PHARMACOLOGICAL AND NUTRITIONAL IMPORTANCE OF ARTEMISIA

Ali Esmail Al-Snafi
Department of Pharmacology, College of Medicine, Thi qar University, Iraq.

Keywords: mugwort; artemisia; artemisinin; secondary metabolites; chemical constituents; herbal drugs; Pharmacology; nutrition, anti-malarial.

Contents

Summary

Artemisia genus is the largest genera of the family (Asteraceae or Compositae). In the current review, the databases including Web Science, Chemical Abstracts, Pub Med, Scopus Medicinal and Aromatic Plants Abstracts, and ScienceDirect, were searched to investigate the chemical constituents and pharmacological effects of Artemisia species. Artemisia species are frequently utilized for the treatment of many diseases especially malaria. The phytochemical analysis revealed that Artemisia species contained essential oils, volatile oils, alkaloids, flavonoids, quinines; tannins, coumarins, in addition to nutritional elements. Artemisia species possessed wide range of pharmacological effects included antimicrobial, anti-malarial, antiparasitic, antiinflammatory, antipyretic, analgesic, anticancer, hypoglycemic, hepatoprotective, renoprotective, neuroprotective, antioxidant, antifertility, hypotensive, emmenagogue, diuretic, immunomodulatory, antiulcerogenic, bile stimulant, anti-venom, hypolipidemic, anticonvulsant and many other pharmacological effects. The current review will highlight the traditional, chemical constituents and pharmacological and nutritional importance of Artemisia species.

1. Introduction

Plants belong to the 'Kingdom' of plants called 'Plantae'. Figure 1 is the Venn diagram showing the composition of this Kingdom.. *Artemisia* is the largest genera of the family (Asteraceae or Compositae), the biggest flowering plant family. It included more than 400 species, the Artemisia species are widely distributed in temperate regions of North America, Mediterranean region, Asia, Africa and Australia. The species grown from sea level to high mountains and from arid areas to wetlands, some species are widely distributed and others are a quite restricted in its distribution. The genus Artemisia is widely used in traditional medicine throughout the world (Vallès *et al*., 2011; Koul *et al*., 2017).

2. Taxonomic Classification of Artemisia

Figure 1 shows the Venn diagram of classification of plants in general. The groups are nested in a hierarchical order. Some of these groups are not differentiated in the case of some plant types. Usually the reference to these groups begins at the level of Family and proceeds downwards into the particular species:

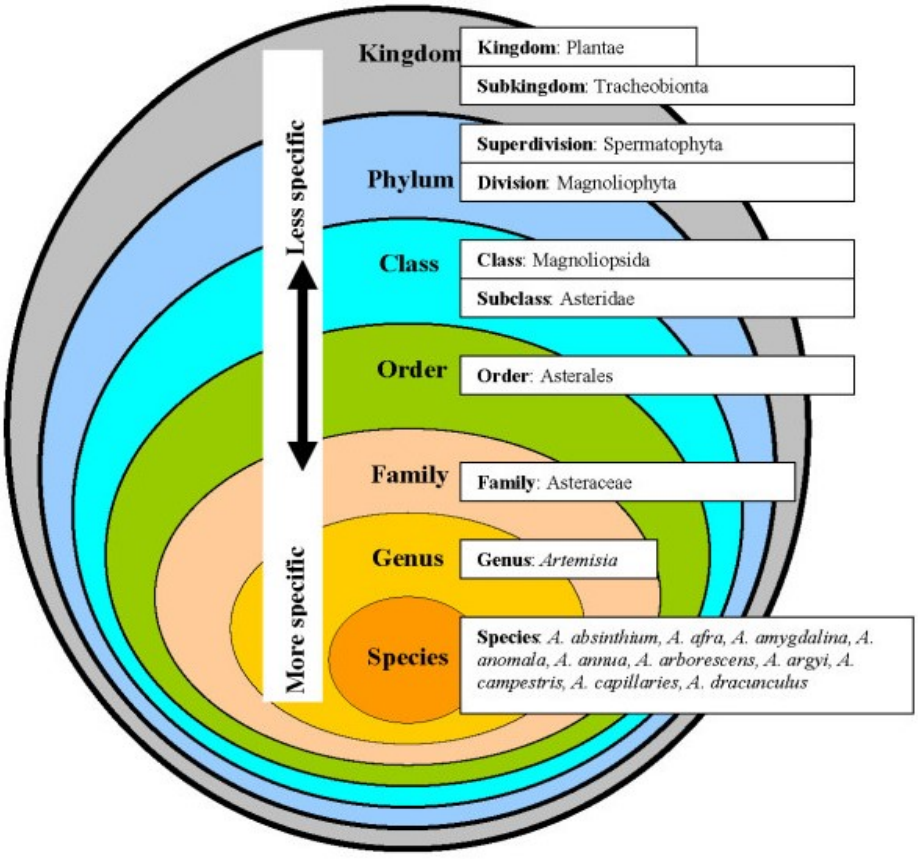


Figure 1. Venn diagram of the kingdom of plants

General classification of the *Plant Kingdom*

- **Kingdom**: Plantae,

- **Subkingdom**: Tracheobionta,
- **Superdivision**: Spermatophyta,
- **Division**: Magnoliophyta,
- **Class**: Magnoliopsida,
- **Subclass**: Asteridae,
- **Order**: Asterales,
- **Family**: Asteraceae,
- **Genus**: *Artemisia,*
- **Species**: *A. absinthium, A. afra, A. amygdalina, A. anomala, A. annua, A. arborescens, A. argyi, A. campestris, A. capillaries, A. dracunculus* etc (ITIS report 2020).

3. Nomenclature and Common Names

The name "*Artemisia*" owes its origin to the ancient Greek word (Artemis = The Goddess, the Greek Queen Artemisia). In the Greek mythology Artemis is the Goddess of hunting, wild nature, , and chastity. Artemis is said to be the daughter of Zeus and sister of Apollo. To the Romans she was known as Diana.

Table 1 lists many important species with their names in different languages as the plants are widely distributed across the planet. The well known English name "Wormwood" is influenced by the traditional use as a cure for intestinal worms (Koul *et al*., 2017).

S.No.	Artemisia	Chinese	English	French	German	Swedish
1.	*A. absinthium*	Ou zhou aie	Absinthe, Absinthe wormwood, Absinthium, Wormwood	Armoise absinthe, Armoise amère, Armoise absinthe	Absinth, Echter Wermut	Malört
2.	*A. afra*		African Wormwood			
3.	*A. alaskana*		Siberian wormwood			
4.	*A. alpine*			armoise du Caucase		kaukasisk malört
5.	*A. annua*		Annual mugwort, Annual wormwood, Sweet annie, Sweet sagewort, Sweet wormwood	Armoise annuelle	Einjähriger Beifuß	Sommarm alört
6.	*A. anomala*	liu ji nu, nan liu ji nu, qi hao				
7.	*A. argyi*	ai	Chinese mugwort			
8.	*A. biennis*		wormwood, slender mugwort	armoise bisanuelle	zweijähriger Beifuß	
9.	*A. californica*		California sagebrush			
10.	*A. campestris*	yin chen, yin chen hao	field sagewort, field wormwood, sagewort wormwood, sand wormwood		Feld-Beifuß	fältmalört
11.	*A. cana*		silver sagebrush			

12.	*A. capillaris*	yin chen, yin chen hao	capillary artemisia, yin-chen wormwood	armoise capillaire		trådmalört
13.	*A. carruthii*		Carruth wormwood			
14.	*A. codonocephala*	ye ai hao				
15.	*A. douglasiana*		Douglas sagewort, northwest mugwort, western mugwort			
16.	*A. dracunculus*		French tarragon, Russian tarragon, Silky wormwood, Tarragon, Wild tarragon	Dragon, Estragon		Dragon
17.	*A. filifolia*		sand-sage			dillmalört
18.	*A. frigid*		Estafiata, fringed-sage, prairie sagewort, wormwood-sage	armoise douce		ismalört
19.	*A. gmelinii*		Russian wormwood			
20.	*A. herba-alba*		white wormwood, desert wormwood	armoise herbe blanche		
21.	*A. indica*		Indian Wormwood			
22.	*A. lactiflora*		white mugwort	armoise à fleurs laiteuses	weißer China-Beifuß	
23.	*A. norvegica*		alpine sagewort, Norwegian mugwort			
24.	*A. nova*		black sagebrush, black-sage, small sagebrush			
25.	*A. pallense*					
26.	*A. papposa*		Owyhee-sage			
27.	*A. pedatifida*		matted sagewort			
28.	*A. pontica*		green-ginger, Roman wormwood	absinthe romaine, armoise de la mer Noire	pontischer Beifuß	romersk malört
29.	*A. princeps*		Japanese mugwort			
30.	*A. pycnocephala*		coastal sagewort			
31.	*A. rigida*:		scabland sagebrush			
32.	*A. rupestris*				Steppen-Beifuß	Stenmalört
33.	*A. schmidtiana*		angel's-hair	armoise de Schmidt		
34.	*A. scoparia*	zhu mao hao	yin-chen wormwood		Besen-Beifuß	vippmalört
35.	*A. stelleriana*		beach wormwood, dusty-miller, hoary mugwort, old-woman	armoise de Steller	Silber-Wermut	sandmalört
36.	*A. suksdorfii*		Suksdorf sagewort			
37.	*A. taurica*		Tauric wormwood			
38.	*A. tridentate*		basin sagebrush, big sagebrush, common sagebrush, sagebrush		dreizähniger Wermut	
39.	*A. tripartite*		three-tip sagebrush			

40.	*A. umbelliformis*		alpine wormwood	genépi	echte Edelraute	Temalört
41.	*A. vulgaris*		Felonherb, green-ginger, mugwort	armoise commune, armoise vulgaire	gemeiner Beifuß, gewöhnlicher Beifuß	gråbo

S.No.	**Artemisia**	**Afrikaans**	**Chinese**	**Spanish**
1.	*A. absinthium*		Ou zhou aie	Absintio, Ajenjo
2.	*A. afra*	als, alsem, wildeals		
6.	*A. anomala*		liu ji nu, nan liu ji nu, qi hao	
7.	*A. argyi*		ai	
10.	*A. campestris*		yin chen, yin chen hao	
12.	*A. capillaris*		yin chen, yin chen hao	
14.	*A. codonocephala*		ye ai hao	
16.	*A. dracunculus*			Dragoncillo, Estragón
34.	*A. scoparia*		zhu mao hao	
41.	*A. vulgaris*			Artemisia, hierba de San Juan

Table 1. Common names of Artemisia plants in other languages

4. Description

Artemisia plants can be categorized as annuals, biennials, perennials, subshrubs, or shrubs, of size 3–350 cm. Other features are as follows:

- Stems usually erect and branched, glabrous or hairy.
- Leaves basal or basal and cauline, alternate, sessile or petiolate, blades filiform, linear, lanceolate, ovate, elliptic, oblong, oblanceolate, obovate, cuneate, flabellate, or spatulate, usually pinnately and/or palmately lobed, sometimes apically ± 3-lobed or -toothed, or entire, faces glabrous or hairy (hairs multicelled and filled with aromatic terpenoids and/or 1-celled and hollow, dolabriform, T-shaped).
- Heads usually discoid, sometimes disciform, in relatively broad, paniculiform arrays, or in relatively narrow, racemiform or spiciform arrays. Involucres campanulate, globose, ovoid, or turbinate, 1.5–8 mm diam.
- Phyllaries persistent, 2-20+ in 4-7 series, distinct, (usually green to whitish green, rarely stramineous) ovate to lanceolate, unequal, margins and apices (usually green or white, rarely dark brown or black) ± scarious (abaxial faces glabrous or hairy). Receptacles flat, convex, or conic (glabrous or hairy), epaleate.
- Ray florets 0 (peripheral pistillate florets in disciform heads usually 1-20, their corollas filiform; corollas of 1–3 pistillate, sometimes ± 2-lobed, weakly raylike).
- Disc florets 2–20(–30+), bisexual and fertile, or functionally staminate; corollas (glabrous or ± hirtellous) usually pale yellow, rarely red, tubes ± cylindric, throats subglobose or funnelform, lobes 5, ± deltate.
- Cypselae fusiform. (Flora of North America; Flora of China).

