

SYMPTOMATOLOGY OF DETRIMENTAL EFFECTS OF PESTICIDES – LITERATURE REVIEW

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SUMMARY – Farm workers chronically exposed to low levels of pesticides seldom show signs and symptoms of clinical significance. Pesticide poisoning can be acute and chronic. The primary targets of toxicity are the hematopoietic system, the cardiovascular system, the reproductive system and the nervous system. Pesticides can cause gene mutations and chromosomal aberrations in exposed individuals. Mild temporary symptoms of poisoning including headache, nausea, vomiting, dizziness, diarrhea, abdominal pain, myalgia, salivation, mental confusion, fatigue, etc., may quite frequently occur. It is essential to recognize detrimental effects of pesticides timely, thus enabling the earliest possible administration of appropriate treatment.

Key words: *Pesticides – adverse effects; Pesticides – toxicity; Agricultural Workers Diseases – poisoning; Occupational Exposure – adverse effects*

Introduction

Pesticides have been used daily for plant protection in rural areas. Besides their protective effect for the plants, they also have detrimental effects for animals and humans, especially if used inappropriately. There is a number of clinical statuses and symptoms associated with pesticide poisoning, accompanied by other vague symptoms such as instability, fatigue, nausea, vomiting, headache, abdominal pain, myalgia, etc.¹⁻³. When suspecting pesticide poisoning, a wide diagnostic work-up is to be done, including complete blood count, blood biochemistry, urine tests, esophagogastroscope and ultrasound of the abdomen in case of gastric discomforts, x-ray, pulmonary function tests, electrocardiography in case of respiratory and/or cardiac problems, neural conductivity tests and magnetic resonance of the brain if required, Rey-Kim memory test, Mini Mental State

Examination (MMSE), and in some cases psychoanalytical tests^{4,6}. Exposure to pesticides causes numerous side effects that often proceed unnoticed or are related to other possible causes. Here is a review of the literature on pesticide detrimental effects.

Review of the Literature

We performed a systematic review of peer-reviewed publications identified through MEDLINE databases (searched through May 2007). The search term was pesticide, and the search was limited to clinical trials and articles in English. The search was extended by review of bibliographies from pertinent original reports of data and review articles. Unpublished trials and data presented only in abstract form were not included. Authors very often report numerous associated detrimental effects manifested by a number of symptoms such as malaise, weakness, abdominal pain, headache, dizziness, tightness, leg and back pain, anemia, nausea, vomiting, dizziness, blurred vision, tachycardia, tachypnea, salivation, miosis, elevated blood pressure, fasciculation, lethargy, etc. (Table 1).

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Received July 25, 2007, accepted August 30, 2007

Table 1. Symptoms noticed by clinicians as related to pesticide exposure

Study author(s)	Pesticide	Symptoms
Ferraz <i>et al.</i> ⁶	fungicide maneb*	plastic rigidity with cogwheel phenomenon, headache, fatigue, nervousness, memory complaints, sleepiness, postural tremor, cerebellar signs, bradykinesia
Youssef <i>et al.</i> ⁷	ivermectin	fever, headache, weakness, nausea, epigastric pain, with no adverse physical or laboratory findings
Shenoy <i>et al.</i> ⁸	ivermectin and diethylcarbamazine	fever, myalgia, headache, lethargy
London <i>et al.</i> ⁹	organophosphate	dizziness, sleepiness, headache and a higher overall neurological symptom score
Parrón <i>et al.</i> ¹⁰	pesticides in greenhouses	spontaneous abortion, depression, headache, tremor, paresthesia
Acuna <i>et al.</i> ¹¹	methyl bromide	insomnia, headache, paresthesia, mood changes and loss of memory and concentration
Mouliá-Pelat <i>et al.</i> ¹²	ivermectin	myalgia, arthralgia, headache, asthenia, anorexia, vertigo, chills
Coutinho <i>et al.</i> ¹³	ivermectin	fever, headache, weakness, myalgia
Misra <i>et al.</i> ¹⁴	organophosphate pesticides	cognitive dysfunction
Ducorps <i>et al.</i> ¹⁵	ivermectin	fever, pruritus, headache, arthralgia
Bauer <i>et al.</i> ¹⁶	mercury and mercuric chloride	headache, nausea, mucosal irritation
Eysseric <i>et al.</i> ¹⁷	chlorate poisoning	respiratory failure, vomiting, headache, stupor, arterial hypotension, cyanosed face and limbs, acute hemolysis, methemoglobinemia
Burgess ¹⁸	phosphine-metamphetamine laboratory	dizziness, cough, headache, diarrhea
Pani <i>et al.</i> ¹⁹	diethylcarbamazine-ivermectin	fever, headache, myalgia
Chodorowski <i>et al.</i> ²⁰	finofril	headache, nausea, vertigo, weakness
Yang <i>et al.</i> ²¹	copper sulfate	gastrointestinal injury, hemolysis, methemoglobinemia, hepatorenal failure, shock
Satar <i>et al.</i> ²²	carbofuran	nausea, vomiting, headache, weakness, dizziness, blurred vision, tachycardia, tachypnea, salivation, miosis, elevated blood pressure, fasciculation
Abue Mourad ²³	organophosphorus insecticides	eyes/face, itching/skin irritation, chest symptoms, increased leukocyte and platelet counts, decreased hemoglobin
Lu ²⁴	pesticide	eye itchiness and blurring of vision, dizziness, headache, respiratory inhalation-vapors and mists
Ernstgard <i>et al.</i> ²⁵	hexanal vapors	discomfort in the eyes and nose, solvent smell, headache
Gunay <i>et al.</i> ²⁶	copper poisoning	malaise, weakness, abdominal pain, headache, dizziness, tightness in the chest, leg and back pain, anemia

