An ethnobotanical survey on the therapeutic use of *Cannabis sativa* L. in the province of Taounate, Morocco

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Research

Abstract

Background: Cannabis has been used for over 4,500 years in different area, including medicine, to treat many illnesses. This study was to investigate to carry out an ethnobotanical survey to collect information on therapeutic uses of this plant by local population.

Methods: Ethnobotanical study was conducted in Taounate province using semi-structured interviews with random informants. The data was analysed using statistical indices and tests as cultural Importance (CI), fidelity level (FL), relative frequency of citation (RFC), Chi square (χ^2) test, logistic regression, multiple corresponding analysis (MCA), and Non-metric multi-dimensional scaling (nMDS).

Results: 65.4 % of the informants used *Cannabis sativa* L. Among them, therapeutic use showed a CI of 0.40. 11 diseases were found to be treated by cannabis. The most recommended preparation method was smoking, and the most common administration method was inhalation. Cham was the most cited ailment with a FL of 92.9 %. Results showed a significant correlation of therapeutic use with sex and type of locality. MCA revealed that people using cannabis for therapeutic use were sharing common trait with male, urban areas, secondary education level, and informants aged between 20 to 40 years. Then, Nmds showed that the treated disease were uniformly dispersed between rural and urban locality.

Conclusion: The present study highlights the importance of therapeutic use of *Cannabis sativa* L. in Taounate province. However, more in-depth phytochemical, pharmacological, toxicological, and clinical research is needed to investigate its effectiveness and safety.

Keywords: Cannabis sativa L., survey, ethnobotany, Taounate, therapeutic use.

Background

Medicinal plants represent the oldest and most widespread form of medicine in the world and continue to be used to this day. In the last 20 years, growing attention has been given to medicinal plants, and many ethnobotanical studies have been conducted (Mohammadi *et al*. 2023, Skalli *et al*. 2019). It is estimated that 80% of the world's population regularly use traditional medicine to treat and/or prevent a variety of diseases (Kachmar *et al*. 2021, Mbuni *et al*. 2020). In Morocco, there are nearly 600 known and used aromatic and medicinal plants among 4,200 species, whose therapeutic properties are passed down orally from generation to generation, mainly in rural areas due to the ease of accessibility and affordability of these plants (Jan *et al*. 2023, Barkaoui *et al*. 2022).

Cannabis sativa L. is a cosmopolitan, annual, dicotyledonous plant belonging to the Cannabaceae family, genus Cannabis (Farag & Kayser 2017). It has been cultivated for over 4,500 years and used in various fields such as medicine, food, textiles, and narcotics (Ross 2005). Research on Cannabis experienced exponential interest during the widespread use of the plant for recreational purposes in the 1960s-70s. In the 1980s-90s, the discovery of cannabinoid receptors highlighted their roles in several physiological processes for maintaining the internal balance of many biological functions (Pagano *et al*. 2022, Pertwee 2006). In the last 20 years, ethnobotanical studies have seen a renewed interest, in various courtry around the world, including Morocco (Mohammadi *et al*. 2023). Many therapeutic uses of *Cannabis sativa* L. were reported in the treatment of different health disorders such as pain, anxiety, nausea, cancer, insomnia, and rheumatism (Chaachouay *et al*. 2022, Amrati *et al*. 2021, Mouna *et al*. 2020, Merzouki *et al*. 1999).

Cannabis began to proliferate in the 1990s in the Taounate province, with a subsequent transfer of traditional knowledge about its various uses to the local population (Blickman 2017). Over time, Taounate province has evolved into a key region for cannabis cultivation and production (UNODC 2003). In June 2021, the Law 13.21, which provided regulation for medical, pharmaceutical, and industrial cannabis use, along with guidelines for its cultivation in specific areas, including Chefchaouen, Taounate, and Al Hoceima. This legal framework has facilitated research on the plant (Bachir *et al*. 2022, General Secretariat of the Government 2021).

In order to contribute to ethnopharmacology and to preserve Moroccan heritage regarding to traditional medicine uses of *Cannabis sativa* L. we conducted a survey on the Taounate province (North Morocco), where to the best our knowledge, few ethnobotanical survey has been done. The main objectives of the present work were to explore the extent of use of cannabis in this province to determine the diseases treated by these this plant, and to investigate the existence of determining relationships between those local knowledge and diverse socio-demographic characteristics (age, gender, educational level, and type of locality) using statistical tools. Furthermore, this work matches with the recent legalisation of *Cannabis sativa* L. in Morocco where it was prohibited since 1953 (Bellakhdar 1997), and the worldwide increasing importance of this plant. This study will helps to promote research around the pharmaceutic industry.

Materials and Methods

Study area

The province of Taounate is part of the Fès-Meknès region in Morocco, located between 34°32'09" north and 4°38'24" west. It is one of the 12 regions created during the territorial reorganization in 2015, with Fès as its capital (Bulletin Officiel, 2015). Taounate is bordered by the provinces of Chefchaouen and Al Hoceima to the north, the Fès region to the south, the province of Taza to the east, and the province of Sidi Kacem to the west (Figure 1). Covering a total area of 5,585 km2, the province of Taounate comprises 49 municipalities, including 5 urban areas and 44 rural areas, as well as approximately 1,600 villages (Figure 1). The region lies with a Mediterranean climatic zone characterized by cold and humid winters (averaging 5°C) and variable precipitation, with northern areas receiving up to 1,800 mm of precipitation per year (Agence urbaine de Taza 2017).

