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Article

Analytical Study of Ginger Plant Extracts

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Abstract: Ginger, a spice with many traditional uses, has been prescribed to treat a wide range of illnesses by different medical traditions. The current study of ginger extracts was conducted using non-ionized water and ethanol (99%) as solvents. UV, FTIR, and GCMS analyses of alcohol extract have confirmed the presence of important phytochemical components in our daily diet. Antioxidant analysis showed that aqueous ginger extract possessed antioxidant properties compared to vitamin C, as the extract was sufficient to impede a ratio of 1,1-bi-phenyl-2-picryl hydrasil-free radicals (DPPH). The DPPH root rickets maximal activity was measured for ascorbic acid (19) part per million and aqueous extract (20.56) part per million, and the results of the qualitative detection of the aqueous extract indicated the presence of steroids, carbohydrates, proteins, phenols, alkaloids, flavonoids, saponins, tannins, which are the main compounds found in the plant that are believed to be responsible for the observed antioxidant activity.

Keywords: steroids. carbohydrates, proteins, phenols. Alkaloids, flavonoids, saponins, tannins

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1. Introduction

Ginger is a tropical plant that is associated with the Zingiberaceae family and belongs to the classified Zingiber. Its rhizomes, which grow underground and contain volatile oil, have a pungent odor and flavor and are pale or yellowish-white in color, are used. Yellow blossoms with purple lips adorn ginger. It is a fragrant, branching, and uneven herb [1]. Only when its spear leaves wilt is it removed. Also, don't grin at it until it's completely dried. It is a widely used seasoning that is cultivated globally. Conventional medicine medicine systems have long recognized dietary ginger (Zingiber officinale Roscoe). Ginger is a monocotyledonous plant in the Zingiberene family, genus Zingiber, and species aromatic herb. Ginger is a tropical and subtropical plant that originated in Southeast Asia and has since spread throughout the world [2]. India is the world's largest producer and emitter of ginger, followed by Nigeria, China, Bangladesh, Indonesia, and Thailand. In India, the state of Kerala ranks first in expressions of region total production planted and planted [3]. The Zingiberaceae family includes about 53 genera and a total of over 1200 species [4]. It has several different medical applications, comprised of anticoagulant and reduces inflammation properties [5], antioxidant [6], and anticancer agent [7], practice many direct and indirect Influences on blood pressure and heart rate, it is capable of being used to Medicated migraine, diabetes, retinopathy, ulcer and cancer [8]. Its tonic aids in memory advancement and liver Hygienic preservation. Some of the conditions it can alleviate include arthritis, dyspepsia, headaches, jaundice, and paralysis [9]. Moreover, it has the potential to help with filariasis therapy [10], Ginger is used to treat colds and is good for digestion and reducing cramping. It is also good for treating gout and should not be given to pregnant women. Ginger can also be

used to dilate blood vessels, stimulate perspiration production, make you feel warm, and relieve heat [11].

2. Materials and Methods

After sourcing the ginger roots from the market, they were transported to the laboratory. Once there, the sample was carefully cut into pieces, dried in a chamber, and crushed into a powder. It was then stored in an airtight container until extraction.

2.1. Preparation of Extract

2.1.1. Aqueous extract

After boiling 10 grams of ginger root powder in 200 milliliters of deionized water for 15 minutes at 80 degrees Celsius until the mixture turned yellow, it was cooled to room temperature and filtered to get a clear, yellow plant extract solution, for diagnostic purposes, the aqueous extract was kept at 5 ° C, this extract is known as aqueous extract [12].

2.1.2. Organic extract

The following steps were taken to prepare the solution for GC MS analysis: 10 grams of ginger powder roots were combined with 100 milliliters of pure ethanol; the mixture was then shaken for 24 hours at 30°C. After that, it was filtered and concentrated [13].

2.2. Phytochemical checking Tests

Qualitative detection of ginger extracts has been carried out to make sure there is being present of active compounds using standard procedures: steroids (chloroform + concentrated H2SO4), carbohydrates (Benedict's reagent), proteins (NaOH+ copper sulfate), phenols, tannins (lead acetate solution), alkaloids (Mayer's Test), flavonoids (Alkaline reagent Test), and Saponins (Foam Test) [14].

