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Original Article

Comparative ethnopharmacological survey: Medicinal plants and remedies for oral health in Meknes, Morocco, and their limits facing modern dentistry

[Estudio etnofarmacológico comparativo: Plantas medicinales y remedios para la salud bucodental en Meknes, Marruecos, y sus límites frente a la odontología moderna]

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Abstract

Context: For centuries, herbal remedies have been widely used to alleviate and prevent oral pathologies.

Aims: To compare the herbalists' knowledge with that of the local population, their prevalence of the use of modern non-pharmacological medicine, and investigate the traditional knowledge of the use of medicinal and aromatic plants for oral health in Meknes, Morocco.

Methods: A cross-sectional survey was conducted using a structured questionnaire. Along with medicinal plants, other remedies such as alum, salt, and vinegar have also been investigated. Statistical calculations by use value, relative frequency of citation, family use value, informant consensus factor, and fidelity level were performed and compared between the two groups.

Results: Numerous medicinal plant species were identified for oral health, namely *Syzygium aromaticum*, *Juglans regia*, and *Ammi visnaga*. Most participants reported using these plants to treat and prevent dental caries, gingivitis, and toothache. Herbalists were found to have a greater knowledge of plants and their uses than the general population. However, a significant proportion of participants, including herbalists, opted for modern medicine or dental care and extraction as treatments of choice, combined or not with traditional treatments.

Conclusions: This study emphasizes the rich understanding of medicinal plants for oral health, underscoring herbalists' role as key informants on traditional plant usage for various oral diseases. The populace's increasing reliance on modern dental treatments highlights the limitations of natural remedies for severe oral conditions. Nonetheless, integrating these plants alongside modern dentistry can optimize oral health prevention strategies.

Keywords: medicinal and aromatic plants; modern dentistry; oral health; traditional knowledge.

Resumen

Contexto: Durante siglos, los remedios herbales han sido ampliamente utilizados para aliviar y prevenir patologías orales.

Objetivos: Comparar el conocimiento de los herbolarios con el de la población local, su prevalencia en el uso de medicina moderna no farmacológica e investigar el conocimiento tradicional sobre el uso de plantas medicinales y aromáticas (MAPs) para la salud oral en Meknes, Marruecos.

Métodos: Se realizó una encuesta transversal utilizando un cuestionario estructurado. Junto con las plantas medicinales, también se investigaron otros remedios como alumbre, sal y vinagre. Se realizaron cálculos estadísticos con valor de uso, frecuencia relativa de citación, valor de uso familiar, factor de consenso del informante y nivel de fidelidad, y se compararon entre los dos grupos.

Resultados: Se identificaron numerosas especies de plantas medicinales para la salud oral, como *Syzygium aromaticum*, *Juglans regia* y *Ammi visnaga*. La mayoría de los participantes informaron usar estas plantas para tratar y prevenir caries, gingivitis y dolor de muelas. Se descubrió que los herbolarios tenían un mayor conocimiento de las plantas y sus usos que la población general. Sin embargo, una proporción significativa de participantes, incluidos los herbolarios, optaron por la medicina moderna o la atención y extracción dental como tratamientos de elección, combinados o no con tratamientos tradicionales.

Conclusiones: Este estudio enfatiza la comprensión sólida de las plantas medicinales para la salud oral, subrayando el papel de los herbolarios como informantes clave sobre el uso tradicional de plantas para diversas enfermedades bucales. La creciente dependencia de la población en tratamientos dentales modernos resalta las limitaciones de los remedios naturales para afecciones bucales graves. Sin embargo, integrar estas plantas junto con la odontología moderna puede optimizar las estrategias de prevención de la salud oral.

Palabras Clave: conocimiento tradicional; odontología moderna; plantas medicinales y aromáticas; salud oral.

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Abbreviations: FL: fidelity level; FUV: family use value; H: herbalists; ICF: informant consensus factor; MAP: medicinal and aromatic plants; P: general population; RCF: relative frequency of citation; UV: use value.

INTRODUCTION

Scientific research conducted in the medical field consistently demonstrates the crucial role of oral health in maintaining overall health and well-being. While traditional approaches have primarily focused on dental health, contemporary research highlights the significance of oral health as a fundamental aspect in promoting systemic health (Fiorillo, 2019; Janakiram and Dye, 2020). Dentistry, once underestimated, has now become an expanding area of interest in medical research due to its potential links to systemic diseases resulting from oral pathologies (Patini, 2020). Numerous scientific studies have emphasized the correlation between periodontal disease and various complications, with a growing body of evidence indicating significant associations between oral disturbances and the development of rare diseases (Genco and Borgnakke, 2013; Hanisch et al., 2019; Kuo et al., 2008). Unlike infections in other parts of the body, oral infections are known to be polymicrobial, making treatment challenging. Moreover, they have implications for the overall well-being of individuals, increasing the likelihood of crises such as heart disease, gastropathy, and certain neuralgias (Hajishengallis and Lamont, 2014; Herrera et al., 2018).

Throughout the world, plant-based remedies have been extensively used for mitigating and preventing various pathologies (Acquaviva et al., 2021; Djuraeva and Abdullabekova, 2020; Manouchehri, 2022). The emphasis on disease prevention has grown over time, with modern scientific methodologies unveiling the therapeutic potential of herbal interventions (Kumar et al., 2021). Prioritizing oral and dental hygiene is crucial for ensuring overall human health. However, incorporating botanical extracts and derivatives into daily practices presents a promising alternative to synthetic agents for managing oral pathologies (Arumugam et al., 2020; Chinsembu, 2016).

Historically, oral health concerns in Morocco have received limited attention and have often been marginalized. Despite the prevalence of oral cavity ailments, a significant portion of the population relies on natural remedies, particularly aromatic and medicinal herbs, to alleviate their symptoms (Kissa et al., 2022). Morocco is renowned for its abundant biodiversity, boasting 5200 species and subspecies of vascular plants, including 900 endemic plants. The Moroccan medicinal flora is estimated to comprise 600 species (Barkaoui et al., 2017). However, there is a lack of research on the use of plants in the oral health sector in Morocco. It is imperative to conduct surveys in different regions of the country and perform chemical and antimicrobial research to bridge this knowledge gap in the field.

Therefore, this study aims to elucidate traditional medicinal practices for oral health in Meknes, Morocco, focusing particularly on the knowledge and practices of herbalists and the general population, mainly in terms of medicinal plants. Through comparative analysis, we seek to discern the efficacy of herbal remedies versus mechanized dental interventions. By linking traditional and modern approaches, this research seeks to establish the role of herbal medicine in oral health management. In addition, it aims to highlight the importance of biodiversity in providing sustainable healthcare solutions and promoting interdisciplinary collaborations.

MATERIAL AND METHODS

Study area

The Prefecture of Meknes, situated in the Fez-Meknes region, is primarily an urban subdivision covering an area of approximately 1786 km^2. It is divided into 21 municipalities, including 15 rural municipalities. Meknes, the capital city of the prefecture, is one of the four imperial cities of Morocco and one of the two major metropolitan centers in the Fez-Meknes region. As of 2014, the legal population of the prefecture reached 835,695 inhabitants, with 82.3% residing in urban areas. Among the population, 58.2% are under the age of 35, and 64% fall within the age range of 15 to 59 years. Geographically, the Prefecture of Meknes is strategically positioned between two mountain ranges, namely the Pre Rif and the Middle Atlas West. Additionally, Meknes serves as a crucial intersection for major transportation routes in the Kingdom of Morocco, including national and provincial roads, sections of freeways, and railways connecting Marrakech and Oujda. The climate in the region is characterized as a semi-continental Mediterranean climate, featuring cool and rainy winters and hot and dry summers (Harouak et al., 2018; Hcp, 2017).

Ethnobotanical survey

Inclusion and exclusion criteria

The study set specific inclusion and exclusion criteria to ensure a uniform and appropriate sample population. Participants were required to be at least 18 years of age, have residency in Meknes Prefecture, and possess the ability to communicate in the local

dialect language. Those who did not meet these criteria were excluded. Additionally, the study excluded individuals with severe mental health issues or physical health conditions that could potentially impede their capacity to provide informed consent or actively participate in the study.

Data collection and sample characteristics

The data collection process for this study was designed to ensure both validity and reliability of the findings. To achieve this, a random sampling technique was employed to select participants from both the general population and herbalists in the Meknes Prefecture, and individuals had to be over 18 years old, residing in the Meknes Prefecture, and able to communicate in the local dialect language to participate. A sample size of 250 individuals was calculated using a formula that took into account various factors such as estimated population size, level of confidence, margin of error, and expected proportion of individuals using medicinal plants for oral health. The sample size calculation was adjusted to exclude individuals who did not meet the inclusion criteria. Of the 250 participants, 65 were herbalists. With a 95% confidence level and a margin of error of ±6.2%, the sample size of 250 individuals provided a statistically significant sample. Practical considerations and available resources were also taken into account during the sampling process, including time constraints and budget limitations. The exclusion criteria were strictly followed to ensure that the sample accurately reflected the population of interest. The investigation was conducted between March 2021 and January 2022, and the survey was adapted to the local characteristics of the region by following the administrative map (Fig. 1) with more members surveyed in the urban area, which contains the majority of the population. A total of 250 individuals were interviewed using a questionnaire adapted to collect data on various aspects such as their profile, preference between modern dentistry and traditional practices, medicinal plants used for oral problems, local names, used parts, mode of preparation, ailments to be cured, and other natural remedies. The collected data were cross-referenced with vernacular and scientific names using published literature.

Questionnaire development and validation

The questionnaire used in this study was developed by the authors based on a comprehensive review of existing literature in the field of ethnobotany. Similar questionnaires from previous studies were examined to identify key areas to explore, including traditional practices in oral health care, medicinal plants used, modes of preparation, parts of plants used, and treated conditions. Special attention was given to formulating questions to ensure participant understanding and relevance to the research objectives. Prior to implementation, the questionnaire underwent an internal validation phase, during which it was reviewed by the authors and experts in the field of ethnobotany. Adjustments were made based on feedback received to ensure clarity and relevance of the questions. The content of the questionnaire was supported by a strong theoretical foundation and common practices in the field of ethnobotany, making it an appropriate tool for data collection in this study.

