

Recipes Research

Relationship between Temperaments of Medicinal Plants and Their Major Chemical Compounds

Mohammad Reza Shams Ardekani^{1,2}, Roja Rahimi¹, Behjat Javadi¹, Leila Abdi¹, Mahnaz Khanavi^{1,2}

Objective: To determine any relationship between temperaments of medicinal plants referred to traditional Iranian manuscripts and their major chemical compounds.

Methods: Plants used in traditional Iranian medicine were categorized based on their major chemical compounds including alkaloids, phenolic compounds, and essential oils. Their temperaments were extracted from traditional herbal pharmacopeias of Iran. The possible relationship between major chemical compounds and temperaments of each group were evaluated.

Results: Plants containing phenolic compounds as their major constituents are hot and dry temperaments except those contain tannins with cold and dry temperaments. Plants containing essential oils have hot and dry temperaments except those whose major essential oils with alcoholic structure which have cold and dry temperaments. Alkaloid-containing plants have cold and dry or hot and dry temperaments based on their alkaloidal structures.

Conclusions: There is a close relationship between major chemical compounds of medicinal plants and their temperaments mentioned in traditional Iranian manuscripts.

Keywords: traditional Iranian medicine; temperament; alkaloids; phenolic compounds; volatile oils

The principles of traditional Iranian medicine (TIM) are based on quadratic elements, which are air, fire, water, and soil and each one has their specific quality: air is hot and moist, fire is hot and dry, water is cold and moist, and soil is cold and dry. Followers of this doctrine believe that the entire world is made from quadratic elements, and the differences and diversities between objects are because of different ratios of these four elements in their structures. Hereby, every object in the world has a specific quality based on dominant element (s) in its structure. This specific quality has been known as temperament (Midzaj). For example, if water is dominant, the object has cold and moist temperament and if water and soil both are dominant the object has cold temperament (Table 1).^{1,2} Belief to temperament has not been exclusively existed in TIM but also in many other traditional medical theories, including Unani (Greek), Arabic, Roman, Indian, European, and Chinese traditional medicines.³ Plants also are not exceptional from this rule and have their own temperaments. The temperaments of plants have been understood in TIM by different methods such as their pharmacological effects, flavor, odor, and color.⁴ There are many herbal pharmacopeias in TIM that describe plants' temperaments such as the volume twenty and twenty one of Al-Havi, Al-Abnya, the second book of Canon, Tohfe- al-omenin, and Makhzan-al-Advia.⁴⁻⁹ The goal of this study is to determine any relationship between temperaments of medicinal plants and their major chemical compounds.

METHODS

Plants referred in TIM were categorized based on their major chemical compounds. Their temperaments were

extracted from Makhzan al-Advia.⁴ The cause for using Makhzan al-Advia for extracting temperaments of plants is recency and universality of this book in comparison to other traditional herbal pharmacopeias and the author of this book, Mohammad Hossein Aghili, gather the opinions of other Iranian scientists existing before him such as Heravi, Avicenna, Razes, and Tonkaboni.⁵⁻⁹ These data were extracted in individual tables based on major chemical compounds including alkaloids, phenolic compounds, and volatile oils and the possible relationship between major chemical contents and temperament of each group were evaluated.

RESULTS AND DISCUSSION

Table 2 shows referred plants in TIM containing alkaloids as a major chemical compound. Alkaloids were categorized to thirteen groups based on their chemical structures including alkaloidal amines, diterpenoid, indole, isoquinoline, pyridine-piperidine, reduced pyridine, quinoline, quinolizidine, sesquiterpene, steroidal, tropone, tropolone, and purine alkaloids. All plants in alkaloidal amines group had hot and dry temperament. Plants with diterpenoid alkaloids have cold and dry temperament. As shown in Table 2, all plants with indole, isoquinoline, or purine alkaloids have hot and dry temperament. Only there is a dissension between Persian

