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Contributing factors for farm workers' exposure to pesticides in the west of the state of Santa Catarina, Brazil

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ABSTRACT. Pesticide overuse is highly harmful to human health and has become a serious public health issue in developing countries, Brazil included. Current study collects and evaluates data on toxicity risk to farmers exposed to pesticides in Marema, a municipality in the west of the Brazilian southern state of Santa Catarina. The sectional, descriptive and observational study comprises a questionnaire with open and closed questions. Retrieved data showed that farmers with low educational level need understandable information to raise their awareness on the use of pesticides, starting from an effective assistance at purchase and in management till the disposal of empty containers. Data show that farmers undergo regular exposure risks to pesticides and traditional practices corroborate for the increase in the environmental damage and health problems.

Keywords: agrochemicals, poisoning, public health.

Fatores contribuintes para a exposição de trabalhadores rurais a pesticidas no Oeste de Santa Catarina, Brazil

RESUMO. Nos países em desenvolvimento como o Brasil, o uso excessivo de pesticidas tem resultado em prejuízos à saúde humana, o que reflete em sério problema de saúde pública. O objetivo deste estudo foi coletar e avaliar dados sobre o risco de toxicidade em agricultores expostos a agrotóxicos no município de Marema, localizado no Oeste de Santa Catarina, região Sul do Brasil. A pesquisa foi conduzida por um estudo descritivo, transversal e observacional por meio de questionário com perguntas abertas e fechadas, com o total de 100 amostras no município. Os dados obtidos demonstram que os agricultores, que possuem baixo nível de educação formal, necessitam de informações compreensíveis e conscientizadoras sobre o uso de agrotóxicos, incluindo por uma efetiva assistência, desde sua aquisição e manejo até o destino final das embalagens vazias. Todos os dados nos levam a sugerir a presença de constante risco de intoxicação por agrotóxicos junto aos agricultores, uma vez que suas práticas corroboram para a instalação de danos ambientais e problemas de saúde.

Palavras-chave: agroquímicos, intoxicação, saúde pública.

Introduction

The development of human society has always been connected to food extraction and gathering, and subsequently to agricultural development. In the course of time, new agricultural practices became necessary and the use of artificial methods of plague control, such as the use of agrochemicals, was required (PEDLOWSKI, 2006).

Brazil is one of the greatest users of pesticides in agriculture and the scenario regarding to social and economic demands is unfortunately not followed by safety practices and methods. Other factors are present to worsen the risk of exposure, such as low schooling level, scarce use of Personal Protection

Equipments (PPE) and the non-compliance to the necessary interspace between applications of the products (PERES et al., 2005a; WAICHMAN et al., 2007).

The employment of pesticides in Brazilian rural areas demands knowledge and perception on the importance of each possible contamination manner. However, social authorities have not given enough attention to these problems and seem to ignore the relationship between human health and the use of pesticides. Yet, knowledge and perception of these risks by the risk-exposed population involve the development of strategies capable of assisting and intervening on such issues (PERES et al., 2005b).

Although it is possible to find Brazilian researches on pesticides and their impact on human health, knowledge on exposure amplitude and on damages to health by intensive use of pesticides is still insufficient. New studies are required to clarify the real situation on pesticide use and exposure (FARIA et al., 2007).

Since agricultural activities are the basis of the economy in the municipality of Marema, Santa Catarina State, Brazil, and due to the epistemological importance of the issue and to the unpublished sampled evaluation in the Brazilian southern state of Santa Catarina, current analysis evaluates the exposure risk of farmers to pesticides. Data obtained would also be a help to public health strategies, specifically on the health of rural workers.

Material and methods

Research consisted of a transversal, descriptive and observation study which evaluated the exposure risk of farmers to pesticides in the municipality of Marema, Santa Catarina State, Brazil, between January and July 2009. Marema is a village some 550 km west from Florianópolis, the capital city of the state of Santa Catarina. According to IBGE (2013) census, Marema has 2,203 inhabitants and its economy is based on swine and poultry production for the agro-industry, and on the production of sugar cane and grape, aimed at the manufacture of sugarcane brandy and wine, respectively. Cereals for local consumption are also produced.

The study sample was determined by measurement proposed by Barbetta (2014), specifically for the municipality's small population. The number of samples was limited to 100 farmers living in the rural area and related to the use of pesticides on work or when exposed direct and indirectly to them, and to their conditions of apparent limitation, especially physical and emotional limitations at the time of form filling.