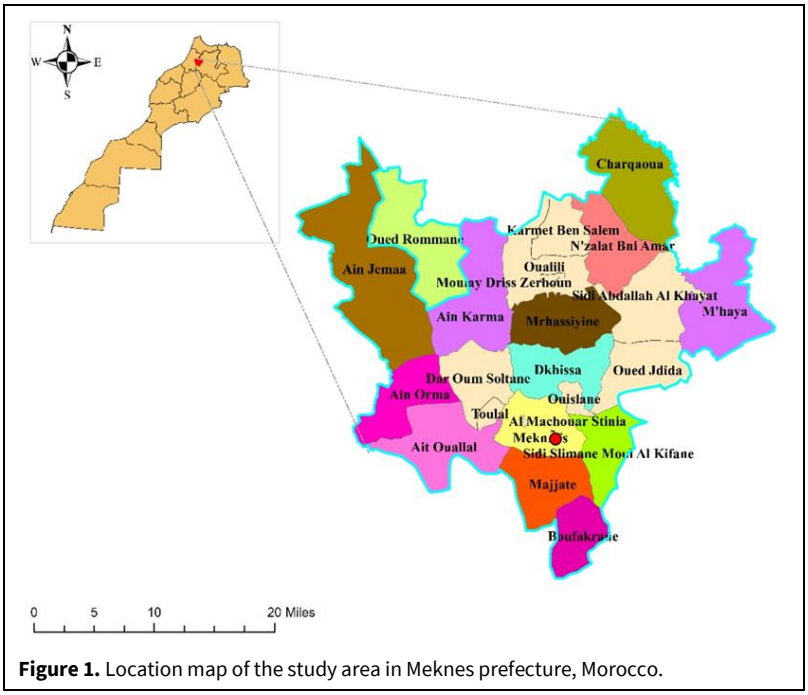

Figure 1. Location map of the study area in Meknes prefecture, Morocco.

Quantitative ethnobotanical analysis

Use value

The use value (UV) is a quantitative measure that reflects the relative importance of each species used by the local population. Higher UVs imply that the species is more commonly used by the population. It is calculated using the formula UV = ∑U/N, where U is the number of uses mentioned by each informant for a species, and N is the total number of informants. Higher UVs indicate a high consensus on the uses of a species among the informants (Idm'Hand et al., 2020; Rahman et al., 2016).

The UVh is the UV calculated for herbalists, and the UVp is the UV calculated for the general population. Those were used to reflect and compare which species are important for each group of informants.

Relative frequency of citation

The relative frequency of citation (RFC) is used to measure the consensus or agreement among informants regarding the use of a particular plant species and is calculated using the formula: RFC = FC/N, where FC is the number of informants who mention the use of the species, and N is the total number of informants. The RFC value ranges from 0 (when nobody refers to the plant as useful) to 1 (when all informants mention the use of the species). Higher RFC indicates that the plant is more commonly mentioned or used in the community (Fatima et al., 2018; Skalli et al., 2019).

The RCFh is the RCF calculated for herbalists, and the RCFp is the RCF calculated for the general population. Those were used to reflect and compere if the two groups agreed on the importance of the same species.

Family use value

The family use value (FUV) is a measure employed to ascertain the importance of different plant families in the studied community. It is computed using the equation FUV = (Sum of UVs)/Ns, where 'Sum of UVs' represents the cumulative use value of all species within the same family, and 'Ns' signifies the total count of species within that particular family. This measure allows us to understand the significance and utility of a whole plant family in the eyes of the community under study. FUVs imply that the family is more commonly used or has more species that are utilized (Chaachouay et al., 2019).

Informant consensus factor

The informant consensus factor (ICF) is used to analyze the homogeneity of the information. It is calculated using the formula ICF = (Nur - Nt) / (Nur - 1), where Nur refers to the number of use reports from informants for a particular plant-use category, and Nt refers to the number of species that are used for that plant-use category. ICF values range between 0 and 1, where high values indicate a high degree of consensus among informants (Balamurugan et al., 2018; Lin et al., 2021).

Fidelity level

The fidelity level (FL) is calculated as FL (%) = (Np/N) * 100, where Np is the number of informants who independently cited the use of a species for the same major purpose, and N is the total number of informants who mentioned the plant for any use. This measure helps to identify the plant species most preferred for each specific ailment or use category (Najem et al., 2020).

Statistical analysis

After the ethnobotanical surveys were completed, the data were copied, coded, verified to eliminate the risk of error using Excel software (Microsoft Office 2016), and then the SPSS software (IBM SPSS Statistics 21) was used to calculate the response frequencies and their percentages in each category. Cross tabulation was used to examine relationships among and between the variables (Herbalist and general population), Chi-square test and Cramer's coefficient were used to examine the differences between these two groups.

RESULTS AND DISCUSSION

Socio-demographic characteristics of informants

Table 1 provides an interesting overview of the socio-demographic characteristics of the informants interviewed in the study area, divided into two groups: herbalists and the general population. Chi-square test statistics and Cramer's coefficient were used to examine the differences between these two groups. In the gender distribution, there is a significant difference between herbalists and the general population (Chi-square <0.0001, Cramer's V = 0.345). Out of the participants, 89.23% (N = 65) of the herbalists were male, while only 11.77% were female. This might be explained by cultural, historical, or social factors. In many societies, certain occupations, such as herbalism, have been traditionally held by men, perhaps due to historical gender roles or societal norms. Similar findings were reported in previous local studies (Beniaich et al., 2022; Zougagh et al., 2019). However, for the general population, the number of females was almost equal to that of males, reflecting a more even interest or reliance on herbal remedies

Table 1. Sociodemographic characteristics of informants.

Variable	Herbalists 65 (26%)	General population 185 (74%)	Total 250 (100%)	Chi-square/ Cramer's V
Gender				
Man	58 (89.23%)	94 (50.81%)	152 (60.8%)	<0.0001*/0.345
Women	7 (11.77%)	91 (49.19%)	98 (39.2%)	
Age				
18-24	4 (6.15%)	15 (8.11%)	19 (7.6%)	
25-34	6 (9.23%)	26 (14.05%)	32 (12.8%)	0.795/0.082
35-49	22 (33.85%)	61 (32.97%)	83 (33.2%)	
49-64	27 (41.54%)	65 (35.14%)	92 (36.8%)	
Over 65	6 (9.23%)	18 (9.73%)	24 (9.6%)	
Family situation				
Single	53 (81.54%)	37 (20.00%)	90 (36%)	
Divorced	8 (12.31%)	4 (2.16%)	12 (4.8%)	0.160/0.144
Married	3 (4.62%)	133 (71.89%)	136 (54.4%)	
Widowed	1 (1.54%)	11 (5.95%)	12 (4.8%)	
Academic level				
Illiterate	14 (21.54%)	39 (21.08%)	53 (21.2%)	
Primary	16 (24.62%)	42 (22.70%)	58 (23.2%)	<0.0001*/0.267
Secondary	29 (44.62%)	43 (23.24%)	72 (28.8%)	
University	6 (9.23%)	61 (32.97%)	67 (26.8%)	
Origin of knowledge				
Herbalists	37 (56.92%)	12 (6.49%)	49 (19.6%)	
Other people's experiences	31 (47.69%)	136 (73.51%)	167 (66.8%)	<0.0001*/0.636
Father to father	9 (13.85%)	73 (39.46%)	82 (32.8%)	
Himself	4 (6.15%)	21 (11.35%)	25 (10%)	

*Denote statistical difference at the 5% level.

among both genders outside of professional practice. Similarly, national surveys have shown consistent results (Bencheikh et al., 2021; Benkhnigue et al., 2012; Chaachouay et al., 2019; Tahraoui et al., 2007; Ziyyat et al., 1997). There was no statistically significant difference in informant age between the two groups (Chi-square = 0.795, Cramer's V = 0.082), with a relatively even distribution in each age bracket, suggesting that interest and expertise in herbal medicine span across various age groups, reflecting the age-old and widespread nature of herbal medicine usage. The majority of herbalists and the general population surveyed were between 49 and 64 years of age, which is in line with the conclusions drawn by certain researchers. The evidence supports the notion that the utilization of medicinal plants tends to increase as individuals age (Abouri et al., 2012; Barkaoui et al., 2017; Benkhnigue et al., 2012; Mehdioui and Kahouadji, 2007). As for marital status, although there was no significant difference (Chi-square = 0.160, Cramer's V = 0.144), the majority of herbalists were single (81.54%), whereas most of the general population were married (71.89%). The unmarried status of herbalists could be due to various factors. For instance, the demands of the profession, such as time investment for study, practice, and potentially unconventional work hours, might influence marital status (Panisoara and Serban, 2013). For education level, a significant difference was observed (Chi-square <0.0001, Cramer's V = 0.267). The majority of herbalists (44.62%) have attained secondary school education, 21.54% have no academic background, 24.62% have primary education, and only 9.23% have a university degree. Whereas, in the general population, a greater number (32.97%) have attained university level. Those results suggest that herbalism as a

profession is accessible to those without higher formal education, while the usage of herbal remedies is widespread across all education levels in the general population (Beniaich et al., 2022; Zougagh et al., 2019). Finally, with regard to the origin of knowledge, there was a significant difference between herbalists and the general population (Chi-square <0.0001, Cramer's V = 0.636). The majority of herbalists acquired their knowledge from other herbalists, indicating a possible mentorship or apprenticeship tradition within the profession (Abouri et al., 2012; Bencheikh et al., 2021; Beniaich et al., 2022; Zougagh et al., 2019). Conversely, the general population relies more on shared experiences, indicating that the knowledge of herbal remedies in the general population may be transmitted informally through social networks, families, and communities (Abouri et al., 2012; Barkaoui et al., 2017).

Fig. 2 indicates that the majority of herbalists have experience ranging from 10 to 20 years, accounting for 35.38% of the sample. Approximately 27.69% of herbalists possess between 1 to 10 years of experience, comprising the second largest group. Close behind, 26.15% have between 20 to 30 years of experience. The smallest group, making up 10.77% of the sample, is composed of herbalists who possess over 30 years of experience. This distribution of experience among the herbalists might suggest that herbalism requires a substantial amount of time to gain proficiency. The smaller percentage of those with experience could potentially be due to retirement or a decreased capacity to practice at an advanced age (El Haouari et al., 2018).

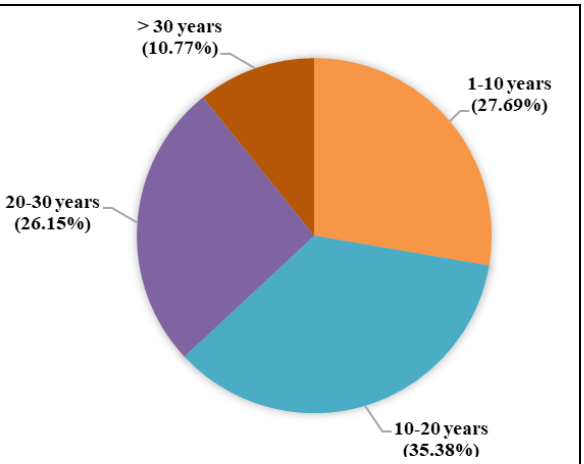

Figure 2. Experience years of herbalists.

