



IJPPR

INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH

An official Publication of Human Journals

ISSN 2349-7203




Human Journals

Research Article

April 2015 Vol.:3, Issue:1


© All rights are reserved by Sreeraj Gopi et al.

Quantitative Measurement of Sesquiterpenes in Various Ginger Samples by GC-MS/MS



IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals

ISSN 2349-7203



Sreeraj Gopi*, Shintu Jude, Karthik Varma

*R&D Centre, Plantlipids Private Limited,
Cochin – 682311.*

Submission: 28 March 2015
Accepted: 3 April 2015
Published: 25 April 2015

Keywords: ginger, sesquiterpenes, essential oils, oleoresin, effect of solvents

ABSTRACT

Ginger is used in traditional medicines extensively in Asia and West south of Africa. The steam distilled oil from ginger contains 'sesquiterpenes' as the major constituents. These 'sesquiterpenes' play a major role in terms of the biological activity of ginger. Different ginger samples have analysed using GC-MS/MS. Based on the results, the effects of raw material variety, extraction method, extraction solvent^{1,2} etc. on the total content of sesquiterpenes have studied. Nigeria ginger oil found to possess more content of sesquiterpenes by composition, than Shimoga (Indian) ginger oil. In case of direct extraction leading to an oleoresin, Shimoga variety contains a little more content of total sesquiterpenes. On comparing the effect of extraction solvents, ethyl acetate is more effective than acetone.



HUMAN JOURNALS

www.ijppr.humanjournals.com

INTRODUCTION

Ginger is the rhizome of 'ginger' plant from the family Zingiberaceae. It has been used traditionally as a kitchen spice and as a medicine for varied human ailments to aid digestion and to treat stomach upset, diarrhoea and nausea etc³. Presence of essential nutrients make ginger, an integral part of many dietary supplements. Some studies support ginger's effect on cancer also⁴. Ginger oil and oleoresin are commonly used as food flavouring agent in soft drinks, as spices in bakery products, in confectionary items, pickles, sauces and as a preservatives etc.

The pungency is produced by non-steam volatile compounds, known as gingerols, while the odour and much of the flavour is determined by the constituents of steam-volatile oils⁵. Ginger contains almost 0.25-3 % of volatile oil. Ginger oil prepared from the steam distillation of dried ginger is a yellow to amber colour viscous fluid, which have a fresh woody, spicy and warm aroma. The essential oil of ginger is composed of sesquiterpene hydrocarbons, monoterpene hydrocarbons, and oxygenated monoterpenes. The monoterpenes are the contributors of aroma of ginger³. Ginger oleoresins are extracted from dried or fresh ginger by solvent extraction. It is dark brown, viscous fluid. The major components of ginger oleoresin are Gingerols and shogaol. As the oleoresin contains a small portion of oil, sesquiterpenes will be present in it.

Sesquiterpenes: Sesquiterpenes are a class of terpenes, consists of 3 isoprene units. They found naturally in plants and insects, as semiochemicals. They are anti microbial and can act as defensive agents or pheromones. Ginger contains almost 64 sesquiterpenes. The presence and content of sesquiterpenes will vary, depending on the origin of the raw material, extraction solvent and method of extraction^{6,7}. Here a comparative study is conducted with ginger from Nigeria and Shimoga, based on these factors. The identification and quantification of sesquiterpenes have done by gas chromatography.

MATERIALS AND METHODS

Materials: Dried ginger of Shimoga (Indian) variety is purchased from Sagar Traders, and Nigerian variety from Century Exports, Nigeria. All the solvents used for GC-MS/MS analysis have purchased from Spectrochem.

Preparation of Samples: Essential oil is collected by steam distillation. Steam is passed through the coarsely ground ginger. The oil and water vapour will pass to a receiver vessel where the oil is condensed, which is separated later from water. The collected oil is made free from water using sodium sulphate. Oleoresin is extracted by percolation. De-oiled raw material dried Nigerian ginger and Shimoga ginger is extracted with acetone and solvent is removed under reduced pressure. In order to find the effect of extraction solvent, oleoresin extracted from Nigerian Ginger, using acetone and ethyl acetate. All the samples are dissolved in acetone and analysed using GC-MS.

Chromatographic conditions: The samples were analysed by a Bruker 436- GC, coupled to a SCION TQMS. Used an Rtx-624 fused silica column of length 60 m and ID 0.25 mm. The column temperature maintained initially at 50⁰C held for 10minutes, and linearly increased with a rate of 10⁰C/min. Injector temperature was 230⁰C. Carrier gas was He, at a flow rate of 1 ml/min, with a constant pressure of 33.1 psi. Samples are dissolved in acetone, and injected with a split ratio of 1:40. Results from the GC have interpreted using NIST (National Institute of Standard and Technology) MS search library v.2.0, which is having data of about 162508 compounds.

