Ethnomedicinal evaluation of medicinal plants used for therapies by men and women in rural and urban communities in Makkah district

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ARTICLE INFO	ABSTRACT
Keywords: Ethnomedicine Ethnobotany Folk medicine Women Men Traditional knowledge	*Introduction:* For the first time, differences in ethnobotanical knowledge of medicinal plants between men and women, as well as tribal and urban populations in the Makkah district, are investigated. The current research aims to provide responses to the following questions: (1) According to tribal and urban cultures, which medicinal plants are used by Saudis in Makkah? (2) In view of demographic differences, how much do male and female use medicinal plants? (3) Are the plants utilized by male and female considerably various? And, (4), how do men and women learn about therapeutic plants? **Methods**: Ethnomedicinal study was carried out in Makkah and its adjacent villages from September 2022 to January 2023. To document local medicinal plants, individuals used free-listing, semi-structured interviews, and an online survey form. In all, 59 male and 62 female were questioned face-to-face, and 239 participants completed the questionnaire, with 110 men and 129 women responding. **Results**: A total of 92 local folks for medicinal plants have been recorded, covering 88 different plant species belong to 36 families. Men cited 69 plants (34 families), whereas women referenced 64. (33 plant families). Males and females know in comparable ways, although they employ different medicinal herbs to remedy a variety of diseases. **Conclusions**: The use of medicinal plants by Saudis in Makkah is dependent on gendered social roles and experiences, as well as population structure. Education and urbanization exert a greater impact on the preference for biomedical or traditional medicinal usage.

1. Introduction

Ethnobotany is the study of the relationships and dealings between people and plants in light of gender perspectives, cultural values, etc. Interactions and relationships between people and plants are different from place to place because of their relative importance, uses, and different social, ethnic, and population factors. Plant exploration's population values are important in the pharmaceutical and nutritional industries (Torres-Avilez et al., 2019; Siraj, 2022). The use of medicinal plant species for a variety of reasons is widespread in order to cover the basic needs for daily lifestyle, such as folk remediation, and to supply novel active elements for the production of modern medicines alongside the traditional ones (Hazrat et al., 2011; Yuan et al., 2016; Cheesman et al., 2017; Ssenku et al., 2022). About 80 % of the world's population relies on an old medicinal system to treat their diseases (Mintah et al., 2019). Since ancient times, people have used an extensive variety of medicinal plants to treat a variety of diseases because they believed they

had less side effects and were easy to obtain. (Shinwari, 2010; Betthauser et al., 2015; Bonini et al., 2018; Boy et al., 2018). Approximately 53,000 medicinal plant species are used for the treatment of diseases (Gulzar et al., 2019a,b). For the year 2002, the value of aromatic and medicinal plants around the world was measured at $62 billion; however, this value is expected to reach $5 trillion by the year 2050 (Hamilton, 2004; Gulzar et al., 2019a,b). Organic chemicals found in plants provide a source of medicines in the form of medicinal plants (Veeresham, 2012; Alqethami and Aldhebiani, 2021). Humans have been using medicinal plants as drugs and remedies for the treatment of various diseases since time immemorial (Shinwari, 2010; Mercanoglu Taban et al., 2021). Medicinal plants are significant healthcare resources in the Arab world because they are integral parts of Prophetic medicine and because the Middle East has a longstanding tradition of studying medicinal plants (Aati et al., 2019).

Saudi Arabia was one of the world's most important crossroads, located between three continents. It has been a commerce center for
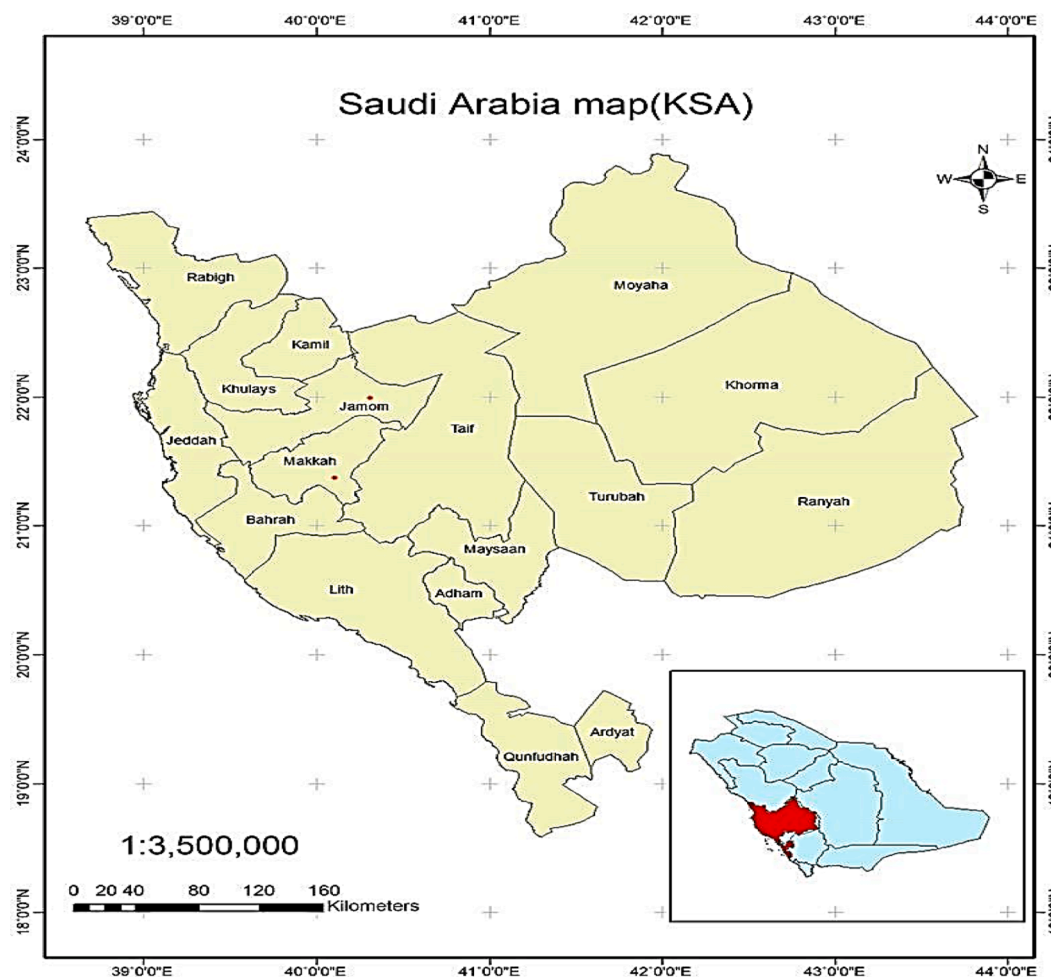

Fig. 1. Map of study area (red color) in Makkah region (Bayounis and Eldamaty, 2022).

centuries due to its proximity to both the Mediterranean Sea and the coasts of the Red Sea and the Persian Gulf (Van Der Veen and Morales, 2015; Aati et al., 2019). This, combined with its different habitats, contributes to a wide range of native and foreign medicinal plants. It is thought that more than 1200 of the 2250 flowering plants in Saudi Arabia can be used in traditional medicine (Alqahtani et al., 2013; Abdel-Sattar et al., 2015; Awadh Ali et al., 2017; Alqethami et al., 2020). The medicinal plants used in the Kingdom of Saudi Arabia have been recorded in two volumes, "Medicinal Plants of Saudi Arabia," published in 1987 and 2000 (Mossa et al., 1987; Al Kazman, 2021; Alqethami and Aldhebiani, 2021). A recent study (Aati et al., 2019) evaluated ethnomedicinal natural plants in Saudi Arabia, indicating that 309 genera and 471 species from 89 plant groups are used in traditional medicine. Although of great importance, these studies do not focus on individual differences in plant usage, nor do they focus on urban traditional medicine.

The Arab world's urban population is growing, reflecting a general trend (United Nations, 2014). This population growth is largely due to out-migration from tribal areas as people wanted good education, employment, and overall living conditions (Alqethami et al., 2020). Although biomedicine is commonly available in urban centers, healthcare dependence on medicinal plants may continue to be the most traditional and easy resource for a lot of people (Wayland and Walker, 2014; Al Kazman, 2021). Scientists have found that folk medicine is used a lot when people move from the village to the city (Van Andel and Carvalheiro, 2013; Haque et al., 2018). Over a hundred medicinal plants have been recorded as being used in Mecca and surrounding villages in

different ways depending on location, gender, experience, and level of education in Saudi Arabia (Alqethami et al., 2017). It was discovered that older people have more experience with and knowledge of medicinal plants that are used in remedy preparation than younger people. However. Men and women have different medicinal plant knowledge all over the world (Estrada-Castillón et al., 2014; Ong and Kim, 2014; Chekole et al., 2015; Bruschi et al., 2019) and may have different preferences for useful plant species (Savo et al., 2011; Bruschi et al., 2019). Women frequently transfer traditional medicinal plant knowledge in native medical systems (Torres-Avilez et al., 2016; Weckmüller et al., 2019). On the other hand, the men have been helped to originate this experience through the generations by some folkloric physicians throughout history, which led them to consider natural resources with a different vision (Torres-Avilez et al., 2016). Gendered divisions of occupation in traditional communities (Estrada-Castillón et al., 2014) and a focus on the diversity of learning help explain differences in knowledge between men and women. Different kinds of jobs for men and women and different ways of learning can make the knowledge of medicinal plants in urban Arab areas different from that in tribal areas (Torres-Avilez et al., 2016; Costa et al., 2021).

The study's goal was to identify, know the correct application, and how men and women among urban and tribal peoples used medicinal plants to cure various health disorders, as well as to verify some ethnobotany facts among them in Makkah city and some surrounding villages by answering the following questions: (1) According to rural and urban cultures, which medicinal plants are used by Saudis in Makkah? (2) In view of demographic differences, how much do men and women

use medicinal plants? (3) Are the plants utilized by men and women considerably different? And, (4), how do men and women learn about therapeutic plants? Considering the male and female structure of Saudi people and Arab world relations, the hypothesis is that men and women learn about plants in various cultures in different ways, which will assist in understanding any potential differences in using plants for treatments.

