

Exploring the miracles toward the Ethnobotany of *Citrus aurantium* L. (Rutaceae) in Iran (hitherto unknown uses of the plant), alongside an overview worldwide

Atena Eslami-Farouji, Fatemeh Jalili

#### Correspondence

Atena Eslami-Farouji<sup>1\*</sup>, Fatemeh Jalili<sup>1</sup>

<sup>1</sup>Department of Biology, College of Science, Shiraz University, Shiraz, Iran

\*Corresponding Author: atena.eslami@shirazu.ac.ir

Ethnobotany Research and Applications 29:47 (2024) - http://dx.doi.org/10.32859/era.29.47.1-52 Manuscript received: 21/09/2024 – Revised manuscript received: 23/09/2024 - Published: 24/09/2024

#### Review

#### Abstract

*Background*: Bitter orange (*Citrus aurantium*, Rutaceae) is extensively cultivated and known in Iran for its feeding and medicinal uses. However, its ethnobotanical knowledge has not yet been fully understood in Iran. To shed further light on the local knowledge of bitter orange within Iranian communities, and to summarize the worldwide pharmacological and traditional uses of *C. aurantium* based on a large number of works, we aim to carry out a comprehensive study of the historical and contemporary medicinal uses of this herb.

*Methods*: To unravel the indigenous knowledge of the bitter orange, data was systematically collected in the region. Semistructured and electronic interviews were performed using 100 participants of dissimilar age, education, gender, and occupation. We also compiled extensive data regarding published papers, libraries, and online databases such as Elsevier, Google Scholar, PubMed, Science Direct, Springer, Taylor and Francis, Web of Science, and Wiley Online Library within Iran and the world.

*Results*: The majority of Iranian respondents were included in the 20-30 and 30-40 age groups, representing the appropriate transmission of herbal medicine knowledge among young people. Various uses of bitter orange were listed, of which the most frequently recorded ailment was the treatment of psychological disease. Flowers were the most frequently used part of the plant. Overall, *C. aurantium* comprises significant chemicals such as carotenoids, essential oils, flavonoids, terpenoids, and is mainly reputed for its beneficial health roles.

*Conclusions*: This study reviews and presents comprehensive information on *C. aurantium* and its outstanding and novel traditional uses, together with its pharmacological properties and bioactive constituents.

Keywords: Bitter orange; Ethnobotany; Herbal medicine; Iran; pharmacological use

### Background

The adverse effects, higher toxicity, and reduced efficacy of synthetic medicines have led to increased interest among local communities in traditional medicine. Thus, there is greater attention to the traditional knowledge of plants, highlighting their crucial contributions to human health and well-being. Ethnobotany, which explores the plant use practices of indigenous communities and traditional healers, has often paved the way for the discovery of new drugs in modern science (examples include aspirin, serine, reserpine, etc.) (Okogun, 2002). Iran, with its rich cultural diversity and traditional practices across

various customs and dialects, holds empirical knowledge about remedies for various illnesses. In addition to ordinary individuals with general herbal prescriptions, there are professional herbal stores (=pharmacies) in Iran known as "attari," where formulated herbal remedies are used to treat ailments. However, it is essential to ensure quality, proper dosage, and standardization in herbal medicines (Okogun, 2002; van Wyk and Prinsloo, 2020).

#### Botany and vernacular names

The genus *Citrus* L., belonging to the family Rutaceae, originated in Southeast Asia (e.g., Langgut, 2017). It is highly used in many countries due to its tasty products (e.g., fruits, spices, and essential oils), refreshing flavor, and nutritional value (e.g., carotenoid, coumarin, dietary fiber, folate flavonoids, Iron, phenol and Vitamin B9 & C). Additionally, it offers economic benefits, ornamental appeal, and, to a lesser extent, serves as a source of timber (e.g., Chooi, 1994; Nalini and Chimmad, 2003; Bora et al. 2020; Othman et al. 2022). Apart from well-known cultivars such as *C. maxima* (Burm.) Merr., *C. medica* L., *C. paradisi* Macfad., *C. reticulata* Blanco, *C. sinensis* (L.) Osbeck, *C. grandis* Osbeck, numerous species within this family are naturally distributed worldwide comprising around 162 genera and 2080 species (Groppo et al. 2022).

Citrus aurantium L. (Rutaceae), commonly known as bitter or sour orange (referred to as "naranj", "naffash", "kabbad", "afei giah" in Iran), is a widely cultivated evergreen tree that can reach up to 10 meters in height (Vandebroek and Picking, 2020). According to the "International Plant Name Index," the correct scientific name for this plant is Citrus × aurantium, which has several infraspecific sub-classifications (available at www.ipni.org). As discussed by previous researchers, it is a product of hybridization between C. maxima and C. reticulata (Anwar et al. 2016; Wu et al. 2018; Guerra et al. 2020). As depicted in Fig. 1, bitter orange exhibits the following morphological features: blunt thorny branches, gravish to brown color, ovate alternate leaves with winged edges, bell-shaped calyx, fragrant white bisexual flowers, and rounded orange fleshy fruits. It is naturally distributed in Africa, Arabia, China, India, Syria, while being cultivated in various parts of the world (e.g., America, Egypt, Italy, Spain) for centuries (Calabrese, 1992; Nicolosi et al. 2000; Pimenta et al. 2017). In Iran, it is found in both the northern regions (Gorgan, Guilan, Mazandaran) and the southern regions (Fars and Khuzestan). Delgosha garden in Shiraz (Fars province, south of Iran) is located near the Tomb of Saadi. It is well-known for its dominant cultivation of bitter orange trees and features an aromatherapy area for visitors. Bitter orange trees are commonly cultivated along streets in various cities, gardens, botanical gardens, and residential yards across Iran. The optimal harvest time for its fruits is typically from November to January. Research by Weisskopf and Fuller (2013) suggests that C. aurantium originated in South China and northern Indo-China, while Mannucci et al. (2018) propose an origin in eastern Africa and Syria. According to the ideas put forth by Paul and Cox (1995) and Vandebroek and Picking (2020), the species is originally native to southeastern Asia. Indeed, favorable ecological conditions (such as climate and soil) allow bitter orange to grow in different regions of the world (e.g., Duarte et al. 2016). The pleasant aroma and taste of this herb have attracted the attention of pharmacologists over time. However, some earlier scientists (e.g., Calabrese, 1998) believe that the color and fragrance of sour oranges considerably lost due to their migration to regions lacking the specific climate and habitats.

Drawing upon relevant literature, our objective is to comprehensively catalogue the local knowledge of bitter orange within Iranian communities. We also aim to facilitate the cultural transfer of traditional scientific wisdom and provide an overview of overseas literature through an extensive survey. To achieve this, we plan to conduct a comprehensive study on this plant, summarizing its chemical constituents, pharmacological properties, and ethnobotanical information. Additionally, we briefly highlight novel insights from Iranian communities and outline future perspectives related to bitter orange.

#### Materials and Methods

#### Study area and research strategy

The present study was conducted from November 2022 to March 2024 in Iran. We administered questionnaires across various regions (Fig. 2), with a particular focus on areas where bitter orange is cultivated (such as Southern Iran).

The questionnaires were filled out through both semi-structured interviews (Fig. 2) and electronic surveys. In the case of electronic questionnaires, images of the bitter orange were included.

Additionally, a specimen of this herb has been deposited in the Herbarium of Shiraz University (HSHU) with the voucher specimen number 55150. Our respondents represent a diverse range of ages, genders, educational backgrounds, and occupations. Additionally, we evaluated the local names, uses, and plant parts used within the studied area. The informers were also asked whether the distribution or cultivation area of this plant had improved, remained unchanged, or declined. Additionally, we conducted thorough bibliographic research on the medicinal and traditional knowledge associated with bitter orange. Our search spanned scientific databases and search engines, focusing on peer-reviewed journals from 1970 to 2023 including resources such as Web of Science and Scopus (Elsevier, Google Scholar, PubMed, Science Direct, Springer, Taylor and Francis, Web of Science, and Wiley Online Library).



Figure 1. Morphological characteristics of *Citrus aurantium*. **a**) life form in Delgosha Garden, **b-c**) leaf, **d-e**) flower, **f-g**) gynoecium and androecium, **h**) androecium, **i-j**) gynoecium, **k**) inflorescence, **I-m**) hesperidium fruit. Images are pictured by the first author (AEF).

We meticulously reviewed over 260 papers and books using the following keywords: "*Citrus aurantium* medicinal/traditional use," "*Citrus aurantium* ethnobotany," and "*Citrus aurantium* local medicinal knowledge." Except for a few, nearly all of these publications were written in English. Furthermore, we closely examined articles that described the chemical or bioactive compounds extracted from bitter orange using various methods.

### **Results and Discussion**

### Traditional uses and ethnopharmacology

*Citrus aurantium*, known locally as "naranj", "narang", "naffash", "kabbad", "afei giah" in Iran, goes by various names in different parts of the world. These include: bigarade, green orange, bitter orange, kijitsu, seville orange, sour orange, zhi qiao, zhi shi, etc. These names are summarized in Table 1.

Country	Vernacular name(s)	Literature cited
Sudan	Limonin, nomilin	Khalid et al. 1986
Malaysia	Limau cula, sweet orange	Chooi 1994
Haiti	Zorange si	Paul and Cox 1995
Brazil	Laranja-amarga, laranja-azeda, laranjacavalo	Carvalho-Freitaz and Costa 2002
China	Chih-shi, Zhi shi	Chen and Chen 2004
Suriname	Swa alanya	Van Andel et al. 2007
Hungary	Narancs	Papp et al. 2011
Algeria	Bourtoukal	Bouabdelli et al. 2012
Bolivia	Naranja agria	Quiroga et al. 2012
Iran	Bahar narang (flower)	Amiri and Joharchi 2013
Egypt	Orange albedo	Osfor et al. 2013
Greece	Bitter orange or sour orange	Sarrou et al. 2013
Brazil	Laranjeira	Grandi 2014
Algeria	Bergamot	Djenane 2015
Nigeria	Gnin-ganin	Ajayi and Moody 2015
India	Nibu	Meena 2015
Nigeria	Orange, bitter orange	Rufai and Fatimah 2015
Poland	Bitter orange or sour orange	Gniewosz et al. 2017
Brazil	Laranja daterra	Palheta et al. 2017
Nigeria	Zingbo	Adedeji et al. 2018
Brazil	Laranjeira	Dias et al. 2019
Nigeria	Orange, bitter orange	Ishaq et al. 2022
Korea	Jigak	Park et al. 2019
Morocco	Bitter orange	Aissaoui et al. 2020
Hungary	Narancs	Petrova et al. 2020
Italy	Melangoli	Biscotti et al. 2021
India	Bitter orange	Daisy et al. 2021
Iran	Narenj	Hosseini et al. 2021
Algeria	Bigaradier, narang	Boungab and Makhlouf 2022
Brazil	Laranjeira	de Oliveira-Melo et al. 2022
China	Changshan-huyou	Gao et al. 2022
Indonesia	Jeruk Hantu, Jeruk Peras	Sofiyanti et al. 2022
Italy	Crispifolia	Di Napoli et al. 2023
Morocco	Ranj	El Kasimi et al. 2023
China	Zhiqiao	Luo et al. 2023
Morocco	Ronge	Lyoussi et al. 2023
Iran	Narang (fruit), bahar narang (flower)	The present study

Table 1. Vernacular names of Citrus aurantium are used by Iranians and local people around the world.



Figure 2. Selected herbal pharmacy photographs prepared during the interviews conducted within Iran in ethnobotany research of *Citrus aurantium*. **a-b**) Urmia, **c-d**) Esfahan, **e**) dried flowers of bitter orange in an herbal pharmacy in Shiraz, **f-g**) Shiraz, **h**) Hamedan, **i**) Karaj, **j**) Shiraz, **k**) bitter orange water in Shiraz.

Based on different authorities, nearly every part of the plant may contain different chemical compounds, and typically, fresh edible parts are consumed whole (Tables 2-3). This topic highlights the medicinal or traditional knowledge related to *C. aurantium*.

Tables 2-5 provide a comprehensive list of traditional uses, the specific plant parts used, preparation methods, routes of administration, main chemical bioactive, animal food, healthcare implications, and a review of literature related to bitter

orange in Iran and other regions worldwide. Interestingly, classical formulations and specific traditional prescriptions associated with *C. aurantium* have been developed for treating various ailments. These healing approaches were mentioned by a number of respondents for the first time and are meticulously documented in a distinct section (Table 6). The details of these therapeutic novelties are outlined in Table 6, with some involving the use of various other herbs.

The informants in our study spanned a wide age range, from 16 to 67 years old. The present study involved 100 interviews across five age groups: younger than 20 years, 20-30 years, 30-40 years, 40-50 years, and individuals older than 50 years (Fig. 3a). Notably, the 20-30 age group accounted for 54% of the ethnobotanical information assessed. The 30-40 age group contributed 21%, while the 40-50 age group provided 16%. However, the <20 age group represented only 7%, and the >50 age group contributed a mere 2% of information related to *C. aurantium* medicinal features. Both male and female respondents actively participated in this project. Statistically, the number of male respondents significantly outweighed the number of females, and the gender distribution was 26% women and 74% men.



Figure 3. a) frequency of different age groups participating in *Citrus aurantium* ethnobotany research, b) academic education, c) describing local methods for harvesting bitter orange, d) the most significant ailments treated by bitter orange, e) plant

parts utilized, **f**) modes of administration for bitter orange remedies, **g**) plant ingredients along with bitter orange for treating ailments.

Scientists believe that the local knowledge of medicinal plants has been lost due to the gradual transfer of this information from older to younger generations. This decline is influenced by continuous cultural shifts, lifestyle changes, and environmental transformations (Srithi et al. 2009; Liu et al. 2023; Manzoor et al. 2023). We hypothesize that ethnobotanical knowledge is predominantly transmitted among individuals aged 20 to 50 years old, and we totally accept this idea that very young people (<20) are almost engaged in formal education at schools, thus; they are involved with different courses that have nothing to do with traditional beliefs (Mpofu and Miruka, 2009; Amir et al. 2019). Based on interview results, approximately 97% of the respondents reside in urban areas. Regarding marital status, 37% of the participants are single, while the remaining 63% are married. In terms of education, around three-quarters of applicants hold a master's degree, while 21% of them have a ≥diploma. Only 5% of the participants possess a doctorate degree or higher. It appears that PhD informants may either be less inclined to fill out questionnaires or lack sufficient information regarding the medicinal value of bitter orange (Fig. 3b). Furthermore, sixty-nine percent (69%) of the respondents personally collected different parts of

the bitter orange, while 26% obtained it from herbal pharmacies (Fig. 3c). When asked about changes in the distribution or cultivation area of *C. aurantium*, 49% of respondents were uncertain (had no idea whether the distribution or cultivation area has been changed or not through time), 28% claimed an increase in abundance, and only 23% believed that the number of bitter oranges had declined.

Among all informants, approximately 67% believe in the efficacy of modern medicinal drugs for curing diseases, while 33% place their trust in traditional remedies. Interestingly, despite a significant number of informants expressing skepticism toward traditional medicinal herbs, only a few (5%) have never used bitter orange to treat ailments. According to our best knowledge and various authorities (refer to Table 2), this herb is renowned for its striking medicinal properties and an incredible history of managing and curing various health conditions. In terms of pharmacological activities, this medicinal herb is prominently used as an anti-inflammatory, insecticide, and for treating coughs, colds, and influenza (Table 2).

Table 2. Review of the ethnobotanical uses of bitter orange in Iran and other parts of the world. The phrase "not-defined" is used whenever we do not find any referenced documentation regarding the literature review. Abbreviations within this table are as follows: GC-MS: gas chromatography/mass spectrometry, HD: Hydrodistillation, UHPLC-Q-TOF/MS: Ultra-high performance liquid chromatography-quadrupole time-of-flight mass spectrometry, RP-HPLC: Reversed-phase high-performance liquid chromatography, HPLC-MS/MS: high-performance liquid chromatography coupled with tandem mass spectrometry.

Country	Plant part used	Preparation	Medicinal or traditional	Route of	Literature cited
		method(s)	uses	administration	
India	Entire	Hot aqueous	Menorrhagia	Oral	Jain and Tarafder
		extract			1970
China, Indo-	Not-defined	Not-defined	Bronchitis, diaphoretic,	Not-defined	Perry 1980
China,			freckle, gout, hysteria,		
Indonesia,			influenza, laxative,		
Philippine			pimple, rheumatism,		
			sedative, stimulant,		
			worm		
Iran	Flower	Hydrolate	Heart tonic, mild	Not-defined	Aynechi 1991
			depression treatment,		
			sedative		
Sudan	Not-defined	Hot aqueous	Malaria	Oral	Khalid et al. 1986
		extract/ dried			
Iran	Flower	Hydrolate	Heart tonic, mild	Not-defined	Zargary 1986
			depression treatment,		
			sedative		
Rarotonga	Branch juice or	Decoction	Convulsion (children),	Oral (three	Holdsworth 1990
Island	Branch+		Gonorrhea	times in each	
	Psidium guajava			day)	
	or				
	Branch+				
	Morinda				
	citrifolia+ Piper				
	methysticum				
India	Entire	Mixed with other boiling, herbs.	Bruising, Influenza, digestive problems.	Oral	Paul and Cox 1995
		water, salt or	epilepsy. emotional		
		vegetables	problems, fever, food		
			preparation, gall bladder		
			disorders, hepatic		
			disorder, rheumatism.		
			skin problems (external		
			use)		
			- /		

Egypt	Not-defined	Not-defined	Fungicidal activity	Not-defined	Ramadan et al. 1996
America	Fruit	Not-defined	Human feeding	Not-defined	Facciola 1998
Italy	Fruit	Hydroalcoolic extracts	Body weight reduction	Oral	Calapai et al. 1999
America	Fruit	Extraction	Body weight reduction	Pill	Colker et al. 1999
Egypt	Leaf	Aqueous ethanol	Food spices	Not-defined	Haggag et al. 1999
America	Dried immature	Not-defined	Weight loss	Powder	Jones 2001
	fruit and peel				
Georgia,	Fruit juice	Chromatography	Cardiovascular	Oral	Penzak et al. 2001
Atlanta			Effects		
Brazil	Fruit peel	Hexanic (HF),	Anticonvulsant,	Oral	Carvalho-Freitas
		dichloromethanic	antispasmodic, anxiety		and Costa, 2002
		(DF) and final	effect, relaxant,		
		aqueous (AF)	sedative/hypnotic		
		fractions			
Italy	Fruit	RP-HPLC	Human cancer,	Not-defined	Pellati et al. 2002
		technique with	cardiovascular problem,		
Amorico	Not defined		Read process and boart	Not defined	Builet al. 2006
America	Not-defined	extraction	rate	Not-defined	Bui et al. 2006
Brazil	Fruit	HD	Antispasmodic, anxiety	Oral	de Moraes Pultrini
			effect, relaxant, sedative		et al. 2006
Greece	Fruit peel	Flash	Insecticidal activity	Not-defined	Siskos et al. 2007
		Chromatography,			
		HPLC			
Suriname	Fruit	Not-defined	Genital bath	Not-defined	Van Andel et al. 2007
India	Fruit peel	Ethanol extraction	Reduce blood glucose	Injection or oral	Sharma et al. 2008
Zambia	Flower	Infusion	Decrease stress	Dried	Kurian 2010
	Fruit pulp	Not-defined	Improve expel	Pulp	_
			defecation, treatment of	·	
			respiratory and nervous		
			system problems, cold,		
			arthritis, fever,		
			headache, convulsion,		
			influenza		_
	Fruit juice	Not-defined	Digestive system and	Liquid	
			liver problems, blood		
			pressure,		_
	Fresh Fruit peel	Not-defined	Acne elimination	Not-defined	_
	Leat + honey	Not-defined	Decrease cough	intusion	A111 11
Iran	Flower	Distillate or	Anxiety effect	Oral	Akhlaghi et al. 2011
		saune solution			
Iran (north)	Dool	Not defined	Aromatharany	Dried and freek	Habibi Dibalani an -
nan (north)	reel	Not-delined	Aromamerapy,	arind slice	DAB INGIGUIA IUIUbn Mosazadob-
			improve memory	Decoction	Savadmahaleh
			laxative, making iam	Decotion	2011
			(disinfectant) and prickle		-011
			(stomach tonic). Nausea		
			parasite removal from		
			digestive, relieve chest		

			pain system, stomach		
			tonic, vomit		
Karaa	Fuult so al	70%		Net defined	Kana at al. 2011
Korea	Fruit peer	70% aqueous methanol	Anti-innammatory	Not-defined	Kang et al. 2011
Hungary	Essential oil	Not-defined	Anti-cough	Raw with sugar	Papp et al. 2011
America	Fruit or fruit	Not-defined	Analgesic, anti-	Not-defined	Stohs et al. 2011
	peel		inflammatory,		
			antispasmodic,		
			carminative, decrease		
			blood pressure,		
			digestive, diuretic, effect		
			central nervous system,		
			sedative, sport		
			performance product,		
			weight loss		
Algeria	Leaf, fruit peel	Aqueous extract	Anti-bacterial, calm	Not-defined	Bouabdelli et al.
			epilepsy, sedative,		2012
			antispasmodic, nervous		
			system, migraine		
France	Leaf	HD	Antioxidant and	Not-defined	Ellouze et al. 2012
			antibacterial activity		
Karnataka	Leaf	Chloroform and	Anti-bacterial	Powder	Gopal 2012
		ethanol			
		extraction			
Bolivia	Leaf	Not-defined	Central nervous system	Infusion,	Quiroga et al. 2012
			problems, washing the	decoction	
			head		
Iran	Flower	Not-defined	Anti-hypertensive,	Not-defined	Amiri and Joharchi
			anxiety effect, cardiac		2013
			tonic, food digestive		
Tunisia	Fruit peel, juice	GC-MS/	Antimicrobial,	Not-defined	Jabri Karoui and
			antioxidant		Marzouk 2013
Greece	Flower, fruit	HD/ GC-MS	Heat disease, nourishing,	Fresh	Sarrou et al. 2013
	peer, rear	200/ 2000 200		Netdefined	Dislay at al. 2014
Iran	Fruit peel	80% aqueous	urease enzyme	Not defined	Biglar et al. 2014
Tunicia	Flower	Distillation water	Aromothoropy (flovor	Not defined	lines at al. 2014
TUTIISId	Flower	Distillation water	and fragrance)	Not-defined	111es et al. 2014
Iran	Flower	Not-defined		Not-defined	lazaveri et al. 2014
ITall	Tiower	Not-defined	sedative	Not-defined	Jazayen et al. 2014
			Schullve		
America	Fruit peel	HPLC-MS/MS	Anti-cancer (lung and	Powder	Park et al. 2014
Korea			prostate)		
Pakistan	Fruit peel	Ethanol	Nephroprotective	Powder	Ullah et al. 2014
		extraction	activity (kidney protect)		
Nigeria	Fruit	Not-defined	Antipyretic	Juice	Ajayi and Moody
U U					2015
Iran	Flower	Methanol	Anxiety, epilepsy,	Powder	Rahnama et al.
		extraction	insomnia, neurological		2015
			diseases		
Nigeria	Fruit	Not-defined	Anti-inflammatory,	Pulp	Rufai and Fatimah
			anticoagulants,		2015
			antimicrobial, antitumor,		

			cure heart disease, anti- diarrhea and dysentery, antiparasitic, anthehelmintic, nervous system, paregoric, gout treatment, treating multi-drug resistance		
Iran	Leaf, fruit peel	GC-MS	Antimicrobial activity	Ripe and unripe	Azhdarzadeh and Hojjati 2016
Iran	Essential oil	Not-defined	Anxiety effect, Aromatherapy,	rubbing oil on the forehead	Bakhsha et al. 2016
Iran	Flower	Hydro-alcoholic extract	Antioxidant activity	Not-defined	Nabavi et al. 2016
South America	Fruit	Not-defined	Anxiety effect	Diazepam, inhalation	Pimenta et al. 2016
Iran	Fruit peel	GC-MS, HD	Condiment, larvicidal activity	Not-defined	Sanei-Dehkordi et al. 2016
Jordan and America	Juice	Physical examination	No cardiovascular effects	Oral	Shara et al. 2016
Iran	Not-defined	SD	Peroxidases catalyze protein oxidation and lipid peroxidation activity	Not-defined	Mohadjerani and Aghaei 2016
Brazil	Fruit, leaf	Tea (decoction)	Albumin deficiency in pregnancy, heart disorders, high cholesterol	Oral	Palheta et al. 2017
Poland	Petitgrain oil	Chromatography, Macrodilution	Anti-bacterial and antifungal activity, aromatherapy, cosmetics, food,	Not-defined	Gniewosz et al. 2017
Nigeria	Fruit and seed	Grinding	Rash	Powder plus soap or cream	Mowobi et al. 2016
	Leaf	Decoction	Measles	Aromatherapy, use in bath, use two or three times daily	
Iraq	Leaves	Magnetic stirrer, soxhlet, precipitation and coloration	Anti-bacterial	Not-defined	Ani et al. 2017
Nigeria	Not-defined	Infusion	Obesity, typhoid fever	Oral	Adedeji et al. 2018
Iran	Peel	Essential oil	Aromatherapy, improve sleep quality, sedative	Not-defined	Arab Firouzjaei et al. 2019
Tunisia	Flower Leaf Peel	Decantation, HD/GC and GC- MS	Antimicrobial effect against bacteria and fungi	Not-defined	Bnina et al. 2019
Brazil	Fruit peel	GC-MS	Anti-fungal	Decoction	Dias et al. 2019
Iran	Fruit peel	DPPH radical scavenging and ferric reducing antioxidant potential assay, GC-MS	Anti-bacterial, antioxidant	Dried, powdered	Farahmandfar et al. 2019

