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Seasonal fluctuations on potency of gingerol content of shunthi (*Zingiber officinale,* Ginger)

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ABSTRACT

Herbal therapies demand increases worldwide for treatment of various diseases. About 75% to 80% of the world population use herbal medicines, mainly in developing countries, for primary health care because of their better acceptability with the human body and lesser side effects. Herbal medicines are used for treatment of such a chronic disease from hundreds of years and are continuously rising in today's era due to less adverse effects, treats root cause and low cost. Medicinal plants are used to treat patients with cardiovascular diseases, which may occur due to ailments of the heart and blood vessels and comprise heart attacks, cerebrovascular diseases, hypertension, and heart failure.Environmental changes have impact on availability of herbal constituents along with its therapeutic efficacy. If harvesting should be done properly at accurate conditions gets yield with more potency. Plant sample used in different seasons, time and places, identification and analysis was performed. Morphological, microscopicaland extractivevalues appear changes. Material collected at different seasons, time and places, identification and analysis by macroscopy, microscopy, proximate analysis, extraction and estimation of gingerol was performed. It shows that higher concentration of gingerol was obtained in rainy season (September), at high altitude (730 m.) and at morning 6.00 am.

Keywords: Alkaloids, Environment, Fluctuations, Herbaltherapy, Identification

INTRODUCTION

Shunthi, Ginger (*Zingiber officinale*) is a popular herbal medicine due to presence of active compounds in it. Ginger is rich in a plant-antioxidant- gingerol that helps to lower the blood pressure by acting as a natural calcium channel blocker. It is high in gingerol. Research has linked this plant-based antioxidant to many health benefits, including lowered blood pressure (Dieniffer Peixoto-Neves *et al.*, 2014). Studies suggest that gingerol may help reduce blood pressure by acting as a natural calcium channel blocker. Calcium channel blockers prevent the movement of calcium into the heart and arterial cells, allowing the blood vessels to relax (Nahida Tabassum and Feroz Ahmad, 2011). Animal studies have shown that sweet basil extracts helped relax blood vessels and thin the blood, which in turn helped reduce blood pressure (Anwar Umar *et al.*, 2010). Heart diseases (HDs) are a major cause of weakness and early death and, therefore, constitute a main communal health problem (Souliman Amrani *et. al.*, 2009). High blood pressure (BP), mentioned as a silent killer, is triggered by a range of factors, including the interaction of genetic and environmental components causing disorderliness in BP regulation (Al Disi SS, *et. al.,* 2015). Hypertension (HTN) is the most common risk factor in acute myocardial infarction and is accountable for about 16.5% deaths annually across the world. It is also the most important reason for the morbidity and mortality accompanying CVDs. It has been predicted that by the year 2025, 29% of the world's adults, or almost 1.56 billion people, will suffer from HTN (Wang J. and Xiong X. *et. al.,* 2012). HTN is described as systolic blood pressure (SBP) ≥ 140 mm Hg and diastolic blood pressure (DBP) ≥ 90 mm Hg, according to the mean of 2 or more appropriate measurements of seated BP (Anwar MA, *et. al.,* 2016). Many antihypertensive mediators are used for the treatment of HTN, such as diuretics, sympatholytic agents, renin inhibitors, angiotensin converting enzyme (ACE) inhibitors, calcium channel blockers, β-adrenergic and α_1/β-adrenergic antagonists, and vasodilators (Hashemi V, *et. al.,* 2017). These drugs have various side effects, including muscle cramps, abnormal heart rate, blurred vision, skin rash, vomiting, kidney failure, extreme tiredness, headache, and edema (Sinha AD and Agarwal R. 2019). Current growth in the

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acceptance of alternative medicines and natural products has drawn attention to traditional medicines for the treatment of CVDs (Singh P, *et. al.*, 2015). Approximately 75% to 80% of the world's population, predominantly in developing countries, uses herbal medicines for primary healthcare because of their better compatibility with the human body, lower costs than novel pharmaceuticals, and fewer side effects (Rastogi S, *et. al.*, 2016). Medicinal plants have also been examined for their therapeutic properties. Some of them play an essential role in the production of over 50% of the currently available pharmaceutical drugs. [11] In this review article, a review of the diverse plants that have antihypertensive effects for use in the management of HTN is presented (Shayganni E, *et. al.*, 2016). *Zingiber officinale* is a herb used in traditional Chinese medicine to treat CVDs. In one study, the aqueous extract reduced BP levels in rats in a dose-dependent manner (100–400 mg/kg). It also induced a vasorelaxant effect and had ROS scavenging ability (Umar A, *et al.* 2010). As per the report of WHO herbal medicine used as labeled medicinal products that obtained from different plant parts. On earth near about 3,00,000 higher plant species are found, of these more than 1,00,000 herbs are proved and noted for having different medicinal activities in treatment of diseases (Shi-Lin Chen *et al.*, 2016). It is necessary to consider environment and herbal supply economy together because of present environmental scenario of the globe and the concurrent need for adequate herbal productivity (Amol P. *et. al.*, 2024).

