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Ethnopharmacological profile of traditional plants used in Morocco by cancer patients as herbal therapeutics

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Abstract

Cancer is one of the major causes of mortality throughout the world. In Morocco, cancer patients are increasing, which indicate that by the year 2020 it is predicted that cancer will be causing seven out of 10 deaths. To reduce this high mortality rate, medical research now turns to the discovery of new molecules that will help to develop natural anticancer drugs. The current study was designed as a prospective randomized investigation on different plants used by the patients of a center for cancer treatment in Morocco. This study was based on a sample of 691 patients from the Cancer Institution in Rabat in a period from September 2009 to march 2010. Among the investigated cases, 272 patients (39%) were identified to regularly use medical plants, and 113 patients among them use plants along with medical treatment. While 159 patients used traditional medicine before using conventional modern drugs. Fifty-five plants have been cited during this study, of which *Aristolochia longa, Trigonella foenum-graecum, Cassia absus* and *Nigella sativa* are the mostly used medicinal plants. Quantitative studies show that the age interval mostly affected by cancer is 40 to 60 years and women are the more prone to cancer. This data shows that phytotherapy has always been practiced in Morocco. Almost all the patients asked have pointed out that the reason for using phytotherapy is poverty.

Keywords: Cancer, Ethnopharmacology; Morocco

Introduction

World Health Organization statistics have estimated that cancer will cause 83.2 million deaths between 2005 and 2015 if the recommended measures are not respected. In 2007, Cancer was the cause of 7.9 million deaths, which is 13% of world mortality (The World Health Statistics, 2008). Currently, Morocco has five public centers and four private clinics for cancer treatment. 7.2 % of cancer patient death every year, with 30000 new cases

diagnosed every year. According to the Ministry of Health, patients must bear up to 90% of the cost of medical treatment certain types of cancer, which reinforces the poverty of the already poor patients. This explains why poor patients prefer traditional medicine. According to the WHO, traditional medicine is widely used in the most countries of Africa. Moroccan traditional pharmacopoeia is one of the richest and varied in the world (Bellakhdar J, 1978; Bellakhdar et al., 1982; Bellakhdar et al., 1991; Benjelloun W, 1991; Bounejmate M, 1997; Bounejmate M, 1995; Boulos L, 1983; Hmammouchi M, 1999; Sijelmassi A, 1993); and the Moroccan flora is known for its highly genetic diversity. In order to establish a list of medicinal plants used by patients with cancer in Morocco, we have conducted a prospective randomized study at the national center of cancer treatment. Within this context, we established an inventory of autochthonous traditional, medical knowledge as a precious source of natural medicine.

Material and Methods

Study design

The work consists of an ethnopharmacological, prospective and randomized investigation. It was carried out on a period of seven months (from September 2009 to March 2010) in two departments at the National Institute of oncology in Rabat (the department of chemotherapy and the department of radiotherapy). This center is National Institute of Oncology (NIO) where patients come from all over Morocco. The patients are taken randomly, to have a heterogeneous point of view: origin, sex, age, socio-professional class, type and stage of cancer. This study has been carried out with the permission of NIO director. All patients have been informed of the study objective and gave their consent.

Selection of parameters

An exhaustive questionnaire was established including: - Information related to the identification of the patient [registration number, sex, age, origin, province region (rural or urban), and socio-professional class]; - Information on pathology [nature, localization, stage and degree of tumor extension as well as protocol and treatment follow-up]; - Information on the use of traditional medicine [use or non use of TM, its use along with modern medicine]; - Information on the anti-cancer plants used [vernacular name and the part of the plant used, the method of preparation, dosage, treatment duration and observance during phytotherapy]; After collecting all the information, a table () was prepared to gather different information on the plants used with their vernacular name and their scientific name.

Statistical analysis

Statistical analysis of data was carried out by Graphpad program (for Windows version 5.01. Graphpad, San Diego, CA, USA) and statistical methodology was based on two axes, which includes descriptive statistics and statistical analysis. Descriptive statistics reveal the frequencies and characteristics of each parameter (average/mean, minimum, maximum). Results are expressed in raw values for qualitative parameters and in mean +/- standard deviation for quantitative parameters. The number of valid data (n active) of each variable has been mentioned in results section. Statistical analysis was based on associated tests such

as the Khi 2 test which measures the gap between the observed frequencies and theoretical frequencies. We have used this test to compare the two sexes. We have also used one factor variance analysis (ANOVA); that estimates intergroup variation (report F). The results are considered significant where p is below 0.05 very significant when $p < 0.01$ and highly significant when $p < 0.001$.

