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Original Research

Unraveling Traditional Knowledge of *Ajuga iva* (L.) Schreb. Used in the Fez-Meknes Area in Morocco

Laila Lahrizi*, Faouzi Errachidi, Houria Nekhla, Lahsen El Ghadraoui

Laboratory of Functional Ecology and Environmental Engineering, Faculty of Sciences and Technology, University of Sidi Mohamed Ben Abdellah, Fez, Morocco

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Abstract

The traditional knowledge of *Ajuga iva* (L.) Schreb. used in Moroccan folk medicine may provide insight into its utilities for further *in vitro* and *in vivo* evaluation. The present work was undertaken with a view to highlighting one of the medicinal plants "musk herb", which has a wide geographical distribution in Morocco and which would be of great added value for the Moroccan pharmacopeia in general. An ethnopharmacological survey was conducted to interview a total of 207 informants, a questionnaire targeted the population of Fez-Meknes region. The interviewed people about the utility of *A. iva* confirmed the effectiveness of this plant in the treatment of numerous illnesses especially those affected digestive system (40.99%), headache (14.07%), fever (11.85%), and other pathologies represented 16.04%. The most part used is the leaves (48.30%) followed by the whole plant (43.47%). The present survey displays the importance of *A. iva* in the medical culture of Fez-Meknes population for the primary and secondary prevention of different disorders. Future mechanistic studies, as well as clinical trials, are needed to evaluate the safety and efficacy of this medicinal plant according to its ethnopharmacological uses.

Keywords: *Ajuga iva*; Ethnopharmacological survey; Moroccan folk; Traditional medicine; Fez-Meknes

Introduction

Natural products have served to satisfy different needs in the daily habits of human life as a good source of nutrients and molecular entities [1]. They are widely used for long time in folk (folklore) medicine thanks to their numerous promising health benefits. This high utility of medicinal plants is based on the easy accessibility, fewer side effects, low costs, and effectiveness [2,3]. Homemade herbal medicine preparation is practiced since early times and is transferred orally across time from generation to generation. Until now, the use of medicinal plants is widespread in developing countries, especially in rural zones [4]. Mounting evidence focused on the traditional preparations used to treat several ailments proved their tremendous properties as a safe way with fewer side effects that may be an alternative for conventional medication [5-7]. The wide range of bioclimatic conditions of Morocco make it a true herbs genetic reserve with a considerable endemism [8]. The plain of Saïss is a fertile region located between Rif and Middle Atlas with rich plant biodiversity. Medicinal plants occupy an important place in daily diet of Fez-Meknes population and practically used to treat different diseases such digestive system disorder, depression, and anxiety [2,9]. At present, few studies were conducted on the

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*Corresponding Author: Laila Lahrizi
Laboratory of Functional Ecology and Environmental Engineering, Faculty of Sciences and Technology, University of Sidi Mohamed Ben Abdellah, Fez, Morocco
Email: lahrizilaila12@gmail.com

ethnopharmacological study of *Ajuga iva* (L.) Schreb. in other regions than that of Fez-Meknes. Current survey was designed to collect the traditional knowledge about different uses of *A. iva* as a medicinal plant widely used in Moroccan folk medicine to prevent or to treat a wide range of human pathologies. For this reason, the ethnopharmacological survey was conducted in the Fez-Meknes area, Morocco.

Material and Methods

Description of the species

The species *A. iva* of the Lamiaceae family, is known by its vernacular ''Chendgora'' in Arabic, ''Touftelba'' in Amazigh, and "Musk Shrimp" in many countries, particularly in Europe and North Africa.

This species is a perennial plant characterized by its bitter taste and a musky smell. This plant has a woody base, creeping green stems, pink flowers, its leaves are linear, 20 cm long, dense and covered with down [7].

Study area

The Fez-Meknes region (Figure 2) covers an area of 40,075 km², i.e. 5.7% of the national territory, and has a population of 4,236,892 inhabitants of which 60.52% are urban. It has a southern part with mountainous reliefs that cover about 40% of the total area of the province and a northern part with hilly reliefs that cover about 60% of the total area of the province. The climate of the region is Mediterranean, with cold, wet winters and hot, dry summers. The average rainfall is around 680 mm/year with maximums that can reach 1800 mm.

