



Epidemiology of acute pesticide poisoning in Morocco: a 7-year retrospective study (2008-2014)

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Abstract

The aim of this study was to determine the epidemiological profile of acute pesticide poisoning. A retrospective study of poisoning cases, declared between January 2008 to December 2014 at the Moroccan Anti-poisoning and Pharmacovigilance Center (MAPPCC), was conducted. During the study period, 6 800 acute pesticides poisoning cases were collected. Most cases resulted from the province of Rabat-Salé Zemmour-Zaer (17%). The average age of patients was 21 ± 14 years. The sex-ratio (female/male) was 1.4. The adults and the teenagers were the most concerned by this type of poisonings, with respectively, 3 436 cases (50.52%) and 1 372 cases (20.17%). In 60.44% of the cases, the poisonings were accidental, with a lethality of 1.14%. The pesticide poisoning occurs more often in urban zones with 90.1%. The insecticides have registered the highest number representing 48.8% of the cases. 201 deaths were declared of the 4 761 patients for whom the outcome was known, with a lethality of 4.2%.

1. Introduction

Pesticide intoxication is considered to be a great hazard to the public health in all across the world [1-2]. Pesticides are intended for the extermination or repelling of insects, weeds, rodents, fungus and other creatures that may threaten the public wellbeing and the national economy. Nevertheless, in the case of misusing or careless storage, these chemicals can also harm humans and cause some solemn or even lethal accidents. According to the World Health Organization (WHO) report in 2004, the annual pesticide intoxication is estimated to be among 1 and 5 million, which includes several thousand fatal cases; additional studies have proved this ascertainable pesticide-related mortality by estimating the annual number of deaths at about 300,000 cases [3-4]. It has also been revealed that 99 % of these deadly poisonings have been acknowledged in developing countries and these latter are notably affected by this affliction due to lack of regulation, monitoring systems and inadequate access to information of the health care systems. In Morocco, between 1989 and 2007, the Moroccan Anti-poisoning and Pharmacovigilance Center (MAPPCC) collected 10 332 cases of acute pesticide intoxication (API), representing 14% of all poisoning cases reports received during the same period, the child under 4 years of age was represented in 28% of the cases [5]. This study aims to describe the epidemiological, clinical and evolutionary aspects of acute poisoning by pesticides in Morocco between 2008 and 2014, In order to promote measures for their medical care and their prevention.

2. Experimental details

The current research constitute a retrospective epidemiological study of in Morocco (6 800 cases) that are reported over a period of seven years, from January 2008 to December 2014, at the Moroccan Anti-poisoning and Pharmaco-vigilance Center (MAPPC) . The data carriers used in this study are the Toxicovigilance forms that are completed by the doctor or nurse in charge of the patient, and the medical records that are set up at the Toxicological Information Service at the MAPPC.

The adopted methodology hinges on giving a thorough description of the studied sample. This description concerned the characteristics of the intoxicated population (year, region, origin, sex, age, type of intoxication, situation, symptomatology, degree and evolution), alongside the characteristics of the toxicant (family of the product under consideration).

The appraisal of the condition severity (grade) was implemented according to the "poisoning severity score" [6]. The age was evaluated via the INTOX classification. The analysis also covers health indicators (Lethality indicates the number of deaths by the number of poisoned cases, and the specific lethality of a given factor). The χ^2 test is employed to find out whether a difference between certain variables is significant. The Odds ratio calculation allows us to reveal the links between the different factors and the evolution of intoxicated patients.

3. Results and Discussion

3-1 Characteristics of the intoxicated population

Throughout the study period, MAPPC, had collected 6 800 cases of pesticide intoxication in Morocco. The results demonstrated that the average age of the intoxicated population was 21 ± 14 years. The poisoning mainly concerned adults between the ages of 20 and 74 (about 50.5%) and the lethality was higher in newborns with 15.38% while the female patients prevailed with 54.4%, sex ratio (F / H) being 1.4, with a higher lethality in male (3.20%). Overall, Nearly 90.1% of the poisoned patients resided in urban areas .

The occurrence rate of the cases had steadily increased up until 2013, from 778 cases in 2008 to reach its peak in 2012 with 1 560 cases. During 2011, the number of intoxication has witnessed a dramatic drop from the year 2010 with 900 cases of declaration. More than half of the patients resided in rural areas (58.52%). The Rabat-Salé Zemmour-Zaer region recorded the maximum number of declarations, with approximately 17% of the cases, followed by Casablanca (13.9%). The highest lethality was recorded in Taza-Al Hoceima-Taounate province (10.06%), followed by the province of Chaouia-Ouadigha (7.44%). (Figure 1) .

