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Ethnobotanical Study of Medicinal Plants Used in the Treatment of Cancers in the City of Casablanca (West-Central of Morocco)

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ABSTRACT

Medicinal plants play an essential role in traditional medicine for the treatment of different diseases. An ethnobotanical study was conducted to evaluate the different modes of use of medicinal plant materials, and enhance the traditional herbal-medicine knowledge on the medicinal plants used traditionally to treat cancers in the Casablanca-Morocco region. Cancer patients in Casablanca were interviewed face to face to get answers to the survey questionnaire. In this survey, 352 plant species from 49 botanical families are reported based on the informant's data, names of plants used to treat cancers, parts of plants used, preparation methods, and route of administration. The study revealed that most of the plants were from the Lamiaceae, Asteraceae, and Myrtaceae families. In addition, the most valuable species include *Syzygium aromaticum*, *Ajuga Iva*, *Marrubium vulgare*, and *Inula viscosa*. Leaves and aerial parts were the most commonly used plant parts accounting for 26.38 and 25.55%, respectively. Preparations made, as a decoction and oral administration were the most frequently used method for recipes. This study showed that medicinal plants play a crucial role in the traditional treatment of different cancers. Therefore, cancer patients living in the economic capital of Morocco depend highly on traditional plant medicine.

Keywords: Ethnobotanical, Casablanca, Medicinal plants, Cancer.

Introduction

Currently, cancer is one of the major public health problems. According to WHO (World Health Organization) latest report in 2018, this scourge is responsible for 13% of global mortality, three-quarter of which occurs in developing countries, particularly in the poorest regions of Asia, South Africa, Sub-Saharan Africa and Latin America. The WHO estimated the mortality rate for cancer to be over 9.5 million in 2018, with nearly one in eleven women and one in eight men dying of the disease. The increase in cancer death-rate is attributed to a significant rise in the number of new cases, reported to be well over 18.1 million in 2018. Asia accounts for 8,751,000 of the cases (48.4%), followed by Europe with 4,230,000 (23.4%), America with 3,792,000 (21.04%) and lastly Africa with 1,055,000 (5.8%)[1]. Cancer is defined as a pathology in which cells proliferate in an uncontrolled and unrestrained manner within the body. The disease can affect people of all ages, including the fetus. However, the risk for most type's increases with age.[2] Cancer has a huge impact on the economy and places a heavy burden on health. In Morocco, cancer is a major public health problem. It is considered as the second cause of death after cardiovascular diseases, with nearly 40,000 new cases diagnosed every year.[3]

Medicinal plants remain one of the primary sources of obtaining new bioactive substances. They are widely used in traditional medicine in developing countries.

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In the absence of the modern medical system, many Mediterranean countries rely on traditional herbal medicine as the primary source(s) of healthcare. The Mediterranean region is associated with documented medicinal and aromatic plants used in their traditional medical practice.[5] According to the World Health Organization (WHO), nearly 80% of the African population uses traditional medicines to meet their primary healthcare needs.[6]

Morocco offers a great diversity of flora and fauna, with several valuable medicinal plant species endemic in the region.[7] This uniqueness of Morocco is due to its geographical location and its highly diversified Mediterranean bioclimatic condition. Studies show that almost 300,000 plants species in the world have therapeutic medicinal properties[8]. Interestingly, more than 40,000 species from over 150 families and 960 genera are used to treat cancer in Morocco. This vast array of medicinal plants are spread across 715,000 kilometre square of the landscape.[9,10]. Due to its richness in medicinal plants, Moroccan traditional medicine has been considered an effective alternative in the treatment of patients with several pathologies;[11] respiratory infections,[12,13] diabetes, heart disease,[14] immunological diseases[15]and urinary tract infections.[16]

This study was undertaken to update the ethnomedicinal knowledge used by the local population in the study area to treat cancers and related diseases. In addition, to contribute to the commercialization and the conservation of the ethnomedicinal knowledge accumulated over centuries by the local population. Well-structured questionnaires were used to collect information about medicinal plants used in cancer treatment.

Materials and Methods

The geographical setting of the study area

Casablanca, the economic capital of the Kingdom and one of its main centers of agricultural activity,[17] belongs to the field of the plain of Chaouia. It is located in the center-west of Morocco, facing the Atlantic Ocean, bounded to the North by the province of Ben Slimane

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to the East and South by the province of Settat. It covers 1140.54 square kilometers, of which 227.82 square kilometers are urbanized and 70 square kilometers of coastline. It is located about 90 Km from Rabat. The climate is oceanic type, subject to maritime influence, characterized by variable rainfall from one year to another, often moderate and irregular in winter with a bit of sweetness. In summer, the area is temperate, humid with high humidity and sunshine throughout the year. Autumn in Casablanca is characterized by the return of the Atlantic climate, in which the average temperature reaches 20°C, while in the summer, the average temperature rises from 28 to 30°C.[18] The reliefs are composed mainly of plains and plateaus with small hills scattered in the contiguous territory. The forests occupy nearly 4000 ha whose main forest areas are those of Bouskoura (3000 ha), Wadi Maleh (340 ha) and Oued N'fifikh (270 ha), which consist mainly of Eucalyptus, pine and palm trees. (Figure 1).