On the other hand, calculation of relative risk (RR) for each age interval as well as sex variable concerning the use of TM has allowed us to estimate the degree of association between two given parameters. If value 1 is included in the confidence interval (CI) of RR, we deduce that there is no association between these two parameters. However, if value 1 is excluded of the CI of RR, we deduce the existence of association between them.

Results and discussion

Frequency of Cancer according to gender

During our investigation, we found that the incidence of cancer in the patients attending the National Institute of Oncology in Rabat is higher among women than men. Of 691 patients, 422 were women (61.1 %), and 301 were men (43.5%) () This data coincides with that of NIO register during the period of our investigation. Out of a total of 2693 patients hospitalized or treated, 1677 were women (62.2%) and 1016 were men (37.7%). This may be explained by the high frequencies, of gyneco-mammary cancers that present 57% of all cancers affecting women in Morocco (Registre des Cancers de la Région du grand Casablanca: 2004, 2007). According to cancers register of Casablanca of 2004, the incidence of global standardized cancers in Morocco is of 101.71 new cases per 100.000 inhabitants per year. Cancer affects more frequently women (raw incidence = 100.1) than man (raw incidence = 84.3), while in other developed countries, cancer is more frequent in man than women (Registre des Cancers de la Région du grand Casablanca: l'année 2004, 2007). Frequency of cancer according to the localization. Breast cancer in women is the most frequent cause of mortality and represents 16% of death in adult women (The World Health Statistics, 2008). In our study it was found that the incidence of breast cancer comes in the first place with a percentage of 34%, and according to the register of Rabat region in 2005, one cancer out of three is breast cancer with a risk cumulated 0-74 years of 3.8%. The number of new cases expected yearly would be 4660. However, the incidence of breast cancer in Morocco (396 for 100000) remains clearly inferior to incidences found in western countries (more than 80 for 100000) (Registre des Cancer de Rabat: Incidence des cancer à rabatannée 2005, 2009).

Bronco-pulmonary cancer in men comes in first place with percentage of 11%. RECRAB of 2005 estimates that the number of new cases expected yearly in Morocco is 3000 with a risk cumulated 0-74 years, that is 3.0% (Registre des Cancer de Rabat: Incidence des cancer à Rabat : 2005, 2009). In developed countries, smoking causes over 80% of such cancers and generally, heavy smoking increases the risk by around 30-fold making lung cancer a major problem in developing countries where the consumption of tobacco is flourishing (Boutayeb A and Boutayeb S, 2005) Non Hodgkin Lymphoma is ranked third, 7%, and it is the most frequent of malignant homeopathies. The incidence of cancers of the lung, colon and rectum, breast and prostate generally increases in parallel with economic

development, while the incidence of stomach cancer usually declines with development (The World Health Statistics, 2008). In developing countries, around 60% of such cancers are thought to be a result of micronutrient deficiencies related to a restricted diet that is low in fruit and vegetables and animal products. There is also consistent evidence that consuming drinks and foods at a very high temperature increases the risk for these cancers (The World Health Statistics, 2008) (Table 1).

Globally, many of the risk factors are due to lifestyle and can be prevented. Physical inactivity, western diet and smoking are prominent causes (Alberti G, 2001). It should be remembered that the patients surveyed were under treatment with either chemotherapy or radiotherapy. Frequency of cancer according to the age. According to cancer register of NIO, the age interval mostly affected by cancer in the course of our investigation is that between 41 and 60 years. This data is similar to that found during our study (Table 2).

Table 1. The incidence of cancer according to its localization (Registre des Cancer de Rabat: Incidence des cancer à rabatannée 2005, 2009).

