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Identification of chemical compounds of *Nardostachys Jatamansi* essence available in Iran

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ABSTRACT

Introduction: With regard to using drugs with plant origin and with the aim of suitable use of these types of drugs and preventing them to be abused, it is necessary to determine the standards of these plants. The aim of the present study was to identify and study chemical compounds of *Nardostachys Jatamans*i essence in Iran and define monograph of this plant for the Iranian plant pharmacopeia.

Methods: In an experimental study the *Nardostachys Jatamans*i specimen was prepared from the market in Iran. The essence of the plant was prepared by the hydro-distillation in *Clevenger apparatus*. Essence was obtained as a greenish yellow oil layer with the 0.07 % yield. The essence compounds were identified quantitatively by Gas Chromatography-Mass Spectroscopy (GC/MS) method.

Results: Totally, 29 compounds were identified in *Nardostachys Jatamans*i essence. The retention indexes (RI) were only similar with overall standard values in two compounds like mesitylene and P-cymene. In this line the RI values about three compounds of valerenic acid, palmitic acid, and valerenyl isovalerate were determined significantly higher than standard values of RI.

Conclusion: The essence prepared from the *Nardostachys Jatamans*i plant in Iran was different in terms of some compounds and components including valerenic acid, palmitic acid, and valerenyl isovalerate and so it is necessary to identify and register quality and quantity characteristics of compounds available in this plat in the Iranian medicinal plants pharmacopeia.

Implication for health policy/practice/research/medical education:
The essence prepared from Nardostachys Jatamansi plant in Iran seems to be different in terms of some compounds and components. So it is necessary to identify and register quality and quantity characteristics of compounds available in this plat in the Iranian medicinal plants pharmacopeia.

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Introduction

Today although most of consumed drugs are synthetic, but it has been estimated that at least one third of all medicinal products have plant origin or have been transformed after they are extracted from the plants. Using medicinal plants for diseases has an old history (1). Medicinal plants have less side effects and risks compared to chemical drugs due to having natural origin and also contiguity and compatibility with the human body physiology. This property is one of the main reasons of returned approach and tendency of people toward medicinal plants and using it compared to chemical drugs (1,2). Therefore, pharmaceutical industries and research groups in many countries have focused their attention on cultivating and producing medicinal plants (2). Citronella or Indian nard (with the scientific name of *Valeriana sisymbriifolium*

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from Valerianaceae family) is a plant that its height reaches to 10-60 cm and mainly grows in summer. This plant has been used as an herbal medicine from the sixteen century (3). It has been used traditionally in different regions of Europe and Asia and today it is accepted as a medicinal plant with various benefits even in North America (4). Accordingly, the *Valeriana sisymbriifolia* has been paid attention by experts in pharmacology and also in the traditional and plant medicine and is used as a medicinal or food complement (5). According to clinical observations, the extract prepared from root of this plant has sedative property and so it is used as an anti-anxiety drug (6-8). Due to the antioxidant property of the extract of this plant, its inhibitive effects on the brain ischemia in animal models of study have been confirmed (9). Also antibacterial effects of this plant in preventing and treating infectious diseases have been proved (10). With regard to the fact that it is economical to use a medicinal plant with high effective materials in pharmaceutical industries, identification of chemical compounds present in plants essence and their effect is very important (11). It is fundamentally possible to understand the drug effect and also to determine effective mechanisms of the plant extract based on identifying compounds and components of the plant extract. Some main extract components of the plant root of *Valeriana sisymbriifolium* include: alkaloids (actinidin, creatinine, valerianine, and valerine), isovaleramide, gamma amino butiric asid (GABA), isovaleric acid, iridoids (isovaltrate).

In the present study the aim was to identify quality and quantity of chemicals in the plant essence of Iran.

Materials and Methods

In a experimental study, *Valeriana sisymbriifolia* specimen was prepared from the Iran market. The dried plant was grinded by the crusher device. Then the essence was collected by the Hydro-distillation method in a Clevenger apparatus for 3 hours. Essence weight ratio of the plant was measured to be 0.07 w/w. The essence was maintained in colored glasses with closed lid in the refrigerator. Compounds available in the essence were determined by the a Gas chromatography device connected to the GC/MS (Hewlett, Packard 5792A, USA), with the ion-trap system, column with the length of 60 m and the diameter of 0.25 mm that the static phase thickness was 0.25 micrometer. The column temperature was set at 60 to 280 °C with gradient of 4 °C per minute, the injection chamber temperature of 280 °C and the ion resource temperature of 250 °C. The helium gas with the purity degree of 99/999, with gas speed of 2 ml/min and the PSI pressure of 17.7 and Electron ionization energy of 70 eV were used.

