IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Comparative Study Of Phytochemical Properties And In Vitro Antioxidant Activities Of Cultivated Ginger (Fertilizer-Treated) And Local Market Ginger

Mamta Rani
Assistant Professor in Chemistry
Govt. Shrimant Madhavrao Scindia PG College, Shivpuri M.P.

ABSTRACT

Ginger is an herb that is used as a spice and medicine, attributed to a diverse array of bioactive compounds known as phytochemicals. In recent years, the global demand for natural and sustainable alternatives has spurred interest in the economic potential of ginger's phytochemical content. This research paper aims to quantitatively assess the phytochemical content economy in ginger, shedding light on its diverse applications and economic significance. By analyzing, we investigated how nature and commerce intersect to shape ginger's phytochemical profile and consequently, its economic value. In conclusion, among the percentages of cultivated ginger rhizome samples obtained from different plots treated with different types of fertilizers, the plots treated with organic fertilizers had the highest percentage (9.23% w/w). The quantification of ginger's phytochemical content economy offers valuable insights into the untapped potential of this golden spice. As we uncover its diverse applications, cultivation practices, and market trends, we present novel pathways to harness ginger's natural riches for the betterment of human health and well-being. Ultimately, this research contributes to a holistic appreciation for the wonders in this unassuming rhizome while laying the groundwork for its continued integration into global markets.

Key words: Ginger, Phytochemical Content, Micronutrients, Bioactive Compounds, Fertilizer.

INTRODUCTION

Fertilizers allow to get high-quality and high-yielding planting material. This could have significant benefits for low-cost agriculture, especially in developing countries such as India (Patil, 2010). Organic fertilizers are efficient alternatives to chemical fertilizers and can improve nutritive value of soil. According to Mahmoud et al., combining organic and inorganic fertilizers improves topsoil fertility, which in turn improves plants growth, productivity and quality. The addition of nutrient sources made a significant difference in plant height and the number of buds per plant (Kale et al.).

Certain types of herbs and spices such as ginger etc. are important ingredients in Indian cuisine. Ginger yields are low due to lack of planted area, loamy sandy loam soil, low fertility and farmer's unawareness of using high quality organic fertilizers. As awareness of the degradation of productive land increases, appropriate adjustments and sustainability. Large amounts of agricultural waste, including cow dung and other biological waste, are abundant in rural areas, but are not recycled or properly utilized. Tiwari, KP et al. investigated vermicomposting as an alternative to the use of organic waste in agriculture.

Vermicompost not only provides nutrients and growth regulators, but also increases soil water retention, Microbial numbers and soil carbon content.

Ginger (Zingiber Officinale), often referred to as the "golden spice," has been treasured for centuries for its distinctive flavor, culinary versatility, and numerous health benefits. Beyond its role as a beloved culinary ingredient, ginger has captured the attention of scientists, researchers, and industries alike due to its rich repertoire of bioactive compounds known as phytochemicals. These phytochemicals, including gingerol, shogaols, zingerone, gingerdiol, and volatile oils, are responsible for the spice's therapeutic properties, ranging from potent antioxidants to anti-inflammatory agents.

The economic significance of ginger extends far beyond its traditional usages, with a burgeoning demand across diverse industries like pharmaceuticals, dietary supplements, herbal remedies, and the food and beverage sector. As the world turns to more sustainable and natural alternatives, the phytochemical content of ginger emerges as a focal point for exploration and innovation, positioning this humble rhizome at the forefront of the botanical renaissance.

However, to fully comprehend the impact of ginger's phytochemical content on the global economy, a comprehensive study becomes imperative. This research paper aims to investigate into the quantitative assessment of the phytochemical content economy in ginger, shedding light on the driving factors behind its market growth, the diverse applications that exploit its medicinal attributes, and the evolving trends that shape its cultivation and trade.

In this pursuit, we endeavor to amalgamate insights from the fields of pharmacology, agronomy, food science, and market economics, to paint a comprehensive picture of ginger's versatile potential and its enduring allure to consumers and industries worldwide. By quantifying the economic contributions of ginger's phytochemical constituents, we hope to facilitate informed decision-making for stakeholders, researchers, policymakers, and businesses seeking to harness the untapped opportunities that this golden spice presents.

Throughout this research, we will investigate the intricate interplay between nature and commerce, exploring how factors influence ginger's phytochemical content and, subsequently, its economic value.

As we embark on this journey of discovery, it is our belief that unraveling the quantifiable phytochemical content economy in ginger will not only enhance our understanding of this extraordinary plant but also offer novel pathways to harness its potential for the betterment of human health and well-being. By illuminating the relationship between science, commerce, and nature, we aim to contribute to the sustainable growth of the ginger industry while promoting a holistic appreciation for the wonders that lie within this small but mighty rhizome.