Some important species of Artermesia are shown in Figure 2.


A. abrotanum


A. absinthium


A. afra


A. annua


A. arbuscula


A. argyi


A. australis


A. biennis

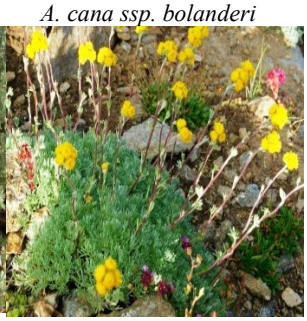

A. campestris

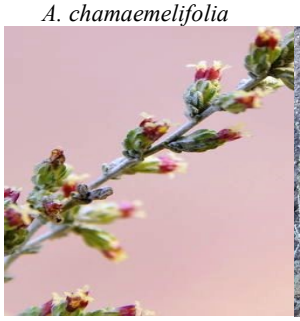

A. cana ssp. bolanderi

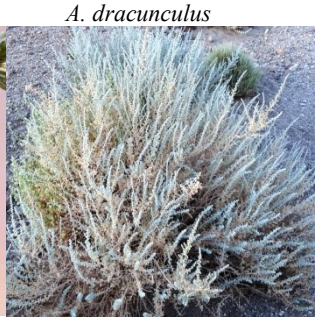

A. chamaemelifolia


A. dracunculus


A. figida


A. glacialis


A. herba-alba


A. judaica


A. judaica ssp sahariensis


A. lactiflora


A. ludoviciana


A. mauiensis

Figure 2. Pictures of Some Artemisia species (Encyclopedia of the Life, 2014; Dressler *et al*., 2014)

5. Traditional Uses of *Artemisia* Species

Artemisia has been used as traditional medicine since ancient times as an anthelmintic, antispasmodic, antirheumatic, and antibacterial agent and for the treatment of malaria, hepatitis, cancer, inflammation, menstrual-related disorders and many other uses. The various *Artemisia spp*. traditional uses different populations are listed in Table 2.

Species	Traditional uses	References
A. absinthium	The essential oil as antimicrobial, antifungal, neuroprotective, antimalarial and antidepressant. The aerial parts as cardiac stimulant, diuretic, antispasmodic, antiseptic, vermifuge, insecticide, acaricide and for the treatment of chronic fevers and hepatitis and for restoration of declining mental function and to improve memory.	Beigh and Ganai 2017
A. afra	In colds, coughs, diabetes, heartburn, bronchitis and asthma.	Van Wyk *et al*., 2004
A. amygdalina	Mostly for treatment of cold, cough, as anthelmintic and vermifuge. It was also used in the treatment of epilepsy, piles, nervous disorders, fever, and pain.	Zeb *et al*., 2018; Rasool *et al*., 2012
A. anomala	To treat fever, empyrosis, inflammation, and dissipated liver function caused by hepatitis.	Tan *et al*., 2014
A. annua	IIn Asia and Africa for the treatment of malaria and fever, in the form of tea or pressed juice. Also to treat autoimmune diseases such as systemic lupus erythematosus and rheumatoid arthritis in traditional Chinese medicine.	Cavar *et al*., 2012; Mueller *et al*., 2000
A. arborescens	In anti-inflammatory agent in traditional medicines	Koul *et al*., 2017
A. argyi	In herbal medicines for treatment of kidney, liver and spleen.	Otsuka *et al*., 1992
A. campestris	The flowers as hypoglycemic, cholagogue, choleretic, digestive, depurative, antilithiasic, and for the treatment of obesity and to decrease cholesterol. As a decoction as antivenin, anti-inflammatory, anti-rrheumatic and antimicrobial.	Sijelmassi, 1993; Hmamouchi, 1999; Bnouham *et al*., 2002
A. capillaries	For inflammation, microbial infections, malaria dampness, fever, jaundice and epidemic hepatitis.	Tajehmiri *et al*., 2014
A. dracunculus	In dampness, fever, jaundice, epidemic hepatitis, allergic rashes, skin wounds, irritations and dermatitis, as vermifuge, laxative, anti-epileptic,	Koul *et al*., 2017

	carminative, and anti-spasmodic.	
A. herba-alba	Treatment of diabetes and hypertension. It was also used in gastric disturbances such as diarrhea, abdominal cramps and a decoction against fever, menstrual and nervous problems.	Mighri *et al*., 2010; Alzweiri *et al*., 2011
A. japonica	The leaf extract for the treatment of malaria and a paste of leaves externally on skin diseases.	Joshi *et al*., 2016
A. judaica	Commonly as anthelmintic.	Abad *et al*., 2012
A. keiskeana	Treatment of gynecopathy, amenorrhea, bruise, and rheumatic disease.	Mohamed *et al*., 2010; Kwak *et al*., 1997
A. ludoviciana	As an antidiarrheal, for coughs, sore throats, and colds.	Moerman 1998; Abad *et al* ., 2012
A. mongolica	To cure inflammations and colds.	Hu *et al*., 1996
A nilagirica	As insecticide, the chewed leaves to treat oral ulcers and externally to treat cuts and wounds. Also in skin diseases, ulcers, bronchitis, tuberculosis, epilepsy, and nervous diseases.	Joshi *et al*., 2016; Mehbubun 2017
A. pontica	Ssedative and an appetizer in Bulgaria.	Todorova *et al*., 1996
A. princeps	Treatment of inflammation, diarrhea, and many circulatory disorders.	Abad *et al*., 2012
A. roxbugiana	To treat fever, malaria, intestinal worms, eye diseases, wounds, cuts and external parasites.	Joshi *et al*., 2016
A. rupestris	Stomach ache, vomiting, diarrhea, and as a hemostatic agent.	Lee *et al*., 2004
A. rutifolia	Treatment of asthma, as diuretic; the fresh herb as an anti-inflammatory and analgesic for toothache; a decoction of the herb in stomach problems, and heart problems.	Sharopov and Setzer 2011; Sharopov *et al*., 2015
A. sieberi	The flowering shoots and leaves were boiled in normal saline and the extracted solution for treatment of gangrenous ulcers, infectious ulcers, and inflammations externally. Also as carminative, to relieve inflammation and abscesses and to prevent leprosy.	Nigam *et al*., 2019
A. tridentata	Its infusion to treat bronchitis and pneumonia.	Moerman 1998
A. vestita	Treatment of fungal skin infections, tympanitis, and thrush.	Abad *et al*., 2012; Klayman 1993
A. vulgaris	As antihypertensive, anti-inflammatory, antispasmodic, carminative, and anthelmintic. Also for treatment of painful menstruation and in the induction of labor or miscarriage.	Quisumbing 1978

Table 2. The Traditional Uses of Artemisia Spp. in Different Populations.

6. Bioactive Ingredients of Artemisia Species

Phytochemical analysis revealed that Artemisia species contained essential oils, volatile oils, alkaloids, flavonoids, quinines; tannins, coumarins, in addition to nutritional elements. Table 3.01 gives details of nutritional content of Artemisia (Iqbal *et al*., 2012; Das 2012), *A. herba-alba* (Al-Masri 2013), and *A. vulgaris* at vegetative period (Wang *et al*., 2019). . Figure 3.02 displays the various bioactive agents in Artemisia species.

Ash	7.5 -8.33mg/100mg
fiber	11.92-40.7 mg/100mg
Fat	2.21 mg/100g
Protein	5.2-24.37 mg/100g
carbohydrate	8.3-13.2 mg/100g
Energy	40 cal/100g
vitamin K2 vitamin	0.32±0.09- 1.21±0.16 µg/g
vitamin K1	1.1±0.15- 2.72±0.28 µg/g
vitamin D2	0.32±0.11- 5.17±0.38 µg/g
vitamin D3	0.32±0.13- 0.87±0.23 µg/g
α- tocopherol	0.11±0.02- 23.12±1.21 µg/g
retinol acetate	0.13±0.06- 1.71±0.15 µg/g
Ca	0.19%
P	0.34

(a) General.

General		**Two specific species**			
***Artemisia* (Iqbal *et al*., 2012; Das 2012).**		***A. herba-alba* (Al-Masri 2013)**		***A. vulgaris* at vegetative period (Wang *et al*., 2019)**	
Constituent	**dry weight %**	**Constituent**	**(g/kg DM)**	**Constituent**	**(%)**
Ash	7.5	Acid-detergent fiber	474.6	Ash	8.33
Carbohydrate	8.3	Crude fiber	407.9	Ca	0.19
Fat	6.07	Crude protein	103.4	Fat	2.21
Fiber	14.2	Lignin	164.1	Fiber 11.92,	11.92
Moisture	11.4	Neutral-detergent fiber	571.8	Flavonoids	13.58
Protein	0.02437	Nanofiber carbohydrate	131.8	Moisture	12.69
Tocopherol	2.74			P	0.34
				Phenolic acids	0.004.25
				Protein	9.26

(b) Specific species

Table 3.01(a). Nutritional Constituents of Artemisia Spp in general (b) Specific species.

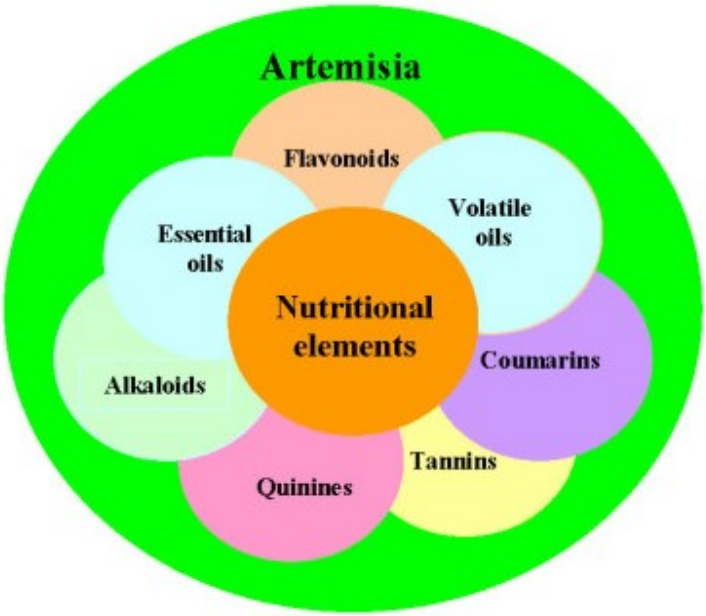


Figure 3. Bioactive Ingredients of Artemisia Species

6.1. Nutritional Elements

Each 5g of the plant contained protein 0.26 g, carbohydrates 0.44 g and energy 2 cal (Food nutrition facts and count calories in food).

Analysis of nutritional elements in Artemisia was carried out in general by Iqbal *et al* (2012) and Das (2012), and for three specific species by Al-Masri (2013), Wang *et al* (2019). The results are shown in Tables 3.01(a&b).

6.2. Amino Acids

The results of analysis for amino acids of certain Artemisia species *A princeps* and *A. argyi* (Kim *et al*., 2015) and for nonessential amino acids are presented in Table 3.02.