Iran	Essential oil	Not-defined Anxiety, aromatherapy	Essential oil Not-defined Anxiety, aromatherapy, Aroma fatigue		Aromatherapy	Abdollahi and Mobadery 2020
Bulgaria	Flower	Solvents (water	Spice in food and	Grounded using	Petrova et al. 2020	
Duigana	Hower	and acetone	cosmetic additive	homogenizer	1 0000 00 000 2020	
		extracts) in an		noniogenizer		
		ultrasonic bath				
lamaica	Fruit fruit iuice	Barbecued	Send away mosquitoes	oral	Vandebroek and	
Januarea	fruit neel leaf	Burning	making lemonade	orar	Picking 2020	
	nut peel, lear	Barring	nrenaring tea remove			
			rust from dish Remove			
			mange and fleas from			
			animal skin. treatment of			
			animal feet			
Italy	Flower, fruit	Not-defined	Food, decrease sugar	Not-defined	Biscotti et al. 2021	
,	,		content, rootstock			
India	Fruit peel	Ethanolic extract	Insecticide	Dried and	Daisy et al. 2021	
	·	plus GC-MS		powdered	,	
Iran	Flower	Decoction	Anti-diarrhea, eye	Oral	Hosseini et al. 2021	
			disorders, making kohl,			
			relaxing			
Iran	Essential oil	Not-defined	Agitation and anxiety,	Aromatherapy	Karimzadeh et al.	
			aromatherapy		2021	
Damascus	Fruit peel	HD, GC-MS	Antitumor, colorectal	Not-defined	Odeh et al. 2021	
			cancer			
India	Not-defined	Not-defined	Cosmetic, vitamin C	Not-defined	Sehgal 2021	
Iran	Essential oil	Not-defined	Aromatherapy	Aromatherapy	Abbaspoor et al.	
					2022	
Brazil	All parts	Not-defined	Albuminuria, anemia,	Not-defined	de Oliveira-Melo et	
			bellyache, catarrh, liver		al. 2022	
			and stomach disorders,			
			malaise, worm			
China	Not-defined	Ethanol	Anticolorectal cancer	Dried and	Gao et al. 2022	
		extraction/	cells activity	powdered		
		UHPLC-Q-				
		TOF/MS				
Iran	Flower	Stem distillation	Aromatherapy	Aromatherapy	Ghods et al. 2022	
Nigeria	Leaves	Ethanolic	Anticoccidial activity	Pulverized	Ishaq et al. 2022	
		extraction				
Algeria	Leaves	HD	Antifungal, pesticide	Powdered	Boungab and	
					Makhlouf 2022	
Iran	Not-defined	Not-defined	Aromatherapy, sleep	Facemask,	Mohammadi et al.	
			disorders	Aromatherapy	2022	
Algeria	Leaf	GC-MS	Anti-inflammatory,	Not-defined	Oulebsir et al. 2022	
			antioxidant			
Brazil	Fruit	Capsule	Cardiovascular safety	Oral	Benjamim et al.	
		comprising p-			2022	
	<b></b>	synephrine		<u> </u>	o (1	
Indonesia	Fruit	Sliced and	Feeding purposes (fresh	Fresh juice and	Sofiyanti et al. 2022	
la a la c	Foundation of the	squashed	juice, dessert)	puip	DiMenseli	
ιταιγ	Fruit peel	HD/ GC-MS	Antibiotilm, antimicrobial	Ground	וט Napoli et al.	
			dNU antiouidanttiuitu		2023	
			antioxidant activity,			
Marazza	Fruit neal			Not dofined	El Kasimi at al 2022	
101010000	Fruit peel	пи	rumigation	Not-defined	El Kasimi et al. 2023	

India	Fruit juice	Fresh	Not-defined	Not-defined	Gautam et al. 2023
Morocco	Flower	Fruit juice	Cosmetic, febrifuge,	Oral	Lyoussi et al. 2023
			sedative		

Notably, bitter orange is predominantly employed in the treatment of psychological disorders, accounting for more than 80% of the total filled questionnaires. Additionally, it is reputed for its sedative, anxiolytic, antioxidant, cold, and headache treatment properties (Fig. 3d), and also serves as feeding purposes, aids in digestion, supports weight loss, and exhibits potential anti-cancer, antibacterial, anti-convulsant, and aromatherapy effects in Iran. Different parts of the plant (Fig. 3e, Table 2) are effective in treating various ailments. Particularly, flowers are the most commonly used plant part in medicinal treatments, followed by fruit, fruit peel, leaf, and seed, respectively (Fig. 3e). The flowers and fruits of this plant have traditionally been applied both as food and medicine. They are readily available in numerous rural and urban Iranian markets due to the widespread cultivation of bitter orange. According to traditional Iranian medicine, the fruit of this plant is cold and dry in nature, and it is recommended to consume it with honey or sugar during winter seasons (Table 6). Conversely, the peel has a hot and dry nature, making it effective for treating various ailments (Table 6). Oral administration of the fruit peel has been cited by respondents in this study and previous researchers for managing disorders such as digestive issues, energizing, healthy hair and skin, kidney health, overweight, anxiety, arthritis, headache, internal bleeding, and acne (see Tables 2 and 6 for more information). The leaf is commonly used to treat conditions such as epilepsy, nervous disorders, antimicrobial activity, and heart problems, while seeds are utilized as an antioxidant, anti-inflammatory, and anti-nociceptive agent. Regarding preparation methods, decoction (49%) is the most commonly used method for therapeutic purposes, followed by fresh use (19%) and fumigation (12%) (Fig. 3f). Nearly 68% of patients use this herb without any additives, whereas the remaining 32% combine bitter orange with other ingredients such as tea, green tea and ginger, chamomile, borage, rosewater and cardamom, and lavender to address various discomforts (Fig. 3g).

#### Chemical composition and pharmacology

A significant number of investigations have critically focused on the chemical compounds, and their pharmacological activity has been confirmed by various researchers (Tables 2-4). It is important to note that many countries are involved in the production of essential oils from bitter orange. These countries include Egypt, France, Italy, Morocco, Spain, Tunisia, Uganda, etc. (Tables 2-3). Over 436 phytochemicals, including flavonoids, glycosides, monoterpenoids, organic acids, and sesquiterpenoids, have already been identified from *C. aurantium* (as detailed in Table 3, and Fig. 4). These secondary metabolites are helpful in curing various diseases such as anxiety (de Moraes Pultrini et al. 2006), lung disorders and prostate cancer (Park et al. 2014), digestive disorders, and overweight (Moraes et al. 2009). To date, various flavonoids, such as hesperidin, naringin and nobiletin, have been extracted and identified from the fruits of *C. aurantium* (Kang et al. 2011; Kim et al. 2012; Lee et al. 2012; Kim et al. 2013; Hamdan et al. 2014; Rufai and Fatimah, 2015; Abou Baker, 2020; Yan et al. 2020; for more details, refer to Table 3).

Methodologically, a multitude of approaches have been employed for the isolation of bioactive, including solvent extraction (Moulehi et al. 2012), aqueous extraction (Rosa-Falero et al. 2015), ultrasound-assisted extraction (Ana et al. 2018), soxhlet extraction (Abou Baker et al. 2020), ultrasound-assisted aqueous two-phase extraction (Yan et al. 2020) (as summarized in Table 3). The concentration of chemical compounds is directly correlated with the quality of the extraction method used (Tables 2-3). Additionally, a glycoside known as 5- hydroxyl-3,5,6,2,4-pentamethoxyflavone (Gao et al. 2022); has been identified from the leaves of bitter orange and is documented in Table 3. Monoterpenoids have also been isolated and identified from the fruit peel and flowers of this herb (as documented in Table 3). These compounds have been extracted using various methods, including hydro-distillation (Tundis et al. 2012; Jabri Karoui and Marzouk, 2013), GC-MS (Farahmandfar et al. 2020), and soxhlet/hydrosol and ethanol extraction (Değirmenci and Erkurt, 2020). According to various researchers (e.g., Jabri Karoui and Marzouk, 2013; Farahmandfar et al. 2020), sesquiterpenoids such as β-Caryophyllene, Germacrene D, Nerolidol, and others have been identified, and separated from the fruit peels of C. aurantium. Popular methods for extracting sesquiterpenoids include solvent extraction/ether-pentane, hydro-distillation (HD)/diethyl ether, and GC-MS (e.g., Jabri Karoui & Marzouk 2013; Farahmandfar et al. 2020) (Table 3). Triterpenes have been reported by some authorities (e.g., Haggag et al. 1999; Pellati and Benvenuti, 2007). Organic acids can be categorized into two main types: fatty acids and phenolic acids. Phenolic acids are extracted from the leaf, flower, fruit juice, fruit peel, and seed (Tounsi et al. 2011; Karimi et al. 2012; Moulehi et al. 2012; Jabri Karoui and Marzouk, 2013; Rufai and Fatimah, 2015; Khettal et al. 2017; Ana et al. 2018; Hao et al. 2019; Değirmenci and Erkurt, 2020; Haraoui et al. 2020; Wen et al. 2021; Gao et al. 2022), while fatty acids are isolated from peels of this taxon (Trabelsi et al. 2016). The most well-known methods for phenolic acid extraction include solvent extraction/ethanol and methanol (80%), hot water, RP-HPLC, ether-pentane, and hydro-distillation (HD)/ultrasound-assisted extraction (UAE) (Table 3).



Figure 4. Visualizing the significant number of chemical compounds extracted and identified by various researchers (see Table 3 for citations).

Table 3. Main components of essential oils from *Citrus aurantium* in Iran and other parts of the world. Abbreviations within this table are as follows: GC-MS: gas chromatography/mass spectrometry, HD: Hydrodistillation, MAHD: Microwave-assisted hydro-distillation, UAE: Ultrasound-assisted extraction, HRGC: High-resolution gas chromatography, HRGC/MS: High-resolution gas chromatography mass spectrometry, GC-FID: Gas chromatography- Flame ionization detection, HPLC: High-performance liquid chromatography, MAE: Microwave-assisted extraction, HS-SPME: ultrasonic-assisted headspace solid phase microextraction, HPLC-MS/MS: high-performance liquid chromatography coupled with tandem mass spectrometry, UA-HS-SPME: Ultrasonic-assisted headspace solid phase microextraction, MSD: Microwave steam distillation, LC-ESI/MS: Liquid chromatography electrospray ionization mass spectrometry, SFME: Solvent-free microwave extraction, SLME: Solvent microwave extraction, UA-ATPE: Ultrasound-assisted aqueous two-phase extraction.

Main components	Plant parts used	Methodology	Literature cited
Essential oils, ethanol, water	Fruit peel	SFE/ CO2 and ethanol (co-solvent)	Kassim and Hameed 1989
Aldehydes amine, coumarin, flavonone, flavone aglycone, glycoside, monoterpene,	Fruit peel	GC-MS	Chouchi and Barth 1996
polymethoxy, psoralens, waxe			
Coumarin, diosmetin 6,8-C-diglucoside, diosmetin 6-C-glucoside, diosmetin 8-C-	Flower and peel	95% aqueous ethanol, 70% aqueous	Haggag et al. 1999
glucoside, flavonoid, hesperidin, isosakurantin-7-O-rutinoside, isosakurantin-7-O-		ethanol	
neoheperidoside, isosinensetin, isovitexin, narinin glucoside, naringin, narirutin,			
neodiosmin, neoerocitrin, neohesperidin, nobelitin, rhamnosyl vitexin, rhiofolin,			
sinensetin, tangeritin, triterpene, vicenin, vitamin, vitexin, vitexin 4-rhamnoside, 2-O-			
xylovitexin, 5-O-demethyl nobelitin			
D-Limonene (90.4%)	Fruit peel	SD/GC-MS	Carvalho-Fretas and Costa
			2002
Aqueous fractions, dichloromethanic, hexanic	Leaf	Hydroethanolic extraction/ maceration and	
		ethanol (70%)	
Linalool (81%)	Flower	UAE/ n-pentane: diethylether	Alissandrakis et al. 2003
Linalool, linalyl acetate, oxygenated compounds	Leaf	SD, HRGC and HRGC/ MS	Kirbaslar and Kirbaslar 2004
Alkaloid, flavonoid, hordenine, N-methyltyramine, octopamine, phenethylamine,	Fruit	GC-MS	Allison et al. 2005
synephrine, tyramine, volatile oil			
a-Terpineol, Benzyl nitrile, cis-Linalool oxide, Geraniol, Geranyl acetate, 2,6-Dimethyl-	Flower	GC-MS	Jeannot et al. 2005
7-octen-2,6-diol, 6-Methyl-5-hepten-2-ol, 6-Methyl-5-hepten-2-one, Indole, Linalool,			
Phenylethyl alcohol, trans-Linalool oxide, Methyl anthranilate, Nerol, Neroli oil, p-			
Menthan-1,8-diol, Terpinen-4-ol, trans-Nerolidol, trans, trans-Farnesol			
Hordenine, N-methyltyramine, octopamine, synephrine, tyramine	Fruit, fruit peel	Liquid, chromatography/ tandem mass	Nelson et al. 2007
		spectrometry (LC/MS/MS)	
Alkaloids (synephrine and octopamine, carotenoid, N-methyltyramine), flavones,	Peel	HPLC/ GC-MS	Pellati and Benvenuti 2007
phenyl-ethylamine protoalkaloid p-synephrine, volatile oil (carotene, cumarines, d-			
limonene, d-linalool, N-acetyl octopamine, flavonoids, gamma-aminobutyric acid,			
pectin, triterpenes, vitamin C)			

Limonin	Seed	Solvent extraction/ Na-CuS, Na-Sal	Dandekar et al. 2008
Limonene, Myrcene, Octanal	Fruit peel	Absolute ethanol	Moraes et al. 2009
Didymin, hesperidin, kaempferol, naringenin, naringin, narirutin, neohesperidin,	Fruit juice	Squeezing	Harapu et al. 2010
nobiletin, poncirin, quercetin			
α-calacorene, α-cyperone, α-humulene, α-pinene, α-terpinyl acetate, β-elemene, β-	Fruit peel	GC and GC–MS	Hosni et al. 2010
pinene, (E)- $\beta$ -ocimone, geranial, limonene, linalool, monoterpene hydrocarbons,			
oxygenated monoterpenes, oxygenated sesquiterpene, sabinene, sesquiterpene			
hydrocarbones, verbenone,			
Flavonoid	Flower	UAE/ Ethanol	Yang et al. 2010
Essential oil composition	Flower, fruit leaf	GC-FID, GC-MS	Dugo et al. 2011
d-limonene, Myrcene	Fruit	GC	Frassinetti et al. 2011
Flavnoids (hesperidin, naringin, nobiletin)	Fruit peel	70% aqueous methanol	Kang et al. 2011
<i>p</i> -Synephrine or <i>p</i> -Synephrine in combination with hesperidin and naringin	Juice	Resting metabolic rates	Stohs et al. 2011
Phenolic compounds	Juice	Solvent extraction/ Methanol (80%)	Tounsi et al. 2011
$\alpha$ -humulene, $\alpha$ -terpineol, $\alpha$ -terpinyl acetate, $\alpha$ -thujone, carvacrol, 6E-farnesol,	Peel	Distillation or HD/ GC and GC-MS	Bourgou et al. 2012
borneol, bornyl acetate, camphor, caryophyllene oxide, cis-Linalool oxide, cis-			
dihydrocarvone, citronellol, geranyl acetate, germacrene D, linalool, linalyl acetate,			
neroli oil, nonanal, spathulenol, terpinene-4-ol, terpinolene, valencene,			
$\alpha$ -caryophyllene, $\alpha$ -cyclogeraniol, $\alpha$ -pinene,2,3-dehydro-1,8-cineole, $\alpha$ -zingiberene,	Leaf	HD	Ellouze et al. 2012
$\beta$ -caryophyllene, Z- $\beta$ -farnesene, $\delta$ -cadinene, caryophyllene oxide, <i>cis</i> - $\alpha$ -santalol, <i>cis</i> -			
linalool oxide, <i>cis</i> -β-ocimene, <i>cis</i> –pyranoid linalool oxide, 2,6-dimethoxy-1-			
methylbenzene, 2,6-di-t-butyl-4-methylphenol, (E)-10-dodecenyl acetate, eucalyptol,			
geranyl acetate, germacrene B, 14-hydroxy-1-epi-caryophyllene, isoborneol,			
isodihydroneptalactone, lilac alcohol A, limonene, linalool, linalyl acetate, myrcene,			
nerol, o-cymene, $\beta$ -phellandrene, pinocarvone, pseudolimonene, R-lavandulyl			
acetate, 8S,13-cedraniol, sabinene, $\alpha$ -terpinene, $\alpha$ -terpineol, terpine-4-ol, 4-			
terpinenyl acetate, trans-4,5-epoxy-(E)-decenal, trans-4,5-epoxy-(E)-2-nonenal, trans-			
linalool oxide, 2-undecenal, 1,3,5-trimethylbenzene, undecan-4-one, 1-(2,3,4,5-			
trimethlphenyl)-butan-1-one,			
Alkaloid, carbohydrate, flavonoid, sterol, tannin, terpenoid	Leaf	Petroleum ether, chloroform and ethanol	Gopal 2012
		extraction	
Phenolic compounds such as caffeic acid, gallic acid, naringin, pyrogallol, quercetin,	Flower	Solvent extraction, Hot water, ethanol and	Karimi et al. 2012
rutin, syringic acid		methanol extraction/ RP-HPLC	
Hesperidin, naringin, nobiletin	Fruit peel	70% aqueous methanol	Kim et al. 2012

Hesperidine, hexamethoxyflavone, 3-hydroxynobiletin, isosinensetin, naringin,	Fruit peel	HPLC	Lee et al. 2012
nobiletin, poncirin, sinensetin, tangeretin, tetramethyl-O-isoscutellarein			
Flavonoids: apigenin, catechin, epigallocatechin, hesperidin, Kaempherol,	Seed	Solvent extraction/ pure methanol	Moulehi et al. 2012
neohesperidin, naphtorecinol, naringin, quercetin, resorcinol, rutin			
Phenolic acid: gallic acid, rosmarinic acid, p-coumaric acid, syringic acid, trans-2-			
hydroxycinnamic acid, vanillic acid			
Chemical compounds	Leaf	UAE/ ethanol, methanol	Ojito et al. 2012
Hesperidin, hexamethoxyflavone, 3-hydroxynobiletin, hydroxypentamethoxyflavone,	Fruit	Anticancer	Park et al. 2012
isosinensetin, nobiletin, naringin, poncirin, sinensetin, tangeretin, tertamethyl-o-			
isoscutellarein,			
Limonene, monoterpene hydrocarbons, oxygenated monoterpenes	Peel	HD/ not defined	Tundis et al. 2012
Limonene, linalool, etc.	Leaf	MAE/ HS-SPME/water	Gholivand et al. 2013
$\alpha$ -csdinol, $\alpha$ -pinene, $\alpha$ -terpinyl acetate, $\alpha$ -terpinyl fomate, $\beta$ -caryophyllene oxide, $\beta$ -	Flower	FID, GC-MS	Hsouna et al. 2013
elemene, $\beta$ -myrcene, $\beta$ - terpinyl acetate, $\gamma$ -elemene, $\gamma$ -terpinene, $\gamma$ -terpineneol, d-3-			
carene, E-β-ocimene, docosane, E-E-farnesal, E-E-farnesol, E-nerolidol, Z-nerolidol, Z-			
$\beta$ -ocimene, ethylbenzene, geranial, geraniol, geranyl acetate, germacrene D,			
isopulegol, limonene, methyl anthranilate, nerolidyl propionate, p-cymene, sabinene,			
terpinen-4-ol, trans-sabinyl acetate, tetratetracontane			
Juice: Monoterpene hydrocarbons: $\alpha$ -phellandrene, $\alpha$ -thujene, limonene (92%),	Juice, peel	Solvent extraction/ Ether-pentane	Jabri Karoui and Marzouk
oxygenated sesquiterpenes plus caryophyllene oxide, flavonoid with rutin, phenolic		HD/ diethyl ether	2013
acids containing p-coumaric and ferulic acid			
Peel: Ferulic acid, flavonoids, limonene, p-coumaric, phenolic compounds			
<i>p</i> -Synephrine or <i>p</i> -Synephrine in combination with hesperidin and naringin	Not-defined	Not-defined	Kaats et al. 2013
Hesperidine, hexamethoxyflavone, 3-hydroxynobiletin, isosinensetin, naringin,	Not-defined	HPLC	Kim et al. 2013
nobiletin, poncirin, sinensetin, tangeretin, tetramethyl-O-isoscutellarein			
Hydrolyzable tannins, flavonoids, flavonols, phenols, polymerized phenols, proantho-	Leaf	Solvent extraction/ methanol and water	Lagha-Benamrouche, and
cyanidins, soluble phenols			Madani 2013
Carbohydrate, flavonoid, phytosterol, protein, saponin, tannin, terpenoid, volatile oil	Leaf	HD	Periyanayagam et al. 2013
Essential oils: $\alpha$ -pinene, $\alpha$ -terpineol, $\beta$ -linalool, $\beta$ -myrcene, eucalyptol, sabinene, 4-			
terpineol			
terpineol linalool, α-terpineol, γ-terpinene	Leaf	HD, GC/ GC-MS	Abderrazak et al. 2014
terpineol linalool, α-terpineol, γ-terpinene	Leaf	HD, GC/ GC-MS	Abderrazak et al. 2014
terpineol linalool, α-terpineol, γ-terpinene	Leaf	HD, GC/ GC-MS	Abderrazak et al. 2014
terpineol linalool, α-terpineol, γ-terpinene carvon, cis-linalool oxide, endo-fenchyl acetate, linalool, trans carveol	Leaf Fruit peel	HD, GC/ GC-MS	Abderrazak et al. 2014

Hesperidin, neohesperidin	Fruit peel	LC-ESI/MS	Hamdan et al. 2014
α-pinene, α-terpineol, β-caryophyllene, β-pinene, γ-terpinene, cis-β-ocimene, caryophyllene oxide, geraniol, geranyl acetate, limonene, linalool, linalyl acetate, myrcene, neroli oils, neryl acetate, sabinene, terpinen-4-ol, trans-linalool oxide, trans-β-ocimene, trans-trans-farnesol	Flower	HD, Cyclohexane, n-hexane, GC, GC-MS	Ines et al. 2014
Flavonoids	Fruit peel	HPLC-MS/MS	Park et al. 2014
Volatile compounds	Flower	UA-HS-SPME/ Distilled water	Rahimi et al. 2014
α-pinene, α-terpineol, β-caryophyllene, β-frenchyl alcohol, β-pinene, acetate geranyl, acetate neryl, anthraniate methyl, bicyclogermacrene, cis-linalool farnesol, oxide, delta-4-carene, geranial, indol, linalool, limonene, linalyl acetat, myrcene, 1,8-cineol, nerol, nerolidol, trans-β-ocimene, sabinene, terpendiol, terpinen-4-ol	Leaf, fruit peel	HD/GC-MS	Trabelsi et al. 2014
α-pinene, β-linalool, β-myrcene, β-pinene, careen, limonene, ocimene	Fruit peel	HD	Djenane 2015
Essential oils: Geranyl acetate, isogeijerin, linalool, linalyl acetate, sabinene	Peel	SFE CO2/ CO2 and diethyl ether	Jerkovic et al. 2015
Neroli, Orange flower water	Flower	HD/ n-hexane	Labadie et al. 2015
α-carene, $α$ -pinene, $α$ -terpineol, $β$ -linalool, $β$ -pinene, $β$ -linalool, (E)- $β$ -ocimene, (Z)- $β$ -ocimene, limonene, linalyl 2-aminobenzoate, geranial ( $α$ -citral), geranylsobutyrate, nerol (cis-geraniol), o-cymen-5-ol, geraniol butyrate, sabinene, terpinen-4-ol, trans- y-caryophyllene	Leaf	GC-MS	Ouedrhiria et al. 2015
Limonene	Fruit	Not-defined	Ramos et al. 2015
Hesperidin, neohesperidin, neohesperidin dihydrochalcone	Leaf	Aqueous extraction	Rosa-Falero et al. 2015
Alkaloid, Coumarins, Flavnoids, Phenolic, Quinine, Reducing sugar, Saponins, Steroids, Tannin	Fruit	95% ethanol extraction	Rufai and Fatimah 2015
Alpha-terpineol, limonene, linalool, nootkatone	Fruit peel, leaf	Cold pressing, HD, SD	Wolffenbuttel et al. 2015
α-pinene, α-terpineol, β-pinene, δ-3-carene, γ-terpinene, (E)-β-limonene oxide, E)-β- ocimene, (Z)-β-limonene oxide, camphene, camphor, caryophyllene, citronellal, geranial, geraniol, geranyl acetate, limonene, linalool, myrcene, neral, neryl acetate, nonanal, octanal, sabinene, terpinolene, terpinen-4-ol	Peel	GC–MS	Zarrada et al. 2015
Hydrocarbonated monoterpene limonene, linalool, oxygenated monoterpene	Leaf, ripe and unripe fruit peel	GC-MS	Azhdarzadeh and Hojjati 2016
D-limonene, β-myrcene	Peel	Soxhlet, SD/ Hexane	Bendaha et al. 2016
Pectin	Peel	MAE/ citric acid (aqueous solution)	Hosseini et al. 2016
Essential oils: $\alpha$ -pinene, $\alpha$ -terpineol, $\beta$ -pinene, $\delta$ -carene, cyclohexene,	Peel	SD/ water, MSD/ water	Kusuma et al. 2016

cyclotrisiloxane, limonene, myrcene

Essential oils:  $\alpha$ -pinene,  $\alpha$ -terpineol,  $\beta$ -fenchyl alcohol,  $\beta$ -pinene,  $\delta$ -guaiene,  $\gamma$ -gurjunene, dimethoxybenzylidene, hexasiloxane, myrcene, n-decanal, n-nonadecanoic, octyl aldehyde, sabinene, thyocynic acid,