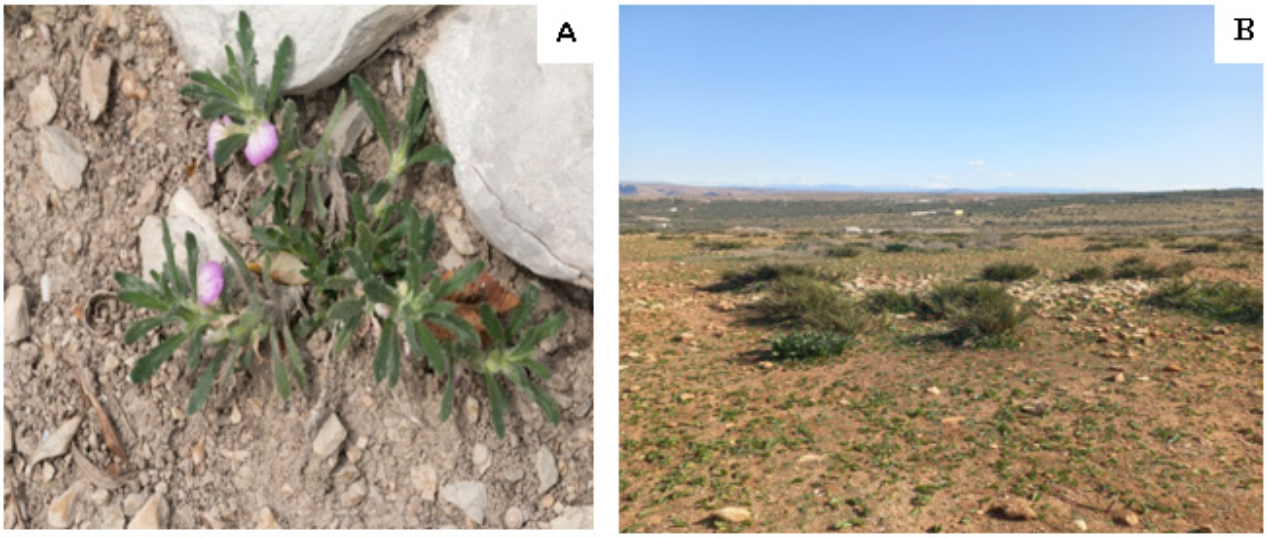

Figure 1. Photograph of the musk ivette (Fez - Meknes region) (A), and the place of its harvest (B)

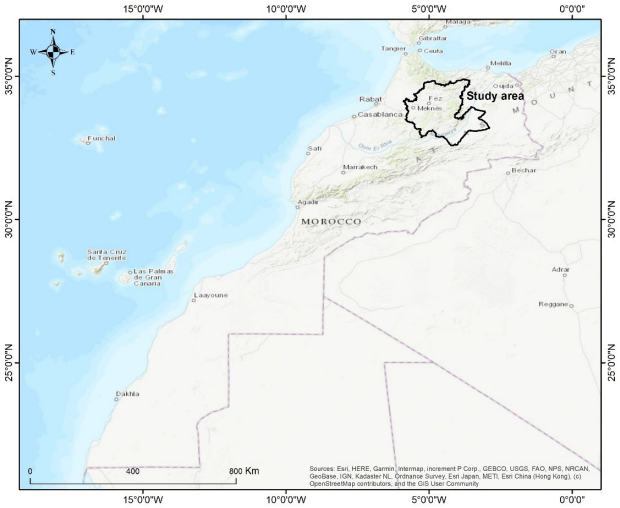

Figure 2. Geographical location of the study region (Fez-Meknes)

The present study was carried out in five main sections of different climate: Ifrane, Imouzzer Kandar, Sefrou, El Menzel and Bhalile. The characteristics of each area are summarized in table 1.

Study method

The ethnopharmacological study was carried out according to the methods of many authors [8,9]. Using survey forms, 250 people were recruited for the study. During each interview, data on the age, sex, level of education, place of residence and family situation of the interviewee, the name of the plant, the method and duration of preparation, the origin and type of plant, the period and technique of harvesting, the mode of use, as well as the toxicity, the pathology treated, the frequency of use, the part of the plant used, the mode of use, the precautions for use were collected.

Table 1. Ecological characteristics of the study stations

Region	Ifrane	Imouzzer kandar	Sefrou	El Menzel	Bhalile	Fez
Coordinates	33°31'60"N 5°7'03"W	33°44'N 5°01'W	33°49'54"N 4°49'40"W	30°50'20"N 43°24'5" W	33°51'00"N 45'20'0" W	34°02'13"N 5°22'00" W
Rainfall (mm)	1498	651	468	549	660	438
Altitude (m)	1664	1367	850	912	982	403
Bioclimatic stage	Humid	Semi-arid	Semi-arid	Semi-arid	Semi-arid	Semi-arid

Data analysis

The obtained results were treated MS Windows excel in the form of codes then statistically analyzed by the Graph Pad Prism version 5.

