Research Article

An Ethnopharmacological Study on the Traditional Medicine of Red Beetroot (*Beta vulgaris* var. rubra L.) in the Region of Beja (Northwestern of Tunisia)

Ala Ayari[1]*, Saber Jedidi[1,2], Houcem Sammari[1] and Hichem Sebai[1]

[1]University of Jendouba, Higher Institute of Biotechnology of Béja, Laboratory of Functional Physiology and Valorization of Bio-resources, Beja, Tunisia

[2]University of Jendouba, Sylvopastoral Institute of Tabarka, Laboratory of Sylvo-Pastoral Resources, Tabarka, Tunisia

*Corresponding Author: Ala Ayari, University of Jendouba, Higher Institute of Biotechnology of Béja, Laboratory of Functional Physiology and Valorization of Bio-resources, Beja, Tunisia.

Abstract

Ethnopharmacology is a field of scientific inquiry dedicated to exploring the traditional utilization of medicinal plants and natural treatments, intending to uncover novel pharmaceuticals and gain deeper insights into the therapeutic properties of plants. Our focus was on conducting an ethnopharmacological investigation into the traditional medicinal uses of red beetroot in the Northwestern region of Tunisia. We chose these specific areas due to their abundance of the plants under study. The findings of our study demonstrated the utilization of Beta vulgaris L. in traditional medicine for treating various ailments, particularly those affecting the digestive system, such as constipation and inflammation. Additionally, our research uncovered the diverse applications of different parts of the red beetroot in its mature state, employing various primary preparation methods: decoction, infusion, and use in Human diets (juices and salads) using primarily the roots. The choice of preparation and administration methods showed a strong correlation with the targeted pathologies. Hence, ethnopharmacological investigations are crucial for guiding us towards identifying specific biological activities and potentially innovating new therapeutic approaches.

Keywords: *Beta vulgaris* L; Ethnopharmacology; Survey; Northwestern Tunisia

Introduction

The word phytotherapy is etymologically constituted of two Greek roots; "phyton" and "therapy," which respectively mean "plant" and "treatment," that is to say, "therapy by plants".

Phytotherapy is a medical practice based on scientific foundations, relying on the experimental evaluation of medicinal herbs [1]. Its origin dates back to traditional knowledge and the popular use of plants. Thus, it aims to treat various functional disorders and pathological conditions using plants or their parts [2]. This approach remains widely practiced in countries preserving ancestral traditions. Consequently, many phytotherapeutic preparations undergo specific pharmacological trials and studies. Some countries have authorized the use of these products as medicines, considering them a form of synergistic and complementary medicine [3].

Medicinal plants, as plants containing chemical substances with biological functions, are an integral part of natural therapies [4]. Their components, also known as active principles, fulfil a role similar to that of drugs and are used in various sectors, such as pharmaceutical production, creams, and other cosmetic products.

This use emphasizes the importance of natural and renewable resources on a global scale. In summary, despite the progress of modern medicine, herbal medicine remains a preferred therapeutic means of cure and prevention for humanity [5].

Beta *vulgaris var. rubra L.*, commonly known as red beetroot, is a vegetable belonging to the Chenopodiaceae family. It is a traditional vegetable utilized for the commercial production of red juice and natural pigments [6]. Cultivated primarily for its roots, which serve both as a food source and as a natural dye, beetroot has evolved into a functional food [7]. Recognized for its nutritional richness, it is a good source of dietary fiber, nitrates, minerals (potassium, sodium, iron, copper, magnesium, calcium, phosphorus, and zinc), vitamins (retinol and B-complex), antioxidants, and betalain pigments [8]. The botanist N.I. Vavilov declared the eastern Mediterranean or Middle East as their origin and Asia Minor as the second source [9]. This species belonging to the Beta vulgaris family is widely distributed in environments characterized by mild to cold temperatures (10-20 °C), particularly around the Mediterranean and Europe (wild species). However, the distribution extends eastward to India, southwestward along the Atlantic coasts to the

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Canary Islands, and northward along the British Isles, Denmark, and Sweden [10]. However, in the present study, we focused on conducting an ethnobotanical survey on the traditional use of red beetroot (*Beta vulgaris* var. rubra L.) in the Beja region (Northwest Tunisia).

Materials and Methods
Choice of the region
The study took place in the Béja region, located in Northwest Tunisia. The choice of this region was made due to its abundance of red beetroot.