Limonene	Fruit	GC	Pimenta et al. 2016
α-Pinene, α-Terpinolene, β-Pirene, β-Myrcene, D1-Limonene, Geranyl acetate, D-	Fruit peel, leaf	GC-MS	Sanei-Dehkordi et al. 2016
Germacrene, Isoterpinolene, Linalool Oxide, Linalyl acetate, Neryl Acetate, Nerolidol,			
Nonanal, 1-Octanol, Palmitic acid, Sabinene Hydrate Acetate, Trans-Caryophyllene,			
Trans-Linalool Oxide, Trans-Ocimene, Trans-Oleic Acid, γ–Terpinene.			
Coumarin, fatty acid ester, phenol, phenol	Peel	SFE CO2/ CO2 and ethanol (co-solvent)	Trabelsi et al. 2016
Alkaloid, flavonoid, glycoside, phenol, saponin, steroid, tannin	Leaf	Aqueous extraction	Ani et al. 2017
Petitgrain oil including $\alpha$ -Pinene, $\beta$ -Pinene, Sabinene, $\beta$ -Myrcene, Limonene, 1, 8,	Not-defined	Macrodilution	Gniewosz et al. 2017
Cineole, $\gamma$ -Terpinene, $p$ -Cymene, $\alpha$ -Terpinolene, Linalool, Linalyl acetate, $\beta$ -			
Caryophyllene, Isoborneol, $\alpha$ -Terpineol, Boineol, Geranial, Geranyl acetate, Nerol,			
Geraniol, Caryophyllene oxide			
Phenolic and flavonoid compounds	Leaf	Solvent extraction/ absolute methanol	Khettal et al. 2017
Flavonoid	Peel	MAE/ aqueous ethanol	Kuchekar 2017
Polysaccharide	Flower	UAE/ Distilled water	Shen et al. 2017
Caffeic acid, chlorogenic acid, coumaric acid, diosmin, ellagic acid, hesperidin, morin,	Peel	UAE/ ethanol and water	Ana et al. 2018
naringin, neohesperidin, phenolic compounds			
$\alpha$ -himachalene, $\alpha$ -pinene, $\alpha$ -terpineol, $\beta$ -pinene, cis-linalool oxide, trans-linalool	Flower, leaf, stem	HD	Ayoub et al. 2018
oxide, 1-eicosene, heptacosane, hexacosane, hexadecanoic acid, hexahydrofarnesyl			
acetone, limonene, linalool, linalyl acetate, myrcene, neryl acetate, neryl acetone,			
octacosane, octadecanoic acid, sabinene, terpinen-4-ol, terpineol			
Farnesol, Geranyl acetate, Linalool, Linalool acetate, Neroldol	Flower	MAHD, SFME, SLME/ Water	Mohagheghniapour et al. 2018
α-pinene, α-terpineol, β-pinene, β-Citronellol, β-Oplopenone, γ-Terpinene,	Fruit peel	HD, GC and GC-MS	Radan et al. 2018
Carvacrol, Caryophyllene oxide, copaene, cis-Linalool oxide, Limonene, Linalool,			
Nerol, Spathulenol, verbenone			
α-cubebene, α-copaene, α-fenchene, α-humulene, α-phellandrene, α-pinene, α-p-	Flower	HD, GC and GC-MS	Bnina et al. 2019
dimethylstyrene, $\alpha$ -humulene, $\alpha$ -terpineol, $\alpha$ -terpineol acetate, $\alpha$ -terpinene, $\alpha$ -			
thujene, ( <i>E,E</i> )- $\alpha$ -farnesene, $\beta$ -bisabolene, $\beta$ -caryophellene, $\beta$ -elemene, $\beta$ -	Leaf		
phellandrene, β-pinene, (E)-β-farnesene, (E)-β-ocimene, (E)-β-farnesene, (z)-β-			
ocimene, δ-cadinene, δ-3-carene, δ-elemene, γ-elemene, γ-terpinene, ( <i>E</i> )-nerolidol, ( <i>E</i> ,Z)-farnesol, ( <i>E</i> ,Z)-farnesol acetate, bicyclogermacrene, camphene, 1,8-cineole, <i>cis</i> -	Peel		

Soxhlet extraction/ n-hexane UAE/ Ethanol UAE/ Citric acid and distilled water GC/MS Soxhlet extraction/ acetone and petroleum ether GC-MS	Hamedi et al. 2019 Hao et al. 2019 Hosseini et al. 2019 Teneva et al. 2019 Abou Baker et al. 2020 Aissaoui et al. 2020
Soxhlet extraction/ n-hexane UAE/ Ethanol UAE/ Citric acid and distilled water GC/MS Soxhlet extraction/ acetone and petroleum ether	Hamedi et al. 2019 Hao et al. 2019 Hosseini et al. 2019 Teneva et al. 2019 Abou Baker et al. 2020
Soxhlet extraction/ n-hexane UAE/ Ethanol UAE/ Citric acid and distilled water GC/MS	Hamedi et al. 2019 Hao et al. 2019 Hosseini et al. 2019 Teneva et al. 2019
Soxhlet extraction/ n-hexane UAE/ Ethanol UAE/ Citric acid and distilled water	Hamedi et al. 2019 Hao et al. 2019 Hosseini et al. 2019
Soxhlet extraction/ n-hexane UAE/ Ethanol	Hamedi et al. 2019 Hao et al. 2019
Soxhlet extraction/ n-hexane	Hamedi et al. 2019
GC-MS	Farahmandfar et al. 2019
Squeeze peel rind	Ben Hsouna et al. 2019
HD	Burnett et al. 2019

Flower

Soxhlet extraction/ hydrosol and Ethanol

extraction

Aliaphatic hydrocarbons: dotriacontan, tertapentacontane

Ester: Linalyl acetate, Neryl acetate

Monoterpene hydrocarbons: α-Pinene, β-Pinene, β-Myrcene, Limonene,

Phenolic and flavonoid

Oxygenated monoterpens: Hotrienol, Linalool, Nerol, Terpineol

Hydroxybenzoic acid, hydroxycinnamic acid Seed Solvent extraction/ Methanol Falcinelli et al. 2020 Flavonoid and phenolic compounds Juice and leaf Solvent extraction/ Methanol (80%). Haraoui et al. 2020 methanol and water Carbohydrate, pigment (chlorophyll, carotenoid, lack anthocyanin), phenol, Solvents (water and acetone extracts) in an Flower Petrova et al. 2020 flavonoid. uronic acid ultrasonic bath Naringin, neohesperidin, synephrine Fruit powder **UA-ATPE**/ ethanol Yan et al. 2020 2-H-1-benzopyran-2-one, 5, 7, dimethoxy, cyclohexaneethanol, e-11-hexadecanoic Fruit peel Ethanolic extract and GC-MS Daisy et al. 2021 acid, ethyl ester, hexadecanoic acid, ethyl ester, heptanoic acid, 2-methy, methyl ester, 2-nonen-1-ol, 2-methyl, 1, 2, 3 propanetriol, 1-acetate, isoamyl nitrite, octadecanoic acid, 2, 3, 5, 6 tetrafluroanisole, Alpha-D-glucopyranoside, Alpha-D-mannofuranoside, alpha-guaiene, D-glucuronic Ethanol (80%)/ Solvent extraction Flower Pasandideh and arasteh acid, D-limonene, caffeine, daphnetin, ester, n-Hexadecanoic acid, n-Octanoic acid 2021 isopropyl, phthalic acid, pyrrolidinone, linalool, 9-Octadecenoic acid, 9,12-Octadecadienoic acid Coumarin, flavonoids, phenolic compounds, polymethoxylated Fruit Solvent extraction/ acetone (80%) Wen et al. 2021 Phenolic content: Albiflorin, apigenin-6,8-di-C-glucoside, apigenin-7-O-rutinoside, Not-defined Ethanol extraction/ UHPLC-Q-TOF/MS Gao et al. 2022 citrusin I, citrusin III, diosmetin-6,8-di-C-glucoside, diosmetin-7-O-neohesperidoside, diosmetin-7-O-rutinoside, epoxybergamottin or cnidicin, eriocitrin, eupatorin, feruloylagmatine, 3,5,6,7,8,3,4-heptamethoxyflavone, heptamethoxyflavone, haploside C. haploside C isomer, hesperetin, hesperetin-7-O-glucoside, hesperetin-7-O-rutinoside, 5-hydroxy-6,7,3,4-tertamethoxy flavone, 5- hydroxyl-3,5,6,2,4pentamethoxyflavone, 7-hydroxy-5,6,8,4-tetramethoxyflavone, isosinensetin, koparin-2-methyl ether, limonin, linderanlide A, linderagalactone C, magnoloside A, meranzin hydrate, meranzin or isomeranzin, monohydroxy-pentmethoxyflavone, monohydroxy-hexamethoxyflavone, monohydroxy-trimethoxyflavone, melitidin, naringenn, naringenin-7-O-neohesperidoside, naringenin-7-O-glucoside, naringin-6malonate, naringenin-7-O-rutinoside, neoponcirin/linderanlide D, neoeriocitrin, nobiletin, osthole, oxypeucedanin, poncirin, sagittatin A, scopoletin, sinensetin,

Değirmenci and Erkurt 2020

subaphyllin, tangeretin, tetramethyl-O-isoscutellarein, tetramethyl-O-scutellarein, tryntonban, veronicastroside

tryptophan, veronicastroside,			
α-Cadinol, α-Humulene, α-Pinene, α-Terpinene, α-Terpineol, α-Thuyene, β-	Leaf	GC-MS	Oulebsir et al. 2022
Bisabolene, $\beta$ -Caryophyllene, $\beta$ -Myrcene, $\beta$ -Phellandrene, $\beta$ -Pinene, $\gamma$ 3-X $\alpha$ pɛvɛ, $\gamma$ -			
Τερπινενε, p-Cymene, B-Germacrene, Camphene, Cis-β-Ocimene, Cis-Oxide linalool,			
Citronellol, Citronellyl acetate, E-β-Farnesene, 2-Ethyl furan, Geraniol, Geranyl			
acetate, Germacra-1,5-dien-4-ol, 1-Hexanol, 2-Hexanal, Limonene, Linalyl Acetate,			
Linalyl propionate, Linalool, Neral, Nerol, Nerolidol, Neryl acetate, Sabinene,			
Spathulenol, T-Cadinol, Terpinolene, Terpinen-4-ol, Terpenyl acetate, Trans-β-			
Ocimene, Trans-Oxide linalool			
α-terpineol, β-citral, β-linalool, β-myrcene, β-pinene, bergamol, caryophyllene, n-	Fruit peel	GC-MS	Di Napoli et al. 2023
decyl acetate, cis-geraniol, geranyl acetate, germacrene D, limonene, neryl acetate,			
n-octanol, trans-geraniol, trans-nerolidol			
α-Pinene, α-Terpinene, β-, 3-Carene, Linalool, Camphene, Caryophyllene E,	Fruit peel	GC-MS	El Kasimi et al. 2023
Cyclobutane, $\gamma$ -Elemene, Geracrene-A or $\beta$ -Bisabolene, Geranyl acetate, Neryl			
acetate, Ocimene, Octan-1-o1, Limonene (86%), 7-Propylidene-bicyclo [4.1.0]			
heptane, Quercetin-7, 3, 4-trimethyl ether, Sabinene, Terpinen-4-ol, Terpinen-1-o1,			
Trans-Limonene-1.2 oxide, Trans-Thymol, Undecanal,			

On the other hand, fatty acids are extracted using SFE CO2/CO2 and ethanol (co-solvent) (Table 3). The ripe fruits of the bitter orange have long been used in Iran as a food additive and medicine. However, in certain cases, only specific parts of the plant should be eaten. For instance, in the case of edible flowers, each part (such as nectar, petals, and pollen) is enriched with different chemical compounds (Mlcek and Rop, 2011; Rop et al. 2012). The extraction method for bioactive substances from edible flowers depends directly on the nourishing content, color, taste, and flavor of foods. It appears that solvent extraction approaches are commonly used by the majority of researchers (Zhao et al. 2019). The flowers of *C. aurantium* are known as a source of essential oils, and their aromatographic characteristics are well-established (Namazi et al. 2014). According to Petrova et al. (2020), almost all extraction methods are dealing with (involve) ethanol or methanol, while water or acetone extracts lack sufficient information regarding the bioactive compounds. Among these phytochemicals, linalool, limonene,  $\alpha$ -pinene, and sabinene (Fig. 4), limonene is the most constituent in the oils obtained from all similar studies, but its percentage varies based on the origin of the plant (Caccioni et al. 1998, Boussaada and Chemli, 2007, Moraes et al. 2009, Hosni et al. 2010).

Natural products have been extensively applied to treat diseases (Table 4). Numerous health care activities of *C. aurantium,* such as fungicidal, antifungal, anti-obesity, cardiovascular, anticonvulsant, anxiolytic, antioxidant, and antibacterial activities, have been critically examined by various researchers across different organisms (Table 4).

Health care	Food	Organism	Literature cited
	Food	Giganishi	Demaden et al. 1006
	Essential on	Fungus	
Antifungal activity	Fruit	Fungus	
Antiobesity activity, cardiovascular toxic	Fruit	Rat	Calapai et al. 1999
effect		_	
Anti-inflammatory anticancer	Not-defined	Rat	Manthey et al. 2001
Anticonvulsant, anxiety effect, sedative/	Fruit peel	Swiss male mouse	Carvalho-Freitas and Costa,
hypnotic			2002
Human cytochrome P450 phenotypes	Not-defined	Human	Gurley et al. 2004
Anxiety treatment	Fruit peel	Mouse	de Moraes Pultrini et al. 2006
Antioxidant	Juice	Rat	Deyhim et al. 2006
Anti-diabetic	Fruit	Mouse	Campbell et al. 2006
Insecticide	Fruit peel	Pine Processionary Moth	Cetin et al. 2006
Weight loss	Not-defined	Human	Gougeon et al. 2006
Weight loss	Not-defined	Human (male)	Sale et al. 2006
Increases metabolic rate and systolic blood	Not-defined	Human	Hoffman et al. 2006
pressure			
Antispasmodic, anxiety effect, relaxant,	Fruit	Fungus	Sokovic and Van Griensven
sedative			2006
Dietary supplement	Unripe fruit	Mouse	Arbo et al. 2008
Dietary supplement	Not-defined	Human	Haller et al. 2008
Anxiety effect, sedative	Fruit peel	Rat	Leite et al. 2008
Subchronic toxicity	Not-defined	Mouse	Arbo et al. 2009
Insecticide	Fruit peel	Insect	Michaelakis et al. 2009
Mosquito repellent	Not-defined	Cockroach	Yoon et al. 2009
Antispasmodic effect on utreus	Flower	Rat	Ahangarpour et al. 2011
Anti-bacterial, antioxidant	Fruit	Bacterium	Frassinetti et al. 2011
Anti-inflammatory activity	Fruit	Mouse	Kang et al. 2011
Anti-bacterial activity	Fruit peel	Bacterium	Bourgou et al. 2012
Feeding	Fruit peel	Animal	Ghanem et al. 2012
Antimicrobial, antioxidant	Flower	Bacterium, fungus, yeast	Haj Ammar et al. 2012
Weight loss products or appetite	Not-defined	Female Sprague–Dawley	Hansen et al. 2012
suppressant		rat	
Anticancer, Anti-inflammatory, antioxidant	Flower	Mouse	Karimi et al. 2012
Weight loss	Fruit	Rat	Peixoto et al. 2012
Gastric Ulcer treatment	Fruit peel	Rat	Polo et al. 2012

Table 4. Application of the organism model *Citrus aurantium* as animal feed or for health care.

Anti-inflammatory	Not-defined	Rat	Kim et al. 2013
Antimicrobial, antifungal	Fruit	Bacterium and fungus	Oliveira et al. 2013
Hypo-Cholesterolemic and Hypoglycemic	Fruit	Albino rat	Osfor et al. 2013
Effects			
Effect pharmacokinetics of amiodarone	Fruit	Rat	Rodrigues et al. 2013
Anti-obesity	Fruit	Sprague-Dawley rat (male)	Verpeut et al. 2013
Anticonvulsant activity	Flower	Mouse	Azanchi et al. 2014
Anti-inflammatory	Fruit peel	Rat	Hamdan et al. 2014
Inhibitory activity	Juice	Bacterium	Karabıyıklı et al. 2014
Anxiety activity	Flower	Male mouse	Khakpour et al. 2014
Anxiety activity	Flower	Male albino mouse	Khosravi et al. 2014
Antimicrobial activity	Fruit peel	Bacterium	Madhuri et al. 2014
Antioxidative activity on uterus	Fruit juice	Female wistar rat	Mansouri and Khaki 2014
Anti-cancer	Fruit peel	Murine	Park et al. 2014
Anti-bacterial activity	Leaf	Bacterium	Periyanayagam et al. 2014
Nephroprotective activity (kidney protect)	Fruit	Animal	Ullah et al. 2014
Repellent activity	Fruit peel	Spider mite	da Camara et al. 2015
Anti-bacterial activity	Leaf	Bacterium	Dadashi et al. 2015
Larvicidal activity	Essential oil	Larvae	El-Akhal et al. 2015
Prohibition of diabetes	Not-defined	Rat	Jia et al. 2015
Analgesic and anti-inflammatory activities	Flower	Mouse and rat	Khodabakhsh et al. 2015
Scopolamine-induced memory	Flower	Rat	Rahnama et al. 2015
impairments or neurological problems			
(e.g., Alzheimer)			
Anxiety effect	Fruit	Animal	Ramos et al. 2015
Anticonvulsant activity	Leaf	Zebrafish	Rosa-Falero et al. 2015
Not-defined	Fruit pulp	Domestic animals like	Rufai and Fatimah 2015
		sheep and goats	
Insecticide	Fruit peel	Whitefly	Zarrad et al. 2015
Antidepressant-like activity	Essential oil	Rat	Xing et al. 2015
Level of anxiety and sleeping time	Flower	Mouse	Abbasnia 2016
Antimicrobial, antioxidant activity,	Bark, leaf	Larvae	Hakima et al. 2016
insecticide effect			
Antimicrobial, antioxidant activity	Flower	Bacterium	Hashemi et al. 2016
Liver protective	Fruit peel	Mouse	Lim et al. 2016
Anxiety effect	Not-defined	Animal	Pimenta et al. 2016
Larvicidal Activity	Fruit peel	Mosquito vector:	Sanei-Dehkordi et al. 2016
		Anopheles stephensi	
Anti-obesity effect	Fruit	Wistar Albino rat	Sule et al. 2016
Antimicrobial effect	Flower	Microbial species	Fathi et al. 2017
Antioxidant activity, treatment of	Flower	Male wistar rat	Keshtkar et al. 2017
myocardial infarction			
Anti-bacterial activity	Fruit juice	Bacterium	Mohammed et al. 2017
Anti-depressant, anxiolytic, sedative	Leaf	Mouse	Wolffenbüttel et al. 2017
Anti-fungal activity	Fruit peel	Fungus	Dias et al. 2019
Anti-obesity effect	Not-defined	Mouse	Park et al. 2019
Morphine tolerance	Fruit	Male wistar rat	Parvizpur et al. 2019
Antimicrobial and antioxidant activity	Fruit peel	Bacterium	Teneva et al. 2019
Nephroprotective activity	Fruit peel	Male wistar rat	Wang et al. 2019
Acaricidal effect	Fruit peel	Arthropod pests:	Aissaoui et al. 2020
		Tetranychus urticae	
		Koch. (spider)	

Parkinson's Disease	Not-defined	Rat (male)	Elyasi and Ghazvini 2020
Liver health	Flower	Rat	Hamedi et al. 2020
Antifungal activity, synergistic potential	Leaf	Fungi	Nidhi et al. 2020
Increase lactate dehydrogenase activity,	Fruit juice	Wistar Rat	Christian et al. 2022
reduce cholesterol, low density lipoprotein,			
triglycerides			
Neuropathy activity	Leaf	Mouse	Habibi et al. 2022
Anticoccidial activity	Leaf	Birds	Ishaq et al. 2022
Kidney stone remedy	Leaf	Rat	Sharma and Gilhotra 2022
Wound Healing Activity	Fruit peel	Albino rat	Cherukuri et al. 2023
Disinfectant	Fruit juice	Striped catfish	Dabsantai and Mahidsanan
			2023
Bioinsecticide	Fruit peel	Arthropod pests:	El Kasimi et al. 2023
		Callosbruchus maculatus	
		F.	
Antiarthritic and anti-inflammatory activity	Leaf	Rat	Shah et al. 2023

Consistent with the results of the reviews presented in Table 4, animal models have been extensively tested to shed further light on the treatment mechanisms of the medicinal properties of plants. Among these models, rats, bacteria, mice, fungi, and fish are particularly well-regarded.

#### Aromatherapy

Aromatherapy is an eco-friendly, safe, and non-polluting natural treatment that has been well-documented by various researchers (Ali et al. 2015 and references therein). Clinical studies have confirmed the aromatherapy effects of *C. aurantium*, as supported by Iranian traditional knowledge. Interestingly, numerous surveys have also referred to the oral use of *C. aurantium* ( $\geq$  80%). The presence of essential oils in plants has led to their use in ailment therapy. These oils exhibit structural and activity similarities to actual hormones (Colegate and Molyneux, 2007). The aroma molecules from *C. aurantium* constituents contribute to immune enhancement and create a safe environment by combating pathogenic agents (e.g., bacteria) (e.g., Baratta et al. 1998). Accumulating evidence supports the aromatherapy effects of *C. aurantium*, particularly when administered via the fruit peel and flower. This activity explored by various researchers (Habibi Bibalani and Mosazadeh-Sayadmahaleh, 2011; Ines et al. 2014; Chaudhari et al. 2016; Gniewosz et al. 2017; Arab Firouzjaei et al. 2019; Abdollahi and Mobadery, 2020; Karimzadeh et al. 2021; Abbaspoor et al. 2022; Ghods et al. 2022; Mohammadi et al. 2022).

#### Sedative

In our contemporary urban society, the combination of polluted air and the constant preoccupation faced by individuals has led to a growing need for sedative remedies that promote calmness and induce restful sleep. Researchers and local communities have explored various plant-based solutions to address this urgent requirement. Bitter orange has obtained significant attention due to its potential tranquillizing effects (Table 2). Here, we summarize findings from multiple studies that validate its calming properties. Perry and Metzger (1980) confirmed the herb's calming activity, and Zargari (1986) and Aynechi (1991) investigations focused on the flowers of bitter orange, further supporting its tranquillizing potential. Carvalho-Freitas and Costa (2002) indicated the sedative activity of the fruit, and Stange et al. (2002) work specifically highlighted the fruit peel of the bitter orange as having sedation properties. Fruit-based experiments of Arias and Ramon-Laca (2005) were also aligned with the same idea. In Brazil, de Moraes Pultrini and his colleagues (2006) employed the hydrodistillation method to explore this trait further. Subsequent investigations by Stohs et al. (2011); Arab Firouzjaei et al. (2019); and Lyoussi et al. (2023) continued to emphasize the sedative potential of bitter orange, either through fruit or its peel.

#### Anxiolytic effect and nervous system disorders

The prevalence of depression is alarmingly high (Wells et al. 1989; Kouzis and Eaton 1994), and tragically, depression may lead to suicidal tendencies in various parts of the world (WHO, 2017). *Citrus aurantium* features prominently in numerous traditional medicinal practices aimed at addressing psychiatric conditions (Tables 2, 4, 5). Researchers have diligently explored the effects of *C. aurantium* fruit and fruit peel extracts on alleviating nervous system disorders, anxiety reduction, and stress management between 2002 and 2016 (Carvalho-Freitas and Costa, 2002; Stange et al. 2002; Arias and Ramon-Laca, 2005; de Moraes Pultrini et al. 2006; Sokovic and Van Griensven, 2006; Ramos et al. 2015; Rufai and Fatimah, 2015; Pimenta et al. 2016). Additionally, some scientists (Akhlaghi et al. 2011; Rahnama et al. 2015; Bakhsha et al. 2016) have

explored the anxiolytic properties of *C. aurantium* flowers using alternative methodologies (Table 2). Additionally, traditional Iranian medicine has formulated diverse herbal remedies to alleviate mental health disorders. Experimental investigations have extended to various model organisms to test the above-mentioned medicinal properties, including Swiss male mice (Carvalho-Freitas and Costa, 2002), fungi (Sokovic and Van Griensven, 2006), rats (Leite et al. 2008), and other animal models (Ramos et al. 2015; Pimenta et al. 2016).

#### Antioxidant activity

Antioxidants, which are abundant in medicinal herbs, play a pivotal role in preventing and treating ailments (Xu et al. 2017). *Citrus aurantium* extracts exhibit remarkable antioxidant activity. With the exception of studies conducted by Haj Ammar et al. (2012), Ellouze et al. (2012), Karimi et al. (2012), Hakima et al. (2016), Hashemi et al. (2016), Nabavi et al. (2016), Keshtkar et al. (2017), and Oulebsir et al. (2022), which specifically investigated the leaf, bark, or flower of bitter orange, other researchers predominantly focused on fruit or fruit peel extracts to evaluate the antioxidant activity of this plant (Tables 2-5).