1. Department of Traditional Pharmacy, Faculty of Traditional Iranian Medicine, Tehran University of Medical Sciences, Tehran, Iran; 2. Department of Pharmacognosy, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran
Correspondence to: Roja Rahimi, Tel/Fax: +98-2166412653, Email: rojarahimi@gmail.com

and Indian philosophers on the temperament of *Papaver somniferum*, as a plant containing isoquinoline alkaloids. Although plants with pyridine-piperidine alkaloids have hot and dry temperament, reduced pyridine ring in alkaloid-containing plants cause cold and dry temperament of them. All plants with tropane alkaloids have cold and dry temperaments. In steroidal alkaloids group there are two plants, *Veratrum album* with hot and dry temperament and *Solanum nigrum* with cold and dry temperament. Although *Solanum nigrum* has cold and dry temperament, but it has been said to have an active compartment with hot nature.⁴ Moreover, plants containing steroidal saponins as their major chemical compounds such as *Smilax glabra* and *Trigonella foenum-graecum* have hot and dry temperament. Thus it seems that steroidal structure causes plants to have hot and dry temperament. There is only one plant in each of

quinoline (*Cinchona succirubra*), quinolizidine (*Cytisus scoparius*), sesquiterpene (*Celastrus paniculatus*), and tropolone (*Colchium autumnale*) alkaloids group mentioned in traditional Iranian manuscripts; thus the results from these groups are not conclusive.

Table 1. Different temperaments based on dominant element (s)

Temperament	Fire	Air	Water	Soil
Hot and dry	*			
Hot and moist		*		
Cold and moist			*	
Cold and dry				*
Hot	*	*		
Cold			*	*
Dry	*			*
Moist		*	*	

Note: *=dominant.

Table 2. Plants used in traditional Iranian medicine containing mainly alkaloids

Alkaloidal type	Scientific name	Traditional Iranian name	Medicinal part	Temperament	References
Alkaloidal amines	<i>Alhagi pseudalhagi</i>	Haj	Stem	Hot & dry	Daniel, 2006
	<i>Urtica dioica</i>	Anjora	Whole plant	Hot & dry	Daniel, 2006
	<i>Adhatoria vasica</i>	Azhouse	Flower	Hot & dry	Pal Singh, 2002
	<i>Canavalia gladiata</i>	Foshagh	Aerial parts	Hot & dry	Pal Singh, 2002
Diterpenoid alkaloids	<i>Aconitum napellus</i>	Khanigh-al-namer	Root	Cold & dry	Daniel, 2006
	<i>Aconitum ferox</i>	Bish	Root	Cold & dry	Daniel, 2006
Indole alkaloids	<i>Strychnos nux-vomica</i>	azaraghi	Seed	Hot & dry	Daniel, 2006
	<i>Peganum harmala</i>	Harmal	Seed	Hot & dry	Daniel, 2006
	<i>Ipomoea hederacea</i>	Niloufar pich	Seed	Hot & dry	Daniel, 2006
Isoquinoline alkaloids	<i>Berberis asiatica</i>	Darheld	Bark	Hot & dry	Daniel, 2006
	<i>berberis vulgaris</i>	Arghis	Bark	Hot & dry	Evans, 2002
	<i>Argemone mexicana</i>	Arghamouni	Leaf	Hot & dry	Daniel, 2006
	<i>Papaver somniferum</i>	Afyoun	Latex	Unani and Persian philosophers: cold & dry, Indian philosophers: hot & dry	Evans, 2002
Pyridine-piperidine alkaloids	<i>Aristolochia longa</i>	Zaravand taval	Root	Hot & dry	Evans, 2002
	<i>Nicotiana tabacum</i>	Tanbakou	Leaf	Hot & dry	Evans, 2002
	<i>Piper nigrum</i>	Filfil	Fruit	Hot & dry	Daniel, 2006
	<i>Piper longum</i>	Darfilfil	Fruit	Hot & dry	Daniel, 2006
Reduced pyridine alkaloids	<i>Conium maculatum</i>	shoukaran	Fruit	Cold & dry	Evans, 2002
	<i>Areca catechu</i>	foufal	Seed	Cold & dry	Evans, 2002
Quinoline alkaloids	<i>Cinchona succirubra</i>	Gane gane	bark	Hot & dry	Evans, 2002
Quinolizidine alkaloids	<i>Cytisus scoparius</i>	Ratam	Tops	Hot & dry	Evans, 2002
Sesquiterpene alkaloids	<i>Celastrus paniculatus</i>	Mal kangni	seed	Hot & dry	Daniel, 2006
Steroidal alkaloids	<i>Veratrum album</i>	Kharbagh sifid	Rhizome	Hot & dry	Evans, 2002
	<i>Solanum nigrum</i>	Tajrizi	fruit	Cold & dry	Evans, 2002
Tropane alkaloids	<i>Hyoscyamus niger</i>	Banj	leaf	Cold & dry	Evans, 2002
	<i>datura stramonium</i>	Jowz masal	fruit	Cold & dry	Evans, 2002
	<i>Mandragora officinarum</i>	Lofah	Leaf and root	Cold & dry	Daniel, 2006
Tropolone alkaloids	<i>Colchium autumnale</i>	Sourenjan	bulb	Hot & dry	Evans, 2002
Purine alkaloids	<i>Camellia sinensis</i>	chai	Leaf	Hot & dry	Evans, 2002
	<i>Coffea arabica</i>	ghahve	seed	Hot & dry	Evans, 2002