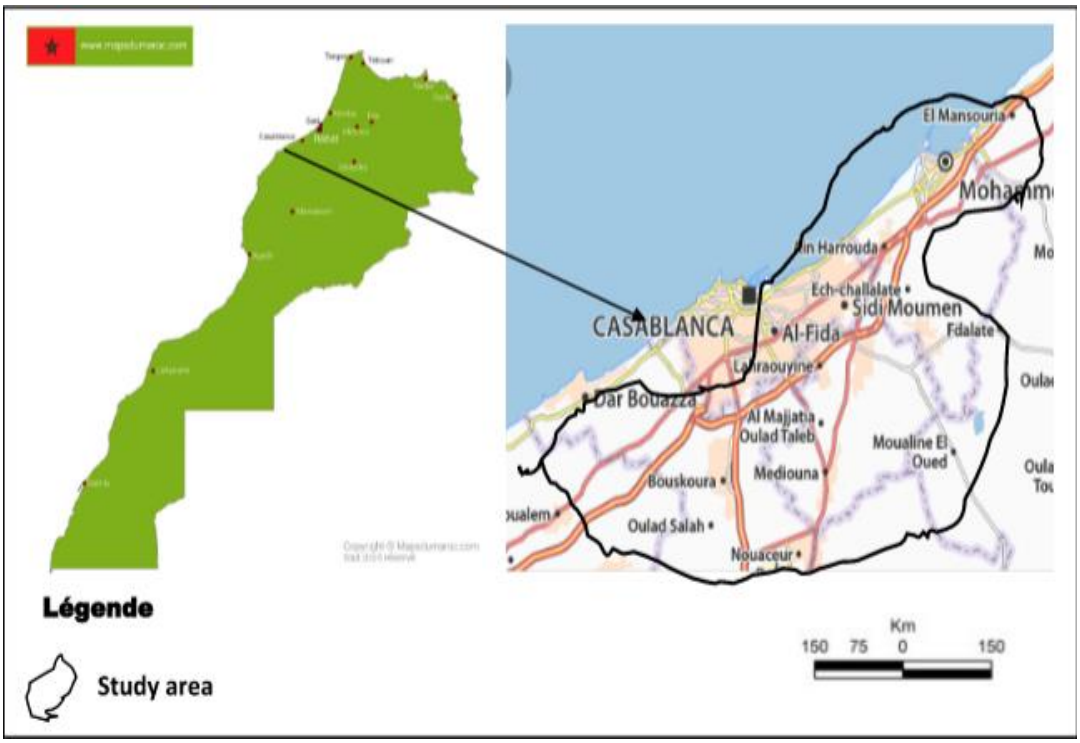

Figure 1: Map of the study area showing the surveyed stations (Casablanca)

Parameters studied
Coherence and convergence parameters: The Data comparison method allowed us to verify the consistency of the information collected in time and space.[19] Information is said to be coherent when repeated twice in two different places and by other informants.

Botanical identity
When assigning the scientific names of medicinal plants used in the traditional treatment of different types of cancer, we encountered confusion between several other plants, such as one vernacular name of several species or different vernacular names of the same species.

Statistical analysis
The ethnobotanical survey results were analyzed using the Excel statistical package. The key indices evaluated include: frequency of the use of medicinal plants by the population, evaluated based on age, sex, level of education, preferred care, parts of the plant used, methods of preparation of the remedies, as well as their routes of administration.

Ethnobotanical survey
Our survey was carried out for one year among cancer patients to find out more about the medicinal plants used in the treatment of cancer. When collecting data from cancer patients, we used a survey questionnaire to explain to patients the study's objectives and the importance of providing us with information to maintain the clarity of our research. During the interview, 299 informants aged 18 to more than 50 years old, divided into 192 women and 107 men of different cultural and social-economic levels were selected randomly from the various existing oncology centers in the city of Casablanca and its surroundings. They were invited to complete a face-to-face questionnaire which was conducted in Arabic dialect, the native language of a vast majority of the respondents in Casablanca, focusing on the following: Date, sheet N°, province, age, sex, level of study, habitat, frequency of use of phytotherapy, vernacular and botanical name of the plants, parts used, the preparation modes, administration routes and reasons for using medicinal plants.

Results and Discussion

Use of medicinal plants by age
The use of medicinal plants in the city of Casablanca is widespread among all age groups. It is predominant among people aged between 40 and 50 years old, with a utilization rate of 40.46%, followed by people aged 30 to 40 (27.75%). However, the more ageing population (≥ 50 years) account for 21.73% of the usage of phytomedicine among those surveyed. While amongst the youngest population, (18-29 years), there was less interest in the use of herbal medicine (10.03%) (Figure 2). The study revealed mistrust of young people for traditional treatments, including medicinal plants, due to a lack of faith in the therapeutic values of the traditional system of medicine. This ethnobotanical survey agrees with other scientific literature from Casablanca, which reported that the frequency of medicinal plant use in cancer treatments increased with age.[20] Another study reported that people aged more than 40 and 50 years use herbs to treat diseases with frequency values of 57% and 18%, respectively.[21]

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The results show that people aged between 40 and 50 years provide more reliable information than other age groups, which may be due to their superior knowledge of the properties and uses of medicinal plants. However, according to Benkhnigue [22], the knowledge base of medicinal plants is currently in danger because of their poor transmission from one generation to another.