Formulation of the questionnaire
A survey form was created with two types of questions posed to volunteers: the first type focuses on the identification and personal information of the interviewee (name, surname, age, profession, etc.), and the second type concerns the identification and use of the plant (ailments treated, harvesting stage, preparation, mode of administration, etc.). An observation column was added at the end of the questionnaire where the interviewee could provide additional information about the use of the plant.

Target population
It is a descriptive cross-sectional study that aims to assess the knowledge of a specific target population. We opted for a comprehensive sampling approach. In total, we collected 100 questionnaires, where the inclusion criteria were mothers, farmers, elderly individuals, and students to ensure a certain reliability of the survey.

Methodology
For the implementation of this questionnaire, we prepared 100 forms. We began by introducing ourselves using a badge containing the necessary identification information for the interviewer. Then, we presented the objectives of our work to establish trust with the interviewees. To ensure the reliability of the survey, we conducted a sort of selection of the people to be interviewed. Elderly individuals were given priority, as well as mothers, farmers, and a few recommended healers. Contact with people occurred at their homes, in markets, with workers in nurseries, and at weekly markets. The individuals were primarily questioned about the use of red beetroot for various treatments. We spent time with each person, especially if they demonstrated good knowledge. Even if the interviewee provided us with information we didn't need, we listened to them to maintain their willingness to continue participating. We only began filling out the form after starting the conversation.

Data Analysis
The data recorded on the survey forms was subsequently processed and entered into Excel. Data analysis utilized simple methods of descriptive statistics. Thus, quantitative variables are described using frequencies. Qualitative variables are described using response frequencies.

Figure 1: *Beta vulgaris* L. (25/02/2023, GPS: 36° 43' 32.3" North, 9° 10' 54.1" Est).

Results
Sociodemographic data of the respondents
Distribution of respondents by gender
A male predominance was observed among the surveyed population. The sex ratio (M/F) was approximately 1.13. (Figure 2).
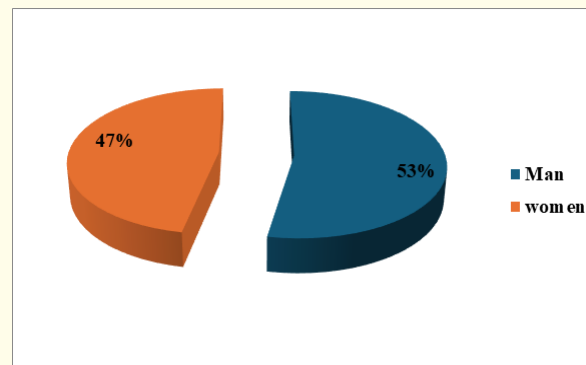

Figure 2: Distribution of participants by sex.

Distribution of respondents by age group
Our population is relatively adult, with ages ranging from 16 to 87 years old. The age group between 30 and 50 years old was predominant (34%). (Figure 3).

Level of education
Regarding the level of education, 45% of the population were university graduates, while the rest of the respondents were distributed among primary education (18%) and secondary education (19%), with 18% of them being illiterate (Figure 4).
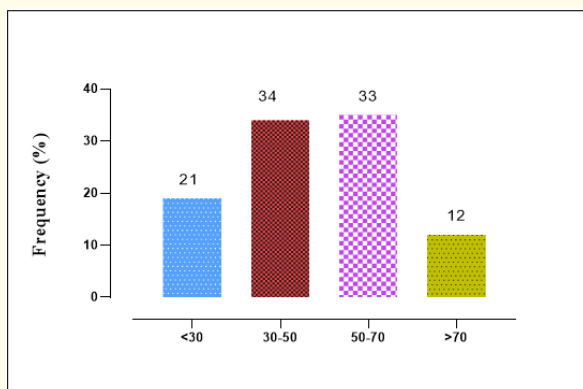
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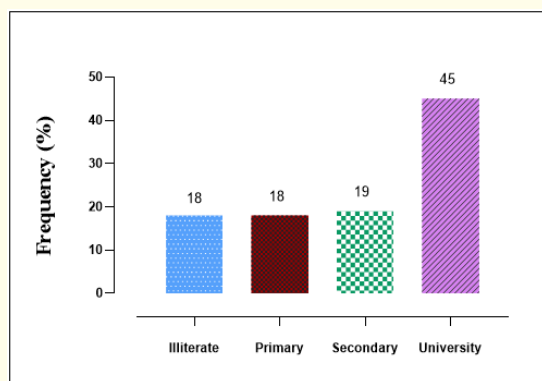**Figure 3:** Distribution of respondents by age group.

