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Increased Beck Depression Inventory Score among Coffee Growers Pesticide Applicators

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Abstract

The extensive use of pesticides has been followed by increasing concerns about their potential acute and chronic effects in general and mental health. Brazil is the greatest pesticides consumer in the world since 2008. Several studies describe the association between the pesticides toxicity and psychiatric disorders, especially depression, but efforts are needed to corroborate these studies. The aim was to map the region studied according to the percentage of people that apply pesticides in the tillage from each rural community included in this study and correlate this data with the percentage of workers with high Beck depression score on that community. A total of 122 male pesticide applicators from seven different cities distributed among thirteen different communities completed the Beck Depression Inventory II. According to the mapping of the region, the percentage of rural workers with high beck score in a given community is significantly correlated with the percentage of pesticide use on that place. This data corroborate many findings that suggest relationship between depressive symptoms and the use of pesticides.

Keywords: Depression; BDI; Rural worker; Pesticides

Introduction

In the rural zone, the work and life conditions are very precarious. Still, the monoculture practiced in the world of agribusiness is an important source of distress and illness [1]. Summed to these factors, pesticides exposure is widely known to be a relevant environmental health issue in rural communities with agricultural activity [2-4]. In Brazil, a country with enormous amount of rural workers, this problem is of great relevance once it has been the larger consumer of pesticides in the world since 2008; the consumption increased 190% over the last decade, significantly above the average of global increase of

93% [5]. Still, Brazil is the largest coffee-producing nation in the world and historically, for over 150 years, it has been the highest global producer of coffee beans [6]. The Caparaó Capixaba region included in the present study belongs to the state of Espírito Santo where the coffee growing is the main and most traditional agricultural activity and it represents the second largest coffee producer in Brazil and the first in Robusta production [6,7]. The state of Espírito Santo has the highest rate of poisoning by pesticides in Brazil [8] and these numbers strongly conduct to researches on the consequences of pesticides use for mental health not only here, but for rural workers in general.

Materials and Methods

It was included one hundred twenty two (n=122) male volunteers aged from 18 to 65 from thirteen communities in the rural zone of seven different cities. All participants are rural workers from the Consortium of Caparaó Capixaba region in the southeast Brazil.

This survey was conducted according to the ethical principles established by the Ethics Committee for Research at the Center of Health Sciences, Federal University of Espírito Santo, Brazil. All participants signed the informed consent forms. This research is part of a project approved by this ethics committee under registration #1.634.021.

The BDI-II is not a depressive disorder diagnosis tool, but rather, a self-report instrument that assesses the presence and severity of depressive symptoms in normal and psychiatric populations. It consists of 21 items that are rated on a 4-point scale ranging from 0 to 3, with higher scores indicative of more severe symptoms of depression [9].

It was already shown that the BDI-II is reliable and valid for measuring depressive symptomatology among Portuguese-speaking Brazilian non-clinical populations. The intraclass

correlation coefficient of the BDI-II was 0.89, and the Cronbach's alpha coefficient of internal consistency was 0.93 [10].

Depressive symptoms according to the BDI-II score were divided into: low Beck score (up to 10) - according to consensual parameter for ups and downs considered normal for both rural and Brazilian population [11,12] - and high Beck score (greater than 10).

Mapped correlation was performed to study the relationship between percentage number of people with high beck score in a given community (y) and the percentage of people that related pesticides use on that community (x). Pearson's correlation coefficient is provided and a p-value <0.05 was considered statistically significant. GraphPad Prism 7.0 (GraphPad Software Inc, San Diego, CA, USA) was employed for statistical analyses and graphic presentations.

Results

The herbicide glyphosate is by far the most common pesticide used by those applicators in the tillage (85.2%) followed by flutriafol (29.5%), cyproconazole (20.5%) and thiamethoxam (15.6%) (Not shown).

The whole sample was divided per community and the amount of people with high Beck score in each community was correlated with the amount of people who reported applying pesticides in the tillage on that community. The analysis showed a moderate positive correlation between these two variables. This mapped analysis demonstrated that regions with higher amount of pesticide applicators has, in fact, larger amount of people with high beck score (number of communities=13; Pearson $r=0.691$; $p=0.0089$; **Figure 1**).

