

Ethnobotanical survey on breast cancer treatment in the M'sila region (Central Algeria)

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Abstract. Research on the use of traditional medicine for breast cancer (BC) treatment is widespread and plays a significant role in healthcare provision. This study aimed to identify the specific plants used in traditional medicine in the M'sila province (Algeria) for BC management. An ethnobotanical study was conducted from mid-February to April 2023. Direct interviews were held, and semi-structured questionnaires were administered to the local population. As a result we identified 18 medicinal plant species with substantial use values (UV > 0.1), belonging to 15 families, mostly the Zingiberaceae, Lamiaceae, Amaryllidaceae, and Asteraceae. The most frequently cited species included *Curcuma domestica* Valet., *Ephedra alata* Decne., *Panax ginseng* C.A. Mey., *Allium sativum* L., *Linum usitatissimum* L., *Zingiber officinale* Roscoe, *Annona muricata* L., and *Atriplex halimus* L. Most commonly, leaves (30.2%) or all parts (20.5%) were used. The majority of the remedies were prepared in the form of decoction (39.0%) and powder (26.2%). The valuable ethnobotanical data from the M'sila region contribute to the knowledge of medicinal plants for BC treatment, and the findings may help to identify new anti-BC agents.

Key words: breast cancer, biodiversity, ethnobotany, plant therapy, Algeria

1. Introduction

Breast cancer (BC) is a serious global public health concern. It is the most common disease being the primary cause of cancer-related mortality in women, accounting for 23% of total cancer cases, and it causes a mortality rate of 2.5% per year (Siegel *et al.* 2019; OMS 2023). Algeria is no exception, recording a high mortality rate despite advancements in disease management, particularly in early detection. Epidemiological surveillance, based on data from the national network of cancer registries, reveals an epidemic trend and a rising incidence rate, estimated at 22.3 cases per 100 000 inhabitants (Smaili *et al.* 2020).

The treatment of BC typically depends on several factors, including its stage and type, the patient's over-

all health, and personal preferences. Surgery is often the first-line treatment for BC. The type of surgery depends on the size and stage of the cancer. Radiotherapy uses high-energy beams to kill cancer cells. It is often applied after surgery to optimize treatment, reduce acute or chronic toxicity, and destroy any remaining cancer cells in the breast (McDonald *et al.* 2016). Furthermore, chemotherapy is often used in the care of women with lymph node-positive BC (Maughan *et al.* 2010).

In many countries, also medicinal herbs are used to treat BC, because various traditional medical procedures, methods, theories, and practices are acknowledged and respected for their role in the maintenance of health and treatment of disease (Che *et al.* 2017). In Algeria, despite the richness of the flora of this country,

there has been little documentation of herbal treatments for cancer so far (Bouhaous *et al.* 2022).

The region of M'sila is known for its traditional medical expertise due to its location in Central Algeria, which provides it with a high level of ecological diversity and rich flora (Sarri *et al.* 2014). However, we chose this study area due to the lack of available data on the traditional use of medicinal herbs for treating BC in Algeria, including M'sila.

Our ethnobotanical investigation in M'sila province was based on a survey questionnaire distributed among the local people. We aimed to collect comprehensive information about the types and rates of medicinal herb usage for BC treatment, and to identify any gaps in scientific understanding. We also hoped that this study will be useful for researchers in developing anti-BC medications in the future and may provide valuable data on botanical resources of this region.

2. Material and methods

2.1. Study area

Our study was conducted in the M'sila province (wilaya), located about 250 km from the capital (Algiers) in the central part of Algeria (Fig. 1). This area, covering 18 175 km², is known for its valuable natural habitats and diverse flora of both economic and ecological value.

2.2. Study design

We conducted the ethnobotanical survey from mid-February to April 2023, using a questionnaire in Arabic. We interviewed 71 participants: cancer patients, health professionals (e.g. pharmacists), and local residents of the study area, including elderly people, herbalists, and students. The survey was entitled “Plant-based BC treatment research” and collected information such as gender, age, level of education, plant names, parts used, and methods of preparation and application.