2. Materials and methods

2.1. Ethics declaration

The ethnobotanical field investigation was carried out with careful attention to ethical guidelines. As the ethical criteria of the American Anthropological Association (2012) and the Code of Ethics of the International Society for Ethnobiology (2006) were adhered to, the institution's ethics committee granted official ethical approval. Ethics Committee of the Unit of Biomedical Ethics Research Committee approval, Umm Al-Qura University, was granted (Reference No **HAPO-02-K-012**–**2023-02**–**1440**). Before the interviews and questionnaire, each participant provided oral or written informed consent.

2.2. Survey duration

After the preliminary survey, a series of target expeditions were conducted in Makkah city and some villages during the fall and winter sessions. A detailed questionnaire for data collection was developed from September 2022 to January 2023. face to face and online-structured interviews were conducted for the ethnobotanical data collection. Before the interviews, all participants provided informed consent and consent for publication.

2.3. Study area

The study area District Makkah city is located in the Makkah governance area of the western region of Saudi Arabia, located at 22° 00′ and 30° 00′ North and 36° 00′ and 44° 00′ East, in a small valley (Fig. 1), 76 km south of the Red Sea coast, west of the Arabian Peninsula (Alqethami et al., 2017). Additionally, some villages surrounded Makkah in the north, e.g., Aljumum, Hada Alsham, and Alfoara. Makkah and its surrounding villages cover 1200 square kilometers and have a population of 9.0 million people, about 52 % Saudis and about 48 % non-Saudi nationals; the ratio of men to women is about 1.3. (Cities, 2018; UN-Habitat, 2018, General Authority for Statistics, 2023) Makkah's flora consists of plants that thrive in subtropical and arid environments.

2.4. Participants in the study area

The study area has a rich diversity of cultures and ethnic groups. Different languages like Arabic, Urdu, English, and others are spoken in the area. Arabic is the dominant language, as 100 % of the studied population can speak and understand it. Various ethnic groups like Saudis, Indians, Southeast Asians, and others reside in the study area. A total of 121 people, 58 men and 63 women, were interviewed about the purpose of the current study.

2.5. Data collection

Face-to-face interviews and an online questionnaire were used to collect ethno-medicinal data. The interviews with people give valuable qualitative information that serves as a benchmark for assessing results from online questionnaires. Semi-structured interviews were conducted to document medicinal plant knowledge and use; data from questionnaires were constructed using the methods of Alexandrides and Sheldon (1996) and Martin (1995), as shown in Supplementary Material (Form 1). Interviews were conducted in Arabic, the mother tongue of all participants. According to Newing's (2010) method, targeted participants who use medicinal plants were chosen. Fifty males and fifty females were questioned for a total of one hundred and twenty one participants in face-to-face interviewing (Alexiades and Sheldon, 1996; Newing, 2010). Participants were divided into seven age groups: those under 25 (6.6 %), those between 25 and 34 (29.8 %), those between 35 and 44 (27.3 %), those between 45 and 54 (19.8 %), those between 55 and 64 (12.4 %), those between 65 and 74 (5.0 %), and those 75 and over (0.8 %) as illustrated in supplementary Material (Form 2). Questions were asked to record local plant names, parts used, uses, treatment and administration, toxicity and side effects, usage of mixes, and how participants learned about medicinal plants, as well as whether they preferred them over biomedicine or traditional medicine. Also, to enhance the fieldwork data, an online survey questionnaire was created with the same questions asked during face-to-face interviews. The online questionnaire page was built with Google Forms, and the link was distributed via social media. The questionnaire was completed by 239 persons, with 129 (54 % female) and 110 (46 % male) respondents. Face-to-face interviews also grouped participants into the same age categories, as shown in the supplemental material (Table S1, S2). Descriptive analyses were important for understanding individuals' attitudes, thoughts, and objectives, as well as for interpreting quantitative data (Abbas et al., 2002).

2.6. Plant collection and identification

The majority of voucher samples were received directly from informants. When this was not available, they were gathered from local apothecary plants and Alhwaj stores. Plant specimens from the Umm Al-Qura University herbarium that were not collected as voucher specimens were utilized to identify them using common names. Voucher specimens (including market samples) were stored in the herbariums of Aljumum University College, Umm Al-Qura University. Collection permissions were not required because no plants were collected freshly from the wild field. The identification of many specimens was also confirmed by taxonomist Qadri Abdul Khaleq, College of applied sciences, Umm Al-Qura University.

2.7. Literature review

A systematic literature study was carried out in order to examine the recorded Saudi Arabian medicinal plant knowledge. Google Scholar, the Saudi Digital Library, Research Gate, and the King Abdullah Library at Umm Al-Qura University searched for articles in both English and Arabic with the keywords "Medicinal Plant, Herbal Medicine, Traditional Medicine, or Ethnobotany," with no date restrictions.

2.8. Data analysis

Regarding replies with in interviews and online questionnaires, two databases were developed. The information gathered was recorded for every individual. A single record of one participant's use of a plant that includes the common name, parts, folk usage, preparation, and intake method. Based on the basic biological mechanisms, explanatory model interview catalogue (EMIC), the diseases were assigned to one of twelve different ideographic categories of herbal remedies (digestive diseases, respiratory diseases, ear and throat diseases, neurologic diseases, dental and periodontal diseases, cardiovascular diseases, skeletal diseases, skin diseases, urologic diseases, reproductive system diseases, endocrine diseases, muscular diseases, pain killers, tonics, and carminatives); according to the international classification of primary care (ICPC) as recommended by (Staub et al., 2015). In order to provide a concise overview of the data provided within each of the databases, descriptive statistical analysis was applied. For each of the datasets, the mean and standard deviation of the number of plants mentioned by men and women within a city or village and across age groups were calculated.

Table 1
An overview of the demographic characteristics of the participants.

| Variables | Participants' category | Number of participants | | | | | | | | Average number of ethno-species listed | | | | | | | |
| | | Interviews | | | | Online questionnaire | | | | Interviews (Men + Women) | | | | Online questionnaire (Men + Women) | | | |
		%	T	W	M	%	T	W	M	%	T	W	M	%	T	W	M
Age (years)	Gender		239	129	110		121	63	58		415	257	158		300	155	145
	<25	34.7	83	34	49	6.6	8	5	3	28.7	119	47	72	6.7	20	13	7
	25–34	25.1	60	40	20	29.8	36	17	19	28.9	120	89	31	31.7	95	42	53
	35–44	31.0	74	42	32	27.3	33	19	14	28.9	120	91	29	25.7	77	42	35
	45–54	7.5	18	10	8	19.8	24	15	9	15.9	66	44	22	18.0	54	32	22
	55–64	0.4	1	0	1	12.4	15	5	10	0.5	2	1	1	9.7	29	8	21
	65–74	0.0	0	0	0	5.0	6	3	3	0.0	0	0	0	5.7	17	11	6
Place	≤75	0.0	0	0	0	0.8	1	0	1	0.0	0	0	0	0.3	1	0	1
	City	77.4	185	88	97	71.9	87	48	39	82.4	342	225	117	76.7	230	120	110
Literacy	Village	22.2	53	42	11	28.9	35	16	19	23.6	98	84	14	23.7	71	33	38
	Illiterate	0.0	0	0	0	7.4	9	7	2	0.0	0	0	0	5.3	16	14	2
	Primary education	2.9	7	5	2	5.0	6	2	4	1.2	5	4	1	1.3	4	1	3
	Secondary education	18.4	44	17	27	43.0	52	20	32	15.4	64	28	36	42.0	126	45	81
Source knowledge	Bachelor	72.4	173	101	72	43.8	53	32	21	69.2	287	208	79	42.3	127	78	49
	Postgraduate	1.7	4	2	2	1.7	2	1	1	3.4	14	12	2	3.7	11	9	2
	Family	77.8	186	97	89	83.5	101	53	48	78.3	325	210	115	75.7	227	116	111
	Social media	8.8	21	10	11	21.5	26	12	14	8.4	35	31	4	19.3	58	33	25
	Internet	9.6	23	14	9	28.9	35	17	18	12.8	53	19	34	24.3	73	34	39
	Books	3.3	8	3	5	5.0	6	1	5	1.9	8	3	5	4.3	13		13
Plant part	Leaves	45.2	108	63	45	66.1	80	40	40	34.5	143	75	68	37.3	112	60	52
	Stem	11.3	27	13	14	18.2	22	10	12	11.6	48	22	26	12.7	38	12	26
	Peel	2.5	6	2	4	5.8	7	5	2	2.4	10	2	8	2.0	6	2	4
	Root	11.3	27	13	14	20.7	25	10	15	6.3	26	12	14	8.7	26	8	18
	Flower	11.7	28	19	9	11.6	14	11	3	7.5	31	18	13	8.3	25	16	9
	Seeds	30.5	73	51	22	61.2	74	41	33	20.2	84	55	29	35.0	105	57	48
	Fruit	11.3	27	13	14	27.3	33	17	16	6.0	25	10	15	12.3	37	13	24
	Gum	5.9	14	9	5	12.4	15	8	7	5.1	21	15	6	7.7	23	12	11
	Whole plant	6.7	16	10	6	36.4	44	19	25	7.0	29	19	10	16.7	50	23	27
Preparation	Decoction	53.1	127	78	49	98.3	119	67	52	36.1	150	96	54	57.3	172	91	81
	Crushed	28.9	69	45	24	33.9	41	19	12	16.6	69	37	32	13.0	39	22	17
	Powder	5.0	12	5	7	21.5	26	13	13	4.1	17	10	7	17.3	52	33	19
	Extract	2.5	6	3	3	6.6	8	6	2	1.0	4	2	2	1.7	5	4	1
	Raw	10.9	26	17	9	14.9	18	7	11	7.0	29	19	10	11.3	34	14	20
	Paste	4.6	11	8	3	6.6	8	4	4	4.8	20	17	3	2.7	8	3	5
	Juice	7.1	17	12	5	10.7	13	3	10	4.8	20	11	9	6.3	19	3	16
	Fresh	3.3	8	7	1	2.5	3	1	2	1.9	8	7	1	1.0	3	1	2
Administration	Oral ingestion	74.1	177	105	72	132.2	160	88	72	53.7	223	123	100	64.3	193	86	107
	Mouth wash	3.8	9	6	3	13.2	16	9	7	2.2	9	5	4	7.3	22	10	12
	Rub in	7.5	18	11	7	24.8	30	17	13	5.3	22	15	7	8.7	26	21	5
	On wound	2.1	5	2	3	1.7	2	1	1	2.2	9	3	6	3.3	10		10
	Feminine wash	0.8	2	2			1.7	2	2		0.5	2	2		0.0		1	
	Chewing	4.2	10	6	4	5.8	7	1	6	3.4	14	11	3	3.7	11	2	9
	Fumigation	2.1	5	2	3	2.5	3	1	2	1.2	5	4	1	1.0	3	1	2
	Hair wash	0.4	1	1		0.0				0.0		1		0.0			

M=Men, W=Women.