Amino acids	**Artemisia species**		
		A. princeps	***A. argyi***
Essential	Histidine	7.18 ± 0.16	2.54 ± 0.06
	Isoleucine6	1.56 ± 0.89	47.62 ± 00.57
	Leucine	59.26 ± 0.65	44.51 ± 0.60
	Phenylalanine	66.05 ± 0.26	93.78 ± 0.74
	Threonine (mg/100 g of dried material)	22.20 ± 1.03	15.12 ± 0.29,
	Valine	102.71 ± 1.97	167.07 ± 0.85
	Alanine	86.90 ± 0.88	34.29 ± 0.60,
	Serine(mg/100 g of dried material)	47.52 ± 0.61	47.48 ± 0.65
	Total	**318.93 ± 1.22**	**370.64 ± 0.27**

Nonessential	β-alanine	16.18 ± 0.78	15.96 ± 0.09
	γ-aminobutyric acid	12.60 ± 0.18	48.52 ± 0.87
	Cysteine	4.42 ± 0.30	4.52 ± 0.25
	Aspartic acid	7.01 ± 0.51	8.68 ± 0.29
	Arginine	29.47 ± 0.68	20.55 ± 0.32
	Glycine	4.57 ± 0.25	11.39 ± 0.35
	Glutamic acid	23.59 ± 0.68	33.45 ± 0.36
	α-aminobutyric acid	2.53 ± 0.44	6.54 ± 0.37
	Tyrosine	7.62 ± 0.13	10.77 ± 0.38
	Total	**242.35 ± 2.24**	**242.15 ± 2.80**
Free (mg/100 g of dried material)	**Total**	**561.28 ± 3.30**	**612.79 ± 2.97**

Table 3.02 Amino acids in *A. princes* and *A. argyi* (Kim *et al*., 2015)

6.3. Fatty Acids

Fatty acid profile of **thirteen** species of Artemisia (Carvalho *et al*., 2011).

- Total lipids content range from 3.31 ± 0.19 to 17.78 ± 0.27 mg/g (fresh weight).
- The three most abundant fatty acids were palmitic acid, linoleic acid and linolenic acid.
- The predominant omega-3 long chain polyunsaturated fatty acids acid in all Artemisia species was linolenic acid, with *Artemisia gmellini*, *Artemisia ludoviciana* and *Artemisia vulgaris*, showing higher amounts of this fatty acid, all the studied thirteen species, were also rich in oleic acid and linoleic acid, accounted for 50–70% of total polyunsaturated fatty acids.
- The ratio of omega-3 long chain polyunsaturated fatty acids to omega-6 long chain polyunsaturated fatty acids was similar in all species, varying from 1.0 to 3.0

Fatty acid analysis of the **five** *Artemisia* species (Kursat *et al*., 2015):

- Dominant fatty acids were palmitic acid, stearic acid, palmitoleic acid, oleic acid, linoleic acid, eicosadienoic acid and docosadienoic acid.
- *armeniaca, A. scoparia* and *A. haussknechtii* contained the highest saturated fatty acid contents (65.21 ±0.51%, 58.01 ±0.36% and 39.84 ±0.49%, respectively).
- *Artemisia* species. *A. haussknechtii* and *A. tournefortiana* contained high levels of monounsaturated fatty acid, 20.58 ±0.36% and 15.56 ± 0.28%, respectively. Linoleic acid, eicosadienoic acid and docosadienoic acid were the dominant polyunsaturated fatty acids in the studied five *Artemisia* species.

6.4. Vitamins and Sterols

Table 3.03. presents vitamin and sterol contents of five Artemisia species (Kursat *et al*., 2015; Brisibe *et al*., 2009)

Vitamins(µg/g)		Sterols(µg/g)	
Vitamin K2	0.32±0.09- 1.21±0.16	α- tocopherol	0.11±0.02- 23.12±1.21
Vitamin K1	1.1±0.15- 2.72±0.28	Retinol acetate	0.13±0.06- 1.71±0.15
Vitamin D2	0.32±0.11- 5.17±0.38	Ergosterol	3.07±0.76- 164.75±2.34
Vitamin D3	0.32±0.13- 0.87±0.23	Stigmasterol	0.74±0.11- 16.76±1.57
		β sitosterol	0.62±0.13- 26.5±1.23

Table 3.03. Vitamin and sterol contents of five Artemisia species (Kursat *et al*., 2015; Brisibe *et al*., 2009)

The total phenolic content in the aerial parts of some Artemisia species were between 9.79 µg GAE/mg and 15.38 µg GAE/mg (Sengul *et al*., 2011).

Eighteen polyphenolic compounds were isolated and identified in *Artemisia* leaves, including hydroxybenzoic acids, hydroxycinnamic acids, flavonols, and catechins. Caffeic and ferulic conjugates, gallic acid and catechin were the main hydroxycinnamic acid and catechins (Carvalho *et al*., 2016).

6.5. Flavonoids

Eight flavononids (quercetin, kaempferol, naringin, rutin, myricetin, morin, naringenin and catechin) were determined in five *Artemisia* species (Kursat *et al*., 2015). These are shown in (µg/g) Table 3.04.

Flavanoid	***Artemisia species***				
	A. armeniaca	***A. haussknechtii***	***A. incana***	***A. scoparia***	***A.tournefortiana***
Catechin	(11486.71±3.52)				(2684.87±3.42)
Kaempferol	(36.56±0.35)				(21.74±0.65)
Morin	(45.35 ± 0.65 – 1406.79 ± 4.12)				
Myricetin	(17332.1±3.55)	(1861.44±1.77)		(111.79±2.34)	(76.25±1.11)
Naringenin	(15.32 ± 0.46 – 191.18 ± 1.22)				
Naringin	(268.13±1.52)		(226.43±1.17)		
Quercetin	(223.32±2.01)		(13.23±0.58)	(645.12±2.13)	(101.69±2.13)
Rutin	(6043.64±3.71)		(7259.43±3.49)		

Table 3.04. Eight Flavonoids in Five Artemisia Spp.

-

-

Bibliography

Abad M.J., Bedoya L.M., Apaza L., Bermejo P. (2012). The *Artemisia* L. Genus: A Review of Bioactive Essential Oils, *Molecules* **17**(3), 2542-2566. [A comprehensive review of *Artemisia* L. Genus]

Abu Zarag M., al-qawasmeh R., Sabri S.S., Munsoor M., Abdalla S. (1995). Chemical Constituents of *Artemisia arborescens* and the Effect of the Aqueous Extract on Rat Isolated Smooth Muscle, *Planta Medica* **61**(3), 242-245. [Present chemical ingredient and Pharmacological investigation of *Artemisia arborescens* on smooth muscles]

Abu-Darwish M.S., Cabral C., Goncalves M.J., Cavaleiro C., Cruz M.T., Efferth T., Salgueiro L. 2015). *Artemisia herba-alba* essential oil from Buseirah (South Jordan): Chemical Characterization and Assessment of Safe Antifungal and Antiinflammatory Doses, *J Ethnopharmacol* **174**,153–160. [This investigate oil constituents of *Artemisia herba-alba*]

Aglarova A.M. (2006). Comparative Analysis of Secondary Metabolites of Artemisia dracunculus L., Russian and French cultivars. Ph.D. thesis, Mahachkala University. [Represent the chemical analysis of the ingredients of Artemisia dracunculus]

Aicha N., Ines S., Mohamed BS., Ines B., Soumaya K., Kamel G., Mohamed N., Imed C., Mohamed H., Leila CG. (2008). Chemical Composition, Mutagenic and Antimutagenic Activities of Essential Oils from (Tunisian) *Artemisia campestris* and *Artemisia herba-alba*, *J of Essential Oil Research* **20**(5), 471-477. [Discuss the the oil ingredients of *Artemisia campestris* and *Artemisia herba-alba*]

Akrout A., Gonzalez L.A. El Jani H. Madrid PC. (2011). Antioxidant and Antitumor Activities of *Artemisia campestris* and *Thymelaea hirsuta* from Southern Tunisia, *Food Chem Toxicol* **49**(2), 342-347 [Investigate the antioxidant and anti-tumor effects of *Artemisia campestris*].

Al-Banna L., Darwish RM., Aburjai T. (2003). Effect of Plant Extracts and Essential Oils on Root-Knot Nematode, *Phytopathologia Mediterranea* **42**(2), 123-128.[Discuss the antiparasitic effect of *Artemisia*].

Almasad M.M., Qazan W.S., Daradka H. (2007). Reproductive Toxic Effects of *Artemisia herba-alba* Ingestion in Female Spague-Dawley Rats, *Pak J of Bio Sci* **10** (18), 3158-3161 [Investigate the reproductive effect of *Artemisia herba-alba* in rats].

Al-Masri M.R. (2013). Nutritive Evaluation of Some Native Range Plants and Their Nutritional and Antinutritional Components, *Journal of Applied Animal Research* **41**(4), 427-431 [Confirmed the nutritional values of *Artemisia*].

Al-Snafi A.E. (2015). The pharmacological Importance of *Artemisia campestris*- A Review, *Asian Journal of Pharmaceutical Research*, **5**(2), 88-92 [A comprehensive review of *Artemisia campestris*].

Al-Wahaibi L.H.N., Mahmood A., Khan M. Alkhathlan H.Z. (2020). Comparative Study on the Essential Oils of *Artemisia judaica* and *A. herba-alba* from Saudi Arabia, *Arab J Chem* **13**, 2053–2065. [The paper discussed the oil constituents of *Artemisia judaica* and *A. herba-alba*]

Alzweiri M., Sarhan A.A., Mansi K. Hudaib M., Abuijai T. (2011). Ethnopharmacological Survey of Medicinal Herbs in Jordan, the Northern Badia Region, *J Ethnopharmacol* **137**, 27–35. [The paper discussed the traditional uses constituents and pharmacology of *Artemisia*]

Amat N., Upur H., Blazeković B. (2010). *In vivo* Hepatoprotective Activity of the Aqueous Extract of *Artemisia absinthium* L. Against Chemically and Immunologically Induced Liver Injuries in Mice. *J Ethnopharmacol*, **131**(2), 478-484 [It confrmed the hepatoprotective effect of *Artemisia absinthium* in immunologically induced liver toxicity]

Ansari S., Siddiqui M.A., Maaz M. Hepatocurative Effect of *Saussurea lappa*, C.B Clarke and *Artemisia absinthium*, Linn in Chronic Hepatitis B, *J Young Pharm* **10**(3), 354-357. [It confrmed the hepatoprotective effect of *Artemisia absinthium* in chronic hepatitis]

Ansari S., Siddiqui M.A., Malhotra S., Maaz M. (2018). Antiviral Efficacy of Qust (*Saussurea lappa*) and afsanteen (*Artemisia absinthium*) for Chronic Hepatitis B: A Prospective Single-Arm Pilot Clinical Trial, *Phcog Res*, **10**, 282-90.

Bailen M., Julio L.F., Diaz C.E., Sanz J., Martinez-Diaz R.A., Cabrera R. (2013). Chemical Composition and Biological Effects of Essential Oils from *Artemisia absinthium* L. Cultivated Under Different

Environmental Conditions, *Indus Crops Prod*, **49**, 102-107. [The paper investigated the constituents of oil of *Artemisia absinthium* and their pharmacology]

Beigh Y.A., Ganai, A.M. (2017). Potential of Wormwood (*Artemisia absinthium* Linn.) Herb for Use as Additive in Livestock Feeding: A Review, *The Pharma Innovation Journal*, **6**(8), 176-187 [It investigated the benifecial nutritional effect of *Artemisia absinthium* in livestock feeding].

Belhamel K., Chalchat J.C., Figuérédo G. Chemical Composition of the Essential Oil from *Artemisia arborescens* L. Growing Wild in Algeria Azedine Abderrahim, *Rec Nat Prod*, **4**(1),87-90 [The paper verified the ingredients of *Artemisia arborescens* oil].

Belhattab R., Boudjouref M., Barroso J. G. Pedro L.P., Figueirido A.C. (2011). Essential Oil Composition from *Artemisia campestris* Grown in Algeria, *Advances in Environmental Biology* **5**(2), 429-432. [The paper investigated the ingredients of *Artemisia campestris* oil]

Bhakuni R.S., Jain D.C., Sharma R.P., Kumar S. (2001). Secondary Metabolites of *Artemisia annua* and Their Biological Activity, *Curr Sci*, **80**, 35–48. [It represent chemical analysis of *Artemisia annua*]

Bnouham M., Mekhfi H., Legssyer A., Ziyyat A. (2002). Ethnopharmacology Forum: Medicinal Plants Used in the Treatment of Diabetes in Morocco, *Int J Diabetes & Metabolism*, **10**, 33-50.

Bora K.S., Sharma A. (2010). Phytochemical and Pharmacological Potential of *Artemisia absinthium* Linn. and *Artemisia asiatica* Nakai: A Review, *Journal of Pharmacy Research*, **3**(2), 325-328.