2.3. Use value (UV)

UV is crucial for determining the relative significance of plant species in relation to a disease and was calculated using the following formula (Andrade-Cetto & Heinrich 2011):

$$UV = \Sigma U/n$$

where U is the total number of use citations by the informants for a given species, and n is the total number of informants.

2.4. Plant identification

The plants were identified by Prof. Sarri Djamel and Prof. Sarri Madani, botanical experts from the Department of Natural Sciences and Life at the Faculty of Science, University of M'sila, Algeria.

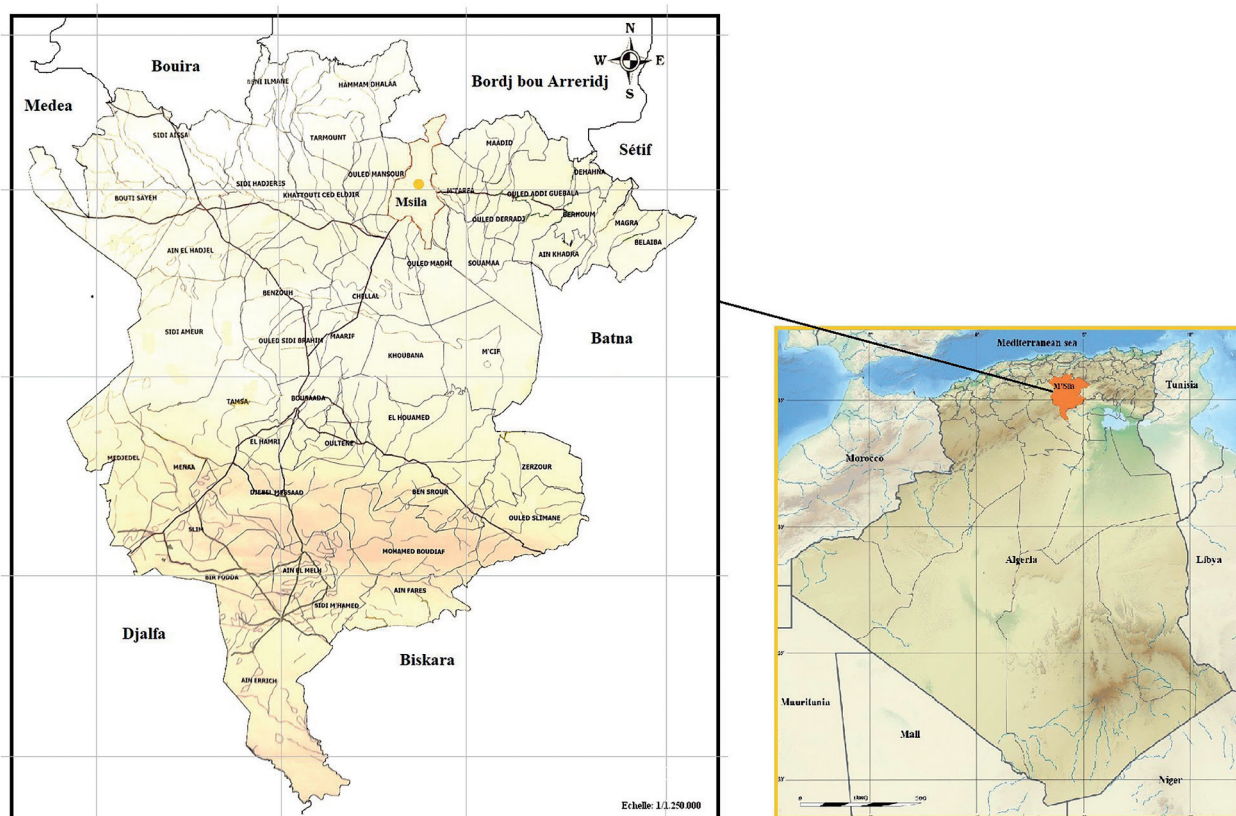


Fig. 1. Geographical map showing the location of the study area in Algeria (M'sila province)

3. Results

3.1. Analysis of the demographic characteristics of the interviewed individuals

The majority of the 71 respondents who used herbal medicine for BC were women (71.8%), while 28.2% were men (Table 1). Thus the skewed gender distribution could cause gender-specific perspectives in the results, but BC affects mostly females.