Localization	Number of patients		Frequency (%)		Frequencies of 2005 in Rabat (%)	
	W	M	W	M	W	M
Tonsil	3	2	0,43	0,28	0,26	0,26
Oral cavity	5	1	0,72	0,14	0	0,26
pharynx	11	26	1,60	3,76	0	0
Colon	11	14	1,60	2,02	1,58	2,60
Cervical	7	-	1,01	0	13,46	-
stomach	17	17	2,46	2,46	3,17	4,69
Liver	2	2	0,28	0,28	1,06	2,34
intestine	9	4	1,30	0,57	0,26	0
tongue	0	1	0	0,14	1,32	0,26
Larynx	0	3	0	0,43	0	3,65
Naso-pharynx	1	2	0,14	0,28	1,58	2,60
Oro-pharynx	0	1	0	0,14	0	0
lips	0	2	0	0,28	0	0
Mediastinal	0	1	0	0,14	0,26	0,52
Esophagus	1	3	0,14	0,43	0,53	0,78
Bone	6	12	0,86	1,73	1,06	0,78
Orbit	0	2	0	0,28	0	0
pancreas	0	4	0	0,57	1,85	2,86
ovaries	27	-	4,00	0	4,49	-
skin	3	7	0,43	1,01	0,26	0,26
peritoneum	4	0	0,57	0	0,26	0
pleura	1	0	0,14	0	0,26	0,52
lung	8	64	1,15	9,26	2,9	19,89
prostate	-	3	0	0,43	-	16,67
rectum	12	13	1,73	1,88	2,64	3,13
breast	229	2	33,14	0,28	33,51	0,78
Central nervous system	2	3	0,28	0,43	2,37	2,60
testicle	-	8	0	1,15	-	0,52
gallbladder	3	1	0,43	0,14	1,58	1,04
uterus	5	-	0,72	0	3,43	-
bladder	1	5	0,14	0,72	0,79	8,07
vulva	1	0	0,14	0	0,53	-
Hodgkin lymphoma	22	21	3,18	3,03	1,06	1,04
Non Hodgkin lymphoma	28	27	4,05	3,90	2,64	5,73
Leukemia	0	2	0	0,28	0,26	1,04

Table 2. The incidence of cancer according to age

Ages	Frequency data of study(%)	Overall frequency between September 2009 and March 2010 (%)
Between 1 and 20 years	25p / 3,6%	116p / 4,3%
Between 21 and 40 years	180p / 26%	499p / 18,5%
Between 41 and 60 years	363p / 52,5%	1342p / 50%
More than 61 years old	117p / 17%	742p / 27,5%

This shows that the incidence of cancer increases with age, while its decrease from 61 years may be explained only by the high rate of deaths.

Frequency of using traditional medicine by NIO patients

Among the total 691 questioned patients, 272 patients (39%) were identified to regularly use medicinal plants along with medical treatment, while 159 patients have used traditional medicine before using medical treatment (Figure1). This data show that phytotherapy is still been practiced in Morocco.

Use of Traditional Medicine according to the gender

We have found that Women (22.5%) use medicinal plants more frequently than men (16,4%); wich confirms results from previous studies (Hamdani S.E, 1984; El Beghdadi M, 1991; Jaouad L, 1992; Nabih M, 1992; Ziyyat A and al., 1997). This may be explained by the high rate of illiteracy among women in relation to men, as well as the transmission of information from mothers to daughters. When we compare the intragroupe variation, the use of medicinal plant was markedly increased 60.60 ± 7.98 and 45.20 ± 5.58 respectively, compared women to men. The difference was significant ($p<0.05$).