Author (s)	Subject	Country
Berhow 1998	Phenolic compounds in <i>citrus</i>	America
Preuss et al. 2002	Citrus aurantium as a thermogenic, weight-reduction replacement for	America
	Ephedra: an overview	
Izquierdo and Sendra	Composition and characterization of Citrus fruits	Spain
2003		
Bent et al. 2004	Weight loss in Citrus aurantium	America
Blumenthal 2004-2005	Synephrine in Bitter Orange Peel	America
Fugh-Berman and Myers	Weight loss in Citrus aurantium	America
2004		
Arias and Ramón-Laca	Citrus and their ancient and medieval uses	Spain
2005		
Haaz et al. 2006	Synephrine activity in obesity and overweight treatment	America
Klontz et al. 2006	Dietary Supplements of Citrus aurantium	America
Pellati and Benvenuti	The analysis of phenetylamine alkaloids in Citrus aurantium	Italy
2007		
Stohs and Shara 2007	Safety and efficacy of Citrus aurantium in Weight loss	America
Dugo and Mondello 2010	Citrus oils and their composition	Italy
Onakpoya et al. 2011	Management of overweight	England
Stohs et al. 2011	Safety of Citrus aurantium in dietary supplements	America
Suryawanshi 2011	Citrus aurantium in treatment of various diseases	India
Stohs et al. 2012	Human Clinical Studies Involving Citrus aurantium	America,
		Jordan
Palazzolo et al. 2013	Use of Citrus Essential Oils	Italy
Stohs 2013	Chemical Compounds and Appetite Suppressant activity	America
Stohs et al. 2013	Primary protoalkaloid and p-synephrine of bitter orange in weight	America
	management	
Ulbricht et al. 2013	Bitter orange (Citrus aurantium) review	America
Nagappan et al. 2014	Anti-cancer and Anti-inflammatory Properties of Korean Citrus Fruits (Citrus	Korea
	aurantium L.)	
Karthikeyan and	Traditional Uses, Phytochemistry and Pharmacology of Citrus aurantium L.	India
Karthikeyan 2014		
Wang et al. 2014	Anticancer effects of Citrus Peel	China
Anwar et al. 2016	Bitter Orange (Citrus aurantium L.) Oils	Saudi
		Arabia,
		Malaysia,
		Italy
Chaudhari et al. 2016	Ethnomedicinal properties of Citrus	India
Duarte et al. 2016	Citrus: the Mediterranean diet	Portugal

Table 5. List of review papers regarding medicinal and ethnobotanical uses of Citrus aurantium.

Cirmi et al. 2017	Anticancer effects of Citrus juices	Italy,
		America
Fahim et al. 2017	Extraction methods	India
Pimenta et al. 2017	Citrus medicinal properties	Brazil
Stohs 2017	Safety, Efficacy of Citrus aurantium extract	America
Dosoky and Setzer 2018	Citrus spp. Essential Oils	America
Mannucci et al. 2018	Citrus aurantium for the Treatment of Anxiety	Italy
Suntar et al. 2018	Citrus aurantium food Ingredient and therapeutic agent	Turkey,
		Pakistan,
		America,
		Italy
González-Mas et al. 2019	Volatile Compounds in Citrus Essential Oils	Spain
Aboualsoltani et al. 2020	Therapeutic effects of Citrus aurantium	Iran
Bora et al. 2020	Essential Oils of Citrus and applications in Food	India
Gaff et al. 2020	Bitter orange peel essential oil	France
Maksoud et al. 2021	Active Constituents, Biological Effects and Extraction Methods	Lebanon,
		France,
		Spain
de Oliveira et al. 2022	Citrus aurantium (Rutaceae) in anxiety disorders	Brazil
Gao et al. 2022	An ethnopharmacological and phytochemical review	China
Koncz et al. 2022	Extracts and p-Synephrine in Citrus aurantium	Hungary and
		Indonesia
Lin et al. 2022	Method of Citrus aurantium Diseases and Pests	China
Aslan et al. 2023	body weight using Citrus aurantium	Turkey
Luo et al. 2023	Health benefits of Citrus aurantium	China
Ogunro et al. 2023	Phytochemistry, therapeutic and safety considerations of Citrus aurantium	Nigeria
Pasdaran et al. 2023	Citrus plants as dietary supplements	Iran

Between 2006 and 2012, Deyhim and his coworkers, Leite et al. and Karimi and his colleagues used rat and mouse as model animals, respectively (Table 4). In contrast, some researchers opted for alternative models, including bacteria, fungi, larvae, and yeast (Frassinetti et al. 2011; Haj Ammar et al. 2012; Hakima et al. 2016; Hashemi et al. 2016; Teneva et al. 2019) (Table 4). Furthermore, fruit juice extracts were administered to the uteri of female Wistar rats, yielding valuable insights into the antioxidant effects of *C. aurantium* (Mansouri and Khaki, 2014) (Table 4).

#### Effects on digestive system disorders

Digestive disorders are a global health concern, leading to increased utilization of healthcare services and substantial financial expenses (Wang et al. 2023). Among potential therapeutic options, *C. aurantium* has been associated with beneficial effects on digestive health. Several studies have contributed to our understanding of *C. aurantium*'s impact. Notable references include works by Paul and Cox (1995), Arias and Alvarez (2005), Kurian (2010), Habibi Bibalani and Mosazadeh-Sayadmahaleh (2011), Stohs et al. (2011) Amiri and Joharchi (2013). These findings collectively emphasize the herb's potential benefits. Furthermore, Polo et al. (2012) investigated this effect using a rat animal model. Based on their research, we strongly recommend conducting a similar investigation within the specific context of digestive disorders to provide valuable insights into the efficacy of this plant as a protective agent.

#### Weight loss

Several people worldwide suffer from obesity and face serious health challenges (Djalalinia et al. 2015), such as cancer, diabetes, and heart disorders (Safaei et al. 2021). Additionally, overweight is globally acknowledged as the fifth key driver of mortality (Smith and Smith, 2016; Safaei et al. 2021). Pilot studies and comprehensive literature reviews support the role of *C. aurantium* in weight loss (Calapai et al. 1999; Colker et al. 1999; Jones, 2002; Pellati et al. 2002; Stohs and Shara, 2007; Stohs et al. 2011; Hansen et al. 2012; Peixoto et al. 2012). By carrying out a test study in rats, researchers demonstrated the weight loss effects of *C. aurantium* fruits (Peixoto *et al.* 2012). American researchers have also written various drafts on overweight and weight reduction (Preuss et al. 2002; Fugh-Berman and Myers, 2004; Haaz et al. 2006). However, scientists (e.g., Sultan et al. 2006; Bakhyia et al. 2017) have raised concerns about the safety of dietary supplements, including bitter

#### Antibacterial activity

Bacterial-based diseases are prevalent infections worldwide, and as bacteria evolve and become resistant to antibiotics, doctors encounter significant challenges (Doron and Gorbach, 2008; Fongang et al. 2023). According to the literature (Gopal, 2012; Gniewosz et al. 2017; Ani et al. 2017; Farahmandfar et al. 2020) and Iranian traditional knowledge, *C. aurantium* has an antibacterial effect. Bacteria were used to assess the validity of this statement by testing the fruit juice, fruit peel, and leaves of this herb (Frassinetti et al. 2011; Bourgou et al. 2012; Periyanayagam et al. 2014; Dadashi et al. 2015; Mohammed et al. 2017).

#### Cardiovascular system disorders

The World Health Organization (WHO) reported cardiovascular problems as the primary reason of death in the world (World Health Organization, 2020; available at https://ourworldindata.org/cardiovascular-diseases). Indeed, a lower level of exercise and consumption of fatty food in modern societies has led to a higher level of cardiovascular diseases and increased mortality rates. Based on this study and previous achievements (Zargari, 1986; Aynechi, 1991; Calapai et al. 1999; Pellati et al. 2002; Habibi Bibalani and Mosazadeh-Sayadmahaleh, 2011; Rufai and Fatimah, 2015; Shara et al. 2016; Palheta et al. 2017; Benjamim et al. 2022), *C. aurantium* is used to protect and treat heart disease (Tables 2-3). Many years ago, Calapai and his colleagues (1999) used rats as a model organism to test the cardiovascular toxic effects in *C. aurantium* fruits. According to Sari et al. (2006) and Maria et al. (2015), carotenoids are effective in managing cardiovascular health.

#### Other activities

In addition to the activities described above, *C. aurantium* possesses numerous medicinal effects. The hydrodistillation of *C. aurantium* fruits exhibits remarkable antispasmodic effects (de Moraes Pultrini *et al.* 2006) on rat and fungi experimental models (Sokovic & Van Griensven 2006; Ahangarpour *et al.* 2011). Siskos and his colleagues (2007) worked on the insecticidal properties of this plant. Furthermore, the reliability of this effect has been examined by other scientists (see Table 2). *Citrus aurantium* extracts also demonstrate anti-inflammatory activity, manage epilepsy, reduce fever, alleviate nausea, treat diarrhea, insomnia, gout, and suppress appetite (see Table 2). Moreover, bitter orange is commonly used for flavoring food in Iran (Table 6), as well as in other countries (Karabıyıklı *et al.* 2014). It is believed that the ripe fruit peel of bitter orange has the potential to be used in chemotherapy in Korea (Nagappan *et al.* 2014). The antifungal activity of this herb is also investigated by researchers (Madhuri *et al.*, 2014; Boungab & Makhlouf 2022). For the curious readers, Tables 2-6 provide additional information regarding the medicinal properties of this herb. Nevertheless, all the above-mentioned effects require further research and the precise dosage of all bioactives needs to be determined.

Table 6. Iranian ethnobotanical novelties unveiling *Citrus aurantium*'s traditional uses. These newfound uses are based on the specific plant parts employed, either individually or in combination with other herbs, as ingredients. Our investigation draws from several interviews and various sources in the literature including works by Zargari, 1986; Saneie, 1994; Aghili-Khorassani (2001); Hassanzadeh (2009); Tavakkoli (2013); Haji-Sharifi (2003, 2017). When discussing multiherbal mixtures, incorporating English names, Iranian local names, and scientific nomenclature.

Plant part used	Administration	Novelty
	Collect a sufficient number of bitter orange flowers, especially	Jam, relaxant, stay hydrated
	male flowers that will never develop into fruits in the future.	
	Separate the petals from each other and thoroughly wash them.	
	Boil the petals in a copper container with plenty of water. To	
	reduce their bitterness, you can either boil the petals three times	
	or add a small amount of orange water to the container. The latter	
<u>Elevuer</u>	option will also preserve the white color of the petals. Finally, add	
Flower	a sugar-water solution to the petals and boil. Once cooled, store it	
	in a glass jar in the refrigerator	
	Bitter orange syrup: Mix 1-liter of bitter orange water with equal	Digestive problems, stomach
	proportions of Valerian (in persian: sonbolattib) (Valeriana	pain, reduce reflux and
	officinalis L.) water and rosewater. Next, add dried and ground	stomach acid
	bitter orange flowers to the mixture. Boil the concoction for	
	approximately 4 hours. Afterward, incorporate around 2 grams of	

ground saffron (in persian: Zaferan) (Crocus sativus L.) and honey.	
Stir thoroughly and pour the resulting mixture into a jar.	
Mix bitter orange syrup with Musk Willow (in persian: bidmeshk) (Salix aegyptiaca L.) water and drink a glass every morning and	Prevent anhidrosis
night for 30 to 40 days	
Add 30 grams of bitter orange flowers to three cups of boiling	Digestive, relief stomach
water. Boil for 15 minutes. Then, add honey and drink a cup before	disorders, anti-parasite,
every meal.	chest pain, insomnia,
	heartbeat, nervous
	disorders, epilepsy
Add the 15 grams of fresh flower and black tea to the boiling	Anticonvulsant, peaceful
water, boil for 15 to 20 minutes. Drink using a candy or honey	sleep
Add a teaspoon of bitter orange flower to a glass of boiling water,	Heart health, anti-cancer,
wait for 15 minutes, then add Damask rose (in persian: gol	treatment of infectious
Mohammadi) ( <i>Rosa × damascena</i> Herrm.). Finally, add a	diseases, relief from
tablespoon of rosewater and honey	insomnia, relief pain,
	digestive
Add 3 to 4 slices of fresh raw and peeled ginger (in persian:	Digestive health, reduce
zanjabil) (Zingiber officinale Roscoe) and 2 teaspoons of dried	cholesterol and blood
bitter orange flower to the 2 cups of boiling water. Finally, add	pressure, strengthening the
some honey.	immune system
Bitter orange and Ceylon cinnamon (in persian: darchin)	Reduce blood sugar and
(Cinnamomum verum J.Presl) herbal tea. Combine 3 teaspoons of	false hunger
dried bitter orange flowers, 1 cinnamon stick, 1 teaspoon of bitter	
orange flower extract, and honey. First, add the bitter orange	
flowers and a cinnamon stick to two cups of boiling water and	
simmer gently. Before serving, add the bitter orange flower extract	
and honey to the tea	
Add a mixture of two teaspoons of bitter orange flowers and one	Urinary system disorders,
teaspoon of lavender (in persian: ostokhoddus) ( <i>Lavandula</i>	asthma, relaxant, strengthen
angustifolia Moench) to two cups of boiling water. Wait for 10	heart, treat cough and cold,
minutes, then drink it with honey	liver disorders, treat
	dizziness
Add an equal amount of bitter orange flowers, lavender (in	Memory improvement
persian: ostokhoddus) ( <i>Lavandula angustifolia</i> ), Valerian (in	
persian: sonbolattib) (Valeriana officinalis L.) and moldavian	
dragonhead (in persian: badranjbuyeh) (Dracocephalum moldavica	
L.) to a boiling water. Wait for ten minutes, then drink it with	
honey	
Add lemon verbena (in persian: behlimou) ( <i>Aloysia citrodora</i> Paláu)	Good for digestive system
to a cup of boiling water, brew for 30 minutes, then, add bitter	and heart function,
orange flower, boil for 10 minutes and drink	treatment of constipation
Mix stinking chamomile (in persian: babouneh) (Anthemis cotula	Digestive, heart health
L.) and bitter orange flowers, add a cup of boiling water, and brew	
for 10 minutes	
Mix green tea and bitter orange flowers, add a cup of boiling	Strengthen immune system,
water, and brew for 15 minutes	reduce cholesterol and
	blood pressure, eliminate
	body toxins, skin health,
	Strengthen immune system
Add jujube (in persian: annab) ( <i>Ziziphus jujuba</i> Mill.) and bitter	Skin Brightening, reducing
	8 8, 8
brange flower to three cups of boiling water, boil for 15-20	tooth decay, digestive

	Add quince (in persian: beh) (Cydonia oblonga Mill.) and bitter	Hearth health, enhancing
	orange flower to three cups of boiling water, boil for 15-20	breathing capacity,
	minutes. Finally, drink the mixture with honey	detoxification, waste
		elimination
	Mix equal amounts of bitter orange and caraway (in persian:	Digestive disorders, stomach
	zenian) ( <i>Trachyspermum copticum</i> (L.) (Link) powders. Dilute a	cleansing, freshening breath
	teaspoon of this mixture in a glass of water	
	Add red feathers (in persian: gol gavzaban) (Echium amoenum	Eliminate body toxins,
	Fisch. & C.A.Mey.) to three cups of boiling water, boil for 20	reduce inflammatory pains
	minutes, then add bitter orange flowers to the mixture and boil for	
	an additional 10 minutes. Finally, drink the mixture with honey	
	Mix bitter orange syrup and rosewater, and drink	Anticonvulsant, improve
		anxiety and depression
	Drink bitter orange syrup with tansy mustard (in persian: Khakshir)	Digestive disorders
	(Descurainia Sophia (L.) Webb ex. Prantl)	
	Place cool tea bags on the eyes	Calm swelling, treat droopy
		eyes
	Soak the flower in water for around 6 hours, use the extract	Hydrate the skin, achieve a
		natural face lift
	Use dried and powdered flowers	Get rid of stomach gas,
		improve intestinal function
	Extract oil	Treat joint disorders such as
Flower, fruit peel		gout and rheumatism,
		prevent hair loss
Flower or flower	Fumigation	Open the skin, clean and
water		make your skin shine and
Water		brightening
Flower or flower	Prepare a mask by combining flower or flower water with grated	Brightening the skin, remove
water	potato (in persian: Sibzamini) (Solanum tuberosum L.) and wheat	dark circles around eyes
	starch. Apply the pasty mask to the skin	
Flower Soft drink	Add dried flowers to a cup of boiled water. cover the cup. After 15	Sedative
	minutes, it will be ready to drink	
	Add bitter orange flower water to Musk Willow (in persian:	Sedative, induces sleep,
	bidmeshk) (Salix aegyptiaca L.) water and drink	treats metal disorders and
		depression, strengthens the
		heartbeat, treats nervous
		headaches and migraine,
		and eliminates stress and
		anxiety
	Drink flower water	Increase appetite, treat
		epilepsy, relieve chest pain,
		belching, tonic
<b>FI</b> .	Mix an equal amount of bitter orange flower water and celery (in	Treat bladder and kidney
Flower water	Mix an equal amount of bitter orange flower water and celery (in persian: karafs) ( <i>Apium graveolens</i> Cham.), allow the mixture to sit	Treat bladder and kidney stones, dietary consideration
Flower water	Mix an equal amount of bitter orange flower water and celery (in persian: karafs) ( <i>Apium graveolens</i> Cham.), allow the mixture to sit for a day, after 24 hours, strain the liquid to separate any karafs	Treat bladder and kidney stones, dietary consideration
Flower water	Mix an equal amount of bitter orange flower water and celery (in persian: karafs) ( <i>Apium graveolens</i> Cham.), allow the mixture to sit for a day, after 24 hours, strain the liquid to separate any karafs pieces.	Treat bladder and kidney stones, dietary consideration
Flower water	Mix an equal amount of bitter orange flower water and celery (in persian: karafs) ( <i>Apium graveolens</i> Cham.), allow the mixture to sit for a day, after 24 hours, strain the liquid to separate any karafs pieces. Add sugar to flower water and drink it before breakfast in the	Treat bladder and kidney stones, dietary consideration Treatment of diarrhea
Flower water	Mix an equal amount of bitter orange flower water and celery (in persian: karafs) ( <i>Apium graveolens</i> Cham.), allow the mixture to sit for a day, after 24 hours, strain the liquid to separate any karafs pieces. Add sugar to flower water and drink it before breakfast in the morning	Treat bladder and kidney stones, dietary consideration Treatment of diarrhea
Flower water	Mix an equal amount of bitter orange flower water and celery (in persian: karafs) ( <i>Apium graveolens</i> Cham.), allow the mixture to sit for a day, after 24 hours, strain the liquid to separate any karafs pieces. Add sugar to flower water and drink it before breakfast in the morning Incorporate into foods	Treat bladder and kidney stones, dietary consideration Treatment of diarrhea Make foods fragrant
Flower water	Mix an equal amount of bitter orange flower water and celery (in persian: karafs) (Apium graveolens Cham.), allow the mixture to sit for a day, after 24 hours, strain the liquid to separate any karafs pieces.Add sugar to flower water and drink it before breakfast in the morningIncorporate into foodsAdd half a cup of bitter orange flower water to a teaspoon of	Treat bladder and kidney stones, dietary consideration Treatment of diarrhea Make foods fragrant Fragrance and skin softness
Flower water	Mix an equal amount of bitter orange flower water and celery (in persian: karafs) (Apium graveolens Cham.), allow the mixture to sit for a day, after 24 hours, strain the liquid to separate any karafs pieces.Add sugar to flower water and drink it before breakfast in the morningIncorporate into foodsAdd half a cup of bitter orange flower water to a teaspoon of honey and 3 to 5 cups of hot milk. Apply the mixture to the skin as	Treat bladder and kidney stones, dietary consideration Treatment of diarrhea Make foods fragrant Fragrance and skin softness
Flower water	Mix an equal amount of bitter orange flower water and celery (in persian: karafs) (Apium graveolens Cham.), allow the mixture to sit for a day, after 24 hours, strain the liquid to separate any karafs pieces.Add sugar to flower water and drink it before breakfast in the morningIncorporate into foodsAdd half a cup of bitter orange flower water to a teaspoon of honey and 3 to 5 cups of hot milk. Apply the mixture to the skin as a mask	Treat bladder and kidney stones, dietary consideration Treatment of diarrhea Make foods fragrant Fragrance and skin softness
Flower water	Mix an equal amount of bitter orange flower water and celery (in persian: karafs) (Apium graveolens Cham.), allow the mixture to sit for a day, after 24 hours, strain the liquid to separate any karafs pieces.Add sugar to flower water and drink it before breakfast in the morningIncorporate into foodsAdd half a cup of bitter orange flower water to a teaspoon of honey and 3 to 5 cups of hot milk. Apply the mixture to the skin as a maskMix half a teaspoon of flower water, two teaspoons of olive oil,	Treat bladder and kidney stones, dietary consideration Treatment of diarrhea Make foods fragrant Fragrance and skin softness Make diet sauce

Ethnobotany	Research	and	Applications	

	Mix boiling water and 3 to 6 teaspoons of flower water, spray the	Natural air freshener,
	mixture around your home	relaxant, aromatherapy
	Boil a teaspoon of flowers in water for 20 minutes, prepare a syrup	Hyperthermia, nervous
Flower leaf	by combining bitter orange and saffron (in persian: Zaferan)	headache, managing nerve
	(Crocus sativus L.), a brew made from the leaves and flowers of	weakness
	this herb	
Flower and fruit	To remove the bitter taste, both parts will be boiled three times.	pickle
peel		
	Fumigation, put the fruit into boiling water and inhale its steam	Relieve nasal congestion
	Extract oil	Anti-worm, detoxify your
Eruit		body, antidote to poisons,
FIUIL		appetizer, chest pain relief
	Apply the fruit directly to the affected area caused by ringworm or	Treat fungal infection
	athlete's foot	
	Prepare a syrup by combining bitter orange, rosewater and Persian	Energetic and joyful
	willow waters together with honey and saffron (in persian:	
	Zaferan) (Crocus sativus L.). Mix these ingredients in a glass of	
	water	
	Drink fruit water	Stop burping, alleviate
		discomfort by the large
		intestine
Fruit water	Rubbing the extract on the skin	Beneficial impact on
		sensitive and oily skin,
		alleviating skin irritation and
		reducing redness,
		brightening skin
	Mix equal amounts of bitter orange flower water, lemon (in	Treat cracked heels on the
	persian: limou torsh) juice (Citrus × limon (L.) Osbeck), glycerin, and	feet
	rosewater, focus on the affected areas	
	Hamis Touleh is a delicious dish from Khuzestan Province in	Digestive improvement,
	southwest Iran. Ground the leaves of common mallow (in persian:	stomach and intestinal
	touleh) ( <i>Malva neglecta</i> Wallr.) and cook them. Then, remove the	cleansing, bladder disorders,
	excess water from the leaves. Fry the onion and garlic, and add	kidney disease, immune
	pomegranate paste to the mixture. Add spices such as salt, pepper	system enhancement,
	and turmeric to the pan, and mix all the ingredients. Add cooked	dysuria treatment
	touleh leaves fry them for a few minutes. Add the fresh juice of	
	bitter orange and wait for 2 minutes. Serve it with bread or rice.	
	Drink fruit water with sugar	Strengthen the stomach,
	-	improve gallbladder and
		blood disorders
	Mix equal amounts of bitter orange fruit, unripe grape juice, and	Treat mumps
Fruit juice	vinegar. Apply this mixture externally to the swelling area of the	-
	throat	
	Gargling the fruit juice	Alleviate sore throat
	Drink fruit juice	Alleviate hiccup
	Mix the fruit juice of bitter orange with an equal volume of orange	Nervous problems
	juice, add three to four times the amount of water, dissolve one	,
	teaspoon of honey or 20 grams of sugar per liter and drink this	
	mixture daily	
	Drink a cup of fruit juice daily	Reduce bad breath, maintain
		oral health
	Mix equal amounts of bitter orange, quince (in persian: heh)	Antinausea of pregnancy
	(Cydonia oblonga Mill) and annle juices. Heat the mixture until its	, and had a or pregnancy
	(cyaoma obionga mini) and apple jules. Heat the mixture until its	

	volume reduces by half and then add sugar. Take one teaspoon	
	before and after each meal	
	Blend the juice of the bitter orange with tamarind (in persian:	Treat skin pores and reduce
	tambre hendi) (Tamarindus indica L.) seed powder and applied it	facial fat
	as a facial mask	
	Spray on hair and then wash it after 3 to 5 minutes for healthy hair	Healthy hair
	Washing the face with fruit juice for around 10 days	Treatment for oily skin
	To prepare bitter orange paste wash the bitter oranges, cut them in half, remove the pulp and seeds, and then extract the juice. Finally, pour the juice into a pot and heat it gently until it reaches a	Apply it to your nails, wait for a few minutes. It strengthens weak and brittle
	boiling point. After a few minutes, the paste will be ready. Once it has cooled, transfer it to a dry jar	nails, hair growth, alleviate melancholy, and reduce excess oil from face and scalp. Additionally, add salt to the past and applying it to red and black spots on the body help remove them from the skin, reduces blood fat and cholesterol, wound ointment, appetizing, increase iron absorption, anti-parasitic, antimicrobial, stay hydrated, detoxify your
		body
	Blue bitter orange sauce is a delicious dish from Mazandaran Province in northern Iran. fry garlic (in persian: sir) ( <i>Allium sativum</i> L.), walnut (in persian: gerdoo) ( <i>Juglans regia</i> L.), and rice flour together. Simultaneously, fry chicken meat, then add the	Kidney stone removal, throat infection treatment, blood pressure and cholesterol reduction
	previously fried mixture to the chicken. Fry all ingredients	
	for around one hour. Divide the hitter orange fruit, removing the	
	fruit neel and seeds. To make the sauce blue, heat an iron spatula	
	on a gas flame until it is hot and red. Insert the hot spatula into the	
	bitter orange for some time until the orange juice turns blue. Pour the blue bitter orange juice into the mixture, cook it, and serve	
	with rice and vegetables	
	Mix equal amounts of bitter orange fruit juice, sweet lemon (in persian: limou shirin) ( <i>Citrus × limetta</i> Risso), lemon (in persian:	Treat fatty liver
	limou torsh) (Citrus × limon (L.) Osbeck), sweet orange (in persian:	
	porteghal) (Citrus × sinensis (L.) Osbeck), and apple (in persian: sib)	
	(Malus domestica (Suckow) Borkh.) juices. Drink the mixture	
	Mix equal amounts of bitter orange fruit juice, and sweet orange	Relieve nervous disorders
	(in persian: porteghal) (Citrus × sinensis) juice. Add water and sugar	
	to taste. Drink 6 to 8 glasses of the mixture	
	Drizzle the juice and pulp over the food to enhance the flavor, and	Fish, kebab, shashlik, making
Fruit juice and pulp	prevent increasing blood pressure, drinking fresh fruit juice is used to control high blood pressure, add its juice to salad Shirazi for an	salad Shirazi
	extra sour taste	
Fruit essential oil,	Mix bitter orange water and rosewater, then, apply it as a skin	Remove freckles, acne and
truit juice	mask for 15 minutes	rashes
Fruit peel	grind dried bitter orange peel, mix it with bitter orange honey, and consume	Alleviate vomiting, prevents diarrhea and vomiting, antioxidant treat influenza