The age of the informants ranged from 20 to over 70 years. The highest percentage (42.3%) was observed in the 20-30 years age group, and the lowest percentage (2.8%) was reported in the 70+ years age group.

Most of the respondents were educated at the university level (66.2%), followed by high school (14.1%), primary school (12.7%), and middle school (7.0%).

Almost half (49.3%) were not employed, 33.8% were employed in professions other than health care, 11.3% were phytotherapist, and 5.6% were herbalists, and no farmers were included in our study (Table 1).

The majority of those using plant therapy for BC had no income (47.9%), followed by those who were employed in professions unrelated to health care (33.8%). Single people (both men and women) were the most involved in our study, with women dominating.

Table 1. Demographic characteristics of the participants of the survey on plant remedies for breast cancer (BC) treatment

Characteristics		Group	Number
Sex		men	20
		women	51
Education level		primary	9
		middle school	5
		high school	10
		university	47
Age group (years)		20–30	30
		31–40	11
		41–50	11
		51–60	9
		61–70	8
		70<	2
Occupation		not employed	35
		phytotherapists	8
		farmers	0
		herbalists	4
		employed in other professions	24
Frequency of use of plants for BC according to salary (Algerian dinars)		not employed	34
		3000-8000	3
		9000-15000	4
		15000-30000	10
		30000-50000	16
		50000-90000	4
		90000<	1
Family status	women	single	31
		married	18
		divorced	0
		widows	2
	men	single	10
		married	7
		divorced	1
		widowers	2

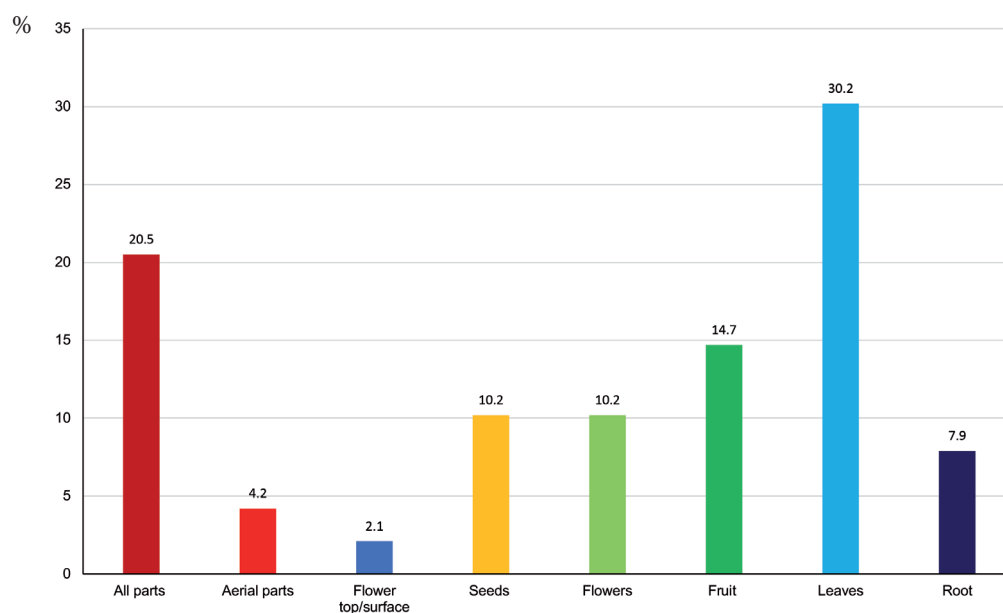


Fig. 2. Frequency of citations of the plant parts used for breast cancer treatment

3.2. The use of plants for BC treatment

This study revealed the use of 68 plant species as herbal remedies for BC in the M'sila province. According to the informants, the majority of these plants (89.7%) were considered to be safe, with no side effects, while the remainder (10.3%) were had side effects.

Either all or only some parts of the plants were selected by the informants. Leaves were the most commonly used plant part (30.2%), followed by whole plant (20.5%), fruits (14.7%), flowers and seeds (10.2% each), and roots (7.9%). The use of aerial parts and flower tops/

surfaces was cited by fewer than 5% of our informants (Fig. 2).