Use of medicinal plants by sex

In this study area, medicinal plants are used by both genders. However, the female gender predominates with 64.21% of women, against 35.78% of men (Figure 3). This confirms that women possess a better knowledge of traditional herbal medicine than men, which may be because, females are more consistent users of spices and aromatic plants and for primary healthcare for their children. These results are consistent with other ethnobotanical studies conducted nationally,[23,24] which reported that women used alternative medicine more frequently, compared to men.[25]

Use of medicinal plants by the level of education of the Surveyed group

The results obtained showed that one third of the population studied (32.77%) has secondary school degree. In comparison, 23.41% are illiterate, 22.07% have a university education, and 21.73% have a primary education degree (Figure 4). People with a secondary level of education and illiterates represent more than half of those who use medicinal plants in the city of Casablanca. Other scientific literature in Central Morocco reported that illiterates, and people with secondary school degree are the most influential users of medicinal plants;[13] this may be probably due to the structure of the inhabitants of this city who are mostly illiterate or having just secondary education.

Use of medicinal plants by habitat

The people surveyed are located throughout the studied region in towns, villages, and rural areas near or far from Casablanca. However, medicinal plants are used much more by urban dwellers (73.23%) than by village dwellers (22.07%) and rural area (6.68%) (Figure 5).

Frequency of use of herbal medicine compared to modern medical treatments

In combination with modern medical care (chemotherapy), or surgery (60.54%), the use of herbal medicine is common among the studied population. This combination is believed to have synergistic effects in 70% of cases surveyed and strengthen the immune system in 18% of cases or reduce the toxicity of chemotherapy in 12% of patients (Figure 6). Both medical and phytotherapeutic treatments have the same frequency of use (19.73%). The respondents' use of orthodox medicine alone is explained by the distrust of this group to traditional treatments and their lack of effectiveness in cancer treatments. The use of herbal medicine by patients can be attributed to several reasons such as the low toxicity of some medicinal plants compared to synthetic drugs.

Use of medicinal plants according to botanical families

Our survey identifies 115 species belonging to 46 families. The plants of the Asteraceae family were the most used in phytomedicine (14.78%). The Lamiaceae family with 11 species accounts for 9.56%; the Solanaceae family with 9 species (7.82%), the Zingiberaceae with 6 species (5.21%), the Fabaceae and Apiaceae with 5 species for each (4.34%), the Cistaceae with 4 species (3.74%), the other remaining botanical families have 3 to 1 species each, or percentages which vary between 2.60% and 0.87%, respectively (Compositaceae, Euphorbiaceae, Liliaceae, Cucurbitaceae, Rosaceae, and Moraceae) (Figure 7). These results showed a large diversity of species used in the treatment of cancer in Casablanca. This extensive knowledge of the use of medicinal plants in the treatment of diseases explains the reliance on the use of medicinal plants by the city's population in the traditional treatment of these types of diseases. Another ethnobotanical survey in Casablanca reported that Aristelochiaceae belongs to the most inventoried family in alternative medicine for cancer treatment.[20] Another study indicates that medicinal plants of the Lamiaceae family are the most used in herbal medicine as a traditional treatment for cancer.[26.] Yet another study reported that Aquilariaceae, Euphorbiaceae, and Aristelochiaceae families possess important anticancer activity[27,28]. Some medicinal plants of the Lamiaceae, Ephedraceae and Cucurbitaceae families have shown anticancer activity.[29, 30]

Used parts of medicinal plants

The therapeutic properties of a given plant differ according to the part used; as such, medicinal plants can be used entirely as a whole or in parts (leaves, stems, seeds, fruits, roots, and bark). In the study area, the leaves of the medicinal palms were the parts most used in traditional treatment with a rate of 26.38%, followed by the roots (15.83%), the flowers (13.61%) and the seeds (6.38%). The remaining plant parts used are represented by a cumulative rate of 8.58% (Figure 8). The most frequent use of leaves by respondents, both in this and other studies can be explained by their store of secondary metabolites responsible for their biological activities. Our results agree with previous studies that reported that the leaves and roots are the most used in phytotherapy [20]. The choice of leaves in traditional treatment could be attributed to the collection, use, and accessibility of roots.[31] Other studies indicate that the aerial parts are the most used in phytotherapy from time immemorial.[32]

The methods of preparation of the medicinal plants used

Several preparation methods (maceration, decoction, infusion and spraying) are used to facilitate the administration of the active ingredients. However, decoction, powder and infusion are the most usable modes accounting for 35.11%, 34.44%, and 11.37%, respectively. The other ways of preparation represent a cumulative rate of 19.05% (Figure 9). This result shows that the population of the city of Casablanca uses the decoction method as a method of preparing medicinal plant-based traditional remedies. Another study reported that medicinal plants are administered in different formulations, including fine powder; the powder is mixed with honey or administered as tea or infusion.[20]

Administration mode of the medicinal plants used

In our study area, traditional treatment with the oral route has a 95.32% rate, followed by poultice for topical application with a rate of 4.34% and lastly by inhalation with a rate of 0.34% (Figure 10). The frequent use of the oral route of administration by the patient may be due to the convenience of this route. Medicinal plants remain an inexhaustible source of bioactive molecules. Some medicinal plants contain anti-cancer molecules such as podophyllotoxins. This substance exerts an antitumor effect by inhibiting the activity of topoisomerase II.[33] Other medicinal plants such as *Bryonia dioica* drives cancer cells of the BL41 line towards apoptosis through activation of the intrinsic mitochondrial pathway.[34]