1. Comparison of Sesquiterpenes present in ginger oils from Indian (Shimoga) & Nigerian

Table 1. Comparison of sesquiterpene content in the oils from Indian ginger and Nigerian ginger

Compound Number	Component	Shimoga	Nigeria
1	<i>Delta-Elemene</i>	0.064	0.117
2	<i>Alpha-Cubebene</i>	Na	0.138
3	<i>Alpha- Copaene</i>	1.295	1.411
4	<i>Trans-Alpha Bergamotene</i>	0.255	0.559
5	<i>Beta-Elemene</i>	0.381	1.071
6	<i>Gamma-Elemene</i>	0.032	0.517
7	<i>Beta- Farnesene</i>	0.226	0.409
8	Caryophyllene	0.119	0.133
9	<i>Beta-Curcumene</i>	0.037	0.812
10	Alloaromadendrene	0.364	1.124
11	<i>Alpha-Curcumene</i>	3.793	11.305
12	Zingiberene	13.488	19.122
13	<i>Alpha-Farnesene</i>	4.09	5.868
14	<i>Beta-Bisabolene</i>	3.27	10.04
15	<i>Beta – Copaene</i>	0.838	Na
16	<i>Beta-Selinene</i>	0.838	1.795
17	<i>Gamma-Muurolene</i>	1.884	4.447
18	<i>Beta-Sesquiphellandrene</i>	5.453	12.369
19	<i>Beta-Cubebene</i>	0.289	0.262
	Total	36.716	71.499

2. Comparison of Sesquiterpenes present in ginger oleoresins from Indian (Shimoga) and Nigerian varieties.

The oleoresins are checked for content of oil in it. Shimoga ginger OR have 8.72 % and Nigeria ginger OR have 8.226 % oil in it. The volatile part is composed of Sesquiterpenes, as given in Table 2.

Table 2. Comparison of Sesquiterpenes present in ginger oleoresins from Indian (Shimoga) and Nigerian varieties

Compound Number	Compound	Shimoga Ginger Or	Nigeria Ginger Or
1	<i>delta</i> -Elemene	0.072	0.035
2	<i>alpha</i> -Cubebene		0.054
3	<i>alpha</i> -Copaene	0.464	0.332
4	<i>trans-alpha</i> Bergamotene	0.178	0.151
5	<i>beta</i> -Elemene	0.537	0.389
6	<i>gamma</i> -Elemene	0.202	0.218
7	<i>beta</i> - Farnesene	0.088	0.049
8	Caryophyllene	0.078	0.061
9	<i>beta</i> -Curcumene	0.13	0.294
10	Alloaromadendrene	0.455	0.454
11	<i>alpha</i> -curcumene	8.155	7.889
12	Zingiberene	28.957	27.287
13	<i>alpha</i> -farnesene	5.699	4.699
14	<i>beta</i> -bisabolene	6.738	6.994
15	<i>beta</i> - copaene		
16	<i>beta</i> -selinene	1.598	1.451
17	<i>gamma</i> -muurolene	3.436	3.241
18	<i>beta</i> -sesquiphellandrene	12.272	12.472
19	<i>beta</i> -cubebene	0.394	0.276
	TOTAL	69.45%	66.35%

2) Comparison of sesquiterpene content in ginger oleoresin, extracted with ethyl acetate and acetone

Table 3. Content of Sesquiterpenes

Compound Number	Component	Ethyl Acetate	Acetone
3	<i>alpha</i> -Copaene	0.677	0.241
4	<i>trans-alpha</i> Bergamotene	0.206	0.121
5	<i>beta</i> -Elemene	0.259	0.152
7	<i>beta</i> - Farnesene	0.174	0.132
10	Alloaromadendrene	0.342	0.387
11	<i>alpha</i> -curcumene	9.405	7.652
12	Zingiberene	36.965	30.725
13	<i>alpha</i> -farnesene	6.626	5.737
14	<i>beta</i> -bisabolene	7.987	6.656
15	<i>beta</i> - copaene	0.941	0.783
16	<i>beta</i> -selinene	1.286	1.166
17	<i>gamma</i> -muurolene	3.71	3.075
18	<i>beta</i> -sesquiphellandrene	15.06	13.374
19	<i>beta</i> -cubebene		
	TOTAL	83.64%	70.20%