The minimal age demanded for participation in the research was 18 years old, disregarding the individuals gender and marital status. Excluding criteria were under 18 years and not living in the areas defined by the study. Since the selection of priorities was done to focus research on several regions, interviews were done in North-South, East-West directions, comprising all rural areas of the municipality, determining a similar pooled rate to each region. Each farm was represented by one individual in the sampling. The project was submitted to and approved by the Committee for Ethics in Research of the *Universidade Comunitária Regional de Chapecó* (Register number 152). A pilot-

study was later undertaken with ten interviewees to evaluate the form and to detect whether it would be rightly interpreted.

A form with open and closed questions was employed to collect data without any waste of time and to support design of the results. Form was filled individually after each interviewed agent received information and signed the Free and Elucidated Term of Consent. The interview was made on the farm of the interviewed agent and included questions on the use of agrochemicals and their impact on health. Questions dealt with age bracket, schooling level, need of agronomic prescription to purchase the products, guidance at the time of purchase the products, level of instruction to the correct handling of these products, label reading, knowledge on the products, mandatory interval between applications, use of personal protective equipment, type of agrochemicals used and health problem diagnosed by physicians.

Results and discussion

Table 1 shows the age of farmers from the municipality of Marema. Most farmers interviewed (approximately 30%) were between 18 and 29 years old, followed by a homogeneous distribution of around 20% of them between 30 to 39, 40 to 49, and 50 to 59 years old. Less than 10% of the interviewed was over 60 years old as showed in Table 1.

Table 1. Age of farmers from the municipality of Marema, Santa Catarina State, Brazil, 2009. Data expressed in percentage, n = 100.

Age Group (years old)	Frequency (%)
18 – 29	30
30 – 39	20
40 – 49	21
50 – 59	20
Above 60	9

Data reported in studies by different authors and in several places in Brazil show a non-homogenous prevalence between 2 and 24% for age range 40-49 years old (DELGADO; PAUMGARTTEN, 2004). The predominant age group in Marema was within the 40-49-year-old bracket. However, prevalence was higher (31-33%) when compared to those found in previous studies cited above. These findings seem to indicate that discrepant variations between the regions described in the literature stems from their own peculiarities, such as cultural, economic and social aspects.

These aspects indicate the farmer's positioning against the risks they are exposed to. Although there is a defensive ideology characterized by a conscious

denial of risks, scanty information or the inability of its appropriation/understanding corroborates other factors that lead farmers increase their exposure to pesticides (SIQUEIRA; KRUSE, 2008). Furthermore, Brazilian agribusiness assimilated the questionable idea of linking increase in agricultural production with an increased use of pesticides (PRIMEL et al., 2005). On the other hand, there is a lack of public policies in the country to provide greater health safety to rural workers (SIQUEIRA; KRUSE, 2008). Therefore, all the above mentioned aspects affect farmers' conduct and consequently their safety to health risk associated to pesticides exposure.

Table 2 shows the education level of the interviewed. In Marema, 58% of the interviewed have incomplete primary schooling; 22% have complete or incomplete high school; 5% has a complete or incomplete higher education.

Table 2. Schooling level among interviewed farmers from Marema, Santa Catarina State, Brazil, 2009. Data expressed in percentage, n = 100.

Schooling level of respondents	Percentage (%)
Basic school concluded	15
Basic school not concluded	58
High school concluded	2
High school not concluded	20
College concluded	4
College not concluded	1

The average schooling level of farmers in Brazil is low, especially with regard to high school, technical high school or higher education (MAZZOLENI; NOGUEIRA, 2006). Current study reveals that the schooling profile in Marema's farmers follows the national profile, or rather, a high percentage of farmers with incomplete primary schooling.

The above is a highly relevant datum since there is a direct correlation between schooling level and intoxication by pesticides. Low schooling level is a risk factor since it jeopardizes the correct understanding of the information on the correct and safe use of pesticides (GRISOLIA, 2005). Further, it appears that the information level transmitted to farmers is as essential as the schooling level required to avoid intoxications (ARAÚJO et al., 2007).

When asked on the use of agronomic prescription to purchase pesticides in the municipality of Marema, 64% declared they needed it to purchase the products, whereas 33% declared they did not.

The guidelines provided by agronomists to farmers at the time of purchase of pesticides were analyzed. In the municipality of Marema, 61%

declared they had received guidance at the time of purchase; however, 33% declared they did not receive any information. Moreover, the reading of the label before handling the product failed for almost half of the interviewed farmers.

The above conditions show high deficiency in fulfilling the law on the use, application and purchase of pesticides, which require technical guidance for their application and at purchasing (SILVA et al., 2005). Further, it is notorious that farmers did not demonstrate any commitment to seek information on the use of the pesticides or, as mentioned above, they may be employing a defensive attitude which leads towards an increased risk to health due to high exposure to pesticides for themselves, their families and environment.