According to the survey conducted on cannabis in Morocco by UNODC (2004), the economy of the Taounate province relies on cereal agriculture, olive cultivation, and livestock. Furthermore, since the end of the last century, cannabis cultivation has experienced exponential growth, primarily driven by young individuals. These data provide a general overview of the

Taounate province and emphasize its significance in relation to cannabis cultivation and its potential for scientific research within the national regulatory and legislative framework established since June 2021.

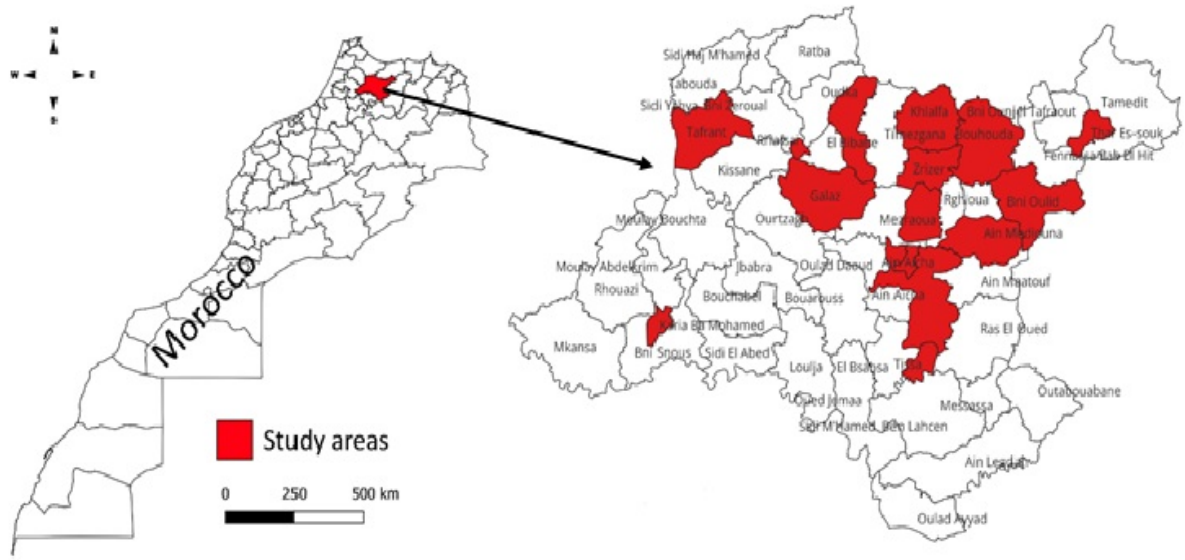

Figure 1. Studies areas in the province of Taounate (The map was modified using the Qgis software)

Data collection

The ethnobotanical survey on *Cannabis sativa* L. was conducted from December 15, 2022, to January 15, 2023, in 15 municipalities, including 5 urban areas (Taounate, Tissa, Karia Ba Mohammed, Ghafsai, and Thar Es-Souk) and 10 rural areas (Bouhouda, Bni Oulid, Ain Mediouna, Khlalfa, Tafrant, Zrizer, Sidi El Makhfi, Ain Aicha, Galaz, and Fericha). Data were collected through random face-to-face interviews in weekly market, on-field group discussions, and by using a semi-structured questionnaire. The selection of municipalities was based on interviews with the local population, existing literature, and the intention to reach a high number of indigenous people across the entire province. A total of 422 participants were interviewed after obtaining their verbal consent, using a questionnaire divided into two parts: the first part focused on sociodemographic characteristics (age, gender, educational level, occupation, type of municipality, and municipality name), while the second part included questions about plant usage, methods of use, vernacular names, plant parts used, treated diseases, and posology.

Quantitative ethnobotanical data

Relative Frequency of Citation (RFC)

The RFC (Relative Frequency of Citation) index was used to assess the significance of plant use within a specific population (Tardío & Pardo-de-Santayana 2008). It is measured on a scale ranging from 0 to 1, where values closer to 0 indicate a lower frequency of citation and, therefore, a lower cultural importance. Conversely, values closer to 1 indicate a higher frequency of citation and, consequently, a stronger cultural importance within the population. The FRC index is calculated using the following formula:

RFC = FC/N

FC: Number of informants mentioning the use of species X; N: Total number of informants.

Cultural Importance Index (CI)

The Cultural Importance Index (CI) is a valuable tool for measuring knowledge variations among different communities and assessing the significance of a plant within a specific category of use (Asseh *et al*. 2019). The values obtained through the CI index provide a quantified measure of the importance of each category of use within a particular environment. The formula used to calculate the CI index is as follows:

CI = UR/N

UR: The number of informants using a given species for a specific category of use; N: Total number of informants.

Fidelity Level (FL)

The FL index was developed by Friedman *et al*. (1986), it is a useful tool for measuring the importance of specific uses of a plant within a particular category of use (Ong and Kim 2014). The values obtained through this index range from 0% to 100%. The index is defined using the following formula:

FL = (Ni/N) *100

Ni: Number of informants who cited the specific use; N: Total number of informants.

