**Chronic and Long-term Effects of Pesticides on Human Health**

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**Chronic and Long-term Effects of**

**Pesticides on Human Health**

**Chronic effects** due to pesticides comprise different kind and degree of intoxications, but are damages to human health as a result of long-term exposure to low levels.

While the picture of **acute poisoning** with various pesticide groups is more or less typical and familiar, and well described in specialized literature, the knowledge about **chronic effects** is rather limited.

The main reasons for that include issues as: the potentiallity of *health damage* is by analogy to findings in experiments with animals; the existing reality of combined and consecutive exposure to several or many different pesticides in one season or during the whole period of service; the difficulty to complete a documentation of chronic and long-term effects during the whole period of *clinical manifestation*, particular for *cancer diseases*; the non-specificity of of the possible health effects, which follow pesticides exposure, in cases when the effects can arise from other causes and other reasons.

Data of experimental studies presented pesticide registration, and obtained in numerous epidemiological investigations, assess the following possible chronic effects in humans: *disturbed liver function*; *nervous, behaviour and psychic deviations*, *suppression of immune reactivity*.

The **category of long-term effects** includes: *the effects on reproduction*; *disturbancy of progeny*; *hereditary malformations, genetoxicity; induction of malignant neoplasms*.

This document will concentrate on the following adverse effects on humans, with the immediate undeline that only indirect evidences for an eventual cause-effect relationship will be discussed: *Pesticides and Cancer, Reproductive Toxicity, Congenital Malformations, Delayed Neurotoxicity and Immune System Suppresion by Exposure to Pesticides.*

**Pesticides and Cancer**

Epidemiological case-control studies has shown a higher risk of *malignant diseases* of the *haemopoetic system (lymphoma, leukaemia and multiple myelomas*), after professional exposure to herbicides and insecticides.

*Carcinoma of the testes*, *the gastrodigestive tract*, *the liver* and *the brain* have been observed in farmers, who have worked as sprayers, and in workers engaged with pesticide production.

Documented are cases of *cancers in children*, whose mothers have been exposed to pesticides, and case in children exposed in their home and garden. These are cases of *neuroblastoma*, *cancer of the rectum*, *of the brain* and *applastic anaemia*. Published is data for enhanced frequency of child malignant diseases in regions with extensive application of pesticides, which such *carcinogenic activity* confirmed by animal tests.

**Reproductive Toxicity**

Well documented is that Occupational Exposure to some fumigants during production and application has caused *sterility*, *azospermia* and *oligospermia*. *Reduced fertility* was observed and documented in cases of workers engaged in the production particularly of the fumigants DBCP (1,2 dibromchloropropan) and ethylendibromide.

*Sterility*, *spontaneous abortions* and *still births* are more frequent in cases of excessive exposure to pesticides of both parents. These data are mainly from observations in workers in grape-producing regions, where hygienic requirements during pesticide application are not observed.

Maybe the Problem is a Pesticide Poisoning?



**Congenital Malformations**

Single reports could be found in literature about cases of *congenital malformations* due to occupational or general exposure to pesticides of the mother during the first three months of pregnancy. Epidemiologic investigations present data about greater risk for different deffects in the progeny, such as *anomalies of the limbs, fissures of the palate and the upper lip, malformations in the CNS*, when the mother lives in a region with higher rates of pesticide application.

Investigation of the role of professional exposure to pesticide is however scarce. In a study of parents working in flower glasshouses higher frequency of negligible defects, such as *subcutaneous hematomas* is registed.

**Delayed Neurotoxicity**

Some organophosphorous pesticides can induce the so-called delayed *neuropathy*. The neural fibers with greater diameter and length in the spinal cord and in the peripheral neurons system are injured. This leads to *muscular weakness*, which can progress to *paralysis*. Most often the lower limbs are affected.

Deviations of *neurobehaviour reactions*, such as *restlessness, difficulty to concentrate the attention, weak memory* and other more insignificant deviations are reported in patients, who suffered acute poisonings by organophosphorous pesticides in previous years. Data about such disturbances at low leves of chronic exposure are not confirmed.