Preferences for oral care approaches and causes for seeking treatment

Table 2 presents the preferences of herbalists and the general population regarding the choice of treatment for oral care, as well as the reasons underlying these preferences. Among herbalists, none preferred exclusively modern dentistry, with 41.54% favoring phytotherapeutic treatments and 58.46% preferring a combination of both. Contrarily, 28.11% of the general population preferred modern dentistry. This divergence could be attributed to the herbalists' inherent bias towards phytotherapeutic treatments, possibly resulting from their extensive experience and confidence in herbal remedies (Nandita et al., 2022). The preference among the general population for modern dentistry might be attributable to broader access to and awareness of modern dental care, as well as perceived effectiveness (Chebib et al., 2023). The reasons cited for this preference were its precision (52.31% herbalists, 29.19% general population) and effectiveness (27.69% herbalists, 70.81% general population). The chi-square test indicated a significant association between the group (herbalist or general population) and treatment preference (p<0.0001), with a moderate strength of association as indicated by a Cramer's V of 0.216. Traditional medicine was found to be less expensive by 53.85% of herbalists and 61.62% of the general population. Herbalists also pointed out the side effects of modern drugs (21.54%) and easier acquisition of traditional medicines (15.38%) as reasons for their preference. Here, the chi-square test again indicated a significant association between the group and the reasons for using traditional medicine (p<0.0001), with a Cramer's V of 0.237 indicating a weak association. It is noteworthy that the primary reasons for preferring modern dentistry differed between the two groups. Herbalists emphasized precision, suggesting a possible respect for the specificity of modern dental interventions. On the other hand, the general population primarily cited effectiveness, implying faith in the results produced by modern dentistry (Sälzer et al., 2020). The perception of traditional medicine being less expensive was shared by the majority of both groups, which may highlight economic considerations as a key factor influencing treatment choice. The fact that herbalists also cited the side effects of modern drugs and the easier acquisition of traditional medicines as reasons for preference further underscores the perceived advantages of herbal remedies, especially in terms of accessibility and safety (Inamdar et al., 2008).

In terms of reasons for seeking oral care treatment, also cited in Table 2, dental pain was the most common among both groups, suggesting that the need for pain management is a universal motivator for seeking oral care (Spector et al., 2012). However, gingivitis and periodontitis were prevalent reasons for herbalists (96.92%), more so than the general population (62.70%). This could indicate that herbalists receive more requests for these conditions from clients or that the prevalence of these conditions is higher in this

Table 2. Treatment choice and causes for consulting by informants

Variable	Herbalists 65 (26%)	General population 185 (74%)	Total 250 (100%)	Chi-square/ Cramer's V
Would you prefer:				
Medical treatments (dentistry)	-	52 (28.11%)	52 (20.8%)	<0.0001*/0.216
Phytotherapeutic treatments	27 (41.54%)	37 (20.00%)	64 (25.6%)	
Both	38 (58.46%)	96 (51.89%)	134 (53.6%)	
Reasons to use modern medicine				
More precise	34 (52.31%)	54 (29.19%)	88 (35.2%)	<0.0001*/0.399
Effective	18 (27.69%)	131 (70.81%)	149 (59.6%)	
Easy access to medicines	1 (1.54%)	43 (23.24%)	44 (17.6%)	
Toxicity of plants	-	14 (7.57%)	14 (5.6%)	
Reasons to use traditional medicine				
Less expensive	35 (53.85%)	114 (61.62%)	149 (59.6%)	<0.0001*/0.237
Side effects of drugs	14 (21.54%)	12 (6.49%)	26 (10.4%)	
Acquisition	10 (15.38%)	20 (10.81%)	30 (12%)	
Ineffective medication	1 (1.54%)	2 (1.08%)	3 (1.2%)	
Reasons for consultation and oral treatment				
Dental pain	46 (70.77%)	141 (76.22%)	187 (74.8%)	0.20/0.144
Abscess/ Cellulitis	5 (7.69%)	20 (10.81%)	25 (10%)	
Aphtha	10 (15.38%)	19 (10.27%)	29 (11.6%)	
Caries	18 (27.69%)	32 (17.30%)	50 (20%)	
Gum pain	38 (58.46%)	53 (28.65%)	91 (36.4%)	
Gingivitis/Parodontitis	63 (96.92%)	116 (62.70%)	179 (71.6%)	
Halitosis	11 (16.92%)	7 (3.78%)	18 (7.2%)	
Herpes	1 (1.54%)	1 (0.54%)	2 (0.8%)	

*Denote statistical difference at the 5% level.

group (Nazir, 2017). The chi-square test showed no significant association between the group and the reasons for consultation (p=0.20), with a Cramer's V of 0.144 suggesting a weak association.

Additional traditional remedies for oral care

Table 3 presents additional traditional treatments cited by informants, including alum, salt, and vinegar, along with their respective methods of use. A significant majority of herbalists, 98.46%, reported the use of alum, compared to just 6.49% of the general population. This indicates a strong preference or belief in the effectiveness and extensive knowledge of this traditional treatment and its historical use in oral care among this group. Conversely, the low percentage of the general population who reported using alum suggests limited knowledge, accessibility, or faith in this method. Indeed, numerous studies have proven alum's effectiveness in reducing plaque, controlling gingivitis, and inhibiting specific micro-organisms (Malekzade et al., 2019; Putt et al., 1996; Thomas et al., 2015; Vanishree et al., 2021). Salt and vinegar were less commonly mentioned. Although these remedies have been described in ancient times, a mixture of salts, alum, and vinegar was even recommended by Hippocrates as a mouthwash to combat halitosis (Gurudath et al., 2012). Regarding the method of use, 100% of the herbalists who mentioned using alum reported using it as a rinse. In contrast, the general population employed a variety of methods, including rinsing, local application, or both. Chi-square and Cramer's V values indicate significant differences in the use of these treatments and their methods of application between the two groups. The uniformity of use of alum as a rinse among herbalists could indicate a common traditional method or a belief in the most effective mode of application. In contrast, the diversity of application methods in the general population

Table 3. Other traditional treatments cited by informants and their method of use.

Variable		Herbalists 65 (26%)	General population 185 (74%)	Total 250 (100%)	Chi-square/Cramer's V
Other traditional treatment	Alum	64 (98.46%)	12 (6.49%)	76 (30.4%)	<0.0001*/0.888
	Salt	1 (1.54%)	17 (9.19%)	18 (7.2%)	
	Vinegar	-	3 (1.62%)	3 (1.2%)	
Method of use	Rinsing	65 (100%)	25 (13.51)	90 (36%)	<0.0001*/0.777
	Local application	-	3 (1.62%)	3 (1.2%)	
	Both	-	2 (1.08%)	2 (0.8%)	

*Denote statistical difference at the 5% level.

could reflect less standardized knowledge or more individual approaches to the use of these remedies.

Analysis and interpretation of plant species preferences and family selection among respondents

Fig. 3 highlights the frequency of citations for each medicinal plant species by the two groups. The data demonstrates that the most frequently mentioned plant by herbalists was *Juglans regia* L., mentioned by 28% of respondents, closely followed by *Syzygium aromaticum* L. (23.3%). *Ammi visnaga* L. (18.5%), *Salvadora persica* L. (16.4%), and *Punica granatum* L. (16.4%) were mentioned more frequently by herbalists (16.4%) compared to the general population. This might be indicative of these plants' particular value or effectiveness in the view of herbalists or perhaps their specialized knowledge about these species. On the other hand, the general population cited *Syzygium aromaticum* L. the most (41.8%), followed by *Juglans regia* L. (34.5%) and *Origanum compactum* Benth./*O. vulgare* L. (31.0%). This suggests that these species might be more well-known, accessible, or favored among the general population, perhaps due to cultural familiarity or the perceived effectiveness of these plants for oral care. Interesting contrasts can be observed between the two groups. For instance, while *Origanum compactum* Benth./*O. vulgare* L. was mentioned by 31.0% of the general population. It was referenced by only 19.4% of herbalists. Similarly, *Syzygium aromaticum* L. was a top choice among the general population but was mentioned less frequently by herbalists (23.3%). On the other end of the graph, plants such as *Marrubium vulgare* L., *Daphne gnidium* L., *Pimpinella anisum* L., *Teucrium polium* L., and *Nerium oleander* L. were solely mentioned by herbalists, indicating that their usage might be more specialized or less known among the general population. Conversely, some plants like *Quercus suber* L. and *Glycyrrhiza glabra* L. were mentioned more frequently by herbalists than the general population, possibly indicating these plants' greater recognition or value in the herbalist community.

Out of 185 individuals from the general population surveyed, 18 people (approximately 9.73%) did not choose any plant-based or phytotherapeutic treatment options. Instead, they preferred mechanical dentistry methods, possibly valuing the precision, effectiveness, and accessibility of modern dental medicine. This indicates that despite the widespread use of traditional and plant-based oral care solutions, a significant subset of the population still leans towards conventional, modern dental treatments.

Fig. 4 presents the frequency of citations, as a percentage, of various plant families by all informants. The most frequently cited plant family was *Lamiaceae* at 17.8%, *Myrtaceae* at 14.4%, and *Juglandaceae* at 11.8%, suggesting a preference or perceived effectiveness of these plant families in traditional oral care. Other plant families with significant mentions include *Asteraceae* at 8.8%, *Apiaceae* at 6.6%, *Oleaceae* and *Punicaceae* at 6.2%, and *Theaceae* at 5.6%. Less frequently cited families include *Fabaceae* (3.4%), *Lauraceae* (3.9%), and *Salvadoraceae* (5.1%). The remaining plant families were each mentioned in less than 3% of citations, including *Amaranthaceae*, *Apocynaceae*, *Fagaceae*, *Liliaceae*, *Malvaceae*, *Ranunculaceae*, *Thymelaeaceae*, *Urticaceae*, and *Zygophyllaceae*. These findings underscore the diversity and complexity of plant species and family preferences in traditional oral care practices. They highlight the influence of factors such as traditional knowledge, perceived effectiveness, accessibility, cultural or individual preferences, and the interaction between traditional and modern approaches. A detailed representation of the relationship between the plants mentioned and the corresponding botanical families is shown in Table 4.

The study in Meknes found that herbalists and the general population both highly favored *Origanum compactum*, *Syzygium aromaticum*, and *Juglans regia* for oral health. This suggests a strong link between their usage and commercial demand (Harouak et al., 2019).

A study conducted in Casablanca identified *Lamiaceae*, *Apiaceae*, *Asteraceae*, and *Myrtaceae* as the most cited plant families (Zougagh et al., 2019). These families are significant as they represent key components of the spontaneous flora in Morocco and the Mediterranean region (Benítez et al., 2010; Khabbach et al., 2012; Zougagh et al., 2019). In a study conducted in the Middle Atlas, the *Asteraceae* family was found to be the most predominant, consisting of 7 species. It was followed by the *Lamiaceae* family (Najem et al., 2020). In Mahajanga, Madagascar, the *Fabaceae* family emerged as the most frequently cited family, comprising ten species (Ranjarisoa et al., 2016). On the other hand, in a study conducted in Mexico, the *Myrtaceae* and *Punica* families were the most cited (Rosas-Piñón et al., 2012).

Assessment of plant use: UV, RFC, and FUV analysis

Table 4 presents plant species along with their respective botanical families, vernacular names, used parts, purposes of oral use, preparation modes, and use methods. Additionally, it includes the use values, the relative frequency of citations for both categories of populations (herbalists and general population), and the family use values.