Medicinal herbs are used in ayurveda from ancient times and are continuously used by human being in the form of newer remedies and dosage forms (Haidan Yuan *et al.*, 2016). For the curing of hypertension and cardiovascular disorders the available allopathic medicines shows side effects and are not being used for prolong duration (Arun Chaudhary, 2017). Herbal medicines that are in use for treatment of hypertension involve medicinal plants with absence of side effects (Wesam Kooti, 2016). Hypertension acts as increasing disorder in universe and also disturbs on economical condition of each nation in the world (Feneli Karachaliou, 2020). As per the report of World Health Association, in 2010 there are more than 375 million patients with cardiac disabilities and approximately 4.5 million patients died yearly, (N. H. Cho *et. al.*, 2018.). World Health Organization (WHO) reports that, more than 80% peoples in countries like India consumes herbal medicines with different components as Ayurvedic system for initial treatment case (Oyinlola Oyebode *et al.*, 2016). WHO has reported 22,000 herbs that are used for treatment of human diseases in the globe. In these approximately 3500 varieties are of Indian origin (Uttpal Anand *et al.*, 2019). Approximately 900 medicinal herbs having shown as remedy for treatment of hypertension. There are number of herbal active components are shown their importance in treating increased blood cholesterol level in humans. (Ngan Tran *et al.*, 2020). HPTLC study helps to gain idea about chromatographic pattern of the components. Current study involves use of HPTLC chromatography to study changes in phytoconstituents. Macroscopic and microscopic study was performed (Asha Thomas *et al.*, 2020). The present study involves results to analyses changes in the gingerol content in ginger rhizome.

MATERIALS AND METHODS

Collection and Identification of Plant material

The plant material was collected from places of Western ghats of Sahyadri, Maharashtra, Pune region, in every month of the year at morning 6 am and evening 6 pm. Authentication was done from Botanical Survey of India, Pune and voucher specimen number BSI/2018/06.

Assessmentofqualityofplantmaterials

The plant materials were assessed as per WHO guideline for macroscopy, microscopy and leaf constants, proximateanalysis and Phytochemicalscreening (Rohit C., And Rajni S., 2023).

Establishmentofqualitativephytoprofileofsuccessivesolventextracts-

Plant extracts were prepared by successive solven textraction method using Soxhlet apparatus that consist of use of n-hexane, chloroform, petroleum ether, ethanol as a solvent. Each time the crude drug material was air dried and extracted with next solvent (Eman I. Abdel-Aal, 2015). The concentrated

Table 1: Monthly Variation in alkaloids with high place and time n= 3 P< 0.05

A	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
L.	4.33 ±0.57	5.00 ±1.00	5.00 ±1.00	5.00 ±1.00	5.00 ±1.00	5.00 ±1.00	5.33 ±1.52	5.33 ±1.52	5.33 ±1.15	5.00 ±1.00	4.67 ±1.15	4.67 ±1.15
M.	4.33 ±0.57	5.00 ±1.00	5.00 ±1.00	5.00 ±1.00	5.00 ±1.00	5.00 ±1.00	5.33 ±1.52	5.33 ±1.52	5.33 ±1.15	5.00 ±1.00	4.67 ±1.15	4.67 ±1.15
H.	4.67 ±0.57	5.33 ±0.57	5.33 ±0.57	5.33 ±0.57	5.33 ±0.57	5.33 ±0.57	5.67 ±1.15	5.67 ±1.15	5.67 ±0.57	5.33 ±0.57	5.00 ±1.00	5.00 ±1.00

A= Altitude, L= Low, M= Medium, H= High

extracts then subjected to various qualitative chemical tests to determine the presence of phytoconstituents like alkaloids, glycosides, carbohydrates, phenolics and tannins, proteins and aminoacids, saponinsandphytosterols (B. Basavaraja *et. al.*, 2023). HPTLC run using mobile phase as Chloroform: Ethyl acetate (7:3) at 256 nm wavelength and 2650 standard AUC.