The ethnomedicinal information gathered during field surveys was transferred to a Microsoft Word and Excel spreadsheet and tabulated for presenting. Multiple measurement ethnobotanical statistics, such as frequency of citation (FC), fidelity level percentage (FL), and informant consensus factor (ICF), were utilized for the data visualization of the extracted statistical information.

2.8.1. Informant consensus factor (ICF)

The Factor Informant Consensus (ICF) was examined to investigate the overall application of plant species by gender and culture among participants. This criteria was developed by Heinrich et al., (1998) to determine potentially beneficial medicinal plants. FIC reveals a correlation between the number of usage reports in each medicinal category and the number of plant species used. Fic may be calculated using the formula Fic = nur - nt/nur − 1, where Fic is the informants' consensus factor, nur is the number of usage citations, and nt is the number of species used. FIC values vary between 0 and 1. The informant consensus factor was also calculated separately for men and women in order to identify any statistically significant differences (Trotter and Logan, 1986; Heinrich et al., 1998; Hassan, Wang, et al., 2017; Asiimwe et al., 2021).

2.8.2. Fidelity level (FL)

The plant species that were medicinally used by men and women in Makkah city and some surrounding villages had a higher fidelity level (FL) than those with less usage. The fidelity level (FL) was calculated to identify medicinally important plant species in the study area. Aliments were grouped into different classes before computing the fidelity level. Fidelity Level (FL) was calculated using the formula FL = Ip/Iu × 100. Ip denotes the proportion of respondents who used medicinal plants for a specific disease, whereas Iu denotes the proportion of respondents who used the same plant for all diseases (Khan et al., 2014; Hassan, Wang, et al., 2017; Asiimwe et al., 2021).

3. Results

3.1. Medicinal plants traditionally used by Saudis in Makkah

In current research survey a total of 88 medicinal plant species from 36 families were documented from 360 participants (121 from face-to-

Table 2

A complete list of plant family used by Saudis in Makkah and the surrounding villages, including plant family and family frequency.

No.	Family	Family frequency
1.	Amaranthaceae	5
2.	Amaranthaceae	
3.	Amaranthaceae	
4.	Amaranthaceae	
5.	Amaranthaceae	
6.	Amaryllidaceae	2
7.	Amaryllidaceae	
8.	Apiaceae	9
9.	Apiaceae	
10.	Apiaceae	
11.	Apiaceae	
12.	Apiaceae	
13.	Apiaceae	
14.	Apiaceae	
15.	Apiaceae	
16.	Apiaceae	
17.	Apocynaceae	3
18.	Apocynaceae	
19.	Apocynaceae	
20.	Arecaceae	1
21.	Asphodelaceae	2
22.	Asphodelaceae	
23.	Asteraceae	5
24.	Asteraceae	
25.	Asteraceae	
26.	Asteraceae	
27.	Asteraceae	
28.	Boraginaceae	1
29.	Brassicaceae	3
30.	Brassicaceae	
31.	Brassicaceae	
32.	Burseraceae	3
33.	Burseraceae	
34.	Burseraceae	
35.	Capparaceae	1
36.	Cucurbitaceae	2
37.	Cucurbitaceae	
38.	Euphorbiaceae	1
39.	Fabaceae	10
40.	Fabaceae	
41.	Fabaceae	
42.	Fabaceae	
43.	Fabaceae	
44.	Fabaceae	
45.	Fabaceae	
46.	Fabaceae	
47.	Fabaceae	
48.	Fabaceae	
49.	Lamiaceae	8
50.	Lamiaceae	
51.	Lamiaceae	
52.	Lamiaceae	
53.	Lamiaceae	
54.	Lamiaceae	
55.	Lamiaceae	
56.	Lamiaceae	
57.	Lauraceae	2
58.	Lauraceae	
59.	Linaceae	1
60.	Lythraceae	2
61.	Lythraceae	
62.	Malvaceae	1
63.	Moraceae	1
64.	Moringaceae	1
65.	Myrtaceae	2
66.	Myrtaceae	
67.	Oleaceae	1
68.	Piperaceae	1
69.	Plantaginaceae	1
70.	Poaceae	2
71.	Poaceae	
72.	Polygonaceae	1
73.	Ranunculaceae	1

Table 2 (*continued*)

No.	Family	Family frequency
74.	Rhamnaceae	1
75.	Rosaceae	5
76.	Rosaceae	
77.	Rosaceae	
78.	Rosaceae	
79.	Rosaceae	
80.	Rubiaceae	1
81.	Rutaceae	2
82.	Rutaceae	
83.	Theaceae	1
84.	Urticaceae	1
85.	Zingiberaceae	3
86.	Zingiberaceae	
87.	Zingiberaceae	
88.	Zygophyllaceae	1

face interviews and 239 from online questionnaires) as presented in (Table 1). Plant parts were used in form of leaves (66.1 and 45.2 %), stems (18.2 and 11.3 %), peel (5.8 and 2.5 %), roots (20.7 and 11.3 %), Flower (11.6 and 11.7 %), seeds (61.2 and 30.5 %), Fruits (27.3 and 11.3 %), gum (12.4 and 5.9 %), and whole plant (36.4 and 6.7 %) for face-to-face interviews and online questionnaires respectively (Table 2). The most diverse families are Fabaceae (27.7 %; 10 species), Apiaceae (25 %; 9 species), Lamiaceae (22.2 %; 8 species). Amaranthaceae, Rosaceae, and Asteraceae were represented by five species each (13.9 %; 5 species). Zingiberaceae, Brassicaceae, Apocynaceae, and Burseraceae were represented by three species each (8.3 %). Poaceae, Cucurbitaceae, Asphodelaceae, Amaryllidaceae, Rutaceae, Myrtaceae, Lauraceae and Lythraceae were represented by two species each (5.5 %). Eighteen families were represented only by one species as presented in (Table 2). A high number of plant citations referred to four families: Apiaceae (133 citations), Lamiaceae (81 citations), Zingiberaceae (67 citations) Fabaceae (55 citations), and Brassicaceae (51 citations). The most popular medicinal species used in current study is *Pimpinella anisum* L. (57 citations), followed by *Zingiber officinale* Roscoe (45 citations), *Matricaria aurea* (Loefl.) Boiss (39 citations), *Foeniculum vulgare* Mill. (35 citations) and 24 citations for both *Psidium guajava* and *Syzygium aromaticum* (L.) Merr. & L.M.Perry as shown in (Table 2).

3.2. Ethnobotanical knowledge of medicinal plants

Out of 203 men and 218 women, informants referring to interviews and online surveys, 88 medicinal species were collected. 45 medicinal plants appear on both men's and women's lists; 22 medicinal plants are listed only by men, while 21 medicinal plants are listed exclusively by women. (Table 3). Men in Makkah and several of its villages most usually cite *Zingiber officinale, Matricaria aurea, Pimpinella anisum, Syzygium aromaticum*, and *Citrus limon*. as their preferred species. Women prefer *Pimpinella anisum, Mentha spicata, Foeniculum vulgare, Matricaria aurea, Zingiber officinale,* and *Trigonella foenum-graecum*. Women, as expected, cite more medicinal plants (353 citations) than men (282 citations) (Table 3). Also, women use a wider range of mixes (94) than men do (26), as shown in the "Supplemental Files" section under "Subtitle (Table S3)".

3.3. Common diseases in the survey

In this survey, respondents mentioned 88 plant species for the treatment of various diseases, which were divided into 15 main disease classes and categorized as digestive diseases, respiratory diseases, ear and throat diseases, neurologic diseases, dental and periodontal diseases, cardiovascular diseases, skeletal diseases, skin diseases, urologic diseases, reproductive system diseases, endocrine diseases, muscular diseases, pain killers, tonics, and carminatives. The informants used the most plant species (40 species) to treat digestive diseases such as

Table 3
A complete list of plants used by Saudis in Makkah and the surrounding villages, including scientific name, family, Flora of Saudi Arabia, vernacular name, therapeutic parts, frequency of citation, preparation, and administration.