Data Analysis

All the data collected on this ethnobotanical survey were transcribed and descriptive analysis was realised by Sphynx Plus 2-V5. Then, we utilized statistical tests to explore and gain insights into the factors influencing the usage of *Cannabis sativa* L. for therapeutic purposes. Bivariate Analysis (Chi-square): This method was employed to examine the associations between the use of *Cannabis sativa* L. for therapeutic purposes and each of the sociodemographic variables. Multivariate Logistic Regression Analysis: This method aimed to determine how combined sociodemographic factors influence the therapeutic use of *Cannabis sativa* L. Its contribution lies in highlighting the most significant factors that affect the therapeutic use of *Cannabis sativa* L. while considering multiple variables simultaneously. Multiple Correspondence Analysis (MCA): MCA was used to understand the typology of *Cannabis sativa* L. users for therapeutic purposes, considering all sociodemographic variables. It allowed us to create a graphical representation of the relationships between variables and reveal associations and patterns not immediately evident in raw data. Non-metric Multidimensional Scaling Analysis (nMDS): The objective of this analysis was to comprehend the relationships between diseases treated with *Cannabis sativa* L. and geographic location. In essence, it enabled us to visualize how different disease types treated with *Cannabis sativa* L. are connected to specific geographic regions, offering a spatial perspective on the patterns of therapeutic cannabis use. We also tested if the rural and urban localities differed in the diseases treatedby *Cannabis sativa* L. using a permuted multivariate analysis of variance (PERMANOVA) with a significant level of 0.05 and 999 permutation and with the adonis2 function in the R package "vegan" (Oksanen *et al*. 2012).

Results

Socio-demographic characteristics of the informants

This survey was on face-to-face interviews with a total of 422 individuals. Among them, 65.4% (276 out of 422; comprising 221 men and 55 women) reported using *Cannabis sativa* L. for various purposes. Table 1 provides an overview of the socio-demographic traits of the participants who use *Cannabis sativa* L.

The age of the participants using *Cannabis sativa* L. ranged from 15 to 67 years. The age groups most observed were between 20 to 40 years (44.2%) and 40 to 60 years (42.8%). Regarding the educational level, the unschooled (16.3%) and primary educational level (40.6%) represent over half of the participants. Then the percentage notably decreases among the participants with a secondary education level (34.8%) and university education level (8.3%). Furthermore, 56.9% of the participants were from rural area and 43.1% belongs to urban area.

Table 1. Sociodemographic characteristics of informants using *Cannabis sativa* L.

Variable	Subgroup	Number	Percentage
Sex	Men	221	77%
	Women	55	23%
Age	<20	5	1.8 %
	20-40	122	44.2 %
	40-60	118	42.8 %
	>60	31	11.2 %
Educational level	Unschooled	45	16.3 %
	Primary	112	40.6 %
	Secondary	96	34.8 %
	University	23	8.3 %
Type of locality	Urban	119	43.1 %
	Rural	157	56.9 %

***Influence of sociodemographic factors on therapeutic use of Cannabis sativa* L.**

The outcomes of the Chi-square test analysis revealed that both sex and type of locality had significant association effect on the therapeutic use of *Cannabis sativa* L., as evidenced by the respective results (p = 3.545 e^{-06}) and (p = 4.843 e^{-06}) (table 2).

	Distribution	Therapeutic use	Non therapeutic use	Chi-square (χ^2)	*p* value
Age	<20	3	16	6.67	0.1538
	20-40	76	113		
	40-60	73	98		
	>60	16	27		
Sex	Men	149	176	20.41	3.545 e^{-06}*
	Women	19	78		
Educational level	Unschooled	27	44	1.30	0.7291
	Primary	68	99		
	Secondary	63	89		
	University	10	22		
Type of locality	Rural	82	180	20.89	4.843 e^{-06}*
	Urban	86	74		

Table 2. Influence of sociodemographic factors on therapeutic use of *Cannabis sativa* L.

Furthermore, the outcomes of the multivariate logistic regression analysis revealed that women exhibited significantly lower odds compared to men, who served as the reference category, as indicated by an odds ratio of 0.2 (95% CI: [0.14, 0.44]) and a p-value of less than 0.01, signifying a highly substantial difference. Additionally, our results indicated a significant association between residing in urban areas and therapeutic *Cannabis sativa* L. use (odds ratio of 2.69, *p*-value less than 0.001) (Figure 2).

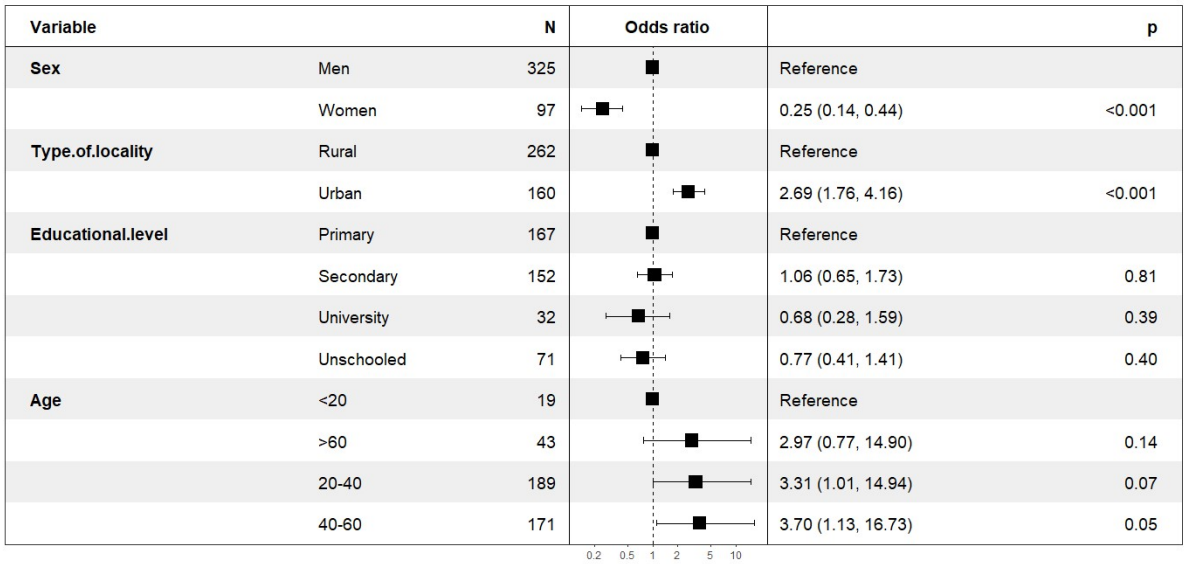

Figure 2. Multiple logistic regression analysis on sociodemographic factors and therapeutic use of *Cannabis sativa* L.