Various methods of applying medicinal plant parts for BC treatment have been reported. According to our results, decoction (39.0%), powder (26.2%), infusion (14.2%), and cream (8.2%) were the most commonly used methods. However, oil, tablets, smoke, raw plants, and baths were the least reported, accounting for fewer than 5% each (Fig. 3).

According to the informants, most of the medicinal plants used for BC are accessible. A total of 67.3% of

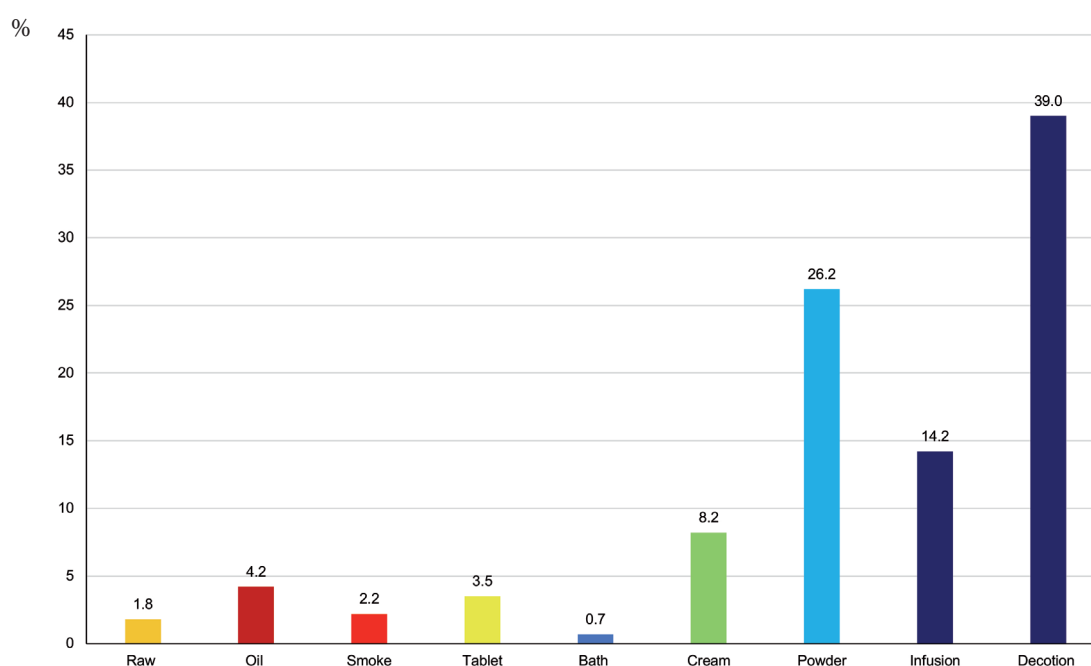


Fig. 3. Frequency of various application methods of plants for breast cancer treatment

Table 2. List of medicinal plants used to treat breast cancer in the M'sila region with the highest use values (UV > 0.1)

Family	Scientific name	Common name	Part used	Application method	UV
Amaranthaceae	<i>Atriplex halimus</i> L.	قطف (saltbush)	leaves	decoction	0.17
Amaryllidaceae	<i>Allium sativum</i> L.	ثوم (garlic)	seeds/fruit	powder/infusion	0.27
	<i>Allium cepa</i> L.	بصل (onion)	aerial parts	decoction/with oil/raw	0.14
Annonaceae	<i>Annona muricata</i> L.	graviola	fruit	cream	0.23
Araliaceae	<i>Panax ginseng</i> C.A. Mey	جنسنگ (ginseng)	leaves/roots	powder/infusion	0.28
Asteraceae	<i>Calendula officinalis</i> L.	أذريون ¹ (pot marigold)	leaves/ flowers	decoction/infusion	0.15
	<i>Arctium palladinii</i> Groosh	أرقطيون ¹ (burdock)	roots	decoction	0.11
Barberidaceae	<i>Aristolochia rotunda</i> L.	برسشم (barberry)	leaves/fruit	decoction/ powder	0.13
Ephedraceae	<i>Ephedra alata</i> Decne	علندة (ephedra)	leaves	decoction	0.41
Lamiaceae	<i>Salvia officinalis</i> L.	مرمريّة ¹ (sage herb)	whole plant/leaves/flowers/seeds	decoction/ powder/oil	0.13
	<i>Mentha spicata</i> L.	نعناع (mint)	whole plant/leaves	decoction/cream/ powder/bath	0.11
Liliaceae	<i>Aloe vera</i> (L.) Burm.f.	الصبار (aloe vera)	aerial parts	cream	0.11
Linaceae	<i>Linum usitatissimum</i> L.	بذور الكتان (linseed)	seeds	decoction/cream	0.24
Rutaceae	<i>Ruta chalepensis</i> L.	فجل (rue)	leaves	decoction	0.11
Thymelaeaceae	<i>Aquilaria malaccensis</i> Lam. (in nature critically endangered!)	عود غريس (agarwood)	whole plant*/leaves/roots/flower surface	decoction/ powder/smoke	0.15
Violaceae	<i>Viola odorata</i> L.	بنفسج (violet)	flowers	decoction	0.11
Zingiberaceae	<i>Curcuma domestica</i> Valetton.	كركم (turmeric)	whole plant/ fruit	powder	0.45
	<i>Zingiber officinale</i> Roscoe	زنجبيل ¹ (ginger)	whole plant/ fruit	decoction/ powder/bath	0.24