Table 3 shows referred plants in TIM containing phenolic compounds as a major chemical compound. Phenolic compounds were categorized to 7 groups including benzophenones, xanthonenes, coumarins, lignans, flavonoids, anthraquinones, and tannins. Exclusive of plants in tannins group, other plants have hot and dry temperament. Plants containing tannins as a major compound have cold and dry temperament.

Table 4 demonstrates referred plants in TIM having volatile oils as a major chemical compound. They were divided into 8 groups based on the structure of major

compounds in volatile oil including alcohols, esters and alcohols, aldehydes, ketones, phenols, ethers, sesquiterpenes, and oleo-gum-resins. All groups except alcohols group contained plants with hot and dry temperament. Plants containing alcohols as a major component of volatile oil have cold and dry temperament. There is a conflict between Persian and Indian philosophers in the temperament of *Cinnamomum camphora*. Persian philosophers suppose that it has cold and dry temperament whereas Indian ones believe that it is hot and dry.

Table 3. Plants used in traditional Iranian medicine containing mainly phenolic compounds

Phenolic type	Scientific name	Traditional Iranian name	Medicinal part	Temperament	References
Benzophenones	<i>Dryopteris filix-mas</i>	Serakhs	Rhizome	Hot & dry	Evans, 2002
	<i>Semecarpus anacardium</i>	Balador	Fruit	Hot & dry	Daniel, 2006
	<i>Curcuma longa</i>	Zard chouba	Rhizome	Hot & dry	Daniel, 2006
	<i>Styrax officinalis</i>	Miaa yabisa	Balsamic resin	Hot & dry	Daniel, 2006
Xanthonenes	<i>Gentiana lutea</i>	Jentiana	Root	Hot & dry	Daniel, 2006
	<i>Mangifera indica</i>	anba	Fruit	Hot & dry	Daniel, 2006
	<i>Apium graveolens</i>	Karafs	Fruit	Hot & dry	Evans, 2002
	<i>Peucedanum officinale</i>	Bokhour-al-ekrad	Root	Hot & dry	Evans, 2002
Coumarins	<i>Ruta graveolens</i>	Sodab	Leaf	Hot & dry	Evans, 2002
	<i>Aegle marmalos</i>	Bal	Fruit	Hot & dry	Daniel, 2006
	<i>Psoralea bituminosa</i>	Trifolon	Seed	Hot & dry	Daniel, 2006
Lignans	<i>Piper cubeba</i>	Kababa	Fruit	Hot & dry	Daniel, 2006
	<i>Linum usitatissimum</i>	Katan	Seed	Hot & dry	Daniel, 2006
	<i>Myristica fragrans</i>	Jowz bouya	Fruit	Hot & dry	Evans, 2002
Flavonoids	<i>Citrus spp.</i>	Morakabat	Peel of fruit	Hot & dry	Evans, 2002
	<i>Iris florentina</i>	Irsa	root	Hot & dry	Daniel, 2006
	<i>Mallotus philippinensis</i>	Vars	Fruit	Hot & dry	Daniel, 2006
	<i>Calendula officinalis</i>	Azaryoun	Flower	Hot & dry	Evans, 2002
	<i>Carthamus tinctorius</i>	Kafeshe	Flower	Hot & dry	Toshikatsu & Kohei, 2000
Anthraquinones	<i>Rubia tinctorum</i>	Ronas	Root	Hot & dry	Daniel, 2006
	<i>Rheum palmatum</i>	Ravand	Root	Hot & dry	Daniel, 2006
	<i>Cassia angustifolia</i>	Sena	leaf	Hot & dry	Evans, 2002
	<i>Aloe barbadensis</i>	Saber	Leaf	Hot & dry	Evans, 2002
	<i>Hypericum perforatum</i>	Houfarighoun	Aerial parts	Hot & dry	Evans, 2002
Tannins	<i>Terminalia chebula</i>	Halila	Fruit	Cold & dry	Evans, 2002
	<i>Terminalia bellerica</i>	Balila	fruit	Cold & dry	Daniel, 2006
	<i>Acacia arabica</i>	Moghilan	bark	Cold & dry	Evans, 2002
	<i>Punica granatum</i>	Anar	Pericarp of fruit	Cold & dry	Evans, 2002
	<i>Quercus infectoria</i>	Balout	Fruit	Cold & dry	Evans, 2002
	<i>Cratagus monogyna</i>	Zarour	Fruit	Cold & dry	Evans, 2002