It may be observed that almost 40% of interviewed Marema's farmers do not have the practice of reading the pesticide label. They underscore that words are printed too small and the terms are too scientific to understand. Information on pesticides is accessed by farmers as an exchange of experience although sometimes they receive information when purchasing the products.

According to Oliveira-Silva (2001), schooling level is particularly related to the reading of labels, i.e., the lower the education level the lower is the understanding of the information on the product's label. Indeed, the schooling level of Marema's farmers may be contributing towards the understanding and need of information on pesticides.

According to the Brazilian Federal Law 7,082, published on July 1989, the containers of pesticides must be returned to the retailer or to receiving depots, and then to the manufacturer. However, such practice is not common among farmers. Frequently farmers throw away the containers, or they burn and bury them without the least care whatsoever (LEITE; TORRES, 2008). In Marema, the 77% of the interviewed declared they returned the containers to the places of purchase, even though they never washed or rinsed them. Lack of care with containers may cause problems to the environment though soil and water contamination and, consequently, damaging human health.

Further, 90% of the interviewed declared they had sufficient knowledge on the use of pesticides; 3% declared little knowledge and 7% declared they did not have any knowledge at all. The predominant answer on the use of pesticides by farmers was one or two applications a year by 35% of the interviewed. It is important to note that Marema's farmers are exposed for several days between three to eight periods a year. However, as the interviews revealed,

they declared they did not care much of their personal protection, even though they knew the risks that these products caused. On the other hand, the knowledge declared by the interviewed is hardly reliable since almost half of them did not read the label and a third did not need any agronomic prescription to purchase the product or receive guidance about the issue.

More than 50% of the interviewed claimed they complied with the law with regard to the mandatory interval between applications of pesticides, even though they stated that it also depended on the chemical used. On the other hand, 30% of the interviewed farmers reported not following the rule. Questions on application methods of the product by farmers showed that the shoulder-held device was used by 38%. However, 32% reported interchangeability of the shoulder-held apparatus and device on tractor, whereas 25% reported use only by tractor. Remaining percentage stated other traditional means at a lower rate.

Further, reports of most interviewed show that they comply to the spacing between harvests to avoid contamination of the environment and themselves with pesticides. However, when questioned about time spacing, many were unable to answer. The above proves that, in certain situations, they cannot comprehend the interspace required. This fact was also reported in other studies in which half of the interviewed ignored or did not understand the required interspace on the labels of pesticides (GODOY; OLIVEIRA, 2004; FARIA et al., 2004).

Further, 12% did not use any PPEs during the setting or the application of pesticides by farmers in Marema; 47% used it partially during setting and application; 28% only during application. Full use of PPEs represented only 12% in pesticide setting and application, following by 1% during application only. Additionally, over 80% of the farmers declared taking a shower after pesticide applications.

Moreover, the methods used to apply pesticides greatly demonstrates farmer's understanding and caution on the risks involved in handling these products (PERES et al., 2005a and b; PERES; MOREIRA, 2007), even though financially limiting factors may occur and determine the level of occupational exposure of farmers (CASTRO; CANFOLONIERI, 2005; FARIA et al., 2009). Shoulder-held apparatus exposes the worker to chemical agents in a very direct manner and this is the method prevalent in the case of Marema's farmers.

Another risk factor to pesticides exposure is the incorrect or incomplete use of PPEs. The Brazilian government maintains campaigns focused on the safe

use of pesticides although they are not effective to effectively raise the awareness of rural workers on this issue (SOARES et al., 2003). Indeed, the use of PPEs is still a practice that must be adopted by most rural workers during pesticide exposure (BEDOR et al. 2009; LEITE; TORRES, 2008; TÁCIO et al., 2008).

The scenario is not different in Marema since only 13% of interviewed reported use of the complete kit. Failure to use PPEs was associated to several causes: uncomfornableness, inconvenience, high costs and excessive heat. Others reported that they used PPEs only when they applied great amounts of pesticides since they believed that low amounts did not cause any intoxication.

It is important to note that Marema's farmers are exposed for several days between three to eight periods a year. However, as the interviews revealed, they declared they did not care much of their personal protection, even though they knew the risks that these products caused. On the other hand, the knowledge declared by the interviewed is hardly reliable since almost half of them did not read the label and a third did not need any agronomic prescription to purchase the product or receive guidance about the issue.

Farmers emphasize that they always take a shower after handling or applying pesticides, even though it occurs hours after application. Moreover, they insist that the practice is not an easy one since normally the working place is not near their homes, and, consequently, they do not return home right after the application. They reinforce this by saying that there is no intoxication risk because they "do not smell the product". The above demonstrates their lack of knowledge on the toxicity of pesticides, on the correct use of these products and on the conduct that must be adopted after the application to avoid further intoxications.