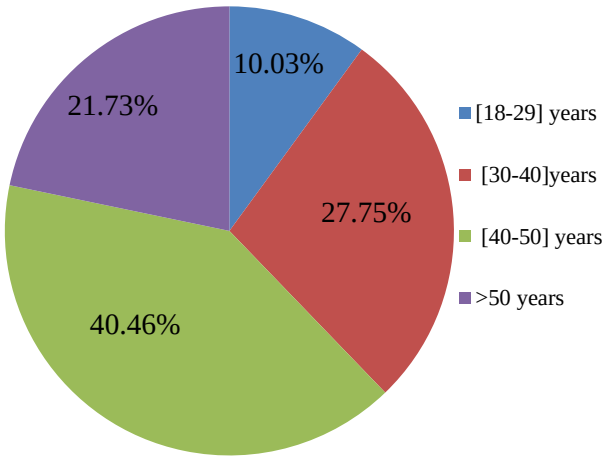

Figure 2: Percentage distribution of the medicinal plants used in the Casablanca by age

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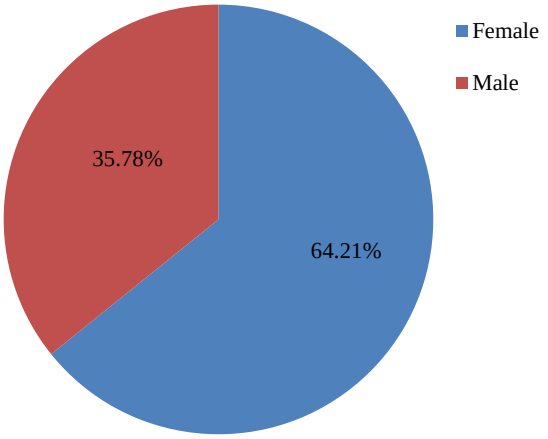

Figure 3: Percentage distribution of the medicinal plants used in the Casablanca by sex

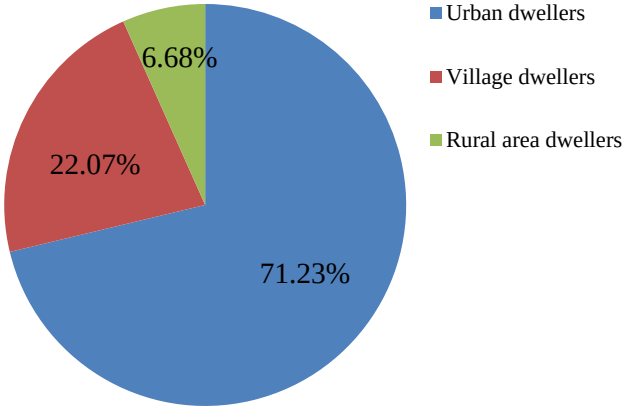

Figure 5: Percentage distributions of the medicinal plants used in the Casablanca by habitat

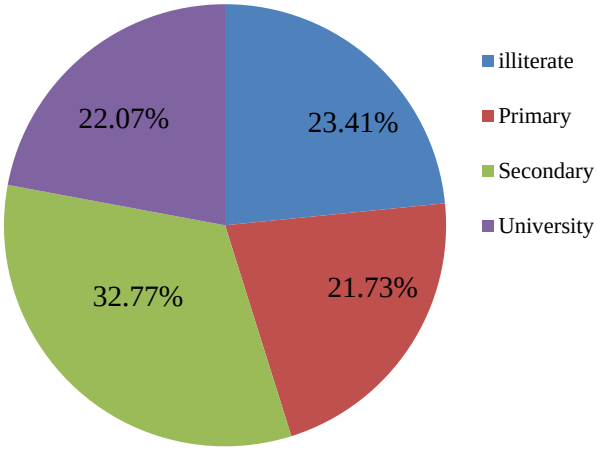

Figure 4: Percentage distribution of the medicinal plants used in Casablanca by the level of education.

