Ethnomedical inventory of the leaves of *Brassica Rapa var rapa* in a northwestern Algeria: qualitative and quantitative approaches

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ABSTRACT

This research aims to conduct an ethnobotanical inventory of the therapeutic use of Brassica rapa var rapa (Brr) leaves in the Tlemcen region, covering three distinct localities: Ghazaouet, Nedroma and Maghnia. To this end, a group of 419 participants was surveyed using an organised questionnaire, of whom 191 reported using the plant. There was a predominance of women (64.39%) in the 60-70 age group (29.84%). The majority of users had varying levels of education, ranging from illiteracy to university level. Although most of them belonged to disadvantaged socio-economic categories, their knowledge of the plant's use was mainly derived from family traditions. The methods of preparation included infusing the leaves in herbal tea and steaming them, with internal use being the most common. Most participants have incorporated the leaves into their daily diet, generally favouring oral consumption. Observations have shown significant consumption of Brr leaves, particularly for treating hypercholesterolemia (17.5%), digestive problems (14.8%) and fever (10.5%). Although the benefits are noticeable but several participants reported adverse effects, including gastrointestinal problems such as vomiting, nausea and diarrhoea, especially associated with long-term use. This research suggests that Brr leaves are a major source of phytoparticles, which makes them a promising natural alternative for use in the pharmaceutical and cosmetics industries.

Keywords: *Brassica rapa. L, Ethnobotany index, Ethnobotany, leaves,*

INTRODUCTION

According to the WHO, 80% of developing countries continue to use traditional medicines derived from medicinal plants (Vaou *et al*., 2021). Ethnobotanical knowledge, transmitted orally from generation to generation, represents a treasure trove of knowledge about medicinal plants and their therapeutic properties.

The Cruciferae family (also known as Brassicaceae) is a group of plants that includes approximately 338 genera and more than 3,700 species. Among these species, *Brassica rapa (B. rapa)* includes several subspecies cultivated as vegetables or oilseeds (*B. rapa ssp. Pekinensis; B. rapa ssp. chinensis; B. rapa ssp. chinensis var. narinosa; B. rapa ssp. chinensis var. nipposinica; B. rapa ssp. rapa)* (Li *et al*., 2024). Similarly, turnips (*Brassica rapa var. rapa L.*) are an excellent source of nutrients, bioactive compounds, minerals, vitamins, fiber, and glucosinolates (glucoraphanin, glucobrassicin, and gluconasturtiin) (Yang *et al*., 2023)**.** These phytochemicals possess the ability to produce biological activities beneficial for therapeutic applications (Mirihagalla and Fernando, 2021).

Several researchers have highlighted the anticancer, antioxidant, antibacterial, anti-inflammatory, and antihypertensive

properties of *Brassica rapa (B. rapa)* (Elhouda-Mekhadmi *et al*., 2024). Because of its high content of bioactive compounds, it is widely used to treat diabetes, hypercholesterolemia, heart disease, and photosensitivity disorders (El kadi *et al*., 2024). However, the aerial parts of *Brassica rapa* remain unexploited despite their biological properties. In this context, the aim was to document local knowledge and practices concerning the therapeutic use of *Brassica rapa* leaves in the Tlemcen region.

MATERIALS AND METHODS

The study was conducted in the Tlemcen region in the communes of Ghazeouette, Nedroma, and Maghnia (Table 1). The information was collected in accordance with ethnobotanical research guidelines (N'Do *et al*., 2024). The study was conducted in three areas of the Tlemcen region and involved a total of 419 participants. The questionnaire included socio-demographic data on the surveyed population and ethnopharmacological data on the plant. Before the interview, informants were given comprehensive information about the questionnaire and its objectives. They were given formal assurances regarding the confidentiality and purely educational use of their data. The questionnaire was designed to be anonymous, optional, and respectful of participants' confidentiality. Furthermore, to facilitate communication with local populations who have low literacy levels, the interview was conducted in Algerian dialect. It is important to note that participants were free to end the interview at any time.

