Complimentary Herbal Treatments Used in Meknes-Tafilalet Region (Morocco) to Manage Cancer

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Abstract

Background. In Morocco, the use of folk medicine and phytotherapy is very common to treat several diseases including cancer. The aim of our study was to perform an ethnobotanical investigation of the plants used in traditional medicine to treat cancer in the region of Meknès-Tafilalet. **Methods.** An ethnobotanical survey has been conducted in Meknès-Tafilalet region (Meknès, Errachidia, Moulay Idriss, Khenifra, Ifrane and Azrou). Information was gathered from traditional healers, herbalists, patients and users of medicinal plants using semi-structures questionnaires. **Results.** Our study demonstrates that the practice of phytotherapy for the treatment of diseases and cancer in particular is important since 68.5% of the informants indicated using medicinal plants. In addition, our study reports that 35 different plants, belonging to 23 botanical families, are used in the Meknes-Tafilalet region. Of those, Lamiaceae, Asteraceae, Liliaceae and Fabaceae are the most used families. In addition, we show that *Aristolochia longa* is the plant mainly used to treat cancer specifically. Our data indicate that leaves and seeds (respectively 36.9% and 28.6%) are the parts of the plants mainly used, largely processed in powder (76.9%). Our data indicate that despite unprecise data on the posology, adverse effects are seen only in 15% of the cases. **Conclusion.** Our study is an essential documentation on traditional use of medicinal plants in Meknes-Tafilalet region that will contribute to the preservation of the ancestral knowledge and will promote protection of biodiversity of this region.

Keywords

Complimentary Medicine, Cancer, Medicinal Plants, Survey,

Meknes-Tafilalet, Morocco

1. Introduction

Cancer is a leading cause of mortality worldwide. According to the World Health Organization (WHO), nearly 1 in 6 of all global deaths in 2015 were due to cancer and statistics indicated that this number will increase to 1 in 5 by 2020. In 2014, cancer was responsible for >23,000 death in Morocco with a slightly higher death rate in men than in women.

At the moment, the most current approaches used to treat and/or prevent progression of cancer are chemotherapy, radiotherapy or surgery, combined or not with targeted therapy, immuno- and/or cell therapy unlike chemotherapy aiming at eliminating metastasized cancer cells, radiation therapy and surgery target tumor cells more locally. Because radiation therapy is relatively imprecise in focusing only on cancer cells, surgery is often the preferred approach as being the most efficient in removing visible tumors. However, smaller nests of cancer cells that will continue to proliferate might still remain in patients, increasing the risk of cancer redevelopment [1].

According to WHO, medicinal plants are used by 80% of the world population to prevent and/or treat various pathologies, including cancer [2].

It is known that over 90% of traditional medicine is based on phytotherapy. In particular, several currently used anti-cancer molecules (such as vinblastine or paclitaxel) take their origin in medicinal plants (respectively *Catharantus roseus* or *Taxus bravifolia*). However, despite their further development by large pharmaceutical companies, those remain largely inaccessible to the African population [3]. In developing countries and particularly in the poorest populations in Africa, traditional medicine remains often the only source of accessible care. Existence and use of traditional medicine using herbal drugs largely depend on plant species diversity and related knowledge on their use. In that context, Morocco, by its geographical situation, has a rich vegetation and an important biodiversity with many aromatic and medicinal plants growing spontaneously. In Morocco, more than 900 endemic plants exist of which 600 species are considered medicinal [4]. Consequently, related to this rich diversity, Morocco has been shown to be a very important exporter of medicinal plants [5]. Local populations and traditional healers in the region of Meknes-Tafilalet use those medicinal plants to prevent and/or treat many diseases, including cancer [6]. According to WHO in 2014, 11% of all death in Morocco was due to cancer, which is remarkably lower than the worldwide incidence (~17%). Whether this is related to the intense use of traditional medicine and the use of medicinal plants in cancer remains unclear. In that context, a complete inventory of medicinal plants traditionally used in disease prevention or treatment is mandatory but is so far unavailable for the region of Meknes-Tafilatlet. Therefore, we performed an ethnobotanical study on indigenous native plants used in traditional medicine against cancer in this specific region of Morocco.