**A summary of the Neurological Diseases due to Exposure to Pesicides:**

Amnesia

Numbness

Neurological Deficits

Learning Disabilities

Liver Damage

Skin and Eye Irritation

Respiratory Paralysis

Parkinson and Alzheimer-like Symptoms

Epilepsy

**Immune System Suppression by Exposure to Pesticides**

Toxicological investigations in recent years have shown that the human immune system can be attacked by long-term exposure to low doses of chemical substances used in various industries or in agriculture.

Organization and functions of the immune system:

The most important function of the immune system is to ensure protection against infections of viruses, bacteria, fungi, parasites, as well as against cancer cells. The organism’s protection is called **immunity** (Latin word, which means “free of”) and displays two main types of protective mechanisms: nonspecific and specific:

**Nonspecific protective mechanisms** include the participation of **substances** (lysosomic enzymes), which suppress the development of microorganisms, **substances** (interferons), which act for protection against viruses, as well as the absorption and digestion by some **cells** (polymorphonuclear leucocytes and macrophages) of alien to the organism **particles** (bacteria).

**Specific type of protective mechanisms** are characterized by recognition of the infectious agent and development of immunologic memory. The latter is a very important mechanism, ensuring at the second encounter of the same agent a quick and strong immune response.

The specific immune system has a complicated organization. It consists of central lymphoid tissue, including bone marrow and thymus, as well as peripheral lymphoid tissue – spleen, lymph nodes, lymph tissue in the intestinal tract.

The main cells of the immune system are the lymphocytes and macrophages. They are divided into different subdivisions, depending on the origin, the characteristics of the cells and their functions.

**Immunotoxicity of the pesticides**

Some individuals exposed for a long time to low pesticide doses can develop certain reactions on the part of the immune system. The damaged immune responce can be of three types:

1. 1. Enhanced sensitivity (allergic reactions);
2. 2. Suppressed reactivity (immune suppression);
3. 3. Reactions of the organism to its own components (autoimmunity).

**1. Allergic reactions** (either quick or delayed) are manifested by unsuitable, enhanced immune responce, which leads to injuries of the tissues. People with predisposition to allergy develop reactions of immediate type, such as *urticaria, conjuncivities, bronchial asthma*.

In these cases there is always a component of family inheritance with such disturbances. In subsequent contacts with the provocative agents, the reaction is much stronger.

The delayed type of **allergic reactions** are manifested usually as *skin irritations*. Development of **combined damages** due to simultaneous sensitizing and toxic effects is also possible. (The problem of allergies resulting from pesticide effect is discussed in the presentation “**Pesticides. Routes of Penetration in the Human Body.** Skin toxicity, skin irritating and skin sensitizing effects).

**2. Immune suppression.** Recently there are many clinical and experimental investigations on the suppression of the organism’s protective mechanisms as a result from contact with pesticides. *Suppressed function of the immune system* can manifest itself by enhanced sensitivity to infectious pathogens, a more difficult and longer course of the infection or greater probability for development of tumor diseases. Immune suppression may affect both the nonspecific and the specific immune response.

**3. Autoimmune reactions**. They represent immune responce directed against one or more components of one’s own organism and consists in developing autoantibodies or autoreactive cells. As a result, a wide spectrum of organ specific diseases can arise, such as *primary thyreoiditis*, *diabetes* or systemic diseases as *collagenoses*.

More probably there is a family predisposition for the development of autoimmunity.

The effects of pesticides, as well as of the remaining toxic substances on immunity show individual variations to their doses, depending on the genetic characteristics of the organism’s immune system.

**General remarks on the immunotoxicity of pesticides.** Usually it is very diffucults to determine when the immunity of a definite person is suppressed by pesticides, because there exist many other factors, which influence nonspecific reactivity. Such are nutrition regime, harmful habits (smoking, use of alcohol), irregular life style, etc.

Only in case a **comparative analysis** is made between the morbidity in a group of population exposed to higher pesticide exposure and a control group exposed to a smaller extent, certain conclusions could be drawn.

Such investigations have been performed and it was found that persons, who are exposed to pesticides, suffer more often and more heavily from **some common diseases of various organs and systems** and most often of the respiratory, digestive, nervous, carvdioascular systems and hemopoesis.

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