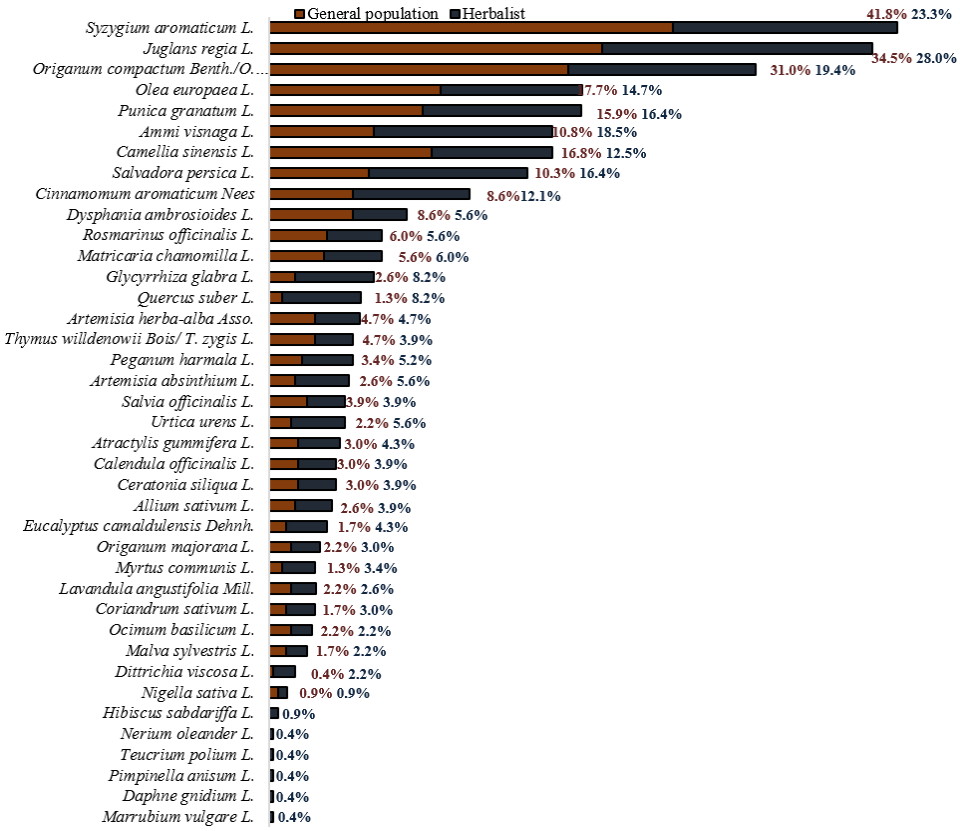

Figure 3. Relative citation percentages of different plant species by herbalists and the general population

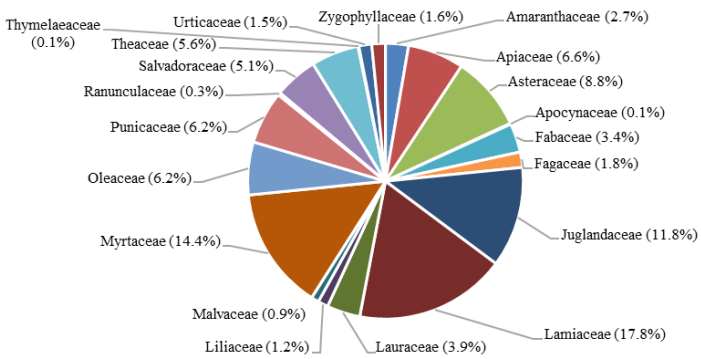

Figure 4. Distribution of plant family selection among respondents.

Table 4. Ethnobotanical Inventory of medicinal plants used for oral health.

Family name	Scientific name	Vernacular name	Used part	Purpose of oral use	Preparation modes	Use methods	UV_h	RCF_h	UV_p	RCF_p	FUV
Amaranthaceae	*Dysphania ambrosioides* (L.) Mosyakin & Clemants	Mkhinza	Leaf Aerial parts	Gum ailments Aphthous stomatitis	Cataplasm Infusion Decoction	Local application Rinsing	0.431	0.200	0.157	0.108	0.136
Apiaceae	*Coriandrum sativum* L.	Kosbor	Leaf Seed	Dental pain Gum ailments Stomatitis	Fresh Dry Infusion	Mastication Rinsing local application	0.308	0.107	0.027	0.021	0.216
	Pimpinella anisum L.	Habat hlawa	Seed	Gum disease	Decoction	Rinsing	0.015	0.015	0	0	
	Ammi visnaga L.	Bchnikha	Flower Stem	Decay prevention Gum disease Halitosis Stomatitis	Dry Infusion	Local application Rinsing	1.508	0.661	0.211	0.135	
Asteraceae	*Atractylis gummifera* L.	Addad	Root Flower	Gum disease Dental abscess Stomatitis	Infusion Decoction	Rinsing	0.308	0.153	0.038	0.037	0.151
	Artemisia absinthium L.	Chiba	Leaf Stem Total plant	Gum disease Dental pain Aphthous stomatitis Candidal stomatitis	Fresh Infusion	Mastication Rinsing	0.523	0.200	0.054	0.032	
	Artemisia herba-alba Asso.	Chih	Leaf Total plant	Gum disease Dental abscess Stomatitis Halitosis	Decoction Infusion	Rinsing	0.631	0.169	0.135	0.059	
	Matricaria chamomilla L.	Babounj	Flower	Gum disease Dental pain Stomatitis Halitosis	Infusion Decoction Maceration	Rinsing	0.662	0.215	0.146	0.070	

Table 4. Ethnobotanical Inventory of medicinal plants used for oral health (continued…)

Family name	Scientific name	Vernacular name	Used part	Purpose of oral use	Preparation modes	Use methods	UV_h	RCF_h	UV_p	RCF_p	FUV
	Calendula officinalis L.	Jemra	Flower	Aphthous stomatitis Candidal stomatitis Gum disease	Floral water Decoction Infusion	Rinsing	0.292	0.138	0.038	0.038	
	Dittrichia viscosa (L.) Greuter	Tarrahla	Leaf Flower	Gum disease	Infusion	Rinsing	0.169	0.077	0.005	0.005	
Apocynaceae	*Nerium oleander* L.	Defla	Flower	Gum disease Dental pain Halitosis	Infusion	Rinsing	0.046	0.015	0	0	0.012
Fabaceae	*Ceratonia siliqua* L.	Kharoub	Fruit	Aphthous stomatitis Gum disease Decay prevention Herpetic Stomatitis	Infusion Decoction Dry Powder	Rinsing Mastication Local application	0.277	0.138	0.038	0.038	0.132
	Glycyrrhiza glabra L.	Arksouss	Stem	Decay prevention Gum disease Dental pain Halitosis Aphthous stomatitis	Infusion Decoction Dry	Local application Rinsing Mastication	0.631	0.292	0.054	0.032	
Fagaceae	*Quercus suber* L.	Dbagh	Bark	Aphthous stomatitis Candidal stomatitis Gum disease Dental dentaire	Infusion Decoction Powder	Rinsing Local application	0.769	0.292	0.043	0.016	0.232
Juglandaceae	*Juglans regia* L.	Souak/wrak lgergaa	Bark Leaf	Gum disease Decay prevention Halitosis Dental pain Stomatitis Dental abscess	Dry Infusion Decoction Cataplasm	Local application Mastication Rinsing	2.492	1	0.875	0.432	1.288

Table 4. Ethnobotanical Inventory of medicinal plants used for oral health (continued…)

Family name	Scientific name	Vernacular name	Used part	Purpose of oral use	Preparation modes	Use methods	UV_h	RCF_h	UV_p	RCF_p	FUV
Lamiaceae	*Ocimum basilicum* L.	Lehabaq	Leaf	Aphthous stomatitis Gum disease	Fresh Dry Infusion Decoction	Mastication Local application Rinsing	0.169	0.077	0.032	0.027	0.185
	Lavandula angustifolia Mill.	Lkhzama	Leaf Flower	Aphthous stomatitis Gum disease Halitosis Herpetic stomatitis	Fresh Infusion Decoction Cataplasm	Mastication Rinsing Local application	0.138	0.092	0.049	0.027	
	Origanum majorana L.	Merdadouch	Leaf Aerial part	Gum disease Dental pain Stomatitis	Decoction Infusion	Rinsing	0.277	0.108	0.027	0.027	
	Marrubium vulgare L.	Mariouath	Leaf	Gum disease	Decoction Infusion	Rinsing	0.046	0.015	0	0	
	Teucrium polium L.	Khayata	Rhizome	Gum disease	Decoction	Rinsing	0.046	0.015	0	0	
	Origanum sp.	Zaatar	Leaf	Gum disease Halitosis Stomatitis Dental pain Dental abscess	Infusion Decoction Dry Fresh Cataplasm	Rinsing Local application Mastication	1.631	0.692	0.670	0.389	
	Rosmarinus officinalis L.	Azir	Leaf	Halitosis Gum disease Dental abscess Dental pain Stomatitis	Infusion Decoction Cataplasm	Rinsing Local application	0.477	0.200	0.157	0.075	
	Salvia officinalis L.	Salmia	Leaf Aerial part	Gum disease	Infusion Decoction	Rinsing	0.338	0.138	0.065	0.048	

Table 4. Ethnobotanical Inventory of medicinal plants used for oral health (continued…)

Family name	Scientific name	Vernacular name	Used part	Purpose of oral use	Preparation modes	Use methods	UV_h	RCF_h	UV_p	RCF_p	FUV
	Thymus sp.	Zaitra	Leaf Aerial part	Gum disease Stomatitis Dental pain Dental abscess	Infusion Decoction	Rinsing	0.554	0.138	0.097	0.059	
Lauraceae	*Cinnamomum aromaticum* Nees	Lkrfa	Bark	Gum disease Stomatitis Dental pain Decay prevention	Infusion Decoction Powder	Rinsing Local application	0.892	0.431	0.168	0.108	0.356
Liliaceae	*Allium sativum* L.	Touma	Clove	Dental abscess Dental pain Gum disease	Fresh Cataplasm	Local application Mastication	0.415	0.138	0.065	0.032	0.156
Malvaceae	*Malva sylvestris* L.	Khobiza	Leaf Stem Aerial part	Gum disease Stomatitis Dental abscess	Fresh Infusion Decoction Cataplasm	Mastication Rinsing Local application	0.123	0.077	0.022	0.022	0.032
	Hibiscus sabdariffa L.	karkadi	Flower	Gum disease	Infusion	Rinsing	0.062	0.031	0	0	
Myrtaceae	*Eucalyptus camaldulensis* Dehnh.	Kaliptus	Leaf	Stomatitis Halitosis Gum disease Dental abscess	Infusion Decoction	Rinsing	0.446	0.154	0.032	0.022	0.538
	Myrtus communis L.	Rayhan	Leaf	Gum disease Halitosis Stomatitis Dental abscess	Infusion Decoction	Rinsing	0.308	0.123	0.022	0.016	

Table 4. Ethnobotanical Inventory of medicinal plants used for oral health (continued…)

