesticide exposure and all hematopoietic cancers as well as non-Hodgkin lymphoma (Merhi et al. 2007). Likewise, there is other scientific evidence that has shown an association between non-Hodgkin lymphoma and the application of pesticides in agriculture (Blair and Hayes, 1982; Hardell et al. 2002; Swaen et al. 1992).

It is worth mentioning that among the cancer affectations in the Guadalupe Victoria common, a case of non-Hodgkin's lymphoma was also found, an incidence presented by a 15-year-old young man. According to reports from his family, during his childhood this young man was working in agriculture, having direct contact with pesticides that he himself applied. With the above, it is based that pesticides have the potential to harm the health of children, causing non-Hodgkin's lymphoma cancer.

So it is necessary to inform the population, communicating the advantages and disadvantages. Among the possible solutions could be to achieve continuous training policies to broaden the knowledge of the theoretical bases that support the effectiveness and deficiencies of pesticides. In order to analyze alternatives with this information to avoid excessive uses of agrochemicals. Another detail to highlight is the lack of attention on the part of the corresponding authorities, a regulation is urgently needed that prohibits, limits and monitors the products that are for sale. An example of this is the Glyphosate product that is shown as the most used agrochemical (Table 3). The information published so far shows that it has been banned in several countries. Because it is highly toxic and extremely dangerous to people's health, causing consequences that include; gastrointestinal disorders, obesity, diabetes, heart disease, depression, autism, infertility, cancer and Alzheimer's among other diseases (Samsel and Seneff, 2013).

On the other hand, there are herbicides, such as Atrazine, whose main quantitative metabolite, dialkylchlorotriazine, has been shown to covalently modify proteins both in vitro and in vivo, suggesting that dialkylchlorotriazine has the potential to alter protein function. cell (Alavanja et al. 2013). In addition, there are concerns about the neuroendocrine disrupting effects of this herbicide (Fraites et al. 2009).

The pesticide Methyl Parathion, in a study in rats, showed alteration in the postnatal development of some neurons in the brain (Gupta et al. 1985). Azinphos Methyl (Gusation) results with Chilina gibbosa mollusk demonstrated signs of neurotoxicity and cholinesterase inhibition after exposure for 48 hours (Cossi et al. 2015). In another study where they applied different concentrations of Gusation in an aquarium with shrimp, they observed a mortality rate of 100% at 24 hours (Baticados and Tendencia, 1991). Paraquat (also called Gramoxone) Scientific studies show that exposure to this herbicide increased the risk of Parkinson's disease by 75% in people 60 years and older who had been exposed to Paraquat at an early age (Costello et al. 2009).

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Vol.3.Issue.2.2016 (April-June) ISSN:2455-0221(P), 2394-2606(O)

Another of the products that they indicated to use frequently in the sample surveyed here was the fungicide Captan. Studies have shown that there is a direct correlation between the use of Captan and the incidence of leukemia and prostate cancer (Mill, 1998), associations have also been observed between this fungicide and the incidence of multiple myeloma (plasma cell cancer) in a recent study carried out in a Canadian population (Pahwa et al. 2012).

The results showed that people who apply pesticides or fertilizers have a higher risk of contracting some type of cancer themselves or their relatives. In a similar study, a relationship was found between breast cancer and pesticides (Santamaría-Ulloa, 2009). In another study conducted by Wesseling et al. (1999) found that in the tercile of rural populations, breast cancer was associated with excess due to pesticide exposures, which was not observed in urban populations. In the same way, in another investigation in urban areas, no association was found between the incidence of breast cancer and the application of pesticides (Muir et al. 2004). In our study we focus on a rural area where most of the inhabitants are engaged in agriculture and have contact with this type of products, so it is believed that the high incidence of cancer is due to this. However, it is advisable to carry out a spatial study that includes urban or semi-urban populations that do not have contact with this type of substance.

Conclusion

In this investigation it can be concluded that the participants indicated ignorance; commenting that they had never related the problem from a health perspective. Emphasizing that in fact in this population there is a high incidence of cancer cases, mainly in adults, who handled this type of product (pesticides) all their lives. In India, pesticides that have been banned in other countries continue to be applied due to their high impact on health, including cancer, which is why changes are required at the regulatory level to try to solve this problem from the root and not try to alleviate the effects.

It is relevant to point out the experience obtained after carrying out the surveys from the same voice of the participants, it is of the utmost importance to inform the population of the limitations in health, due to the use of broad-spectrum agrochemicals. Therefore, it is necessary to carry out more extensive, quantitative and scientific studies (forceful and conclusive) that involve the different actors related to the prevention and training of appropriate uses of agrochemicals both in agricultural work and in homes.

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