Consume dried and ground fruit neel with water	Anti-worm remove parasites
	from intestine and stomach
	hearthurn alleviate vomiting
Fragment the fruit neels into nieces or nowder, then hold them in	Reduces fever and alleviate
water for 20 minutes. Add honow and drink a cup after even meal	cold symptoms, colming
water for 20 minutes. Add honey and drink a cup after every mean	
	heartbeat
Use green fruit peel to make syrup or add ground dried fruit peel	Digestive disorders
to the boiling water. Brew for 15 minutes and drink before meal	
Separate the white layers inside the fruit peel. Cut the fruit peels	Strengthen the stomach,
into pieces or powder them, then, add tea to the peels and brew in	decrease gastric secretion,
water for 10 minutes, drink the tea	anti-hemorrhagic
Fruit peels fragmented into pieces or powdered and dried before	Acne and eczema, anti-
being consumed by afternoon tea, pour a powder or sliced fruit	bacterial, anti-inflammatory,
peel into a boiling water, and drink after fifteen minutes with	arthritis, antioxidant,
candy, honey or sugar, spray on skin and hair or added to bath	bladder and gallbladder
water to relieve skin disorders (health)	disorders, cold treatment,
	digestive system, energizing,
	headache, healthy hair.
	kidney health, lose weight
	oral hygiene, prevent
	internal bleeding prevent
	nausea prevent skin aging
	romovo fat from skin
Take fresh fruit peol of the hitter grange congrete it from the fruit	
rince it theroughly place the peol in a pet, add water to cover the	constipation, carminative
finite real, heilfer 20 to 20 minutes, drain the water to cover the	
ruit peel, boli for 20 to 30 minutes, drain the water from the pot,	
add new water to the pot. Add sugar, boll again for 15 to 20	
2 hours often diagon	
Shours after unifier	
Mix 5 teaspoons of ground fruit peel and 2 teaspoons of green	Hair strengthening
walnut (in persian: gerdoo) shell ( <i>Jugians regia</i> L.). Boil the mixture	
in water for 15 minutes. Use the mixture to wash your hair	
Make the jam following the same method used for flower jam	Jam
Grind the following ingredients: bitter orange fruit peel jam (250	Antiepileptic
gr), lavender (in persian: ostokhoddus) ( <i>Lavandula angustifolia</i> ),	
safflower (in persian: golrang) (Carthamus tinctorius L.) (5 gr),	
common peony (in persian: gole sadtoumani or oud salib) (Paeonia	
officinalis L.) (15-20 gr), mix the ground ingredients with sugar.	
Consume 2 to 3 teaspoons of the mixture every day. It has also	
been mentioned to add Marjane daryaie (coral) to the above	
mixture.	
Grind the following ingredients: bitter orange fruit peel jam (5 gr),	Diarrhea treatment
pomegranate (in persian: anar, nar or golnar) (Punia granatum L.)	
(5 gr), (in persian: kondor) (Boswellia thurifera Roxb.) (5 gr), sicilian	
sumac (in persian: somagh) (Rhus coriaria L.) (15 gr), coriander (in	
persian: geshniz) (Coriandrum sativum L.) (5 gr), mix the ground	
ingredients with sugar. Consume a teaspoon after each meal	
Grind the following ingredients: bitter orange fruit peel (10 gr).	Treat shivering
carnation (in persian: mikhak or gharanfol) ( <i>Dianthus</i> sp.) (5 gr).	
nutmeg (in persian: Joz hendi) ( <i>Myristica fragrans</i> Houtt ) (5 gr)	
white turmeric (in persian: Jadvar, zardchoube sefid) (Curcuma	
zedogrig (Christm ) Roscoe (5 gr) greater galangal (in persian:	
Kholanian) (Alninia officinarum Hance) (5 gr.), basil (in persian:	
revision (Arphina official and Harley (5 gr), basin (in persidit.	
reynany seed (Ochnum bushcum L.) (10 gr), caruanoni (in persian.	

	hel siah or hil gharabi) ( <i>Elettaria cardamomum</i> (L.) Maton (5 gr),	
	myrrh (in persian: marmaki) ( <i>Commiphore</i> Jacq.) (5 gr), lemon balm	
	(in persian: faranjmeshk) (Melissa officinalis L.), lavender (in	
	persian: ostokhoddus) (Lavandula angustifolia), mix the ground	
	ingredients with honey. Consume two to three teaspoons every	
	day	
	Grind the following ingredients: bitter orange fruit peel (5 gr),	Heart health
	Cevlon cinnamon (in persian: darchin) ( <i>Cinnamomum verum</i> ) (5	
	gr), red feathers (in persian; gol gavzaban) (Echium amoenum	
	Fisch, & C.A.Mey.) (10 gr), cape ricegrass (in persian: bahman sefid)	
	(Stipa capensis Thunb. (10 gr), pinecone ginger (in persian:	
	zaranbad) (Zingiber zerumbet (L.) Roscoe ex Sm (5 gr), acorn	
	squash (in persian: kadou) seed ( <i>Cucurbita peno</i> L.) (20 gr).	
	common nurslane (in persian: khorfe) seed (Portulaca oleracea L)	
	(5 gr) wild carrot (in persian: havii) (Daucus carota L) (10 gr)	
	clover (in persian: shabdar) ( <i>Trifolium</i> L) (5 gr) lemon halm (in	
	persian: faranimeshk) ( <i>Melissa officinalis</i> L.) (5 gr), elephant grass	
	(in persian: tabashir) ( <i>Saccharum ravennae</i> (1) 1 (5 gr) incense	
	tree (in persian: oud) ( <i>Aquilaria sinensis</i> (Lour) Spreng (5 gr) rose	
	(in persian: gole sorkh) ( <i>Rosa</i> sp.) cardamom (in persian: bel siah	
	or hil gharahi) ( <i>Flettaria cardamomum</i> (I.) Maton (5 gr) moldavian	
	dragonhead (in persian: hadranibuyeh) (Dracocenhalum moldavica	
	1) mix the ground ingredients with honey. Consume two to three	
	teasnoons every day	
	Grind the following ingredients: hitter grange fruit neel (10 gr)	Relieve back nain sciatica
	nutmeg (in persian: loz hendi) (Myristica fragrans) (5 gr) carnation	and knee pain
	(in persian: mikhak or gharanfol) ( <i>Dignthus</i> sp.) (5 gr). Cevlon	
	cinnamon (in persian: darchin) ( <i>Cinnamomum verum</i> ) (5 gr), rose	
	(in persian; gole sorkh) ( <i>Rosa</i> sp.), banafshe ( <i>Viola</i> L.) (10 gr).	
	pinecone ginger (in persian: zaranbad) (Zingiber zerumbet (5 gr).	
	hyssop (in persian: gol zofa) ( <i>Hyssopus officinalis</i> L.) (10 gr), bay	
	tree (in persian: barge boo or habbolghar) (Laurus nobilis L.).	
	lavender (in persian: ostokhoddus) (Lavandula anaustifolia) (10 gr).	
	meadow saffron (in persian: soranian) ( <i>Colchicum</i> L.) (15 gr)	
	Grind the following ingredients: bitter orange fruit peel (20 gr) and	Anti-addiction
	flower (10 gr), violet (in persian: Banafshe) root ( <i>Viola</i> I.) (25 gr).	
	white indian sandalwood (in persian: sandal sefid) ( <i>Santalum</i>	
	album L) (10 gr), and incense tree (in persian; oud) (Aquilaria	
	sinensis (Lour.) Spreng. (10 gr), mix the ground ingredients with	
	rosewater. Consume 1.5 glasses every day	
Fruit peel, flower	Preparation of bitter orange oil: combine equal amounts of bitter	Reducing wrinkle, treating
	orange fruit peel and flowers, add the mixture to Sesame (in	acne and pimple, stress
	persian: Konied) ( <i>Sesamum indicum</i> L.) oil. Place the container in	reduction, skin rejuvenation.
	direct sunlight for 3 weeks. Sun exposure allows the oil to absorb	natural antispasmodic.
	the beneficial compounds from the peel and flowers. Finally, strain	improve intestinal problems
	the infused oil to remove all solid particles. Consume daily	and diarrhea
	Grill the bitter orange, peel off the charred skin, and drink the	Lung infection
	edible part with a few teaspoons of honey	
	Cut the fruit into two pieces, remove the seeds, and then add	Cough relief. phlegm
Fruit	starch and sugar. Place it on the fire. and drink the juice before	removal
Tut	breakfast	
	Add honey or sugar	Influenza, Relieve
		problematic coughs

Fruit fruit pool	Cook the entire fruit, including the flesh, fruit peel, and seeds, and	Soften the hair, relief body
and cood	then apply it to the hair and skin	itching, removes all types of
and seed		acne, treat fat
Fruit, fruit peel	Cook the entire fruit, including the flesh, fruit peel, and seeds, add	Soften the hair, remove
and seed	vinegar	pimples and reduce itching
	Remove the bitter orange seeds from ripe fruits, wash the	Anthelmintic and
	separated seeds thoroughly. Separate the outer shell from the	antiparasitic for children
	seeds. Allow the remaining seeds to dry naturally at room	
	temperature. Finally, grind the seeds into a fine powder	
	Grind the bitter orange and Castor seeds (in persian: castor oil (in	Digestive disorders,
	persian: karchak) ( <i>Ricinus communis</i> L.) into a fine powder, use the	antioxidant, anti-
	powdered mixture	inflammatory, antimicrobial
		and antifungal activity
	Making kohl for the eye: grind hazelnut (in persian: fandogh)	Remove phlegm (mucus)
	(Corylus avellana L.), almond (in persian: badam) (Prunus dulcis	from the eye
Seed	(Mill.) D.A. Webb), and bitter orange seeds. Place the mixture on a	
Seeu	spreader flame. Position a metal dish at a small distance obove the	
	spreader flame. After the seeds have completely burned, scrape	
	the soot off with a knife. Finally, store the kohl	
	Oil extraction	Hair growth, blood sugar
		regulation, kidney health,
		anti-cancer, fungal infection
		management, digestive, anti-
		inflammatory effects
	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr)	Herbal remedy for scorpion
	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus</i> × <i>limon</i> ) seeds. Apply this mixture to the site of the scorpion	Herbal remedy for scorpion bites
	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite	Herbal remedy for scorpion bites
	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus</i> × <i>limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces,	Herbal remedy for scorpion bites Anticonvulsant,
	<ul> <li>Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr)</li> <li>(<i>Citrus × limon</i>) seeds. Apply this mixture to the site of the scorpion bite</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with</li> </ul>	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative,
	<ul> <li>Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr)</li> <li>(<i>Citrus × limon</i>) seeds. Apply this mixture to the site of the scorpion bite</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes.</li> </ul>	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia,
	<ul> <li>Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr)</li> <li>(<i>Citrus × limon</i>) seeds. Apply this mixture to the site of the scorpion bite</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes.</li> <li>Wash three to five leaves of bitter orange, cut them into pieces,</li> </ul>	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders
	<ul> <li>Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr)</li> <li>(<i>Citrus × limon</i>) seeds. Apply this mixture to the site of the scorpion bite</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes.</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the</li> </ul>	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders
leaf	<ul> <li>Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr)</li> <li>(<i>Citrus × limon</i>) seeds. Apply this mixture to the site of the scorpion bite</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes.</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour.</li> </ul>	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders
Leaf	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus</i> × <i>limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic,
Leaf	<ul> <li>Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr)</li> <li>(<i>Citrus × limon</i>) seeds. Apply this mixture to the site of the scorpion bite</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes.</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour.</li> <li>Extraction of pounded fresh leaves are used after boiling with honey</li> </ul>	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant,
Leaf	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus</i> × <i>limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic,
Leaf	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion,
Leaf	<ul> <li>Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr)</li> <li>(<i>Citrus × limon</i>) seeds. Apply this mixture to the site of the scorpion bite</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes.</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour.</li> <li>Extraction of pounded fresh leaves are used after boiling with honey</li> </ul>	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver
Leaf	<ul> <li>Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr)</li> <li>(<i>Citrus × limon</i>) seeds. Apply this mixture to the site of the scorpion bite</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes.</li> <li>Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour.</li> <li>Extraction of pounded fresh leaves are used after boiling with honey</li> </ul>	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver disorder, sedative
Leaf	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver disorder, sedative Digestive, promote better
Leaf	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey Grind the following ingredients together: bitter orange leaf (20 gr) and flower (5 gr), afsentin ( <i>Artemisia absinthium</i> L.) (15 gr),	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver disorder, sedative Digestive, promote better sleep, treat epilepsy
Leaf	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey Grind the following ingredients together: bitter orange leaf (20 gr) and flower (5 gr), afsentin ( <i>Artemisia absinthium</i> L.) (15 gr), Damask rose (in persian: gol Mohammadi) ( <i>Rosa × damascena</i> )	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver disorder, sedative Digestive, promote better sleep, treat epilepsy
Leaf Leaf Leaf and flower	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey Grind the following ingredients together: bitter orange leaf (20 gr) and flower (5 gr), afsentin ( <i>Artemisia absinthium</i> L.) (15 gr), Damask rose (in persian: gol Mohammadi) ( <i>Rosa × damascena</i> ) petal (10 gr), anison seeds ( <i>Pimpinella anisum</i> L.) (15 gr),	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver disorder, sedative Digestive, promote better sleep, treat epilepsy
Leaf Leaf and flower	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey Grind the following ingredients together: bitter orange leaf (20 gr) and flower (5 gr), afsentin ( <i>Artemisia absinthium</i> L.) (15 gr), Damask rose (in persian: gol Mohammadi) ( <i>Rosa × damascena</i> ) petal (10 gr), anison seeds ( <i>Pimpinella anisum</i> L.) (15 gr), faranjmeshk ( <i>Melissa officinalis</i> ) (5 gr), pouneh leaves ( <i>Mentha</i>	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver disorder, sedative Digestive, promote better sleep, treat epilepsy
Leaf Leaf and flower	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey Grind the following ingredients together: bitter orange leaf (20 gr) and flower (5 gr), afsentin ( <i>Artemisia absinthium</i> L.) (15 gr), Damask rose (in persian: gol Mohammadi) ( <i>Rosa × damascena</i> ) petal (10 gr), anison seeds ( <i>Pimpinella anisum</i> L.) (15 gr), faranjmeshk ( <i>Melissa officinalis</i> ) (5 gr), pouneh leaves ( <i>Mentha pulegium</i> L.), mix them thoroughly, boil the mixture in water. Drink	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver disorder, sedative Digestive, promote better sleep, treat epilepsy
Leaf Leaf and flower	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey Grind the following ingredients together: bitter orange leaf (20 gr) and flower (5 gr), afsentin ( <i>Artemisia absinthium</i> L.) (15 gr), Damask rose (in persian: gol Mohammadi) ( <i>Rosa × damascena</i> ) petal (10 gr), anison seeds ( <i>Pimpinella anisum</i> L.) (15 gr), faranjmeshk ( <i>Melissa officinalis</i> ) (5 gr), pouneh leaves ( <i>Mentha</i> <i>pulegium</i> L.), mix them thoroughly, boil the mixture in water. Drink a cup of this tea after dinner.	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver disorder, sedative Digestive, promote better sleep, treat epilepsy
Leaf Leaf and flower	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey Grind the following ingredients together: bitter orange leaf (20 gr) and flower (5 gr), afsentin ( <i>Artemisia absinthium</i> L.) (15 gr), Damask rose (in persian: gol Mohammadi) ( <i>Rosa × damascena</i> ) petal (10 gr), anison seeds ( <i>Pimpinella anisum</i> L.) (15 gr), faranjmeshk ( <i>Melissa officinalis</i> ) (5 gr), pouneh leaves ( <i>Mentha</i> <i>pulegium</i> L.), mix them thoroughly, boil the mixture in water. Drink a cup of this tea after dinner. Add dried leaves and twice the weight of leaves in fruit peels to	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver disorder, sedative Digestive, promote better sleep, treat epilepsy Enhance memory, muscle
Leaf Leaf and flower Leaf and fruit peel	Grind bitter orange (4 gr) and lemon (in persian: limou torsh) (4 gr) ( <i>Citrus × limon</i> ) seeds. Apply this mixture to the site of the scorpion bite Wash three to five leaves of bitter orange, cut them into pieces, add candies, and add the mixture to the boiling water. Brew with gentle heat for approximately 15 minutes. Wash three to five leaves of bitter orange, cut them into pieces, add sugar or honey, place the mixture in boiling water. Boil the mixture for approximately one hour. Extraction of pounded fresh leaves are used after boiling with honey Grind the following ingredients together: bitter orange leaf (20 gr) and flower (5 gr), afsentin ( <i>Artemisia absinthium</i> L.) (15 gr), Damask rose (in persian: gol Mohammadi) ( <i>Rosa × damascena</i> ) petal (10 gr), anison seeds ( <i>Pimpinella anisum</i> L.) (15 gr), faranjmeshk ( <i>Melissa officinalis</i> ) (5 gr), pouneh leaves ( <i>Mentha pulegium</i> L.), mix them thoroughly, boil the mixture in water. Drink a cup of this tea after dinner. Add dried leaves and twice the weight of leaves in fruit peels to boiling water, and brew with gentle heat	Herbal remedy for scorpion bites Anticonvulsant, anthelmintic, sedative, insomnia, Liver disorders Anthelmintic, anticonvulsant, antiperspirant, diaphoretic, epilepsy, food digestion, healthy heart, insomnia, liver disorder, sedative Digestive, promote better sleep, treat epilepsy Enhance memory, muscle strength

### Conclusion

Cultivated plants of the family Rutaceae are critically consumed as sources of fruit products, medicines, flavoring food, and ornamentals. This study is a compilation of the bitter orange ethnobotany in Iran, along with a traditional and medicinal summary of *C. aurantium* worldwide. The ethnobotanical study of *C. aurantium* in Iran unfolded the importance of the species in traditional medicine. This study significantly outlines the global perspective of this herb in terms of curing ailments,

such as nervous system, cardiovascular, anti-inflammatory, digestive problems, antibacterial, etc. The results of the present study were reached after a comprehensive study of published and unpublished literature, online databases, author experience, as well as filling out questionnaires by local people. During the last century, the natural ecosystem has suffered remarkable changes in the distribution of natural plants. The traditional use of this herb has been validated by various laboratory and organismal model experiments. More than 436 chemical bioactives have been identified and reported from the plant. Linalool, limonene, and  $\alpha$ -pinene are found to be the main chemical compounds of *C. aurantium*. While pharmacological results are promising, we assume that more robust clinical surveys must be done to draw sufficient evidence regarding C. aurantium ethnomedicinal properties. In addition, we assume that the mechanism of chemical compound activity within the traditional uses of this plant is considered vague and in-depth investigations are critically suggested herein. According to Iranian old ethnobotanical books, the mechanism of side effects remains unknown and should be paid further attention in future studies. Regarding the toxic effects of this herb, several issues are still under question and should be critically resolved using in vivo and in vitro (clinical) trials. According to a comparative investigation of the antique (classical or ancient) documents, modern investigations clearly validated the folk medicinal knowledge of C. aurantium. In conclusion, C. aurantium is a convincing herb in the treatment of various health disorders within the human body, and pharmacologists may use much more modern techniques to isolate and identify these bioactive compounds accurately. Eventually in vivo organism investigations and clinical experiments are needed to prove the safety of drug administration of C. aurantium.

#### Declarations

List of abbreviations: GC-MS: gas chromatography/mass spectrometry, HD: Hydrodistillation, HPLC: High-performance liquid chromatography coupled with tandem mass spectrometry, UHPLC-Q-TOF/MS: Ultra-high performance liquid chromatography-quadrupole time-of-flight mass spectrometry, RP-HPLC: Reversed-phase high-performance liquid chromatography, MAHD: Microwave-assisted hydro-distillation, UAE: Ultrasound-assisted extraction, HRGC: High-resolution gas chromatography, HRGC/MS: High-resolution gas chromatography mass spectrometry, GC-FID: Gas chromatography- Flame ionization detection, MAE: Microwave-assisted headspace solid phase microextraction, UA-HS-SPME: Ultrasonic-assisted headspace solid phase microextraction, UA-HS-SPME: Ultrasonic-assisted headspace solid phase microextraction, SD: Steam distillation, MSD: Microwave steam distillation, LC-ESI/MS: Liquid chromatography electrospray ionization mass spectrometry, SFME: Solvent-free microwave extraction, SLME: Solvent microwave extraction, UA-ATPE: Ultrasound-assisted aqueous two-phase extraction.

Ethics approval and consent to participate: Not applicable

Consent for publication: Authors are consent to participate in this manuscript

Availability of data and materials: All data are available in the manuscript

Competing interests: The authors declare that they have no competing interests

Funding: Not applicable

**Author contributions:** The first author (Atena Eslami-Farouji) developed the concept, data curation, investigation, methodology, formal analysis, supervision, conducted the literature review worldwide, analyzed data, and prepared the original draft. The second author (Fatemeh Jalili) provided data on the traditional uses of *Citrus aurantium*.

#### Acknowledgements

The first author of this study (AEF) appreciates Shiraz University for the financial support. She also wants to show her deep gratitude from Prof. Dr. Ahmad Reza Khosravi, and Prof. Dr. Mohammad Jamal Saharkhiz for their precious comments. Copilot used to grammar check of the manuscript.

#### Literature cited

Abbasnia VS. 2016. The effect of *Citrus aurantium* flowers aqueous extract on sleeping time and the level of anxiety in mice. Journal of Birjand University of Medical Sciences 23(4):307-314.

Abbaspoor Z, Sharifipour F, Siahposh A, Nazaralivand R, Mohaghegh Z, Siahkal SF, 2022. Effects of Aromatherapy with *Citrus aurantium* Lavender on Sexual Function of Postmenopausal Women: A Randomized Controlled Trial. Journal of Family & Reproductive Health 16(2):147.

Abderrezak, MK, Abaza, I, Aburjai, T, Kabouche, A, Kabouche, Z. 2014. Comparative compositions of essential oils of *Citrus aurantium* growing in different soils. Journal of Materials and Environmental Science 5(6):1913-1918.

Abdollahi F, Mobadery T. 2020. The effect of aromatherapy with bitter orange (*Citrus aurantium*) extract on anxiety and fatigue in type 2 diabetic patients. Advances in Integrative Medicine 7(1):3-7. doi: 101016/jaimed201901002.

Abou Baker, DH, Ibrahim, BM, Hassan, NS, Yousuf, AF, El Gengaihi S. 2020. Exploiting *Citrus aurantium* seeds and their secondary metabolites in the management of Alzheimer disease Toxicology Reports 7:723-729 doi: 101016/jtoxrep202006001.

Aboualsoltani, F, Bastani, P, Khodaie, L, Fazljou SMB. 2020. Therapeutic Effects of *Citrus aurantium* Components on Psychological States: A Systematic Review. Crescent Journal of Medical & Biological Sciences 7(4).

Adedeji, DE, Kayode J, Ayeni MJ. 2018. An ethnobotanical study of plant species used for medicine by the Eegun indigenous tribal group of Lagos State, Nigeria. Notulae Scientia Biologicae 10(3):318-327 doi: 1015835/nsb10310306.

Aghili-Khorassani MH. 2001. Makhzanoladvie. First ed, Bavardaran, Iran.

Ahangarpour A, Oroojan AA, Amirzargar A, Ghanavati M. 2011. Antispasmodic effects of *Citrus aurantium* flowers aqueous extract on uterus of non-pregnant rats. Iranian Journal of Reproductive Medicine 9(4):289.

Aissaoui AB, Bouayad N, Zantar S, El Amrani A. 2020. Study of the effect of *Citrus sinensis* and *Citrus aurantium* essential oils on *Tetranychus urticae* Koch (acari: tetranychidae). International Agricultural Biological Life Sciences Conference Edrine, Turkey 84-98.

Ajayi TO, Moody JO. 2015. Ethnobotanical survey of plants used in the Management of obesity in Ibadan, south-western. Nigerian Journal of Nigerian Pharmaceutical Research 11(1):22-31.

Akhlaghi M, Shabanian G, Rafieian-Kopaei M, Parvin N, Saadat M, Akhlaghi M. 2011. *Citrus aurantium* blossom and preoperative anxiety. Brazilian Journal of Anesthesiology. 61:707-712 doi: 101016/S0034-7094(11)70079-4.

Ali B, Al-Wabel NA, Shams S, Ahamad A, Khan SA, Anwar F. 2015. Essential oils used in aromatherapy: A systemic review Asian Pacific Journal of Tropical Biomedicine 5(8):601-611 doi: 101016/japjtb201505007.

Alissandrakis E, Daferera D, Tarantilis PA, Polissiou M, Harizanis PC. 2003. Ultrasound-assisted extraction of volatile compounds from *Citrus* flowers and *Citrus* honey. Food Chemistry. 82(4):575-582 doi: 101016/S0308-8146(03)00013-X.

Allison DB, Cutter G, Poehlman ET, Moore DR, Barnes S. 2005. Exactly which synephrine alkaloids does *Citrus aurantium* (bitter orange) contain? International Journal of Obesity 29(4):443-446 doi: 101038/sjijo0802879.

Amir HM, Grace OM, Wabuyele E, Manoko MLK. 2019. Ethnobotany of *Aloe* L (Asphodelaceae) in Tanzania. South African Journal of Botany 122:330-335 doi: 101016/jsajb201901038.