Family name	Scientific name	Vernacular name	Used part	Purpose of oral use	Preparation modes	Use methods	UV_h	RCF_h	UV_p	RCF_p	FUV
	Syzygium aromaticum (L.) Merr. & L.M.Perry	Oudnouar ou krnfl	Floral bud	Dental pain Gum disease Decay prevention Stomatitis Halitosis Dental abscess	Dry Powder Infusion Decoction	Local application Mastication Rinsing	2.015	0.831	1.157	0.524	
Oleaceae	*Olea europaea* L.	Zitoun	Leaf Oil	Gum disease Dental pain Stomatitis Halitosis	Infusion Decoction Fresh	Rinsing Mastication	1.323	0.523	0.395	0.222	0.636
Punicaceae	*Punica granatum* L.	Roman	Fruit husk	Gum disease Stomatitis Dental abscess	Infusion decoction Powder Dry	Rinsing Local application	1.431	0.585	0.303	0.200	0.596
Ranunculaceae	*Nigella sativa* L.	Sanouj	Seed	Gum disease	Infusion decoction	Rinsing	0.062	0.031	0.027	0.011	0.036
Salvadoraceae	*Salvadora persica* L.	Oud alarak	Stem	Decay prevention Gum disease Dental pain Halitosis Aphthous stomatitis	Dry Decoction infusion	Local application Mastication Rinsing	1.385	0.585	0.259	0.130	0.552
Theaceae	*Camellia sinensis* L.	Atay	Leaf	Gum disease Halitosis Stomatitis Decay prevention	Decoction Infusion	Rinsing	0.923	0.446	0.351	0.211	0.496

Table 4. Ethnobotanical Inventory of medicinal plants used for oral health (continued…)

Family name	Scientific name	Vernacular name	Used part	Purpose of oral use	Preparation modes	Use methods	UV_h	RCF_h	UV_p	RCF_p	FUV
Thymelaeaceae	*Daphne gnidium* L.	Alzzaz	Leaf	Dental pain Gum pain	Decoction Infusion	Rinsing	0.031	0.015	0	0	0.008
Urticaceae	*Urtica urens* L.	Lhariga	Leaf Aerial parts	Gum disease Stomatitis Dental abscess Dental pain	Infusion Decoction Fresh	Rinsing Local application	0.385	0.200	0.027	0.027	0.120
Zygophyllaceae	*Peganum harmala* L.	Lharmal	Seed	Gum disease Dental abscess Aphthous stomatitis Herpetic stomatitis Dental pain	Infusion Decoction Powder	Rinsing Local application	0.446	0.185	0.076	0.043	0.172

UVh: Use value for herbalists; UVp: Use value for the general population; RCFh: Relative Frequency of Citations for herbalists; RCFp: Relative Frequency of Citations for the general population; FUV: Family Use Value of informants.

Table 5. Informant consensus factor (ICF) values in the treatment of oral complaints, by informant category.

Oral ailment	Herbalists			General population		
	Nur	Nt	ICF	Nur	Nt	ICF
Dental abscess	32	10	0.710	25	13	0.500
Aphthous stomatitis	100	28	0.727	58	22	0.632
Candidal stomatitis	40	21	0.487	20	11	0.474
Dental pain	105	22	0.798	115	17	0.860
Gum pain	311	37	0.884	179	27	0.854
Gum inflammation	532	39	0.928	436	28	0.938
Halitosis	39	15	0.632	58	13	0.789
Herpetic stomatitis	11	6	0.500	8	7	0.143
Decay prevention	109	12	0.898	88	14	0.851
Gum bleeding	215	35	0.841	90	24	0.742

Nur: number of use reports from informants for a particular plant-use category; Nt: number of species that are used for that plant-use category.

For herbalists, the plant with the highest UV (2.492) is *Juglans regia* L. This indicates that this plant species is most commonly used by herbalists for oral health purposes. Other plants with high UV include *Syzygium aromaticum* L. (2.015), *Origanum sp*. (*compactum* or *vulgare*) (1.631), *Ammi visnaga* L. (1.508), *Punica granatum* L. (1.431), and *Olea europaea* L. (1.323). It is important to note that these values might reflect the professional knowledge of herbalists rather than broader community use. The lowest UV in this category was recorded for *Pimpinella anisum* L., with 0.015. On the other hand, the plant with the highest UV for the general population is *Syzygium aromaticum* (1.157). This suggests that this species is most commonly used by the general population, possibly reflecting its accessibility, efficacy, or cultural significance. Other species with high UV values in this category included *Juglans regia* L. (0.875), *Origanum sp*. (0.670), *Olea europaea* L. (0.395), and *Camellia sinensis* L. (0.351). *Dittrichia viscosa* (0.005) was the species with the lowest UV. *Pimpinella anisum* was among the plants that were not cited by the general population. This variation in UV between the two populations points to differing practices, preferences, or knowledge between herbalists and the broader community.

Juglans regia L. has the highest RFC value for herbalists (1), followed by *Syzygium aromaticum* (0.831) and *Origanum* sp. (0.692). Similarly, for the general population, these plants also rank high in RFC, though the order differs: *Syzygium aromaticum* leads (0.524), followed by *Juglans regia* L. (0.432) and *Origanum* sp. (0.389). This indicates that these species are the most frequently cited by both herbalists and the general population, highlighting their significance in oral health practices reported by the informants.

The study conducted by Zougagh et al. (2019) recorded the highest UV value of 0.94 for *Syzygium aromaticum*. In the study conducted by Najem et al. (2020), the most significant UV values were obtained for *Ruta montana* L. (0.431), followed by *Ammi visnaga* L. (0.362). Regarding the RCF, according to the herbalists of the Middle Atlas region, the highest values were reported for *Marrubium vulgare* L., followed by *Ruta montana* L., *Atractylis gummifera* L., and *Olea europaea* L.

The family with the highest FUV is *Juglandaceae* (1.288), to which *Juglans regia* L. belongs. This suggests that this family of plants has significant importance in the community for oral health practices. It is used for various oral health issues, including gum disease, decay prevention, halitosis, dental pain, stomatitis, and dental abscesses (Bhardwaj et al., 2023). This result was in line with the highest FUV reported in Casablanca for oral health (Zougagh et al., 2019).

ICF and FL values analysis for oral ailments among different informant categories

The informant consensus factor (ICF) values for various oral health conditions in Table 5 provide insightful patterns on the consensus among herbalists and the general population regarding the preferred medicinal plants used in treatment. For dental abscesses, herbalists demonstrate a higher ICF (0.710) than the general population (0.500), indicating more agreement among them on the efficacious plant species. Similarly, for aphthous stomatitis, herbalists exhibit a marginally higher ICF (0.727) over the general population (0.632), suggesting a slightly tighter consensus. In contrast, the agreement level for the use of plants in treating candidal stomatitis is fairly comparable between the herbalists (ICF = 0.487) and the

general population (ICF = 0.474). Both groups display high ICF values for dental and gum pain; however, the general population has a slightly stronger consensus for dental pain, while the herbalists have a higher consensus for gum pain. The highest consensus across both groups is noted for gum inflammation, indicating a strong agreement on the medicinal plants used for its treatment. In treating halitosis, a greater consensus is observed among the general population as opposed to the herbalists. Conversely, the herbalists demonstrate a significantly higher consensus for herpetic stomatitis than the general population, suggesting more certainty or agreement among them regarding the plants used. Finally, both groups display high ICF values for decay prevention and gum bleeding, yet the herbalists show a slightly higher consensus in both cases. Overall, these ICF values reflect the degree of shared knowledge and agreement among informants about the effective use of plant species for specific oral health conditions (Caunca and Balinado, 2021), with varying degrees of consensus observed between herbalists and the general population.

Table 6 presents the fidelity levels of various plant species used for treating dental ailments, including dental abscesses, aphthous stomatitis, candidal stomatitis, dental pain, gum pain, and gum inflammation, among the general population (P) and herbalists (H). For dental abscesses, plants like *Atractylis gummifera*, *Urtica urens*, *Allium sativum*, and *Lavandula angustifolia* showed varied fidelity levels between the two groups. For instance, *Atractylis gummifera* and *Allium sativum* were more favored by herbalists, while *Lavandula angustifolia* and *Urtica urens* were popular among the general population. *Malva sylvestris* and *Myrtus communis* (P: 50%) had high fidelity levels within the general population. For the treatment of aphthous stomatitis, *Ocimum basilicum*, *Urtica urens*, and *Calendula officinalis* had high fidelity levels in both groups. *Atractylis gummifera* and *Ceratonia siliqua* were commonly preferred by the general population. The highest fidelity level was attributed to *Atractylis gummifera* when treating candidal stomatitis. *Artemisia herba-alba* had a fidelity level of 12.20% among herbalists, and *Malva sylvestris* was given a fidelity level of 25% by the general population for treating this ailment. Regarding dental pain, both groups agreed on the efficacy of *Coriandrum sativum* and *Syzygium aromaticum*. *Daphne gnidium* (50%) and *Nerium oleander* (33.33%) had high fidelity levels exclusively among herbalists. On the other hand, the general population expressed their trust in *Lavandula angustifolia* (22.22%), *Peganum harmala* (21.43%), and *Allium sativum* (33.33%). For the treatment of gum pain, *Daphne gnidium* notably shows an extremely high fidelity level among herbalists (50%). *Dittrichia viscosa* (100%) and *Origanum majorana* (60%) demonstrate high fidelity levels within the general population compared to herbalists. *Nigella sativa* exhibits nearly similar high trust levels among both groups, followed by *Quercus suber* and *Coriandrum sativum*. The treatment of gum inflammation involved a wide range of plants that exhibited high fidelity levels. Both groups similarly agreed on the use of *Juglans regia*, *Cinnamomum aromaticum*, *Olea europaea*, and *Punica granatum*. Plants like *Pimpinella anisum*, with a level of 100%, and *Hibiscus sabdariffa*, with a level of 50%, were specifically preferred by herbalists. In terms of halitosis, both groups recorded significant fidelity levels for *Lavandula angustifolia*, *Glycyrrhiza glabra*, *Artemisia absinthium*, and *Camellia sinensis*. *Eucalyptus camaldulensis* and *Salvadora persica* were among the most favored by the general population, while herbalists showed a noticeable preference for *Nerium oleander*. For the treatment of herpetic stomatitis, the general population primarily favored *Urtica urens*, while herbalists preferred *Peganum harmala*. It is important to note that *Ceratonia siliqua* was used by both groups to treat this ailment. *Glycyrrhiza glabra* and *Ammi visnaga* demonstrated high fidelity levels among both groups in preventing tooth decay. Herbalists, however, had a particular inclination towards *Salvadora persica*, while the general population strongly preferred *Quercus suber* and *Juglans regia*. When it comes to gum bleeding, herbalists displayed a marked preference for *Teucrium polium*, *Origanum majorana* L., *Eucalyptus camaldulensis* Dehnh, and *Artemisia* species. The general population also used these plants to a lesser extent and exhibited considerable usage of *Ocimum basilicum* L. Despite these variations, it's vital to understand that these fidelity levels simply represent the relative popularity or usage of these plants for oral health issues among the two groups, and they do not necessarily correlate with the effectiveness of these remedies. The effectiveness of these plants would require rigorous scientific testing and should not be inferred solely from their popularity.