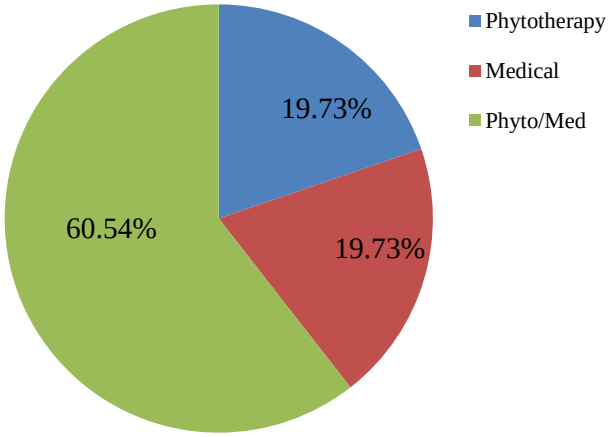

Figure 6: Frequency of use of phytotherapy and modern medicine in the Casablanca

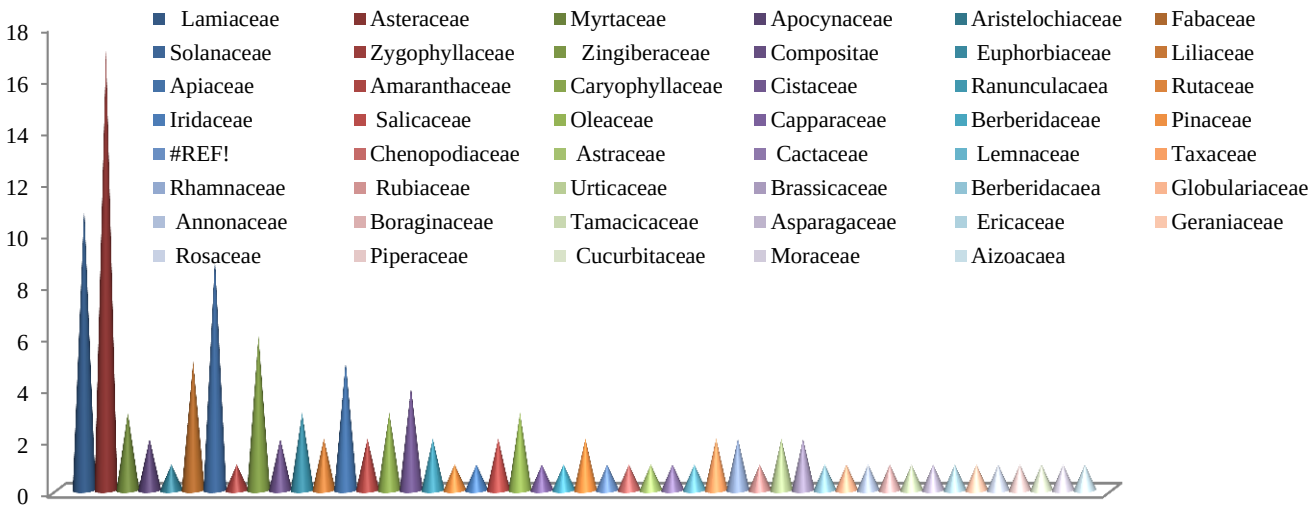

Figure 7: The classification of medicinal plants used mainly by the population studied by botanical families

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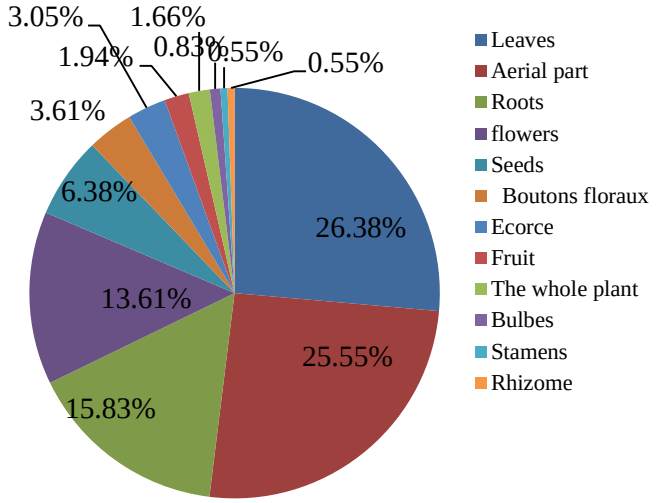

Figure 8: Percentages of the different parts used in medicinal plants

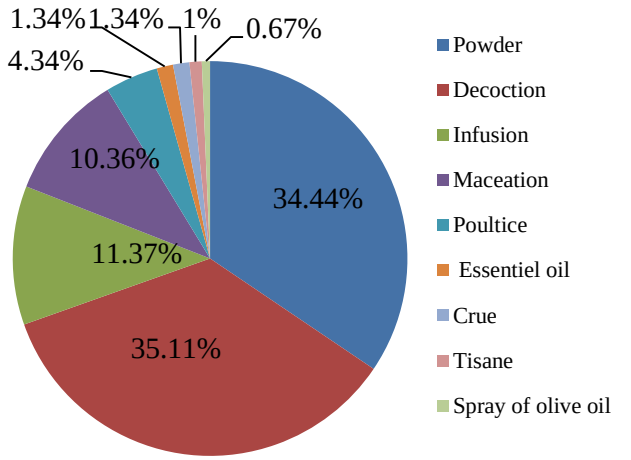

Figure 9: Percentages of preparation methods of medicinal plants used in Casablanca

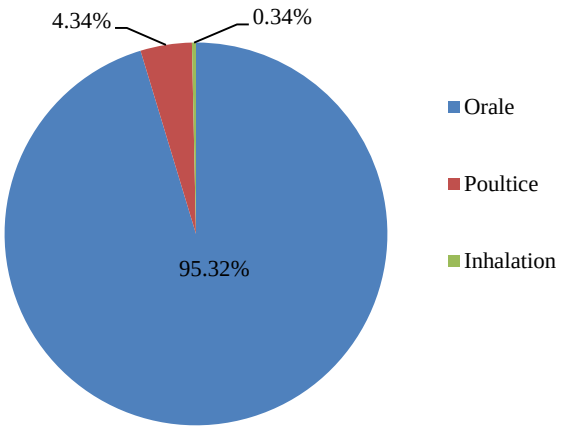

Figure 10: Percentage distribution of modes of administration of the medicinal plants used in Casablanca

Conclusion

In Morocco and like all developing countries, because of the high cost of cancer treatments and the devastating side effects of orthodox medications, medicinal plants are essential in managing this social scourge. In addition, the ethnopharmacological survey we conducted in Casablanca revealed several medicinal plants (352 species belonging to 49 botanical families) and different recipes used by patients to treat various cancers. Some medicinal plants exhibiting toxic effects were also used in remedies for different cancer treatments. Hence, the need for comprehensive studies on the safety of these herbal formulations should be the focus of more research.

Conflict of Interests

The authors declare no conflict of interest.

