

Full Length Research Paper

Evaluation of the therapeutic and toxicological knowledge of herbalists on the most notified plants in the poison control and pharmacovigilance center of Morocco

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According to the World Health Organization, 80% of the population in developing countries is engaged in traditional medicine. Consequently, the issue of poisoning by plants is not negligible. The objective of this study is to evaluate the therapeutic and toxicological knowledge of herbalists of the most reported plants in the anti-poison center of Morocco. Field study by direct interview with 20 herbalists of the Rabat-Témara region to assess their therapeutic and toxicological knowledge of the most reported plants in the anti-poison center of Morocco, as well as the conditions of their sale, through a questionnaire. A total of 20 herbalists were accepted to participate in the study. Not all of them had a herbalist certificate and only two knew all the plants studied. The most recommended plant by herbalists to their clientele was *Atractylis gummifera*. Although the law prohibits the possession and sale of any toxic plant, the availability of these plants to the herbalists surveyed varies between 100% for *A. gummifera* and 0% for *Hyoscyamus falezlez*. None of the herbalists received notifications of cases of intoxication. Although the therapeutic knowledge of herbalists was well advanced, their toxicological knowledge was not, so we note that the majority of herbalists did not know with precision the possible side effects of the plants sold, or how they could be used safely. Although plants have real and beneficial effects, they are not devoid of side effects that can sometimes be fatal; hence the need to focus on regulation of the functions of the herbalist.

Key words: Herbalists, plants, phytotherapy, poisoning by plants.

INTRODUCTION

Since time immemorial, humans have used plants: first to feed themselves, then to heal themselves. Medication by plants is currently experiencing a veritable revival,

particularly in countries like Morocco, which is known for its great wealth of plants (nearly 42 000 species, including nearly 600 used in traditional medicine)

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(Hmamouchi, 1995). The World Health Organization estimates that 80% of the world's population uses herbal medicines for some aspect of primary healthcare. Although modern medicine is well developed almost everywhere in the world, a significant proportion of the population still relies on herbalists and traditional healers, generally poorly or not at all trained about the diagnosis of diseases and handling of herbal medicine (Bousliman et al., 2012; Bouayyadi et al., 2015).

Consequently, the proportion of intoxications linked to the use of plants is not negligible; they still constitute today a frequent cause of hospitalization in Morocco (Hamia et al., 2009). According to the latest general report of the Anti-poison and Pharmacovigilance Center of Morocco (CAPM), 197 cases of intoxication by plants and products of the traditional pharmacopoeia (PPPT) were identified in 2017, making it the ninth most common (1.17%) cause of intoxication in Morocco. Moreover, the incriminating PPPT were unknown in 27.04% of cases (Chebat, 2017). Thus, there is a need to evaluate the clinical efficacy of plants, ensure their safety, strengthen the knowledge and performance of herbalists and phytotherapists, and ensure adequate follow-up of patients. For this reason a field study was conducted with herbalists to evaluate their toxicological and therapeutic knowledge of the principal plants cited in cases of vegetal intoxication collected by the CAPM, and to determine the availability and conditions of sale of these plants.

MATERIALS AND METHODS

A transverse descriptive study was conducted by direct interview with 20 herbalists of the region of Rabat-Témara. This study took place from 01 June to 30 August 2016. A field survey by means of a questionnaire (Annex 1) was carried out. The plant objects of study were the 10 plants most reported to the Phytovigilance Unit of the CAPM. The list of these plants was retrieved during a meeting with Unit officials. The plants are reported to the CAPM by their French, Arabic, or Amazigh common names, and the center systematically specifies the scientific name of the plant according to the international binomial nomenclature. These declarations are registered in a Herbal medicines adverse events database. The herbalist participants in our study were randomly selected without distinction as to sex, age, or professional experience. The established questionnaire contained 17 questions (9 multiple-choice and 8 open questions) and covered four main topics:

- (i) Information concerning the herbalist;
 - (ii) Information on the plant, its use, and its mode of preparation;
 - (iii) Information about its availability to the herbalists and the conditions of its sale;
 - (iv) Information about the toxicity of the plant in question.
- The results obtained from this study were analyzed through the software SPSS.10.