CONCLUSION

This paper demonstrates the opinions of traditional philosophers about temperaments have a strong scientific fundament in modern medicine. However traditional philosophers didn't have advanced instruments for identification of chemical constituents in plants, but they have explained their opinions about phytochemistry by

theory of quadratic elements and defining temperaments of plants. There are many medicinal plants in the world and their temperaments haven't been mentioned in traditional Iranian manuscripts, but tables of this paper may help researchers to guesstimate their temperaments based on their major chemical compounds. Moreover, for many plants in traditional Iranian manuscripts their

Table 4. Plants used in traditional Iranian medicine containing mainly volatile oils

Volatile oil type	Scientific name	Traditional Iranian name	Medicinal part	Temperament	References
Alcohols	<i>Coriandrum sativum</i>	Geshniz	Fruit	Cold & dry	Evans, 2002
	<i>Rosa spp.</i>	Vard	Flower	Cold & dry	Evans, 2002
	<i>Santalum album</i>	Sandal	Wood	Cold & dry	Evans, 2002
Esters and alcohols	<i>Lavandula officinalis</i>	Ostokhodous	Aerial parts	Hot & dry	Evans, 2002
	<i>Rosmarinus officinalis</i>	Eklil al- jabal	Flowering tops	Hot & dry	Evans, 2002
	<i>Elettaria cardamomum</i>	Hil	Seed	Hot & dry	Evans, 2002
	<i>Menthe piperita</i>	Nana	Leaf	Hot & dry	Evans, 2002
	<i>Alpinia galanga</i>	Khoulenjan	Rhizome	Hot & dry	Evans, 2002
Aldehydes	<i>Cinnamomum zeylanicum, C. cassia</i>	Darchini	Bark	Hot & dry	Evans, 2002
	<i>Melissa officinalis</i>	badranjbouye	Aerial parts	Hot & dry	Evans, 2002
Ketones	<i>Carum carvi</i>	Karvia	Fruit	Hot & dry	Evans, 2002
	<i>Cuminum cyminum</i>	Kamoon	Fruit	Hot & dry	Evans, 2002
	<i>Anethum graveolens</i>	Shebet	Fruit	Hot & dry	Evans, 2002
Phenols	<i>Syzigium aromaticum</i>	Gharanfol	Flower	Hot & dry	Evans, 2002
	<i>Thymus vulgaris</i>	Hasha	Aerial parts	Hot & dry	Evans, 2002
Ethers	<i>Pimpinella anisum</i>	anisoun	Fruit	Hot & dry	Evans, 2002
	<i>Illicium verum</i>	Badian khatayi	Fruit	Hot & dry	Evans, 2002
	<i>Foeniculum vulgare</i>	Raziane	Fruit	Hot & dry	Evans, 2002
	<i>Cinnamomum camphora</i>	Caphour	Wood	Persian philosophers: cold & dry, Indian philosophers: Hot & dry	Evans, 2002
Sesquiterpenes	<i>Petroselinum sativum</i>	Jafari	Fruit	Hot & dry	Evans, 2002
	<i>Myristica fragrans</i>	Jowze bouya	Fruit	Hot & dry	Evans, 2002
	<i>Acorus calamus</i>	Agir toriki	Rhizome	Hot & dry	Evans, 2002
	<i>Zingiber officinalis</i>	zanjabil	Rhizome	Hot & dry	Evans, 2002
	<i>Matricaria chamomilla</i>	baboune	Flower	Hot & dry	Evans, 2002
	<i>Achillea spp.</i>	Berenjasef, boumadaran	Flower	Hot & dry	Evans, 2002
	<i>Artemisia absinthium</i>	Afsantin	Aerial parts	Hot & dry	Evans, 2002
Oleo-gum-resins	<i>Commiphora myrrha</i>	Mor	Product Obtained from stem	Hot & dry	Evans, 2002
	<i>Commiphora mukul</i>	Moghl	Product Obtained from stem	Hot & dry	Evans, 2002
	<i>Ferula assa-foetida</i>	Anghouzeh	Product obtained from incision of root an stem	Hot & dry	Evans, 2002
Oleo-gum-resins	<i>Ferula galbaniflua</i>	Barijeh	Product obtained from incision of root an stem	Hot & dry	Evans, 2002
	<i>Boswellia carterii</i>	Kondor	Product Obtained from incision of bark	Hot & dry	Evans, 2002
	<i>Pistacia lentiscus</i>	Mastaki	Product Obtained from bark	Hot & dry	Evans, 2002
	<i>Pistacia khinjuk</i>	Saghez	Product Obtained from incision of bark	Hot & dry	Evans, 2002
	<i>Dorema ammoniacum</i>	Oshagh	Product Obtained from incision of stem and branch	Hot & dry	Evans, 2002