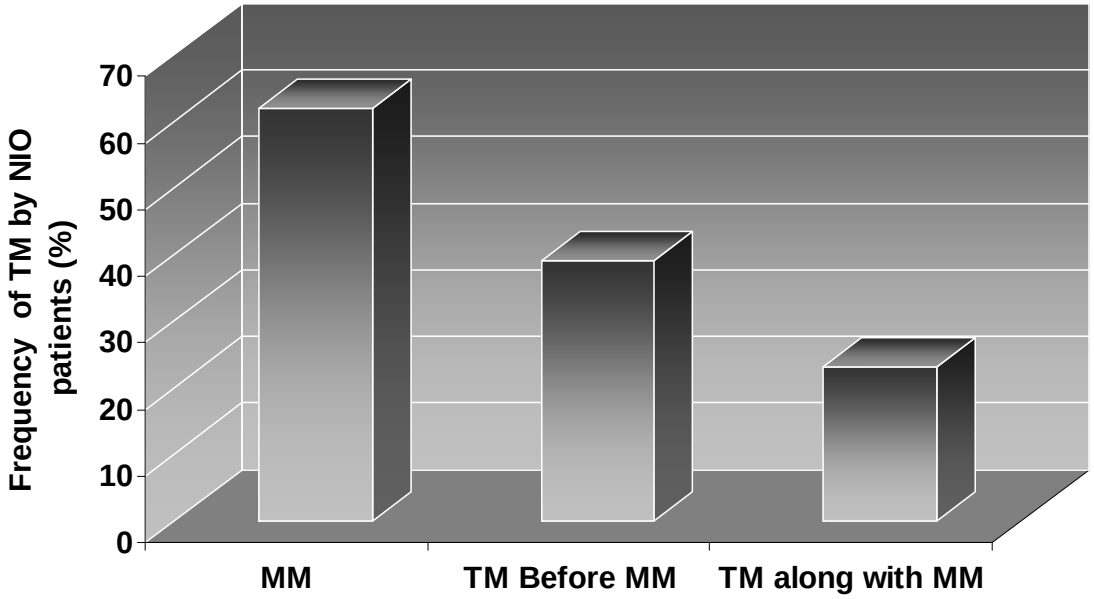

Figure 1. Frequency of using Traditional Medicine by NIO patients

Use of Traditional Medicine according to age

The age interval between 41 years and 60 years use more frequently TM compared to other age intervals. In some ethnopharmacological studies (El Beghdadi M, 1991; Nabih M, 1992), the same results have been found.

Certainty and error biases

Data collection relative to origin, place of residence, age as well as type, stage and localization of tumor have been established with the help of the person responsible of hospital register of NIO, and with the study of medical files of each questioned patient. The accuracy of information on the use of traditional medicine as well as the socio-professional Class remains underestimated since it depends on the degree of the goodwill of participation. During the investigation, there was some reluctance from some patients about clearly and honestly answering questions concerning their use of medicinal plants, either out of fear of their clinician, or fear of the consequences of our investigation. The variable of sex has never been missing in our data.

Use of medicinal plants in Morocco

The use of medicinal plants for therapeutic purposes is considered by many people as not being very efficient, but for being at least well tolerated because it is natural and is part of "soft" medicine. In all the regions of Morocco, each home has a stock of medicinal plants that are used as home pharmacy for a number of diseases (Weniger B, 1991). In Morocco, people have free access to medicinal plants "without prescription" (Claisse R, 1990),

According to our investigation, the majority rate of patients who use medicinal plants have a low income and live far from the hospital, which explains their resorting to medicinal plants to be cured. The origin and their educational level were also a variable because in traditional medicine, the statements of an illiterate or of an expert are not the same. (Figure 2). Many studies have shown that traditional medicine is still used; the biological activity of each plant must be scientifically proved. Several authors have shown that the use of traditional medicine is between 55% and 90% depending on the place of origin of the tradipracticians (Sekkat C, 1987; Bendali M,1991;El Beghdadi M, 1991; Magoua N, 1991; Jaouad L, 1992; Nabih M, 1992; Bellakhdar J, 1997; Ziyyat A and al., 1997). Medicinal plants used in traditional medicine by the patients of the National Institute of Oncology in Rabat. Fifty-five plants have been cited during this investigation of which *Aristolochia longa, Trigonella foenum-graecum, Cassia absus* and *Nigella sativa* are the most used (Table 3). Among these plants, 28 that are proven they have anticancer activity (Table 4).

The toxicity and side effects of medicinal plants

The effect of the action of a drug results in the risk benefit ratio. It depends on the drug itself, dose, disease, other drugs consumed in parallel and the patient himself. Only the clinician can find the balance between the toxic doses and the therapeutic doses expected. However, the role of the clinician lack in Traditional Medicine, which explains the high rate of poisoning caused by this treatment.