Boudreau A., Richard A.J., Burrell J.A., King W.T., Dunn R., Schwarz J.M., Ribnicky D.M., Rood J., Salbaum J.M., Stephens J.M. (2018). An Ethanolic Extract of *Artemisia scoparia* Inhibits lipolysis *In Vivo* and has Antilipolytic Effects on Murine Adipocytes *In Vitro*, *Am J Physiol Endocrinol Metab*, **315**(5), E1053–E1061.

Bouzenna H., Krichen L. *Pelargonium graveolens* L'Her. and *Artemisia arborescens* L. Essential Oils: Chemical Composition, Antifungal Activity Against *Rhizoctonia solani* and Insecticidal Activity Against *Rhyzopertha dominica*, *Nat Prod Res*, **27**, 841–846.

Brewer T.G., Grate S.J., Peggins J.O., Weina P.J., Petras J.M., Levine B.S., Heiffer M.H., Schuster B.G. (1994a). Fatal Neurotoxicity of Arteether and Artemether, *Am J Trop Med Hyg*, **51**, 251–259.

Brewer T.G., Peggins J.O., Grate S.J., *et al*. (1994b). Neurotoxicity in Animals Due to Arteether and Artemether, *Trans R Soc Trop Med Hyg*, **88**(suppl 1), S33–36.

Brisibe E.A., Umeron E.U., Brisibe F., Petras J.M., Levine B.S., Weina P.J., Swearengen J., Heiffer M.H., Schuster B.G. (2009). Nutritional Characterization and Antioxidant Capacity of Different Tissues of *Artemisia annua* L., *Food Chemistry*, **115**, 1240-1246.

Burits M., Asres K., Bucar F. (2001). The antioxidant activity of the essential oils of *Artemisia afra, Artemisia abyssinica* and *Juniperus procera*, *Phytotherapy Research* **15**, 103–108.

Carner A., Doskaya M., Degirmenci A., Can H., Baykan S., Uner A. (2008). Comparison of the Effects of *Artemisia vulgaris* and *Artemisia absinthium* Growing in Western Anatolia Against Trichinellosis (*Trichinella spiralis*) in Rats, *Exp Parasitol*, **119**, 173-179 .

Carvalho I.S., Cavaco T., Brodelius M. (2016). Phenolic Composition and Antioxidant Capacity of Six *Artemisia* Species, *Industrial Crops and Products*, **3**, 382-388.

Carvalho I.S., Teixeira M.C., Brodelius M. (2011). Fatty Acids Profile of Selected *Artemisia* Spp. Plants: Health Promotion. LWT, *Food Science and Technology*, **44**, 293-298.

Cavar S., Maksimovic M., Vidic D. Paric A.. (2012). Chemical Composition and Antioxidant and Antimicrobial Activity of Essential Oil of *Artemisia annua* L. from Bosnia, *Ind Crop Prod*, **37**, 479–485.

Cha J.D., Jeong M.R., Choi H.J., Jeong S.I., Moon S.E., Kim Y.H., Yun S.I., Kil B.S., Song Y.H. (2005). Chemical Composition and Antimicrobial Activity of the Essential Oil of *Artemisia lavandulaefolia*, *Planta Med*, **71**(6), 575-577.

Chiung-Sheue C., Shi-Lin Y., Roberts M.F. Elford B.C., Phillipson J.D (2004). Antimalarial Activity of *Artemisia annua* Flavonoids from Whole Plants and Cell Cultures, *Plant Cell Reports*, **8**, 637-640.

Cho J.Y., Jeong S.J., Lee H.L., Park K.H., Hwang D.Y., Park S.Y., Lee Y.J., Moon J.H., Ham K.S. (2016). Sesquiterpene Lactones and Scopoletins from *Artemisia scoparia* Waldst. & Kit. and Their Angiotensin I-Converting Enzyme Inhibitory Activities, *Food Sci Biotechnol*, **25**(6), 1701–1708.

Choi M.K., Han J.M., Kim H.G., Lee J.S., Lee J.S., Wang J.H., Son S.W., Park H.J., Son C.G. (2013). Aqueous Extract of *Artemisia capillaris* exerts Hepatoprotective Action in Alcohol-Pyrazole- Fed Rat Model, *Journal of Ethnopharmacology*, **147**(3), 662–670 .

Chong L., Jia-Xiu D., Li-Li J. Chemical Constituents of Petroleum Ether Extract from the *Artemisia sacrorum* Ledeb, *J Med Sci Yanbian Univ*, **36**, 27-28.

Clarkson C., Maharaj V.J., Crouch N.R., Grace O.M., Pillay P., Matsabisa M.G., Bhagwandin N., Smith P.J., Folb P.I. (2004). *In Vitro* Antiplasmodial Activity of Medicinal Plants Native to or Naturalised in South Africa, *Journal of Ethnopharmacology*, **92**, 177–191.

Dahmani-Hamzaoui N., Baaliouamer A. (2005). Chemical Composition of the Algerian Essential oil of *Artemisia herba-alba* Native to Dejelfa, *Riv Ital EPPOS*, **40**, 7–13.

Daradka H.M., Badawneh M., Al-Jamal J.A., Bataineh Y. (2014). Hypolipidemic Efficacy of *Artemisia absinthium* Extracts in Rabbits, *World Appl Sci J*, **31**(8), 1415-1421 .

Das S. *Artemisia annua* (Qinghao): A Pharmacological Review, *IJPSR*, **3**(12), 4573-4577.

Dhibi S., Bouzenna H., Samout N., Tlili Z., Elfeki A., Hfaiedh N. (2016). Nephroprotective and Antioxidant Properties of *Artemisia arborescens* hydroalcoholic Extract Against Oestroprogestative-Induced Kidney Damages in Rats, *Biomed Pharmacother*, **82**, 520-527.

Dhibi S., Ettaya A., Elfeki A., Hfaiedh N. (2015). Protective Effects of *Artemisia arborescens* Essential Oil on Oestroprogestative Treatment Induced Hepatotoxicity, *Nutr Res Pract*, **9**(5), 466-471.

Diawara H.Z., Ganfon H., Gbaguidi F., Yemoa A., Bero J., Jansen O., Evrard B., Moudachirou M., Frederich M., Leclercq J.Q. (2015).. The Antimalarial Action of Aqueous and Hydro alcoholic Extracts of *Artemisia annua* L. Cultivated in Benin: In *Vitro* and *In Vivo* Studies, *Journal of Chemistry and Pharm Research*, **7**(8), 817-823.

Djidel S., Khennouf S. (2014). Radical Scavenging, Reducing Power, Lipid Peroxidation Inhibition and Chelating Properties of Extracts from *Artemisia campestris* L. Aerial Parts, *Annual Research & Review in Biology*, **4**(10), 1691-1702.

Dunay I.R., Chan W.C., Haynes R.K., Sibley L.D. (2009). Artemisone and Artemiside Control Acute and Reactivated Toxoplasmosis in a Murine Model, *Antimicrob Agents Chemother*, **53**, 4450-4456.

Dunker A.K., Cortese M.S., Romero P., Lakoucheva L.M., Uversky V.N. (2005). Flexible Nets. The Roles of Intrinsic Disorder in Protein Interaction Networks, *FEBS J*, **272**, 5129-5148.

Efferth T., Dunstan H., Sauerbrey A. (2001). The Antimalarial Artesunate is Also Active Against Cancer, *Int J onc*, **18**, 767-73.

El-Amier Y.A., Al Borki A.S., Elagami S.A. (2019). Potential of Wild Plant *Artemisia judaica* L. as Sustainable Source of Antioxidant and Antimicrobial Compounds, *Journal of Experimental Sciences*, **10**, 04-08.

El-Massry K.F., El-Ghorab A.H., Farouk A. Antioxidant Activity and Volatile Components of Egyptian *Artemisia judaica* L, *Food Chem*, **79**, 331–336.

Emami S.A.,Vahdati-Mashhadian N., Vosough R., Oghazian M.B. (2009). The Anticancer Activity of Five Species of Artemisia on Hep2 and HepG2 Cell Lines, *Pharmacologyonline*, **3**, 327-39.

Erel S.B., Reznicek G., Senol S.G., Karabay N.U., Sibel Y. (2012). Antimicrobial and Antioxidant Properties of Artemisia L. Species from Western Anatolia, *Turk J Biol*, **36**, 75-84.

Farah R., El Ouassis D., Madjdi H., Essid R., Amira S, El Houda H. N. (2017). Chemical Composition and Biological Effects of Essential Oil of *Artemisia judaica* an Endemic Plant from Central Sahara of Algeria Hoggar, *Int J Biosci*, **10**(1), 16–23.

Ferrera J.F. (2004). *Artemisia annua* L.: The Hope Against Malaria and Cancer. Medicinal and Aromatic Plants: Production, Business & Applications, Proceedings of the Jan 15-17/2004 Meeting, Mountain State University, Beckley.

Feuerstein I., Danin A., Segal R. (1988). Constitution of the Essential Oil from an *Artemisia herba-alba* Population of Spain, *Phytochemistry*, **27**, 433–434.

Flora of China. Artemisia Linnaeus, Sp. Pl. 2: 845. http://www.efloras.org/ florataxon.aspx? flora_id= 2&taxon _id= 102682#:~:text=1753.

Flora of North America. Artemisia Linnaeus, Sp. Pl. 2: 845. http://www.efloras.org/ florataxon.aspx? flora_id= 1&taxon_id=102682

Foglio M.A., Dias P.C., Antonio M.A., Possenti A., Rodrigues R.A.F., Silva E.F., Rehder V.L.G., Carvalho J.E. (2002). Antiulcerogenic Activity of Some Sesquiterpene Lactones Isolated from *Artemisia annua*, *Planta Medica*, **68**(6), 515-518.

Food nutrition facts and count calories in food, Mugwort, https://slism.com/calo rie/106301/

Gathirwa J.W., Rukunga G.M., Njagi E.N.M., Omar S.A., Guantai A.N., Muthaura C.N., Mwitari P.G., Kimani C.W., Kirira P.G., Tolo F.M., Ndunda T.N., Ndiege I.O. (2007). *In Vitro* Antiplasmodial and *In Vivo* Antimalarial Activity of Some Plants Traditionally Used for the Treatment of Malaria by the Meru Community in Kenya, *Journal of Natural Medicines*, **61**, 261-268.

Geesi M.H., Anwar F., Bakht A. (2018). Volatile Composition, Physicochemical Properties, Kinetic Study and Antioxidant Potential of Endemic Artemisia (*Artemisia judaica* L.) Essential Oil, *IAJPS*, **5**(5), 4088- 4096.

Ghazanfar K, Ganai BA, Akbar S, Mubashir K., Dar S.K., Dar MY., Mohammad Y., Tantry M.A. (2014). Antidiabetic Activity of *Artemisia amygdalina* Decne in Streptozotocin Induced Diabetic Rats, *Biomed Res Int,* **2014**,185676.

Ghorab H., Laggoune S., Kabouche A., Semra Z., Kabouche Z. (2013). Essential Oil Composition and Antibacterial Activity of *Artemisia campestris* L. from Khenchela (Algeria), *Der Pharmacia Lettre*, **5**(2),189-192.

Gilani A.U.H., Janbaz K.H. (1995). Preventive and Curative Effects of *Artemisia absinthium* on Acetaminophen and CCl_4-Induced Hepatotoxicity, *Gen Pharmacol*, **26**(2), 309-315.

Guan X., Ge D., Li S., Huang K., Liu J., Li F. (2019). Chemical Composition and Antimicrobial Activities of *Artemisia argyi* Lévl. et Vant Essential Oils Extracted by Simultaneous Distillation-Extraction, Subcritical Extraction and Hydrodistillation, *Molecules*, **24**, 483.

Guantai A.N., Addae-Mensah I. (2008). Cardiovascular Effect of *Artemisia afra* and its Constituents, *Pharmaceutical Biology*, **37**, 351–356.