Analysis of sociodemographic variables and therapeutic or non-therapeutic use of respondents by multiple corresponding analysis (MCA)

The multiple correspondence analysis (MCA) of the different variables showed that the two dimensions alone absorb 29.7 % of the overall inertia (figure 3). This allows us to classify all the modalities in three distinct groups.

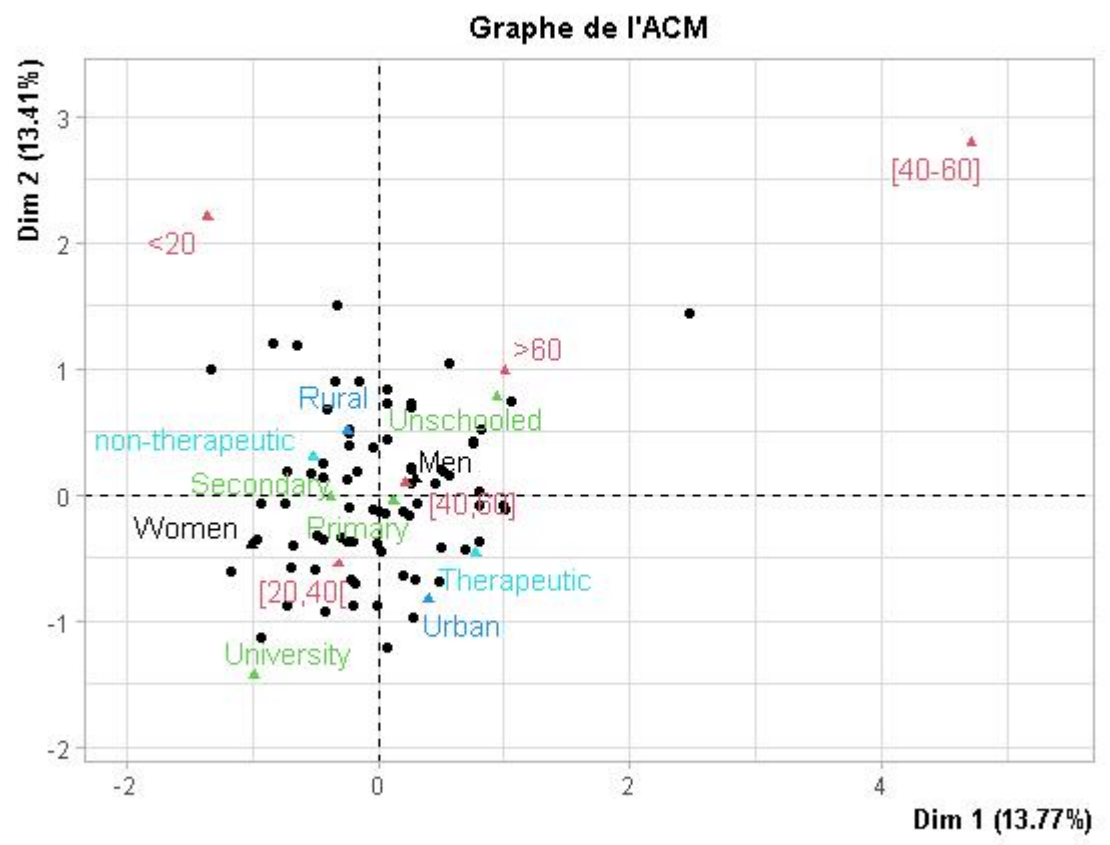

Figure 3. Visualization of Multiple Correspondence Analysis (MCA)

Group 1 consists of people residing in rural areas who don't use *Cannabis sativa* L. for therapeutic reasons. This group is primarily composed of women under 20 with limited formal education. Additionally, it includes individuals over 60, mostly men in urban areas, who use *Cannabis sativa* L. for therapeutic purposes.

Group 2 findings underscore notable trends in the use of therapeutic *Cannabis sativa* L. The analysis reveals that most users are men and tend to live in urban areas. The age bracket most frequently linked to therapeutic *Cannabis sativa* L. usage is between 40 and 60 years, followed by those aged 20 to 40. In contrast, individuals under 20 and over 60 are less prevalent in the therapeutic *Cannabis sativa* L. user demographic. Furthermore, a significant portion of women belongs to the non-user category.

Group 3 reveals significant trends related to participants' age, educational level, and gender. There is a notable representation of individuals aged over 60 and those unschooled, with both men and women being included in these categories. Conversely, participants with a secondary education level are also part of the study, demonstrating a substantial distribution across the age groups of 40 to 60 and 20 to 40 years.

Vernacular name

In the study area, the informants reported "**l'kîf**" mostly for psychotropic use and "**qanneb**" for textile use as vernacular names of *Cannabis sativa* L. species.