Relative frequency of citation, RFC: This index was calculated by dividing the number of informants citing a plant species as useful (frequency of citation, FC) by the total number of informants participating in the study (N). It was evaluated on a scale of [0-1], with a value close to 0 indicating a lower frequency of citation and, consequently, less cultural importance. Conversely, values close to 1 indicate a higher frequency of citation and, consequently, greater cultural importance among the population. The following formula was used to determine the RFC index: FC/N = RFC (Balafraj *et al*., 2024).

Fidelity level, FL (%): Measures the reliability of the main therapeutic uses of plants for a specific condition by healers in the region studied. It is calculated using the following formula: FL (%) = Np /N×100. The NP index corresponds to the number of informants who report using a specific plant species to treat a specific disease, while the N index corresponds to the total number of informants who use plants as medicine to treat a specific disease. The highest level of fidelity corresponds to maximum agreement on the use of a species.

Cultural Importance Index, CI: This is used to assess the importance of a plant in a specific category of use and can be expressed using the following formula: UC: UR/N. Where N is the total number of informants and UR is the number of informants citing a species for a specific use.

RESULTS AND DISCUSSION

Demographic characteristics of informants

The study was conducted among 419 people. Among those surveyed, 191 individuals reported that they were familiar with the plant and its therapeutic uses, with a predominance of women (64.39%) and an age group of 61-70 years with a threshold of (29.84%) (Table 2). Similarly, illiterate individuals had the highest level of knowledge, with a percentage of 30.89%. In addition, individuals with a university education had a similar level of knowledge to illiterate individuals (28.27%).

According to the results, individuals with a low socioeconomic status are the most frequently exposed to herbal medicine, with a percentage of 54.97%. On the other hand, married people represent the highest percentage of knowledge**,** (85.34%) (Table 2).

Our survey confirmed that people over the age of 41 have the highest level of knowledge about the plant studied, compared to other age groups. This is consistent with their experience with modern therapy, which causes side effects and is ineffective, prompting them to search for safer and more natural alternatives. This trend has been demonstrated in other studies (Li *et al*., 2024). In addition, women show a dominance (64.39%) compared to men, which is in agreement with the findings of (Lazli *et al*., 2019), who reported a higher proportion of women (71.8%). It is known that women in North Africa are involved in ethnobotanical practices and have some experience with traditional alternative medicine, which is passed down from generation to generation. Statistical analysis showed that the level of education had no influence on participants' responses regarding knowledge of the target plant, which is similar to some previous studies (Hedidi *et al*., 2024).

The population with low socioeconomic status has a good knowledge of plants (54.97%). Due to their limited income, many people turn to herbal medicine, which remains less expensive than modern medicine. Several previous studies have confirmed this result (James *et al*., 2018). Similarly, 85.34% of the population report being married, it is possible that this is due to the fact that married people can avoid or reduce the material expenses necessary to pay doctors and pharmacists by turning to herbal medicine (Benlarbi *et al*., 2023). Several studies confirm our results (Yabrir *et al*., 2019).

Characteristics related to the use of the plant

According to Table 3, 45,9% of the population interviewed indicated that they had learned about the plant through a family source. Similarly, more than half of the population uses the leaves of the plant in fresh form (51.4%) with internal application (52%). On the other hand, the population under study uses eight methods for preparing the leaves of the plant, the most common of which is in the form of herbal tea (22.8%). A large percentage of our population (68%) consumes the aerial parts of *Brassica rapa var rapa* as food. Users confirmed their use of the plant with other liquid additives. It was noted that *Brassica rapa var rapa* leaves were used with water by 49,8% of respondents, followed by olive oil at a usage rate of 17%, honey 31% and eggshell 0.3%.

According to our survey, we found that the aerial parts of *Brassica rapa* var rapa are commonly used to treat several conditions, the most common of which are hypercholesterolemia (17.5%), digestive disorders (14.8%), and fever (10.5%). Furthermore, the majority of the population that uses Br leaves as a treatment are adults (42.6%), followed by the elderly (38.8%) (Table 3).