Gul M.Z., Sambamurthy C.S., Pujar M.D., Manjulatha K., Bhat M.Y. (2016). Bioassay-Guided Fractionation and *In Vitro* Antiproliferative Effects of Fractions of *Artemisia nilagirica* on THP-1 Cell Line, *Nutr Cancer*, **68**(7), 1210-1224.

Hadi A., Hossein N., Shirin P., Najmeh N., Abolfazl M. (2014). Anti-Inflammatory and Analgesic Activities of *Artemisia absinthium* and Chemical Composition of its Essential Oil, *Intern J of Pharmac Sci Rev and Res*, **24**(2), 237-244 .

Hamed B.N., Serria H.T., Lobna M., Khaled Z. (2014). Aqueous Leaves Extract of *Artemisia campestris* Inhibition of the Scorpion Venom Induced Hypertension, *Journal Medicinal Plants Research*, **8**(13), 538-542.

Han J.M., Kim H.J., Choi M.K., Lee J.S., Lee J.S., Wang J.H., Park H.J., Son S.W., Hwang S.Y., Son C.G. (2013). *Artemisia capillaris* Extract Protects Against Bile Duct Ligation- Induced Liver Fibrosis in Rats, *Experimental and Toxicologic Pathology*, **65**(6), 837–844.

He C.S., Yue H.Y., Xu J., Liu J., Li Y.Y. (2012). Protective Effects of Capillary Artemisia Polysaccharide on Oxidative Iinjury to the Liver in Rats with Obstructive Jaundice, *Experimental and Therapeutic Medicine*, **4**(4), 645–648 .

Hien T.T., Turner G.D., Mai N.T., Phu N.H., Bethell D., Blakemore W.F., Cavanagh J.B., Dayan A., Medana I., Weller R.O., Day N.P., White N.J. (2003). Neuropathological Assessment of Artemether-Treated Severe Malaria, *Lancet*, **362**, 295–296.

Hmamouchi M. Les Plantes Médicinales et Aromatiques marocaines, Imprimeries de Fedala. 1999. http://www.idpc.ma/view/documentation/bibliopci:35? titleinitial= h&num=3

Hong J.H., Lee I.S. (2009). Effects of *Artemisia capillaris* Ethyl Acetate Fraction on Oxidative Stress and Antioxidant Enzyme in High- Fat Diet Induced Obese Mice, *Chemico-Biological Interactions*, **179**(2-3), 88–93.

Hong S.H., Seo S.H., Lee J Choi B. (2004). The Aqueous Extract from *Artemisia capillaris* Thunb. Inhibits Lipopolysaccharide- Induced Inflammatory Response Through Preventing NF-κ B Activation in Human Hepatoma Cell Line and Rat Liver, International Journal of Molecular Medicine, **13**(5), 717–720 .

Hsu E. (2006). Reflections on the Discovery of the Antimalarial Qinghao, Br J Clin Pharm, **61**, 666–670.

Hu J., Zhu Q., Bai S., Jia Z. (2000). New Eudesmane Sesquiterpene and Other Constituents from *Artemisia mongolica*, *Planta Med*, **62**(5), 477-478.

Hu Y.Q., Tan R.X., Chu M.Y., Zhou J. (2000). Apoptosis in Human Hepatoma Cell Line SMMC-7721 Induced by Water- Soluble Macromolecular Components of *Artemisia capillaris* Thunberg, *Japanese J of Cancer Res*, **91**, 113–117.

Hu Z.H., Zhang P., Huang D.B., Wu JZ. (2012). New Guaianolides from *Artemisia anomala*, *J Asian Nat Prod Res,* **14**(2), 111-114.

Huffman A., Klepser M.E., Ernst E.J., Keele D., Roling E., Viljoen A.M. (2002). Susceptibility of Opportunistic Bacteria and Yeasts to the Volatile Oils of *Artemisia afra*, *Lippia javanica*, *Lippia scaberrima, Myrothamnus flabellifolius* and *Osmitopsis asteriscoides*, *J of Infectious Dis Pharmacotherapy*, **5**, 43–50.

Hurabielle M., Eberle J., Paris M. (1982). Etude des Flavonoïdes d'*Artemisia campestris* Sous- Espèce Glutinosa, *Planta Med*, **46**(10), 124-125.

Iqbal S., Younas U., Chan K.W., *Zia-Ul-Haq M., Ismail M.* (2012). Chemical Composition of *Artemisia annua* L. Leaves and Antioxidant Potential of Extracts as a Function of Extraction Solvents, *Molecules*, **17**(5), 6020–6032.

ITIS report, Artemisia. (2020). https://www.itis.gov/servlet/SingleRpt/SingleRpt? search_topic= TSN&search_value=35431#null

Janackovic P., Novakovic J., Sokovic M., (2015). Composition and Antimicrobial Activity of Essential Oils of *Artemisia judaica*, *A. herba-alba* and A. *arborescens* from Libya, *Arch Biol Sci*, **67**(2), 455–466.

Jeong S.H., Kim J., Min H. (2018). *In Vitro* Antiinflammatory Activity of the *Artemisia montana* Leaf Ethanol Extract in Macrophage RAW 264.7 Cells, *Food and Agricultural Immunology*. **29**(1), 688–698.

Ji S., Lu G., Meng D., Li N., Li X. (2010). Chemical Constituents from the Folium *Artemisiae argyi* (Ⅱ), *J Shenyang Pharm Univ*, **27**(548-550),566.

Jian D.C., Joshi S.B., Parial S. (2009). Comparison of Antiinflammatory Activity of *Artemisia annua* Leaves Extracts Obtained Through Conventional and New Method, *J of Pharmacy Research*, **1**(1), 36.

Joshi R., Satyal P., Setzer W. (2016). Himalayan Aromatic Medicinal Plants: A Review of their Ethnopharmacology, Volatile Phytochemistry, and Biological activities, *Medicines*,**3**(1), 6.

Khataibeh M.H., Daradka H. (2007). Antiandrogenic Activity of *Artemisia herba-alba* in Male Rats, with Emphasis on Biochemical Parameters, *Asian J of chemistry*, **19**(4), 2595-2602.

Khattak S.G., Gilama S.N., Ikram M. (1985). Antipyretic Studies on Some Indigenous Pakistani Medicinal Plants, *J Ethnopharmacol*, **14**, 45-51 .

Kiani B.H., Ullah N., Haq I., Mirza B. (2015). Transgenic *Artemisia dubia* WALL Showed Altered Phytochemistry and Pharmacology, *Arab J Chem*, **12**(8): 2644-2654.

Kim E.K., Kwon K.B., Han M.J., *et al*. (2007). Inhibitory Effect of *Artemisia capillaris* Extract on Cytokine-Induced Nitric Oxide Formation and Cytotoxicity of RINm5F Cells. *Intern J of Mol Med*, **19**(3), 535–540.

Kim J.K., Shin E.C., Lim H.J., *et al*. (2015). Characterization of Nutritional Composition, Antioxidative Capacity, and Sensory Attributes of Seomae Mugwort, a Native Korean Variety of *Artemisia argyi* H. Lév. & Vaniot, *J Anal Methods Chem* **2015**, 916346.

Kim J.T., Park J.Y., Seo H.S. *In Vitro* Antiprotozoal Effects of Artemisinin on *Neospora caninum*, *Veterinary Parasitology*, **103**(1-2), 53-63.

Kim S.M., Lee S.J., Saralamma V.G., Ha S.E., Vetrivel P., Desta K.T., Choi J.Y., Lee W.S., Shin S.C., Kim G.S., Kim G.S. (2019). Polyphenol Mixture of A Native Korean Variety of *Artemisia argyi* H. (Seomae Mugwort) and Its Antiinflammatory Effects, *Intern J of Mol Med*, **9**, 1741-1752.

Kirbag S., Bagci E., Civelek S., Kursat M. (2019). Antimicrobial Properties and Essential Oils Compositions of Artemisia L. Subgen. Drancunculus (Bess.) Rydb. Taxa, *AÇÜ Orman Fak Derg*, **20**(2), 144-149.

Kissinger E., Hien T.T., Hung N.T., Nam N.D., Tuyen N.L., Dinh B.V., Mann C., Phu N.H., Loc P.P., Simpson J.A., White N.J., Farrar J.J. (2000). Clinical and Neurophysiological Study of the Effects of Multiple Doses of Artemisinin on Brain- Stem Function in Vietnamese Patients, *Am J Trop Med Hyg*, **63**, 48–55.

Klayman D.L. (1993). *Artemisia annua*: From Weed to Respectable Antimalarial Plant. In: Kinghorn AD, Balandrin MF (eds.) Human Medicinal Agents from Plants, *ACS Symposium Series* (USA), 242-255.

Kodippili K., Ratnasooriya W.D., Premakumara S., Udagama P.V. (2011). An Investigation of the Antimalarial Activity of *Artemisia vulgaris* Leaf Extract in A Rodent Malaria Model. *International Journal of Green Pharmacy*: 276-281.

Kordali S., Cakir A., Mavi A., Kilic H., Yildirim A. (2005). Screening of Chemical Composition and Antifungal and Antioxidant Activities of the Essential Oils from Three Turkish Artemisia species, *J Agric Food Chem*, **53**(5), 1408-1416.

Kordali S., Kotan R., Mavi A., Kilic H., Yildirim A. (2005). Determination of the Chemical Composition and Antioxidant Activity of the Essential Oil of *Artemisia dracunculus* and of the Antifungal and Antibacterial Activities of Turkish *Artemisia absinthium*, *A. dracunculus, Artemisia santonicum,* and *Artemisia spicigera*, *J Agric Food Chem*, **24**, 9452–9458.

Koreeda M., Nagaki M., Hayami K.I., Matsueda S. (1988). Studies on Sesquiterpene Lactones. XIII: Chemical Constituents of *Artemisia Montana* (NAKAI) PAMP, *Yakugaku Zasshi*, **108**(5), 434-436.

Korkmaz H., Gürdal A. (2002). Effect of *Artemisia santonicum* L. on Blood Glucose in Normal and Alloxan- Induced Diabetic Rabbits, *Phytother Res*, **16**(7), 675-676.

Koul B., Taak P., Kumar A., Khatri T., Sanyal I. (2017). The Artemisia Genus: A Review on Traditional Uses, Phytochemical Constituents, Pharmacological Properties and Germplasm Conservation, *J Glycomics Lipidomics*, **7**:1.

Kraft C., Jenett-Siems K., Siems K., Jakupovic J., Mavi S., Bienzle U., Eich E. (2003). *In Vitro* Antiplasmodial Evaluation of Medicinal Plants from Zimbabwe, *Phytotherapy Research*, **17**, 123–128.

Kursat M., Emre I., Yilmaz O., Civelek S., Demir E., Turkoglu I. (2015). Phytochemical Contents of Five Artemisia Species, *Not Sci Biol*, **7**(4), 495-499.

Kwak J.H., Jang W.Y., Zee O.P., Lee K.R. (1997). Artekeiskeanin A: A New Coumarin-Monoterpene Ether from *Artemisia keiskeana*, *Planta Med*, **63**(5), 474-476.

Lang S.J., Schmiech M., Hafner S., Paetz C., Steinborn C., Huber R., Gaafary M.E. (2019). Antitumor Activity of an *Artemisia annua* Herbal Preparation and Identification of Active Ingredients, *Phytomedicine*, **62**, 152962.

Lee H.J., Zerin T., Song Y.H., Lee B.E., Song H.Y. (2013). Immunomodulation Potential of *Artemisia capillaris* Extract in Rat Splenocytes, *Intern J of Phytomedicine*, **5**(3),356–361.

Lee K.H., Min Y.D., Choi S.Z., Kwon H.C., Cho O.R., Lee K.C., Lee K.R. (2004). A New Sesquiterpene Lactone from *Artemisia rubripes* Nakai, *Arch Pharm Res*, **27**(10), 1016-1019.

Lee M.R. (2002). Plants Against Malaria. Part 2: *Artemisia annua* (Qinghaosu or the Sweet Wormwood), *J R Coll Physicians Edinb*, **32**, 300-305.