No.	scientific name	F	V	Part used	Therapeutic Use	Frequency of citation		Preparation	Administration
						M	**F**		
	Acacia ampliceps Maslin	Y	الطلح altalh	Leaves	Stop The Bleeding	1	0	decoction	Oral ingestion
	Acacia Senegal (L.) Willd.	N	الصمغ العربي alsamgh alarabi	Resin	For Kidneys And Salts, Arthritis, Indigestion, Back Treatment, Gingivitis	2	4	Crushed, chewing, added to water or milk,	Oral ingestion (drink, food), gargling
	Acacia sp.	Y	القرظ alqrd	Leaves	Body Protection	1	0	fumigation	inhalation
	Aerva javanica Juss.	Y	الطرف altarf	Flowers, Leaves	Diabetic - Diuretic	1	1	decoction	Oral ingestion
	Alkanna tinctoria Tausch	Y	جوا الخوا alkoagoa	leaves	Precipitated Blood -Uterin Air	0	2	crushed	fumigation
	Allium cepa L.	N	البصل albasal	Fruit	For Burns, Sniffles	2	0	decoction, Fresh	on wound, Oral ingestion
	Allium sativum L.	N	ثوم althom	Fruit, seeds	Disease Relief, Nerves, Uterus, Bones, Brain, Blood Pressure	5	2	By heating like tea, crushed, add to juice, chewing	Oral ingestion (drink, food)
	Aloe brevifolia Mill.	Y	الصبرة alsbrh	Resin	Paranasal Sinuses	0	1	crushed	Oral ingestion
	Aloe vera (L.) Burm.f.	N	صبار sabar	Leaf, bark	Hair Strengthening, Arthritis, For The Skin	0	1	Fresh	Rub in
	Ammi visnaga (L.) Lam.	N	بذور الخلة bthor alklh	seeds	Bladder Stones	0	1	By heating like tea	Oral ingestion (drink)
	Anastatica hierochuntica L.	Y	كف مريم kaf maryam	Seed, leaf	Expedite Childbirth	0	1	By heating like tea	Oral ingestion (drink)
	Anethum graveolens L.	N	الشبث althbth	leaves	Respiratory System – Digestive	1	0	By heating like tea	Oral ingestion
	anisosciadium lanatum Boiss.	Y	البسباس البري albsbas albri	Fruits	Digestive	1	0	By heating like tea	Oral ingestion
	Artemisia Judaica L.	Y	الشيح alsheh	Shins, Leaves	Acidity, Ulcers	1	0	By heating like tea	Oral ingestion
	Astragalus sarcocolla Dymock	Y	العنزوت alanzrot	Resin	Digestive	1	2	decoction	Oral ingestion
	Aucklandia costus Falc.	N	القسط الهندي alqesd alheendi	Roots, Stem	Respiratory, Delayed Pregnancy, Stomach Pain	3	3	Powder, By heating like tea	Oral ingestion (drink, food)
	Beta vulgaris L.	Y	البنجر albanjr	Roots	Anemia	0	1	juice	Oral ingestion (drink)
	Boswellia sacra Flück.	N	لبان الذكر lban althakr	Resin	Respiratory, Digestive	0	3	Decoction, infusion, powder,	Oral ingestion (drink, food)
	Cactaceae	N	الصبار alsabar	Resin	Hair Loss	1	3	Infusion	Rub in
	Calligonum comosum L'Hér.		الارطا alarta	shins	Feminine Lotion	0	1	solution	Feminine lotion
	Calotropis procera (Aiton) Dryand.	N	العشر alashr	Resin, Leaves	Alopecia, Warts	1	1	Milky substance sweeps in alopecia	Sweep, rub in
	Camellia sinensis (L.) Kuntze	N	الشاي الاخضر alshaay alakhdar	Leaves	Digestive	0	3	By heating like tea	Oral ingestion (drink)
	Capparis spinosa L.	Y	الشفلح alshflh	Leaves	Teeth, Back Problems	0	1	crushed	On wound
	Carthamus tinctorius L.		العصفر alasfor	Flowers, Leaves	Respiratory, Endocrine, Treat Depression, Neurological	2	2	By heating like tea	Oral ingestion (drink)
	Carum carvii (Archila) J. M.H.Shaw.	Y	الكراوية alkarawia	seeds	Digestive, Menstrual Pain Relief	5	0	By heating like tea and put it with milk and honey	Oral ingestion
	Chenopodiastrum murale (L.) S.Fuentes, Uotila & Borsch.	N	العفينة alafenh	leaves	Teeth Pain In Babes	0	1	crushed	Put it in baby head
	Cinnamomum tamala T. Nees		ورق الغار warq alqar	Leaves	Respiratory, Digestive	0	1	With food	Oral ingestion (drink, food)
	Cinnamomum verum J. Presl	N	القرفة alqurfa	All plant, bark, wood	Blood Sugar, Flatulence, Diarrhea, Facilitate Childbirth, Menstrual Pain	9	5	By heating like tea, crushed	Oral ingestion (drink, food)
	Citrullus colocynthis (L.) Schrad.	Y	الحدج alhdg	Fruits	Hemorrhoids	2	0	crushed	Rub in
	Citrus limon (L.) Osbeck.	N	الليمون allaymun	Leaves, Fruit	Respiratory, Stomach Pain, Ear And Throat, Hyperthermia, Cholesterol Lowering	12	12	Infusion, decoction, with honey and food, juice, powder, raw.	Oral ingestion (drink, food)
	Citrus-sinensis (L.) Osbeck.	N	البرتقال albortqal	Fruits	Immunity Booster, Sniffles	5	2	Fresh, juice	Oral ingestion
	Cocos nucifera	N	جوز الهند juz alhind	Leaf	Chronic Cough	0	1	By heating like tea, crushed, fresh, chewing	Mouth wash, Rub in
	Coffea arabica L.		البن alben	Seeds,peel	Wounds, Digestive	1	2	Decoction, powder	Oral ingestion, on wound
	Coleus forskohlii Briq.	Y	الشار alshar	Leaves-resin	Ear Pain	1	0	Squeeze	Put in ear
	Commiphora gileadensis (L.) C.Chr.	Y	البشام albasham	Resin	For Burns - Wounds	1	0	Fresh	Rub in

(continued on next page)

Table 3 (*continued*)

No.	scientific name	F	V	Part used	Therapeutic Use	Frequency of citation		Preparation	Administration
						M	**F**		
	Commiphora myrrha Engl.	Y	المر almor	Resin, leaves	Hemorrhoids, Respiratory, Phlegm And Congestion, Wounds	3	2	Decoction, infusion, powder,	rub in, put it on wound, wash.
	Cucurbita ficifolia Bouché.	N	بذر القرع bthor alqra	Seeds	Prostate Enlargement	1	0	By heating like tea	Oral ingestion
	Cuminum cyminum L.	Y	الكمون alkamo uwn	Seeds, All plant	Digestive, Fungi, Flatulence	3	6	By heating like tea, crushed, solution	Oral ingestion (drink, food)
	Curcuma longa L.	N	الكركم alkarkum	Rhizome, All plant, fruit	Respiratory, Skeletal, Muscular Pain, For The Skin, Digestive	8	13	Decoction, infusion, powder,	Oral ingestion (drink), on wound, mouth wash
	Cydonia oblonga Mill.	Y	السفرجل alsfarqal	fruit	Digestive -Cholesterol -Anti-Inflammation	0	1	fresh	Oral ingestion
	Cymbopogon schoenanthus Spreng.		الاذخر aladhkhir	shins	Respiratory, Headache, Blood Pressure-Reduce Sugar Cholesterol-Anxiety-Stress	2	5	By heating like tea, fumigation	Oral ingestion (drink), inhalation
	Elettaria cardamomum (L.) Maton	N	الهيل alhel	Seeds	Cold, Stomach	0	1	By heating like tea	Oral ingestion
	Ferula assa-foetida L.		الحلتيت alhaltet	Seeds, Resin	Respiratory System - Digestive	3	0	Powder, By heating like tea	Oral ingestion (drink)
	Ficus carica L.	Y	التين alteen	Fruits	Hemorrhoid Treatment, Blood Pressure	1	1	Juice, fresh	Oral ingestion
	Foeniculum vulgare Mill.	Y	الشمر alshamer	Seeds, whole plant	Digestive, Cough, Flatulence, Colic	12	23	By heating like tea	Oral ingestion (drink)
	Geum urbanum L.	Y	عشبة المدينة ashbat almadenh	Shins, Leaves	Expulsion Of Toxins	0	2	decoction	Oral ingestion
	Glycyrrhiza glabra L.	Y	عرق السوس arq asws	roots	Respiratory System-Skin-Stomach Sedative-Arthritis	3	1	Placed in a cloth Soaked in water	Oral ingestion (drink)
	Haloxylon salicornicum (Moq.) Bunge ex Boiss.	Y	الرمث alremth	Leaves	Joints, Bones	3	0	crushed	Rub in
	Hibiscus sabdariffa L.	N	الكركديه alkarkadih	Flowers, Leaves	To Lower Blood Pressure, For Healthy Hair, Sore Throat, Gastroenteritis	6	3	By heating like tea, Infusion, decoction, juice	Oral ingestion (drink), rub in
	Hordeum vulgare L.	N	الشعير alshair	Seeds	Kidney Pain, Diuretic, Expulsion Of Toxins	2	1	By heating like tea	Oral ingestion
	Lawsonia inermis L.	Y	الحناء alhena	Leaves	For Hair Grow, Headaches	0	2	powder	Wash, rub in
	Lens culinaris Medik.		العدس aladas	Seeds	Muscular Pain	1	0	powder	on wound
	Lepidium sativum L.	Y	الرشاد alrashad	Seeds	For Bruising, Hair Loss, For Bones, Diarrhea, Digestive	3	10	Powder, By heating like tea, soak with water, crushed	on wound, Oral ingestion (drink)
	Leptadenia pyrotechnica (Forssk.) Decne.	Y	المرخ almarkh	Shins	Cough, Worms	1	1	decoction	Oral ingestion
	Linum usitatissimum L.	N	بذرة الكتان bthrat alkatan	seeds	Immunity Booster, Nerves, Uterus, Bones, Brain	1	1	Crushed, Fresh	On wound, Oral ingestion
	Malus domestica (Suckow) Borkh.	N	التفاح altofah	Peel	Immunity Booster	0	1	Fresh	Oral ingestion
	Matricaria aurea (Loefl.) Boiss.	Y	البابونج albabong	Flowers, Fruit, Leaves	Respiratory, Neurological, Digestive, Menstrual Pain, Anemia, Rheumatism Treatment	19	20	decoction	Oral ingestion (drink)
	Mentha spicata L.	Y	النعناع alneana	Leaves, flower	Ear And Throat, Respiratory, Stomach Pain	10	24	By heating like tea	Oral ingestion (drink)
	Moringa oleifera Lam.	Y	المورينجا almorenga	Leaves	To Lower The Sugar Level	2	1	By heating like tea	Oral ingestion (drink)
	Nasturtium officinale R. Br.	Y	الجرجير algarger	leaves	Flu	1	0	fresh	Oral ingestion
	Nigella sativa L.	N	الحبه السوداء alhaba alsoda	Seeds	Congestion, Digestive, Expectorant, Immunity Booster, Kidney Disease-Breast	7	10	With honey and food, juice, powder, infusion, decoction, raw.	Oral ingestion (drink, food), fumigation, chewing.
	Olea europaea L.	Y	الزيتون alzeeton	Leaf, Seed, fruit	For Diabetics, Man's Cartilage, Roughness, Skin-Heart Health -Cholesterol-Digestive	5	5	By heating like tea, fresh, Infusion	Oral ingestion (drink),rub in
	Origanum majorana L.	Y	البردقوش albrdaqwsh	Leaves, Seed	Endocrine, Neurological, Digestive, Respiratory	1	3	decoction	Oral ingestion (drink)
	Petroselinum crispum (Mill.) Fuss	N	البقدونس albaqdunis	Leaves, whole plant	Gallstones, Stomach Pain, Urinary Tract	7	11	By heating like tea, fresh	Oral ingestion
	Pimpinella anisum L.	N	الينسون alyansun	Seeds, whole plant	Ear And Throat, Digestive, Respiratory, Neurological	17	40	By heating like tea	Oral ingestion (drink)
	Piper nigrum L.	Y	فلفل ابيض felfl abid	Seeds	Improve Blood Circulation	1	0	Crushed	Oral ingestion
	plantago ovate L.	N	القبساس aliasbiqul	Leaves	Stomach	1	0	By heating like tea	Oral ingestion
	Prunus dulcis D.A.Webb.	Y	لوز lwz	Seeds	Immunity Booster	1	0	Fresh	Oral ingestion