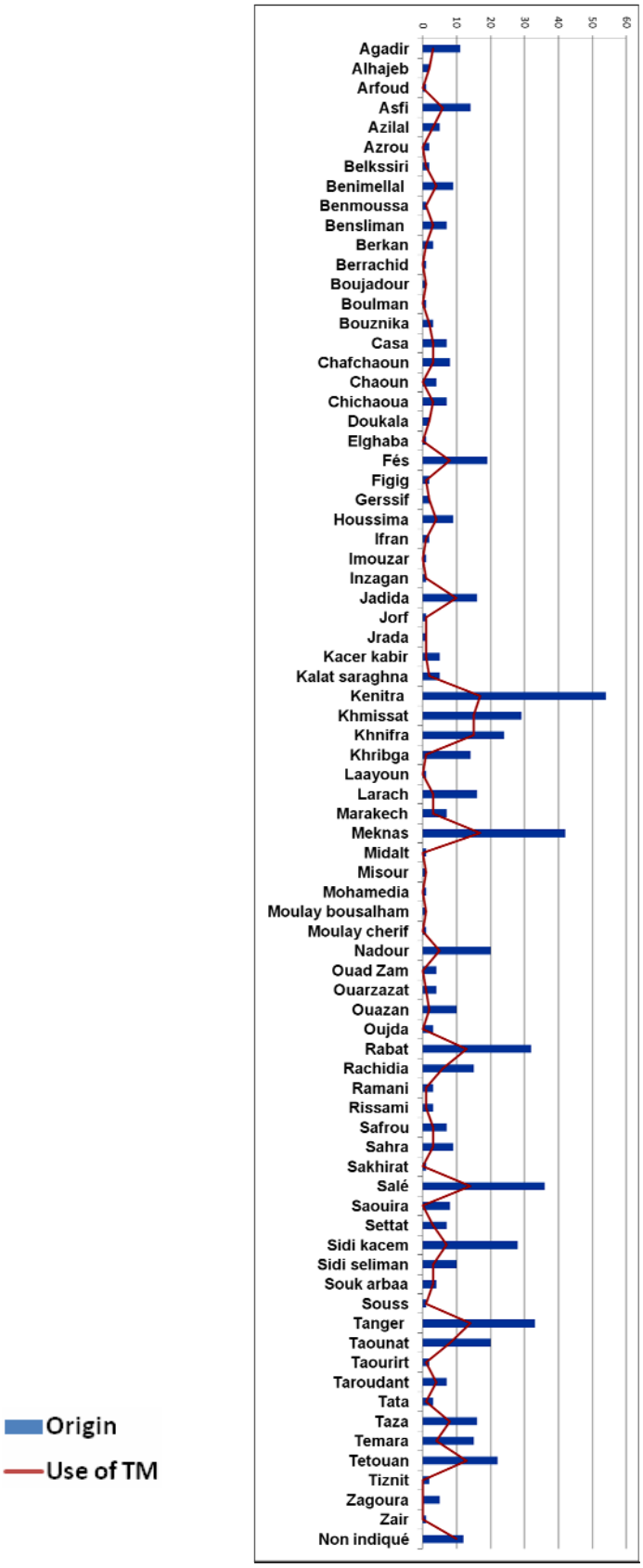

Figure 2- Use of Traditional Medicine according to the origin

Table 3 Medicinal plants used in traditional medicine by the patients in current study.

Scientific name	Local (Vernacular) name	Part used (Number of citation)	Preparation Administration	Types of Cancer
Anacardiaceae				
Pistacia lentiscus.	Drou	Leaf (5)	Brut, Decoction (Oral)	Digestive
Apiaceae				
Apium graveolens	Krafess	Leaf (1)	Decoction (Oral)	Digestive, Kidney
Ammodaucus leucotrichus	Kamounsooufi	Seed (4)	Grind with honey (Oral)	Lung
Carum carvi.	Karwiya	Seed (2)	Grind with honey (Oral)	Lung
Coriandrum sativum	Qezbour	Aerial parts (3)	Grind with honey (Oral)	Digestive, Kidney
Cuminum cyminum	Kamoun	Seed (1)	Grind with honey (Oral)	Lung
Daucus carota	Khizzou	Root (5)	Decoction (Oral)	Digestive, Kidney
Foeniculum vulgare	Nafaâ	Seed (6)	Decoction (Oral)	Digestive
Petroselinum crispum	Maâdanous	Aerial parts (3)	Decoction (Oral)	Kidney
Pimpinella anisum.	Habbathlawa	Seed (1)	Decoction (Oral)	Digestive, Kidney
Apocynaceae				
Nerium oleander	Defla	Leaf (1)	Decoction (Mouthwash)	Gingival
Araliacées				
Panax ginseng	Jinsin	Leaf (1)	Grind with honey (Oral)	Lung
Arécacées				
Phoenix dactylifera	Tamer	Fruit (2)	Brut (Oral)	Lymphoma
Aristelochiaceae				
Aristolochia longa	pBerraztam	Root (98)	Grind with honey (Oral)	General
Boraginacées				
Borago officinalis	Hobouballikaah	Stamen (2)	Grind with honey (Oral)	General
Cruciferae				
Lepidium sativum	Hebbrchad	Seed (9)	Grind with honey (Oral)	Lung, Digestive
Capparaceae				
Capparis spinosa	Kebbar	Fruit (2)	Grind with honey (Oral)	Lymphoma