phytochemistry was not well studied. In Makhzan-al-Advia, one of the last traditional herbal pharmacopeias of Iran, more than one thousand plants have been described and some of them were not identified yet. Thus it should be notified that the tables in this paper do not include all plants mentioned in TIM.

REFERENCES

1. Aghili, MH. Kholase al hekma (Persian). Quom: Esmailian; 2006: 35-42.
2. Chaghmini MM. Qanunchi Fi Al-Tibb (Arabic). Tehran: Iran University of Medical Sciences; 2004: 1-4.
3. Shahabi S, Hassan ZM, Mahdavi M, Dezfouli M, Torabi Rahvar M, Naseri M, et al. Hot and cold natures and some parameters of neuroendocrine and immune systems in traditional Iranian medicine: A preliminary study. *J Alt Comp Med* 2008; 14: 147–156.
4. Aghili MH. Makhzan-al-Advia (Persian). Tehran: Tehran University of Medical Sciences; 2009.
5. Razi M. Alhavi fi-al-tib (Arabic). Beirut: Dar Al_Kotob Al-ilmiyah; 2000: 20, 21.
6. Heravi M. Alabnya an al-Haghayegh al-Advia (Persian). Tehran: Tehran University; 1992.
7. Avicenna. Al Qanun Fil Tibb (Arabic). New Delhi: Jamia Hamdard Printing Press; 1998: 2.
8. Avicenna. Al Qanun Fil Tibb (Arabic). Tehran: Soroush Press; 2005: 2.
9. Tonkaboni MM. Tohfeh al-Momenin (Persian). Tehran: Shahid Beheshti University of Medical Sciences; 2007.
10. Daniel M. Medicinal plants: chemistry and properties. Enfield: Science publishers; 2006.
11. Pal Singh A. A treatise on phytochemistry. Nutfield: Emedia Science Ltd; 2002.
12. Evans WC. Trease and Evans pharmacognosy, 15th Ed. London: WB Saunders; 2002.
13. Toshikatsu O, Kohei K. Flavonoid constituents in the petals of carthamus tinctorius: structures of quinochalcones and flavonols, and their biosynthetic pathway. *FFI journal* 2000; 189: 5-14.

(Received June 28, 2010)