Figure 4: Distribution of respondents by educational level.

Data related to red beetroot

Harvesting stage

According to the survey, 88% of the respondents stated that the *Beta vulgaris* L. plant is more effective when it is mature (Figure 5A).

Plant parts used

Roots were the most commonly used component at 73%, followed by leaves at 24%, and rarely the whole plant (3%) (Figure 5B).

Utilization state

Figure 5C shows that respondents used red beetroot in a fresh or dried state (90% and 9%, respectively).

Preparation method

The survey reveals four preparation methods (Figure 5D)

- A decoction made from dried leaves, flowers, and powders.
- An infusion made from a dry powder of the entire plant parts.
- Beetroot juice is the most commonly used, made from the roots.
- Use in human food, such as salads

Mode of administration

Generally, the preparation is taken orally at a rate of approximately 97%, followed by local application (2%) (Figure 5E).

Traditional and medicinal use

Red beetroot was employed by the participants as a remedy for addressing various health conditions (Figure 5F):

- Renal failure (4%)
- Hypertension (7%)
- Digestive Tract Diseases (37 %)
- Cancer treatment (28%)
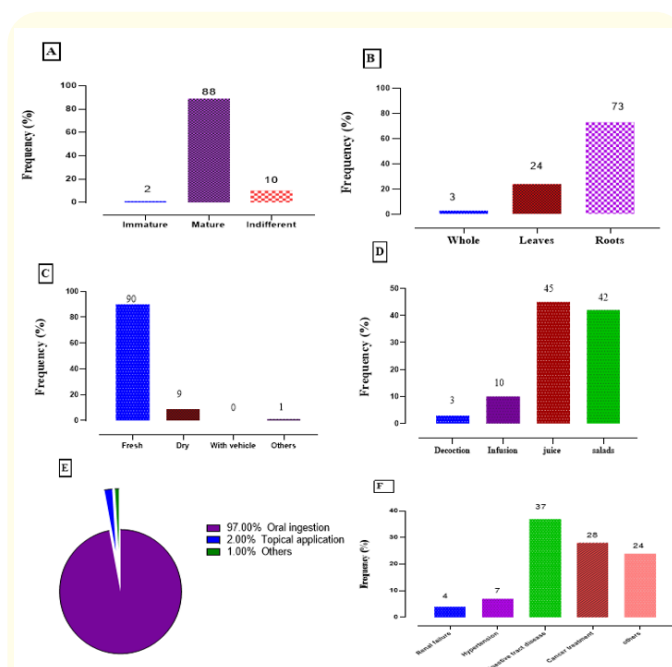- Other pathologies (24%): liver diseases, anemia, diabetes, energy for athletes.

Figure 5: Ethnopharmacological survey on harvesting stage (A), part used (B), utilization state (C), preparation method (D), mode of administration (E) and traditional and medicinal use (F) of red Beetroot.
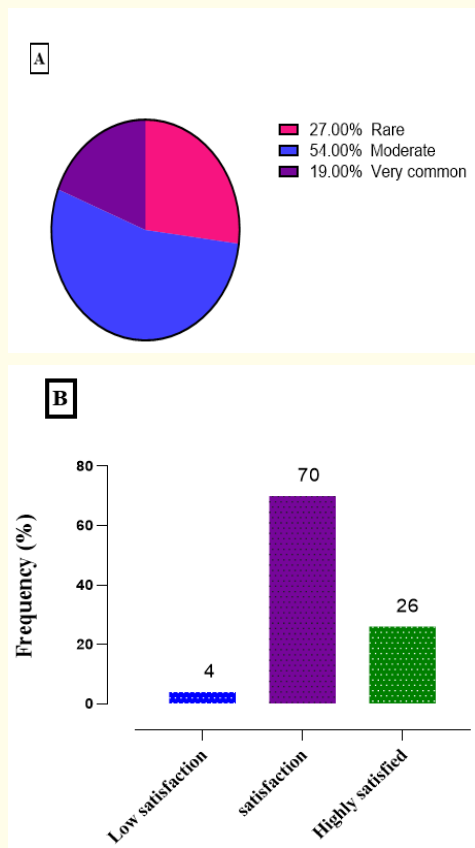
Frequency of intake and satisfaction rate

The survey revealed that the majority of respondents moderately used red beetroot, approximately 54% (Figure 6A).