2. Materials and Methods

2.1. Description of the Study Area

The study was performed in performed in several zones of Meknès-Tafilalet region, including Meknes, Errachidia, Moulay Idriss, Khenifra, Ifrane and Azrou (Figure 1).

It extends from the South-East to the North-West Morocco, the Meknes-Tafilalet Region bordered on the north Gharb-Chrarda-BéniHssen region to the west by Chaouia-Ouardigha and Tadla-Azilal, to the east and north-east by the regions of Oriental and that of Fès-Boulemane and to the south by Algeria. The area of the region is 73,253 Km^2. Meknes enjoys a predominantly Mediterranean climate influenced by the Middle Atlas and the Atlantic Ocean.
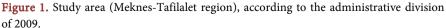
2.2. Ethnobotanical Survey

The ethnobotanical survey was conducted from March 1st to November 30st 2015. All information was collected from traditional healers, herbalists, patients and users of medicinal plants.

The data were collected through semi-structures interviews and were conducted in Arabic and Berber language.

From each participant, the following information was gathered and set on an identity card:

- Name, age, gender, cultural level, occupation;
- Date and place of the gathered information;

Figure 1. Study area (Meknes-Tafilalet region), according to the administrative division of 2009.

- Name of the plant: botanical name and vernacular name;
- Ecological distribution (local or imported, cultivated species or spontaneous);
- Parts of the plant used (e.g. leaves, fruit, roots, seeds, and stem);
- The source of their medicinal plant;
- Reasons for using specific medicinal plants;
- Results of the phytotherapy (good, average or variable);
- Knowledge on toxic plants;
- Mode of preparation, use, dose and duration of the use;
- Presence or absence of observed effects.

As a result, completed questionnaire forms of 540 persons based on their knowledge their implications in the medicinal plant sector (collectors, vendors and traditional healers, users of medicinal plants …) served as a support for the survey. Example of such a questionnaire is shown in de supplemental material.

These informants provided data about the plants used to manage cancer, parts used, local plant names, preparing procedures, mode of administration and any side effects. Each interview lasted approximately 2 hours and all participants were informed about the purpose of this study.

2.3. Plant Materials

Samples of the inventoried plants were collected and identified by the botanist of the faculty using the botanical references on the practical flora of Morocco [7]. The identified plants were made in herbarium specimens, deposited and stored in the Health and Environment laboratory (LHE), Faculty of Sciences, Moulay Ismail University, Meknès, Morocco.

2.4. Ethnobotanical Data Analysis

Data were analyzed using SPSS and Excel software.

2.4.1. Informant Consensus Factor
Informant consensus factor (ICF) was calculated with the following formula:

$$\text{ICF} = \left(N_{ur} - N_t \right) \big/ \left(N_{ur} - 1 \right)$$

where N_{ur} refers to the total number of use reports for each ailment category and N_t is the number of taxa used in that category [8].

2.4.2. Fidelity Level
Fidelity level (FL) was calculated using the following formula:

$$\left(\text{FL\%} \right) = N_p \big/ N * 100 \, ,$$

where N_p refers to the number of informants citing the use of the plant for a particular ailment category and N is the total number of informants citing the plant for any ailment category [9].

2.4.3. Frequency Citation and Relative Frequency Citation
Frequency citation (FC) was obtained using the following formula:

FC = (Number of times a particular species was mentioned/total number of times that species were mentioned) *100 [10].

Relative frequency of citation (RFC) was calculated by the following formula:

$$RFC = FC/N\left(0 < RFC < 1\right)$$

This index is obtained by dividing the number of informants mentioning a useful species frequency of citation by the total number of informants in the survey (N) [11].

2.4.4. Use Value

The UV was calculated as previously described by Philips *et al.* [12], as

$$UV = \sum U/N$$

where U represents the number of use reports and N is the total reports on the specific identified plant.

