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Occupational health risk of farmers exposed to pesticides in agricultural activities

Venugopal Dhananjayan and Beerappa Ravichandran

Abstract

Farmers are routinely exposed to various types of agrochemicals, but there is no evidence about adverse effects posed by these chemicals on human health. Studies from all over the world have shown negative health effects of commonly used pesticides in the agricultural occupation. Correlation between occupational exposure to pesticides and development of a wide variety of diseases ranging from respiratory effects to various types of cancer has been identified. Although the published information does not include all variables that can assist in exposure risk assessment, the real risk associated with pesticide exposure is well established. It is more than obvious that the agricultural community needs the implementation of a new agricultural concept regarding food production, which is safer for farmers, farm-workers, and the environment. This review paper summarizes the most recent findings describing the association between occupational exposure to pesticides and related health effects on farmers and farm-workers regularly involved in agricultural activities.

Addresses

Industrial Hygiene & Toxicology Division, Regional Occupational Health Centre (Southern), Indian Council of Medical Research, Poojanahalli Road, Kannamangalo Post, Devanahalli TK, Bangalore 562110, India

Corresponding author: Dhananjayan, Venugopal (dhananjayan_v@yahoo.com)

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Keywords

Occupational health, Pesticide exposure, Health effects, Farmers.

Introduction

Various type of exposure during work activities may affect the health conditions of farmers in agricultural practices, despite the use of personal protective equipment (PPE). Adverse effects associated with occupational exposure have been observed in a large number of studies [1,2]. All these effects may involve biomolecular alterations, resulting in the development of specific diseases [3,4]. Although all components included in pesticides seem to be non toxic to humans, several studies have demonstrated that chronic exposure to pesticides may be a serious risk factor for the development of chronic diseases [5,6]. Exposure of farmers to pesticides can be through multiple pathways, including consumption of contaminated food, residing close to agricultural fields, and agricultural occupation. The risk of exposure will vary based on the type of pesticide, the duration and route of exposure, and the health status of each individual. The numerous negative health effects that have been associated with pesticides are dermatological, gastrointestinal, neurological, carcinogenic, respiratory, and reproductive effects. Also, accidental or intentional exposure to pesticides may result in death [7]. In addition, pesticide residues have been detected in human breast milk samples, while there are concerns about prenatal exposure and health effects on children [8].

Rural workers, farmers, and farm-workers are considered as a major risk group that receives the greatest exposure to pesticides by transporting, mixing, loading, and applying pesticides. Many workers are not aware of the risks associated with the use of pesticides, whereas the lack of training and equipment for safely handling pesticides increases health risk [9]. However, detailed understanding of pesticide exposure among farm-workers is essential for drawing firm conclusions about potential health effects. On this ground, this review paper summarizes health risks associated with occupational exposure to pesticides among farmers and farm-workers regularly involved in agricultural activities. The paper aims at highlighting the health risk associated with agricultural activities, focusing on the major health effects and recent findings regarding health effects that have been associated with exposure to common classes of chemical pesticides.

Methodology

This review paper was based on a non-systematic methodological approach to explore the available literature published between January 2016 and March 2018. Articles that showed occupational exposure of farmers to pesticides in common agricultural activities were identified through online electronic databases (e.g., PubMed, Science Direct, Web of Science, and other web sources). The search keywords were occupational exposure, agricultural pesticides, farmers and farm-

workers, health effect of pesticides, occupational diseases. A preliminary total of 309 related published articles were selected from the literature, excluding duplicates. The references of those publications were checked for additional recent articles in relevant international journals to compile adequate information for discussion. The publications that are closely related to this review paper are discussed.

Results and discussion

This review combined published results of various health effects of farm-workers exposed to pesticides in agricultural activities. Figure 1 illustrates the different activities of farmers and farm-workers exposed to pesticides during and after pesticide applications in the field. The published information was categorized based on the nature of health risk and presented in Figure 2. The majority of the publications (41%) were related to neurological disorders, followed by other health risks (14%), cancer (13%), poisoning (8%), respiratory problems (7%), reproductive disruption and genotoxicity (6% each), and chronic kidney diseases (5%).

Haematological and biochemical changes

Assessment of greenhouse workers exposed to pesticides revealed increased levels of erythrocytes, leukocytes, platelets, and haemoglobin, but decreased levels of erythrocyte acetylcholinesterase and glucose, creatinine, total cholesterol, triglyceride, and alkaline phosphatase relative to controls [3]. Exposure to pesticides was significantly correlated with reduction in pseudocholinesterase (PChE) activity, induced hematotoxicity, oxidative stress, and genotoxicity in greenhouse workers [10]. Nassar et al. [4] evaluated the effects of pesticides on blood indices as well as on thyroid and reproductive hormones among adult male volunteers. The study of Pressuti et al. [11] observed significant increases in multiple myeloma risk with the use of carbaryl, captan and DDT. Increased risk of death due to non-Hodgkin lymphoma (NHL) was observed among young farm-workers exposed to agrochemicals in southern Brazil [7]. Riaz et al. [12] determined the correlation between pesticide exposure, physical health and susceptibility towards tuberculosis along with alterations in haematological indices and liver enzymes in pesticide operators in Punjab, India. Prenatal exposure to organochlorine pesticides (OCPs) was marginally associated with decreases in neutrophil counts [13]. Parks et al. [14] suggested possible association of systemic lupus erythematosus (SLE), an autoimmune disease, with

Figure 1

Farmers and farm-workers exposed to pesticides (Ravichandran et al., unpublished pictures).