Scientific name	Local (Vernacular) name	Part used (Number of citation)	Preparation Administration	Types of Cancer
Caryophyllaceae				
Corrigiola telephiifolia	Sarghina	Root (1)	Decoction (Oral)	Digestive, Liver
Herniaria glabra	Hrassetlehjer	Aerial parts (1)	Decoction (Oral)	Digestive, Renal
Chenopodiaceae				
Chenopodium ambrosioides	Mkhinza	Leaf (1)	Decoction (Oral)	Amygdale
Haloxylonsco parium	Eremt	Leaf, Fruit (1)	Decoction (Oral)	Liver
Compositae				
Artemisia absinthium L.	Chiba	Leaf (1)	Infusion (Oral)	Digestive
Artemisia vulgaris	Chih	Aerial parts (2)	Infusion (Oral)	Digestive
Artemisia herba-alba	Chihelkhorrassani	Aerial parts (1)	Infusion (Oral)	Digestive
Inula viscosa (L.) Ait.	Bagraman	Leaf, Flower (22)	Grind with honey (Oral)	Breast
Euphorbiaceae				
Euphorbia resinifera	Daghmous	Aerial parts (8)	Grind with honey (Oral)	General
Fabaceae				
Cassia absus	Habatalbaraka	Seed (58)	Grind with honey (Oral)	General
Cicer arietinum	Homos	Seed (58)	Grind with honey (Oral)	Lung
Vicia faba	Foul	Seed (1)	Grind with honey (Oral)	Lung
Iridacées				
Crocus sativus	Zâafran	Stamen (3)	Decoction (Oral)	General
Lamiaceae				
Ajuga iva L.	Chendgoura	Rod, Leaf (6)	Grind with honey (Oral)	Breast
Lavandula officinalis L.	Khzama	Leaf (9)	Infusion (Oral)	The urinary and genital system
Marrubium vulgare L.	Marrîwet	Rod, Leaf (19)	Decoction (Oral)	Digestive,
Mentha pulegium L.	Fliyou	Rod, Leaf (7)	Infusion (Oral)	Gingival
Origanum compactum	Zaâtar	Rod, Leaf (44)	Infusion (Oral)	Digestive, Gingival
Rosmarinus officinalis L.	Azîr	Leaf (4)	Decoction(Oral)	Digestive

Scientific name	Local (Vernacular) name	Part used (Number of citation)	Preparation Administration	Types of Cancer
Salvia officinalis L	Salmiya	Leaf (2)	Infusion (Oral)	Intestine, Lung
Thymus ssp.	Zîtra	Rod, Leaf (1)	Infusion (Oral)	Digestive
Leguminosae				
Trigonella foenum-graecum	Halba	Seed (60)	Grind with honey (Oral)	Digestive
Liliacaea				
Allium cepa L.	El Bassla	Bulb (1)	Brut (Oral)	General
*Allium sativum*L	Touma	Bulb (14)	Brut (Oral)	General
Linaceae				
Linum usitatissimum	Zariatalkhatan	Seed (13)	Grind with honey (Oral)	Lymphoma
Liliacées				
Aloe ferox	Siber	Leaf (4)	Extraction (Oral)	Digestive
Lythraceae				
Lawsonia inermis	Henna	Flower (5)	Grind with water (Cataplasm)	Skin
Moracées				
Ficus carica	Karmous	Fruit (2)	Brut (Oral)	Digestive
Myrtaceae				
Myrtuscommunis L.	Rihan	Leaf (4)	Decoction (Oral)	Digestive
Oléacées				
Olea europaea	Zaytoun	Fruit (2)	Extraction (Oral)	Lung
Pinacées				
Pinus halepinsis	Katran	Seed (1)	Extraction (Oral)	Esophagi
Punicaceae				
Punica granatum	Rouman	Rind (2)	Decoction (Oral)	Skin
Ranunculaceae				
Nigella sativa	Samouj, Haba Saoudaâ	Seed (54)	Grind with honey (Oral)	General
Sapotaceae				
Argania spinosa	Argan	Seed (1)	Extraction (Oral)	Skin