3. Results and Discussion

3.1. Users Characteristics

In our study, we identified that 62% of the medicinal plant users are female. This proportion of women is higher than in the study by Barkaoui *et al.* [13] but is in accordance with others [2] who showed that traditionally, women are more holders of the traditional phototherapy knowledge [14]. This apparent discrepancy is likely to be explained by the different region investigated.

Results of our survey indicate that 68.5% of the people undergoing the survey use phytotherapy to improve their life quality and treat themselves against diseases or injuries. Interestingly, 63.5% of all informant people do not have social cover, while only 36.5% have some form of cover that in mostcases is incomplete and does not cover all involved costs. Altogether, these data indicate that in the Meknes-Tafilalet region, the limited access to modern medical care is somehow compensated by the intense use of medicinal plants.
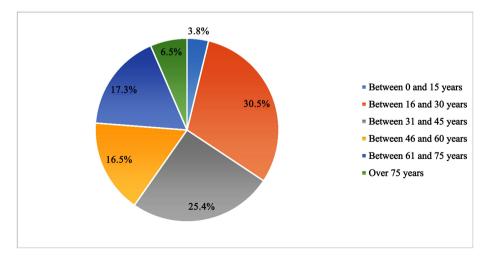
Our study shows that the users of the medicinal plants are not the people that received high education. On the contrary, 60% of medicinal plants users are illiterate, 22% and 13% have respectively a primary and secondary school level while 5% of medicinal plants users have a university level. This result is comparable to other described on the use of medicinal plants to treat diabetes mellitus in another region of Morocco [13]. In addition, in other countries such as India, Togo and Bangladesh, the same conclusion could be drawn [15] [16] where the traditional knowledge on medicinal plants is mainly transmitted orally, from generation to generation and not through the classical organized education systems. Our data indicate that the knowledge about use of medicinal plants in traditional medicine remains under taught in the current education system, being a risk for the loss of knowledge on the prevention and/or therapeutic effects of some herbal drugs used in traditional medicine.
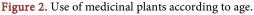
Surprisingly, as shown in Figure 2, 30.5% of the medicinal plant's users were

between 16 and 30 years old, followed by the group of 31 - 45 years who represent 25.4% of the users of phytotherapy. Users between 46 - 71 years represent around 17% of total users of medicinal plants while people > 75 years or <15 are in minority, representing respectively 6.5% and 3.8% of the users. This result is in fact not in accordance with what was seen in other areas in Morocco where knowledge on medicinal plants rely mainly on elderly people [13]. However, it is worth noticing that in their study, the most represented age group was between 50 to 70 years old, indicating that younger people likely moved from rural to more urban area, where they will be less confronted to traditional medicine. In our study, the main users are between 16 to 45 years old and 53.3% of the survey participants are of rural origin. Our data indicate that in the region of Meknes-Tafilalet, younger generations do not move to the urban areas, stay confronted with the use of traditional medicine and are more prone to sustain the knowledge on the use of those to treat diseases. We can also speculate that this can be due to changes in mentality in a society that promotes the use of more natural and traditional approaches to treat diseases.

3.2. Use of Medicinal Plants: Administration Route, Preparation and Doses

As summarized in Table 1 [17], medicinal plants in the region of Meknes-Tafilalet are in a large majority orally used (77% of the cases). External use represents 21.4% of the cases and inhalation is the administration route less used (1.8% of the cases). Data obtained in our study are in accordance of a recent study performed at the National Institute of Oncology in Rabat showing that the administration route for 98% of patients using phytotherapy to treat their cancer is oral, followed by the dermal route (1.5%) and finally the rectal route for 0.5% of the patients. Similarly as shown by others, traditional treatments against diabetes are also shown to be largely taken orally, via tea drinking [13].

Figure 2. Use of medicinal plants according to age.