The majority of participants were satisfied after using our plant (70%), while 26% were very satisfied (Figure 6B).

Reasons for phytotherapy with red beetroot

Most of the respondents (45%) preferred phytotherapy with *Beta vulgaris* L. over modern medicine to avoid the side effects of synthetic drugs; 44% cited its effectiveness; and 10% used this plant because of its low cost (Figure 7A).

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Figure 6: Ethnopharmacological survey on frequency of intake (A) and satisfaction rate (B) of red Beetroot
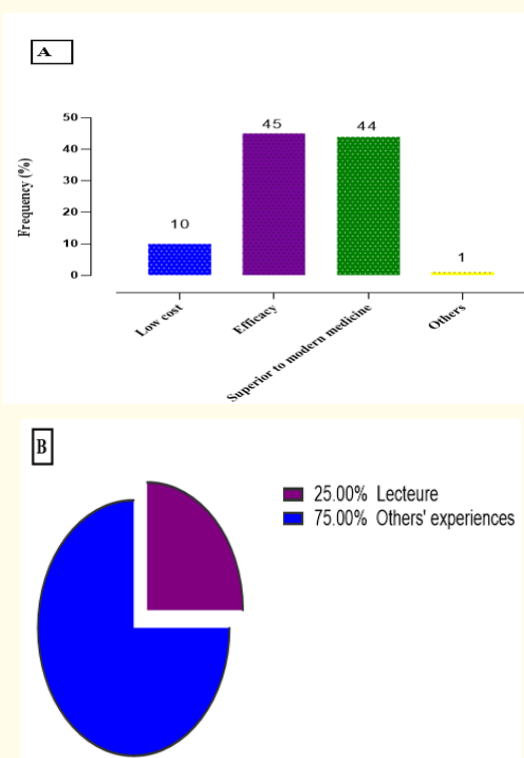
Figure 7: Ethnopharmacological survey on reasons for phytotherapy (A) and acquired information (B) of red Beetroot.

Only 25% of the participants acquired information by reading scientific references, while 75% used red beetroot based on the experiences of others (Figure 7B).

Discussion

Over the past few years, numerous research efforts have aimed at discovering new natural bioactive compounds with biological activities. Ethnopharmacological investigation plays a bridging role between two medicines, both traditional and conventional [11]. In the same vein, previous studies have explored the benefits and traditional medicinal use of several plants in Tunisia, such as carob, chamomile [12], lemon balm [13], and dill [14].

The field investigation has shown us that the knowledge of the plant in question, their modes of use and their properties are the result of experiences passed down through generations. The ethnobotanical surveys conducted in the field allowed us to interview 100 individuals, among whom 53% were men. The median age ranged between 30 and 50 years. The survey revealed that this plant is well-known but moderately utilized. The roots are the most utilized (73%) compared to other parts.

The great beet has been used by the respondents as a remedy for the treatment of various pathologies. Digestive tract diseases ranked first with a rate of around 37%, followed by cancer treatment (28%). The use of this plant for kidney diseases and hypertension is less frequent (renal failure (4%), hypertension (7%)). Interventional studies have explored beetroot's impact on various health aspects, including type 2 diabetes, cardiovascular diseases, hypertension, dyslipidemia, and intestinal inflammation [15-17]. In addition, bioactive molecules have been included for their benefits in the diet of ruminants [18].

The participants also utilize four methods of preparation, which encompass brewing dried leaves into a decoction, steeping a dry powder to create an infusion, commonly employing beetroot juice derived from the roots, and incorporating it into human food, such as salads. The mode of administration strongly depends on the pathology being treated. Indeed, Benjamin *et al.* demonstrated that nitrate (NO_3)-rich beetroot juice reduces systolic blood pressure in patients with arterial hypertension [19].

Conclusion

According to the findings of this research, it is evident that the traditional utilization of aromatic and medicinal plants remains prevalent in the Beja region. Therefore, this investigative study represents a valuable repository of knowledge that will enhance our understanding of the national medicinal flora and help preserve expertise in Northwestern Tunisia. Furthermore, these findings could serve as a database for further research in the fields of phytochemistry and pharmacology.

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Research Ethics Committee Approval

The research paper was permitted to be published in any open access journal.

Conflicts of Interest

The authors of the paper have no conflict of interest.

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