In the study of Zougagh et al. (2019), the highest ICF value was attributed to Gum disease, which includes gum inflammation, gum pain, and gum bleeding. The same study also reported high FL values for widely used medicinal plants. Specifically, the 100% fidelity level was attributed to plants used as remedies for a single type of disease, compared to those used for multiple types of diseases. In agreement with these findings, Najem et al. (2020) reported a high ICF value for dental abscess, followed by dental pain and gingivitis, as reported by herbalists of the Middle Atlas region. The highest FL reported in the latter study was associated with *Ruta montana* L. for the treatment of gingivitis, and *Ammi visnaga* was highly recommended for the treatment of various oral conditions.

Table 6. Evaluation of fidelity levels (FL) in the usage of medicinal plants for oral disorders.

Ailments	FL by plants
Dental abscess	*Atractylis gummifera* L. (P: 14.29%, H: 35%), *Eucalyptus camaldulensis* Dehnh (H: 6.9%), *Lavandula angustifolia* Mill. (P: 22.22%, H: 10%), *Malva sylvestris* L. (P: 50%), *Peganum harmala* L. (P: 7.14%), *Urtica urens* L. (P: 40%, H: 16%), *Myrtus communis* L. (P: 50%), *Artemisia herba-alba Asso.* (P: 8%, H: 7.32%), *Matricaria chamomilla* L. (P: 3.7%), *Syzygium aromaticum* (L.) Merr. & L.M.Perry (P: 3.74%, H: 1.53 %), *Ammi visnaga* L. (P: 2.56%), *Origanum* sp. (H: 2.83%), *Rosmarinus officinalis* L. (P: 3.45%, H: 3.23%), *Juglans regia* L. (P: 0.62%), *Allium sativum* L. (P: 8.33%, H: 29.63%), *Thymus* sp. (H: 2.78%)
Aphthous stomatitis	*Ocimum basilicum* L. (P: 50%, H: 36.36%), *Cinnamomum aromaticum* Nees. (P: 3.23%, H: 1.72%), *Ceratonia silique* L. (P: 57.14%, H: 16.67%), *Atractylis gummifera* L. (P: 42.86%, H: 20%), *Coriandrum sativum* L. (P: 20%, H: 5%), *Eucalyptus camaldulensis* Dehnh (H: 6.9%), *Lavandula angustifolia* Mill. (H: 20%), *Origanum majorana* L. (P: 20%) *Urtica urens* L. (P: 40%, H: 32%), *Glycyrrhiza glabra* L. (P: 10%, H: 4.88%), *Camellia sinensis* (L.) Kuntze (P: 4.62%, H: 1.67%), *Artemisia absinthium* L. (P: 20%, H: 5.88%), *Artemisia herba-alba* Asso. (P: 12%, H: 9.76%), *Matricaria chamomilla* L. (P: 14.81%, H:18.6%), *Calendula officinalis* L. (P: 28.57%, H: 31.58%), *Syzygium aromaticum* (L.) Merr. & L.M.Perry (P: 4.21%, H: 4.58%), *Quercus suber* L. (P: 12.50%, H: 4%), *Punica granatum* L. (P: 1.79%, H: 4.30%), *Peganum harmala* L. (H: 6.9%), *Salvadora persica* L.(P: 8.33%, H: 2.22%), *Olea europaea* L. (P: 2.74%, H: 3.49%), *Origanum* sp.(P: 2.42%, H: 8.49%), *Rosmarinus officinalis* L. (P: 6.9%), *Thymus* sp. (P: 11.11%, H: 16.67%), *Juglans regia* L. (P: 2.47%, H: 6.17%), *Ammi visnaga* L. (H: 2.04%), *Dysphania ambrosioides* L. (H: 3.57%), *Allium sativum* L. (H: 11.11%), *Malva sylvestris* L. (H: 12.50%), *Myrtus communis* L. (H: 5%)
Candidal stomatitis	*Ocimum basilicum* L. (P: 16.67%), *Cinnamomum aromaticum* Nees (H: 1.72%), *Atractylis gummifera* L. (P: 42.86%, H: 20%), *Coriandrum sativum* L. (H: 5%) *Eucalyptus camaldulensis* Dehnh (H: 10.34%), *Origanum majorana* L. (H: 5.56%), *Malva sylvestris* L. (P: 25%), *Camellia sinensis* (L.) Kuntze (H: 1.67%), *Artemisia absinthium* L. (H: 2.94%), *Artemisia herba-alba Asso.* (P: 8%, H: 12.2%), *Matricaria chamomilla* L. (H: 6.98%), *Syzygium aromaticum* (L.) Merr. & L.M.Perry (P: 2.34%, H: 0.76%), *Quercus suber* L. (H: 2%), *Punica granatum* L. (P: 1.79%, H: 1.08%), *Olea europaea* L. (P: 2.74%,H: 2.33%), *Origanum* sp. (H: 1.89%), *Rosmarinus officinalis* L. (P: 6.9%, H: 3.23%), *Juglans regia* L. (P: 0.62%, H: 1.85%), *Thymus* sp. (P: 5.56%, H: 8.33%), *Allium sativum* L. (H: 7.41%), *Myrtus communis* L. (H: 5%), *Urtica urens* L. (H: 8%), *Calendula officinalis* L. (H: 5.26%)
Dental pain	*Cinnamomum aromaticum* Nees (P: 12.90%, H: 6.9%), *Coriandrum sativum* L. (P: 60%, H: 35%), *Lavandula angustifolia* Mill (P: 22.22%), *Origanum majorana* L. (H: 5.56%), *Glycyrrhiza glabra* L. (P: 10%, H: 9.79%), *Artemisia herba-alba Asso.* (P: 4%, H: 2.44%), *Matricaria chamomilla* L. (P: 7.41%, H: 2.33%), *Syzygium aromaticum* (L.) Merr. & L.M.Perry (P: 28.97%, H: 21.37%), *Peganum harmala* L.(P: 21.43%, H: 3.45%), *Punica granatum* L. (P: 1.79%, H: 6.45%), *Ammi visnaga* L (H: 9.18%), *Nerium oleander* L. (H: 33.33%), *Salvadora persica* L. (P: 6.25%, H: 4.44%), *Dysphania ambrosioides* L. (P: 6.9%), *Olea europaea* L. (P: 16.44%, H: 12.79%), *Origanum sp.*(P: 5.56%, H: 4.72%), *Rosmarinus officinalis* L. (P: 6.9%, H: 3.23%), *Juglans regia* L. (P: 2.47%, H: 4.32%), *Thymus* sp. (P: 11.11%, H: 5.56%), *Allium sativum* L. (P: 33.33%, H: 18.52%), *Myrtus communis* L. (H: 5%), *Urtica urens* L. (H: 4%), *Daphne gnidium* L. (H: 50%), *Quercus suber* L. (H: 8%)
Gum pain	*Ocimum basilicum* L. (H: 9.09%), *Cinnamomum aromaticum* Nees (P: 22.58%, H:27.59%), *Ceratonia siliqua* L. (P: 28.57%, H: 5.56%), *Atractylis gummifera* L. (H: 5%), *Coriandrum sativum* L. (P: 20%, H: 35%), *Eucalyptus camaldulensis* Dehnh (P: 16.67%, H: 17.24%), *Lavandula angustifolia* Mill. (H: 10%), *Origanum majorana* L. (P: 60%, H: 22.22%), *Glycyrrhiza glabra* L. (P: 20%, H: 9.76%), *Camellia sinensis* (L.) Kuntze (P: 18.46%, H: 30%), *Artemisia absinthium* L. (H: 17.65%), *Artemisia herba-alba* Asso. (P: 20%, H: 9.76%), *Matricaria chamomilla* L. (P: 18.52%, H: 18.6%), *Syzygium aromaticum* (L.) Merr. & L.M.Perry (P: 19.63%, H: 19.58%), *Quercus suber* L. (P: 25%, H: 38%), *Peganum harmala* L. (P: 21.43%, H: 13.79%), *Hibiscus sabdariffa* L. (H: 25%), *Punica granatum* L. (P: 14.29%, H: 27.96%), *Ammi visnaga* L. (P: 7.69%, H: 17.35%), *Teucrium polium* L. (H: 33.33%), *Salvadora persica* L. (P: 8.33%, H: 15.56%), *Dysphania ambrosioides* L. (P: 13.79%, H: 32.14%), *Olea europaea* L. (P: 20.55%, H: 23.26%), *Origanum* sp.(P: 16.13%, H: 20.75%), *Rosmarinus officinalis* L. (P: 13.79%, H: 25.81%), *Nigella sativa* L. (P: 40%, H: 50%), *Salvia officinalis* L. (P: 16.67%, H: 22.73%), *Juglans regia* L. (P: 13.58%, H: 24.07%), *Dittrichia viscosa* (L.) Greuter (P: 100%, H: 45.45%), *Thymus* sp. (P: 16.67%, H: 16.67%), *Allium sativum* L. (P: 33.33%, H: 7.41%), *Marrubium vulgare* L. (H: 33.33%), *Malva sylvestris* L. (H: 25%), *Myrtus communis* L.(H:20%), *Urtica urens* L. (H: 4%), *Daphne gnidium* L. (H: 50%)

Table 6. Evaluation of fidelity levels (FL) in the usage of medicinal plants for oral disorders (continued...)