Amiri MS, Joharchi MR. 2013. Ethnobotanical investigation of traditional medicinal plants commercialized in the markets of Mashhad. Avicenna Journal of Medicine 3(3):254-271.

Ana CC, Jesús PV, Hugo EA, Teresa AT, Ulises GC, Neith P. 2018. Antioxidant capacity and UPLC–PDA ESI–MS polyphenolic profile of *Citrus aurantium* extracts obtained by ultrasound assisted extraction. Journal of Food Sciences and Technology 55:5106-5114 doi: 101007/s13197-018-3451-0.

Ani KAAA, Minnat TR, Jalyl OK. 2017. Phytochemical Analysis and Inhibitory Effect of *Citrus aurantium* L (Bitter Orange) Leaves on some Bacterial Isolates in vitro. Diyala Journal for Pure Science. 13(1-part 2).

Anwar S, Ahmed N, Speciale A, Cimino F, Saija A. 2016. Bitter orange (*Citrus aurantium* L.) oils, United Kingdom. In: Preedy VR. (ed). Essential oils in food preservation, Flavor and safety. Monash University, Australia, Academic Press, Pp. 259-268 doi: 101016/B978-0-12-416641-700029-8.

Arab Firouzjaei Z, Illali ES, Taraghi Z, Mohammadpour RA, Amin K, Habibi E. 2019. The effect of *Citrus aurantium* aroma on sleep quality in the elderly with heart failure. Journal of Babol University of Medical Sciences. 21(1): 181-187 doi: 1022088/jbums211181.

Arbo MD, Larentis ER, Linck VM, Aboy AL, Pimentel AL, Henriques AT, Dallegrave E, Garcia SC, Leal MB, Limberger RP. 2008. Concentrations of p-synephrine in fruits and leaves of *Citrus* species (Rutaceae) and the acute toxicity testing of *Citrus aurantium* extract and p-synephrine. Food and Chemical Toxicology. 46(8):2770-2775 doi: 101016/jfct200804037.

Arbo MD, Schmitt GC, Limberger MF, Charão MF, Moro ÂM, Ribeiro GL, Dallegrave E, Garcia SC, Leal MB, Limberger RP. 2009. Subchronic toxicity of *Citrus aurantium* L (Rutaceae) extract and p-synephrine in mice Regulatory. Toxicology and Pharmacolology 54(2):114-117 doi: 101016/jyrtph200903001.

Arias BA, Ramón-Laca L. 2005. Pharmacological properties of *Citrus* and their ancient and medieval uses in the Mediterranean region. Journal of Ethnopharmacology 97(1):89-95. doi: 101016/jjep200410019.

Aslan, MN, Sukan-Karaçağıl, B, Acar-Tek, N. 2023. Roles of *Citrus* fruits on energy expenditure, body weight management, and metabolic biomarkers: a comprehensive review. Nutrition Reviews, 13:nuad116 doi: 101093/nutrit/nuad116.

Aynechi Y. 1991. Pharmacognosy and medicinal plants. University Press Center, Tehran, Iran.

Ayoub A, Fatima K, Mohammed T. 2018. Chemical characterizations of the aromatic compositions of two citrus species: *citrus aurantium* and *Citrus reticulata*. Drug Design, Developmental and Theory 2(3):80-83 doi: 1015406/mojddt20180200032.

Azanchi T, Shafaroodi H, Asgarpanah J. 2014. Anticonvulsant activity of *Citrus aurantium* blossom essential oil (neroli): involvment of the GABAergic system. Natural Product Communications 9(11):1615-1618.

Azhdarzadeh F, Hojjati M. 2016. Chemical composition and antimicrobial activity of leaf, ripe and unripe peel of bitter orange (*Citrus aurantium*) essential oils. Nutrition and Food Sciences Research 3(1):43-50.

Bakhsha F, Yousefi Z, Aryaee M, Jafari SY, Derakhshanpoor F. 2016. Comparison effect of Lavender and *Citrus aurantium* aroma on anxiety in female students at Golestan University of Medical Sciences. Journal of Basic Research in Medicinal Sciences.

Bakhyia N, Dusemund B, Richter K, Lindtner O, Hirsch-Ernst K I, Schäfer B, Lampen A. 2017. Gesundheitliche Risiken von synephrin in Nahrungsergänzungsmitteln Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 3(60):323-331 doi: 101007/s00103-016-2506-5.

Baratta MT, Dorman HD, Deans SG, Figueiredo AC, Barroso JG, Ruberto G. 1998. Antimicrobial and antioxidant properties of some commercial essential oils. Flavour and Fragrance Journal 13(4):235-244.

Ben Hsouna A, Gargouri M, Dhifi W, Ben Saad R, Sayahi N, Mnif W, Saibi W. 2019. Antioxidant capacity and UPLC–PDA ESI– MS polyphenolic profile of *Citrus aurantium* extracts obtained by ultrasound assisted extraction. Environmental Toxicolology 34:388–400 doi: 101002/tox22693.

Bendaha H, Bouchal B, El Mounsi I, Salhi A, Berrabeh M, El Bellaoui M Mimouni M. 2016. Chemical composition, antioxidant, antibacterial and antifungal activities of peel essential oils of *Citrus aurantium* grown in Eastern Morocco. Der Pharmacia Lettre 8:239-245.

Benjamim CJR, Júnior FWDS, Porto AA, Rocha ÉMB, Santana MD, Garner DM, Valenti VE, Bueno Júnior CR. 2022. Bitter orange (*Citrus aurantium* L) intake before submaximal aerobic exercise is safe for cardiovascular and autonomic systems in healthy males: a randomized trial. Frontiers in Nutrition 9:890388 doi: 103389/fnut2022890388.

Bent S, Padula A, Neuhaus J. 2004. Safety and efficacy of *Citrus aurantium* for weight loss. American Journal of Cardiology 94(10):1359-1361 doi: 101016/jamjcard200407137.

Berhow M. 1998. Survey of phenolic compounds produced in citrus United States Department of Agriculture. Bulletin/ Agricultural Research Service Technology 1856:16-18.

Biglar M, Sufi H, Bagherzadeh K, Amanlou M, Mojab F. 2014. Screening of 20 commonly used Iranian traditional medicinal plants against urease. Iranian Journal of Pharmaceutical Research 13(Suppl): p195.

Biscotti N, Bonsanto D, Laghetti G. 2021. Ethnobotanical Study on Traditional Use of Local Fruit Varieties in Gargano National Park (Apulia, Italy). Genetic Resources and Crop Evolution 2:871-925 doi: 101007/s10722-021-01286-2.

Blumenthal M. 2004-2005. Bitter orange peel and synephrine Parts 1 & 2 American Botanical Council Accessed 27 December 2019 at http://abcherbalgramorg/site/DocServer/Bitter\_Orange\_Peel\_and\_Synephrinepdf?docID=221.

Bnina EB, Hajlaoui H, Chaieb I, Said MB, Jannet HB, Daami-Remadi M. 2019. Chemical composition, antimicrobial and insecticidal activities of the Tunisian *Citrus aurantium* essential oils. Czech Journal of Food Sciences 37(2):81-92. doi: 1017221/202/2017-CJFS.

Bonamin F, Moraes TM, Dos Santos RC, Kushima H, Faria FM, Silva MA, Junior IV, Nogueira L, Bauab TM, Brito ARS, da Rocha LR. 2014. The effect of a minor constituent of essential oil from *Citrus aurantium*: The role of β-myrcene in preventing peptic ulcer disease. Chemico-Biological Interactions 212:11-19. doi: 101016/jcbi201401009.

Bora H, Kamle M, Mahato DK, Tiwari P, Kumar P. 2020. *Citrus* essential oils (CEOs) and their applications in food: An overview. Plants 9(3):357. doi: 103390/plants9030357.

Boukhennoufa A, Benmaghnia S, Meddah B, Meddah ATT. 2020. Antioxidant activity of extracts formulated from *Citrus aurantium* and *Artemisia herba-alba*. European Journal of Biological Research 10(4):343-351. http://dxdoiorg/105281/zenodo4058836.

Boungab K, Makhlouf KE. 2022. Antifungal activity of *Citrus aurantium* L essential oil against crown rot of wheat caused by *Fusarium graminearum*. Pakistan Journal Phytopathology 34(2):201-211.

Bourgou S, Rahali FZ, Ourghemmi I, Saïdani Tounsi M. 2012. Changes of peel essential oil composition of four Tunisian *citrus* during fruit maturation. The Scientific World Journal 2012:1-10. doi: 101100/2012/528593.

Boussaada O, Chemli R. 2007. Seasonal variation of essential oil composition of *Citrus aurantium* L var *amara*. Journal of Essential Oil-Bearing Plants. 10(2):109-120. http://dxdoiorg/101080/0972060X200710643528.

Bui LT, Nguyen DT, Ambrose PJ. 2006. Blood pressure and heart rate effects following a single dose of bitter orange. Annals of Pharmacotherapy 40(1):53-57. doi: 101345/aph1g488.

Burnett CL, Fiume MM, Bergfeld WF, Belsito DV, Hill RA, Klaassen CD, Liebler DC, Marks Jr JG, Shank RC, Slaga TJ, Snyder PW. 2019. Safety assessment of *Citrus*-derived peel oils as used in cosmetics. International Journal of Toxicology 38(2\_suppl):33S-59S. doi: 101177/1091581819862504.

Caccioni DR, Guizzardi M, Biondi DM, Renda A, Ruberto G. 1998. Relationship between volatile components of *Citrus* fruit essential oils and antimicrobial action on *Penicillium digitatum* and *Penicillium italicum*. International Journal of Food Microbiology 43(1-2):73-79 doi: 101016/s0168-1605(98)00099-3.

Calabrese F. 1992. The history of *Citrus* in the Mediterranean countries and Europe. International Society of Citriculture. Proceedings International Society 1:35–38.

Calabrese F. 1998. La Favolosa Storia degli Agrumi. L'Epos Societa Editrice, Palermo.

Calapai G, Firenzuoli F, Saitta A, Squadrito F, Arlotta MR, Costantino G, Inferrera G. 1999. Antiobesity and cardiovascular toxic effects of *Citrus aurantium* extracts in the rat: a preliminary report. Fitoterapia 70(6):586-592.

Campbell JI, Mortensen A, Mølgaard P. 2006. Tissue lipid lowering-effect of a traditional Nigerian anti-diabetic infusion of *Rauwolfia vomitoria* foilage and *Citrus aurantium* fruit. Journal of Ethnopharmacology. 104(3): 379-386. doi: 101016/jjep200512029.

Carvalho-Freitas MIR, Costa M. 2002. Anxiolytic and sedative effects of extracts and essential oil from *Citrus aurantium* L. Biological Pharmaceutical Bulletin. 25(12):1629-1633. doi: 101248/bpb251629.

Cetin H, Erler F, Yanikoglu A. 2006. Toxicity of essential oils extracted from *Origanum onites* L and *Citrus aurentium* L. against the pine processionary moth, *Thaumetopoea wilkinsoni* Tams. Folia Biologica 54(3-4):153-157 doi: 103409/173491606778557473.

Chaudhari SY, Ruknuddin G, Prajapati P. 2016. Ethnomedicinal values of *Citrus* genus: A review. Medical Journal of Dr. D.Y. Patil University 9(5):560-565.

Cherukuri S, Chenandel JK, Chen TT, Crampton L. 2004. Chinese medical herbology and pharmacology. Art of Medicine Press, City of Industry, California.

Chooi OH. 1994. The ethnobotnay of *citrus* and their relatives. Korean Journal of Plant Taxonomy 24(3):157-171 doi: 1011110/kjpt1994243157.

Chouchi D, Barth D, Reverchon E, Della Porta E. 1996. Bigarade Peels Oil Fractionation by Supercritical Carbon dioxide Desorption. Journal of Agricultural and Food Chemistry 44(4):1100-1104.

Christian EO, Adebayo OA, Lauretta IE, 2022. The impact of *Citrus aurantium* fruit juice on Bodyweight and Haematological Parameters of Wistar rats. International Journal of Hematology 5(2):56-67.

Cirmi S, Maugeri A, Ferlazzo N, Gangemi S, Calapai G, Schumacher U, Navarra M. 2017. Anticancer potential of *Citrus* juices and their extracts: A systematic review of both preclinical and clinical studies. Frontiers in Pharmacology 8:420 doi: 103389/fphar201700420.

Colegate SM, Molyneux RJ. 2007. Bioactive natural products: detection, isolation, and structural determination, Boca Raton. In: Steven M, Colegate M, Russell J, Molyneux. (eds). London, New York, CRC press.

Colker CM, Kalman D, Torina GC, Perlis T, Street C. 1999. Effects of *Citrus aurantium* extract, caffeine, and St John's Wort on body fat, lipid levels, and mood states in overweight adults. Medicine & Science in Sports & Exercise 31(5):S118.

da Camara CA, Akhtar Y, Isman MB, Seffrin RC, Born FS. 2015. Repellent activity of essential oils from two species of *Citrus* against Tetranychus urticae in the laboratory and greenhouse. Crop Protection 74:110-115.

Dabsantai K, Mahidsanan T. 2023 Effect of *Citrus aurantium* juice as a disinfecting agent on quality and bacterial communities of striped catfish steaks stored at –20° C. Peer J 11:e15168 doi: 107717/peerj15168.

Dadashi M, Eslami G, Goudarzi H, Fallah F, Hashemi A, Dabiri H, Taheri S, Ardeshiri N. 2015. Antibacterial effects of *Citrus aurantium* on bacteria isolated from urinary tract infection. Research in Molecular Medecine 3(4): 47-50.

Daisy AS, Lakshmi RM, Praveena A. 2021. Insecticidal and plant growth promoting activity of *Citrus aurantium* peel. International Journal of Entomological Research 42-48.

Dandekar DV, Jayaprakasha GK, Patil BS. 2008. Hydrotropic extraction of bioactive limonin from sour orange (*Citrus aurantium* L) seeds. Food Chemistry 109(3):515-520 doi: 101016/jfoodchem200712071.

de Moraes Pultrini A, Galindo LA, Costa M. 2006. Effects of the essential oil from *Citrus aurantium* L. in experimental anxiety models in mice. Life Sciences 78(15):1720-1725 doi: 101016/jlfs200508004.

de Oliveira DF, Martins JA, Oliveira CR. 2022. Pharmacological aspects of *Citrus aurantium* (Rutaceae) in anxiety disorders. Brazilian Journal of Natural Sciences 4(3):E1532022-8 doi: 1031415/bjnsv4i3153.

Değirmenci H, Erkurt H. 2020. Relationship between volatile components, antimicrobial and antioxidant properties of the essential oil, hydrosol and extracts of *Citrus aurantium* L. flowers. Journal of Infection and Public Health. 13(1):58-67 doi: 101016/jjiph201906017.

Deyhim F, Lopez E, Gonzalez J, Garcia M, Patil BS. 2006. *Citrus* juice modulates antioxidant enzymes and lipid profiles in orchidectomized rats. Journal of Medicinal Food 9(3):422-426 doi: 101089/jmf20069422.

Di Napoli M, Castagliuolo G, Badalamenti N, Maresca V, Basile A, Bruno M, Varcamonti M, Zanfardino A. 2023. *Citrus aurantium* 'Crispifolia' Essential Oil: A Promise for Nutraceutical Applications. NutraC – Health & Nutrition Store 3(1):153-164. doi: 103390/nutraceuticals3010011.

Dias TMC, Monteiro VS, Souza AJ, Pena RS, Caneschi C. 2019. Ethnobotanical Study of medicinal plants used by the Santana do Campestre District Community–Minas Gerais–Brazil. Brazilian Journal of Health and Pharmacy 1(4):19-31 doi: 101590/1519-6984216848.

Djalalinia S, Qorbani M, Peykari N, Kelishadi R. 2015. Health impacts of obesity. Pakistan Journal of Medical Sciencec 31(1):239-242. doi: 1012669/pjms3117033.

Djenane D. 2015. Chemical profile, antibacterial and antioxidant activity of Algerian *Citrus* essential oils and their application in *Sardina pilchardus*. Foods 4(2):208-228. doi: 103390/foods4020208.

Doron S, Gorbach SL. 2008. Bacterial infections: overview. International Encyclopedia of Public Health 273-282. https://101016/B978-012373960-500596-7.

Dosoky NS, Setzer WN. 2018. Biological activities and safety of *Citrus* spp essential oils. International Journal of Molecular Sciences 19(7):1-25. doi: 103390/ijms19071966.

Duarte A, Fernandes MJ, Bernardes JP, Miguel MG. 2016. *Citrus* as a component of the Mediterranean diet. Journal of Spatial and Organizational Dynamics 4(IV):289-304.

Dugo G, Bonaccorsi I, Sciarrone D, Costa R, Dugo P, Mondello L, Santi L, Fakhry HA. 2011. Characterization of oils from the fruits, leaves and flowers of the bitter orange tree. Journal of Essential Oil Research 23(2):45-59. doi: 101080/1041290520119700446.

Dugo G, Mondello L. eds, 2010. *Citrus* oils: composition, advanced analytical techniques, contaminants, and biological activity, Boca Raton. In: Dugo G, Mondello L. (eds). London, New York, CRC press.

El Kasimi R, Douiri F, Haddi K, Boughdad A. 2023. Bioactivity of Essential Oil from *Citrus aurantium* Peel against the Pulse Beetle *Callosbruchus maculatus* F. on Chickpea. Agriculture 13(2):232. doi: 103390/agriculture13020232.

El-Akhal F, Lalami AEO, Guemmouh R. 2015. Larvicidal activity of essential oils of Citrus sinensis and *Citrus aurantium* (Rutaceae) cultivated in Morocco against the malaria vector Anopheles labranchiae (Diptera: Culicidae). Asian Pacific Journal of Tropical Disease. 5(6):458-462. doi: 101016/S2222-1808(15)60815-5.

Ellouze I, Abderrabba M, Sabaou N, Mathieu F, Lebrihi A, Bouajila J. 201.2 Season's variation impact on *Citrus aurantium* leaves essential oil: chemical composition and biological activities. Journal of Food Sciences 77(9):T173-T180. doi: 101111/j1750-3841201202846x.

Elyasi L, Ghazvini H. 2020. The protective effects of *Citrus aurantium* extract on a 6-hydroxydopamine-induced model of Parkinson's disease in male rats. Anatomical Sciences Journal 17(1):1-6.

Facciola S. 1998. Cornocupia II: A Source Book of Edible Plants. second ed, Vista, CA Kampong publications, United States, The University of Michigan.

Fahim M, Shrivastava B, Shrivastava AK, Ibrahim M, Parveen R, Ahmad S. 2017. Review on extraction methods, antioxidant and antimicrobial properties of volatile oils. Annals of Phytomedicine 6(2):5-46. doi: 1021276/ap201872.

Falcinelli B, Famiani F, Paoletti A, D'Egidio S, Stagnari F, Galieni A, Benincasa P 2020 Phenolic compounds and antioxidant activity of sprouts from seeds of *Citrus* species. Agriculture 10(2):33. doi: 103390/agriculture10020033.

Farahmandfar R, Tirgarian B, Dehghan B, Nemati A, 2020 Comparison of different drying methods on bitter orange (*Citrus aurantium* L) peel waste: Changes in physical (density and color) and essential oil (yield, composition, antioxidant and antibacterial) properties of powders. Journal of Food Measurement and Characterization. 14:862-875. doi: 101007/s11694-019-00334-x.

Fathi H, Paknejad S Ahanjan M 2017 Evaluating antimicrobial effects of different orange blossom extract (*Citrus aurantium* L) on microbial species in vitro Health. Biotechnology Biopharma 1:25-36.

Fongang H, Mbaveng AT, Kuete V. 2023. Global burden of bacterial infections and drug resistance. Advances in Botanical Research 106:1-20. doi: 101016/bsabr202208001.

Frassinetti S, Caltavuturo L, Cini M, Della Croce CM, Maserti BE. 2011. Antibacterial and antioxidant activity of essential oils from *Citrus* spp. Journal of Essential Oil Research 23(1):27-31. doi: 101080/1041290520119700427.

Fugh-Berman A, Myers A. 2004. *Citrus aurantium*, an ingredient of dietary supplements marketed for weight loss: current status of clinical and basic research. Experimental Biology and Medicine. 229(8):698-704. doi: 101177/153537020422900802.

Gaff M, Esteban-Decloux M, Giampaoli P. 2020. Bitter orange peel essential oil: a review of the different factors and chemical reactions influencing its composition. Flavour and Fragrance Journal 35(3):247-269. doi: 101002/ffj3570.

Gao L, Gou N, Amakye WK, Wu J, Ren J. 2022. Bioactivity guided isolation and identification of phenolic compounds from *Citrus aurantium* L with anti-colorectal cancer cells activity by UHPLC-Q-TOF/MS. Current Research in Food Sciences 5:2251-2260. doi: 101016/jcrfs202211013.

Gautam S, Adhikari BS. 2023. Ethnobotanical documentation of Harike Wildlife Sanctuary (Ramsar Site), Punjab: A case study. Ethnobotany Research and Applications 25:1-25.

Ghanem N, Mihoubi D, Kechaou N, Mihoubi NB. 2012. Microwave dehydration of three *Citrus* peel cultivars: Effect on water and oil retention capacities, color, shrinkage and total phenols content. Industrial Crops and Products 40:167-177. doi: 101016/jindcrop201203009.

Ghods AA, Sotodeh-Asl N, Zia H, Ghorbani R, Soleimani M, Vaismoradi M. 2022. December Effect of *Citrus aurantium* Aroma on the Happiness of Pre-Hospital Emergency Staff: A Randomized Controlled Trial. Journal of Healthcare Engineering. 10(12):2475 MDPI. doi: 103390/healthcare10122475.

Gholivand MB, Piryaei M, Abolghasemi MM. 2013. Analysis of volatile oil composition of *Citrus aurantium* L by microwaveassisted extraction coupled to headspace solid-phase microextraction with nanoporous based fibers. Journal of Separation Science 36(5):872-877. doi: 101002/jssc201200674.

Gniewosz M, Kraśniewska K, Kosakowska O, Pobiega K, Wolska I. 2017. Chemical compounds and antimicrobial activity of petitgrain (*Citrus aurantium* L var *amara*) essential oil. Herba Polonica 63(4):18-25. doi: 101515/hepo-2017-0021.

González-Mas MC, Rambla JL, López-Gresa MP, Blázquez MA, Granell A. 2019. Volatile compounds in *Citrus* essential oils: A comprehensive review. Frontiers in Plant Science 10:12. doi: 103389/fpls201900012.

Gopal PV. 2012. Evaluation of Anti-Microbial Activity of *Citrus aurantium* Against Some Gram Positive and Negative Bacterial Strains. Pharmacia 1(3):107-109.

Gougeon R, Harrigan K, Tremblay JF, Hedrei P, Lamarche M, Morais JA. 2005. Increase in the thermic effect of food in women by adrenergic amines extracted from *Citrus aurantium*. Obesity research 13(7):1187-1194. doi: 101038/oby2005141.

Grandi TSM. 2014. Tratado das plantas medicinais [recurso eletrônico]: Mineiras, Nativas e Cultivadas First ed, Dados eletrônicos Belo Horizonte, Adaequatio Estúdio pp 1204.

Groppo M, Afonso L F, Pirani JR. 2022. A review of systematics studies in the *Citrus* family (Rutaceae, Sapindales), with emphasis on American groups Brazilian Journal of Botany 45(1):181-200. doi: 101007/s40415-021-00784-y.

Guerra S, Guerra M, Mendes S, Soares Filho WDS, Pedrosa-Harand A. 2020. Karyotype variability of sour orange (*Citrus aurantium* L) and the origin of its heteromorphic karyotypes Tree. Genetics Genomes 16(6):78. doi: 101007/s11295-020-01471-x.

Gurley BJ, Gardner SF, Hubbard MA, Williams DK, Gentry WB, Carrier J, Khan IA, Edwards DJ, Shah A. 2004. In vivo assessment of botanical supplementation on human cytochrome P450 phenotypes: *Citrus aurantium, Echinacea purpurea,* milk thistle, and saw palmetto. Clinical Pharmacolology & Therapeutics 76(5):428-440. doi: 101016/jclpt200407007.

Haaz S, Fontaine KR, Cutter G, Limdi N, Perumean-Chaney S, Allison DB. 2006. *Citrus aurantium* and synephrine alkaloids in the treatment of overweight and obesity: an update. Obesity Reviews 7(1):79-88. doi: 101111/j1467-789X200600195x.

Habibi B, Eteref Oskouie T, Vaez H, Delazar A, Amani P. 2022. Effect of Hydroethanolic Extract of *Citrus aurantium* Leaves and Magnesium Sulfate in Mice Model of Vincristine-Induced Neuropathy. Iranian Journal of Pharmaceutical Sciences 18(1):9-17.

Habibi Bibalani G, Mosazadeh-Sayadmahaleh F. 2011. Recognition and consumption use and medicinal properties of sour orange (*Citrus aurantium*) by rural people in East part of Gilan Province (North Iran). Journal of Medicinal Plants Research 5(7):1238-1243. doi: 105897/JMPR9001076.

Haggag EG, Mahmoud II, Abou-Moustafa EA, Mabry TJ. 1999. Flavonoids from the leaves of *Citrus aurantium* (sour orange) and *Citrus sinensis* (sweet orange) Asian Journal of Chemistry 11:707-714.

Haj Ammar A, Bouajila J, Lebrihi A, Mathieu F, Romdhane M, Zagrouba F. 2012. Chemical composition and in vitro antimicrobial and antioxidant activities of *Citrus aurantium* L flowers essential oil (Neroli oil). Pakistan Journal of Biological Sciences 15(21):1034-1040. doi: 103923/pjbs201210341040.

Haji-Sharifi A. 2003. Asrare giahan darouie. 17th ed, Hafez Novin, Tehran, Iran. 1080 pp.