It appears that the majority of our informants (45.9%) acquired their knowledge of the uses of this plant as an alternative medicine from their families and family traditions. The trust we place in our ancestors about this subject illustrates why this plant has been valued for many generations and continues to hold significance over time (Jadid *et al*., 2020). A significant proportion of our population (17.5%) confirmed the use of Br leaves mainly to treat cholesterol. This therapeutic property may be explained by its high flavonoid and polyphenolic compound content, which regulate and control the biosynthesis of 3-hydroxy-3-methylglutaryl coenzyme A reductase (HMG CoA reductase), leading to a decrease in cholesterol levels (Fard *et al*., 2015). Our informants (14.8%) use the leaves to treat digestive disorders. It is known that Brassica rapa L leaves contain high levels of carbohydrates, mainly in the form of polysaccharides, which protect the gastrointestinal mucosa and facilitate intestinal transit (Abid *et al*., 2022). They are also rich in glucosinolates, which are biologically inactive compounds that are converted into active isothiocyanates by myrosinase, known for their anti-

inflammatory, antioxidant, chemopreventive, cytotoxic and anticancer properties (Dejanović *et al*., 2021). The analgesic effect (against migraines and rheumatic pain) reported by our population is attributed to the abundance of secondary metabolites (Nazar *et al*., 2023).

According to our study, researchers have confirmed the use of leaves to treat obesity, which may be explained by improvements in blood lipid profiles and a reduction in body fat accumulation. Similarly, *Brassica rapa* leaves have hypoglycemic activity by promoting peripheral glucose absorption in tissues, reducing hepatic gluconeogenesis, regulating carbohydrate metabolism and decreasing intestinal absorption of dietary carbohydrates by promoting the production of insulin or other insulin-like substances (Fard *et al*., 2015).

The population surveyed consumed *Brassica rapa* leaves for their anti-flu properties. This therapeutic benefit is due to their high vitamin C content, which can promote iron absorption (Dejanović *et al*., 2021). According to (Swastika *et al.* 2019), boiled Br leaves are an excellent source of vitamins K, A, and C, as well as folate and lutein. They also contain dietary nitrates, which are beneficial for cardiovascular health. These nitrates help lower blood pressure and improve blood vessel health. The vitamins and antioxidants present play an essential role in immune, ocular, and osseous health. Another study showed that extracts from *Brassica rapa* leaves have angiotensin-converting enzyme (ACE) inhibitory activity, which helps lowering blood pressure (Abid *et al*., 2022).

On the other hand, the aerial part of Br is osteoprotective due to its high vitamin C content, which contributes to the creation of collagen, an essential element for bone health. In addition, the administration of vitamin C with calcium in postmenopausal women has shown an increase in bone mineral density (BMD) in the femur. Vitamin K is also responsible for the production of osteocalcin, a protein essential for the regulation of bone muscles.

Our survey found that studied population uses *Brassica rapa* leaves as a natural therapy for nephrolithiasis. *In vivo* studies have shown that *Brassica rapa* leaf extract protects the kidneys in rats with nephrolithiasis induced by a calcium-rich diet, and on diabetic nephropathy (Salem *et al*., 2018). These therapeutic effects are mainly due to the bioactive compounds present in the leaves (Meliani *et al.,* 2023), such as polyphenols, flavonoids, tannins and dietary fiber, which help to reduce oxidative stress and tissue inflammation in general

Duration of treatment

The data presented in Figure 1, indicated that the majority of participants use Brassica rapa leaves for a period of 1 to 7 days using four methods: orally (70.3%), topically (22.3%), through massage (2.1%), and by mastication (13.0%).

Risks and secondary effects

During our survey, most participants confirmed that use of the plant is asymptomatic: no vomiting (74.4%), no nausea (76.4%), no diarrhea (72.3%), no intoxication (63.1%). (Figure 2) However, like any medicinal plant, its many benefits do not prevent it from being harmful if misused. Indeed, participants reported that the plant could cause adverse effects, and these side effects can occur at varying frequencies depending on the duration and frequency of use of the plant, but this situation remains limited.

Influence of demographic factors on knowledge of *Brassica rapa* var rapa

The results of the chi-square test analysis showed that age, level of education, socio-economic status and family situation had a significant association with knowledge and the use of *Brassica rapa* L leaves, as can be

seen in the P values in Table 4 ($P < 0.001$). Cramer's V method allows for a comparison of the strength of the link between two analysed variables. The variables studied are more dependent when V is close to zero. Conversely, it will be 1 when the two variables are completely linked. The standard interpretation rules are as follows: (Amrouche *et al*., 2019).