Use categories

Our survey revealed four range of applications of cannabis reported by the participants. Among these applications, the most frequently mentioned category was cosmetics (used for hair, nails and skin), accounting for 39%. Then therapeutic category (used to treat ailment in human), with 32.6%, followed by animal feed category with 27.4% and textile category (used for making ropes), with only 1% (figure 4).

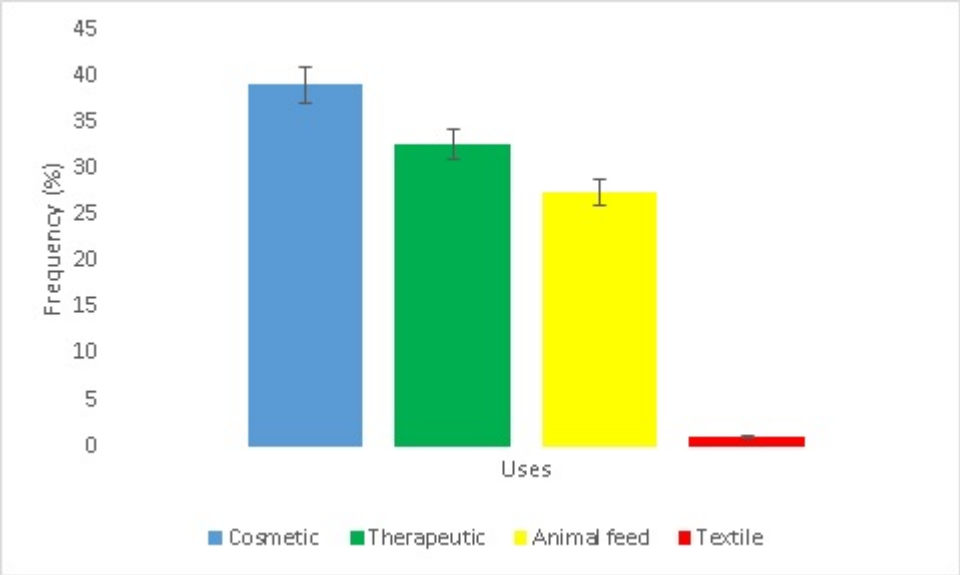

Figure 4. Use categories of *Cannabis sativa* L. in the province of Taounate

***Diseases treated by Cannabis sativa* L.**

The survey revealed that cannabis was reported to be used as a treatment for 11 different diseases. these treatments were predominantly based on recommendations from acquaintances, family members, herbalist, or by them self. The results showed that 156 respondents (50.8%) mentioned the use of cannabis for treating Cham. It a disease poorly documented, it affects children aged between 6 to 12 months, and is characterised by symptoms such as head swelling, diarrhea, and incessant crying. According to the participants this disease is generally caused by strong smell or magic) Also, 34 (11.1%) respondents reported its use for diabetes, 25 (8.1%) for injuries, 24 (7.8%) for pain, 21 (6.8%) for anxiety, 17 (5.5%) for insomnia, 9 (2.9%) for cancer, 8 (2.9%) for headaches, 6 (2%) for stomach disorders, 5 (1.6%) for dizziness, and 2 (0.7%) for glaucoma (Figure 5).

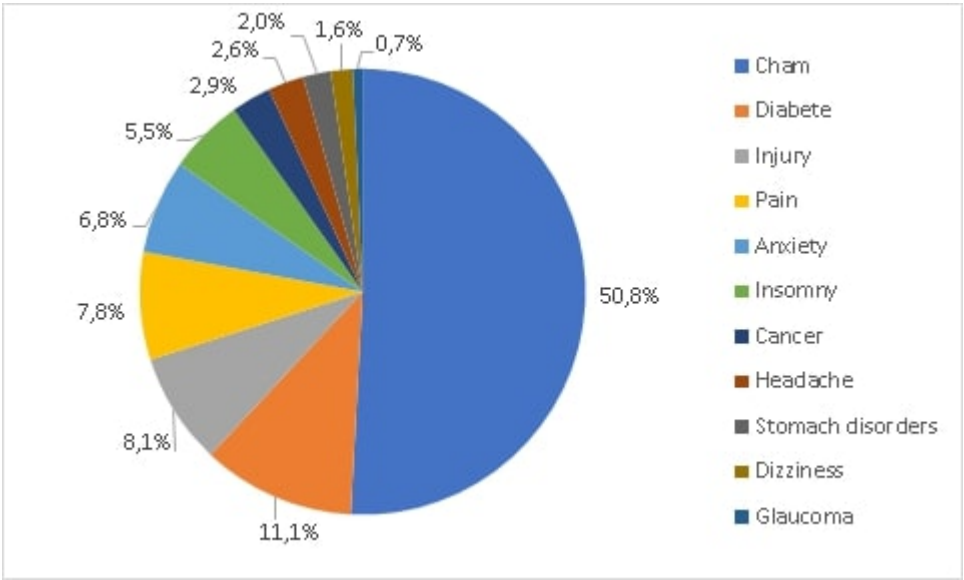

Figure 5. Diseases treated by informants using Cannabis sativa L. as a medicinal plant.

Dissimilarity analysis of samples across disease categories in rural and urban localities

The non-metric multidimensional scaling (nMDS) plot in Figure 4B reveals distinct patterns that are pivotal to our understanding of the relationships between disease types treated by *Cannabis sativa* L. and geographical locality.