Lee Y.K., Hong E.Y., Whang W.K. (2017). Inhibitory Effect of Chemical Constituents Isolated from *Artemisia iwayomogi* on Polyol Pathway and Simultaneous Quantification of Major Bioactive Compounds, *Biomed Res Int*, **12**(4), 1-12.

Leonardi E., Gilvary G., White N.J., Nosten F. (2001). Severe Allergic Reactions to Oral Artesunate: A Report of Two Cases, *Trans R Soc Trop Med Hyg*, **95**,182–183.

Li L., Liu H., Tang C., (2017). Cytotoxic Sesquiterpene Lactones from *Artemisia anomala*, *Phytochemistry Letters*, **20**, 177-180.

Lin F.D., Luo D.W., Ye J., Xiao M.T. (2014). Chemical Constituents of *Artemisia lactiflora* (II), *Zhongguo Zhong Yao Za Zhi*, **39**(13), 2531-2535.

Liu X.C., Lu X.N., Liu ZL. (2014). GC-MS Analysis of Insecticidal Essential Oil of Aerial Parts of *Artemisia anomala* S. Moore Against *Liposcelis Bostrychophila badonnel* (Psocoptera: Liposcelididae), *Journal of Entomology and Zoology Studies*, **2**(4), 172-176.

Lone S.H., Bhat K.A., Naseer S., Rather R.A., Khuroo M.A., Tasduq S.A. (2013). Isolation, Cytotoxicity Evaluation and HPLC- Quantification of the Chemical Constituents from *Artemisia amygdalina* Decne, *J Chromatogr B Analyt Technol Biomed Life Sci*, **940**, 135-141.

Lopes-Lutz D., Alviano D.S., Alviano C.S., Kolodziejczyk P.P. (2008). Screening of Chemical Composition, Antimicrobial and Antioxidant Activities of Artemisia Essential Oils, *Phytochemistry*, **69**(8), 1732-1738 .

Mahmoudi M., Ebrahimzadeh M.A., Ansaroudi F., Nabavi S.F., Nabavi S.M. (2009). Antidepressant and Antioxidant Activities of *Artemisia absinthium* L. at Flowering Stage, *African Journal of Biotechnology*, **8**(24), 7170-7175 .

Mangena T., Muyima N.Y.O. (1999). Comparative Evaluation of the Antimicrobial Activities of Essential Oils of *Artemisia afra, Pteronia incana* and *Rosmarinus officinalis* on Selected Bacteria and Yeast Strains, *Letters in Applied Microbiology*, **28**, 291–296.

Mannan A., Ahmed I., Arshad W., Asim M., Qureshi R.A., Hussain I., Mirza B. (2010). Survey of Artemisinin Production by Diverse Artemisia Species in Northern Pakistan, *Malaria Journal*, **9**, 310.

Masotti V., De Jong L., Moreau X., Rabier J., Laffont-Schwob I., Thiery A. (2012). Larvicidal Activity of Extracts from Artemisia Species Against *Culex pipiens* L. Mosquito: Comparing Endemic Versus Ubiquist Species for Effectiveness, *Comptes Rendus Biologies*, **335**(1), 19-25.

Masuda Y., Asada K., Satoh R., Takada K., Kitajima J. (2015). Capillin, A Major Constituent of *Artemisia capillaris* Thunb. Flower Essential Oil, Induces Apoptosis Through the Mitochondrial Pathway in Human Leukemia HL-60 Cells, *Phytomedicine*, **22**(5), 545–552.

Mehbubun N. (2017). Study of A Rare Medicinal Plant *Artemisia nilagirica*: Phytochemical Screening, Antioxidant Properties and Antimicrobial Activities, Bechelor thesis, BRAC University, 58-63.

Meierzu BC. (2011). The Rise to Prominence of *Artemisia annua* L. – The Transformation of a Chinese Plant to A Global Pharmaceutical, *Revue Africaine de Sociologie*, **14**(2), 24–46 .

Mei-Tian X., Jing Y., Ben-Bo H. (2011). Study on Chemical Constituents of *Artemisia lactiflora*, *Chin Pharm J*, **46**, 414-417.

Metwally MA. (2001). Chemical Constituents of *Artemisia inculta*, *Boll Chim Farm*, **140**(4), 265-266.

Mighri H., Hajlaoui H., Akrout A., Najjaa N., Neffati M. (2010). Antimicrobial and Antioxidant Activities of *Artemisia herba-alba* Essential Oil Cultivated in Tunisian Arid Zone, *C R Chimie*, **13**, 380-386.

Mills S., Bone K. (2000). *Principles and Practice of Phytotherapy: Modern Herbal Medicine*. London: Churchill Livingstone.

Moerman DE. (1998). *Native American Ethnobotany,* 1st ed. Portland, USA, Timber Press, Incorporated.

Mohamed A.H., El-Sayed M.A., Hegazy M.E., Helaly S.E., Esmail A.M., Mohamed N.S. (2010). Chemical Constituents and Biological Activities of *Artemisia herba-alba*, *Rec Nat Products*, **4**, 1-25.

Mohammadian A., Moradkhani S., Ataie S., Shayesteh T.H., Sedaghat M., Kheiripour N. (2016). Antioxidative and Hepatoprotective Effects of Hydroalcoholic Extract of *Artemisia absinthium* L. in Rat, *J HerbMed Pharmacol*, **5**(1), 29-32.

Mojarad T.B., Roghani M., Zare N. (2005). Effect of Subchronic Administration of Aqueous *Artemisia annua* Extract on α1- Adrenoceptor Agonist- Induced Contraction of Isolated Aorta in Rat, *Iranian Biomedical Journal*, **9**(2), 57-62.

Mokhtar A.B., Ahmed S.A, Eltamany E. Karanis P. (2019). Anti-Blastocystis Activity *In Vitro* of Egyptian Herbal Extracts (Family: Asteraceae) With Emphasis on *Artemisia judaica*, *Int J Environ Res Public Health*, **16**(9), 1555.

Mubashir K., Ganai B.A., Ghazanfar K., Akbar S., Malik A.H., Masood A. (2013). Evaluation of *Artemisia amygdalina* D. for Anti-Inflammatory and Immunomodulatory Potential, ISRN Inflamm, **2013**, 483646.

Mueller M.S., Karhagomba I.B., Hirt H.M., Wemakor E. (2000). The Potential of *Artemisia annua* L. as a Locally Produced Remedy for Malaria in the Tropics: Agricultural, Chemical and Clinical Aspects, *J Ethnopharmacol*, **73**, 487–493.

Mukinda JT. (2005). Acute and Chronic Toxicity of the Flavonoid- Containing Plant, *Artemisia afra* in Rodents. MSc thesis, University of the Western Cape, Bellville- South Africa.

Mulatu A., Mekonnen Y. (2007). Spasmolytic Effects of *Artemisia afra* and *Artemisia rehan* in Tissue Preparations, *Ethiopian Medical*, **45**(4), 371-376.

Munyangi J., Cornet-Vernet L., Idumbo M., Lu C., Lutgen P., Perronne C., Ngombe N., Bianga J., Mupenda B., Lalukala P., Mergeai G., Mumba D., Towler M., Weathers P. (2019). *Artemisia annua* and *Artemisia afra* Tea Infusions vs. Artesunate- Amodiaquine (ASAQ) in Treating *Plasmodium falciparum* Malaria in a Large Scale, Double Blind, Randomized Clinical Trial, *Phytomedicine*, **57**, 49–56 .

Muto T., Watanabe T., Okamura M., Moto M., Kashida Y., Mitsumori K. (2003). Thirteen Week Repeated Dose Toxicity of Wormwood (*Artemisia absnthium*) Extract in Rats, *The Journal of Toxicological Sciences*, **28**(5), 471-478.

Muyima N.Y.O., Zulu G., Bhengu T., Popplewell D. (2002). The Potential Application of Some Novel Essential Oils as Natural Cosmetic Preservatives in an Aqueous Cream Formulation, *Flavour and Fragrance Journal*, **17**, 258–266.

Nadeem M., Shinwari Z.K., Qaiser M. (2013). Screening of Folk Remedies by Genus Artemisia Based on Ethnomedicinal Surveys and Traditional Knowledge of Native Communities of Pakistan, *Pak J Bot*, **45**, 111-117.

Nageeb A., Al-Tawashi A., Emwas A.H.M., Al-Talla Z.A.H., Al-Rifai N. (2013). Comparison of *Artemisia annua* Bioactivities Between Traditional Medicine and Chemical Extracts, *Current Bioactive Compounds*, **9**(4), 324-332.

Naik S.K., Mohanty S., Padhi A., Pati R., Sonawane A. (2014). Evaluation of Antibacterial and Cytotoxic Activity of *Artemisia nilagirica* and *Murraya koenigii* Leaf Extracts Against Mycobacteria and Macrophages, *BMC Complement Altern Med*, **14**, 87.

Naili M.B., Alghazeer R.O., Saleh N.A. Al-Najjar A.Y. (2010). Evaluation of Antibacterial and Antioxidant Activities of *Artemisia campestris* (Astraceae) and *Ziziphus lotus* (Rhamnacea), *Arabian Journal of Chemistry*, **3**, 79–84.

Nibret E., Wink M. (2010). Volatile Components of Four Ethiopian Artemisia Species Extracts and Their In Vitro Antitrypanosomal and Cytotoxic Activities, *Phytomed*, **17**, 369-374.

Nigam M., Atanassova M., Mishra A.P., Pezzani P., Devkota H.P., Plygun S., Salehi B., Setzer W., Sharifi-Rad J. (2019). Bioactive Compounds and Health Benefits of Artemisia Species, *Natural Product Communic*: 1–17.

Numonov S., Sharopov F., Salimov A., Sukhrobov P., Atolikshoeva S., Safarzoda R., Habasi M., Aisa H.A. (2019). Assessment of Artemisinin Contents in Selected Artemisia Species from Tajikistan (Central Asia), *Medicines*, **6**, 23.

Obolskiy D., Pischel I., Feistel B., Glotov N., Heinrich M. (2011). *Artemisia dracunculus* L. (Tarragon): A Critical Review of its Traditional Use, Chemical Composition, Pharmacology and Safety, *J Agri Food Chem*, **59**(21), 11367-11384.

Ogbole E.A., IdyuIsaiah A., Ogundeko T., Asalu A., Builder M., Aguiyi J. (2014). Acute Toxicity Studies of Locally Cultivated *Artemisia annua* Leaf Extract in Rats, *World J Pharm Sci*, **2**(12), 1864-1870.

Onuchak L. A., Kurkin V. A., Minakhmetov R. A., Kurkina A.V. (2000). HPLC Analysis of *Artemisia dracunculus* Extracts, *Chem Nat Compd (Khim Prir Soedin)*, **36**, 115–117.

Orjih A.U. (1996). Haemolysis of *Plasmodium falciparum* Trophozoite- Infected Eryuthrocytes After Artemisinin Exposure, *Br J Haematol*, **92**, 324–8.

Ornano L., Venditti A., Ballero M., Sanna C., Quassinti L., Bramucci M., Lupidi G., Papa F., Vittori S., Maggi F., Bianco A. (2013). Chemopreventive and Antioxidant Activity of the Chamazulene- Rich Essential Oil Obtained from *Artemisia arborescens* L. Growing on the Isle of La Maddalena, Sardinia, Italy, Chem Biodivers, **10**(8), 1464-1474.

Otsuka K., Shoji J., Takido M. Cho S. (1992). Cho S. *A Pictorial Encyclopedia of Chinese Medical Herbs* (I). Chuokoran-Sha Inc. Tokyo, Japan.

Panda S., Rout J.R., Pati P., Ranjit M., Sahoo S.L. (2018). Antimalarial Activity of *Artemisia nilagirica* against *Plasmodium falciparum*, *J Parasit Dis*, **42**(1), 22–27.