$0 \leq V < 0.1$: very weak or no dependence; $0.1 \leq V \leq 0.3$: weak dependence; $0.3 \leq V < 0.5$: moderate dependence; $0.5 \leq V$: strong dependence.

As can be seen in Table 4, the results of our study reveal that the link between (age, level of education, socio-economic status and family situation) and knowledge of the plant is respectively (weak: 0.3, 0.3), (moderate: 0.4) and (very weak: 0.2).

The Relative frequency of citation (RFC) of this study is 0.45, showing that less than 50% of the population uses the plant, Although the proportion obtained may seem relatively low, a result probably influenced by the small sample size and which could change as the study area expands, this result can also be explained by the popular perception that traditionally favors the root, considered the most useful and valuable part of the plant, to the detriment of the leaves, which have fewer uses. However, the data collected clearly show that this often-neglected part of Br is not limited to traditional therapeutic uses. But also, it plays a significant role in other fields, as illustrated by the Cultural Importance Index (CI). The leaves are mainly consumed as food (70%), used for Cosmetics (18%), for animal feed (11%). for their aromatic qualities (3%) and as a condiment (1%). (Table 5).

As part of our research, we identified that the aerial parts of *Brassica rapa* var rapa are used to treat 15 categories of diseases and symptoms as detailed in (Table 6). Cholesterol treatment is particularly notable, with a fidelity rate of 20.94%, indicating its frequent use. Digestive disorders follow with a rate of 17.80%, while fever ranks third with a rate of 12.52%, The other ratios were arranged as follows: Rheumatism 9,42%, Obesity 8,37% Rheum 7,85, Osteoporosis 7,85, Migraine 7,32, Immune system booster 5,75, Diabetes 4,71, Skin disease 4,71, Anemia 4,18, Cancer 2,61, kidney disease 2,61%, cardiovascular disease 2,61%, Injurie and fracture 0,52%. (Table 6). In terms of fidelity, our community is interested in this plant and is loyal to its use in treating various diseases. studies such as (Rehman *et al*., 2017) the one conducted in Punjab, Pakistan, have shown that respondents reported using *Brassica rapa* L leaves and roots to treat stomach problems and ulcers with a Fidelity rate of 97.22%.another study (Rao *et al.*, 2015) conducted in India mention that the whole plant of *Brassica rapa* L (root and leaves and seed) used to treat andrological problems, gynecological and birth problems with a fidelity rate of 100%. These benefits were not shown in our study, A study also (Nazli *et al.*, 2022) showed the use of *Brassica rapa L* to treat skin diseases and drug poisoning, but it did not mention the level of fidelity. Nazar *et al*. (2023) showed that *Brassica rapa* L used to treat diabetes with an FL % of 12,5%, For other results, the study by (Swastika *et al.,* 2019) highlighted that *Brassica rapa L.* exhibits cardiovascular and lipid-lowering effects, antioxidant, anti-diabetic, anti-inflammatory, hepatoprotective, nephroprotective, anticancer, anti-obesity, and analgesic properties, confirming its strong therapeutic potential against various metabolic and inflammatory disorders. These findings therefore support the relevance of the traditional uses reported by local populations, particularly for managing cholesterol levels, digestive problems, and fever-related conditions.

CONCLUSION

Our study revealed the notable therapeutic potential of *Brassica rapa* var. rapa leaves in the Tlemcen region, where they are traditionally used to treat various diseases. This local knowledge provides a valuable basis for future research in phytochemistry and pharmacology, highlighting the

importance of traditional knowledge in the development of new therapeutic solutions.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Table 1: Climatic parameters of study areas

Parameters	Regions		
	Ghazaouet	**Maghnia**	**Nedroma**
Latitude (UTM)	35° 05′ 38″	34° 49' 59.99"	35°00′48″
Longitude (UTM)	1° 51′ 37″	-1° 42' 59.99"	1°44′52″
Altitude (m)	20	487	355
Temperature (C°)	17.0	17.1	16.9
Precipitation (mm)	374	365	400
Climate	Mediterranean	arid	Mediterranean