In 60.44% of the cases, the poisonings were accidental, with a lethality of 1.14%. The clinical condition of the patients was predominantly symptomatic (59.3%), with a specific lethality of 3.80%. The degree of severity of the poisoning was moderate for the most part (Grade 2) (33.25%). 201 deaths were declared of the 4 761 patients for whom the outcome was known, with a lethality of 4.2%. Table 1 and figure 2 display the results of the analysis according to the parameters related to the intoxicated population.

Based on the World Health Organization report, the annual number of pesticide intoxications is estimated to be between 1 and 5 million, of which several thousand cases were fatal. In consonance with the Paris poisoning center and between the years 1992 and 1998, pesticides were involved in 1.9% of the received cases [7]. In 2002, pesticides were the receivers of 6.9% of the calls to US poisoning center. In Morocco, even though few studies have focused on the place of pesticides in toxic pathology, some of them have shown that they are a non negligible cause of intoxication. According to data from the Moroccan Anti-poisoning and Pharmaco-vigilance Center, acute pesticide poisoning (APP) was ranked fourth after drugs poisoning, industrial products and food, and their crude incidence rate at the national level was 2.3 per 100,000 population in 2007 and 2.56 per 100,000 population in 2008 [8].

In our series, men and women were affected in a similar way; the mean age of the patients was 21 ± 14 years with a sex ratio (F / H) of 1.49. Conforming to the analyzed data, adults and adolescents are the most influenced, with frequencies of 50.52% and 20.17%, respectively.

This result is in agreement with a study national carried out by MAPPC, according to which adults accounted for 45.1% of all cases of pesticide and agricultural poisoning [9]. The impact of age could probably be in relations with the severity of the suicidal circumstances in these two groups with relatively higher ingested doses than in unintended circumstances. Voluntary circumstances accounted for 39.6% of cases with a specific lethality of 5.72%, which 40% are suicidal intoxications.

This quite high rate may be due essentially to the over dose ingested when the patient is depressed. This could also be explained by the young age of the Moroccan population and the confrontation of young people with difficulties in life and family problems, conjugal, sentimental, educational failures but above all unemployment) [10].

The rural population is more affected by pesticide poisoning at a rate of 58.5%, which could be connected to the expanded exposure to pesticides during farming activities, and the inaccessibility of rural areas to the health facilities and services of the Anti-poisoning Center or ignorance of the effectiveness of this Center. Pesticide intoxication mostly took place at home (5,241 cases). Furthermore, in 1998, the Center Anti Poison in Toulouse received 15,300 calls, 55% of which were accidental domestic poisonings (Center Anti Poison Toulouse).

Table I: Characteristics of the intoxicated population

Variable	Effective (%)	Cured cases	Deceased cases	SL*(%)
	(total.N=) 6800			
Age groups				
New born	13	6	2	15.38
Walking baby	1 120	888	7	0.63
Children	632	437	12	1.90
Teenagers	1 372	840	47	3.43
Adults	3 436	2 265	129	3.75
Elderly	26	17	2	7.69
Unknown	201	71	2	0.99
Total	6 800	4 524	201	2.95
Sex				
Male	2 629	1777	84	3.20
Female	3 696	2423	112	3.03
Unknown	475	360	5	1.05
Total	6 800	4 560	201	2.96
Origin				
Urban	1 932	2 806	121	6.26
Rural	3 980	1 214	57	1.43
Unknown	888	540	23	2.59
Total	6 800	4 560	201	2.96
Clinical condition				
Symptomatic	4 030	2 657	153	3.80
Asymptomatic	2 170	1 503	43	1.99
Unknown	600	340	0	-
Total	6 800	4 500	196	2.96
Circumstance				
Accidental	4 110	2925	47	1.14
Voluntary	2 690	1635	154	5.72
Unknown	0	0	0	-
Total	6 800	4 560	201	2.96
Type of intoxication				
Isolated	6 372	4 238	198	3.11
Collective	428	322	3	0.70
Unknown	0	0	0	-
Total	6 800	4 560	201	2.96
Place				
Domestic	5 241	3 562	162	3.09