RESULTS

After having consulted the head of the Phytovigilance Department of the CAPM, the 10 plants most reported to the Department (Table 1) are as follows: *Atractylis*

gummifera; *Papaver somniferum*; *Datura stramonium*; *Nerium oleander*; *Mandragora autumnalis*; *Rubia peregrina*; *Hyoscyamus falezlez*; *Citrullus colocynthis*; *Aristolochia longa*; *Indigo* sp. During the period of study, 30 herbalists were consulted (12 in Temara and 18 in Rabat), but only 20 agreed to participate in the study. The average age of the participants, all male, was 39 years (range: 22-60). Of the 10 plants studied, 9 were deemed poisonous plants (*A. gummifera*; *P. somniferum*; *D. stramonium*; *N. oleander*; *M. autumnalis*; *C. colocynthis*; *A. longa*, *H. falezlez*, *Indigo* sp) the one plant not deemed poisonous (*R. peregrina*) can become toxic under certain conditions of use. None of the participants was a holder of herbalist's certificate. The rest of the results will be presented according to other major axes addressed.

Information on the plant, its use, and its mode of preparation

The average number of Arabic vernacular names reported varies between one and four appellations for *D. stramonium* (Chdaq jemal; Alhayare; Habate semkala; Alghita). Apart from their therapeutic uses, 20% of the plants were used as an abortifacient, 20% for criminal intent, 15% in witchcraft, and 10% as psychoactive plants. *A. gummifera*; *N. oleander*; *R. peregrina* and *C. colocynthis* were known by all the herbalists surveyed (100%), while *H. falezlez* was known only by two (10%) herbalists. The plants most recommended to the public were *A. gummifera*; *R. peregrina*; *Indigo* sp and *C. colocynthis*. Table 1 summarizes the principal therapeutic uses of the plants studied as expressed by the herbalists consulted.

Information about its availability to the herbalists and the conditions of its sale

A. gummifera; *C. colocynthis*; *R. peregrina* were available to all the herbalists (100%) interviewed, while *H. falezlez* was not available to any herbalist. The average number in grams sold for each plant is reported in Table 1.

Information about the toxicity of the plant in question

No herbalist reported ever receiving notifications about cases of intoxication. The declared symptoms of toxicity were generally digestive and neuropsychologic. Of the toxic plants, only *A. gummifera* was recognized as toxic by all (100%) of the interviewed herbalists, while none of the surveyed herbalists (0%) knew *H. falezlez* to be a toxic plant. The toxic risks most announced to buyers were those of *A. gummifera*, *C. colocynthis* and *M. autumnalis*.

Table 1. The top ten most notified plants in the phytovigilance department of CAPM.

