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Evaluation of chronic intoxication by organophosphate insecticides among hygiene workers in the city of Fez, Morocco

Évaluation de l'intoxication chronique par les insecticides organophosphorés chez les agents d'hygiène de la ville de Fès, Maroc

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Summary

Context of the study. The use of pesticides in the field of public health involves a risk for both humans and the environment.

Objective. The purpose of this study, carried out for the first time in the center of Morocco, was to evaluate chronic intoxication by organophosphate insecticides. This was done through the evaluation of cholinesterase activity as a biomarker of pesticide intoxication among a population of hygiene workers who daily handled these products, in six districts of the city of Fez.

Method. This study is a descriptive cross-sectional study including 30 consenting hygiene workers carried out during a period of 4 months (February–May 2015). The study included a physical examination and biotoxicological measurements: plasma and erythrocyte acetylcholinesterase activity. Erythrocyte acetylcholinesterase activity was determined by spectrophotometric method at ambient laboratory temperature (25 °C) using the kit “Test Mat - model 400”.

Results. Twenty-nine subjects of the studied population were of male gender with an average age of 48 ± 8 years and a body mass index of $25.67 \pm 2.09 \text{ kg/m}^2$; and only one subject was of female gender aged 56, and a body mass index of 26.25 kg/m^2 . The somatic clinical examination of the participants in this study revealed neither

Résumé

Contexte. L'utilisation des pesticides dans le domaine de l'hygiène publique comporte un risque pour l'homme et aussi pour l'environnement.

Objectif. Cette étude, réalisée pour la première fois au centre du Maroc, avait pour but d'apprécier l'intoxication chronique par les insecticides organophosphorés. Cela, à travers l'évaluation de l'activité enzymatique du cholinestérase en tant que biomarqueur de cette intoxication chez une population d'agents d'hygiène, manipulateurs quotidiens de ces produits, au niveau de six arrondissements de la ville de Fès.

Méthode. C'est une étude transversale descriptive portant sur 30 personnes consentantes, réalisée durant une période de 4 mois (février à mai 2015). L'étude a comporté un examen physique et des mesures biotoxicologiques. Le dosage de l'acétylcholinestérase a été réalisé par une méthode spectrophotométrique, à la température ambiante du laboratoire (25 °C) à l'aide de l'appareil Test-Mate model 400.

Résultats. Vingt-neuf sujets de la population étudiée étaient de sexe masculin avec un âge moyen de 48 ± 8 ans et un indice de masse corporelle de $25,67 \pm 2,09 \text{ kg/m}^2$; et un seul sujet était de

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serious clinical history nor cases of pesticide poisoning. The mode value of erythrocyte cholinesterase activity was 54, and that of plasmatic cholinesterase activity was 65. The measured cholinesterase activity is not correlated with age but it is correlated with the body mass index. Three cases showed a decrease in cholinesterase activity of the order of (35%, 36%, and 25%) compared to 30% as recommended by the World Health Organization.

Conclusion. These results relating to the determination of cholinesterase activity, although preliminary, should reassure the exposed persons and the authorities concerned without neglecting the systematic control of the three cases detected. The use of organophosphates in the field of public health requires regular checking, precautions, and training of the hygiene workers to avoid any serious health risk.

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sex féminin d'un âge de 56 ans et un indice de masse corporelle de 26,25 kg/m². L'examen clinique somatique, effectué sur les participants à cette étude, n'a révélé ni antécédents cliniques graves, ni cas d'empoisonnements aux pesticides. Le mode de l'activité cholinestérasique érythrocytaire a été de l'ordre de 54 et celui de l'activité cholinestérasique plasmatique a été de 65. L'activité cholinestérasique mesurée n'est pas corrélée à l'âge mais elle est corrélée à l'indice de la masse corporelle. Trois cas ont présenté une diminution de l'activité enzymatique des cholinestérasées de l'ordre de 35 %, 36 %, 25 %. Le seuil de 30 % est celui recommandé par l'Organisation mondiale de la santé.

Conclusion. Ces résultats relatifs au dosage de l'activité cholinestérase, bien que préliminaires, peuvent rassurer les personnes exposées et les autorités concernées sans pour autant négliger la surveillance systématique des trois cas détectés. L'utilisation des pesticides nécessite un contrôle, des précautions et une formation des agents manipulateurs quotidiens de ces produits pour éviter tout risque sanitaire grave.

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Mots clés : Organophosphorés, Intoxication, Évaluation, Agents d'hygiène, Risque sanitaire, Fès - Maroc

English version

Introduction

Pesticides are all the chemical or biological products intended to destroy living elements considered as vermin (microbes, vectors, animals or plants), or interrupt their development. The use of the pesticides (insecticides, herbicides, fungicides, etc) enable to improve the outputs and diversity of the agricultural products as well. It also made it possible to control a certain number of vectorial diseases (Malaria, leishmaniasis, Dengue, West Nile, etc). However, that was not without side effects. Indeed, the accidental or voluntary exposure to pesticides is potentially toxic, often with mortal or unfavorable predictions [1].

According to the report of the World Health Organization (WHO), the annual number of intoxications by pesticides is estimated between 1 and 5 million, of which several thousands are mortal [2]. Other studies show that each year, there are 1 million involuntary intoxications and 2 million intentional intoxications, with 220,000 deaths [3]. The pesticides—because of the facility of their availability and their broad agricultural or domestic use, in particular organophosphates (OP) and the carbamates (CM)—are the principal responsible agents [4].

In Morocco, although few studies focused on the role of the pesticides in toxic pathology, some of them showed that they constitute a cause of intoxication far from being negligible.

According to the data of the Anti Poison and Pharmacovigilance Centre of Morocco (APPCM), the Acute Intoxications with Pesticides (AIP) occupy the 4th position after the drugs, the industrial products and foods. Their rough rate of incidence at the national level was of 2.3 for 100,000 inhabitants in 2000, and 2.56 for 100,000 inhabitants in 2005 [5]. According to the APPCM, the highest lethality by the AIP were recorded in the area of Tadla-Azilal (9%), followed by the area of Doukala Abda (5.5%) [5,6]. These statistics are quite sufficient to confirm the existence of a serious public health problem.

In Morocco, pesticides are mainly used by three principal departments: the Interior (for mosquito control), Health (for the fight against disease vectors) and Agriculture (for the fight against plant ravagers). Unfortunately, most of these widespread pesticides do not reach their target. An important part of these products is dispersed in the atmosphere either during application or by evaporation; which will, undoubtedly, affect the human health [7]. Certain harmful effects on health due to the exposure to a pesticide (chemical irritations, allergies, intoxications...) can be felt immediately after the exposure. Other effects can appear after several years, for example cancer [8–10].

Our study aimed at the evaluation of the enzymatic activity of the cholinesterase as a biomarker of this intoxication on a population of workers of hygiene, daily manipulators of these products, in six districts of the city of Fez.

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