them are cultivated, 22.9% grow spontaneously, and 9.8% are imported (Table 2).

The informants reported various sources of information about the plants used for BC treatment. Most of them (37.1%) had this knowledge from others' experience in general. Furthermore, 26.7% of the participants derived their knowledge from herbalists, 21.6% from herbal books, 10.1% were pharmacists, and 4.5% had personal experience.

3.3. Floristic analysis

The results of the ethnobotanical survey conducted in the study region allowed us to compile a list of 68 medicinal plant species, as mentioned above, but only the top 18 species among 15 families had substantial use values (UV > 0.1). Among these documented families,

the Zingiberaceae, Lamiaceae, Amaryllidaceae, and Asteraceae exhibited a species count of 2 each, while the remaining families were represented by single species in this group.

4. Discussion

Our ethnobotanical study conducted in the M'sila province, with a sample size of 71 randomly selected individuals who had information about herbal treatment for BC, included both women and men from the local population. The results provide valuable insights into the use of plants in cancer treatment and the participants' knowledge of plant therapy. Understanding their motivations, sources of information, and consumption habits is crucial to providing guidance and support to

make informed choices and avoid potentially harmful interactions that may affect their health management. Despite the growing number of papers published in recent years on the interaction between herbal remedies and traditional chemotherapies, awareness of the importance of this risk and the consequent training of health professionals seems urgent but is still in progress. However, there are a few points in our study that need to be discussed.

Our study included both genders (men and women), while earlier studies conducted in Algeria (Mascara and Tlemcen), Palestine, and Canada focused only on women (Helyer *et al.* 2006; Benarba 2015; Benarba *et al.* 2015; Jaradat *et al.* 2016; Tachema & Bendimerad 2018). The majority of informants in our study (71.8%) who had information about herbal treatment were women, which was significantly different from a study carried out by Lutoti *et al.* (2023), where 72.3% were men. The notable difference may be because women in Algeria have greater knowledge and interest in traditional remedies than men, e.g. in Kabylia, where Meddour *et al.* (2010), Benkhniqne *et al.* (2010), and Adouane (2016) showed that women have much more resources for plant therapy. Furthermore, the higher participation rate of women in our study can be attributed to their prominent role as primary caregivers, which stems from their biological and socio-cultural responsibilities as mothers (Bendif *et al.* 2021).

In our study, a vast majority of individuals (66.2%) had a high level of education, being either graduates or currently studying at the university. Conversely, others had completed their education at the high/middle or primary school level. This finding is consistent with similar studies conducted in Palestine (Jaradat *et al.* 2016), Uganda (Lutoti *et al.* 2023), and Canada (Helyer *et al.* 2006). In contrast, studies conducted in Mascara (Benarba *et al.* 2015) and Tlemcen (Tachema & Bendimerad 2018) showed that the majority of participants in those regions had no formal education. The notable number of individuals with a university education in our study can be attributed to the fact that educated individuals have a better understanding of the efficacy of medicinal herbs and therefore have greater interest and willingness for active participation in research.