Scientific name	Local (Vernacular) name	Part used (Number of citation)	Preparation Administration	Types of Cancer
Thymelaeaceae				
Thymelaea lathyroides	Ftiticha ,matnan	Aerial parts (2)	Decoction (Oral)	Uterus
Verbenaceae				
Verbena officinalis	Louiza	Leaf (1)	Infusion (Oral)	Gallbladder
Zingiberacées				
Zingiber officinale	Sknjbir	Root (1)	Grind with honey (Oral)	General
Zygophylaceae				
Peganum harmala	alharmal	Seed (1)	Grind with honey (Oral)	General

Table 4. List of medicinal plants reported to have anticancer activity.

Species	Family	Reference
Pistacia lentiscus L.	*Anacardiaceae*	Balan K.V, 2007
Petroselinum crispum Mill.	*Apiaceae*	Hui Z and al., 2006
Nerium oleander	*Apocynaceae*	Luay J.R and al., 2001
Panax ginseng C.A. Meyes	*Araliaceae*	Shi S and al., 2011
Phoenix dactylifera	*Arécaceae*	Biglari F and al., 2011
Capparis spinosa L.	*Cruciferae*	Sze-Kwan L and al., 2009
Chenopodium ambrosioides	*Chenopodiaceae*	Ruffa M. J and al., 2002
Artimesia vulgaris	*Compositae*	Nibret E and al., 2010
Artemisia herba-alba	*Compositae*	Nibret E and al., 2010
Inula viscosa (L.) Ait.	*Compositae*	Danino O and al., 2009
Euphorbia resinifera	*Euphorbiaceae*	Lavie D and al., 1963
Cicer arietinum	*Fabaceae*	Ajiaikebaier A and al., 2011
Crocus sativus	*Iridaceae*	Akshi H. A and al., 2009
Rosmarinus officinalis L.	*Lamiaceae*	Shuwen C and al., 2001
Salvia officinalis L.	*Lamiaceae*	Toshiya M and al., 2002
Trigonella foenum-graecum	*Leguminosae*	Jayadev R and al., 2004
Allium cepa L.	*Liliacaea*	Jun Y and al., 2004
Allium sativum L.	*Liliacaea*	Yoshiyuki M and al., 2010
Linum usitatissimum	*LinaceaeMoraceae*	Abarzua S and al., 2007
Ficus carica	*Myrtaceae*	Sarfaraz Khan M and al., 2011
Olea europaea	*Oléaceae*	Mijatovic S.A and al., 1955
Pinus halepinsis mill	*Pinaceae*	Volker M-S and al., 2011
Punica granatum L.	*Punicaceae*	Oliveira L.P and al., 2010
Nigella sativa L.	*Ranunculaceae*	Worthen D.R and al., 1998
Argania spinosa	*Sapotaceae*	El Babili F and al., 2010
Verbena officinalis	*Verbenaceae*	UcarTurker A and al., 2010
Zingiberofficinale roscoe	*Zingiberaceae*	Kim E-C and al., 2005
Peganum harmala L.	*Zygophylaceae*	Changhong W and al., 2005

Moreover, there are plants that are proven to be toxic such as *Pinus halepinsis*, *Peganum harmala, Aristolochia longa* and *Euphorbia resinifera*, regardless of their toxicity these plants are used by patients in the INO and have a degree of toxicity or side effects. Despite the existence of the modern medicine for cancer treatment, traditional medicine continues to be a viable health alternative for the large underprivileged section of the Moroccan population. Phytotherapy should not be an alternative medicine but a real tool of discovering new molecules of diverse structure, as a potential lead compounds.

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Conflict of Interest statement

There is no conflict of interest associated with the authors of this paper, and the fund sponsors did not cause any inappropriate influence on this work.

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