Professional	320	268	1	0.31
Public	149	105	5	3.36
school	26	24	0	-
Other	22	28	2	9.09
Unknown	1042	584	31	2.98
Total	6 800	4 571	201	2.96
Grade(PSS)				
Grade 0(None)	1 218	1 218	0	-
Grade 1(Minor)	554	554	0	-
Grade 2(Moderate)	2 261	2 261	0	-
Grade 3(Severe)	332	332	0	-
Grade 4(Fatal)	201	0	201	100
Unknown	2 234	1 982	-	-
Total	6 800	6 347	201	2.96
<i>S.L : Specific lethality=(Number of deaths due to poisoning / Number of intoxicated patients)*100; PSS : Poisoning Score Severity</i>				

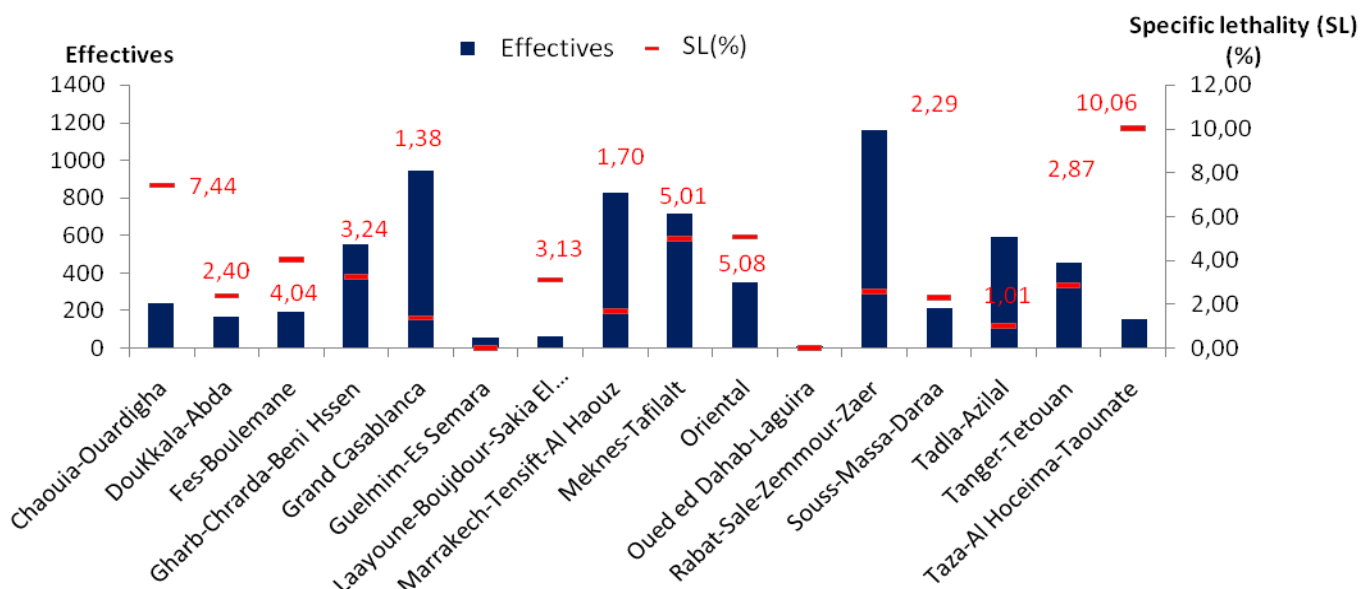


Figure1: Distribution of the declarations number and the specific lethality according to the families.

Pursuant to the results, the region of Rabat-Salé Zemmour-Zaer was the most affected with 17% of the cases, which was followed by Grand Casablanca (13.9%), this is attributed to the availability of prohibited products on the domestic market through underground sales or smuggling. Thus, the recommendation of certain products for a specific type of crop, or even for "domestic" use is prominent [15]. The clinical course of intoxication by pesticides was generally favorable, and death occurred in 201 cases .In the literature, the frequency varies from 4 to 25% .

3.2. Toxic related characteristics

The figure below (Figure2), showcases the number of declarations and the specific lethality of the families of the pesticides under consideration: the insecticides have registered the highest number of declarations during the period 2008-2014 which represents 48.8% of the cases. The poisoning by the rodenticides comes in second position with 28.53% of the cases. Nevertheless, the most important lethality was seen in poisoning by herbicide (5.13%), followed by insecticides (2.40%). This could be attributed to the availability and easy access of agricultural products, especially in rural areas, including agricultural fields and land of the region.