Table 3 (*continued*)

No.	scientific name	F	V	Part used	Therapeutic Use	Frequency of citation M	Frequency of citation F	Preparation	Administration
	Prunus mahaleb L.	N	المحلب almhalab	seeds	Poor Hair, Headaches	0	2	powder	Rub in
	Psidium guajava L.	N	الجوافة aljwafa	Leaves	Respiratory, Diarrhea, Childbearing	6	14	By heating like tea	Oral ingestion (drink)
	Punica granatum L.	N	الرمان alroman	Peel, Fruit	Gastritis, Skin Diseases, Stomach Pain, For Hair	2	7	By heating like tea, crushed, chaff, juice	Oral ingestion (drink), rubbed on the head
	Rhanterium epapposum Oliv.	Y	العرفج alarfag	Fruits, Shins	Asthma, Joints	0	1	decoction	Oral ingestion
	Rhazya stricta Decne.	Y	حرمل harmel	Seed, Leaves, Roots	Toothache, Colic, Stomach Pain, Cough, Skin	2	5	Crushed, Add to the juice, decoction	Oral ingestion (drink),Rub in
	Ricinus communis L.	Y	زيت الخروع zayt alkharue	seeds	Digestive	1	0	Fresh oil	Oral ingestion
	Salvia hispanica L.	N	بذر الشيا budhur alshya	Seeds	Improve Blood Circulation	1	0	By heating like tea	Oral ingestion
	Salvia officinalis L.	N	الميرمية almiramia	Leaf, flowers	Anxiety, Cleans The Womb, Abdominal Pain, Hormonal Problems, Reduce Bleeding	7	6	By heating like tea, crushed	Oral ingestion
	Salvia Rosmarinus Schleid.	N	اكليل الجبل aklil aljabal	Leaves	Digestive, Respiratory, Diuretic, Stimulate Blood Circulation	1	5	Powder, By heating like tea, inhalation	Oral ingestion
	Senna alexandrina Mill.	Y	السنا مكي alsna makiy	Leaves, Whole plant	Digestive, Constipation, Colon Cleaning	11	4	decoction	Oral ingestion (drink)
	Spinacia oleracea L.	N	سبانخ sbankh	Leave	Anemia	0	1	Fresh	Oral ingestion
	Syzygium aromaticum (L.) Merr. & L.M.Perry.	N	القرنفل alqaranful	Flower buds, Seed	Dental And Periodontal, Digestive, Neurological Nausea, For Hair, Kidney-Organize Shugar In Blood – Gingivitis	14	8	By heating like tea. Crushed, chaff	Oral ingestion (drink), mouth wash
	Tamarindus indica L.	N	التمر الهندي altamr alhindiu	Fruits	Digestive-Reduces Fever	2	0	By heating like tea, juice	Oral ingestion
	Teucrium marum L.	N	الجعده aljaeduh	Leaves	Stomach Pain	1	0	By heating like tea	Oral ingestion (drink)
	Teucrium marum L.	Y	الجعدة aljaeduh	Leaves	Tummy Ache	2	0	By heating like tea	Oral ingestion
	Thymus vulgaris L.	N	الزعتر alzaetar	Leaves, oil	Digestive, Respiratory	5	10	By heating like tea, crushed	Oral ingestion (drink),rub in
	Trachyspermum ammi Sprague	N	النانخة alnaanikha	Seeds, fruit	Stomach, Diarrhea, Flatulence Kidney Stones	3	5	By heating like tea	Oral ingestion
	Tribulus terrestris L.	Y	الشرشر alsharshar	Shins, Leaves	Kidney Stone	1	0	decoction	Oral ingestion
	Trigonella foenum-graecum L.	Y	الحلبة alhalba	seed	Cough, Diarrhea, Urinary Tract, Asthma, Obesity, Strengthen The Bones, Stomach Pain, Reduce Period Pain	5	15	By heating like tea, crushed, chaff	Oral ingestion (drink, food)
	Urtica dioica L.	N	القراص alqaras	flowers	Arthritis	2	0	Crushed, By heating like tea	Oral ingestion
	Vigna radiata (L.) R. Wilczek.	Y	الماش almash	Seeds	Strengthen The Bones	1	1	crushed	Oral ingestion
	Zingiber officinale Roscoe	N	الزنجبيل alzanjanil	Roots, Fruit, stalk	Digestive, Ear And Throat, Respiratory	26	19	Decoction, infusion, juice, powder, with honey, milk and food	Oral ingestion (drink, food)
	Ziziphus spina-christi (L.) Willd	Y	السدر alsudr	Leaves	For Wounds, Digestive, Respiratory, Skin, Magic And Envy, Headaches	5	5	decoction, infusion, powder, raw	Oral ingestion (drink), on wound, wash, rub in
	Total Of Plants Citation By Gender					69	64		
	Citation Depend On Gender Only					23	21		
	Common Citation Men + Women					45			

F: Flora of KSA, V: Vernacular name, Y:Yes , N: No.

diuretic, gastrointestinal, anti-diarrheal, laxative, colonic, nausea, diarrhea, indigestion, ulcers, and acidity. Respiratory disorders are the second most common categorization of medicinal plants in folk medicine, with 28 plants being used to treat diseases such as asthma, cough, congestion, paranasal sinuses, and bronchitis. Also, fifteen plant species were reported to treat skeletal diseases, whereas 10 plant species were reported for each neurologic disease and cardiovascular disease, as illustrated in (Table 3).

3.4. Participants' ICF

When both men and women are taken into account, the informant consensus factor (Table 4) shows that people agree most about how to treat ear and throat illnesses, and respiratory diseases, but there is little agreement on how to take medicinal plant as tonic. Heinrich et al. (1998) say that ICF values of 0.68 or more show a high level of consensus. So, most of the populations that have been studied agree on which plants to use for most types of medicine (Teka et al., 2020). There are no ICF differences when considering men's and women's responses separately. So, men and women were had high ICF values (>0,68) for digestive diseases, respiratory diseases, ear and throat diseases, neurologic diseases, dental and periodontal diseases, cardiovascular diseases, skeletal diseases, skin diseases, urologic diseases, reproductive system diseases, endocrine diseases, muscular diseases, pain killers, tonics, and carminatives. (Table 4). The most popular species used by men to treat digestive ailments is *Zingiber officinale* (26 repetitions), and the most

Table 4

Informant Consensus Factor (ICF) of traditional medicine plants use by men and women in Makkah and some surrounded villages.

Categories of Disorders	Men			Women		
	Nur	Nt.	Fic	Nur	Nt.	Fic
Digestive diseases	172	40	0.76	265	40	0.84
Respiratory diseases	151	28	0.81	218	28	0.87
Ear and Throat diseases	82	8	0.90	110	8	0.92
Neurologic diseases	64	10	0.84	92	10	0.89
Dental & Periodontal diseases	16	4	0.75	14	4	0.71
Cardiovascular diseases	35	10	0.71	33	10	0.69
Skeletal diseases	58	15	0.82	74	15	0.86
Skin diseases	25	7	0.72	33	7	0.78
Urologic diseases	33	6	0.81	40	6	0.85
Reproductive system diseases	36	11	0.69	35	11	0.68
Endocrine diseases	3	2	0.68	5	2	0.6
Muscular diseases	9	2	0.77	13	2	0.84
Pain Killer	46	5	0.68	70	15	0.78
Tonic	15	7	0.53	20	7	0.65
Carminative	27	5	0.81	39	5	0.87

Nur: Number of participants, Nt: Number of taxa, Fic: Informant Consensus Factor (ICF = Nur - Nt/Nur).

popular species used by women to treat same therapeutic category is *Pimpinella anisum* (40 repetitions). Ginger and anise are the most common species used by both men and women to treat lung, ear, and throat diseases. Men and women both use mint to treat neurological diseases more than any other plant. Even though ICF is pretty high for women (0.84), it is pretty low for men (0.76), the most common species used by both are *Pimpinella anisum, Foeniculum vulgare, Curcuma longa*, and *Senna alexandrina*. The most common species used by both genders is the same, *Matricaria aurea*. Lastly, the most common species used by both genders in the study areas to treat respiratory and neurological diseases is Matricaria aurea, while for treating oral disorders, gingivitis, and dental pain, the male participants used Syzygium aromaticum more than the females. Other than that, men and women have reached an agreement on how to treat a wide range of disorders.