Author's Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

Table 1: The classification families based on the species numbers

Family	Number of species	Frequency of mention
Lamiaceae	11	9.56
Asteraceae	17	14.78
Euphorbiaceae, Caryophyllaceae, Myrtaceae, Oleaceae	3	2.60
Solanaceae	9	7.82
Apiaceae, Fabaceae	5	4.34
Apocynaceae, Ranunculacaea, Rhamnaceae Amaranthaceae Urticaceae, Taxaceae, Compositae, Liliaceae Salicaceae Brassicaceae, Pinaceae	2	1.73
Zingiberaceae	6	5.21
Cistaceae	4	3.74
Aizoaceae, Moraceae, Cucurbitaceae, Piperaceae, Rosaceae, Geraniaceae, Ericaceae, Asparagaceae, Rubiaceae Tamacicaceae, Boraginaceae, Annonaceae, Globulariaceae, Berberidacaea, Lemnaceae, Cactaceae, Asteraceae, Zygophyllaceae Aristelochiaceae Chenopodiaceae, Berberidaceae, Capparaceae, Rutaceae, Iridaceae	1	0.87

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Table 2: Catalogue of anticancer medicinal plants

Family	scientific name of the species	French name	English name	Vernacular name	Parts used	Method of preparation	Administration mode	Frequency of use
Aizoaceae	*Aizoon canariense*	Aizoon de Canaries	Dog paw	Lghessala	Leaves	Decoction	Oral	1
	Hammada scoparia	Saligne à balai	-	Remt	Leaves	Decoction	Oral	4
Amaranthaceae	*Alriplex halimus*	Arroche maritime	-	lhetba/Aremmas/ L'gtaf	Aerial part/ Stem with leaves	Decoction	Oral	3
Annonaceae	*Annona Muricata*	Corossol	Graviola	Graviola	Fruit	Crue	Oral	1
	Eryngium tricuspidatum	Chardon-Roland	-	Mghizela	Leaves	Powder with honey	Oral	2
	Carum carvi	Carvi	Meridian fennel	Karwiya	Seeds	Decoction	Oral	1
	Ammi majus	Ammi commun	Bishop's weed	Trilan	Seeds	Infusion	Oral	1
Apiaceae	*Bupleurum semicompositum*	Buplèvre glauque	-	Adolfsa/L-heyara	Flowery top	Decoction	Oral	1
	Magydaris panacifolia	-	-	Frifra	Root	Spraying with olive oil	Oral	1
	Nerium oleander	Laurier-rose	Yellow oleander	Defla	Aerial part / Leaves /flowers	Powder with honey /infusion/Powder with olive oil/decoction	Oral	12
Apocynaceae	*Caralluma europaea*	Carraluma d'Europe	-	Daghmous	Stem	Powder with honey	Oral	7
Aristolochiaceae	*Aristolochia longa*	Aristolochia longue	Long aristolochia/ Sarrasine	Berraztam	Root/Ecorce	Powder with honey /Decoction	Oral/ Poultice	16
Asparagaceae	*Asparagus horridus*	Asperge horrible	-	Sekoum	Root	Powder with honey	Oral	1
Asteraceae	*Inula viscosa*	Inule visqueuse	Yellow fleabane	Magramane/ Terhala	Aerial part/ Root	Powder with honey Tisane /maceration	Oral	6
	Artemisia herba-alba	Armoise herbe blanche	Wormwood	Chih lkharassani	Aerial part / Leaves	Infusion/ decoction	Oral	4
	Artemisia absinthium	Absinthe	Absinthe	Chiba	Aerial part	Decoction	Oral	3
	Cynara cardunculus	Cardon	Cardoon	khorchef	Sides	Crue	Oral	2
	Lactuca serriola	Laitue sauvage	Prickly lettuce	Hedba lbldia	Leaves	Poultice	Poultice	1
	Rhaponticum acaule	Rapontique à tige courte	-	Tafgha	Root	Powder/ Decoction	Oral	4
	Echinops spinosus	Tribu des chardons	Thistle tribe	Tasekra	Root	Powder/ Decoction/ Infusion	Oral	6

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	Launaea nudicaulis	Launée à tiges nues	Bhatal	lfengri	Leaves	Tisane/Poudre	Oral	2
	Ormenis eriolepis	-	-	Gartofa/Hellala	Leaves	Decoction/ Maceration/Powder	Oral	5
	Ormenis mixta	Camomille sauvage	-	Hallala	Aerial part	Maceration	Oral	1
	Cynara humilis	Petit artichaut	Wild thistle	Timta	Root	Decoction	Oral	2
	Anvillea garcinii		-	Nougd	The whole plant	Decoction	Oral	1
	Centaurea sulphurea	Chardon étoile sicilien	Sicilian star thistle	Bejjâ nhal/Bûneggir	flowers	Spraying with olive oil	Oral	1
	Scolymus hispanicus	Scolyme d'Espagne	Common golden thistle	Garnina	Root	Powder with honey	Oral	1
	Atractylis gummifera	Chadron à glu	Distaff thistle	Addad	Root	Decoction	Oral	1
	Anacyclus pyrethrum	Camomille espagnole	Mount Atlas daisy	Ud-al attas/Ginass	Root	Decoction/ Poudre avec miel	Oral	2
Astraceae	*Achillea milleforium*	Achillée millefeuille	Yarrow	Richiya	Leaves/ Root	Decoction	Oral	3
Berberidaceae	*berberis hispanica*	Daphne gnidium	Daphne gnidium	Leng/agris	Leaves/ Ecorce of Root	Decoction/ Powder with honey	Oral	3
Boraginaceae	Borago officinalis	Bourrache	Borage	Hobbub likah	Pollen grains	mélanger avec miel	Oral	1
Brassicaceae	*Nasturtium Officinale*	Cresson	Watercress	Grnounch	Aerial part	Decoction	Oral	1
	Brassica nigra	Moutarde noire	Black mustard	bouhamou	Aerial part	Powder with honey	Oral	1
Cactaceae	*Opuntia ficus-indica*	Figuier de barbarie	Indian fig	Hendiya/ Nejma lhendiya	Flowers	Powder	Oral	3
Capparaceae	*Capparis spinosa*	Câprier épineux	Caper bush	Kebbar	Fruit	Powder with honey	Oral	2
	Spergularia marginafa	Petits épis de mer	Lesser sea-spurrey	Âoude boughlam	Aerial part	Decoction	Oral	1
Caryophyllaceae	*Corrigiola telephiifolia*	-	-	Sarghina	Root	Powder with honey	Oral	3
	Silene vulgaris	Silène enflé	Maidenstears	Tighighecht	Leaves	Powder with honey	Oral	1
Chenopodiaceae	*Fredolea aretioïdes*	-	-	Akennoud/Sellaâ	Leaves / Root	Decoction	Oral	3
	Cistus albidus	Ciste blanchâtre	-	tuzzala	Leaves	Decoction	Oral	1
Cistaceae	*Cistus ladanifer*	Ciste ladanifère	Gum rockrose	Touzalte	Leaves	Infusion	Oral	2
	Cistus salviifolius	Ciste à feuilles de sauge	Sage-leaved rock-rose	boutour	Leaves	Infusion	Oral	1
	Cistus monspeliensis	Ciste de Montpellier	Montpellier cistus	Tuzzalabèda	Flowers	Decoction	Oral	1
Compositae	*Dittrichia viscosa*			Térhala	Root	Tisane	Oral	3
	Artemisia herba-alba	Absinthe blanche	White wormwood	Chih lkharassani	Aerial part / Leaves	Infusion/ decoction	Oral	4