The Shepard diagram (reveals a significant correlation between the observed distances and the distances calculated by the ordination, with a coefficient of determination R^2 exceeding 0.99. This strong correlation attests to the reliability of the

adjustment carried out by the NMDS method. Furthermore, the low value of stress, measured at only 0.07, also confirms the high quality of adjustment achieved by the NMDS (see Figure 6A). This combination of results underlines the relevance of the two-dimensional representation of the similarities between objects in the analysis, as well as the robustness of the method used for this study.

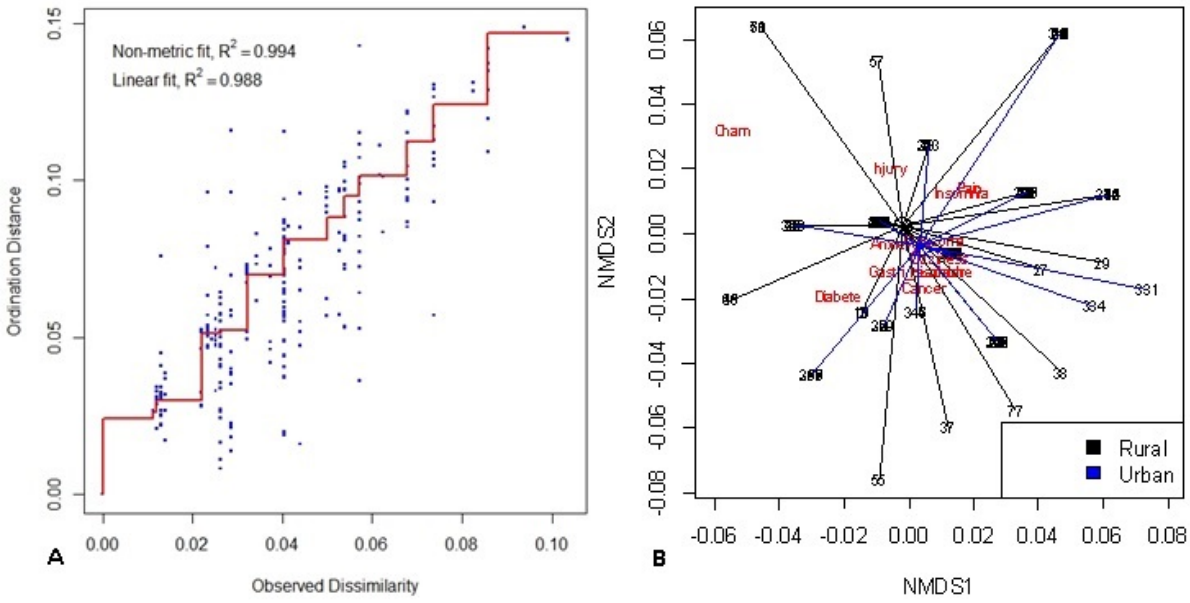

Figure 6. (A) Shepard stress plot. Relationship between NMDS ordination distance and original observed distance. (B) Non-metric multidimensional scaling (NMDS) plot based on Bray-Curtis

Dissimilarities were clearly evident in the non-metric multidimensional scaling (NMDS) plot, as depicted in the figure 6B. The samples did not exhibit distinct separation based on the diseases treated by *Cannabis sativa* L. or the type of locality. In fact, the points representing the diseases treated by *Cannabis sativa* L. were uniformly dispersed across the plot, far removed from the centroid of the ellipse that delineates the two locality types, rural and urban. These findings suggests no noticeable relationship between treated diseases and geographical locality type in the NMDS analysis, indicating no significant grouping or trend in sample distribution based on these factors.

In light of the visually suggestive results from the nMDS graph, the imperative need for rigorous statistical validation of our hypothesis becomes clear. To achieve this, our PERMANOVA analysis revealed that there was no significant differences in the diseases treated by *Cannabis sativa* L. between the rural and urban localities studied ($F = 2.564$; $p = 0.055$).

Plant part(s) used, preparation methods and administration

The most used plant parts were leaves and flowers (46.4 %), followed by seeds (7.2 %). Among the informants, 86.5 % of the used plant parts were in dry state, and 13.5 % in fresh state (figure 7).

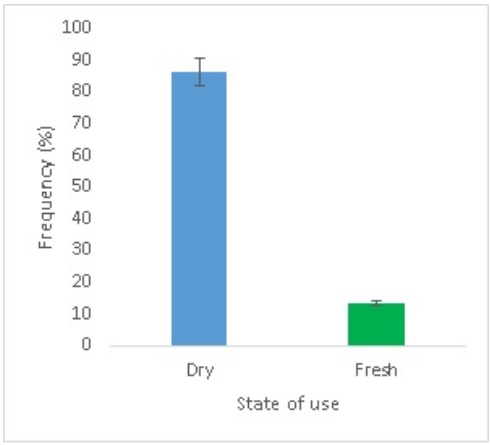

Figure 7. State of plant parts used by informants

In the present study, smoking was the most common preparation method (83.1 %), followed by vegetable oil (13.9 %), and powder (3 %) (figure 8). For example, smoking leaves and/or flowers of *Cannabis sativa* L. was suggested for treatment of Cham (table 3). The most common administration route was inhalation (83.1 %), followed by topical oil application (13.9 %), and oral (3 %).