Table 2. Incidence of particular symptoms in poisoning with certain pesticides

Study author(s)	Pesticide	Incidence of particular symptoms	
Agarwal ²⁷	organophosphorus poisoning	vomiting	96.8%
		nausea	82.1%
		miosis	64.2%
		excessive salivation	61.1%
		blurred vision	54.7%
		giddiness	93.7%
		headache	84.2%
		disturbances of consciousness	44.2%
		sinus tachycardia	25.3%
		sinus bradycardia	6.3%
		depression of ST segments with T-wave inversion	6.3%
		hypertension	10.5%
		muscular twitching	2.1%
		albuminuria	12.6%
azotemia	18.9%		
inhibition of acetylcholinesterase enzyme activity	78.9%		
Neuberger <i>et al.</i> ²⁸	dioxin	sleep disturbance	44%
		headache	32%
		neuralgia	30%
Gomes <i>et al.</i> ²⁹	long-term exposure to pesticides	conjunctiva irritation	47.3%
		watery eyes	52.2%
		blurred vision	63.3%
		dizziness	55.2%
		headache	63.7%
		muscular pain	61.1%
		weakness	76.6%
Buchholz <i>et al.</i> ³⁰	methomyl-contaminated salt	nausea	95%
		dizziness	72%
		abdominal cramps	58%
		headache	52%
		vomiting	51%
		chills	48%
		diarrhea	46%
		lightheadedness, disequilibrium	48%
		Bussaratid <i>et al.</i> ³¹	ivermectin
myalgia	30%		
drowsiness	30%		
pruritus	20%		
nausea/vomiting	20%		
dizziness	15%		
diarrhea	15%		
feeling of short breath	10%		
feeling of palpitations	10%		
constipation	5%		
anorexia	5%		
headache	5%		
Tsai <i>et al.</i> ³²	methomyl	general weakness	84%
		ataxia	82%
		dizziness	82%
		vomiting	80%
		sweating	75%
		floating sensation	71%
		headache	69%
		dyspnea	69%
		blurred vision	67%

The occurrence and incidence of particular pesticide poisoning symptoms significantly vary depending on the pesticide applied (Table 2).

Discussion

Pesticides have been widely used in developing countries over years. Their effects to the environment and living beings are significant. Pesticide pollution is detrimental to human health. The effects can be seen on a short- or long-term basis and the symptoms can vary from headache to cancer³³. Cytogenetic studies showed a significantly higher rate of chromosomal aberrations in the exposed group compared to the control group³⁴. The primary targets of toxicity are the hematopoietic system (serum cholinesterase inhibition), the cardiovascular system (cardiovascular lesions, abnormalities in heart rate and increase in heart-to-body ratio, the reproductive system (placental morphology, fibrosis and hemorrhage, and inhibition of DNA synthesis in seminiferous tubules), and the nervous system (headache, muscle weakness, insomnia, dizziness, and impaired memory)³⁵.

Pesticides are handled carelessly, and 92% of workers involved in the mixing, loading, and spraying of insecticides and fungicides used no protective clothing or equipment whatsoever. Some 62% of workers reported at least one illness associated with mixing or spraying pesticides. The most frequently reported symptoms were headache, nausea, vomiting, dizziness, skin irritation, and blurred vision. Only 21% of affected workers required medical care^{36,37}. It has been noticed that numerous symptoms present in pesticide poisoning also appear with other numerous diseases and syndromes, but also independently as isolated symptoms. Therefore, pesticide poisoning symptoms should be borne in mind. Certainly, the basis of the diagnosis of pesticide detrimental effects is their application and, whenever possible, laboratory toxicological analysis of the poisoning. Very often, pesticide poisoning cannot be proven by laboratory methods, but the patient's history and clinical examinations help in diagnosing the actual causes of the disease.

In mild cases of poisoning, abundant hydration will suffice, however, in more severe cases the treatment consists of mechanical ventilation, vasoactive amines, methylene blue, plasma exchange, exchange transfusion, and hemodialysis¹⁷. It is essential to recognize detrimental effects of pesticides timely, thus enabling the earliest possible administration of appropriate treatment.

Education of the users of pesticides and the community in general is essential to upgrade the awareness of the toxicity of these agents and to reduce the associated morbidity.

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Sažetak

SIMPTOMATOLOGIJA ŠTETNIH UČINAKA PESTICIDA – PREGLED LITERATURE

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Poljoprivrednici koji su kronično izloženi niskim razinama pesticida rijetko pokazuju klinički značajne znakove i simptome. Trovanje pesticidima može biti akutno i kronično. Primarna ciljna tkiva toksičnosti su krvotvorni sustav, kardiovaskularni sustav, reproduksijski sustav i živčani sustav. Kod izloženih osoba pesticidi mogu uzrokovati mutacije gena i poremećaje kromosoma. Blaži, prolazni simptomi trovanja su često glavobolja, mučnina, povraćanje, omaglica, proljev, bolovi u trbuhu, bolovi u mišićima, salivacija, zbunjenost, umor itd. Od bitne je važnosti pravodobno prepoznati štetno djelovanje pesticida, čime se omogućava primjena odgovarajuće terapije što je ranije moguće.

Ključne riječi: *Pesticidi – štetni učinci, Pesticidi – toksičnost; Poljoprivrednici – otrovanje; Profesionalna izloženost – štetni učinci*