3.5. Fidelity level of medicinal plants

Top five of high FL value (100) of frequently used traditional medicinal plants as remedy in Makkah observed for P*etroselinum crispum, Lepidium sativum, Citrus sinensis, Salvia Rosmarinus*, and *Carum carvi*, while the lowest FL (25) for *Ziziphus spina-christi*, and (33.3) for *Commiphora myrrha,* and *Foeniculum vulgare* as shown in Table 5. Whereas, for village's participants, the high FL value (100) of frequently used traditional medicinal plants were reside for most species in rate 85.5 %, and the lowest FL (33.3) for *Acacia tortilis* (Table 6).

3.6. Preparation of ethnomedicines

For the preparation of ethnomedicines the Interviews participants (face to face) used leaves (66.1 %), stems (18.2 %), peel (5.8 %), roots (20.7 %) flowers (11.6 %), seeds (61.2 %), fruits 27.3 %), gum (12.4 %), and whole plant (36.4 %), the average number of ethno-species listed were 37.3, 12.7, 2.0, 8.7, 8.3, 35.0, 12.3, 7.7, 16.7 % respectively (Table 1, 2) and (Fig. 2). For Online questionnaire the most plant parts used were leaves and seeds (45.2, 30.5 %) and the lowest is peel (2.5 %). Out of total recipes preparation decoction was observed (98.3 %), Crushed (33.9 %), powder (21.5 %), extract (6.6 %) and Paste (6.6 %), Juice (10.7 %), and fresh (2.5 %) as shown in (Table 1, 2) and (Fig. 3). Also, the average number of preparation method either decoction, crushed, powder, extract, paste, juice, or fresh were 57.3, 13.0, 17.3, 1.7, 2.7, 6.3, 1.0 % respectively from face to face interviews. Furthermore, the Online questionnaire, the decoction and crushed were most preparation method used with the average number of ethno-species (36.1, 16.6 %) respectively.

Table 5

Fidelity Level values of frequently used traditional medicinal plants as remedy in Makkah.

No	Plant Scientific Name	Disorders	LP	LU	FLValue
58	*Agave deserti*	For Wounds	1	1	100
8	*Allium cepa*	Respiratory System, Skeletal System, Skin, Burns	2	2	100
19	*Allium sativum*	Nervous System, Reproductive System, Pain Relief	5	7	71.4
29	*Aloe vera*	Treatment For Hair Loss	3	4	75
44	*Ammi visnaga*	Bladder Stones	1	1	100
56	*Anastatica hierochuntica*	Acceleration Of Childbirth	1	1	100
63	*Artemisia judaica*	Digestive	2	3	66.6
52	*Beta vulgaris*	Anemia	1	1	100
49	*Calligonum comosum*	Feminine Wash	1	1	100
4	*Camellia sinensis*	Digestive	1	1	100
42	*Camellia sinensis*	Digestive	1	1	100
36	*Carthamus tinctorius*	Depression And Stress Treatment	3	3	100
40	*Carum carvi*	Menstrual Pain Relief	4	4	100
62	*Citrullus colocynthis*	Hemorrhoids	1	1	100
10	*Citrus limon*	Digestive, Throat, Fullness, And Fever	9	12	75
9	*Citrus sinensis*	Digestive, Throat	6	6	100
57	*Cocos nucifera*	Chronic Cough	1	1	100
54	*Coffea arabica*	Wounds	1	1	100
68	*Coleus forskohlii solenostemon*	Ear Pain	1	1	100
17	*Commiphora myrrha*	Respiratory System, Reproductive Hormones, Skin Diseases, Ear, And Throat	1	3	33.3
50	*Commiphora myrrha*	Hemorrhoids	1	1	100
25	*Commiuphor a myrrha*	Superficial Wounds	3	4	75
61	*Cucurbita ficifolia*	Prostate Enlargement Plus Childbearing	2	2	100
22	*Cuminum cyminum*	Digestive	8	9	88.88
18	*Curcuma longa*	Nervous System, Reproductive System	10	17	58.8
55	*Cymbopogon*	Respiratory, Influenza	2	2	100
69	*Eruca sativa*	Ful	1	1	100
51	*Ferula assa-foetida*	Digestive	1	1	100
27	*Ficus carica*	Treatment Of Blood Pressure And Hemorrhoids	2	2	100
2	*Foeniculum vulgare*	Digestive System, Respiratory System	20	30	66.6
20	*Foeniculum vulgare*	Nervous System, Reproductive System	1	3	33.3
65	*Geum urbanum*	Digestive Disorder	1	1	100
13	*Hibiscus sabdariffa*	Body Tonic That Lowers Blood Pressure	5	6	83.3
12	*Hordeum vulgare*	Kidney Disease, Urologist, Carminative	3	3	100
47	*Lawsonia inermis*	For Hair to Grow	1	1	100
53	*Lens culinaris*	Muscular Pain	1	1	100
41	*Lepidium sativum*	Musculoskeletal System, Bruises	7	7	100
59	*Linum usitatissimum*	Lmmunity Booster	1	1	100
32	*Malus domestica*	Strengthening The Immune System	1	1	100
14	*Matricaria aurea*	Digestive, Respiratory, Ear And Throat, And Influenza	22	34	83.3
3	*Mentha spicata*	Digestive System, Respiratory System, Nervous System, Burns	18	25	72
35	*Nigella sativa*	Respiratory System, Expectorant, Protection For The Body, Tonic	9	14	64.28.
28	*Olwa europae*	Diabetes, Skin Treatment	4	4	100

Table 5 (*continued*)

No	Plant Scientific Name	Disorders	LP	LU	FLValue
7	*Origanum syriacum*	Respiratory, Endocrine, And Nervous	4	5	80
5	*Petroselinum crispum*	Digestive Pain, Gallstones	9	9	100
6	*Pimpinella anisum*	Digestive, Nervous, And Respiratory Pain	31	46	67.3
60	*Piper nigrum*	Improve Blood Circulation	1	1	100
31	*Prunus dulcis*	Raising Immunity	1	1	100
45	*Prunus mahaleb*	Poor Hair	1	1	100
33	*Psidium guajava*	Respiratory, Digestive	13	16	81.2
11	*Punica granatum*	Digestive	7	9	77.7
67	*Rhanterium epapposum*	Asthma	1	1	100
1	*Rhazya stricta*	Digestive	2	2	100
37	*Saivia rosmarinus*	Blood Circulation Stimulant, Digestive Aid, Diuretic	6	6	100
16	*Salvia officinalis*	Respiratory, Reproductive Hormones, Urinary, And Digestive Tract	13	14	92.8
26	*Saussurea costus*	Digestive, Respiratory, And Pregnancy Delay	8	11	72.7
43	*Sengalia Senegal*	Gastrointestinal And Digestive Systems	2	2	100
34	*Senna alexandrina*	Digestive	11	11	100
46	*Spinacia oleracea*	Anemia	1	1	10
21	*Syzygium aromaticum*	Nervous System, Reproductive System, Teeth, Gums, Heart, And Blood Vessels	13	18	72.2
30	*Teucrium marum*	Digestive	2	2	100
38	*Thymus vulgaris*	Respiratory, Digestive Systems	8	9	88.8
64	*Trachyspermum ammi*	Digestive	1	1	100
23	*Trigonella foenum-graecum*	Digestive	8	9	88.88
39	*Urtica dioica*	Arthritis	2	2	100
66	*Vigna radiata*	Joints And Bones	1	1	100
15	*Zingiber officinale*	Digestive System, Respiratory System, Skin Diseases, Influenza, Throat	29	38	76.3
48	*Ziziphus spina-christi*	Dandruff	1	4	25

LP: respondents number used medicinal plants for a specific disease, LU: the number of respondents used same plant for any disease, FL = Ip/Iu × 100.

3.7. Route of administration and dosage

The route of administration for ethnomedicines was mostly observed orally, with additives like sugar, milk, and juice. There was no set dosage, as there is with modern medicines, but they were administered based on disorder and need. Ethnomedicines were used with teaspoons and fingertips, which were passed from generation to generation. Some elderly people were observed who regularly used ethnomedicines in crushed form for many disorders.

3.8. Gender, age classes, literacy level, and occupation

The average number of ethno-species used by men and women in online questionnaires and face-to-face interviews for many variables and demographic descriptors. Out of 121 face-to-face informants, 58 were male and 63 were female (Table 1). Females (70.2 %) were more knowledgeable than males (68.6 %). Saudis in Makkah learned about medicinal plants from family (83.5 %), social media (21.5 %), the internet (28.9 %), and books (5.0 %). The online questionnaire yielded different rating results for knowledge, but the basic source of experience is still family (778.%) as shown in Fig. 4. Age-wise, the informants were observed in several categories in the range of 25 to 75 years, as shown in Table 1. The age groups 25–34 and 35–44 years were most represented

Table 6
Fidelity Level values of frequently used traditional medicinal plants as remedy in Villages.