Ailments	FL by plants
Gum inflammation	*Ocimum basilicum* L. (P: 16.67%, H: 36.36%), *Cinnamomum aromaticum* Nees (P: 54.84%, H: 44.83), *Ceratonia siliqua* L. (H: 38.89%), *Atractylis gummifera* L. (H: 15%), *Coriandrum sativum* L. (H: 15%), *Eucalyptus camaldulensis* Dehnh (P: 33.33%, H: 34.48%), *Lavandula angustifolia* Mill. (P: 11.11%, H: 50%), *Origanum majorana* L. (H: 33.33%), *Malva sylvestris* L. (P: 25%, H: 50%), *Myrtus communis* L. (P: 50%, H: 40%), *Glycyrrhiza glabra* L. (P: 20%, H: 26.83%), *Camellia sinensis* (L.) Kuntze (P: 53.85%, H: 45%), *Syzygium aromaticum* (L.) Merr. & L.M.Perry (P: 19.63%, H: 32.82%), *Artemisia absinthium* L. (P: 30%, H: 35.29%), *Artemisia herba-alba* Asso. (P: 32% , H: 24.39%), *Matricaria chamomilla* L. (P: 33.33%, H: 32.56%), *Calendula officinalis* L. (P: 71.43%, H: 36.84%), *Quercus suber* L. (P: 37.5%, H: 36%), *Peganum harmala* L. (P: 35.71%, H: 41.38%), *Hibiscus sabdariffa* L. (H: 50%), *Punica granatum* L. (P: 64.29%, H: 39.78%), *Ammi visnaga* L. (P: 46.15%,H: 30.61%),*Teucrium polium* L. (H: 33.33%), *Nerium oleander* L. (H: 33.33%), *Salvadora persica* L. (P: 35.42%, H: 27.78%), *Dysphania ambrosioides* L. (P: 58.62%, H: 46.43%), *Olea europaea* L. (P: 49.32%, H: 39.53%), *Origanum sp*. (P: 53.23%, H: 41.51%), *Rosmarinus officinalis* L. (P: 34.48%, H: 41.94%), *Nigella sativa* L. (P: 40%, H: 50%), *Salvia officinalis* L. (P: 75%, H: 40.91%), *Juglans regia* L. (P: 45.06%, H: 40.12%), *Dittrichia viscosa* (L.) Greuter (H: 45.45%), *Thymus* sp. (P: 38.89%, H: 25%), *Allium sativum* L. (P: 25%, H: 18.52%), *Marrubium vulgare* L. (H: 33.33%), *Urtica urens* L. (H: 24%), *Pimpinella anisum* L. (H: 100%)
Halitosis	*Eucalyptus camaldulensis* Dehnh (P: 33.33%), *Lavandula angustifolia* Mill. (P: 22.22%, H: 10%), *Glycyrrhiza glabra* L. (P: 20%, H: 9.76%), *Camellia sinensis* (L.) Kuntze (P: 6.15%, H: 5%), *Artemisia absinthium* L. (P: 10%, H: 8.82%), *Artemisia herba-alba* Asso. (H: 2.44%), *Matricaria chamomilla* L. (P: 3.7%, H: 4.65%), *Syzygium aromaticum* (L.) Merr. & L.M.Perry (P: 7%, H: 3.82%), *Punica granatum* L. (P: 3.57%, H: 1.08%), *Ammi visnaga* L. (P: 12.82%, H: 5.10%), *Nerium oleander* L.(H: 33.33%), *Salvadora persica* L. (P: 14.58%, H: 6.67%), *Olea europaea* L.(H: 1.16%), *Origanum sp*. (P: 1.61%, H: 0.94%), *Rosmarinus officinalis* L. (P: 10.34%), *Juglans regia* L. (P: 7.41%, H: 2.47%), *Myrtus communis* L. (H: 5%)
Herpetic stomatitis	*Ceratonia siliqua* L. (P: 14.29%, H: 11.11%), *Lavandula angustifolia* Mill. (P: 11.11%), *Urtica urens* L. (P: 20%, H: 8%) *Artemisia herba-alba* Asso. (H: 4.88%), *Matricaria chamomilla* L. (P: 3.7%), *Syzygium aromaticum* (L.) Merr. & L.M.Perry (P: 0.93%, H: 0.76%), *Peganum harmala* L. (H: 10.34%), *Origanum sp.* (P: 0.81%), *Salvia officinalis* L. (H: 4.55%), *Juglans regia* L. (P: 0.62%)
Decay prevention	*Cinnamomum aromaticum* Nees (P: 3.23%, H: 5.17%), *Ceratonia siliqua* L. (H: 5.56%), *Glycyrrhiza glabra* L. (P: 10%, H: 26.83), *Camellia sinensis* (L.) Kuntze (P: 6.15%), *Artemisia herba-alba* Asso. (P: 4%), *Syzygium aromaticum* (L.) Merr. & L.M.Perry (P: 7.48%, H: 9.16%), *Quercus suber* L. (P: 12.5%), *Punica granatum* L. (P: 7.14%, H: 1.08%), *Ammi visnaga* L. (P: 25.64%, H: 26.53%), *Salvadora persica* L. (P: 16.67%, H: 33.33%), *Dysphania ambrosioides* L. (P: 3.45%), *Olea europaea* L. (P: 1.37%, H: 1.16%), *Origanum sp.* (P: 9.68%, H: 0.94%), *Juglans regia* L. (P: 16.67%, H: 12.35%), *Thymus* sp. (P: 5.56%, H: 5.56%), *Artemisia absinthium* L. (H: 2.94%)
Gum bleeding	*Ocimum basilicum* L. (P: 16.67%, H: 18.18%), *Cinnamomum aromaticum* Nees (P: 3.23%, H: 12.07%), *Ceratonia siliqua* L. (H: 22.22%), *Atractylis gummifera* L. (H: 5%), *Coriandrum sativum* L. (H: 5%), *Eucalyptus camaldulensis* Dehnh (P: 16.67%, H: 24.14%), *Lavandula angustifolia* Mill. (P: 11.11%), *Origanum majorana* L. (P: 20%, H: 33.33%), *Glycyrrhiza glabra* L. (P: 10%, H: 12.20%), *Camellia sinensis* (L.) Kuntze (P: 10.77%, H: 16.67%), *Artemisia absinthium* L. (P: 10%, H: 26.47%), *Artemisia herba-alba Asso.* (P: 12%, H: 26.83%), *Matricaria chamomilla* L. (P: 14.81%, H:16.28%), *Syzygium aromaticum* (L.) Merr. & L.M.Perry (P: 3.27%, H: 5.34%), *Quercus suber* L. (P: 12.5%, H: 12%), *Peganum harmala* L. (P: 14.29%, H: 24.14%), *Hibiscus sabdariffa* L. (H: 25%), *Punica granatum* L. (P: 5.36%, H: 18.28%), *Ammi visnaga* L. (P: 5.13%, H: 9.18%),*Teucrium polium* L. (H: 33.33%), *Salvadora persica* L. (P: 10.42%, H: 10%), *Dysphania ambrosioides* L. (P: 17.24%, H: 17.86%), *Olea europaea* L. (P: 6.85%,H: 16.28%), *Origanum sp.* (P: 10.48%, H: 17.92%), *Rosmarinus officinalis* L. (P: 17.24%, H: 22.58%), *Nigella sativa* L. (P:20%), *Salvia officinalis* L. (P: 8.33%, H: 31.82%), *Juglans regia* L. (P: 10.49%, H: 8.64%), *Dittrichia viscosa* (L.) Greuter (H: 9.09%), *Thymus sp*. (P: 11.11%, H: 19.44%), *Allium sativum* L. (H: 7.41%), *Malva sylvestris* L. (H: 12.50%), *Myrtus communis* L. (H: 20%), *Urtica urens* L. (H: 4%), *Calendula officinalis* L. (H: 26.32%)

H: Herbalists, P: General population.

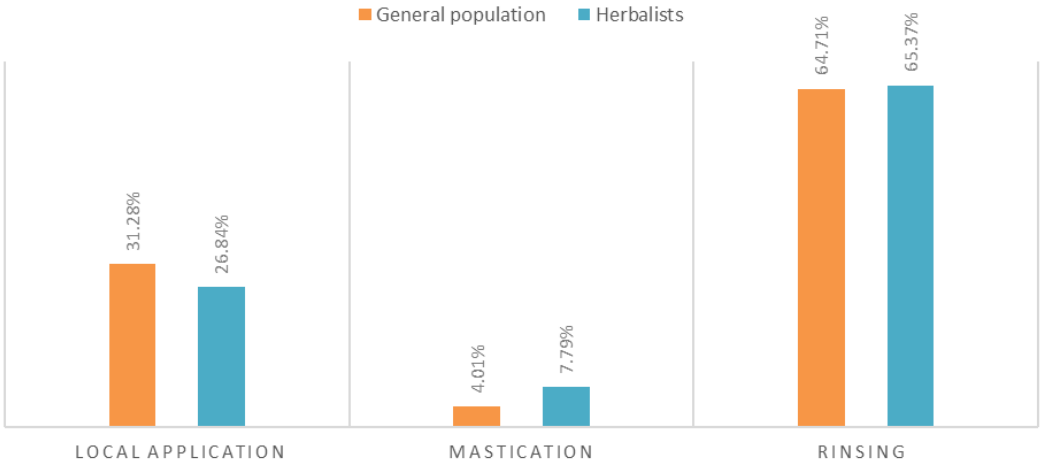

Figure 5. Administration methods cited by informants from both categories.

In the study conducted by Ranjarisoa et al. (2016) in Madagascar, the highest ICF values were found for tooth decay and gum disease, while the highest FL value for oral hygiene was assigned to *Cajanus cajan* L.

Administration methods

Fig. 5 shows the general population, and a group of herbalists administer plants for oral care (local application, chewing, rinsing). The majority of both groups prefer rinsing as a method of administration, with 64.71% of the general population and 65.37% of the herbalists. This might suggest that the plants are mainly used in teas, decoctions, or other water preparations. This practice could be primarily used to address oral health conditions such as gum diseases, dental pain, or halitosis. Local application is the second most used method by both groups, with 31.28% of the general population and 26.84% of the herbalists applying plants locally. This might mean that plants are often used topically, perhaps for gum or oral mucosa conditions, aches, or other ailments. Chewing (mastication) is the least common method of administration for both groups. However, it is interesting to note that herbalists use this method almost twice as much as the general population (7.79% vs. 4.01%). This could indicate that the group might have access to or knowledge about specific safe and beneficial plants to chew.

Local studies on oral care have consistently reported similar results, highlighting the effectiveness of mouthwashing and local application as commonly used methods (Harouak et al., 2019; Najem et al., 2020; Zougagh et al., 2019). These findings align with studies conducted in other countries that have reported similar results (Ranjarisoa et al., 2016; Rosas-Piñón et al., 2012).

Parts used

Fig. 6 presents the percentage usage of different plant parts by two groups: The general population and a group of herb collectors/healers. For both the general population and the herbalists, the most commonly used part of the plant is the leaf (35.53% and 33.23%, respectively). This implies that the leaf might have the most significant perceived medicinal or functional benefits among all plant parts. Given that leaves are often the most plentiful and accessible part of a plant, their high usage is not surprising. Their prevalent use might be attributed to their wide variety of active compounds, which might vary based on the plant species.

The second most used part by the general population is the bark at 15.31%, whereas for the herbalists, it's also the bark but at a slightly higher percentage (15.62%). This could suggest a common understanding between both groups about the benefits of using the bark of plants.