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Cucurbitaceae	*Citrullus colocynthis*	Pastèque	Colocynth	lehdej	Seeds	Powder	Poultice	1
	Mercurialis annua	Mercuriale annuelle	Annual mercury	Hurryqa lmelsâ/hriga	Leaves / Aerial part	Decoction/maceration	Oral	5
	Euphorbia falcata	Euphorbe en faux	-	Hayat noufous	The whole plant	Infusion	Oral	1
Euphorbiaceae	*Euphorbia résinifera*	Euphorbe en résine	Resin spurge	Ssekoum	Leaves	Powder with honey	Oral	1
Ericaceae	*Arbutus enedo*	Arbousier	-	Leng	Aerial part	Powder with honey	Oral	1
	Retama monosperma	Balai de la mariée	Bridal broom	R'tem	Leaves	Maceration	Oral	2
	Trifolium arvense	Trèfle des champs	Hase's-foot clover	Nefla	Aerial part / Root	Powder	Poultice	1
	Ononis hirta	-	-	Showk al-jamal	Aerial part	Infusion/Maceration	Oral	6
Fabaceae	*Medicago sativa*	Luzerne bigarrée	Lucerne/Alfalfa	Fsa alberriya	Leaves	Powder	Oral	1
	Teline linifolia	Balai méditerranéen	Mediterranean broom	Mrekh	Leaves	Decoction	Oral	1
Geraniaceae	*Erodium guttatum*	-	-	Rgem	Leaves	Decoction	Oral	1
Globulariaceae	*Globularia alypum*	Globulaire buissonnante/ Turbith	Globular bush	Zrika/Taslgha	Leaves	Decoction	Oral/ Poultice	2
Iridaceae	*Crocus sativus*	Safran cultivé	Saffron	Zâafran	Stamens	Mix with honey	Oral	4
	Thymus algériensis	Thym d'Algérie	Algerian thyme	Zaatar	Aerial part	Essentiel Oil	Oral	1
	Ajuga iva	Bugle petit-if	-	chandgoura	Aerial part / The whole plant	Powder with honey /Decoction	Oral	16
	Marrubium vulgare	Marrube	Horehound	Meriwte	Aerial part /Leaves	mélanger with olive oil** /Decoction/ Infusion	Oral	14
	Rosmarinus officinalis	Romarin	Rosemary	Azir	Aerial part	Decoction/ Powder with honey /infusion	Oral	10
Lamiaceae	*Thymus vulgaris*	Thym commun	Thyme	Zitra	Aerial part	Decoction/ Maceration	Oral	5
	Lavandula stoechas	Lavande des Maures	Spanish lavender	halhal	Leaves/flowers	Decoction/ Infusion	Oral	3
	Origanum compactum	Origan	Oregano	Za'ater	Leaves	Decoction/ Infusion/ Maceration	Oral	5
	Teucrium polium	Germandrée d'Aragon	Felty germander	Jaâda/Jaâda rmadia	Aerial part / Leaves	Decoction/ Infusion	Oral	5