In our study, we found that different age groups of informants used medicinal plants for BC at different rates. In particular, a higher rate of plant use (42.3%) was observed among informants aged less than 30 years, suggesting that younger generations have greater awareness and knowledge of the potential benefits of medicinal plants for BC.

This finding is in line with a study in Palestine (Jaradat *et al.* 2016), which reported comparable results among individuals aged 30–37 years, with a rate of 72.3%. In contrast, studies in Algeria (Benarba 2015;

Tachema & Bendimerad 2018) showed that older generations (45+ years) were more likely to know about the use of plants for BC.

The results of our study reveal a remarkable distribution of employment among herbal medicine users: as many as 49.3% were not employed. These results are consistent with a study conducted in Mascara, where a substantial majority (72.2%) of interviewed herbal medicine users were identified as housewives. It is important, however, to note that the term “housewife” in Algeria does not imply a lack of employment, as these women often have also other roles and responsibilities (Benarba 2015). In contrast, a study conducted in Uganda reported that all informants were employed, with business and agriculture being the main economic activities for 65% of participants. Similarly, in Canada, a smaller proportion (31%) of herbal medicine users were not employed (Helyer *et al.* 2006; Lutoti *et al.* 2023).

All this suggests that herbal medicine use is not restricted to a particular employment status and is common among people from various occupational backgrounds. The analysis of informants' salaries in our study revealed that nearly half of the interviewed herbal medicine users (47.9%) were not employed, followed by the group of individuals receiving salaries ranging between 30000 DA and 50000 DA (22.5%). These findings indicate the diverse demographic characteristics of individuals seeking alternative treatment options for BC, especially those with good or high salary rates, who still return to herbal medicine and are trusting its efficacy. This highlights the importance of herbal medicine as a complementary therapy in the management of BC, attracting individuals from various income levels.

The results show that the majority (57.7%) of the participants of both genders (female and male) were single. This finding contrasts with previous studies conducted in Algeria (Mascara), Palestine, Uganda, and Canada, which reported a predominance of married individuals among herbal medicine users for BC (Helyer *et al.* 2006; Benarba *et al.* 2015; Jaradat *et al.* 2016; Lutoti *et al.* 2023). The difference in marital status may be attributed to the age composition of our study participants, with the highest proportion of young individuals under 30 years of age, many of them being still students. Younger people are more likely to be single, which explains the higher prevalence of single participants in our research compared with the other studies.

Our analysis revealed that the majority (89.7%) of the plants used by the individuals for BC were believed to be safe and have no side effects, while 10.3% had some side effects. This result was in agreement with that of Jaradat *et al.* (2016), who reported that since the plants they identified were edible and mostly used

in food, the rate of toxicity or side effects could be considered low or non-existent. The results showed that among the informants, decoction (39.0%), powder (26.2%), and infusion (14.2%) were the most commonly used methods for preparing medicinal plants. These findings are consistent with previous Algerian studies conducted in the Tlemcen and Mascara regions, which reported similar methods of plant use (Benarba 2015; Tachema & Bendimerad 2018). Similarly, studies conducted in Palestine, Burkina Faso, and Uganda also showed concordance with our findings (Helyer *et al.* 2006; Jaradat *et al.* 2016; Lutoti *et al.* 2023).

It is worth mentioning that in the Algerian context, earlier research in the Mascara region specifically highlighted the prevalence of raw application and decoction (65.8% and 17.0%, respectively) (Benarba 2015). The most frequently cited method in a study conducted in Canada was the consumption of herbs alongside vitamins (Helyer *et al.* 2006). The preference for decoction in the present study can be attributed to its ability to extract a maximum amount of active constituents. However, boiling the constituents could be harmful, especially when the active ingredients are heat-labile substances (Jaradat *et al.* 2016).

Our study revealed that leaves were the most commonly used plant part for BC treatment, accounting for 30.2% of the total. This finding is consistent with previous studies in which leaves were also reported as the most frequently used part, with usage percentages ranging from 33% to 46% (Jaradat *et al.* 2016; Tachema & Bendimerad 2018; Thiombiano *et al.* 2022; Lutoti *et al.* 2023). In contrast, Benarba (2015) reported that roots (61.6%) and seeds (27.6%) were the most commonly used plant parts. The high percentage of leaf use in many reports can be attributed to the easy accessibility and role of leaves as important storage organs for secondary metabolites (Bitsindou 1986; Bigendako-Polygenis & Lejoly 1990; Thiombiano *et al.* 2022).