2.3. UV-VIS spectrometry

A UV-visible spectrophotometer (UV-1900i, SHIMADZU, JAPAN) was used to evaluate ginger extract using a 10 mm cell operating at room temperature with a slit width of 2 nm. The extract was examined using visible and ultraviolet light with wavelengths varying between 210 and 800 nm for approximation. The aqueous extract was passed through a filter paper after being centrifuged at 3000 rpm for 10 minutes and then diluted 1:10 with the same solvent for UV-vis spectrophotometry examination.

2.4. FTIR spectrometry

The complementary (IR) spectral features provided more good information about the biochemical components of the rhizome of Zingiber extracts. FTIR spectroscopy was collected using a Bruker FTIR spectrometer. The chemical Fourier transform infrared spectroscopy (FT-IR) was used to validate the functional groups. The infrared spectra of the extract of Zingiber were measured as KBr in the 400 to 4000 cm-1 range.

2.5. Preparation of Samples for GC-MS Analysis

One ml of concentrated ethanolic extract was taken, diluted to 10 ml with ethanol, and filtered with a 0.22 μm filter to purify it from impurities.

2.5.1. GC-MS Experimental Procedures

The following circumstances were satisfied during the GC-MS analysis: the instrument used was a Japanese SHIMAZU 5890-11 gas chromatograph, the integrated GC column was an OV 101 coated with polymethyl silicon (0.25 mm x 50

m), and the following procedures were followed: Adjustable thermostat with a temperature range of 80–200°C, with a pace of 5°C/min for the first minute and 200°C for the second. Helium is used as the carrier gas, the injection temperature is 230°C, the flow rate is 77 ml/min, and the flow split ratio is 50. It is 300 degrees Celsius at the FID. We used a GC-MS QP 2010 Plus gas chromatograph from Shimazu, Japan, operating at 230 °C for the injector and 100 kPa for the carrier gas. At 50 ml/min, the column's dimensions were 30 m in length and 0.25 mm in diameter. Automated GC-MS was used with a reagent voltage of 1.5 kV and a sample rate of 0.3 s to analyze the rinses. The analysis started at 3 minutes and took a total of 45 minutes [15]

2.6. Antioxidant Activity

The 2, 2-diphenyl-1 picrylhydrazyl (DPPH) free radical scavenging activity was used to test the ginger extract's antioxidant activity in vitro.

2.6.1. Preparation of test sample

The DPPH assay was used to investigate the free radical scavenging activity of ginger extract. This extract was tested at a range of concentrations, including 10, 25, 50, 60, and 100 μg/mL. A 150 mL methanol solution comprising different quantities of sample solution was added to 3 mL of the daily generated DPPH and methanol solution. Optical density changes were observed using a UV spectrophotometer at 517 nm, 20 minutes after the first mixing; a standard reference was vitamin C. To find out how well the sample scavenged DPPH, we compared its absorbance to that of the reference solution. The proportion of radical scavenging activity of the DPPH was determined using the following formula: This is the formula for antiradical activity: (Ao - AC) /Ao×100. In this case, the absorbance of the control (Ao) and the sample (Ac) when both are present are used. The mean radical scavenging activity was expressed as a percentage based on the averaged findings of three separate trials [16].

3. Results and Discussion

3.1. Phytochemical checking Tests

Examining and studying the presence of plant chemical compounds in both extracts of ginger leaves are shown in Table (1).

Table 1. Bioactive components extract of ginger plant.

Active compounds	Experiments reagents	Indication	Results
Steroids	chloroform+ concentrated H_2SO_4 layer yellow + green fluorescence	chloroform+ concentrated H_2SO_4 layer yellow + green fluorescence	+ve
Carbohydrates	Benedict's test green solution	Benedict's test green solution	+ve
Proteins	NaOH+ copper sulfate color	NaOH+ copper sulfate color	+ve
Phenolic compounds and Tannins	lead acetate white precipitate	lead acetate white precipitate	+ve
Alkaloids	Mayer's test White precipitate	Mayer's test white precipitate	+ve
Flavonoids	Alkaline Reagent Test colorless	Alkaline Reagent test colorless	+ve
Saponins	Foam test foam white	Foam test foam white	+ve
tannins	lead acetate yellowish precipitate	lead acetate yellowish precipitate	+ve

Key: ++ = High concentration, + = Presence of bioactive compound, – = Absence of bioactive compound

All the results obtained are in agreement with previous studies.