RESULTS AND DISCUSSION

Plant leaf color is dark green, strong odor and taste, shape is oblong simple, petiolate, exstipulated. Entire margin, atapering base and acuminate apex, leathery touch, smoothand shiningtexture. Cell wall is single layered epidermis made up of compactly arranged barrel shaped parenchymatous cells. Vascular Bundle isArc shaped, conjoint, collateral and closed. Enclosed by a parenchymatous bundle health. Vessels with pitted thickening, anomocytic or anisocytic Stomata, glandular, multicellular uniseriate (40 to 110µ) trichomes, Prismatic calciumoxalate crystals and starch grains are present.

Chemical constituents in leaf show presence of alkaloids and its percentage varies at different environmental conditions (Table 2; Figure 1).

Table 2: Monthly variation in yield mg/g with place and time n= 3 P< 0.05

A	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
L.	2.97 ±0.51	2.83 ±0.72	2.80 ±0.50	2.93 ±0.15	2.73 ±0.50	2.87 ±0.49	2.93 ±0.28	3.20 ±0.60	3.27 ±0.46	3.03 ±0.49	2.90 ±0.51	2.87 ±0.55
M.	3.30 ±0.17	3.17 ±0.15	3.13 ±0.28	3.23 ±0.15	2.87 ±0.30	3.43 ±0.32	3.50 ±0.36	3.53 ±0.50	3.60 ±0.20	3.37 ±0.58	3.23 ±0.55	3.20 ±0.68
H.	3.43 ±0.05	3.33 ±0.15	3.27 ±0.05	3.50 ±0.10	3.23 ±0.05	3. 80 ±0.10	3.77 ±0.15	3.87 ±0.05	3.93 ±0.11	3.70 ±0.10	3.57 ±0.05	3.53 ±0.05

A= Altitude, L= Low, M= Medium, H= High, Mg/gm= Milligram/ gram, Med. = Medium (Altitude)

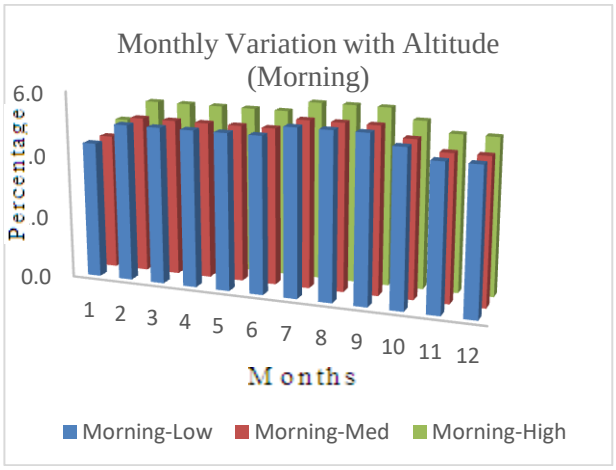

Fig. 1: Changes with Altitude time

HPTLC analytical method was used to confirm the availability of gingerol in ethanolic plant extract with its percentage obtained as 3.93 mg/gm at Rf value 0.51 (Tab. 3; Fig. 4).

Table 3: HPTLCanalysis of *gingerol*

Rf Value	Season	Area (AU)	Yield(mg/g)
0.51	Summer	3402.7	3.50
	Rainy	6719.5	3.93
	Winter	5292.8	3.43