The chemical class of pesticides responsible for poisoning varies from one country to another, the organophosphates predominate the majority of published studies [10-11]. In our research, the insecticides are accounted for 48.8% of intoxication cases. These results are comparable to those of most published studies [12-13]. Hence, in Morocco, the epidemiological data established by the MAPPC, shows that organophosphorus pesticides are accountable for 13% poisoning [14]. This can be elucidated by the accessibility and easy reach of agricultural products, especially in rural areas.

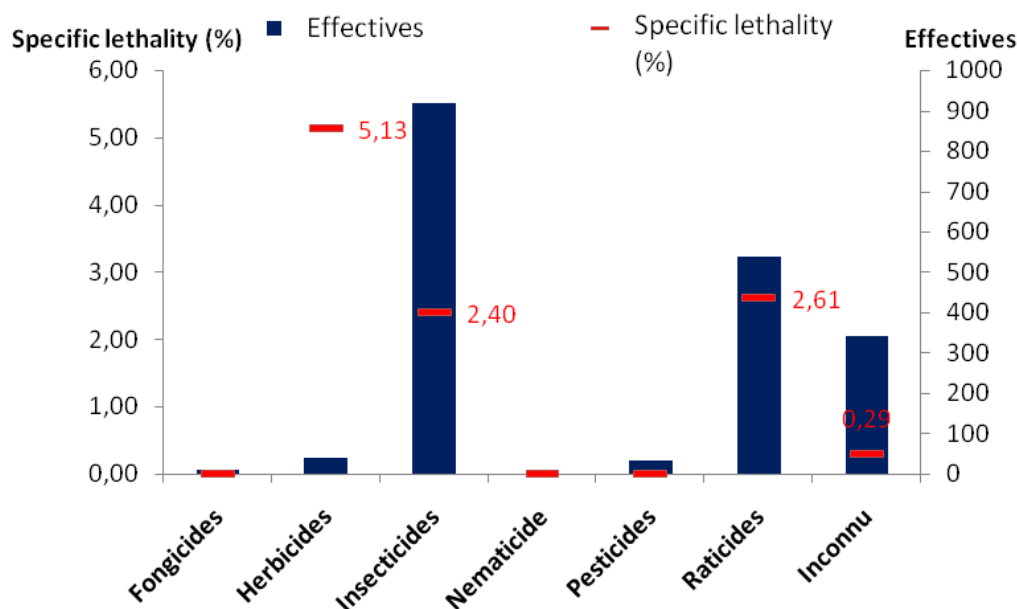


Figure 2: Number of declarations and specific lethality's distribution according to the families of the toxicants.

3.3. Effects of certain factors on the progress of the patients

The second table points out the analysis of the connection between evolution and the socio-epidemiological and evolutionary studied parameters.

Table II: Factors significantly associated with the progress of intoxicated patients

Variable (first modality vs second modality)	Evolution (Healed vs Deceased) (N=4052 ; N=46)	OR [CI 95%]	P
Origin (Rural vs Urban)	4560 vs 201	2,33 [1,11-4,88]	0,028
Clinical Status (Asymptomatic Vs Symptomatic)	4500 vs 196	6,51 [3,50-12,13]	0,001
** Very significant link (p=0,01) ; *** Highly significant link (p=0,001). OR : Odds Ratio ; IC 95 % : Confidence interval at 95 %.			

Among the six studied variables which are; Sex, Age, Circumstance, origin, Type of intoxication and clinical condition, the origin of the patients, their clinical condition, had a significant association with death, while patients of rural origin were twice more likely to die than those with urban one. This phenomenon could be associated with inadequate health and road infrastructures in addition to the communication ways (telephone, fax ...) in the rural world. Patients with an asymptomatic condition were 6 times more at risk of eventual death, since without warning symptoms for the victim or even preliminary symptoms that were not disturbing (vertigo-vomiting ...), the patient and those around him will not know when to go to health facilities (Hospital, clinic ...) [16] (Table II).

Conclusions

The realization of such a study, allows us to see a change in the profile of pesticide poisoning, And requires action to be taken for the population, health professionals and phytopharmaceutical industries in Morocco. The establishment of a surveillance system based on MAPPC data is one of the major issues of toxicovigilance for the years to come.

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