Table 1. List of medicinal plants used in Meknes-Tafilalet recorded in our ethnobotanical survey:

Family	Scientific name and herbarium reference	Voucher codes	Local name	Part used	Preparation	Mode of administration	UV	Corresponding References
Aristolochiaceae	*Aristolochia longa L.*	LHE.06	برزطم	Roots	Powder, Cataplasm	Oral, External use	0.124	Bellakhdar *et al.*, 1997
Lamiaceae	*Marrubium vulgare L.*	LHE.21	مريوتة	Leaves	Decoction	Oral	0.102	Bellakhdar *et al.*, 1997
Cannabinées	*Cannabis sativa L.*	LHE.13	الكيف	Seeds, Leaves	Powder	Oral	0.072	Bellakhdar *et al.*, 1997
Fabaceae	*LinumusitatissimumL.*	LHE.18	زريعة الكتان	Seeds	Powder, Decoction, Maceration	Oral	0.064	Bellakhdar *et al.*, 1997
Euphorbiacées	CarallumaeuropeaGuss.	LHE.17	الدغموس	Stems, Leaves	Decoction, Powder	Oral	0.059	Bellakhdar *et al.*, 1997
Zygophyllaceae	Peganumharmala L.	LHE.34	الحرمل	Seeds	Decoction, Cataplasm	Oral	0.053	Bellakhdar *et al.*, 1997
Zingiberaceae	Zingiber officinalis Rosc.	LHE.35	سكينجبير	Roots	Infusion, Powder	Oral	0.053	Bellakhdar *et al.*, 1997
Asteraceae	Artemisia herba Alba Asso.	LHE.08	الشيح	Leaves	Infusion	Oral	0.053	Bellakhdar *et al.*, 1997
Fabaceae	Trigonellafoenumgraecum L.	LHE.19	الحلبة	Seeds	Cataplasm	External use	0.046	Bellakhdar *et al.*, 1997
Cupressaceae	*Juniperusphoenicea*L.	LHE.16	العرعار	Whole plant	Fumigation	Inhalation	0.042	Bellakhdar *et al.*, 1997
Berberidaceae	*Berberis hispanica* Boiss. et Reut	LHE.11	اغريس	Roots, Leaves	Decoction, Powder	Oral	0.042	Bellakhdar *et al.*, 1997
Apocynaceae	*Nerium oleander* L.	LHE.04	الدفلة	Leaves	Infusion, Fumigation	Oral, Inhalation	0.042	Bellakhdar *et al.*, 1997
Liliaceae	*Ajuga iva* L.	LHE.26	الشندكورة	Leaves	Infusion	Oral	0.036	Bellakhdar *et al.*, 1997
Renonculaceae	*Nigella sativa* L.	LHE.31	السانوج	Seeds	Cataplasm, Powder	External use, Oral	0.033	Bellakhdar *et al.*, 1997
Capparaceae	*Capparis spinosa* L.	LHE.14	الكبار	Fruit	Decoction	Oral	0.029	Bellakhdar *et al.*, 1997
Lamiaceae	*Origanum compactum.* Benth	LHE.24	الزعتر	Leaves	Decoction	Oral	0.022	Bellakhdar *et al.*, 1997
Brassicaceae	*Lepidiumsativum*L.	LHE.12	حب الرشاد	Seeds	Powder, Cataplasm	External use, Oral	0.019	Bellakhdar *et al.*, 1997
Myrtaceae	*Syzygiumaromaticum*	LHE.30	عود القرنفل	Seeds	Powder	External use	0.013	Bellakhdar *et al.*, 1997
Salicacées	*Populus Alba* L	LHE.33	الصفصاف	Fruit	Fumigation	Inhalation	0.013	Bellakhdar *et al.*, 1997
Asteraceae	*Inula viscosa* Ait.	LHE.10	مكرمان	Leaves	Infusion	Oral	0.011	Bellakhdar *et al.*, 1997
Apiaceae	*Carum carvi* L.	LHE.01	الكروية	Roots	Powder, Decoction, Fumigation	Oral, Inhalation	0.009	Bellakhdar *et al.*, 1997