Arabic names	vernacular	Scientific Latin name	Main therapeutic uses announced by herbalists	Number of herbalist who knows the plant	Number of Herbalist Advising the plant to the public	Availability of the plant at the herbalist	Average number in gr sold at a time	The symptoms of toxicity announced by the herbalists	Number of Herbalist Advertising Toxicity of Plant	Number of Herbalist Know Toxic Plant
Adda		<i>Atractylis gummifera</i>	Skin lightening (18*); Anti acne (12*) Andabscess (3*)	20*	09 * including 8 * explain the mode of use: powder + henna skin	20*	30 g	Eye toxic (2*) + vomiting (5*) + death (16*)	20* only	08* inform about its toxic risk
Khachkhach; kharchacha; alafyoune		<i>Papaver somniferum</i>	Hypnotic for children (16*); Anxiolytic (4 *)	18*	0*	16*	07 g	Physical and psychic dependence (8*); digestive (3*); neurologicdisorders (5*)	18* only	1* informs about its toxic risk
Chdaqjema; alhayare; habatesemkala; alghita		<i>Datura stramonium</i>	Hypnotic (10*); Antitussive (3*); Antiseptic (2*); Exciting of CNS (3*)	15*	1*	13*	06g	delirium and hallucinations (8*)	15* only	1* informs about its toxic risk
Defla; alhloya; almor		<i>Nerium oleander</i>	Antirheumatic(12*); Antiparasitic (3*); Against dermatosis(3*)	20*	2 * none of which explains the method of preparation	18*	12 g	hepatic (3*); renal (4*); several organs disorders (5*)	15* only	2* informs about its toxic risk
Bidelghoul;teryala		<i>Mandragoraaut umnalis</i>	Aphrodisiac (08*); antirheumatic(08*); to beautify the hair (2*)	13*	02 * none of which explains the method of preparation	10*	150 mg	delirium and hallucinations (10*)	12* only	4* informs about its toxic risk
Fuwwa		<i>Rubia peregrina</i>	Antianemic (13*); for hair coloring (9*)	20*	08 * including 05 * explain the preparation mode: decoction in milk	20*	50 g	00	-	-
Btina		<i>Hyoscyamus falezlez</i>	For weight gain (1*)	02*	00*	00*	-	00*	00*	00*
Hdej; hantel; ferzir		<i>Citrullus colocynthis</i>	Antirheumatic(13*) Aphrodisiac (9*); hypoglycemic (4*); Antivenin (4*)	20*	05 * including 03* explain the preparation mode: put the drug underfoot	20*	80 g	delirium (05*); death (04*)	18 * only	5* informs about its toxic risk
bereztem		<i>Aristolochia longa</i>	Anticancer (13*); Anti hair loss (3*); Wound healing (2*)	16*	02 * that explain the method of preparation: mixing honey with powdered drugs	10*	50 g	No herbalist knows the symptoms	04* none*	informs about its toxic risk
Nila		<i>Indigo sp</i>	A component of «khol» (11*) applied on the eyes; skin lightening (5*)	16*	08* including 04* explain the method of preparation: drug powder + soap	15*	30 g	In case of ingestion: digestive and renal disorders (02*)	03* none*	informs about its toxic risk

g : grams, *Number of herbalist.

DISCUSSION

Men have always tried to use the properties of certain plants for therapeutic purposes. Evidence of the use of plants for medicinal purposes dates as far back as 60 000 years ago (Solecki and Shanidar, 1975).

In Morocco the use of plants is far from negligible and it is practiced in a completely anarchic way. The Moroccan population often uses them for therapeutic purposes without taking any precautions.

Unfortunately, this enthusiasm, which is not without some hurdles and overruns imply a significant impact on plant-related poisoning (Pentel et al., 2005).

Several factors explain this often irrational and uncontrolled use for this medicine called natural medicine, firstly its reputation for safety and efficacy, its affordability compared to modern medicine, sometimes unable to treat a disease (Lehmann, 2015; Die-Kacou et al., 2009; El Hassani et al., 2013). Besides the lack of an official and codified traditional pharmacopoeia, and the lack of legislation and control determining a viable distribution system to ensure the quality of these products. In the same way, the real ignorance of the properties, the modes of use and the potential risks of the plants, by the people who sell these plants ("achaba" and "aatara"). Which failures open the way to all kinds of skidding in the collection, sale and use of plants, and also hinder the development, optimization and development of our natural resources (Soulaymani, 2010). The "Achaba" are the actual herbalists or merchant who sell the products of plant origin mainly (medicinal plants, condiments and toxic plants), but also minerals and animals or parts of animals. They play an important role at the medical level through the availability of their products and the propagation of their advice (Bellakhdar, 1997; Meziane, 2003). Unfortunately the level of knowledge and skill of some "achaba" is not all satisfactory.

Rarely prescribed by doctors, most of these products, which moreover have a very variable quality in the absence of standards of quality and control, are on free sale and in retail among herbalists.

From a legislative point of view, the profession of herbalist in Morocco is regulated by three separate laws dating all before 1960 (Soulaymani, 2010). The Dahir of February 27, 1923 relating the practice of the profession of herbalist to the provisions of the Dahir of April 12, 1916 whose second article is: "it is especially forbidden for herbalists to sell any poisonous or toxic plant".

Indeed, at many "achaba" plants and animal and mineral toxic products continue to be sold (Soulaymani, 2010), as for example in our case: *A. gummifera* which is sold by all the herbalists interviewed; *P. somniferum*; *D. stramonium*; *N. oleander*; *M. autumnalis*; *C. colocynthis*; *A. longa*; *H. falezlez* and *Indigo* sp.