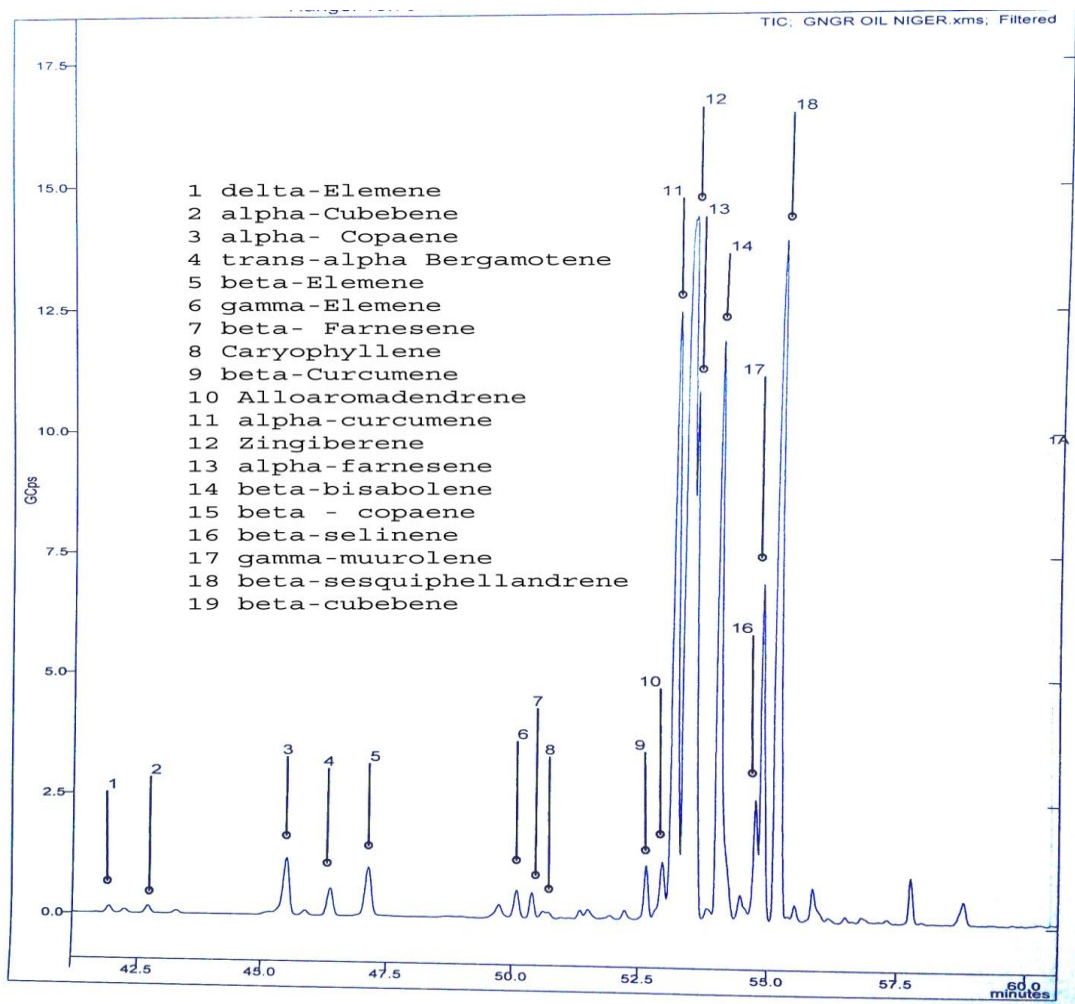


Fig.1. Chromatogram for shimoga ginger oil

CONCLUSION

GC-MS has been shown to be a valuable tool for the analysis of ginger constituents. On behalf of the present study, total Sesquiterpenes content is more in Nigerian ginger oil than Indian (Shimoga) ginger oil. Nigerian oil has a total of 71.4 % Sesquiterpenes, while shimoga oil contains 36.716 %. Shimoga oil does not contain *alpha*-Cubebene, while Nigerian oil does not have *beta*-copaene in it.

Shimoga ginger OR have 8.72 % oil in it. *Alpha* -Cubebene is missing in Shimoga OR also. Without *alpha*-Cubebene and *beta*-copaene, it contains a total of 69.45 % of Sesquiterpenes. Nigerian ginger OR have 8.226 % oil, which have 66.35 % total Sesquiterpenes in it. It does not contain *beta*-copaene.

On comparing the solvent effect on extraction of Sesquiterpenes, it is found that, ethyl acetate extract have 83.64 % Sesquiterpenes in its oil part, while acetone extract have 70.20 % Sesquiterpenes.

REFERENCES

- 1) Comparison of Essential oil Composition of Three Ginger Cultivars from Sub Himalayan Region, Suresh V Nampoothiri et al , Asian Pacific Journal of Tropical Biomedicine, APJTB 2012, (S1347-S1350)
- 2) Isolation and Identification of Ginger Essential Oil, Kamaliroosta z. et al, *Journal of Food Biosciences and Technology*, (3) 2013 , 73-80,
- 3) Solid-phase micro-extraction—comprehensive two-dimensional gas chromatography of ginger (*Zingiber officinale*) volatiles, Yajing Shao et al , *Flavour Fragr. J*, 8, 2003, 5-12.
- 4) Inhibitory activity of ginger oil against breast cancer cells, M.Sc. thesis, The Department of Food Science, Agricultural and Mechanical College, Louisiana State University, 2011.
- 5) Characterization of ginger (*Zingiber officinale* Rosc.) germplasm based on volatile and non-volatile components , Jaleel et al, *African Journal of Biotechnology* , 11(4), 777-786, 2012.
- 6) Comparative chemical composition and antimicrobial activity fresh & dry ginger oils (*zingiber officinale* roscoe), Indu et al, *International journal of current pharmaceutical research*, 2 (4), 2010.
- 7) Comparative Studies on Physicochemical Properties and GC-MS Analysis of Essential Oil of the Two Varieties of Ginger (*Zingiber officinale*), Shahin Aziz et al, *Int.J.Pharm. Phytopharmacol.Res.*, 1(6): 367-370, 2012