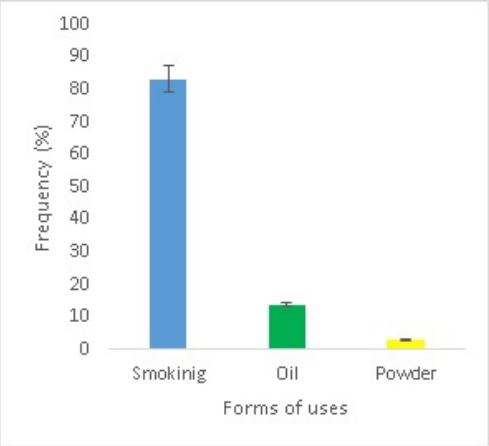

Figure 8. Methods of consumption reported by the informants

Table 3. Plant parts used of *Cannabis sativa* L. by the local people in the province of Taounate

Plant parts	Mode of preparation/ administration	Treated ailments
Leaves/Flowers	Smoked with or not *Nicotiana tabacum* leaves using sebsi with a narrow clay bowl called "Shqaf" that represents approximatively 25 mg; inhaled	Cham; diabetes; pain; anxiety; insomnia; cancer; headache; dizziness; glaucoma.
Leaves/Flowers	A small handful of powder mixed with pure honey and T*rigonella foenum graecum*; orally	Gastric diseases
Seeds	Oil mixed with or without olive oil; topical application	Injuries

Posology

In this survey, most of the informants use *Cannabis sativ*a L. as medicinal plant without any specific dose. In fact, the results showed that smoking *Cannabis sativa* L. leaves mixed with *Nicotiana tabacum* leaves and blow it to the patient for 3 to 5 times heals cham. In addition, one to two spoons are used for treating gastric disorders. Concerning the duration of using *Cannabis sativa* L. as medicinal plant by local population was not specific. According to the population surveyed, no adverse effects were reported.

Quantitative analysis

In this study, the RFC values of *Cannabis sativa* L. in the province of Taounate was 0.65. This value showed that more than 50 % of the local population use the plant for therapeutic, cosmetic, feed or textile purpose. Among the categories of use, Cosmetic had the highest CI value of 0.48, followed by therapeutic with a CI of 0.40, while animal feed had a CI of 0.33, and textile had a CI of 0.01 (Table 4).

Table 4. Cultural Importance Index of *Cannabis sativa* L. in the different localities visited.

Category of use	**Cutural Importance Index (CI)**
Cosmetic	0.48
Therapeutic	0.40
Feed	0.33
Textile	0.01

Our results demonstrate that the Cannabis plant is reported to treat 11 different categories of diseases. Among these categories, the treatment of Cham was associated with a very high level of fidelity, with a noteworthy value of 92.9 %. Diabetes was the next most notable category, with a level of fidelity of 20.2 %, followed by injuries with 14.9 %, and pains with 14.3 % (table 5). These findings highlight the perceived effectiveness of the Cannabis plant in treating these particular diseases according to the respondents in the survey.

Table 5. Percentage of Fidelity level of diseases treated by *Cannabis sativa* L.

Diseases	Number of citation	Fidelity Level (FL)
Cham	156	92.9 %
Diabetes	34	20.2 %
Wounds	25	14.9 %
Pain	24	14.3 %
Anxiety	21	12.5 %
Insomnia	17	10.1 %
Cancer	9	5.3 %
Headaches	8	4.8 %
Gastric disorders	6	3.6 %
Diziness	5	3%
Glaucoma	2	1.2 %

Discussion

In our survey, sociodemographic results showed that the age of all participants was between 15 and 67 years, and the most presented group of respondents was between 20 and 40 years (44,2 %), followed by the group between 40 and 60 years (42,8 %). Older people seem to have a better knowledge than other ages groups, as reported by Bouarfa *et al*. (2020) in the province of Taounate and by Skalli *et al*. (2019), and Barkaoui *et al*. (2022) in various provinces of Morocco. A significant association between the sex and therapeutic use of cannabis was observed, where men showed a greater knowledge about cannabis than women, as mentioned by Bouarfa *et al*. (2020) and Merzouki and Molero Mesa (1999), contrary to what can be found in most surveys that were involved on other species as mentioned by Sekkat *et al*. (2023). This may be due to the fact that men use more often this plant, mainly for psychotropic purpose, as well as for other uses.

Regarding the educational level, data showed that 50 % of the informants were unschooled or had primary education level. This means that cannabis use is more common among individuals who are unschooled or had primary educational level, which may suggest that they have more expertise in its uses. These results are like those reported by Kachmar *et al*. (2021) in the provincial region of Taza, and Benkhaira *et al*. (2021) in the same province of our study. Besides, nonsignificant association was observed between the educational level of the informants and their therapeutic knowledge on the plant. Furthermore, the study highlights the emphasizes use of medicinal plants in rural areas compared to urban areas, with a prevalence rate of 56.9 %. However, urban areas reported a significant relationship with the therapeutic use of cannabis. This can be attributed to the rural exodus that started in the 1970s and continues today, with 152,000 migrants per year according to HCP (2023), who take their knowledge with them from rural to urban area.

In traditional uses, *Cannabis sativa* L. could be used in various sectors like manufacturing of tools (clothing, rope, and paper), cosmetics, medication, human food, and animal feed (Hourfane *et al*. 2023, Chaachouay *et al*. 2022). According to Bellakhdar (1997), the use of cannabis by Moroccan people dates back to 1800 mainly for their psychoactive and therapeutic properties. Our study showed that cosmetics and medication were the main sectors using *Cannabis sativa* L. in Taounate province, with more than 71.6 %. Furthermore, the Chi square (χ^2) test showed a significant correlation between the therapeutic use of *Cannabis sativa* L. with the variables of sex and type of locality. When the multivariate analysis indicated that men and individuals living in urban locality showed a highly significant association with the use of cannabis in therapeutic than women and individuals living in rural locality. These results are confirmed by Dalli *et al*. (2023) and Bellakhdar (1997).