In Morocco, the job-training of herbalists is usually done, oral transmission of knowledge from father to son

or from teacher to boy (Bellakhdar, 1997), therefore, knowledge in botany and herbal medicine may be lost. None of the herbalists participating in our survey has a certificate or diploma in herbalism, while the Dahir of February 19, 1960 with Article 17 stipulates that to hold and sell the plants or parts of medicinal plants, fresh or dry, the exception of plants classified in the various tables of poisonous substances, the person concerned must be provided with the herbalist's certificate and authorized under the conditions provided in Article 2 of the same Dahir.

If the legal vacuum is patent regarding the function of herbalist and the herbalism in Morocco, it is as much of the specialized and academic training in the field, evidenced by an herbalist diploma, and which allows these herbalists to have the necessary skills (knowledge of the properties, the indications and toxicities, supply, preparation of mixtures, etc.) (Soulaymani, 2010). Each plant may have more than one vernacular name, the herbalist may not know them all, and so errors in plant determination are possible. Behind the therapeutic use, it has been found in this study that other etiology can lead to intoxication by plants, such their use: as abortive; for criminal purposes; in witchcraft or as psychoactive substance.

The evolution and increasing enthusiasm of phytotherapy, during last year's, have deepened the analysis of its therapeutic efficacy and specially its toxicological aspect. This last aspect remains behind the progress of herbal medicine. Indeed, the use of traditional herbal treatments can cause therapeutic failures or accidents. This observation has been confirmed by our results, since most of the therapeutic uses reported by herbalists are described in the literature (Table 2), except in two cases. The first, *H. falezlez*, which was known only from two herbalists, one of whom reported that it is used to fatten, indication not reposted in the literature. The second case concerned *A. longa*, for which three herbalists declare that it is used against hair loss. Certainly, our herbalists have not cited all traditional uses, since a single plant may have several uses, but at least those mentioned are the main traditional uses, which have a close relationship with the mechanism of action of chemical components of the plant. Unlike the well advanced therapeutic knowledge of herbalists, toxicological knowledge remains behind the first. This is how we found that the majority of herbalists don't know exactly the manifestations of toxicity, nor the potential side effects, nor how they can be safely used, especially since the majority of the events cited are not mentioned in the literature. Table 2 summarizes the main traditional use and main symptoms of intoxication described in the literature of the top ten most notified plants in the phytovigilance department of CAPM. Moreover, these events cited by our herbalists have no scientific arguments that can be explained by the mechanisms of action of the toxic components of the plant in question.

Table 2. Main traditional uses and main symptoms of intoxication described in the literature of the top ten most-notified plants in the phytovigilance department of CAPM.