Continued

Liliaceae	*Urginea maritima* L	LHE.28	بصل الفار	Other	Powder	Oral	0.007	Bellakhdar *et al.*, 1997
Apiaceae	*Coriandrum sativum* L.	LHE.02	القزبور	Seeds	Powder	Oral	0.007	Bellakhdar *et al.*, 1997
Iridaceae	*Crocus sativus* L.	LHE.20	الزعفران	Bulbs	Powder	Oral	0.003	Bellakhdar *et al.*, 1997
Arecaceae	*Chamaerops humilis* L.	LHE.05	الدوم	Whole plant	Fumigation	Inhalation	0.003	Bellakhdar *et al.*, 1997
Chenopodiaceae	*Chenopodium ambrosioides*	LHE.15	مخينزة	Leaves	Decoction, Cataplasm	Oral	0.003	Bellakhdar *et al.*, 1997
Lamiaceae	*Melissa officinalis* L.	LHE.22	الحبق	Leaves	Decoction	Oral	0.003	Bellakhdar *et al.*, 1997
Lamiaceae	*Mentha suaveolens* Ehr.	LHE.23	مرسيطة	Leaves	Infusion, Cataplasm	Oral, External use	0.003	Bellakhdar *et al.*, 1997
Lamiaceae	*Rosmarinus officinalis*	LHE.25	ازير	Leaves	Infusion	Oral	0.001	Bellakhdar *et al.*, 1997
Liliaceae	*Allium sativum* L.	LHE.27	الثومة	Other	cataplasm	Oral	0.001	Bellakhdar *et al.*, 1997
Asteraceae	*Carthamustinctorius* L	LHE.09	العصفور	Other	Powder	Oral	0.001	Bellakhdar *et al.*, 1997
Lythraceae	*Lawsoniainermis* L.	LHE.29	الحنة	Leaves	Powder, Decoction, Maceration	Oral	0.001	Bellakhdar *et al.*, 1997
Apiaceae	*Petroselinum sativum* Hoffm	LHE.03	المعدنوس	Leaves	Decoction	Oral	0.001	Bellakhdar *et al.*, 1997
Rosaceae	*Rosa canina* L.	LHE.32	التابغة	Whole plant	Fumigation, Cataplasm	Inhalation, External use	0.001	Bellakhdar *et al.*, 1997
Asclepiadacees	*Silybummarianum* L.	LHE.07	شدق الجمل	Seeds	Decoction	Oral	0.001	Bellakhdar *et al.*, 1997

The method of preparation and use of the medicinal plants reported in our study are shown in Figure 3, upper panel and Table 1. Powdered plants mixed with honey or milk is the preferred mode of use (42% of the cases). Decoction, cataplasm and herbal tea (*i.e.* infusion) are used in 27.6%, 18% and 10% of cases respectively. Finally, maceration or using the medicinal plants in their natural form is almost not used (<0.4% of the cases) and are comparable to other studies in Morocco and other countries, also for other diseases than cancer, such as diabetes or skin disorders [13] [18].

As shown in our study, the use of medicinal plants is the region of Meknes-Tafilalet is important and their use is mainly administered orally, in a powder form. Because they might have different preventive and/or therapeutic properties, the part of the plant processed was also investigated in order to identify which the part of the plant is the most commonly used. Various parts of the plant are consumed, as displayed in Figure 3, lower panel. The most commonly used plant parts are leaves and seeds (respectively 36.9% and 28.6%). Roots are

also prepared but are used to a lower extent. The remaining parts of the plant (such as roots or bulb) represent a cumulative rate of 11.1%. The results of our study are comparable to other studies where leaves and seeds are the most commonly parts of the plants used [13].