Map of depression X pesticide use in each community

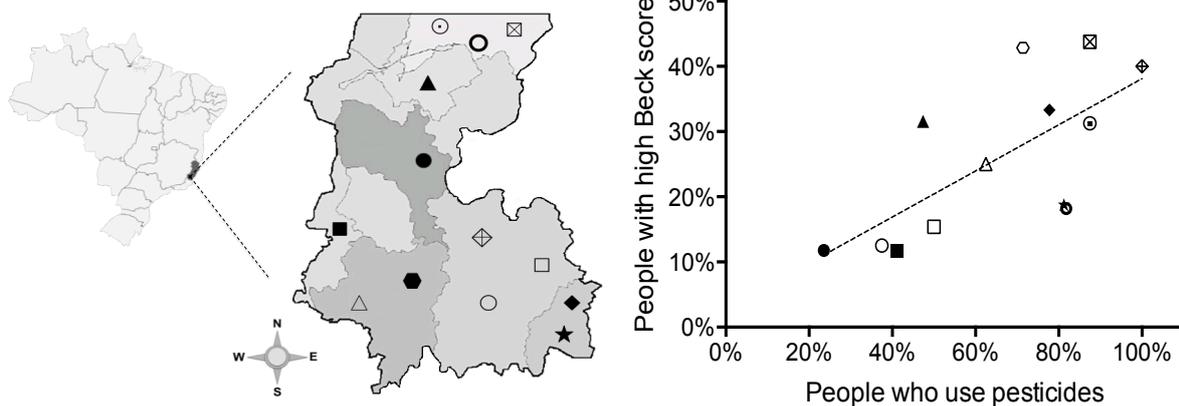


Figure 1 Mapping of positive correlation between quantity of people with high Beck score and people who use pesticides among rural communities (number of values=13; Pearson correlation; $r=0.691$; $**p=0.0089$).

Discussion

Here we demonstrated an unprecedentedly mapping of the rural communities distributed throughout the Southeast Brazil showing that increased amount of people with high Beck score in a such community is linearly correlated with increased amount of pesticide users on that community.

The presence of depressive symptoms compromise enormously the quality of life [13] and according to the severity and intensity of those symptoms, its impact on general welfare can be up to 23 times greater relatively to other physical diseases [14]. Faria et al. described that pesticide poisoning was strongly associated with minor psychiatric disorders, emphasizing the dimension of the problem and the importance of adopting new policies for the protection of farm workers' mental health [15]. Concrete evidences show higher numbers of hospitalization due to mood disorder and suicide attempt among residents in areas with higher use of pesticide [16]. On the other hand, controversies can be observed in these kinds of studies because of hard physical labor, excessive stress and

mental suffering intrinsic to the labor in the countryside as consequences of losses in production for example [17,18]. Aware that not only intense exposure to pesticides but also occupational exposure in agriculture can work as risk factors for mental health impairment, studies aiming to investigate real association between depression and pesticides use are encouraged in different conditions. Defining the direction of the causal link of pesticides use and psychiatric conditions is a great challenge.

In the present study, glyphosate—most used herbicide worldwide according to WHO— was by far the most used pesticide in the tillage. It is an organophosphate compound that has been controversially related to not affect the nervous system at the same intensity that other organophosphorus, however, It has already been described that several herbicides, including glyphosate, may also have important neurotoxic effects [19-21]. An important research that investigated especially depressive symptoms in relation to pesticide exposure is the Agricultural Health Study performed between 1993 and 1997 in USA. Among pesticide applicators of this study, the

chance of depressive disorder diagnosis was higher for several classes of pesticides. Curiously, the probability for herbicides exposure was so higher than for insecticides and higher than others classes [22].

Future perspectives include expanding the investigation in the region studied to verify the association between different classes of pesticides and depressive symptoms. The goal is to promote intervention actions to improve the quality of life of rural workers and their families through a continuous work on education and health.

Conclusion

The abusive application of pesticides is an alarming data that has been proved to affect individual, familiar and public health. Environmental exposure to pesticides can affect the mental health by many ways and here we strengthened the relation between pesticides use and depressive symptoms, which seems to be linked with some neurotoxic process that needs to be elucidated. Intervention actions are encouraged to decrease these psychiatric symptoms that can lead to serious disorders.

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