The storage of pesticides is another factor that requires attention. Storage has to be done in a specific place to avoid contact with other products and people who may be nearby. In the literature there are various reports on the specific place to store and maintain pesticides products, which range between 30% (MONQUERO et al., 2009) to 52% (DELGADO; PAUMGARTTEN, 2004).

If compared to data found in Marema, this percentage is fairly low, since over 70% of the interviewed have an appropriate place to store these products, although 30% of them do not. Normally, the interviewed guarded pesticides in warehouses far from water sources and premises.

The use of the follow pesticides groups by farmers were herbicides (glyphosate, bipyridyls, derivatives of pyridinecarboxylic acid, triazines,

isoxazolidynone, triazolone, sulphoniureas, ariloxialcanoic acid, and imidazolinone), insecticides (termiticides, organophosphorus compounds, pyrethroids, derivatives of ariloxialcanoic, oxime cyclohexanone and benzoylurea), fungicides (strobilurins, dithiocarbamates, triazole, dicarboximide) and, with less frequency, growth adjuster and adjuvants (dinitroaniline). However, 83% of the interviewed reported high frequency rates in the use of the herbicide glyphosate, commercialized as Roundup®.

Most pesticides used in agriculture are phosphonomethyl amino acids herbicides, organophosphorus compounds, bipyridyl and formicides (ARAÚJO et al., 2007; FARIA et al., 2004), not uncommonly used in combined formulas (ARAÚJO et al., 2007). It is thus relevant to report that Marema's farmers use these classes of pesticides throughout the year, sometimes in a combined way and sometimes separately.

Table 3 shows the health problems diagnosed by physicians in farmers of Marema, and their frequency. Diagnosed problems of the respiratory (15%) and digestive (15%) systems were the main health issues among the interviewed. They were followed by cardiac (14%), nervous (14%) and muscle-skeletal (11%) systems. Remaining percentage was divided into several pathologies, albeit at less than 10% rates.

Table 3. Health problems diagnosed by physicians in farmers of Marema, and their frequency.

Health problems in farmers	Frequency (%)
Respiratory system	15
Cardiac system	14
Muscle-skeletal system	11
Immunological system	03
Renal system	07
Nervous system	14
Digestive system	15
Others	20
No one	00

Indeed, the Marema farmers reported health problems, predominantly with regard to the respiratory, digestive, cardiac, muscle-skeletal and nervous systems. Although it is impossible to relate directly the disturbances with the use of agrochemicals by farmers, it is plausible to admit that they may be useful to detect intoxication cases and thus occupational risks, due to the routine of the interviewed and their families.

In fact, several studies report symptoms such as headaches, dizziness, fatigue, cloudy vision, vomiting, depression, hypertension, and breast, liver and prostate cancers (LEVIGARD; ROZEMBERG, 2004), which may be related to agrochemical

exposure, especially when exposure occurred during several days and in more than three times a year (ARAÚJO et al., 2007; CARNEIRO et al., 2009).

Similarly, diseases and health problems that could be related to pesticides were not included in the strategies of public health policies, especially preventive health actions. In fact, compounded to the difficulties on the responsible use of pesticides, which may trigger many more disorders than those identified, there is no effective system for identifying and reporting these health problems in Brazil (SOARES et al., 2005).

In fact, society as a whole is much more concerned, consciously or unconsciously, in increasing profits and productivity to improve the international trade balance, than with the health of rural workers (PERES et al., 2005a). It seems that no one notes that if, on the one hand, there is an increase in profits, on the other hand, there is a greater financial load on the Brazilian national health system (SUS) to recover the worker's health, especially those indirectly exposed to pesticides (SIQUEIRA; KRUSE, 2008).

In the wake of such reports, the authors searched for records on intoxication preserved at the Municipal Secretariat of Health in Marema to confirm the data found in the interviews with Marema's farmers on intoxication cases. However, nothing was found since patients were directed to neighboring cities which were able to assist them in these cases. Indeed, records may be found in these cities.

It is important to emphasize that many farmers complained of the symptoms but did not seek a doctor. It is highly common that they evaluate themselves whether it is an intoxication case or not. Such procedure is not effective with regard to public health policies capable of working with a local or regional strategic planning of public health with regard to pesticides.

Conclusion

Current study showed that Marema's farmers with low schooling level require much information to raise their awareness on the use of pesticides. This may start from an effective assistance since its purchase and management until the final disposal of the empty containers. Data suggest that there is a rather regular pesticide exposure risk to farmers since their practices contribute to increase environmental damage and health problems. Further, data in current study provide a status picture on pesticide exposure of farm workers that should be taken into account for the introduction of

health intervention strategies by the government's educational and regulatory agencies.

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