Doses of the medicinal plants are more difficult to quantify as it is a lot more subjective. 37.2% of the informants included in our study indicated using a handle of them in their preparation while 0.8% mentioned a pinch. In a large majority (62% of the users), medicinal plants were used with unspecific doses. However, the notion of dose is essential as some plants used for therapeutic purposes may, at higher doses, be toxic and compromise human health. This is indeed the problem for plants rich in thujon such as the sage (*Salvia officinalis*), the white mugwort (*Artemisia herba alba*) and the wormwood (*Artemisia arborescens* L.), being medicinal at low doses but shown to be very toxic at high doses [19].
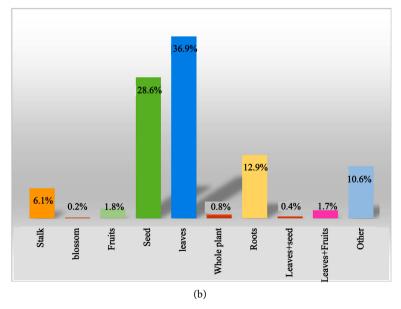

(a)

(b)

Figure 3. Preparation and use of the medicinal plants. (a) preparation modes of the medicinal plants; (b) part of the plants used to prepare remedies.

3.3. Medicinal Plant Species Specifically Targeting Cancer

Data of our study indicate that 31.8% of the people involved in the survey were diagnosed having cancer. In that context, one question remains: which plants are reported to be specifically used against cancer in the region of Meknes-Tafilalet? In our study, 35 different species from 23 families, specifically used to treat cancer, were identified and are reported in Table 1.

The results show that in terms of use, *Aristolochia longa* L. is ranked first with (12%), followed by *Marrubium vulgare* L. with (10.8%) and *Cannabis sativa* L. with 7.1%, while the rest of the plants cited by the population remain used but at a much lower rate. As summarized in Figure 4, the Lamiaceae family (with 5 species) represents the plant family mostly used. Asteraceae, Liliaceae and Apiaceae, all containing 3 species and Fabaceae (containing 2 species) remain however commonly used. The remaining plant families reported only contain one species. This result is comparable with the study of Barkaoui *et al.* indicating that these 3 main families are not only used against cancer (as shown in our study), but also against other diseases such as diabetes mellitus [13].

The analysis of the data showed that the Lamiaceae family is the mostly used family, which is likely due to the presence of the quinones known to play a role in the oxidation-reduction reactions by inhibiting the proliferation of tumor cells [20]. Indeed, an evaluation of the chemical composition of *Marrubium vulgare* L, a member of the Lamiaceae family has shown the presence of chemical components (flavonoid, tannins …) displaying antioxidant activities by the trapping free radicals. Antioxidants are indeed known to be cancer chemopreventiveagents that can therefore have a preventive effect on the occurrence of certain types of cancer [21]. As demonstrated by the group of El Rhaffari *et al.* on cutaneous leishmaniasis, the Lamiaceae family is the most frequently used family [22]. Finally, cannabis derivatives have been demonstrated to exert anti-proliferative effects in cell cultures [23] [24] as in animal models [7], therefore explaining its common use. Surprisingly, the family Aristolochiaceae with its unique species *Aristolochia Longa* used in our study is the most commonly used medicinal plants (12%). It is most likely related to its abundance in the region of Meknes-Tafilalet and to its efficacy in fighting against specific cancer types, such as the Burkitt'slymphom. Indeed, this was also confirmed by Benarba *et al.* [25], who demonstrated the efficacy of the aqueous extract of *Aristolochia Longa* on the cytotoxic and apoptogenic activity of BL41 Burkitt lymphoma cells. Based on these data, the aqueous extract of *Aristolochia longa* has been therefore reported as a promising source of new treatments for Burkitt and other types of Lymphoma and might explain its large use in cancer, as shown in our study.