The results of our study highlight the various sources of information about the plants used to treat BC. Among the respondents, 37.1% reported gaining their knowledge from personal accounts and experiences shared by others. In addition, 26.7% relied on herbalists as a source of information, while 21.6% referred to herbal books. These findings differ from those of a study conducted in Palestine, where the information about herbal remedies for BC was obtained from family friends (26%), patients (6.8%) or doctors (1.4%) (Jaradat *et al.* 2016). Another survey in Tlemcen revealed that the main sources of information were the social environment (57%), herbalists (14%), and other unspecified sources (18%) (Tachema & Bendimerad 2018). Furthermore, a study in Canada revealed that conventional doctors (40%) were the main source of information, followed by pharmacists and friends (20% each) (Helyer *et al.* 2006). These variations

in information sources highlight the different cultural and geographical contexts in which individuals seek knowledge about herbal remedies for BC. This study showed that most of the medicinal plants are cultivated (67.3%) or can be easily found in the wild (22.9%). This observation suggests that the Algerian climate is conducive to the successful cultivation of a wide range of herbal species. On the other hand, in Palestine and Uganda, the plants are mostly found in the wild, indicating their local origin (Jaradat *et al.* 2016; Lutoti *et al.* 2023).

The survey enabled the identification of 18 plant species (belonging to 15 botanical families) with substantial use values. Among them, the most represented families were the Zingiberaceae, Lamiaceae, Amaryllidaceae, and Asteraceae, whereas the most cited species were *Curcuma domestica*, *Ephedra alata*, *Panax ginseng*, *Allium sativum*, *Linum usitatissimum*, *Zingiber officinale*, *Annona muricata*, and *Atriplex halimus*. Compared with other Algerian studies, in Mascara, *Aristolochia longa* L. was the most commonly used by BC patients (31.9%), followed by *Berberis vulgaris* L. (27.6%) and *Atriplex halimus* (14.9%) (Benarba 2015). In Tlemcen, interviewed people preferred *Berberis vulgaris* (64.1%), *Prunus persica* (62%), *Nigella sativa*/*N. damascena* (54.3%), *Atriplex halimus* (34.8%), *Retama raetam* (34.8%), *Annona muricata* (12%), *Aristolochia longa* (10.9%), *Allium sativum* (10.9%), and *Curcuma longa* (8.7%) (Tachema & Bendimerad 2018).

In the Palestinian study, the most commonly used plants were *Ephedra alata*, *Arum palaestinum*, *Nigella arvensis*, *Phoenix dactylifera*, *Olea europaea*, *Annona muricata*, *Linum bienne*, and *Trigonella arabica* (Jaradat *et al.* 2016). In the Ugandan study, the most cited plants were *Annona muricata* L., *Steganotaenia araliacea*, *Mondia whitei*, *Catharanthus roseus*, and *Vernonia amygdalina* (Lutoti *et al.* 2023). In Burkina Faso, the most frequently listed plants were *Flueggea virosa*, *Khaya senegalensis* and *Ximenia americana* (Thiombiano *et al.* 2022). Despite the differences in the percentages of use, the consistency of findings between our study and previous research conducted in Mascara, Tlemcen, and Palestine highlight the important reputation and widespread use of these plant species for their renowned anti-BC properties.

5. Conclusions

The ethnobotanical survey involved 71 people and identified 68 species used for BC treatment. Among them, 18 species of 15 families had substantial use values ($UV > 0.1$), on top of them *Curcuma domestica* and *Ephedra alata*. Most commonly, leaves or whole plants were used. Decoction, powder, and infusion were the most frequent forms of administration. The baseline

data provided by this study may serve as models or leads for the discovery and development of BC drugs, so future researchers should work to verify the usefulness of the recorded plants through chemical evaluation, pharmacological testing against BC cells, and clinical evaluation.

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Critical revision of the article: S. Djamel, A. Dehimat

Final approval of article: A. Dehimat

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