Qualitative chemical examination of extractsshowspresenceofalkaloids such as

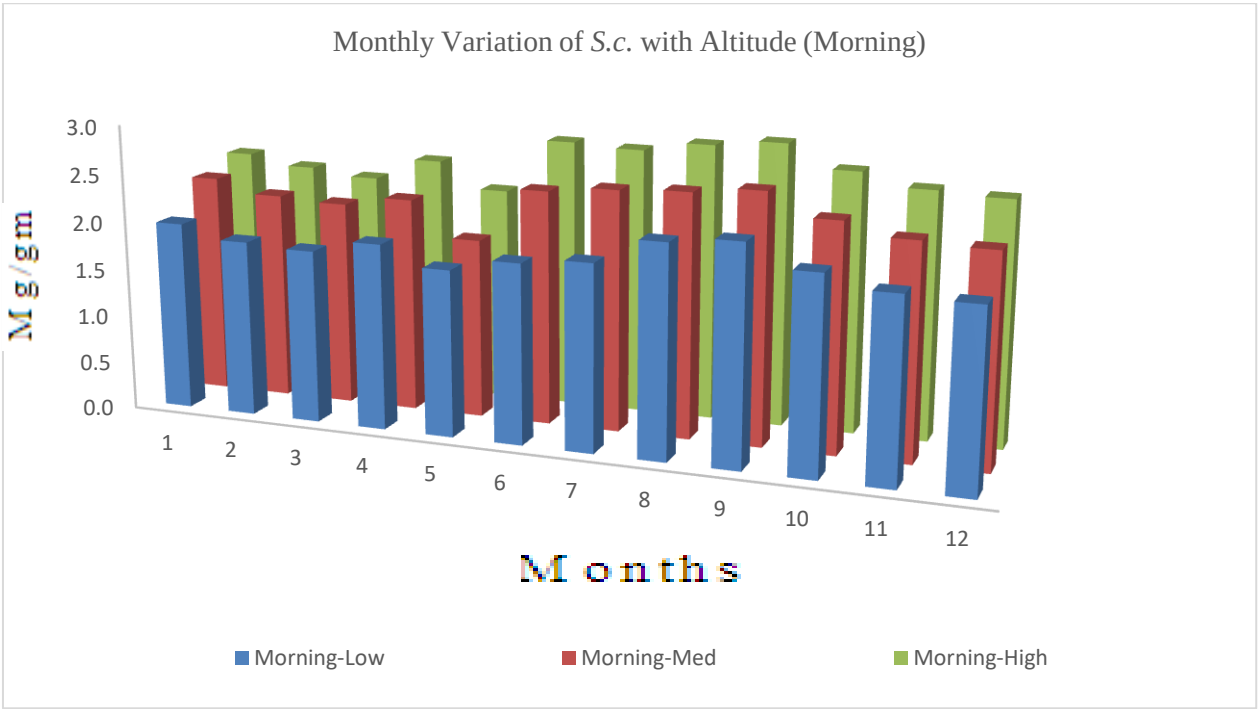

Fig. 2: Monthly Variation of with place and time

gingerol, oils, lipids, glycosides etc. It was observed that, at every month of the year, at different time and places, there is a change in HPTLC pattern. Gingerol content is significantly variable in rainy season i.e. in September, at morning time and high altitude. Current research work can be useful for selection of month, place and time of harvesting crude drugs.