Regarding the toxicity of the medicinal plants used, 87.5% of the users indicated that the used plants were not toxic, while others indicated some degree to toxicity. It should be noted that in our study area, the percentage of clear adverse effects (such as kidney dysfunction, hypotension, diarrhea …) resulting from the intense use of the medicinal plants was only 15%. When observed, severity of the

adverse effects reported was broad and different, accounting for 46.3% for kidney damage, 16.7% for vomiting, 14.8% for liver damage, 11.1% for constipation, 5.6% for hypotension, 3.7% for skin irritation and 1.9% for abortion cases (**Figure 5**). Our data are in accordance with data reported in a study performed by Barnes *et al.* where the occurrence of adverse effects in 515 users combining medicinal herbs with traditional medical treatment was reported to be 26% [26]. Whether the somehow higher incidence observed in England is a coincidence or related to the used combined approach remains to be determined. The occurrence of adverse effects reported in our study might also be related to a misuse and lack of rigor of use of the medicinal plants, such as falsification, misidentification of the species, incorrect dosage, errors in use and contamination with toxic metals, microbes, microbial toxins and environmental pollutants [2].

3.4. Ethnobotanical Indices

The data obtained were analyzed and ranked on the basis of informant concensus factor (ICF), fidelity Level (FL), use value (UV) and relative frequency
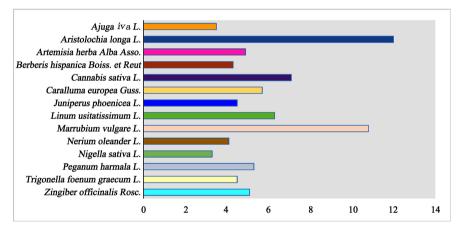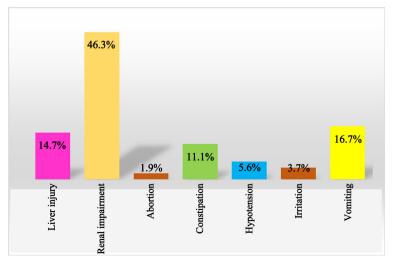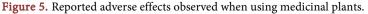

Figure 4. Species commonly used in the region Meknes-Tafilalet.

Figure 5. Reported adverse effects observed when using medicinal plants.

of citation (RFC).

The recorded use reports data have been classified to different types of cancer (Table 2). The highest ICF (0.93) was registered for breast cancer, followed by ovarian cancer (0.81), which could be due to the increased prevalence of these two types of cancer worldwide but also in Morocco [27].

RFC was calculated only for the most cited species and ranged from 0.01 to 0.03. The maximal values were stored for *Aristolochia longa L.* (0.03) and *Marrubium vulgare* (0.03) (Table 3) which were been listed by all the interviews who reported having knowledge about cancer treatment by plants or having used it. In our study, the RFC is low, most likely explained by the severity of the disease or the non-use of plants in all regions and by all the population for the supporting treatment of cancer.

The toxicity of certain plants in the Meknes Tafilalet region was reported following the various undesirable effects encountered after consumption of these plants (Table 4). The highest FL was recorded for *Aristolochia longa L.* (FL = 57.14%), reported to induce a number of adverse effects including severe renal impairment and liver injury. Our data are in accordance with the findings of others [26] [28] who indicated that this species contain aristolochic acid, responsible for irreversible kidney damage with hematuria as well as limb paralysis. Calculations of FL% indicated that *nigella sativa* and *peganumharmala* are also responsible for liver alterations in many cases. Interestingly, *trigonellafonecumgraecum L.* was only plant associated with abortion for 19.40%. As opposed to our study, *Oueslati et al.* reported that this plant is however used in India during pregnancy and breastfeeding as it stimulates lactation [29]. According to the respondents, *Allium sativum L.* was the main plant (FL = 30.76%) causing hypotension. Indeed, it has been previously shown that the water extract of *Allium sativum* when administered intravenously produces a significant fall in mean blood pressure [30]. Finally, *Chenopodiumambrosoides* (FL = 37.5%) was the most cited species by the population for cases of vomiting.

Table 2. Informant consensus factor.

	Number of used reports	Number of species	Informant consensus factor (ICF)
Breast cancer	131	10	0.93
Lung cancer	83	13	0.85
Ovarian cancer	103	20	0.81
Blood cancer	29	9	0.71
Stomach cancer	27	11	0.61
Skin cancer	75	30	0.6
Bone cancer	19	10	0.5
Brain cancer	27	15	0.46
Bowel cancer	9	6	0.37
Prostate cancer	7	5	0.33

Table 3. list of the most used medicinal plants.