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	Salvia aegyptiaca	Sauge égyptienne	Egyptian sage	Tazoukennit	Leaves	Powder with honey /Decoction	Oral	4
	Vitex agnus-castus	Vitex / Gattilier	Chastetree / Vitex	Bou mettin	Leaves	Powder with honey	Oral	3
	thymus satureioides	Thym à nervures	Fiveribbed Thyme	Za'at	Aerial part	Decoction	Oral	1
Lemnaceae	*Urginea maritima*	Squill	Squill	Beslet eldib	Bulb	Powder with honey	Oral	2
	Asparagus stipularis	-	-	Sakkoum	Aerial part	Decoction	Oral	1
Liliaceae	*Allium sativum*	Ail	Garlic	Touma	Aerial part	Powder with honey	Oral	7
Moraceae	*Ficus carica*	Figuier		Karmôs	Fruit	Powder	Oral	1
	Syzygium aromaticum	Clou de girofle	Clove	Quoranful	Bouton floraux	Powder/ maceration/ essentiel oil with honey	Poultice/ oral	10
Myrtaceae	*Myrtus communis*	Myrte commun	Myrtle	Rayhan	Aerial part / Leaves	Maceration/ Decoction/ essentiel oil/ Powder with honey	Oral	5
	Eucalyptus sailgna	Eucalyptus	Eucalyptus	Eucalyptus	Leaves	Infusion	Oral	1
Oleaceae	*Olea europaea* var. *sylvestris*	Oleastre	Olive	Zitoune/Azmour	Leaves	Powder with honey	Oral	2
	Phyllirea angustifolia	Filaire à feuilles étroites	-	Metwal	Aerial part	Maceration	Oral	1
	Fraxinus angustifolia	Frêne oxyphylle	Narrow-leafed ash	Lsantayr	Aerial part	Powder with honey	Oral	1
Pinaceae	*Cedrus atlantica*	Cèdre de l'Atlas	Atlas cedar	L-ârz / Atgal	Ecorce	Decoction	Oral	1
	Pinus sylvestris	Pin sylvestre	Scots pine	tayda	Ecorce	Decoction	Oral	2
Piperaceae	*Piper cubeba*	Poivron à queue/cubeb	Tailed pepper	L-kebbaba	Seeds	Powder with honey*	Oral	1
Ranunculacaea	*Ranunculus bullatus*	Renoncule d'automne	Autumn buttercup	wden l'hallûf	Root	Decoction	Oral	1
	Nigella sativa	Cumin noir	Black caraway	Sanuj	Seeds	Powder with honey	Oral	3
Rhamnaceae	*Ziziphus lotus*	Jujube	-	Sedra	Root	Powder with honey	Oral	1
	Rhamnus alaternus	Nerprun alaterne	Nerprun alaterne	Mliless	Leaves	Decoction	Oral	1
Rosaceae	*Crataegus laciniata*	Aubépine orientale	Oriental hawthorn	Misnaghtan	Aerial part	Powder with honey*	Oral	1
Rubiaceae	*Rubia tinctorum*	Garance du teinturier	Dyer's madder	Fowa	Root	Infusion	Oral	2
Rutaceae	*Ruta chalepensis*	Rue de Chalep	Fringed rue	L-fijel	Aerial part	Decoction	Oral	1

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	Populus alba	Peuplier blanc	Poplar	Safsaf	Aerial part / Leaves	Maceration/Infusion	Oral	2
Salicaceae	*Salix alba*	Saule blanc	White willow	Oud El ma/ L'oûd labied/ Bu-swalef	Bouton floraux/ Ecorce	Decoction/ Infusion	Oral	2
	Solanum sodomaeum	Pomme du diable	Devil's Apple	Hedja	Fruit	Powder	Poultice	1
	Withania adpressa	-	-	Lbayda	Leaves	Decoction	Oral	1
	Atropa belladonna	Belladone	Deadly nighshade	Zbib lydour	Leaves	Infusion/Decoction	Orale	2
	Mandragora autumnalis	Mandragone	Mandrake/ autumn mandrake	bid al ghul	Root	Decoction	Poultice	2
	Withania frutescens	Withanie frutescente	Withanie shrubby	Tirnet	Leaves	Decoction	Inhalation	1
Solanaceae								
	Hyoscyamus niger	Jusquiame/ henbane	Black henbane	Sikeran	Leaves	Essentiel oil	Poultice	1
	Solanum nigrum	Morelle noire	European black nightshade	Aneb adib	Leaves	Decoction with olive oil	Oral	1
	Lycium intricatum	Lycium imbriqué	Lycium	L'ghardeg	The whole plant	Decoction	Oral	1
	Datura stramonium	Datura bleu	Jimsonweed	chedak jmal	Seeds	Powder with honey	Oral	1
Tamacicaceae	*Tamarix geluta*	-	-	Tikiout	Aerial part	Decoction	Oral	1
Taxaceae	*Taxus baccata*	If	Yew	Îgen	Ecorce	Decoction	Oral	1
	Daphne gnidium	Daphné à feuilles de lin	Flax-leaved daphne	Âlezzâz	Ecorce	Powder	Oral	1
Urticaceae	*Urtica dioica*	Grand ortie	Common nettle	L-hurriga lmelssa	Seeds	Maceration	Oral	1
	Urtica urens	Ortie brûlante	Annual nettle	Hariga	The whole plant	Jus	Oral	1
	Elletaria cardomonum	Cardamome verte	Green cardamom	Qaaqolla	Seeds	Infusion	Oral	1
	Tetraena gaetula	-	-	Laagaya	Aerial part	Decoction	Oral	1
	Nitraria schoberi	Buisson de dillon	Dillon bush	Agerzim	Leaves	Infusion /Decoction	Oral	3
Zingiberaceae	*Curcuma xanthorrhiza*	Curcumine	Curcumin	Kharqûm	Rhizome	Powder with honey	Oral	2
	Fraxinus angustifolia	Frêne à feuilles étroites	Narrow-leafed ash	Lsantayr	Aerial part	Powder with honey	Oral	1
	Alpinia officinarum	Galanga	Lesser galangala	Khodenaj	Rhizome	Powder with honey	Oral	1
Zygophyllaceae	*Peganum harmala*	Esfand/Rue sauvage	Esfand/Wild rue	harmel	Root / Seeds	Powder	Oral	11

* Olive oil: oil of *Olea europaea*
**Honey: honey bee, Apis mellifera

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