Organophosphates in Chlorpyrifos Insecticide: Neurobehavioral Development of Children in Agricultural Communities

Sravya Uppalapati
Virginia Commonwealth University, uppalapatis@vcu.edu

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The chemicals found in fertilizers and pesticides are known to adversely affect the human nervous system even at low levels of exposure. Neither the agricultural industry nor the EPA can deny scientific findings regarding the toxic qualities of organophosphates in the insecticide chlorpyrifos, but that does not deter pesticide manufacturers from selling harmful products. In fact, Dow AgroSciences, a pesticide company, states on its website that, “Insecticides, such as chlorpyrifos, provide important protection for our food supply and thus safeguard farm and consumer economy.” To understand the health risks associated with pesticide exposure, I studied the influence of organophosphates in the insecticide chlorpyrifos on children living in agricultural communities, primarily in Salinas Valley, California. I performed the review by analyzing a variety of articles and academic sources that focused on organophosphate exposure and child neurobehavioral functioning. The findings indicate that organophosphates found in the insecticide chlorpyrifos block the enzyme acetylcholinesterase and initiate the accumulation of the neurotransmitter acetylcholine, leading to impairments in attention and cognition. Farm children exposed to the chemicals via the mother during gestation period or who are exposed through inhalation or physical contact may be at higher risks for ADHD and autism than reference children who are typically only exposed to organophosphate exposure through diet. Further study is needed to understand gender-based effects following organophosphate exposure. It is only through understanding the damaging effects of chemicals in pesticides that policies can be constructed to effectively reduce pesticide application and encourage alternatives of crop rotation, intercropping, crop diversity, and the use of pests to fight pests in the agricultural society.

Introduction

The application of pesticides began in the United States in the 1930s. In the years following World War II, synthetic pesticides have become an important form of pest management. The chemicals found in pesticides are known to adversely affect the human nervous system even at low levels of exposure. Farmers justify the spraying of pesticides because for every $1 spent on pesticides, there is a return of $3 to $5 through increased crop yield (Pimentel et al. 274). The insecticide chlorpyrifos is applied on grain, cotton, fruit, nut, and vegetable crops to control pests. More than 20 million pounds of the product are sprayed annually in the U.S to control beetles, ants, worms, cockroaches, flies, mosquitoes and termites. The chemical organophosphates in chlorpyrifos is directly linked to thousands of pesticide poisoning incidents. The treatment of chlorpyrifos results in chemical organophosphate exposure and serious health risks in humans.

Abstract

Farmers spray pesticides that contain organophosphates to support their harvest. The pesticides from the field pass through the air to nearby homes. There is a direct relationship between proximity to treated farmland and organophosphate exposure.

The children living in agricultural areas are especially susceptible to harmful chemicals when parents bring home insecticide particles. The organophosphates in chlorpyrifos attach to the belongings and clothing of farmworkers during work on the field. Infants and children are in sensitive stages of development and the organophosphates build up in their bodies through ingestion, inhalation, and dermal contact.

In agricultural communities, mothers typically work during pregnancy. The pesticides on the farm pass through the amniotic fluid, blood-brain barrier and placenta of the fetus. The risk of pervasive developmental disorders and delayed mental development increases when the normal coalescing of the nervous system is disturbed.

The behavior, memory and motor skills of children are negatively related to postnatal organophosphate exposure. The effects of pesticide contact may be cumulative and only recognized at later ages. Peripheral neuropathy and carpal tunnel syndrome illustrate the risk of constant, low-level organophosphate exposure.

Insecticides possess an acute neurotoxicity that causes an irreversible inhibition of acetylcholinesterase (AChE) activity at cholinergic synapses. The inhibition of AChE results in the accumulation of acetylcholine, which triggers the repeated activation of the nicotinic acetylcholine receptor (nAChR). When children inhale organophosphates, AChE is inhibited and the subsequent accumulation of acetylcholine depolarizes the postsynaptic cell and causes neuromuscular paralysis.

Introduction

The findings indicate that organophosphates found in the insecticide chlorpyrifos block the enzyme acetylcholinesterase and initiate the accumulation of the neurotransmitter acetylcholine, leading to impairments in attention and cognition. Farm children exposed to the chemicals via the mother during gestation period or who are exposed through inhalation or physical contact may be at higher risks for ADHD and autism than reference children who are typically only exposed to organophosphate exposure through diet. The effects of constant, low-level organophosphate exposure may be cumulative and only recognized at later ages. Further study is needed to understand gender-based effects following organophosphate exposure. It is only through understanding the harmful effects of chemicals in pesticides that policies can be constructed to effectively reduce pesticide application and encourage alternatives of crop rotation, intercropping, crop diversity, and the use of pests to fight pests in the agricultural society.

Conclusion

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Works Cited

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