In the following, we shall investigate into the scientific basics of ginger's phytochemical profile, and present a comprehensive analysis of its economic impact, thus paving the way for a new era of ginger exploration and utilization.

Fertilizer Application

Treatments of soil include two-stage nitrogen application with organic fertilizers, two-stage nitrogen application with chemical fertilizers, and combinations thereof applied to crops during cultivation in 4 different plots. Fertilizer applied as per the treatment as well as mixed systematically with the soil.

METHOD

Five plants marked out randomly from each plot for growth observation. Readings was taken from five plants and calculated per plant basis. Then rhizome was dried in sunlight but not in direct sunlight. Rhizomes of Ginger Samples 1 to 4 were packed separately using plastic boxes then making code as “Sample:1 (S#1), Sample:2 (S#2), Sample:3 (S#3), and Sample:4 (S#4). Sample: 5 (S#5)” was purchased from local market finally made the powder as per requirement.

ANALYSIS OF PLANT MATERIAL (RHIZOME) OF CULTIVATED GINGER

Extraction using "Maceration Method"

Rhizomes of *Zingiber officinale* (S#1 to 4) was subjected to extraction using maceration methods. Powdered rhizome was weighed S#1 (5.4 g), S#2 (6.2 g), S#3 (9.4 g), S#4 (16.4 g), and S#5 (15.1 g) and packed in (1 liter) air tight glass Bottle. For extraction process rhizome was treated by Hydroalcoholic (CH_3OH: Water; 70:30v/v) as a solvent for 1 day. Final residue was collected in the flask. The solvent removed from the extract by evaporation method (Mukherjee, 2007). The extracts were collected from each sample and weigh equally so that w/w% can be calculated.

Determination of percentage yield

The percentage yield of each extract was calculated by using following formula:

$$\text{Percentage yield} = \frac{\text{Weight of Extract}}{\text{Weight of powdered drug}} \times 100$$

Phytochemical Screening

Phytochemical examinations were carried out for all the extracts as per the standard methods (Khandelwal, 2005).

Estimation of "total alkaloids content"

In rhizome extract (1 mg) CH_3OH was mixed to make more dilute solution and filtered after addition of 1.0 ml 2.0 Normal HCl solution. To this solution in the separating funnel add 5.0 milliliter of "bromocresol green sol."As well as 5.0 milliliter of "phosphate buffer". This mixture stirred forcefully with 1.0, 2.0, 3.0, and 4.0 ml of $CHCl_3$, then "collected in a 10.0 ml flask" and distil water added to volume with $CHCl_3$ to make dilute solution. Similarly, generate a set of "atropine reference standard solutions" (40.0, 60.0, 80.0, 100.0, and 120.0 µg/ml) using the same procedure. Measure the "absorbance of the test solutions and standard solutions relative to the reagent blank at 470 nanometre using a UV/Vis spectrophotometer". Total alkaloid concentrations were calculated as mg of AE per 100 mg of extract (Shamsa et al., 2007).

Estimation of total flavonoids content

Determination of total flavonoids content was based on aluminum chloride method (Parkhe and Bharti, 2019). Dissolve 10.0 mg of quercetin in 10.0 ml of CH_3OH and prepare various aliquots from 5 to 25 µg/ml in CH_3OH. 10.0 mg of the of this sample is made soluble in 10.0 ml of CH_3OH and filtered. For flavonoid determination, take 3ml of extract (1mg/ml). Add 1.0 ml of 2.0% aluminum chloride solution to 3.0 ml of "rhizome material or each standard then let stand at 25^0C for 15 minutes, finally measure absorbance at 420 nm".

Estimation of total phenol content

The total phenolic content of extracts was measured by a modified Folin-Ciocalteu method (Parkhe and Bharti, 2019). Dissolve 10 mg of "gallic acid" in 10 ml of CH_3OH and prepare various aliquots from 10 to 50 µg/ml in CH_3OH. 10 mg of the dried extract was dissolved in 10 ml of CH_3OH and filtered. 2 milliliters (1mg/ml) of this extract were used for C_6H_5OH determination. "Mix 2 ml of extract and each standard with 1 ml of Folin-Ciocalteu reagent (prediluted to 1:10 v/v with distilled water) and 1 ml (7.5 g/l) of Na_2CO_3. Vortex the mixture for 15 seconds and let stand for 10 minutes until color develops. Measure the absorbance at 765 nm using a spectrophotometer".