Haji-Sharifi A. 2017. Dayeratolmaaref giah darmani Iran. 17<sup>th</sup> ed, Hafez Novin, Tehran, Iran. 1080 pp Hakima OM, Sabrina AK, Nassima BB. 2016. Phytochemical Study and Evaluation of Antimicrobial, Antioxidant and Insecticidal Activity of Essential Oils and Polyphenols of Bitter Orange (*Citrus aurantium* L). Journal of Advances in Chemical engineering 3:163-167.

Haller CA, Duan M, Jacob III P, Benowitz N. 2008. Human pharmacology of a performance-enhancing dietary supplement under resting and exercise conditions. British Journal of Clinical Pharmacology 65(6):833-840. doi: 101111/j1365-2125200803144x.

Hamdan DI, Mahmoud MF, Wink M El-Shazly AM. 2014. Effect of hesperidin and neohesperidin from bittersweet orange (*Citrus aurantium* var *bigaradia*) peel on indomethacin-induced peptic ulcers in rats. Environmental Toxicology and Pharmacology 37(3):907-915 doi: 101016/jetap201403006.

Hamedi A, Jamshidzadeh A, Dana M, Pasdaran A, Heidari R. 2020. Investigation of the effect of essential oil from *Citrus aurantium* L flowers on liver health parameters in a laboratory animal model. Feyz Medical Sciences Journal 24(1):38-47.

Hamedi A, Zarshenas MM, Jamshidzadeh A, Ahmadi S, Heidari R, Pasdaran A. 2019. *Citrus aurantium* (bitter orange) seeds oil: pharmacognostic, anti-inflammatory and anti-nociceptive properties. Trends in Pharmacological Sciences 5(3):153-164. doi: 1030476/tips2019829961020.

Hansen, DK George NI, White GE, Pellicore LS, Abdel-Rahman A, Fabricant D, Food and Drug Administration, 2012. Physiological effects following administration of *Citrus aurantium* for 28 days in rats. Toxicology and Applied Pharmacology 261(3):236-247. doi: 101016/jtaap201204006.

Hao K, Hu W, Hou M, Cao D, Wang Y, Guan Q, Zhang X, Wang A, Yu J, Guo B. 2019. Optimization of ultrasonic-assisted extraction of total phenolics from *Citrus aurantium* L blossoms and evaluation of free radical scavenging, anti-HMG-CoA reductase activities. Molecules 24(13):2368. doi: 103390/molecules24132368.

Haraoui N, Allem R, Chaouche TM, Belouazni A 2020. In-vitro antioxidant and antimicrobial activities of some varieties *Citrus* grown in Algeria. Advances in Traditional Medicine 20(1):23-34. doi: 101007/s13596-019-00379-9.

Harapu CD, Miron A, Cuciureanu M, Cuciureanu R. 2010. Flavonoids--bioactive compounds in fruits juice. Revista Medico-Chirurgicala a Societatii de Medici Si Naturalisti Iasi 114(4):1209-1214.

Hashemi SMB, Amininezhad R, Shirzadinezhad E, Farahani M, Yousefabad SHA. 2016. The Antimicrobial and Antioxidant Effects of *Citrus aurantium* L Flowers (B ahar N arang) Extract in Traditional Yoghurt Stew during Refrigerated Storage. Journal of Food Safety 36(2):153-161. doi: 101111/jfs12222.

Hassanzadeh ZA. 2009. Farhang Darouhaye Giahei. Eighth ed, Golpa, Tehran, Iran.

Hoffman JR, Kang J, Ratamess NA, Jennings PF, Mangine G, Faigenbaum AD. 2006. Thermogenic effect from nutritionally enriched coffee consumption. Journal of the International Society Sports Nutrition 3(1):35. doi: 101186/1550-2783-3-1-35.

Holdsworth DK. 1990. Traditional medicinal plants of Rarotonga, Cook Islands part I. International Journal of Crude Drug Research 28(3): 209-218. doi: 103109/13880209009082815.

Hosni K, Zahed N, Chrif R, Abid I, Medfei W, Kallel M, Brahim NB, Sebei H. 2010. Composition of peel essential oils from four selected Tunisian *Citrus* species: Evidence for the genotypic influence. Food Chemistry 123(4):1098-1104. doi: 101016/jfoodchem201005068.

Hosseini SH, Bibak H, Ghara AR, Sahebkar A, Shakeri A. 2021. Ethnobotany of the medicinal plants used by the ethnic communities of Kerman province, Southeast Iran. Journal of Ethnobiology and Ethnomedicine 17(1):1-35. doi: 101186/s13002-021-00438-z\_

Hosseini SS, Khodaiyan F, Kazemi M, Najari Z. 2019. Optimization and characterization of pectin extracted from sour orange peel by ultrasound assisted method. International Journal of Biological Macromolecules 125:621-629. doi: 101016/jijbiomac201812096.

Hosseini SS, Khodaiyan F, Yarmand MS. 2016. Optimization of microwave assisted extraction of pectin from sour orange peel and its physicochemical properties. Carbohydrate Polymerers 140:59-65. doi: 101016/jcarbpol201512051.

Hsouna AB, Hamdi N, Halima NB, Abdelkafi S. 2013. Characterization of essential oil from *Citrus aurantium* L. flowers: antimicrobial and antioxidant activities. Journal of Oleo Science 62(10):763-772. doi: 105650/jos62763.

Ines E, Hajer D, Rachid C. 2014. Aromatic quality of Tunisian sour orange essential oils: Comparison between traditional and industrial extraction. Natural Volatiles & Essential Oils 1(1):66-72.

Ishaq AN, Sani D, Abdullhi SA, Jatau ID. 2022. In vitro anticoccidial activity of ethanolic leaf extract of *Citrus aurantium* L against *Eimeria tenella* oocysts. Sokoto Journal of Veterinary Sciences 20(5):37-43. doi: 101016/jprmcm2022100138.

Izquierdo L Sendra JM. 2003. *Citrus* fruits/ composition and characterization. Encyclopedia of Food Science 1335-1341. doi: 101016/B0-12-227055-X/00241-8.

Jabri Karoui I, Marzouk B. 2013. Characterization of bioactive compounds in Tunisian bitter orange (*Citrus aurantium* L.) peel and juice and determination of their antioxidant activities. BioMed Research International 345415. doi: 101155/2013/345415.

Jain SK Tarafder CR. 1970. Medicinal plant-lore of the santals (A revival of PO Bodding's work). Economic Botany 24:241-278.

Jazayeri SB, Amanlou A, Ghanadian N, Pasalar P, Amanlou M. 2014. A preliminary investigation of anticholinesterase activity of some Iranian medicinal plants commonly used in traditional medicine. Daru Journal of Pharmaceutical Sciences 22:1-5. doi: 101186/2008-2231-22-17.

Jeannot V, Chahboun J, Russell D, Baret P. 2005. Quantification and determination of chemical composition of the essential oil extracted from natural orange blossom water (*Citrus aurantium* L. ssp *aurantium*). International Journal of Aromatherapy 15(2):94-97. doi: 101016/jijat200503012.

Jerković I, Družić J, Marijanović Z, Gugić M, Jokić S, Roje M. 2015. GC-FID/MS profiling of supercritical CO2 extracts of peels from *Citrus aurantium*, *C sinensis* cv Washington navel, *C sinensis* cv Tarocco and *C sinensis* cv Doppio Sanguigno from Dubrovnik Area (Croatia). Natural Product Communications 10(7):1934578X1501000745. doi: 101177/1934578X1501000745.

Jia S, Hu Y, Zhang W, Zhao X, Chen Y, Sun C, Li X, Chen K. 2015. Hypoglycemic and hypolipidemic effects of neohesperidin derived from *Citrus aurantium* L in diabetic KK-A y mice. Food and Function Journal 6(3):878-886. doi: 101039/c4fo00993b.

Jones D, Zhishin LLC. 2001. The regulation of appetite, body weight and athletic function with materials derived from *Citrus* varieties. United States Patent and Trademark Office 224:873. https://wwwfreepatentsonlinecom/6224873html.

Kaats GR, Miller H, Preuss HG, Stohs SJ. 2013. A 60-day double-blind, placebo-controlled safety study involving *Citrus aurantium* (bitter orange) extract. Food and Chemical Toxicology 55:358-362. doi: 101016/jfct201301013.

Kang SR, Park KI, Park HS, Lee DH, Kim JA, Nagappan A, Kim EH, Lee WS, Shin SC, Park MK, Han DY. 2011. Anti-inflammatory effect of flavonoids isolated from Korea *Citrus aurantium* L. on lipopolysaccharide-induced mouse macrophage RAW 2647 cells by blocking of nuclear factor-kappa B (NF-kB) and mitogen-activated protein kinase (MAPK) signalling pathways. Food Chemistry 129(4):1721-1728. http://dxdoiorg/101016/jfoodchem201106039.

Karabıyıklı Ş, Değirmenci H, Karapınar M. 2014. Inhibitory effect of sour orange (*Citrus aurantium*) juice on *Salmonella Typhimurium* and *Listeria monocytogenes* LWT-Food. SciTechnol 55(2):421-425. doi: 101016/jlwt201310037.

Karimi E, Oskoueian E, Hendra R, Oskoueian A, Jaafar HZ. 2012. Phenolic compounds characterization and biological activities of *Citrus aurantium* bloom. Molecules 17(2):1203-1218. http://dxdoiorg/103390/molecules17021203.

Karimzadeh Z, Azizzadeh Forouzi M, Rahiminezhad E, Ahmadinejad M, Dehghan M. 2021. The effects of lavender and citrus aurantium on anxiety and agitation of the conscious patients in intensive care units: A parallel randomized placebocontrolled trial. BioMed Research International 2021:1-8. doi: 101155/2021/5565956.

Karthikeyan V, Karthikeyan J. 2014. *Citrus aurantium* (bitter orange): A review of its traditional uses, phytochemistry and pharmacology. International Journal of Drug Discovery and Herbal Research 4(4):766-772.

Kassim DM, Hameed MS. 1989. Direct Extraction-Separation of Essential Oils from *Citrus* Peels by Supercritical Carbon Dioxide. Separation Science and Technology 24:427–1435.

Keshtkar S, Komeili G, Keshavarzi F, Jahantigh M. 2017. Cardio protective effects of hydroalcholic *Citrus aurantium* extract on myocardial infarction induced by isoproterenol in male rats. Journal of Cardiology & Current Research 10(2):00359. doi: 1015406/jccr20171000359.

Khakpour S, Khosravi M, Mashayekhipour Z, Jahromy MH. 2014. Effect of *Citrus aurantium* L essential oil and haloperidol on anxiety in male mice. World Journal of Neuroscience 4(05):427. doi: 104236/wjns201445047.

Khalid SA, Farouk A, Geary TG, Jensen JB. 1986. Potential antimalarial candidates from African plants: an in vitro approach using *Plasmodium falciparum*. Journal of Ethnopharmacology 15(2):201-209. doi: 101016/0378-8741(86)90156-x.

Khettal B, Kadri N, Tighilet K, Adjebli A, Dahmoune F, Maiza-Benabdeslam F. 2017. Phenolic compounds from *Citrus* leaves: Antioxidant activity and enzymatic browning inhibition. Journal of Integrative and Complementary Medicine 14(1): 20160030. doi: 101515/jcim-2016-0030.

Khodabakhsh P, Shafaroodi H Asgarpanah J. 2015. Analgesic and anti-inflammatory activities of *Citrus aurantium* L blossoms essential oil (neroli): involvement of the nitric oxide/cyclic-guanosine monophosphate pathway. Journal of Natural Medicines 69:324-331. doi: 101007/s11418-015-0896-6.

Khosravi M, Khakpour S, Adibi L, Jahromy MH. 2014. A study of the effect of *Citrus aurantium* L essential oil on anxiety and its interaction with GABAergic pathways in male mice. Journal of Behavioral and Brain Science 4(10):470. http://dxdoiorg/104236/jbbs2014410046.

Kim JA, Park HS, Kang SR, Park KI, Lee DH, Nagappan A, Shin SC, Lee WS, Kim EH, Kim GS. 2012. Suppressive effect of flavonoids from Korean *Citrus aurantium* L. on the expression of inflammatory mediators in L6 skeletal muscle cells. Phytotherapy Research 26(12):1904-1912. doi: 101002/ptr4666.

Kim JA, Park HS, Park KI, Hong GE, Nagappan A, Zhang J, Han DY, Shin SC, Won CG, Kim EH, Kim GS. 2013. Proteome analysis of the anti-inflammatory response of flavonoids isolated from Korean *Citrus aurantium* L. In lipopolysaccharide-induced L6 rat skeletal muscle cells. The American Journal of Chinese Medicine 41(04):901-912.

Kirbaslar G, Kirbaslar SI. 2004. Composition of Turkish bitter orange and lemon leaf oils. Journal of Essential Oil Research 16(2):105-108. doi: 101080/1041290520049698663.

Klontz KC, Timbo BB, Street D. 2006. Consumption of dietary supplements containing *Citrus aurantium* (bitter orange)—2004 California behavioral risk factor surveillance survey (BRFSS). Annals of Pharmacotherapy 40(10):1747-1751. doi: 101345/aph1H196.

Koncz D, Tóth B, Bahar MA, Roza O, Csupor D. 2022. The safety and efficacy of *Citrus aurantium* (bitter Orange) extracts and p-Synephrine: a systematic review and meta-analysis. Nutrients 14(19):4019. doi: 103390/nu14194019.

Kouzis A C, Eaton WW. 1994. Emotional disability days: prevalence and predictors. American Journal of Public Health 84:1304-1307. doi: 102105/AJPH8481304.

Kuchekar DM, Upadhye M, Chawan S. 2017. Spectrophotometric Quantification of Flavonoid Content in Herbal Drugs Extracts and Optimization of Microwave Assisted Extraction Technique by Using Different Solvents. World Journal of Pharmaceutical Research 6:562-569. doi: 104103/0973-1296149721.

Kurian JC. 2010. Healing Wonders of Plants, illustrated, Zambia Adventist Press, Zambia.

Kusuma HS, Putra AFP, Mahfud M. 2016. Comparison of two isolation methods for essential oils from orange peel (*Citrus auranticum* L) as a growth promoter for fish: Microwave steam distillation and conventional steam distillation. Journal of Aquaculture Research & Development 7:409. doi: 104172/2155-95461000409.

Labadie C, Ginies C, Guinebretiere MH, Renard CM, Cerutti C, Carlin F. 2015. Hydrosols of orange blossom (*Citrus aurantium*), and rose flower (*Rosa damascena* and *Rosa centifolia*) support the growth of a heterogeneous spoilage microbiota. Food Research International 76:576-586. doi: 101016/jfoodres201507014.

Lagha-Benamrouche S, Madani K. 2013. Phenolic contents and antioxidant activity of orange varieties (*Citrus sinensis* L and *Citrus aurantium* L.) cultivated in Algeria: Peels and leaves. Industrial Crops and Products 50:723-730. doi: 101016/jindcrop201307048.

Langgut D. 2017. The *Citrus* route revealed: from Southeast Asia into the Mediterranean. HortScience 52(6):814-822. doi: 1021273/HORTSCI11023-16.

Lee DH, Park KI, Park HS, Kang SR, Nagappan A, Kim JA, Kim EH, Lee WS, Hah YS, Chung HJ, An SJ. 2012. Flavonoids isolated from Korea *Citrus aurantium* L. induce G2/M phase arrest and apoptosis in human gastric cancer AGS cells. Evidence-Based Complementary and Alternative and Medicine 2012:1-11. doi: 101155/2012/515901.

Leite MP, Fassin JrJ, Baziloni EM, Almeida RN, Mattei R, Leite JR. 2008. Behavioral effects of essential oil of *Citrus aurantium* L. inhalation in rats. Revista Brasileira de Farmacognosia 18:661-666. doi: 101590/S0102-695X2008000500003.

Lim SW, Lee DR, Choi BK, Kim HS, Yang SH, Suh JW Kim KS. 2016. Protective effects of a polymethoxy flavonoids-rich *Citrus aurantium* peel extract on liver fibrosis induced by bile duct ligation in mice. Asian Pacific Journal of Tropical Medicine 9(12):1158-1164. doi: 101016/japjtm201610009.

Lin Y, Xu J, Zhang Y. 2022. Identification method of *Citrus aurantium* diseases and pests based on deep convolutional neural network. Computational Intelligence Neuroscience 2022:1-8. doi: 101155/2022/7012399.

Liu S, Zhang B, Lei Q, Zhou J, Ali M, Long C. 2023. Diversity and traditional knowledge of medicinal plants used by Shui people in Southwest China. Journal of Ethnobiology and Ethnomedicine 19(1):1-53. doi: 101186/s13002-023-00594-4.

Luo J, Yuan H, Mao L, Wu J, Jiang S, Yang Y, Fu Y, Liu L, Chen S, Wang W. 2023. The young fruit of *Citrus aurantium* L or *Citrus sinensis* Osbeck as a natural health food: A deep insight into the scientific evidence of its health benefits. Arabian Journal of Chemistry 104681. doi: 101016/jarabjc2023104681.

Lyoussi B, Bakour M, Cherkaoui-Tangi K, El-Hilaly J, Hano C. 2023. Ethnobotanical Survey and Pharmacological Screening of Medicinal Plants Used as Antihypertensive in Sefrou Province (Middle-North of Morocco): Benefits and Challenges. Frontiers in Bioscience-Scholar 15(1):4-14. doi: 1031083/jfbs1501004.

Madhuri S, Hegde AU, Srilakshmi NS, Prashith Kekuda TR. 2014. Antimicrobial activity of *Citrus sinensis* and *Citrus aurantium* peel extracts J Pharm Sci Innov 3(4):366-368. doi: 107897/2277-4572034174.

Maksoud S, Abdel-Massih RM, Rajha HN, Louka N, Chemat F, Barba FJ, Debs E. 2021. *Citrus aurantium* L active constituents, biological effects and extraction methods an updated review. Molecules 26(19):5832. doi: 103390/molecules26195832.

Mannucci C, Calapai F, Cardia L, Inferrera G, D'Arena G, Di Pietro M, Navarra M, Gangemi S, Spagnolo EV, Calapai G. 2018. Clinical Pharmacology of *Citrus aurantium* and *Citrus sinensis* for the Treatment of Anxiety Evidence-based complementary and alternative medicine: eCAM, 2018:3624094. doi: 101155/2018/3624094.

Mansouri E, Khaki A. 2014. The effect of *Citrus aurantium* on uterus apoptosis and serum antioxidants in rats exposed to electromagnetic fields. Crescent Journal of Medicine and Biological Sciences. 1(4):143-146.

Manthey JA, Guthrie N, Grohmann K. 2001. Biological properties of citrus flavonoids pertaining to cancer and inflammation. Current Medicinal Chemistry 8(2):135-153. doi: 102174/0929867013373723.

Manzoor M, Ahmad M, Zafar M, Gillani SW, Shaheen H, Pieroni A, Al-Ghamdi AA, Elshikh MS, Saqib S, Makhkamov T, Khaydarov K. 2023. The local medicinal plant knowledge in Kashmir Western Himalaya: a way to foster ecological transition via community-centred health seeking strategies. Journal of Ethnobiology and Ethnomedicine 19(1):56. doi: 101186/s13002-023-00631-2.

Maria AG, Graziano R, Nicolantonio DO. 2015. Carotenoids: potential allies of cardiovascular health? Food and Nutrition Research 59(1):26762. doi: 103402/fnrv5926762.

Meena VK. 2015. Ethnobotany of the Pratapgarh tehsil of Rajasthan. PhD dissertation, University of Kota, Rajasthan, India. Pp 1-181.

Michaelakis A, Papachristos D, Kimbaris A, Koliopoulos G, Giatropoulos A, Polissiou MG. 2009. *Citrus* essential oils and four enantiomeric pinenes against *Culex pipiens* (Diptera: *Culicidae*). Parasitology Research 105:769-773 doi: 101007/s00436-009-1452-7.

Mlcek J, Rop O. 2011. Fresh edible flowers of ornamental plants–A new source of nutraceutical foods. Trends in Food Science & Technology 22(10):561-569 doi: 101016/jtifs201104006.

Mohadjerani M, Aghaei A. 2016. The Effect of *Citrus aurantium, Foeniculum vulgare* and *Rosmarinus officinalis* Essential Oils on Peroxidase Activity. Medicine Laboratory Journal 10(1):17-23.

Mohagheghniapour A, Saharkhiz MJ, Golmakani MT, Niakousari M. 2018. Variations in chemical compositions of essential oil from sour orange (*Citrus aurantium* L) blossoms by different isolation methods. Sustainable Chemistry and Pharmacy 10:118-124. doi: 101016/jscp201810008.

Mohammadi F, Moradi M, Niazi A, Jamali J. 2022. The Impact of Aromatherapy with *Citrus aurantium* Essential Oil on Sleep Quality in Pregnant Women with Sleep Disorders: A Randomized Controlled Clinical Trial. International Journal of Community Based Nursing & Midwifery 10(3):160.

Mohammed BB, Najim SY, Shatti ZO, Jasim EI, Dari WA. 2017. Comparative study of Antibacterial activity between the *Citrus limon* (Lemon) & *Citrus aurantium* (Bitter Orange) Extracts on *Pseudomonas aeruginosa*. Mintage Journal of Pharmaceutical and Medical Sciences 20-23.

Moraes TM, Kushima H, Moleiro FC, Santos RC, Rocha LRM, Marques MO, Vilegas W, Hiruma-Lima CA. 2009. Effects of limonene and essential oil from *Citrus aurantium* on gastric mucosa: role of prostaglandins and gastric mucus secretion. Chemico-Biological Interactions 180(3):499-505. doi: 101016/jcbi200904006.

Moulehi I, Bourgou S, Ourghemmi I, Tounsi MS. 2012. Variety and ripening impact on phenolic composition and antioxidant activity of mandarin (*Citrus reticulate* Blanco) and bitter orange (*Citrus aurantium* L) seeds extracts. Industrial Crops and Products 39:74-80. doi: 101016/jindcrop201202013.

Mowobi GG, Abubakar S, Osuji C, Etim VN, Ogechi N, Egya JJ. 2016. Ethnobotanical survey of medicinal plants used for the treatment of skin disease in Keffi, Nigeria. American Journal of Phytomedicine and Clinical Therapeutics 4(2):073-090.

Mpofu D, Miruka CO. 2009. Indigenous Knowledge Management Transfer Systems across generations in Zimbabwe: IKS in other contexts. Indilinga: African Journal Indigenous Knowledge Systems 8(1):85-94.

Nabavi SF, Nabavi SM, Ebrahimzadeh MA. 2016. Antioxidant activity of hydro-alcoholic extracts of 4 *citrus* species flower. Progress in Nutrition 18(1):74-80.

Nagappan A, Park HS, Hong GE, Yumnam S, Lee HJ, Kim DH, Kim EH. 2014. Anti-cancer and anti-inflammatory properties of Korean citrus fruits (*Citrus aurantium* L.). Journal of Korean Clinical Health Science 2(1):73-78.

Nalini AS, Chimmad BV. 2003. Morphological and nutritional characteristics of selected *Citrus* fruits of Uttara Kannada District Karnataka. The Journal of Agricultural Science 16(4):533-538.

Namazi M, Akbari SAA, Mojab F, Talebi A, Majd HA, Jannesari S. 2014. Effects of *Citrus aurantium* (bitter orange) on the severity of first-stage labor pain. Iranian Journal of Pharmaceutical Research 13(3):1011.

Nelson BC, Putzbach K, Sharpless KE, Sander LC. 2007. Mass spectrometric determination of the predominant adrenergic protoalkaloids in bitter orange (*Citrus aurantium*). Journal of Agricultural and Food Chemistry 55(24):9769-9775. doi: 101021/jf072030s.

Nicolosi E, Deng ZN, Gentile A, La Malfa S, Continella G, Tribulato E. 2000. *Citrus* phylogeny and genetic origin of important species as investigated by molecular markers. Theoretical and Applied Genetics 100:1155-1166.

Nidhi P, Rolta, R, Kumar, V, Dev, K and Sourirajan A. 2020. Synergistic potential of *Citrus aurantium* L. essential oil with antibiotics against *Candida albicans*. Journal of Ethnopharmacology 262:113135. doi: 101016/jjep2020113135.

Odeh F, Rahmo A, Alnori AS, Chaty ME. 2012. The cytotoxic effect of essential oils *Citrus aurantium* peels on human colorectal carcinoma cell line (Lim1863). Journal of Microbiology, Biotechnology and Food Sciences 1(6):1476-1487.

Ogunro O, Richard G, Izah SC, Ovuru KF, Babatunde OT Das M. 2023. *Citrus aurantium*: Phytochemistry, Therapeutic Potential, Safety Considerations, and Research Needs, Nigeria. In: Izah, SC, Ogwu, MC, Akram, M. (eds). Herbal Medicine Phytochemistry: Applications and Trends, Springer International Publishing, Cham, Pp 1-40. doi: 101007/978-3-031-21973-3-69-1.

Ojito Ramos K, Herrera Sánchez Y, Vega Pérez N, Portal Villafaña O. 2012. Actividad antioxidante in vitro y toxicidad de extractos hidroalcohólicos de hojas de *Citrus* spp. (Rutaceae). Revista Cubana de Plantas Medicinales 17(4):368-379. doi: 101016/jindcrop201202013.

Okogun JI. 2002. Drug discovery through ethnobotany in Nigeria: some results. Advances in Phytomedicine 1:145-154. doi: 101016/S1572-557X(02)80021-6.

Oliveira SAC, Zambrana JRM, Di Iorio FBR, Pereira CA, Jorge AOC. 2013. The antimicrobial effects of *Citrus limonum* and *Citrus aurantium* essential oils on multi-species biofilms. Brazilian Oral Research 28:22-27. doi: 101590/s1806-83242013005000024.

Onakpoya I, Davies L, Ernst E. 2011. Efficacy of herbal supplements containing *Citrus aurantium* and synephrine alkaloids for the management of overweight and obesity: a systematic review. Focus on Alternative and Complementary Therapies 16(4):254-260. doi: 101111/j2042-7166201101115x.