Results

The greenish yellow essence with the 0.07% yield in terms of the weight (w/w) was obtained from this plant. Totally 29 compounds were extracted in evaluating different components of the *Valeriana sisymbriifolia* extract that retention time values of these compounds were variable between 4.96 related to mesitylene and 34.32 related to valerenyl isovalerate. In result of comparing the RI of each of the *Valeriana sisymbriifolia* essence components in Iran with standard cases (Table 1), It was determined in this study that the RI values were similar to world standard values in only two compounds including mesitylene and p-cymene. In this line, the RI values were a little higher from standard values about some compounds including n-octanol, linalool, naphthalene, α-terpineole, cuminal, carvone, trans-anethole, thymole, carvacrol and valerenal in the compound presented in our study. However, the RI value was determined significantly higher than the standard values of RI about some compounds like valerenic acid, palmitic acid and valerenyl isovalerate.

Discussion

In evaluating compounds of the *Valeriana sisymbriifolia* essence and materials by the GC/MS method the index of retention time is used. However, this index is potentially affected by other variables and conditions like temperature, chromatography column length and the column diameter, so other index named retention index or RI was used. In this study based on determining the RI index about each component of *Valeriana sisymbriifolia* and comparing it with standard RI values we found that the main difference between compounds presented in our study and cases mentioned in standard pharmacopeias was mainly in three compounds of valerenic acid, palmitic acid and valerenyl isovalerate that RI related to each three cases was determined significantly higher than standard values. In other words, *Valeriana sisymbriifolia* specimens in Iran can be differentiated from other specimens in other countries in terms of values of the above three compounds.

Valerenic acid has been identified as GABA-A receptor agonist that plays an important role as a sedative. Also, its role as an anti-inflammation is also proposed (14,15). About palmitic acid also recent researches have suggested sedative effects of this fatty acid and also its effect on modulating glucose metabolism (16). Based on above findings and with regard to obvious differences in above compounds between Iranian specimens and standard in the *Valeriana sisymbriifolia* essence, the therapeutic effects of this essence in Iranian specimens can be different from specimens in other points and so it is necessary to add mentioned characteristics in pharmacopeia of Iranian medicinal plants. Totally, it can be concluded that the essence prepared from the *Valeriana sisymbriifolia* plant in Iran is different in terms of amount of some compounds like valerenic acid, palmitic acid and valerenyl isovalerate and with regard to clinical effects of these components specially sedative effects, anti-inflammation and also its effects in regulating the glucose metabolism, it is necessary

Table 1. Comparing the RI of each of the *Valeriana sisymbriifolia* essence components in Iran with standard cases

No	RT	Compound	%	RI	Book-R
1	4.96	mesitylene	0.1	994	994
2	5.66	p-cymene	0.2	1026	1026
3	6.84	n-octanol	0.1	1072	1070
4	7.65	linalool	0.4	1099	1098
5	10.04	Naphthalene	0.7	1181	1179
6	10.33	α-terpineole	0.2	1190	1189
7	11.84	Cuminal	0.6	1240	1239
8	11.97	carvone	0.3	1244	1243
9	13.27	Trans-anethole	0.9	1284	1283
10	13.58	thymol	1.0	1292	1290
11	13.89	Carvacrol	1.1	1302	1298
12	16.19	β-patchoulene	0.5	1377	1380
13	17.10	α-gurjunene	0.2	1405	1410
14	17.75	β- gurjunene	0.6	1428	1434
15	18.02	aromadendrene	0.5	1437	1441
16	18.44	α- patchoulene	0.4	1451	1456
17	18.61	allo-aromadendrene	0.8	1457	1461
18	19.60	valencene	0.3	1489	1491
19	20.31	7- epi-α-selinene	0.4	1513	1517
20	21.04	α-calacorene	0.2	1539	1542
21	22.18	Caryophyllene oxide	3.9	1578	1583
22	22.31	Globulol	1.5	1582	1585
23	24.37	Patchouli alcohol	6.1	1656	1658
24	24.75	14-hydroxy-9-epi-(E) caryophyllen	5.2	1669	1670
25	24.88	valeranone	6.0	1674	1675
26	26.07	Valerenal	3.4	1717	1715
27	30.15	Valerenic acid	0.9.	1880	1862
28	32.44	Palmitic acid	0.4	1976	1969
29	34.32	Valerenyl isovalerate	0.2	2058	2052

Retention indices on HP-5 capillary column t: trace (≤0.05%), %: calculated form TIC data

to identify and register qualitative and quantitative properties of *Valeriana sisymbriifolia* components in Iranian medicinal plant pharmacopeia.

Authors' contributions

All the authors wrote the manuscript equally.

Conflict of interests

The authors declared no competing interests.

Ethical considerations

Ethical issues (including plagiarism, misconduct, data fabrication, falsification, double publication or submission, redundancy) have been completely observed by the authors.

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