Paolini J., El Ouariachi M., Bouyanzer A., Hammouti B., Desjobert J.M., Costa J., Muselli A. (2010). Chemical variability of *Artemisia herba-alba* As so Essential Oils from East Morocco, *Chem Papers*, **64**(5), 550–556.

Parameswari P., Devika R., Vijayaraghavan P. (2019). *In Vitro* Antiinflammatory and Antimicrobial Potential of Leaf Extract from *Artemisia nilagirica* (Clarke) Pamp, *Saudi J Biol Sci*, **26**(3), 460–463.

Qadir M., Banday J.A., Shah W.A. GC-MS Analysis and Antioxidant Activity of Essential Oil of *Artemisia amygdalina* from Kashmir, India, *The Journal of Phytopharmacology*, **3**(4), 234-237.

Qingjuan L.I., Chen W., Fan J., Qian Z., Li X.H., Liu C.Y. (2014). Study on the Chemical Constituents of *Artemisia myriantha* Wall.Ex Bess, *Chin J Mod Appl Pharm*, **31**,706-710.

Quisumbing E. (1978). *Medicinal Plants of the Philippines*. Manila, Philippines: Bureau of Printing.

Rabe T., Van Staden J. (1997). Antibacterial Activity of South African Plants Used for Medicinal Purposes, *Journal of Ethnopharmacology*, **56**, 81–87.

Radulovic N.S., Randjelovic P.J., Stojanovic N.M., Blagojević P.D., Stojanović-Radić Z.Z., Ilić I.R., Djordjević V.B. (2013). Toxic Essential Oils. Part II: Chemical, Toxicological, Pharmacological and Microbiological Profiles of *Artemisia annua* L. Volatiles, *Food and Chemical Toxicology*, **58**, 37–49.

Ragasa C.Y., de Jesus J.P., Apuada M.J., Rideout J.A. (2008). A New Sesquiterpene from *Artemisia vulgaris*, *Nature Med*, **62**, 461–463.

Rasool R., Ganai B.A., Akbar S., Kamili A.N. (2013). Free Radical Scavenging Potential of *In Vitro* Raised and Greenhouse Acclimatized Plants of *Artemisia amygdalina*, *Chin J Nat Med*, **11**(4), 377-384.

Rasool R., Ganai B.A., Kamili A.N. Akbar S. (2012). Antioxidant Potential in Callus Culture of *Artemisia amygdalina* D, *Natural Product Research*, **26**(22), 2103–2106.

Rekkab S., Abaza I., Chibani S., Kabouche A., Kabouche Z. (2016). Chemical Composition of the Essential Oil of Aerial Parts of *Artemisia herba-alba* Asso. from Oum El-Bouaghi (Algeria) and Chemotaxonomic Survey, *J Mater Environ Sci*, **7**(12), 4383–4390.

Richard A.J., Burris T.P., Sanchez-Infantes D., Beyl R., Burris T.P., Mynatt R., Ribnicky D.M., Stephens J.M. (2014a). Artemisia Extracts Activate PPARγ, Promote Adipogenesis, and Enhance Insulin Sensitivity in Adipose Tissue of Obese Mice, *Nutrition*, **30**(Suppl), S31–S36, .

Richard A.J., Fuller S., Fedorcenco V., (2014b). *Artemisia scoparia* Enhances Adipocyte Development and Endocrine Function *In Vitro* and Enhances Insulin Action *In Vivo*, *PLoS One*, **9**, e98897.

Rosanova M.T., Stamboulian D., Lede R. (2012). Revisión Sistemática: Cuál es el Agente Tópico Más Eficaz en la Prevención de Infecciones en el Paciente Quemado, *Arch Argent Pediatr*, **110,** 298-303.

Saddi M., Sanna A., Cottiglia F., Chisu L., Bonsignore L., De Logu A.(2007). Antiherpevirus Activity of *Artemisia arborescens* Essential Oil and Inhibition of Lateral Diffusion In Vero cells, *Ann Clin Microbiol Antimicrob*, **6**, 10-16.

Sahu N., Meena S., Shukla V., Chaturvedi P., Kumar B., Datta D., Arya K.R. (2018). Extraction, Fractionation and Re-Fractionation of *Artemisia nilagirica* for Anticancer Activity and HPLC-ESI-QTOF-MS/MS Determination, *J Ethnopharmacol*, **213**, 72-80.

Sajid M., Khan M.R., Shah N.A., Ullah S., Younis T., Majid M., Ahmad B., Nigussie D. (2016). Proficiencies of *Artemisia scoparia* Against CCl_4 induced DNA Damages and Renal Toxicity in Rat, *BMC Complement Altern Med*, **16**: 149.

Sajjad N., Wani A., Sharma A., Ali R., Hassan S., Hamid R., Habib H., Ganai B.A. (2019). *Artemisia amygdalina* Upregulates Nrf2 and Protects Neurons Against Oxidative Stress in Alzheimer Disease, *Cell Mol Neurobiol*, **39**(3), 387-399.

Saleh M.A., Belal M.H., EL-Baroty G. (2006). Fungicidal Activity of *Artemisia herba-alba* Asso (Asteraceae), J of Envir Sci Health Part B: Pesticides, *Food Contaminants Agricultural Wastes*, **41**(3), 237-244.

Sallal A.K.J., Alkofahi A. (1996). Inhibition of the Hemolytic Activities of Snake and Scorpion Venoms *In Vitro* with Plant Extracts, *Biomedical Lett*, **53**(212), 211-215.

Sansa G., Rjeibi I., El Ayeb M., Srairi-Abid N., Bellasfer Z., Fekhih A. (2007). Use of Medicinal Plants Against Scorpionic and Ophidian Venoms, *Archives de L'Institut Pasteur de Tunis*, **84**(1-4), 49-55.

Santomauro F., Bilia A.R., Flamini G. Sacco C. (2015). Antibacterial Activity of Tuscan *Artemisia annua* Essential Oil and its Major Components Against some Foodborne Pathogens, *LWT-Food Science and Technology*, **64**(2), 1251-1254.

Sayyah M., Nadjafnia L., Kamalinejad M. (2004). Anticonvulsant Activity and Chemical Composition of *Artemisia dracunculus* L. Essential Oil, *J Ethnopharmacol*, **94**, 283–287.

Sefi M., Fetouri H., Makni M. Zeghal N. (2010). Mitigating Effects of Antioxidant Properties of *Artemisia campestris* Leaf Extract on Hyperlipidemia, Advanced Glycation end Products and Oxidative Stress in Alloxan-Induced Diabetic Rats, *Food Chem Toxicol*, **48**(7), 1986-1993.

Sefi M., Bouaziz H., Soudani N., Boudawara T., Zeghal N.(2011). Fenthion Induced-Oxidative Stress in the Liver of Adult Rats and Their Progeny: Alleviation by *Artemisia campestris*, *Pesticide Biochemistry and Physiology*, **101**(2), 71-79.

Sen R., Bandyopadhyay S., Dutta A., Mandal G., Ganguly S., Saha P. (2007). Artemisinin Triggers Induction of Cell-Cycle Arrest and Apoptosis in *Leishmania donovani* Promastigotes, *J med microb*, **56**, 1213-8.

Sengul M., Ercisli S., Yildiz H., Gungor N., Kavaz A., Cetin B. (2011). Antioxidant, Antimicrobial Activity and Total Phenolic Content Within the Aerial Parts of *Artemisia absinthum, Artemisia santonicum* and *Saponaria officinalis*, *Iranian J of Pharmac Res*, **10**(1), 49-56.

Shafi G., Hasan T.N., Syed N.A., Al-Hazzani A.A., Alshatwi A.A., Jyothi A., Munshi A. *Artemisia absinthium* (AA): A Novel Potential Complementary and Alternative Medicine for Breast Cancer, *Mol Biol Rep*, **39**(7), 7373-7379.

Shafi N., Khan G.A., Ghauri E.G. (2004). Antiulcer effect of *Artemisia absinthium* L. in rats, *Pak J Sci Ind Res*, **47**(2),130-134.

Sharopov F.S., Setzer W.N. (2011). Thujone-Rich Essential Oils of *Artemisia rutifolia* Stephan ex Spreng. Growing Wild in Tajikistan, *J Essent Oil Bear Pl*, **14**(2), 136-139.

Sharopov F.S., Zhang H., Wink M., Setzer WN. (2015). Aromatic Medicinal Plants from Tajikistan (Central Asia), *Medicines*, **2**(1), 28-46.

Sherif A., Hall R.G. El-Amamy M. (1987). Drugs, Insecticides and Other Agents from Artemisia, *Medical Hypotheses*, **23**, 187-193.

Siddiqui M.A., Ansari S. (2015a). Therapeutic Effect of a Unani Formulation on Hepatitis B Surface Antigen in Chronic Hepatitis B: A Case Series, *Asian J Pharm Clin Res*, **8**(5), 76-78 .

Siddiqui M.A., Ansari S. (2015b). Efficacy of a Unani Formulation on Viral Load in Chronic Hepatitis B, *Indo Am J Pharm Research*, **5**(04), 1487-90 .

Sijelmassi A. *Les Plantes Médicinales du Maroc*. Edition Le Fennec, Casablanca. Maroc, 1993.

Soliman M.M.M. (2006). Phytochemical and Toxicological Studies of Artemisia L. (Compositae) Essential Oil Against Some Insect Pests, *Acta Phytopathologica et Entomologica Hungarica*, **41**(3-4), 395-406.

Soliman MMM. (2007). Phytochemical and Toxicological Studies of Artemisia L. (Compositae) Essential Oil Against Some Insect Pests, *Archives of Phytopathology and Plant Protection*, **40**(2), 128-138.

Song W.X., Ji T.F., Si Y.K., Su Y.L., YK S., YL S. (2006). Studies on Chemical Constituents in Herb from *Artemisia rupestris*, *Zhongguo Zhong Yao Za Zhi*, **31**(21), 1790-1792.

Squires J.M., Ferreira J.F., Lindsay D.S., Zajac A.M. (2011). Effects of Artemisinin and Artemisia extracts on *Haemonchus contortus* in Gerbils (*Meriones unguiculatus*), *Veterinary Parasitology*, **175**(1), 103–108.

Suseela V., Gopalakrishnan V.K., Varghese S. (2010). *In Vitro* Antioxidant Studies of Fruits of *Artemisia nilagirica* (Clarke) Pamp, *Indian J Pharm Sci*, **72**(5), 644–649.

Suzhang Z., Wei Y., Zhengyi G. (2016). Study on the Chemical Constituents of *Artemisia scoparia*, *J Xinjiang Med Univ*, **39**, 408-410.

Tajehmiri A., Issapour F., Moslem M.N., Lakeh M.T., Kolavani M.H. (2014). *In Vitro* Antimicrobial Activity of *Artemisia annua* Leaf Extracts against Pathogenic Bacteria, *Adv Stud Biol*, **6**, 93-97.

Tan X., Wang Y.L., Yang X.L. Zhang DD. (2014). Ethyl Acetate extract of *Artemisia anomala* S. Moore Displays Potent Antiinflammatory Effect, *Evidence-Based Complementary and Alternative Medicine*, **2014**, 681352.

Tariku Y., Hymete A., Hailu A., Rohloff J. (2011). *In Vitro* Evaluation of Antileishmanial Activity and Toxicity of Essential Oils of *Artemisia absinthium* and *Echinops kebericho*, *Chem Biodivers*, **8**(4), 614-623.

Tariq K.A., Chishti M.Z., Ahmad F., Shawl A.S. (2009). Anthelmintic Activity of Extracts of *Artemisia absinthium* Against Ovine Nematodes, *Vet Parasitol*, **160**(1- 2), 83-88 .

Tezuka Y., Stampoulis P., Banskota A.H., Awale S., Tran K.Q., Saiki I., Kadota S. (2000). Constituents of the Vietnamese Medicinal Plant Orthosiphon Stamineus, *Chem Pharm Bull*, **48**, 1711–1719.

Todorova M.N., Tsankova E.T., Trendafilova A.B., Gussev C.V. (1996). Sesquiterpene Lactones with the Uncommon Rotundane Skeleton from *Artemisia pontica* L., *Phytochemistry*, **41**(2), 553-556.