Measurement of in vitro antioxidant activity using the DPPH method

"DPPH scavenging activity was measured using a spectrophotometer". Prepare a stock solution (6.0 mg, dissolved in 100 ml CH_3OH) with an initial absorbance of 1.50 ml. In 1.50 ml CH_3OH, "After 15 minutes, the absorbance decreased in the presence of various concentrations (10-100 mg/ml) of sample extract. Add 1.5 ml of DPPH solution to 3 ml of CH_3OH and measure absorbance at 517 nm as a control reading. Place 1.5 ml of DPPH and 1.5 ml of test samples of various conc. into a series of volumetric flasks and adjust the final volume to 3 ml using CH_3OH. 3 trial samples were collected, and then processed. In last, calculated the average. After 15 min at 517 nm, the absorbance of various concentrations of DPPH showed a final decrease (Parkhe and Jain, 2018).

Results of Percentage Yield

Table 1: Percentage yield of different samples

Sr. No.	Sample	Treatment of plot done by	Percentage yield (w/w)
1.	S#1	Organic fertilizer	9.23%
2.	S#2	Chemical fertilizer	3.87%
3.	S#3	Mix (Both Organic and Chemical fertilizer)	4.13%
4.	S#4	No treatment	3.10%
5.	S#5	Sample obtain from local market	4.62%

Results of "Estimation of total Alkaloid Flavonoids and Phenol Content"

Table 2: Estimation of total alkaloid,"flavonoidsand phenol content"of *Zingiber officinalis* extract

S. No.	Sample	Total alkaloid content	Total flavonoids content	Total phenol content
		mg/ 100 mg		
1.	S#1	-	1.64	0.935
2.	S#2	6.21	1.27	1.750
3.	S#3	2.85	1.55	0.814
4.	S#4	-	1.66	1.721
5.	S#5	-	2.05	1.150

Results of "antioxidant activity using DPPH method"

Table 3: Absorbance of "ascorbic acid and given samples using DPPH method"

S. No.	Conc. (µg/ml)	Absorbance					
		Ascorbic acid	S#1	S#2	S#3	S#4	S#5
1	10.0	0.623	1.036	0.941	1.015	0.976	1.102
2	20.0	0.532	0.964	0.866	0.932	0.925	1.069
3	40.0	0.441	0.950	0.593	0.915	0.883	0.965
4	60.0	0.352	0.906	0.522	0.858	0.820	0.902
5	80.0	0.223	0.894	0.363	0.524	0.728	0.864
6	100	0.109	0.856	0.297	0.408	0.698	0.812
	Control	**1.122**					

Table 4: % Inhibition of ascorbic acid and given samples using DPPH method

S. No.	Concentration (µg/ml)	% Inhibition					
		Ascorbic acid	S#1	S#2	S#3	S#4	S#5
1	10	44.47	7.66	16.13	9.53	13.01	1.78
2	20	52.58	14.08	22.81	16.93	17.55	4.72
3	40	60.70	15.32	47.14	18.44	21.3	13.99
4	60	68.63	19.25	53.47	23.52	26.91	19.61
5	80	80.12	20.32	67.64	53.29	35.11	22.99
6	100	90.29	23.7	73.52	63.63	37.78	27.63
IC $_{50}$ value		**18.77**	**267.81**	**56.67**	**83.69**	**140.35**	**172.50**