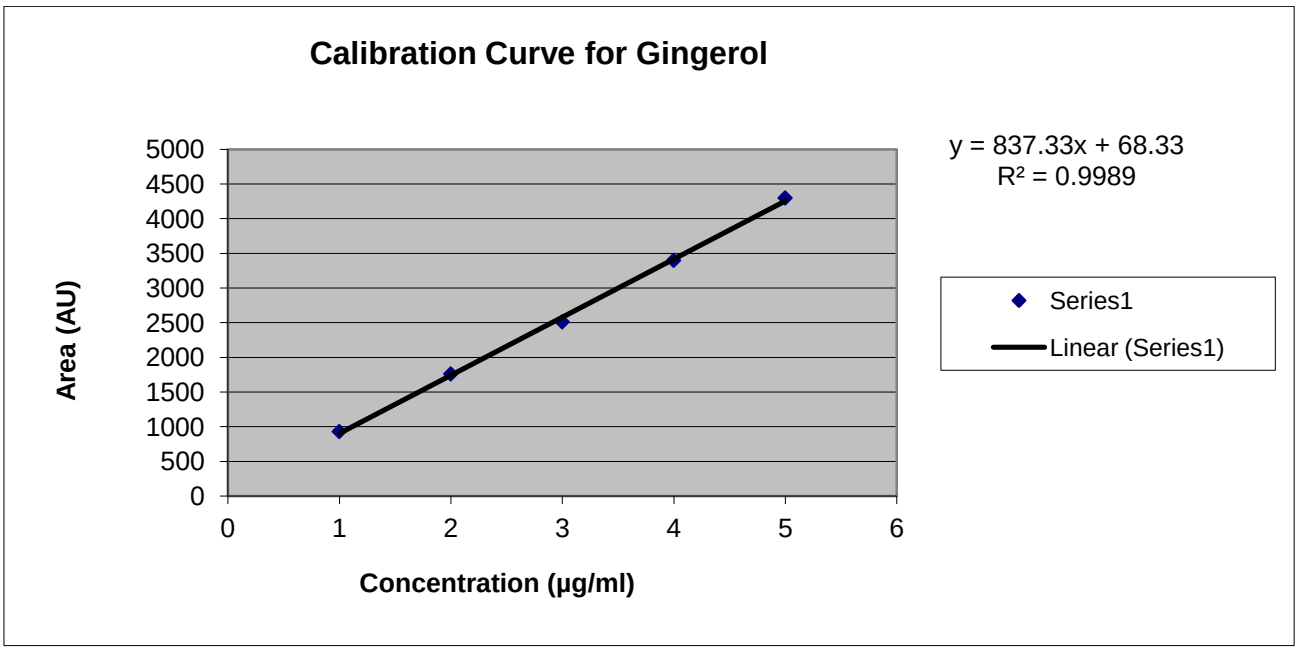

Fig. 3 Calibration curve of Gingerol

CONCLUSION

From the study it is concluded that as the environmental changes related with the season, time and place of collection of the plant and it is proportional to the changes in herbal active components. In the month of September eugenol content found to be more at morning 6.00 am and at 730-meter-high altitude.

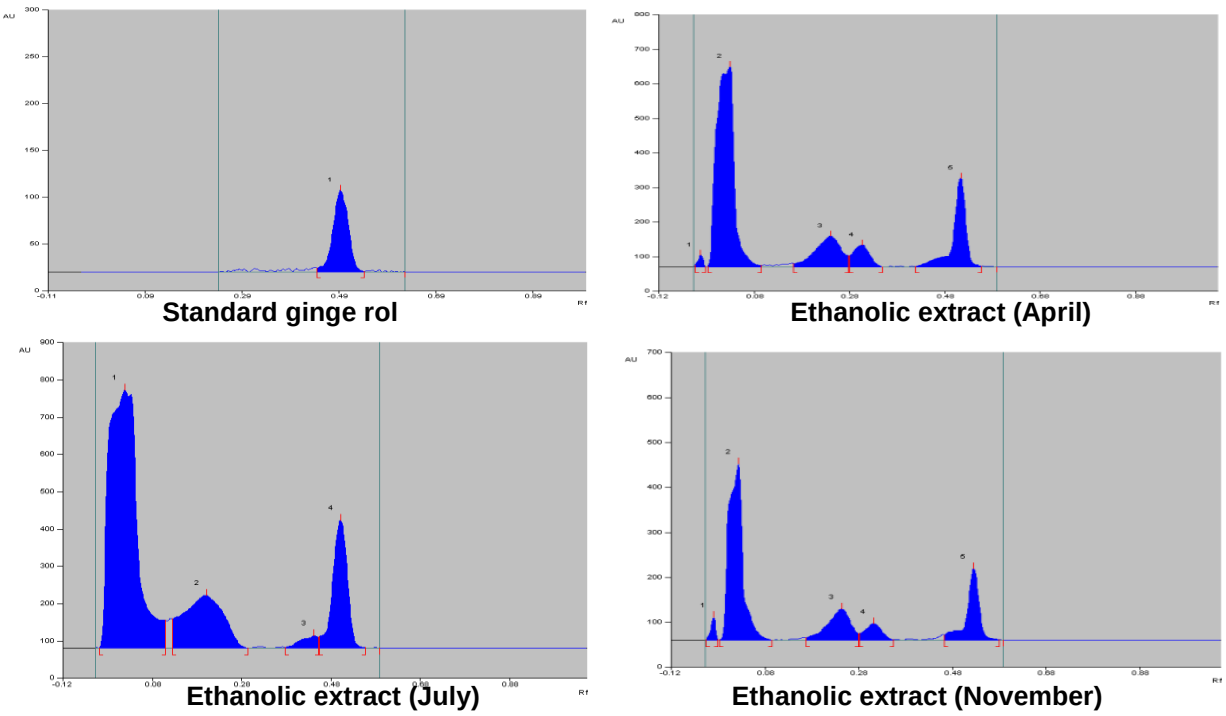

Fig. 4: Chromatogran of Gingerol

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CONFLICT OF INTEREST STATEMENT

Author notifies that experimental study carried out without any financial or non-financial support for the procedures mentioned in the report.

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