The usage of the flower is considerably higher among the herbalists (13.94%) compared to the general population (8.58%). This might indicate that the herbalists have additional knowledge or skills that allow them to make more use of the flowers. The rhizome is the least used part for both groups, with almost negligible use. This plant part may be less known or less accessible to both groups. The usage of the whole plant is also considerably higher among the herbalists (4.29%) compared to the general population (2.60%). This could suggest that herbalists are more likely to use the whole plant, potentially using a holistic approach to healing. Notably, only the general population uses petals (0.77%), although this is a small percentage. This could indicate a difference in cultural practices, knowledge, or preferences between

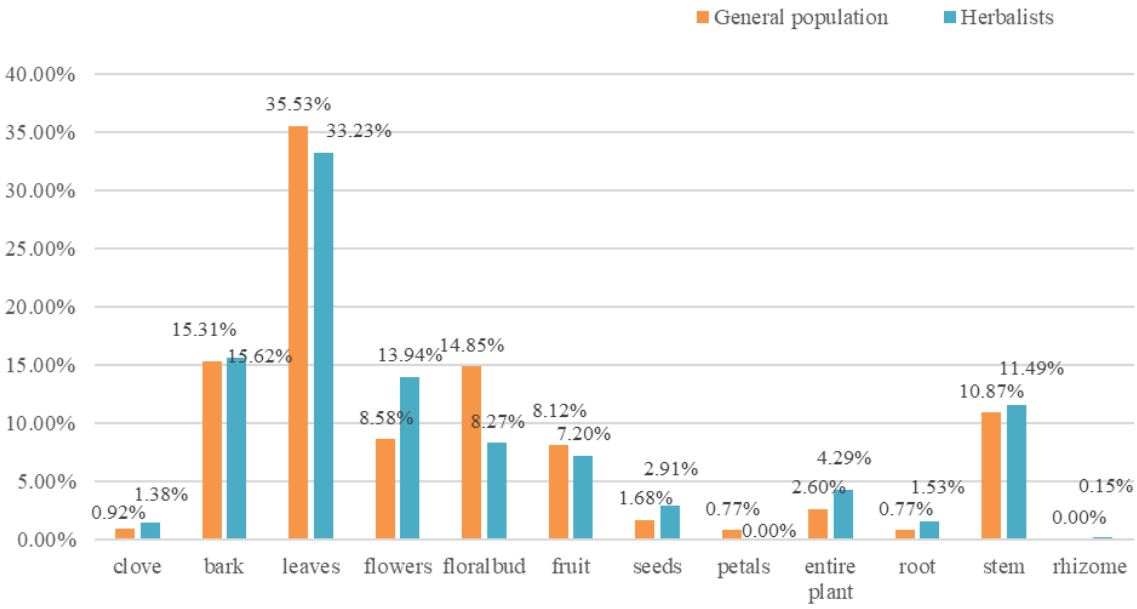

Figure 6. Parts of the plants used by the informants.

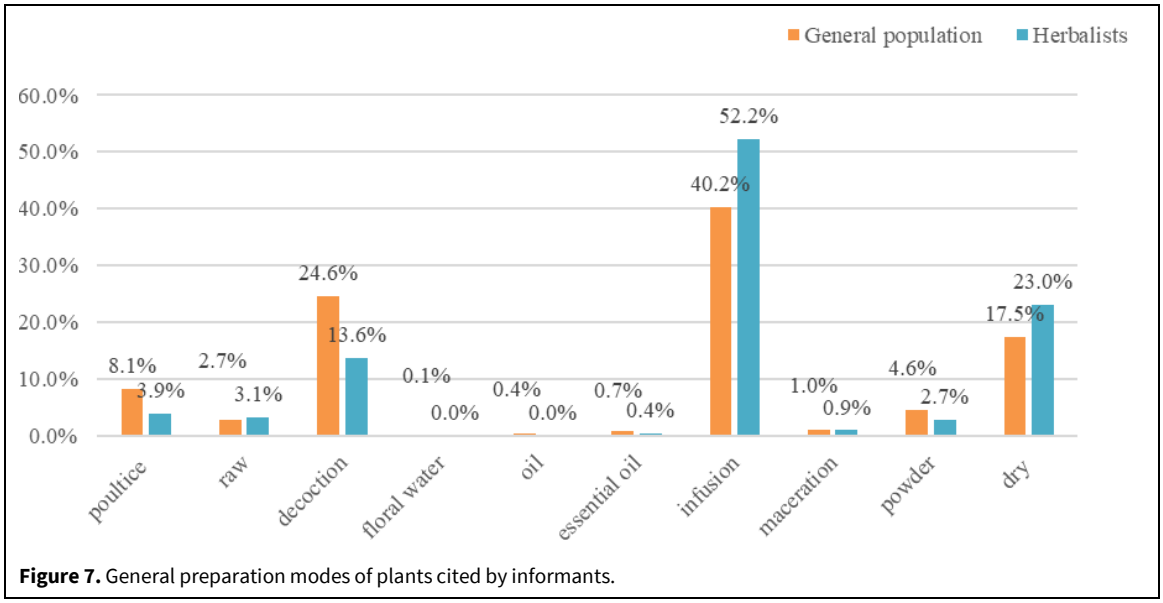

Figure 7. General preparation modes of plants cited by informants.

the two groups, or it could simply reflect differences in access to specific plant species.

In other studies conducted in Morocco, it was found that leaves were the most commonly used plant part (Beniaich et al., 2022; Najem et al., 2020; Zougagh et al., 2019). This finding is consistent with similar studies conducted in other countries (Fatima et al., 2018; Omwenga et al., 2015; Rahman et al., 2016; Ranjarisoa et al., 2016; Rosas-Piñón et al., 2012).

Preparation modes

Fig. 7 represents the preferred preparation methods for plant usage by the general population and a group of herbalists. Infusion is the most common preparation method for both groups, with the general population at 40.2% and the herbalists at a higher rate of 52.2%. This might suggest that teas and other infused beverages are the most common way to consume these plants, probably due to their ease of preparation and traditional use in many cultures. The second most common method for the general population is decoction at 24.6%. However, for herbalists, drying the plant is the second most common method at 23.0%. This could suggest that the herbalists may be preserving plants for future use or selling, whereas the general population may be using fresh plants as needed. The least used method by the general popula-

tion is floral water (0.1%), whereas for the herbalists, there's no usage of floral water and plant oil (both 0.0%). It could be possible that these methods are more complex, time-consuming, or require special knowledge or equipment, making them less accessible for these groups. Interestingly, herbalists use raw plants more often than the general population (3.1% vs. 2.7%). They also apply poultices less often than the general population (3.9% vs. 8.1%). These differences might indicate variations in knowledge, culture, or preferences between the groups.

Infusion and decoction were the most commonly cited methods for preparing the plants in the studies conducted by Beniaich et al. (2021) and Zougagh et al. (2019). Similarly, in the study by Najem et al. (2020), the highest percentage was attributed to decoction, followed by the use of raw plant material. In other international studies, decoction and powder were also mentioned as common preparation methods (Fatima et al., 2018; Omwenga et al., 2015; Ranjarisoa et al., 2016).

CONCLUSION

Through the collection of data from both groups, a comprehensive list of 39 medicinal plants from 20 families was compiled. The sociodemographic analysis highlighted notable differences in gender and education level between the herbalists and the general population. The comparison between modern mechanized dentistry and phytotherapy revealed the significant role of modern dentistry in alleviating oral ailments while acknowledging the importance of phytotherapy in managing symptoms of oral diseases. Traditional remedies like alum were also identified as part of the treatment options. The quantitative analysis further highlighted interesting disparities in plant species preferences and their recommended use between the two groups. However, both herbalists and the general population showed similar patterns in terms of the mode of administration, the plant parts used, and the preparation methods, with minor variations.

The high point of our study presents a comprehensive analysis of the use of medicinal plants in oral health management in Meknes, Morocco. We identified distinct knowledge patterns between herbalists and the general population through comparative examination, highlighting the importance of integrating traditional wisdom with modern dental interventions. The lessons learned from this study support inclusive, patient-centered oral health care strategies that draw on both traditional remedies and contemporary dental practices. In the future, further research into the efficacy and safety of specific medicinal plants promises to enrich evidence-based oral care practices in Meknes, Morocco, and beyond.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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AUTHOR CONTRIBUTION:

Contribution	Benabderrahmane A	Atmani M	Rhioui W	BoutagayoutA	Belmalha S
Concepts or ideas	x				x
Design	x	x			x
Definition of intellectual content	x				
Literature search	x				
Experimental studies	x				
Data acquisition	x		x		
Data analysis	x			x	
Statistical analysis	x			x	
Manuscript preparation	x				
Manuscript editing	x	x	x		x
Manuscript review	x	x	x	x	x

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Supplementary data

Fiche de questionnaire de l'étude ethnobotanique des PAM utilisées en buccodentaire

Enquêteur(s) **Date :**

Information sur la personne enquêtée :

1. Profil d'informateur

Lieu (ville/village, Douar, commune.) :_____

Coordonnées GPS :

Niveau d'étude : ☐ Analphabète ☐ Primaire ☐ Secondaire ☐ Universitaire

Situation familiale: ☐ Marié ☐ Célibataire ☐ Divorcé ☐ Veuf

Age : ☐ 18-24 ☐ 25-34 ☐ 35-49 ☐ 49-64 ☐ 65>

Sexe : ☐ Masculin ☐ Féminin

Personnes ciblées ☐ Population Générale ☐ Herboriste

Années d'expérience :_____

Comment avez-vous eu ces connaissances?

☐ Lui-même ☐ Expérience des autres ☐ Livres ☐ Occasionnellement ☐ Herboriste Autres _____

Que préférez-vous ?

Les soins médicaux

Pourquoi la médecine moderne ?

Efficace Plus précise Toxicité des plantes

Acces facile aux médicaments

Sexe clients : ☐ Femmes (>50%)

Les soins phytothérapeutiques

Pourquoi la médecine traditionnelle ?

Efficace Moins chère Acquisition

Effets secondaires des médicaments Médicament inefficace

☐ Hommes (>50%)

2- Information générales sur les plantes utilisées en buccodentaire

Partie utilisée

☐ Feuille ☐ Pétale ☐ Fleurs

☐ Plante entière ☐ Racine ☐ Ecorce

☐ Tige ☐ Rhizome ☐ Graines

☐ Fruits Autres combinaisons_____

Mode de préparation

☐ Décoction ☐ Infusion ☐ Macération

☐ Poudre ☐ Eau florale ☐ Cataplasme

☐ Cru ☐ Séché ☐ Huile essentielle

☐ Huile Autre_____

Méthode d'administration

☐ Application locale ☐ Rinçage ☐ Ingestion ☐ Mastication

Effets secondaires signalés

☐ Allergie ☐ Toxicité hépatique ☐ Cardiotoxicité ☐ Intoxication par ingestion Autre_____

3- Motifs de visites de la population souffrante de problèmes bucco-dentaires

Carie : ☐ Douleur ☐ Abcès/cellulites

Gingivites et parodontites :

☐ Douleur ☐ Saignements ☐ Herpès ☐ Aphtes ☐ Candidose buccale

Informations sur les plantes en buccodentaire

Informations sur les plantes en buccodentaire																						Page ..... / .....
Effets secondaires																						
Résultat	Satisfaisant																					
	Peu Satisfaisant																					
	Déçu																					
Combinaisons possibles																						
administration																						
préparation																						
Durée du traitement																						
Posologie générale																						
Parties utilisée																						
But d'utilisation Bucco-dentaire																						
Saison de collecte																						
disponibilité (1-2-3)																						
importée	Non (Maroc) Lieu de cueillettes																					
	Oui (pays)																					
locale	cultivée																					
	spontanée																					
nom vernaculaire																						
Nom scientifique																						