No	Plant Scientific Name	Disorders	LP	LU	FLValue
8	*acacia ampliceps*	Body tonic	1	1	100
37	*Acacia Senegal*	Treatment for Kidney Diseases as well as Dental and Gum Diseases	2	2	100
54	*Acacia Senegal*	Periodontal or Kidney Treatment	2	2	100
52	*Acacia tortilis*	Put a stop to the bleeding.	1	3	33.3
45	*Aerva javanica*	Diabetic, diuretic	1	1	100
60	*Alkanna tinctoria*	Reproductive System	1	1	100
43	*Alove Vera*	Respiratory	1	1	100
58	*Anethum graveolens*	Diarrhea	1	1	100
41	*Anisosciadium lanatum*	Digestive	1	1	100
49	*Astragalus sarcocolla*	Digestive	1	1	100
53	*Boswellia sacra*	Respiratory	1	1	100
44	*Calotropis Gigantea*	Wounds	2	2	100
17	*Camellia sinensis*	Digestive	1	1	100
35	*Camellia sinensis*	Digestive	1	1	100
21	*Carthamus tinctorius*	Diseases of the nervous system	2	2	100
13	*Carum carvi*	Digestive	2	2	100
32	*Cassia angustifolia*	Reproductive System, Digestive System	3	3	100
11	*Cinnamomum verum*	Reproductive system; diseases of the reproductive system	3	3	100
30	*Citrus × sinensis*	Body tonic	3	3	100
20	*Citrus limon*	Throat disorders; a body tonic	6	10	60
29	*Coffea arabica*	Digestive	1	1	100
51	*Commiphora gileadensis*	for burn injuries	4	4	100
5	*Cuminum cyminum*	Digestive	3	3	100
1	*Curcuma longa*	Skeleton, carminative, and body tonic	3	4	75
61	*Cydonia oblonga*	Digestive	1	1	100
14	*Cymbopogon schoenanthus*	Nervous system, respiratory, ear, and throat	4	4	100
23	*Elettaria cardamomum*	Gastrointestinal and respiratory diseases	2	2	100
47	*Ferula assa- foetida*	Asthma, Sore Throat, and Respiratory System	2	2	100
40	*Frangula alnus*	Digestive	1	1	100
39	*Garden cress*	Alhaykal Aleazmiu	2	2	100
57	*Glycyrrhiza glabra*	Respiratory	1	1	100
42	*Haloxylon salicornicum*	Muscular pain and bones	1	1	100
6	*Hibiscus sabdariffa*	Ear and throat diseases	1	1	100
25	*Lawsonia inermis*	Diseases of the nervous system	1	1	100
48	*Leptadenia pyrotechnica*	Cough Worms	1	1	100
55	*Linum usitatissimum*	Neurologic	1	1	100
16	*Matricaria aurea*	Gastrointestinal, nervous system, and respiratory	5	7	71.4
9	*Mentha spicata*	body tonic, respiratory system, digestive system, ear, and throat	8	12	66.6
18	*Moringa oleifera*	Digestive	1	1	100
27	*Nigella sativa*	Body tonic	1	1	100
36	*Nigella sativa*	Digestive	2	2	100
28	*Olea europaea*	Skeletal diseases, skin diseases, and lowering the level of sugar	2	2	100
33	*Origanum majorana*	Pco (Polycystic Ovary)	1	1	100
46	*Petroselinum crispum*	Gallstones	2	2	100
12	*Pimpinella anisum*	Diseases of the digestive, nervous, digestive, and tonic systems	10	12	83.3

Table 6 (continued)

No	Plant Scientific Name	Disorders	LP	LU	FLValue
3	plantago ovate	Gastrointestinal, carminative, and nervous systems	5	5	100
26	Prunus mahaleb	Diseases of the nervous system	1	1	100
10	Psidium guajava	Respiratory, Ear and Throat, and Gastrointestinal	7	7	100
38	Punica granatum	Body Tonic	1	1	100
15	Razhya stricta	digestive and respiratory systems	5	5	1000
56	Salvia hispanica	Cardiovascular	1	1	100
59	Salvia officinalis	Diarrhe	1	1	100
34	Spinach oleracea	Anemia	1	1	100
31	Syzygium aromaticum	Gum and skin diseases	7	10	70
7	Tamarindus indica	Digestive	2	2	100
2	Thymus vulgaris	Respiratory, anti-cold, and digestive	4	4	100
4	Trachyspermum ammi	Digestive	3	3	100
50	Tribulus terrestris	Kidney Stone	1	1	100
22	Trigonella foenum-graecum	Diseases of the digestive system, tonic for the body, urinary tract	9	12	75
62	Vulgare hordeum	Urologic	1	1	100
19	Zingiber officinale Roscoe	Tonic for the body; ear and throat diseases	7	8	87.5
24	Ziziphus spina-christi	Diseases of the allergic nervous system	2	2	100

LP: respondents number used medicinal plants for a specific disease, LU: the number of respondents used same plant for any disease, FL = Ip/Iu × 100.

in the interview section (29.8 and 27.3 %, respectively), whereas less than 25 years and 35–44 years were more likely to respond to questions in the questionnaire. According to literacy level of interviews participates were illiterate (7.4 %), Primary education (5.0 %), Secondary education (43.0 %), Bachelor (43.8 %), and Postgraduate (1.7 %) (Table 1). It was observed that percentage of illiterate literate people had less knowledge for number of ethno-species in folk medicine (5.3 %) than those of literate people (95 %). But totally for Online questionnaire were literate peoples (Fig. 5). Contrary to what we expected, the number of plants cited by both men and women did not increase with age, nor with the presence of children or people living in the house shared with the informants.

3.9. Cure-type preferences

As seen in Tables S1, S2 in the appendix and Table 7 below, the types of cures that people like can lead to differences in how much they know. The number of medicinal plants mentioned is inversely related to how much people like biomedicine. This is true for both men and women, and it is statistically significant. Also, men who say they prefer using medicinal plants list a lot more of them. In general, both men and women seemed to prefer using medicinal plants over biomedicine. Most men (76, 33.8 %) used both medicinal plants and biomedicine, but 19 (11.8 %) preferred biomedicine and 92 (52.5 %) preferred using medicinal plants. Some of the women (54, or 30 %) liked to use both medicinal plants and biomedicine. Another 108 (or 50 %) liked to use medicinal plants instead of biomedicine, and only 19 (19.3 %) liked biomedicine. When sick, most men and women would first try to heal themselves with plants. Men would only use them to treat minor illnesses and would go to a doctor if the illness lasted more than three days, if their body temperature was high, or if the pain got worse. Women would wait longer to see a doctor if they had a disease that lasted for a week or more, if it was hard to find the cause, or if the disease was serious or chronic.

4. Discussion

The study is linked to (Ong and Kim, 2014; Alqethami et al., 2020), who discussed ethnomedical knowledge in relation to many variables for men and women in urban and rural for the future of traditional medicine. According to (Deeba, 2009; Nisar et al., 2017), who uses crushing, decoction, and grinding techniques for active compound extraction, the method of plant preparation for traditional medicine by crushing and decoction of plant species for ethnomedicines may show promising results (Abubakar and Haque, 2020). The various plant species were used in single, combined, fresh, and dried forms. Our findings agree with (Khan and Khatoon, 2008; Ali et al., 2011; Alamgeer et al., 2013; Abubakar and Haque, 2020). Informants, on the other hand, use herbal medications that have undergone crushing and decoction to get results quickly. Also, regarding plant species used in the cure of health disorders that were categorized into groups, depending on the treatment, plants with a high ICF value can be considered more pharmacologically active as compared to plants with a low ICF value. FIC values will be high if most informants acknowledge the use of one or a few plants to treat a specific disease (Canales et al., 2005; Jafarirad and Rasoulpour, 2019). Based on different ethnobotanical indices, the potential plant candidates for discovering new drugs are *Zingiber officinale*, *Pimpinella anisum*, *Foeniculum vulgare*, *Curcuma longa*, *Senna alexandrina*,
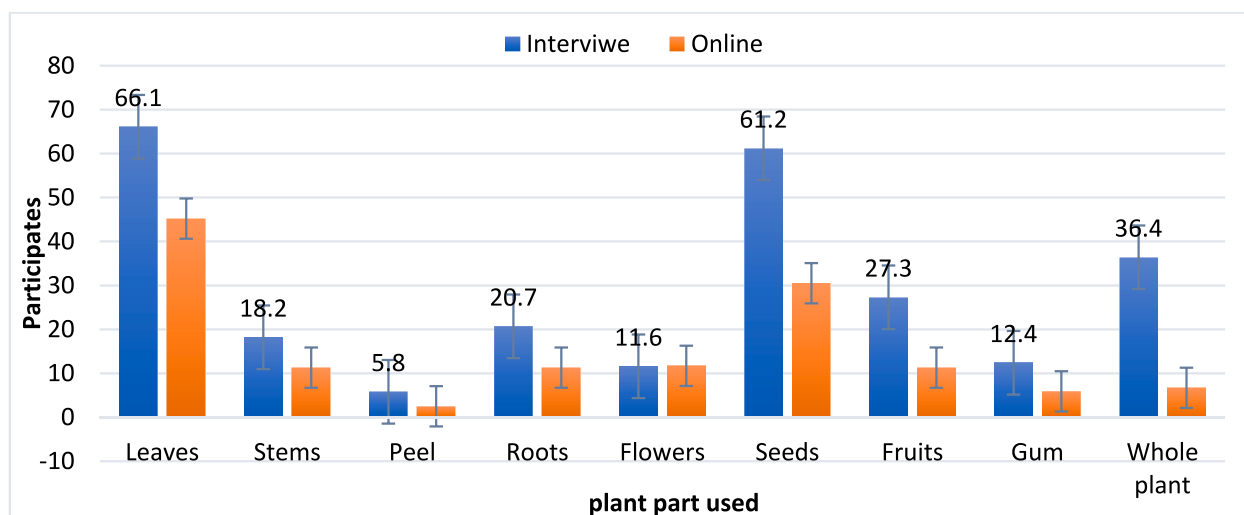