Osfor MMH, Hegazy A, El-Moaty MA, Elmadbouly MA, Afify RAM, Elbahnasawy AS. 2013. Hypo-cholesterolemic and hypoglycemic effects of orange albedo powder (*Citrus aurantium* L) on male albino rats. International Journal of Food Science 2(2):70-76. doi: 1011648/jijnfs2013020217.

Othman HIA, Alkatib HH, Zaid A, Sasidharan S, Rahiman SSF, Lee TP, Dimitrovski G, Althakafy JT, Wong YF. 2022. Phytochemical composition, antioxidant and antiproliferative activities of *Citrus hystrix, Citrus limon, Citrus pyriformis,* and *Citrus microcarpa* leaf essential oils against human cervical cancer cell line. Plants 12(1):134. doi: 103390/plants12010134.

Ouedrhiri W, Bouhdid S, Balouiri M, Lalami AEO, Moja S, Chahdi FO, Greche H. 2015. Chemical composition of *Citrus aurantium* L leaves and zest essential oils, their antioxidant, antibacterial single and combined effects. Journal of Chemical and Pharmaceutical Research 7(1):78-84.

Oulebsir C, Mefti-Korteby H, Djazouli ZE, Zebib B, Merah O. 2022. Essential Oil of *Citrus aurantium* L Leaves: Composition, antioxidant activity, elastase and collagenase inhibition. Agronomy Journal 12(6):1466. doi: 103390/agronomy12061466.

Palazzolo E, Laudicina VA, Germanà MA. 2013. Current and potential use of *Citrus* essential oils. Current Organic Chemistry 17(24):3042-3049. doi: 102174/13852728113179990122.

Palheta IC, Tavares-Martins ACC, Lucas FCA, Jardim MAG. 2017. Ethnobotanical study of medicinal plants in urban home gardens in the city of Abaetetuba, Pará state, Brazil Bol Latinoam Caribe. Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas16(3): 206-262.

Papp N, Bartha S, Boris G Balogh L. 2011. Traditional uses of medicinal plants for respiratory diseases in Transylvania. Natural Product Communications 6(10):1934578X1100601012 PMID: 22164782.

Paramanayagam A, Prabakaran R, Mayakannan M, Vuppalapati L. 2023. Evaluation of cutaneous wound healing activity of *Citrus aurantium* fruit peel extract-based ointment in Albino rats. Research Journal of Pharmacy and Technology 16(1):250-254. doi: 1052711/0974-360X202300046.

Park J, Kim HL, Jung Y, Ahn KS, Kwak HJ, Um JY. 2019. Bitter orange (*Citrus aurantium* Linné) improves obesity by regulating adipogenesis and thermogenesis through AMPK activation. Nutrients 11(9):1988. doi: 103390/nu11091988.

Park KI, Park HS, Kim MK, Hong GE, Nagappan A, Lee HJ, Yumnam S, Lee WS, Won CK, Shin SC, Kim GS. 2014. Flavonoids identified from Korean *Citrus aurantium* L inhibit Non-Small Cell Lung Cancer growth in vivo and in vitro. Journal of Functional Food 7:287-297. doi: 101016/jjff201401032.

Park KI, Park HS, Nagappan A, Hong GE, Lee DH, Kang SR, Kim JA, Zhang J, Kim EH, Lee WS, Shin SC. 2012. Induction of the cell cycle arrest and apoptosis by flavonoids isolated from Korean *Citrus aurantium* L. in non-small-cell lung cancer cells. Food Chemistry 135(4):2728-2735. doi: 101016/jfoodchem201206097.

Parvizpur A, Parnian K, Samankan S, Fathiazad F, Charkhpour M. 2019. Evaluation of the Effects of Chronic Administration of *Citrus aurantium* Essential Oil on the Development of Tolerance and Dependence to Morphine. Pharmaceutical Sciences 25(1):17-23. doi: 1015171/PS20193.

Pasandideh S, Arasteh A. 2021. Evaluation of antioxidant and inhibitory properties of *Citrus aurantium* L. on the acetylcholinesterase activity and the production of amyloid nano-bio fibrils. International Journal of Biological Macromolecules 182:366-372. doi: 101016/jijbiomac202104043.

Pasdaran A, Hamedi A, Shiehzadeh S Hamedi A. 2023. A review of *Citrus* plants as functional foods and dietary supplements for human health, with an emphasis on meta-analyses, clinical trials, and their chemical composition. Clinical Nutrition ESPEN 54:311-336. doi: 101016/jclnesp202302001.

Paul A, Cox PA. 1995. An ethnobotanical survey of the uses for *Citrus aurantium* (Rutaceae) in Haiti. Economic Botany 249-256. doi: 101007/BF02862342.

Peixoto JS, Comar JF, Moreira CT, Soares AA, De Oliveira AL, Bracht A, Peralta RM. 2012. Effects of *Citrus aurantium* (bitter orange) fruit extracts and p-synephrine on metabolic fluxes in the rat liver. Molecules 17(5):5854-5869.

Pellati F, Benvenuti S, Melegari M, Firenzuoli F. 2002. Determination of adrenergic agonists from extracts and herbal products of *Citrus aurantium* L var *amara* by LC. Journal of Pharmaceutical and Biomedical Analysis 29(6):1113-1119.

Pellati F, Benvenuti S. 2007. Chromatographic and electrophoretic methods for the analysis of phenetylamine alkaloids in *Citrus aurantium.* Journal of Chromatography A 1161(1-2):71-88 doi: 101016/jchroma200705097.

Penzak SR, Jann MW, Cold JA, Hon YY, Desai HD, Gurley BJ. 2001. Seville (sour) orange juice: synephrine content and cardiovascular effects in normotensive adults. The Journal of Clinical Pharmacology 41(10):1059-1063.

Periyanayagam K, Dhanalakshmi S, Karthikeyan V, Jagadeesan M. 2013. Phytochemical studies and GC/MS analysis on the isolated essential oil from the leaves of *Citrus aurantium* Linn. Journal of Natural Product and Plant Resources 3(6):19-23.

Periyanayagam K, Dhanalakshmi S, Karthikeyan V, Magesh M. 2014. Antibacterial activity of *Citrus aurantium* leaf essential oil against *S aureus* and *MRSA*. Journal of Drug Discovery and Therapeutics 2:54-60.

Perry LM, Metzger J. 1980. Medicinal Plant of East and South East Asia. The MIT Press, Cambridge, London, 44(92): 133.

Petrova I, Petkova N, Ivanov I, Todorova M, Ognyanov M, Bileva T, Haytova D. 2020. Bioactive compounds and antioxidant activity of extracts from edible flowers of *Punica granatum* and *Citrus aurantium*. Journal of Hygienic Engineering and Design 33:120-129.

Pimenta FCF, Alves MF, Pimenta MBF, Melo SAL, Almeida AAFD, Leite JR, Pordeus LCDM, Diniz MDFFM, Almeida RND. 2016. Anxiolytic effect of *Citrus aurantium* L on patients with chronic myeloid leukemia. Phytotherapy Research 30(4):613-617. doi: 101002/ptr5566.

Pimenta FCF, Tavares ND, Neto GC, Alves M, Pimenta MF, Diniz JM, de Medeiros AC, Diniz MD. 2017. Pharmacological actions of *Citrus* species In: Gill H, Garg H. (eds). *Citrus* Pathology. IntechOpen. Pp. 197-211. doi: 105772/66464.

Polo CM, Moraes, TM, Pellizzon CH, Marques MO, Rocha LRM, Hiruma-Lima CA. 2012. Gastric ulcers in middle-aged rats: The healing effect of essential oil from *Citrus aurantium* L. (Rutaceae). Evidence-Based Complementary Alternative and Medicine 2012:509451. doi: 101155/2012/509451.

Preuss HG, DiFerdinando D, Bagchi M, Bagchi D. 2002. *Citrus aurantium* as a thermogenic, weight-reduction replacement for *Ephedra*: an overview. Journal of Medicine 33(1-4):247-264.

Quiroga R, Meneses L, Bussmann RW. 2012. Medicinal ethnobotany in Huacareta (chuquisaca, Bolivia) Journal of Ethnobiology and Ethnomedicine 8(1):1-14. doi: 101186/1746-4269-8-29.

Radan M, Parčina A, Burčul F. 2018. Chemical composition and antioxidant activity of essential oil obtained from bitter orange peel (*Citrus aurantium* L) using two methods. Croatica Chemica Acta 91(1):125-128. doi: 105562/cca3294.

Rahimi A, Hashemi P, Talei GR, Borzuei M, Ghiasvand AR. 2014. Comparative analyses of the volatile components of *Citrus aurantium* L flowers using ultrasonic-assisted headspace SPME and hydrodistillation combined with GC-MS and evaluation of their antimicrobial activities. Analatical and Bioanalytical Chemistry Research 1(2):83-91. doi: 1022036/abcr20146025.

Rahnama S, Rabiei Z, Alibabaei Z, Mokhtari S, Rafieian-Kopaei M, Deris F. 2015. Anti-amnesic activity of *Citrus aurantium* flowers extract against scopolamine-induced memory impairments in rats. Neurological Sciences 36:553-560. doi: 101007/s10072-014-1991-2.

Ramadan W, Mourad B, Ibrahim S, Sonbol F. 1996. Oil of bitter orange: new topical antifungal agent. International Journal of Dermatology 35(6):448-449. doi: 101111/j1365-43621996tb03032x.

Ramos CAF, Sá RDCDS, Alves MF, Benedito RB, de Sousa DP, Margareth de Fátima FM, Araújo MST, de Almeida RN. 2015. Histopathological and biochemical assessment of d-limonene-induced liver injury in rats. Toxicology Reports 2:482-488. doi: 101016/jtoxrep201501001.

Rodrigues M, Alves G, Falcão A. 2013. Investigating herb–drug interactions: the effect of *Citrus aurantium* fruit extract on the pharmacokinetics of amiodarone in rats. Food and Chemical Toxicology 60:153-159. doi: 101016/jfct201307041.

Rop O, Mlcek J, Jurikova T, Neugebauerova J, Vabkova J. 2012. Edible flowers—a new promising source of mineral elements in human nutrition. Molecules 17(6):6672-6683. doi: 103390/molecules17066672.

Rosa-Falero C, Torres-Rodríguez S, Jordán C, Licier R, Santiago Y, Toledo Z, Santiago M, Serrano K, Sosa J, Ortiz JG. 2015. *Citrus aurantium* increases seizure latency to PTZ induced seizures in zebrafish thru NMDA and mGluR's I and II. Frontiers in Pharmacology 5:284. doi: 103389/fphar201400284.

Rufai Y, Fatimah S. 2015. Preliminary Phytochemical Investigations with Quantitative Fractionation of Orange Pulp (*Citrus aurantium* var *dulcis* L): Natural Product Waste as Medicine a Recent Study. Theory and Applications of Microbiology 3:144-152.

Safaei M, Sundararajan EA, Driss M, Boulila W, Shapi'i A. 2021. A systematic literature review on obesity: Understanding the causes & consequences of obesity and reviewing various machine learning approaches used to predict obesity. Computers in Biology and Medicine 136:104754.

Sale C, Harris RC, Delves S, Corbett J. 2006. Metabolic and physiological effects of ingesting extracts of bitter orange, green tea and guarana at rest and during treadmill walking in overweight males. International Journal of Obesity 30(5):764-773. doi: 101038/sjijo0803209.

Sanei-Dehkordi A, Sedaghat MM, Vatandoost H, Abai MR. 2016. Chemical compositions of the peel essential oil of *Citrus aurantium* and its natural larvicidal activity against the malaria vector *Anopheles stephensi* (Diptera: Culicidae) in comparison with *Citrus paradisi*. Journal of Arthropod-Borne Diseases 10(4):577.

Saneie S. 1994. Noskhe Shafa. 21th ed, Hafez Novin, Tehran, Iran. 610 pp.

Sari V, Nurmi T, Mursu J, Rissanen TH. 2006. Carotenoids and cardiovascular health. The American Journal of Clinical Nutrition 83(6):1265-1271. doi: 101093/ajcn/8361265.

Sarrou E, Chatzopoulou P, Dimassi-Theriou K, Therios I. 2013. Volatile constituents and antioxidant activity of peel, flowers and leaf oils of *Citrus aurantium* L growing in Greece. Molecules 18(9):10639-10647. doi: 103390/molecules180910639.

Sehgal AB. 2021. Hitherto Unknown Uses of Plants by Indigenous People of Himachal Pradesh. Glob Journal of Interdisciplinary Soccial Sciences 4(3):164-167.

Shah BP, Patel NA, Shah SK. 2023. Anti-arthritic activity of ethanolic extract of *Citrus aurantium* Linn leaves in complete freund's adjuvant induced arthritis in rats. Indian Drugs Journal 60(03):81.

Shara M, Stohs SJ, Mukattash TL. 2016. Cardiovascular safety of oral p-synephrine (bitter orange) in healthy subjects: a randomized placebo-controlled cross-over clinical trial. Phytotherapy Research 30(5):842-847. doi: 101002/ptr5590.

Sharma M, Fernandes J, Ahirwar D, Jain R. 2008. Hypoglycemic and hypolipidimic activity of alcoholic extract of *Citrus aurantium* in normal and alloxan-induced diabetic rats. PharmacologyOnline 3:161-171.

Sharma YK Gilhotra UK. 2022. Effect of *Citrus limon* (L), *Citrus aurantium* and *Citrus medica* on ethylene glycol induced urolithiasis in rats. Journal of Pharmaceutical Negative Results 601-608.

Shen CY, Yang L, Jiang JG, Zheng CY, Zhu W. 2017. Immune enhancement effects and extraction optimization of polysaccharides from *Citrus aurantium* L. var *amara*. Food & Function 8(2):796-807. doi: 101039/C6F001545J.

Siskos EP, Konstantopoulou MA, Mazomenos BE, Jervis M. 2007. Insecticidal activity of *Citrus aurantium* fruit, leaf, and shoot extracts against adult olive fruit flies (Diptera: Tephritidae). Journal of Economic Entomology 100(4):1215-1220. doi: 101093/jee/10041215.

Smith KB, Smith MS. 2016. Obesity statistics. Prim Care: Clin Off Pract 43(1):121-135.

Sofiyanti N, Iriani D, Wahyuni PI, Idani N, Lestari P. 2022. Identification, morphology of *Citrus* L (Aurantioideae-Rutaceae Juss) and its traditional uses in Riau Province. Indonesia Biodiversity Journal 23(2). doi: 1013057/biodiv/d230247.

Soković M, Van Griensven LJ. 2006. Antimicrobial activity of essential oils and their components against the three major pathogens of the cultivated button mushroom, *Agaricus bisporus*. European Journal of Plant Pathology 116:211-224. doi: 101007/s10658-006-9053-0.

Srithi K, Balslev H, Wangpakapattanawong P, Srisanga P, Trisonthi C. 2009. Medicinal plant knowledge and its erosion among the Mien (Yao) in northern Thailand. Journal of Ethnopharmacology 123(2):335-342. doi: 101016/jjep200902035.

Stange RR, Midland SL, Sims JJ, McCollum TG. 2002. Differential effects of *Citrus* peel extracts on growth of *Penicillium digitatum*, *P. italicum*, and *P. expansum*. Physiological and Molecular Plant Pathology 61(5):303-311. doi: 101006/pmpp20030447.

Stohs SJ, Preuss HG, Keith SC, Keith PL, Miller H Kaats GR. 2011. Effects of p-synephrine alone and in combination with selected bioflavonoids on resting metabolism, blood pressure, heart rate and self-reported mood changes. International Journal of Medical Sciences 8(4):295. doi: 107150/ijms8295.

Stohs SJ, Preuss HG, Shara M. 2012. A review of the human clinical studies involving *Citrus aurantium* (bitter orange) extract and its primary protoalkaloid p-synephrine. International Journal of Medical Sciences 9(7):527. doi: 107150/ijms4446.

Stohs SJ, Preuss HG, Shara M. 2013. Issues regarding a FACT review paper on the efficacy of herbal supplements containing *Citrus aurantium* and synephrine alkaloids for the management of overweight and obesity. Focus on Alternative and Complementary Therapies 1(18):45-47. doi: 101111/fct12005.

Stohs SJ, Shara M. 2007. A review of the safety and efficacy of *Citrus aurantium* in weight management Obesity In book: Epidemiology, pathophysiology, and prevention. 371-382.

Stohs SJ, Shara M. 2013. Review of the safety and efficacy of bitter orange (*Citrus aurantium*) and its primary protoalkaloid, p-synephrine, in weight management. Phytotherapy Research doi: 101002/ptr3490.

Stohs SJ. 2013. Problems with *Citrus aurantium* information in "A review on botanical species and chemical compounds with appetite suppressing properties for body weight control". Plant Foods for Human Nutrition 68(3):329-331. doi: 101007/s11130-013-0376-7.

Stohs SJ. 2017. Safety, efficacy, and mechanistic studies regarding *Citrus aurantium* (bitter orange) extract and p-synephrine Phytotherapy Research 31(10):1463-1474. doi: 101002/ptr5879.

Sule JO, Arhoghro ME, Onyije FM. 2016. Antiobesity Effect of *Citrus aurantium* (Bitter Orange) on Wistar Albino Rat Fed with Formulated Fatty Diet. Journal of Medical and Biological Research 2(6):104-108.

Suntar I, Khan H, Patel S, Celano R, Rastrelli L. 2018. An overview on *Citrus aurantium* L: Its functions as food ingredient and therapeutic agent Oxidative. Oxidative Medicine and Cellular Longevity 1-12. doi: 101155/2018/7864269.

Suryawanshi JAS. 2011. An overview of *Citrus aurantium* used in treatment of various diseases. African Journal of Plant Sciences 5(7): 390-395.

Tavakkoli A. 2013. Giahan Darouei. Nazari, Tehran, Iran.

Teneva D, Denkova-Kostova R, Goranov B, Hristova-Ivanova Y, Slavchev A, Denkova Z, Kostov G. 2019. Chemical composition, antioxidant activity and antimicrobial activity of essential oil from *Citrus aurantium* L. zest against some pathogenic microorganisms Zeitschrift für Naturforschung C 74(5-6):105-111. doi: 101515/znc-2018-0062.

Tounsi MS, Wannes WA, Ouerghemmi I, Jegham S, Njima YB, Hamdaoui G, Zemni H, Marzouk. B. 2011. Juice components and antioxidant capacity of four Tunisian *Citrus* varieties. Journal of the Science of Food and Agriculture 91(1):142-151.

Trabelsi D, Aydi A, Zibetti AW, Della Porta G, Scognamiglio M, Cricchio V, Langa E, Abderrabba M, Mainar AM. 2016. Supercritical extraction from *Citrus aurantium* var *amara* peels using CO2 with ethanol as co-solvent. The Journal of Supercritical Fluids 117:33-39.

Tundis R, Loizzo MR, Bonesi M, Menichini F, Mastellone V, Colica C, Menichini F. 2012. Comparative study on the antioxidant capacity and cholinesterase inhibitory activity of *Citrus aurantifolia* Swingle, *C. aurantium* L, and *C. bergamia* Risso and Poit peel essential oils. Food Science Journal 77(1):H40-H46 doi: 101111/j1750-3841201102511x.

Ulbricht C, Costa D, Giese N, Isaac R, Liu A, Liu Y, Osho O, Poon L, Rusie E, Stock T, Weissner W. 2013. An evidence-based systematic review of bitter orange (*Citrus aurantium*) by the Natural Standard Research Collaboration. Journal of Dietary Supplements 10(4):391-431 doi: 103109/193902112013830821.

Ullah N, Khan MA, Khan T, Ahmad W. 2014. Nephroprotective potentials of *Citrus aurantium*: A prospective pharmacological study on experimental models. Pakistan Journal of Pharmaceutical Sciences 27(3):505-510 PMID: 24811809.

Van Andel T, Behari-Ramdas J, Havinga R, Groenendijk S. 2007. The medicinal plant trade in Suriname. Ethnobotany and Research Applications 5:351-372.

van Wyk AS, Prinsloo G. 2020. Health, safety and quality concerns of plant-based traditional medicines and herbal remedies. South African Journal of Botany 133:54-62. doi: 101016/jsajb202006031.

Vandebroek I, Picking D. 2020. Popular medicinal plants in Portland and Kingston, Jamaica. Economic Botany 89-94.

Verpeut JL, Walters AL, Bello NT. 2013. *Citrus aurantium* and *Rhodiola rosea* in combination reduce visceral white adipose tissue and increase hypothalamic norepinephrine in a rat model of diet-induced obesity. Nutrition Research Reviews 33(6):503-512. doi: 101016/jnutres201304001.

Wang L, Wang J, Fang L, Zheng Z, Zhi D Wang S, Li S, Ho CT, Zhao H. 2014. Anticancer activities of *Citrus* peel polymethoxyflavones related to angiogenesis and others. BioMed Research International 2014:1-10. doi: 101155/2014/453972.

Wang R, Hassan W, Jabeen Q, Ahmed H, Iqbal O. 2019. *Citrus aurantium* ameliorates cisplatin-induced nephrotoxicity. BioMed Research International 1-9. doi: 101155/2019/3960908.

Wang R, Li Z, Liu S, Zhang D. 2023. Global, regional, and national burden of 10 digestive diseases in 204 countries and territories from 1990 to 2019. Frontiers in Public Health 11:1061453.

Weisskopf A, Fuller D. 2013. *Citrus* fruits: origins and developments, London. In: Smith C. (ed), Encyclopedia of Global Archaeology. Springer, New York, Ny, Pp. 1479–1483.

Wells KB, Stewart A, Hays RD, Burnam MA, Rogers W, Daniels M, Berry S, Greenfield S, Ware J. 1989. The functioning and well-being of depressed patients: results from the Medical Outcomes Study. Jama 262:914-919. doi: 101001/jama198903430070062031.

Wen L, He M, Yin C, Jiang Y, Luo D, Yang B. 2021. Phenolics in *Citrus aurantium* fruit identified by UHPLC-MS/MS and their bioactivities. Food Sciences and Technology (LWT) 147:111671.

Wichtl, M, Bisset NG. 1994. Herbal drugs and phytopharmaceuticals: A Handbook for Practice on a Scientific Basis. Medpharm GmbH Scientific Publishers, University of Michigan.

Wolffenbüttel AN, Zamboni A, Becker G, Dos Santos MK, Borille BT, de Cássia Mariotti K, Fagundes AC, de Oliveira Salomón JL, Coelho VR, Ruiz LV, de Moura Linck V. 2017. *Citrus* essential oils inhalation by mice: Behavioral testing, GCMS plasma analysis, corticosterone, and melatonin levels evaluation. Phytotherapy Research 32(1):160-169. doi: 101002/ptr5964.

Wolffenbuttel AN, Zamboni A, Kerpel dos Santos M, Tassi Borille B, Americo Augustin O, de Cassia Mariotti K, Bainy Leal M, Pereira Limberger R. 2015. Chemical components of *Citrus* essential oils from Brazil. Journal of Natural Products 5(1):14-27. doi: 102174/221031550501150414095331.

World Health Organization 2017. Depression and other common mental disorders: Global Health Organization. http://iriswhoint/handle/10665/254610 License: CC By-NC-SA 30 IGO.

World Health Organization 2020. Air Quality Guidelines for Europe, second ed 91:273 pp.

Wu GA, Terol J, Ibanez V, López-García A, Pérez-Román E, Borredá C, Domingo C, Tadeo FR, Carbonell-Caballero J, Alonso R, Curk F. 2018. Genomics of the origin and evolution of *Citrus*. Nature 554(7692):311-316 doi: 101038/nature25447.

Xing H, Zhang K, Zhang R, Shi H, Bi K, Chen X. 2015. Antidepressant-like effect of the water extract of the fixed combination of *Gardenia jasminoides*, *Citrus aurantium* and *Magnolia officinalis* in a rat model of chronic unpredictable mild stress. Phytomedicine 22(13):1178-1185. doi: 101016/jphymed201509004.

Xu DP, Li Y, Meng X, Zhou T, Zhou Y, Zheng J, Zhang JJ, Li HB. 2017. Natural antioxidants in foods and medicinal plants: Extraction, assessment and resources. International Journal of Molecular Sciences 18(1):96. doi: 103390/ijms18010096.

Yan Y, Zhou H, Wu C, Feng X, Han C, Chen H, Liu Y, Li Y. 2021. Ultrasound-assisted aqueous two-phase extraction of synephrine, naringin, and neohesperidin from *Citrus aurantium* L. fruitlets Preparative Biochemistry & Biotechnology 51(8): 780-791 doi: 101080/1082606820201858427.

Yang L, Cao YL, Jiang JG, Lin QS, Chen J, Zhu L. 2010. Response surface optimization of ultrasound-assisted flavonoids extraction from the flower of *Citrus aurantium* L. var *amara*. Journal of Separation Science 33(9):1349-1355. doi: 101002/jssc200900776.

Yoon C, Kang SH, Yang JO, Noh DJ, Indiragandhi P, Kim GH. 2009. Repellent activity of *Citrus* oils against the cockroaches *Blattella germanica*, *Periplaneta americana* and *P fuliginosa*. Journal of Pesticide Science 34(2):77-88. doi: 101584/jpesticsG07-30.

Zargari A. 1986. Medicinal Plants, fourth ed, Tehran University Publications, Tehran, Iran, Pp. 249-252.

Zarrad K, Hamouda AB, Chaieb I, Laarif A, Jemâa JMB. 2015. Chemical composition, fumigant and anti-acetylcholinesterase activity of the Tunisian *Citrus aurantium* L. essential oils. Industrial Crops and Products 76:121-127. doi: 101016/jindcrop201506039.

Zhao L, Fan H, Zhang M, Chitrakar B, Bhandari B, Wang B. 2019. Edible flowers: Review of flower processing and extraction of bioactive compounds by novel technologies. Food Research International 126:108660. doi: 101016/jfoodres2019108660.