Plants	Main traditional uses	Main symptoms of the poisoning
<i>Atractylis gummifera</i> (Daniele et al., 2005; Skalli et al., 2002; Mouaffak et al., 2013).	Stop the bleedings; facilitate the deliveries; treat freckles, acne pimples and abscess	Convulsive crises ; vomitings ; fulminant hepatitis
<i>Papaver somniferum</i> (Bousliman et al., 2012 ; El Hafian et al., 2014).	Sedative of nervous system; hypnotic especially for the children	ringing in the ears; vomiting; constipation; bradycardie respiratory disorders; somnolence.
<i>Datura stramonium</i> (Flesch, 2005 ; Bhakta and Subedi, 2013; Hammiche et al., 2013).	Aphrodisiac; analgesic, hypnotic; antitussive; vulnerary.	Agitation, confusion, hallucinations, delirium, dryness of the mucous, mydriasis, tachycardia
<i>Nerium oleander</i> (Hammiche et al., (2013) ; Fakoorziba et al., 2015; Barguil and Anger, 2012 ; Flesch and Krencker, 2007).	Treatment for dermatosis ; rheumatic pains; leprosy, malaria; venereal diseases and diabetes	Digestive disorders, vision and colors disorders, atrioventricular block, bradycardia
<i>Mandragora autumnalis</i> (Passos and Mironidou-Tzouveleki, 2016); Piccillo et al., 2006); Ghourri et al., 2014) ; Gouaz, 2017).	Aphrodisiac, hypnotic, fortifying hair, used in urinary tract infections and in rheumatism	hallucinations, gastrointestinal irritation, mydriasis, tachycardia
<i>Rubia peregrina</i> (El Hafian et al., 2014 ; Gouaz, 2017 ; El Azzouzi and Zidane, 2015).	Treatment of anemia, icterus, liver disease and bowel pain; used to color hair	hepatic toxicity
<i>Hyoascyamus falezlez</i> (Hammiche and Maiza, (2006); Schmelzer and Gurib-fakim, (2008) ; Gaillard et al., 2001).	relieves pain, muscle cramps, spasms, palpitations, asthma, anxiety, treatment of cystitis	Narcotic action and important hallucinogen
<i>Citrullus colocynthis</i> (Hammiche et al., 2013 ; Benkhniqne et al., 2014; Bnouham et al., 2002).	Actions: antirheumatic, purgative, anthelmintic, aphrodisiac, antidiabetic; so against venomous bites	Vomiting, abdominal pain, bloody diarrhea, confusionalstate
<i>Aristolochia longa</i> (Bouayyadi et al., 2015; Gouaz, 2017 ; Zekkour, 2008).	Cancer treatment, scorpion stings and bites, arthritis; healing wounds	Irreversible renal damage, limb paralysis, respiratory disorders
<i>Indigo</i> sp (Labiba et al., 2012; Bellakhdar, 1997).	Skin disorders, antiparasitic and antiseptic. treatment of cough and ophthalmia, is part of the constituents of Khôl	Liver injury, cardiocirculatory failure

Considering these results, we can see that the majority of herbalists, who are supposed to play a very useful role in the proper use of these products by their permanent availability in the service of the citizen, don't have the necessary and sufficient skills to advise or sell the plants. Also, the sold quantity in grams of these plants, in most cases exceeds the toxic doses described in the literature, which exposes to the risks of poisoning even more that these toxic risks are not always declared to the users, and that for most consumers, natural is synonymous to harmless, however a plant can be both useful and toxic, it is only a question of dose. Indeed, plants are considered by the population as health products and they must therefore obey, as for medicines, strict standard rules that only the specialist in herbal medicine can respond (Zeggwagh et al., 2013). Unfortunately, the legal vacuum maintains anarchy in the marketing of medicinal and toxic plants. However, the authorities must intervene to ensure the application and compliance of existing laws, to provide continuing training in herbalism; to organize awareness-raising campaigns for herbalists on the dangers of misuse of certain plants and the serious and

even fatal adverse effects that result, as well as on the growing interest in the spontaneous notification of adverse effects observed when using the plants for therapeutic purposes, which is the cornerstone of phytovigilance from which the benefit / risk ratio of plant use can be evaluated.

Conclusion

The problem of the toxicity arises for products which get through the evaluation and scientific control, although the market of these products is expanding rapidly. Many people and sometimes the medical corps consider that plants are safe and harmless because they are natural. At present, the warnings are more and more frequent and the awareness by the healthcare professionals is increasing. We hope that a sufficient attention should be given to the exercise of the profession of herbalists, because they are considered as an important link in the chain of securitization of phytotherapy. This calls for regulating a profession of herbalists in our country.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Annex 1

QUESTIONNAIRE

Herbalist N°:; Age:.... sex :..... area of residence:.....

Plant X :.....

1. Do you know the plant X? YES NO
2. The plant X is available in your shop? YES NO
3. It has another name? YES NO
4. If yes, What are the others?.....
5. What are their therapeutic uses?.....
6. It has any misuses?
7. What is the part of the plant sold?.....
8. Which is its frequency of sale?.....
9. What is the average of grams sold at the same time?
10. You recommend it to the public? YES NO
11. Do you know that it is a toxic plant? YES NO
12. If yes, and according to your knowledge, which are his symptoms of toxicity?.....
13. You inform the buyers of its toxic risks? YES NO
14. Do you explain to the buyers the mode of preparation and the dose to use?
YES NO
15. Have you already received a notification about case of toxicity due to this plant? YES NO
16. If yes, what was your requested action?.....
17. Do you have an herbalist's certificate? YES NO