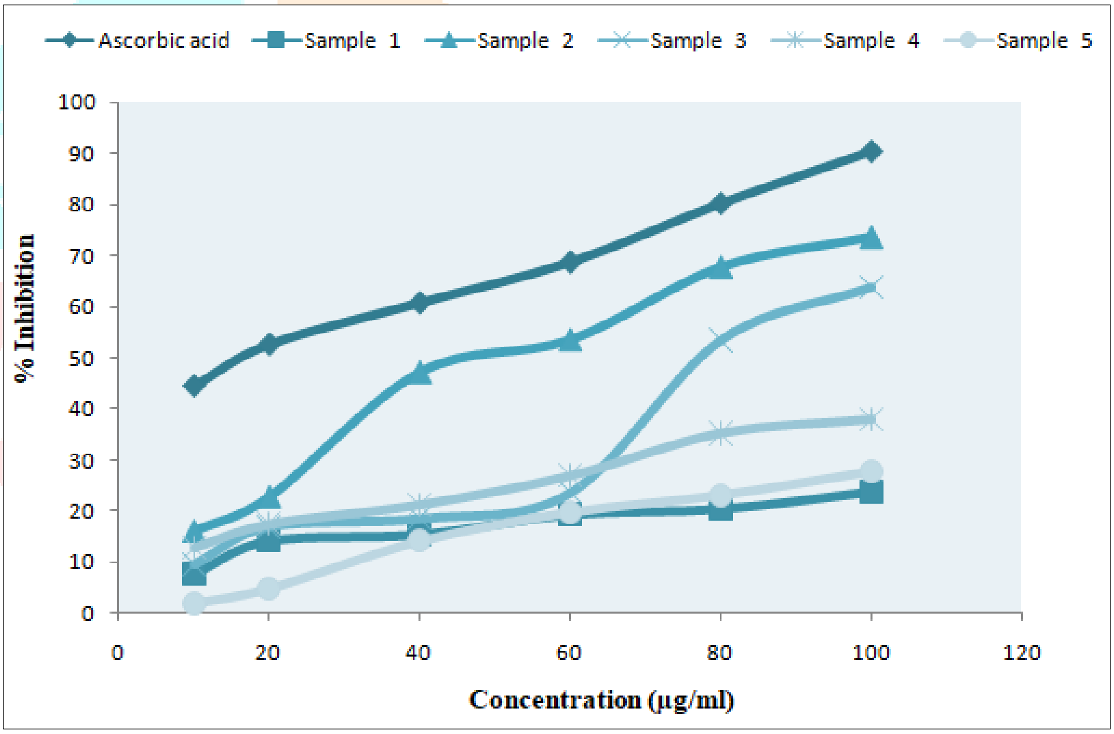

Fig.-1: % Inhibition of "ascorbic acid and given sample susing DPPH method"

CONCLUSION

After performing the above research study, we conclude that among the percentages of cultivated ginger rhizome samples obtained from different plots treated with different types of fertilizers, the plots treated with organic fertilizers had the highest percentage (9.23% w/w). Organic fertilizers (biofertilizer or vermicompost), chemical fertilizers (urea or NPK) and their combinations have great importance in overall plant development and quality of biochemical parameters as well as plant chemicals content of ginger (Zingiber *officinale*).Their use in cultivation improves and enhances most of the growth characteristics, yield composition, rootstock yield, yield quality, rootstock density and crude fiber content. These treatments also increase the nitrogen, phosphorus and potassium content of rhizomes and shoots. Organic fertilizers also help improve rhizome quality.

REFERENCES

1. Patil N. M. "Biofertilizer Effect On Growth, Protein And Carbohydrate Content In Stevia Rebaudiana Var Bertoni" Recent Research in Science and Technology 2010, 2(10): 42-44 ISSN: 2076-5061 www.recent-science.com
2. Mahmoud, E. K. (2009). Effects of Different Organic and Inorganic Fertilizers on Cucumber Yield and Some Soil Properties World Journal of Agricultural ScienceS#5(4):408-414.
3. Kale RD, Bano K, Bagyaraj DJ.(1992). *Influence of vermi compost applicationion the available macronutrients and selected Microbial population in Paddy field*. Cell Boil. Biochem. 24:1317-1320.
4. Tiwari KP, Singhai NK, Kushwah RS and Gupta BS *Effect of vermicompost on productivity of ginger " Journal of Pharmacognosy and Phytochemistry*, www.phytojournal.com
5. R. Jazokaite, M. Marksa, A. Zevzikoviene, A. Zevzikovas. Chromatographic analysis of 6-gingerol and 6-shogaol using tlc and hplc methods. ScienceRise Pharmaceutical Science. 2019; 10-15.
6. Khandelwal KR. Ed.Practical pharmacognosytechnique and experiments.23rded. Vol. 15;2005.
7. Mukherjee PK. Quality Control of Herbal Drugs, 2nd Edition, Business Horizons. 2007; 2-14.
8. Kokate CK. Ed. Practical Pharmacognosy, 4thEdn., *Vallabh Prakashan*: 1994; 112:120.
9. Fazel Shamsa, Hamidreza Monsef, RouhollahGhamooshi, Mohammadreza Verdianrizi. Spectrophotometric determination of total alkaloids in some Iranian medicinal plants. Thai J Pharm Sci. 2008; 32: 17-20.
10. Geeta Parkhe, Deepak Bharti. Phytochemical investigation and determination of total phenols and flavonoid concentration in leaves extract of *Vitex trifolia* Linn. Journal of Drug Delivery & Therapeutics. 2019; 9(4):705-707.
11. ParkheG, JainP. Study of antioxidantpotential of hydroalcoholic extract of *Anethum graveolens*. Career.IntJSci Technol.2018;1(2):39-45.
12. P. Padmanabhan and S. N. Jangle. Evaluation of *in-vitro* anti-inflammatory activity of herbal preparation, a combination of four medicinal plants. International Journal of Basic and Applied Medical Sciences. 2012; 2(1): 109–116.