Results and Discussion

Information on informants

Figure 3 displays the interviewer's information including gender, age, school level, profession, and location. Among the 207 informants, 113 were women (54.60%) and 94 men (45.40%). All informants have a medicinal use history of herbs as a source of ingredients needed in the treatment of such diseases. The age of people interviewed ranged between 20 and over 60 years. All participants in the current survey were regrouped into three age range as follow: 20-40 years, 40-60 years, and > 60 years with 33.80%, 44.70%, and 21.90%, respectively. Concerning their education level 25.10% were unschooled, 22.20%, 15.90%, and 36.70% declared that were attended primary, secondary, and university school level, respectively. A half of interviewed people were unemployed and 19.80% were employed; while the rest of the informants (29.50%) declared that they have other professions. 162 persons lived in the urban location; while 45 informants were rural people.

Name, source, and part used of plant

Table 1 displays general information about the studied plant. All interviewed people know *A. iva* named differently including Chendgora, Touftelba, Boutafalt, Tichmouzati. The plant was collected directly in the nature of purchased from herbalist market. Informants declared that the herb used to treat their pains is a cultivated plant (99.52%). The most part used in folk medicine is leaves (48.30%) followed by whole plant (43.47%).

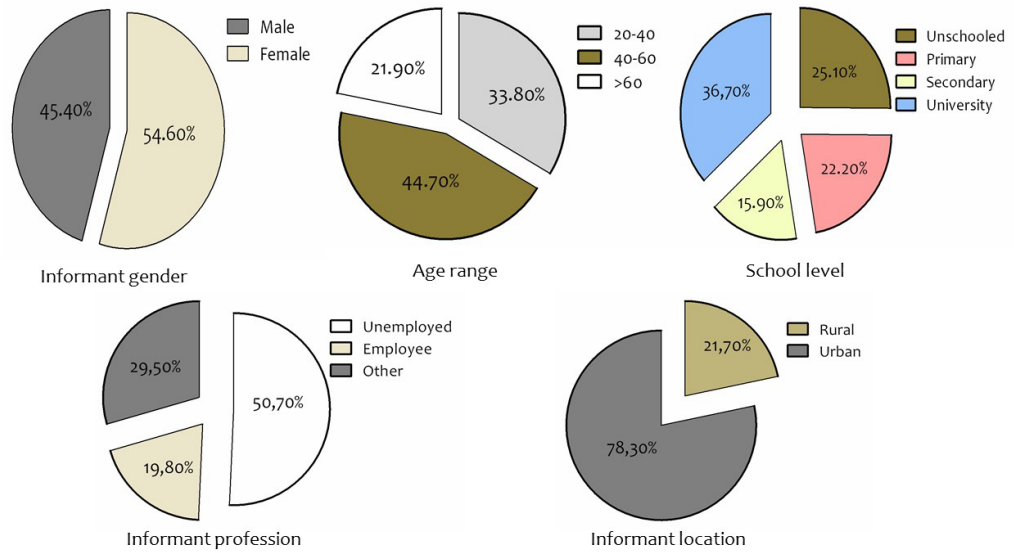

Figure 3. General information on interviewed people.

Table 2. General information of A. iva.

Variable	Subgroup	Number	Percentage (%)
Knowledge of plant	Yes	207	100%
	No	0	0%
Vernacular name	Chendgora	179	86.47%
	Touftelba	26	12.56%
	Boutafalte	1	0.48%
	Tichmouzati	1	0.48%
Information source	Herbalist	23	11.11%
	Nature	108	52.17%
	Parents	76	36.71%
	Other	0	0%
Plant	Savage	1	0.48%
	Cultivated	206	99.52%
Used part	Leaves	100	48.30%
	Stem	11	5.31%
	Seeds	4	1.93%
	Fruits	0	0
	Roots	2	0.96%
	Whole plant	90	43.47%
Usage	Alone	156	75.36%
	Combined	51	24.63%

Uses of A. iva

In this section of the study, the interviewed population mentioned that they used the herb in different domain such as therapeutic, cosmetic, and culinary. Figure 4 displays the proportion of different uses of *A. iva*. The use of herb as therapeutic agent represented 80.07%; while culinary and cosmetic uses represented 15.63% and 4.29%, respectively.

Medical plants were and still are an important source of active ingredients with tremendous effects to calm human pains used generation by generation of different civilizations. Herbs are widely used in folk and conventional medicine as a promising source of drugs [10-12]. Therapeutic effects of *A. iva* were previously studied *in vitro* and *in vivo* and revealed that the extract at a dose of 10 mg/kg for two weeks did not induce any sign of toxicity [13]. On the other hand, it is used to treat diabetes, hypertension, gastrointestinal disorders, and has diuretic effect [14,15]. Phytocosmetics have recently gained an important interest due to their effectiveness and their positive results. Beauty applications of medicinal herbs were dated over 2500 years and the developed knowledge has been handed down across time from one generation to another [16]. It is worthy of note that the wide range of use of this plant in traditional medicine is supported by experimental studies.