U.S. National Plant Germplasm System. Artemisia, http://tn-grin.nat.tn/gringlobal/taxonomylist.aspx?category= species & type=genus&value=Artemisia&id=997

Utzinger J., Xiao S.H., Tanner M., Keiser J. (2007). Artemisinins for Schistosomiasis and Beyond, *Curr Opin Invest Dr*, **8**,105-116.

Valdés A.F., Martínez J.M., Lizama R.S. , Vermeersch M., Cos P., Maes L. (2008). *In Vitro* Antimicrobial Activity of the Cuban Medicinal Plants *Simarouba glauca* DC, *Melaleuca leucadendron* L and *Artemisia absinthium* L., *Mem Inst Oswaldo Cruz*, **103**(6), 615-618.

Vallès J., Garnatje T., Hidalgo O., Martin J., Pellicer J., Garnatje T. (2011). Biology, Genome Evolution, Biotechnological Issues and Research Including Applied Perspectives in Artemisia (Asteraceae), *Advances in Botanical Research*, 60, 349-419.

Van Vugt M., Angus B.J., Price R.N., Mann C., Simpson J. Poletto C., Htoo S.E., Looareesuwan S., White N.J., Nosten F. A. (2000). A Case-Control Auditory Evaluation of Patients treated with

Artemisinin Derivatives for Multidrug- Resistant *Plasmodium falciparum* malaria, *Am J Trop Med Hyg*, **62**, 65–69.

Van Vuuren, S.F., Viljoen, A.M. (2006). A Comparative Investigation of the Antimicrobial Properties of Indigenous South African Aromatic Plants with Popular Commercially Available Essential Oils, *Journal of Essential Oil Research*, **18**, 66–71.

Van Wyk B.E., Wink M. *Medicinal Plants of the World*. Briza Publications, Pretoria, South Africa, 2004: PP 54–56.

Verma P.R., Subburaju T., Balakrishnan N. (2006). Larvicidal Activity of *Artemisia nilagirica* (Clarke) Pamp. and *Ocimum sanctum* L.: A Preliminary Study, *Journal of Natural Remedies*, **6**, 157-161.

Wang D.Q.,Yang J., Xu J. (2020). Polyphenol and Flavonoids Content and Antioxidant Activity of Different Solvent Extracts from *Artemisia argyi*, *Asian Journal of Immunology*, **3**(4), 30-35.

Wang J., Lin L., Li B., Zhang F., Liu N. (2019). Zhang F and Liu N. Dietary *Artemisia vulgaris* Meal Improved Growth Performance, Gut Microbes, and Immunity of Growing Rex Rabbits, *Czech Journal of Animal Science*, **64**(4), 174–179.

Wang J.X., Tang W., Zhou R., Wan J., Shi L.P., Zhang Y. (2008). The New Water-Soluble Artemisinin Derivative SM905 Ameliorates Collagen- Induced Arthritis by Suppression of Inflammatory and Th17 Responses, *British J of Pharma*, **153**(6), 1303–1310.

Wang Q.H., XL W., Wang JH. (2011). Chemical Constituents of *Artemisia frigida* (II), *Chin Tradit Herbal Drug*, **42**, 1075-1078.

Wang S., Tu P. Anti- Neuroinflammatory Constituents from *Artemisia argyi*, *J Chin Pharm Sci*, **22**, 377-380.

Wang X.Q., Zhou C.J., Zhang N., Wu G., Li M. (2011). Studies on the Chemical Constituents of *Artemisia lavandulaefolia*, *Zhong Yao Cai*, **34**(2), 234-236.

Wang Y., Yin J., Qiao Y., Zhang H., Lu X. (2007). Studies on Antioxidant Activity and Chemical Constituents of *Artemisia halodendron*, *Asian J Tradit Med*, **2**, 30-33.

Wang Z.Q., Zhang X.H., Yu Y., Tipton R.C., Raskin I., Ribnicky D., Johnson W., Cefalu W.T. (2013). *Artemisia scoparia* Extract Attenuates Non-Alcoholic Fatty Liver Disease in Diet- Induced Obesity Mice by Enhancing Hepatic Insulin and AMPK Signaling Independently of FGF21 Pathway, *Metabolism*, **62**, 1239–1249.

Woerdenbag H.J., Pras N., Bos R., Visser J.F., Hendriks H., Malingré T.M. (1991). Analysis of Artemisinin and Related Sesquiterpenoids from *Artemisia annua* L. by Combined Gas Chromatography/mass Spectrometry, *Phytochem Anal*, **2**, 215–219.

Wojtkowiak-Giera A., Derda M., Kosik-Bogacka D., Kolasa-Wołosiuk A., Solarczyk P., Cholewinski M., Wandurska-Nowak E., Jagodzinski P.P., Hadas E. (2018). Influence of *Artemisia annua* L. on Toll-Like Receptor Expression in Brain of Mice Infected with *Acanthamoeba Sp*., *Exp Parasitol*, **185**, 17–22.

Woodrow C.J., Haynes R.K., Krishna S. (2017). Artemisinins, *Postgrad Med J*, **81**, 71–78.

Wu T., He F., Ma Q.L.Chen J., Aisa HA. , (2017). Chemical Constituents of *Artemisia rupestris*, *Chem Nat Compd*, **53**(5), 991-993.

Xiao M.T., Luo D.W., Zan K., Ye J., PF T. (2015). Chemical Constituents from the Aerial Parts of *Artemisia lactiflora* (III), *J Chin Pharm*, **50**, 209-212.

Xueyuan G., Yeliang L., Zhen H., Xiaoming Z. (2016). Study of Screening the Effective Part of Alcohol Extract of *Artemisia anomala* S. Moore on Antifocal Cerebral Ischemia, *Chin J Mod Appl Pharm*, **33**(10), 1243.

Yan D., Chun L., Choi E.M., Ra, J. C., Kim Y. H. (2009). Chemical Constituents from *Artemisia iwayomogi* Increase the Function of Osteoblastic MC3T3-E1 Cells, *Nat Prod Sci*, **15**, 192-197.

Yang C., Hu D.H., Feng Y. (2015). Antibacterial Activity and Mode of Action of the *Artemisia capillaris* Essential Oil and its Constituents Against Respiratory Tract Infection-Causing Pathogens, *Mol Med Rep*, **11**(4), 2852-2860.

Yang B., Zhou S., Li C., Wang Y. (2010). Toxicity and Side Effects of *Artemisiae annuae, Zhongguo Zhong Yao Za Zhi*, **35**(2), 204-207.

Yashphe J., Feuerstein I., Barel S., Segal R. (1987). The Antibacterial and Antispasmodic Activity of *Artemisia herba-alba* Asso. II. Examination of Essential Oils from Various Chemotypes, *Int J Crude Drug Res*, **25**(2), 89-96.

Yashphe J., Segal R., Breuer A., Erdreich-Naftali G. (1979). Antibacterial Activity of *Artemisia herba-alba*. *J of Pharma Sci*, **68**(7), 924-925.

Yazdanparast R., Saee A. (1999). Effects of Aqueous Tarragon, *Artemisia dracunculus*, Extract on Lipid and Coagulatory Parameters in Rats, *Biomed Lett*, **59**, 137–141.

Yh H., Li Y. (1994). Chemical Constituents of *Artemisia roxbugiana* Wall, *Zhongguo Zhong Yao Za Zhi*, **19**(164-165), 191.

Yucheng G., Zuozuo T. (1993). Chemical Constituents of Japanese Wormwood (*Artemisia japonica*), *Chin Tradit Herbal Drug*, **24**, 122-124.

Zan K., Chen X.Q., Chai X.Y., Wu Q., Fu Q., Zhou S.X., Tu P.F. (2012). Two New Cytotoxic Eudesmane Sesquiterpenoids from *Artemisia anomala*, *Phytochem Lett*, **5**, 313-315.

Zeb S., Ali A., Zaman W., Ullah F., Shakoor A. (2018). Pharmacology, Taxonomy and Phytochemistry of the Genus Artemisia Specifically from Pakistan: A Comprehensive Review, *Pharm Biomed Res*, **4**(4), 1-12.

Zeng W., Liang H. (2014). Flavonoids from *Artemisia gmelinii* Web. Ex Stechm, *J Chin Pharm Sci*, **23**(7), 496-499.

Zeng Y.T., Jiang J.M., Lao H.Y., Guo J.W., Lun Y.N., Yang M. (2015). Antitumor and Apoptotic Activities of the Chemical Constituents from the Ethyl Acetate Extract of *Artemisia indica*, *Mol Med Rep*, **11**(3), 2234-2240.

Zeraati F., Esna-Ashari F., Araghchian M., Hossein A. (2014). Evaluation of Topical Antinociceptive Effect of *Artemisia absinthium* Extract in Mice and Possible Mechanisms, *Afr J Pharm Pharmacol*, **8**(19), 492-496 .

Zhang D.D., Li J.T., Zhang L.J., Gao Y.H., Pan Y.F., Bian K. Li Y.J. (2007). iNOS inhibitory Effect of Total Flavones of *Artemisia anomala* S. Moore Purified by Different Kinds of Macroporous Resin, *Chemistry*, **5**(1),70-73.

Zhang H., Xu G., Zhang H. (2008). Scavenging Capacity of *Artemisia anomala* S. Moore on Superoxide Free Radical and Hydroxyl Free Radical. Journal of Wuxi University of Light Industry 2008; https://en.cnki.com.cn/Article_ en/CJFDTOTAL-WXQG 200006008.htm

Zhang L.B., Lv J.L., Chen A.U., Hong L., Yan X.Q., Duan J.A. (2013). Chemical Constituents from *Artemisia argyi* and Their Chemotaxonomic Significance, *Biochemical Systematics and Ecology* **50**, 455-458.

Zhang Y., Zhang J., Yao J., Yang Y.L., Wang L., Dong L.N. (2005). Studies on the Chemical Constituents of the Essential Oil of *Artemisia dracunculus*, *Zhongguo Zhong Yao Za Zhi*, **30**(8), 594-596.

Zhang Y.X., Sun H.X.(2009). Immunosuppressive Effect of Ethanol Extract of *Artemisia annua* on Specific Antibody and Cellular Responses of Mice Against Ovalbumin, *Immunopharmacol Immunotoxicol*, **31**(4), 625-630.

Zhao J.Y., Zheng X.X., Newman R.A., Zhong Y., Liu Z.J., Nan P. (2013). Chemical Composition and Bioactivity of the Essential Oil of *Artemisia anomala* from China, *J Essent Oil Res*, **25**,520-525.

Zhao Y., Geng C.A., Sun C.L., Ma Y.B., Huang X.Y., Cao T.W., He K., Wang H., Zhang X.M., Chen J.J. (2015). Isolation, Synthesis and Anti-Hepatitis B Virus Evaluation of p-Hydroxyacetophenone Derivatives from *Artemisia capillaries*, *Bioorganic & Medicinal Chemistry Letters*, **25**(7), 1509–1514 .

Zhao Y., Geng C.A., Sun C.L., Ma Y.B., Huang X.Y., Cao T.W., He K., Wang H., Zhang X.M., Chen J.J. (2014). Polyacetylenes and Antihepatitis B virus Active Constituents from *Artemisia capillaries*, *Fitoterapia*, **95**, 187–193.

Zimmermann-Klemd A.M., Reinhardt J.K., Morath A., Schamel W.W., Steinberger P., Leitner J., Huber R., Hamburger M. and Gründemann C. (2020). Immunosuppressive Activity of *Artemisia argyi* Extract and Isolated Compounds, *Frontiers in Pharmacology*, **11**, 402.

Biographical Sketch

Al-Snafi is a professor of pharmacology. He got his PhD in pharmacology and therapeutics from Baghdad College of Medicine 1996. He is the author of 25 textbooks, published 296 papers and supervised 15 PhD and 35 MSc students. He is the founded and was dean of two colleges of pharmacy in Iraq, for 5 years. He worked as chancellor of Thi qar University- South of Iraq, for 8 years.