Fig. 2. Most plant part used ethnomedicine in Makkah and surrounded villages for Interviews and online questionnaire.
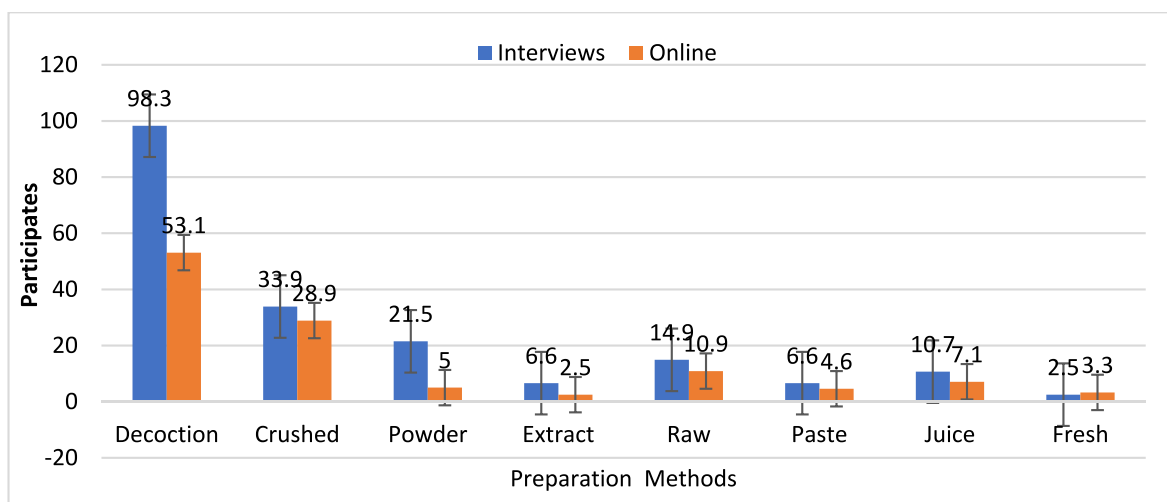
Fig. 3. Preparation of medicinal plants for using in ethnomedicine in Makkah and surrounded villages for Interviews and online questionnaire.
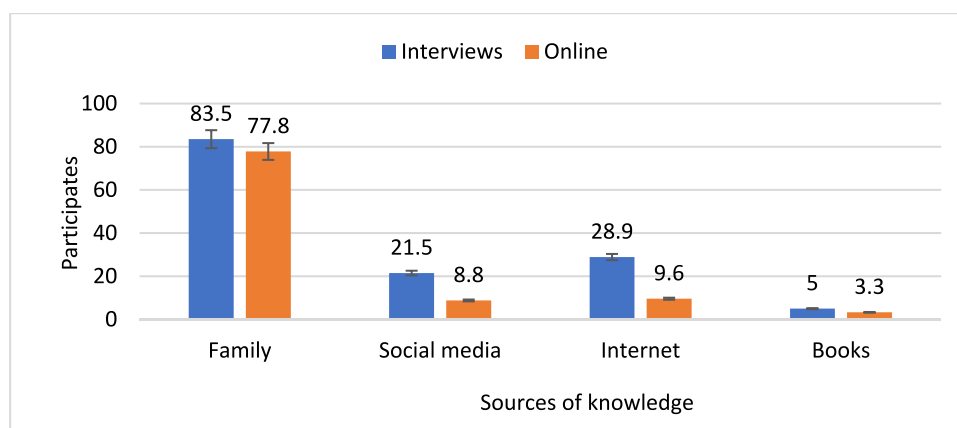

Fig. 4. The sources of medicinal plants knowledge mentioned by male and female in Makkah and surrounded villages for interviews and online questionnaire.
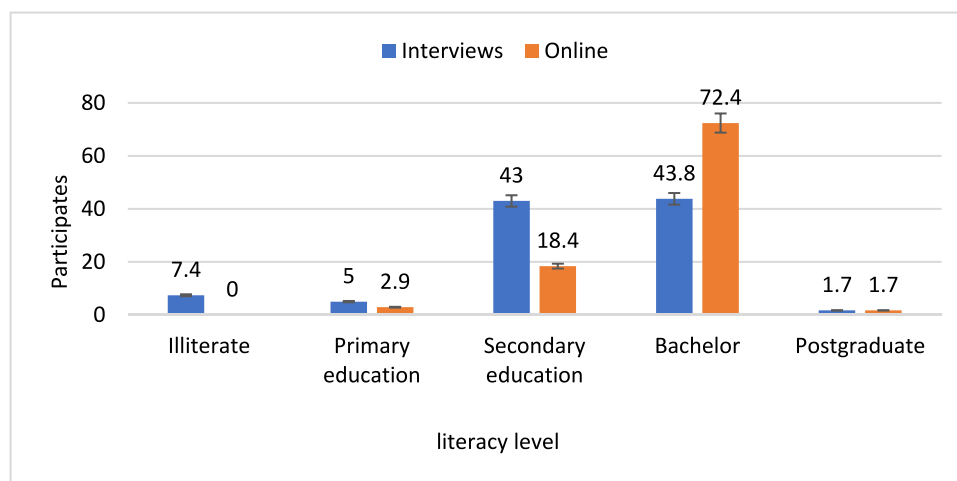

Fig. 5. literacy level of participates of interviews and online questionnaire in Makkah and surrounded villages.

Matricaria aurea, Petroselinum crispum, Lepidium sativum, Citrus sinensis, Salvia Rosmarinus and *Carum carvi.*

Plants of the Fabaceae, Apiaceae, and Lamiaceae (most commonly cited families) which agree with findings of previous studies by (Alqethami et al., 2017; Ullah et al.,2020)., Zingiberaceae, and Brassicaceae

are important families. Those families are regularly used, reflecting the influence of historical herbal trade in remediations (Amar and Lev, 2017). Since ancient times, several plants, such as Syzygium aromaticum, Curcuma longa, and Zingiber officinale, have been brought into the Roman world via the Arabian Peninsula (Van Der Veen and Morales,

Table 7
Preferences for the cure kind in the light gender.

Gender	Total of Informants	Preferable cure-type								
		MP			AM			Bothe		
		no.	%	N	no.	%	N	no.	%	N
F	62	31	50.0[B]	108	12	19.3[A]	28	19	30.6[B]	54
M	59	31	52.5[B]	92	7	11.8[A]	19	20	33.8[B]	76

M/F = Male/Female, MP/AM = Medicinal Plants/Allopathic Medicine, N: plants listed, A p < 0.05, level of significance ≤ 0.01 of root growth inhibition compared with negative control; B p < 0.05, level of significance ≤ 0.05 of root growth inhibition compared with negative contro[l.]

2015). Additionally, a lot of the described medicinal plants are spices, which have chemical properties that make them desirable medicinal plants. These plants are particularly rich in phytochemical compounds, of which only small amounts are needed for a medicinal effect, facilitating early long-distance trade (Van Der Veen and Morales, 2015). Spices were shipped through ports whose principal purpose was to assist this type of trade. These ports also served as food transfers to Makkah region. Additionally, a third of the therapeutic plants utilized in this region are food plants, which is congruent with data from Makkah (Alqethami et al., 2017). In this study, onion, orange, lemon, and olive are cited as prominent edible plants (Table 3). The widespread use of food plants as medicinal products by the urban population (Vandebroek and Balick, 2012) may be the result of easy access to these plants. The widespread medicinal use of spices and foods in cities may be a global characteristic of urban ethnobotanical knowledge, as these are readily available even in rural environments (Alqethami et al., 2017). In addition to herbs and food plants, a significant number of medicinal plants reported in this study are mentioned in the narratives of the Prophet's life, demonstrating the extensive influence of prophetic medicine in Makkah region. e. g*., Nigella sativa, Senna alexandrina, Trigonella foenumgraecum,* and *Foeniculum vulgare* plants (Alqethami et al., 2017; El-Seedi et al., 2019; Mehmood et al., 2021). Consequently, local medicine may also be affected by religious factors.

Not Men, as expected, use fewer medicinal plants than women, but their knowledge of them appears to be equal, and the plants used are nearly identical. For instance, almost every plant known to men was also known to women. Second, the most common therapeutic plants are the same for many ailments. Although it was expected that the women would have an increased number and variety of plants listed due to their roles as housewives and primary family care as mentioned in many studies(Torres-Avilez et al., 2016; Alqethami et al., 2020) but the knowledge of men and women was extremely close. Some of the mixtures mentioned by informants are combinations of plants usually eaten as vegetables or tonics (Table S3). It is well known that some plant mixtures work better as medicines than their individual parts, and that the right drug combination can help treat many diseases that have more than one cause, like cancer and heart disease (Gras et al., 2018).

Men and women appear to understand and use plants in similar ways in crucial aspects. Traditional medical plant knowledge relates to a variety of experiences passed down from generation to generation (Díaz-Reviriego et al., 2016; Jamshidi-Kia et al., 2017; Costa et al., 2021). It was discovered that information transmission occurs in the study area not just through friends and family, the internet, and social media but also from relatives to others. These findings agree with those from other Arabian cities (Alqethami et al., 2017). After family, social media and the Internet are the most often mentioned knowledge sources. Face-to-face interviews helped us understand that when a social network is unavailable, men and women turn to websites with comparable content. Men's and women's knowledge, however, does not appear to rise with age and appears to be more influenced by advances in media and information technology.

On the other hand, some current research indicates that traditional and modern medicine can be practiced simultaneously in the Arabian Peninsula, or if one fails, the other will be attempted, but when modern medicine is successful, traditional medicine tends to fade (Tounekti et al., 2019). The current study notes that much fewer plants are known by both men and women who choose biomedicine. Saudis in Makkah, like Saudis in other urban centers, still treat minor illnesses at home. Finally, the using of medicinal plants is still a big part of urban health care (Teixidor-Toneu et al., 2017).

5. Conclusion

Among Saudis in Makkah, medicinal plants play a major role in healthcare. Historical, economic, and religious considerations seem to affect both the variety of medicinal plants used in folk medicine and the methods in which they are administered. Both men and women practice traditional medicine in Makkah. However, the findings of the present study reveal that folk medicine is mainly practiced by middle-aged men and women, as well as by those individuals who demonstrate a strong interest in using medicinal plants. Men are familiar with a subset of the plants that women utilize, and vice versa, maybe as a result of learning from the same online and social media sources. Numerous medicinal plants are also used as vegetables, fruits, grains, oils, and spices. So, in the era of information technology, gender and urban issues must always be considered when conducting ethnopharmacological research in different cultures.

CRediT authorship contribution statement

Sameer H. Qari: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Afnan Alqethami:** Formal analysis, Investigation, Funding acquisition. **Alaa T. Qumsani:** Formal analysis, Investigation, Funding acquisition.

Declaration of Competing Interest

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jsps.2023.101881.

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