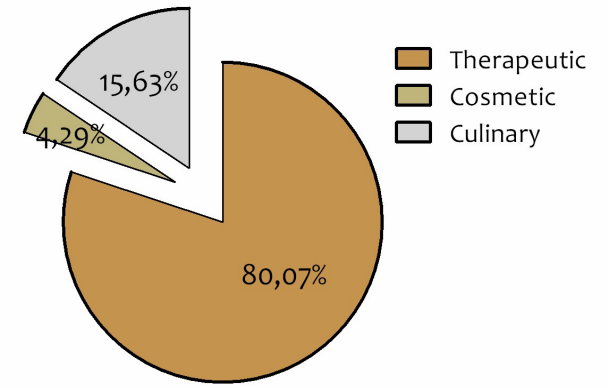

Figure 4. Different uses of *A. iva* in the Fez-Meknes region

Pathologies treated with A. iva by Fez-Meknes population

Human needs to treat and prevent different illnesses caught throughout their lives enhance the use of numerous herbs which develop wide medical knowledge of natural resources. Figure 5 summarizes different pathologies treated with *A. iva* as a natural remedy used in Moroccan traditional medicine. At the head list of the pathologies treated with *A. iva*, we find those related to digestive system with high proportion (40.99%), followed by others pathologies (16.04%), headache (14.07%), fever (11.85%), diarrhea (6.91%),

hypertension (4.94%), urinary infections (4.44%), and heart diseases (0.74%). Previously, it is shown that the *A. iva* treat gastrointestinal disorders as a natural remedy in Moroccan folk medicine evoked for the first time by Bellakhdar et al. 1991 [17]. Phytochemical analysis proved that this herb possesses numerous compounds with high inhibition potential of key enzymes implicated in diabetes [18]. According to an *in vivo* study conducted by El hilaly et al. 2002 [15] on rats, the plant significantly decreased plasma glucose levels at dose of 10 mg/kg during three weeks which support its traditional applications to treat diabetes. The extracts of *A. iva* possess high inhibitory properties on xanthine oxidase and revealed high antioxidant potential [19]. In addition, it exerts an anti-inflammatory effect through inhibition of phagocytosis, reduction of oxidative stress [20], and suppression of the expression of inflammatory factors including cyclooxygenase-1 and 2, nitric oxide synthase (NOS), NO, pro-inflammatory cytokines, and tumor necrosis factor alpha [21]. The administration of aqueous extract of *A. iva* at dose of 500 mg/kg reduced contractile response to noradrenaline of aorta through controlling NO expression implicated in vasorelaxation without affecting systolic blood pressure [22]. A recent study by the same authors showed that the aqueous extract of *A. iva* significantly reduced systolic blood pressure and did not induce any change in the urine output in rats [23].

Mounting evidence proved that *A. iva* has an important impact on hindering the growth of pathogen microbes including *Bacillus cereus*, *Echerichia coli, Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Aspergillus clavatus*, *Aspergillus niger*, and *Fusarium* [24]. The same findings are evoked by other researchers [25,26].

These beneficial properties of *A. iva* confirmed by different *in vitro* and *in vivo* studies are highly associated with its complex and diverse phytochemical composition. It contains several active compounds such as natingin, naringenin, apigenin, and apigenin 7-O-glucoside as major ingredients [23].

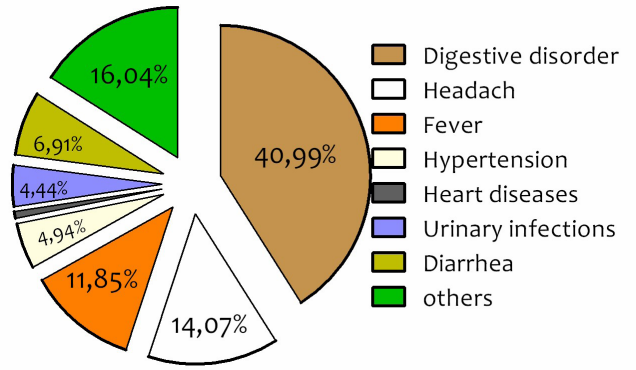

Figure 5. Different pathologies treated with *A. iva*

Conclusion

The current survey conducted in the Fez-Meknes is considered the first report realized in this region that reported the traditional knowledge of *A. iva*. The informant evoked that they used this plant specially to treat diseases affected digestive system. Also, the most part used is the leaves and the plant was sometimes combined with other medicinal materials to boost their activity. The findings may be considered as a basis of further experimental studies.

Ethical Approval and Consent to Participate

All interviewees consented.

Availability of Data and Materials

The data used in this work are available.

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Conflict of Interests

The authors declare that they have no conflict of interest.

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