Species	Numberof time the species cited	Frequency Citation (FC)	Relative Frequency Citation (RFC)
Aristolochia longa	72	17.52	0.032
Marrubium vulgare L.	5	14.11	0.026
Cannabis sativa L.	36	8.76	0.016
Linum usitatissimum L.	32	7.79	0.014
Caralluma europea Guss.	29	7.06	0.013
Zingiber officinalis Rosc	26	6.33	0.011
Artemisia herba Alba Asso.	25	6.08	0.011
Peganum harmala L.	27	6.57	0.012
Trigonella foenum graecum L.	23	5.60	0.010
Juniperus phoenicea L.	23	5.60	0.010
Berberis hispanica Boiss. et Reut	22	5.35	0.010
Nerium oleander L.	21	5.11	0.009
Ajuga iva L.	17	4.14	0.007

Table 4. Fidelity level values for adverse effects inventoried following the consumption of plants.

Adverse effects reported	Medicinal plants reported	Fidelity Level (%)
	Aristolochia longa	21.05
	Nigella sativa L.	20.83
	Peganum harmala L.	20.83
	Marribium vulgare	19.04
Liver disorders	*Chenopodium ambrosioides*	18.75
	Neruim oleander	15.38
	Urginea maritima L.	13.33
	Artemisia herba Alba Asso.	11.11
	Silybum marianum L.	2.44
	Aristolochia longa	57.14
	Marribium vulgare	51.02
	Neruim oleander	38.46
	Nigella sativa L.	37.5
Renal disorders	*Chenopodium ambrosioides*	25
	Urginea maritima L.	21.05
	Peganum harmala L.	16.66
	Silybum marianum L.	6.33
Abortion	*Trigonella foenum graecum L.*	19.40

Continued

Constipation	*Origanum compactum. Benth*	20.58
	Artemisia herba Alba Asso.	17.28
	Allium sativum L.	30.76
Hypotension	*Aristolochia longa*	21.05
	Chenopodium ambrosioides	18.75
	Zingiber officinalis Rosc	4.6
Irritation	*Lepidium sativum L.*	33.33
	Peganum harmala L.	62.5
	Chenopodium ambrosioides	37.5
	Allium sativum L.	29.66
	Nigella sativa L.	28.29
	Aristolochia longa L.	26.31
Digestive disorders	*Origanum compactum. Benth*	24.13
	Marribium vulgare	23.8
	Neruim oleander	20.73
	Trigonella foenum graecum L.	15.02
	Urginea maritima L.	9.22
	Zingiber officinalis Rosc	1.3

In our study, the frequency of use (UV) ranged between 0.1% and 12.4% (Table 1). *Aristolochia longaL.* (UV = 12.4%) and *Marrubium vulgare* (UV = 10.2%) are the most frequently used plants in the studied region. This can be explained by the fact that these two species are the best known and therefore the most widely used by the population of the region of Meknes-Tafilalet for the treatment of cancer. We have to acknowledge that the use values that we report are lower than reported in other studies for other disease [31]. However, these studies examine other diseases, so our results could possibly be related to the severity of the disease and the sensitization compared to the adverse effects following the use plants [6].

4. Conclusion

The current study aimed to inventories as completely as possible of the medicinal plants used in the Meknes-Tafilalet region for the treatment of cancer and brought together the information concerning the therapeutic uses traditionally practiced in this region. Our study demonstrates that folk medicine plays an important role in the healthcare system for people in this region of Morocco. Finally, our study is an essential documentation on traditional use of medicinal plants in Meknes-Tafilalet region that will contribute to the preservation of the ancestral knowledge and will promote protection of biodiversity of this region.

Acknowledgements

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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List of Abbreviations

WHO: World Health Organization

ICF: Informant Consensus Factor

RFC: Relative Frequency Citation

FC: Frequency Citation

UV: Use value

FL: Fidelity Level

AEs: Adverse Effects