Cognitive impairment in agricultural workers and nearby residents exposed to pesticides in the Coquimbo Region of Chile

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ABSTRACT

Chronic exposure to organophosphate pesticides is a worldwide public health concern associated with several psychiatric disorders and dementia. Most existing studies on the effects of pesticides only evaluate agricultural workers. Therefore, this study sought to establish if individuals indirectly exposed to pesticides, such as residents in agricultural areas, also suffer cognitive impairments. Neuropsychological evaluations were carried out on three groups (n = 102): agricultural workers directly exposed to pesticides (n = 32), individuals living in agricultural areas indirectly (i.e. environmentally) exposed to pesticides (n = 32), and an unexposed control group (n = 38). The assessed cognitive processes included memory, executive functions, attention, language, praxis, and visuoconstruction. The direct exposure group performed significantly lower in executive function, verbal fluency, and visual and auditory memory tests than the indirect exposure group, which, in turn, performed worse than the unexposed group. Even after adjusting for age, gender, and educational level, both exposure groups showed higher rates of cognitive deficit than control individuals. In conclusion, both direct and indirect chronic exposure to pesticides affects cognitive functioning in adults and, consequently, actions should be taken to protect the health of not only agricultural workers, but also of residents in agricultural areas.

1. Introduction

Worldwide pesticide use in the agricultural industry and for domestic purposes is associated with serious occupational health problems and deleterious environmental impacts (Suratman et al., 2015). Growth of the Chilean agricultural sector in recent decades has necessitated the expansion of areas used for crop production. Consequently, pesticide use has also increased, leading to acute intoxication outbreaks in agricultural areas, mainly during the spraying season (Pancetti et al., 2011; Zúñiga-Venegas et al., 2015).

In the Coquimbo Region, most of the applied agricultural pesticides belong to the organophosphate chemical family, which is used for insect management (Moretto, 1998). Acute organophosphate poisoning produces cholinergic symptoms resulting from the molecular inhibition of acetylcholinesterase, a key enzyme in central and peripheral synapses (Marrs, 1993). On the other hand, chronic exposure often goes unnoticed, with long-term consequences only becoming evident with the occurrence of neuropsychiatric and carcinogenic disorders, congenital malformations (Mostafalou and Abdollahi, 2013), and neurodegenerative diseases (Wang et al., 2014). Abundant evidence supports that prolonged exposure to organophosphate and carbamate pesticides produces cognitive impairment that can be detected in exposed individuals through neuropsychological performance evaluations (Colosio et al., 2009; Rohlman et al., 2007). Indeed, exposure has been linked with impairments in intellectual functioning, academic skills, abstraction abilities, reasoning, and motor and social skills, among others. Furthermore, some studies specifically highlight psychomotricity, short-term memory, working memory, and attention as the most affected cognitive functions (Baldi et al., 2003; Kamel and Hoppin, 2004), and major impairments in planning abilities...