The RFC value of cannabis in the province of Taounate was 0.65 which means that more than 50 % of the local population have knowledge about traditional uses of cannabis. Among these various uses, therapeutic use was presented by a cultural index value of 40 %. The plant's therapeutic properties that have been experimentally demonstrated by several studies carried out in vitro and in vivo (Haddou *et al*. 2023, Kim *et al*. 2023, Breijyeh *et al*. 2021). Our survey reported 11 diseases

treated by cannabis. Among them, cham was the most cited diseases treated by cannabis in the local population, as indicated by their notably high frequency of use and FL value. In addition, nonnoticeable relationship between treated diseases and geographically locality was observed. In another ethnobotanical study conducted by Bouarfa *et al*. (2020) in the province of Taounate, Cham has similarly topped the list. Other studies carried out by Amrati *et al*. (2021) among communities living in mountainous area of Fez-Meknes region, and by Benali *et al*. (2017) in the province of Guercif (North-East of Morocco) reported that this plant is used to treat cancer. In Moulay Yacoub region and province of Taounate, the plant is also consumed to treat skin diseases (El Khomsi *et al*. 2022, El-Hilaly *et al*. 2003).

The use of leaves and flowers has been reported as the most used parts of *Cannabis sativa* L. (46.4 %), followed by seeds (7.2 %). The use of leaves and flowers are explained by the fact that their composition present a variety of secondary metabolites like cannabinoids, terpenoids, and flavonoids (Judžentienė *et al*. 2023, Chaachouay *et al*. 2022). Indeed, the use of leaves could be explained by the ease of harvest and simplicity of the herbal remedy preparation (Benkhaira *et al*. 2021, El-Assri *et al*. 2021). Regarding the preparation method, Smoking was the most used by the informants due to their better knowledge about this method. This observation agrees with Balant *et al*. (2021), which indicate that smoking is the most frequently way of consumed cannabis.

Furthermore, the method of administration mostly used by the informants in our survey was inhalation as mentioned by Bouarfa *et al*. (2020). This method is preferred by the informants due to the rapid absorption of the active ingredients through inhalation, which leads to a relatively quick onset of effects within a few minutes (Bridgeman & Abazia 2017). The combustion of cannabis allows to increase the concentration of Δ9-tetrahydrocannabinol (THC) that would be inhaled by decarboxylation of Δ9-tetrahydrocannabinolic acid (THCA) (Gigopulu *et al*. 2022). On the contrary, orally administered cannabis does not produce effect until 30 min to 2 hours due to the absorption of THC by the intestine and his transport to the liver according to the national academy of sciences report on the health effects of cannabis and cannabinoids.

The duration of treatment with *Cannabis sativa* L. among the informants was not specified, indicating that it can vary from as short as one day to weeks or even years. Furthermore, the dosage of cannabis was not specified by the informants. Unfortunately, unspecified doses of medicinal plants can lead to adverse effects as some plant species become toxic if misused (El-Assri *et al*. 2021). The effectiveness of cannabis in treating the mentioned diseases need to be further investigated through research studies. Such studies would provide additional evidence to confirm the therapeutic potential of this plant for various adverse health conditions.

This study was conducted only in the region of Taounate and for a short period. A longer period adding other localities and regions who respect the law 13.21 would be added to reach a better result. The study highlights the potential of *Cannabis sativa* L. as a source of drugs for various diseases, warranting further preclinical and clinical investigation. However, it is important to acknowledge the challenges encountered in data collection due to the reluctance of many individuals to share their knowledge. This hesitance may stem from a fear of authorities or confusion about the researchers' intentions.

Conclusion

The present survey represents one of the few studies focused on ethnopharmacological knowledge held by informants in Taounate province using *Cannabis sativa* L. as medicinal plant. These participants provided detailed information about cannabis uses, vernacular names, treated diseases, plant parts used, preparation methods and administration.

The results revealed that 32.6 % of the informant used this plant for therapeutic use to treat 11 different diseases. As regard to relationship between sociodemographic variables and therapeutic use by the population are sharing common traits: Men, aged from 20 to 40 with a secondary educational level and living in urban area.

After the legalization of cannabis for cultural, industrial, pharmaceutical, and cosmetic purposes, which had been prohibited from 1953 to 2021, we faced challenges during this survey. Some participants hesitated to respond due to their concerns about authorities. Additionally, further surveys are necessary to broaden the scope to other regions, as allowed by Law 13.21.

The findings of this study have allowed us to bring attention to the traditional medicinal knowledge regarding *Cannabis sativa* L. within the population of Taounate province. Moreover, these results can serve as foundational data for future research in phytochemical and pharmacological studies.

Declarations

Ethics approval and consent to participate: Prior to the survey, we obtained oral informed consent from each participant.
Consent for publication: Not applicable
Availability of data and materials: The article contains the supporting figures and tables for the study's results, while the original datasets can be obtained from the primary author upon request.
Competing interests: The authors declare that there are no conflicts of interest in this article.
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Author's contribution: TB and SS designed the questionnaire. TB, AB, and AEB conducted the personal interviews. SB did the statistical analysis. SS, CR, and HR supervised the study. TB wrote the original draft of the manuscript. All the authors analysed the data. SS, SB, SM, CR, and HR critically revised the manuscript. All the authors approved the final draft of manuscript after revision.

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