Table 2: Demographic characteristics of informants

Parameters		**Frequency**	**Percentage (%)**
Age	[20-30]	03	1.57
	[31-40]	12	6.28
	[41-50]	29	18.18
	[51-60]	38	19.89
	[61-70]	57	29.84
	[71-80]	52	27.22
Gender	Female	123	64.39
	Male	68	35.26
Level of education	Illiterate	59	30.89
	Primary	36	18.84
	Average	14	7.32
	Secondary	28	14.65
	University	54	28.27
Socio-economic status	Low	105	54.97
	Average	65	34.03
	High	21	10.99
Family situation	Married	163	85.34
	Single	16	8.37
	Divorced	1	0.52
	Widowed	111	5.75

Table 3: Characteristics related to the use of the plant

Characteristics	Frequency	**Percentage (%)**
Source of knowledge about the plant		
Through family	135	45.9
Through studies	14	4.8
Through social environment	90	30.6
Through scientific documentation	55	18.7
Technique for using the plant		
Fresh	145	51.4
Dried	30	10.6
After heat treatment	107	37.9
Mode of utilization		
Internal	158	52.0
External	92	30.3
Both	54	17.8
Preparation technique		
Cataplasm	41	10.7
Infusion	87	22.8
Fumigation	13	3.4
Decoction	56	14.7
Steam	80	20.9
Salad	32	8.4
Raw	52	13.6
Powder	10	2.6
Aqueous extract	11	2.9
Other Uses		
Cosmetics	34	17.3
Animal feed	21	10.7
Food	134	68.0
Condiments	3	1.5
Aromatic properties	5	2.5
Additives associated with the plant		
Other medicinal plants	4	1
Water	191	49,8
Olive oil	65	17
Honey	122	31
Eggshell	1	0.3
Medicinal properties		
Kidney disease	5	2.2
Skin disease	9	3.9
Digestive disorder	34	14.8
Hypercholesterolemia	40	17.5
Immune system booster	11	4.8
Anemia	8	3.5
Cancer	5	2.2
Cardiovascular disease	5	2.2
Osteoporosis	15	6.6
Diabetes	9	3.9
Rheumatism	18	7.9

Obesity	16	7.0
Migraine	14	6.1
Fever	24	10.5
Injurie and fractures	1	0.4
Rheum	15	6.6
Target population for treatment		
Babies	26	5.8
Children	26	5.8
Adults	191	42.6
Pregnant women	31	6.9
Seniors	174	38.8

Table 4: Influence of demographic factors on knowledge of *Brassica rapa* var rapa

	Distribution	Informants – Experts	Informants Non-experts	Chi - squared X^2	P value	Cramer's V
Age	[20-30]	03	27			
	[31-40]	12	32			
	[41-50]	29	46	38.781	0.000	0.304
	[51-60]	38	50			
	[61-70]	57	33			
	[71-80]	52	40			
Gender	Female	123	144	0.69	0.436	0.013
	Male	68	84			
Level of education	Illiterate	59	16			
	Primary	36	49			
	Medium	14	45	47.355	0.000	0.336
	Secondary	28	33			
	University	54	85			
Socio-economic level	Low	105	37			
	Medium	65	173	79.152	0.000	0.435
	High	21	18			
Family situation	Married	163	151			
	Single	16	40	23.578	0.000	0.237
	Divorced	01	15			
	Windowed	11	22			

Table 5: Index of cultural importance of *Brassica rapa var rapa* leaves in the different localities visited.

Parameters	Use Reports (UR)	Cultural Importance Index (CI)
Cosmetics	34	0.18
Animal feed	21	0.11
Food	134	0.70
Condiment	3	0.01
Aromatic properties	5	0.03

Table 6: Percentage of fidelity level of diseases treated by *Brassica rapa L* leaves

Diseases	Citation number	Fidelity Level FL (%)
Kidney disease	5	2.61
Skin disease	9	4.71
Digestive disorder	34	17.80
Hypercholesterolemia	40	20.94
Immune system booster	11	5.75
Anemia	8	4.18
Cancer	5	2.61
Cardiovascular disease	5	2.61
Osteoporosis	15	7.85
Diabetes	9	4..71
Rheumatism	18	9.42
Obesity	16	8.37
Migraine	14	7.32
Fever	24	12.52
Injurie and fractures	1	0.52
Rheum	15	7.85

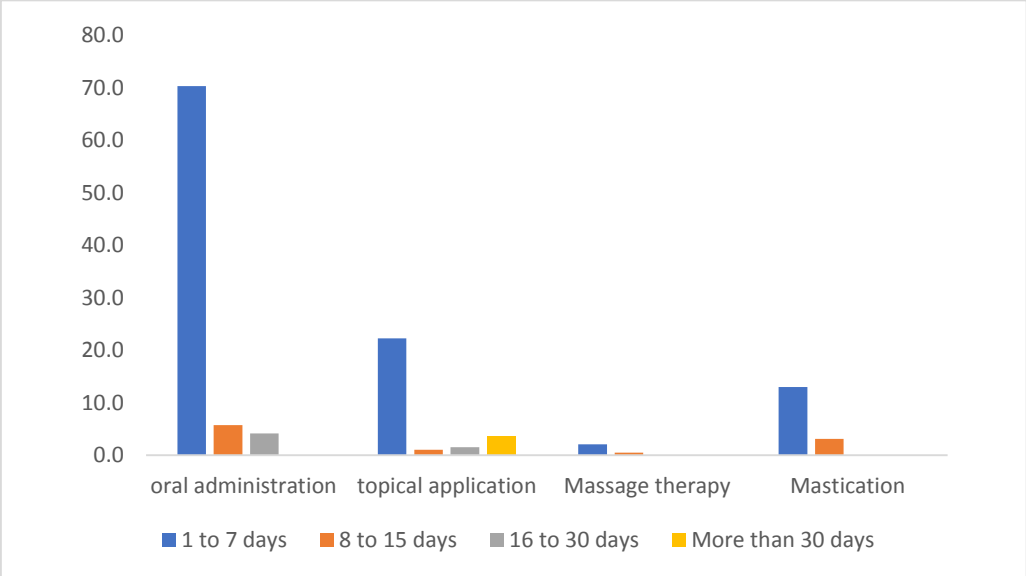

Figure 1: Treatment duration

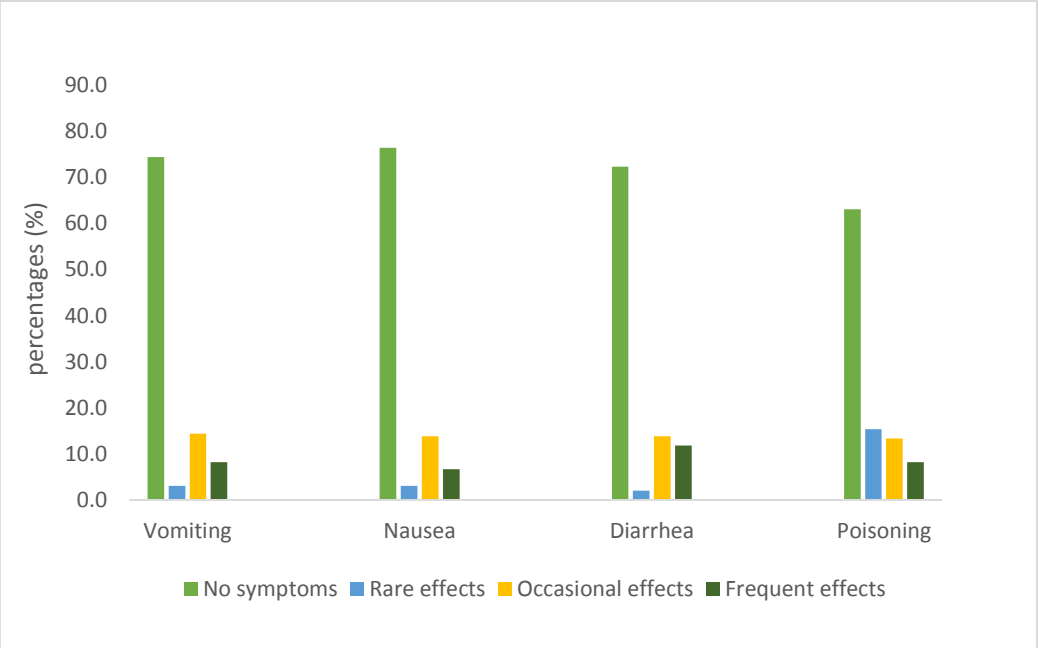

Figure 2: **Risks and secondary effects**