3.2. UV-VIS spectrometry

The detection of a band within the wavelength range of 200 to 300 nanometers provides a distinct indication of the existence of heterogeneous atoms and unsaturated groups (e.g., N, O, and S). Consequently, this rule eliminates the possibility that the extract contains organic chromophores. Unfortunately, it's not easy to tell which components have which absorption peaks, therefore UV-vis analysis has its limitations. This study will demonstrate why additional analytical methods, such FTIR and GCMS, are needed to complement the UV-vi results.

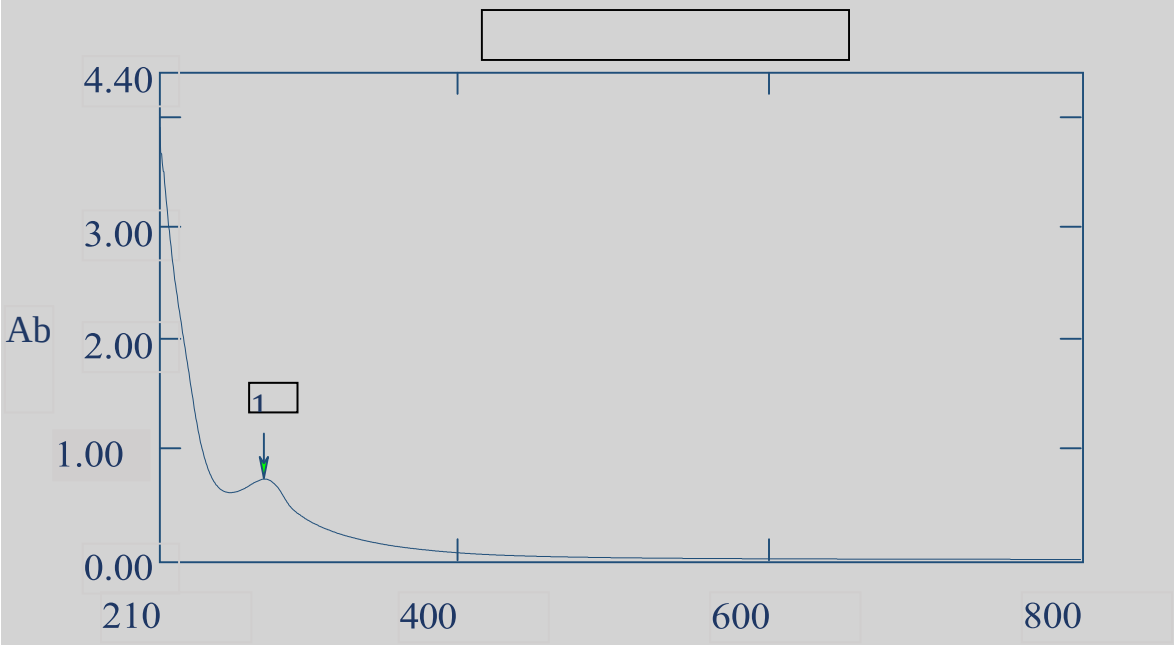


Figure 1. UV visible spectrophotometer for aqueous extract of ginger plant.

3.3. FTIR spectrometry

For FT-IR spectra, the distinctive band at:

- (3272_3421) cm^{-1} O-H stretch of Phenolic, Flavonoids, Carbohydrates compounds.
- (3164-3188) cm^{-1} NH stretch of Alkaloids and some other compounds that contain a group NH.
- (1698) cm^{-1} c=o for fatty acids and proteins.
- (1636) cm^{-1} for c=o of amide.
- (1039-1278) cm^{-1} for c=o of ether compounds.
- (1303) cm^{-1} for O-H carboxylic acid.
- the range (400-600) cm^{-1} for metals in compounds.
- (2875) cm^{-1} for CH_3 group, (1339) cm^{-1} for NO_2 and (1150) cm^{-1} for SO_2 group.

Figure 2. The infrared spectra of the extract of ginger plant.

3.4. GC-MS Analysis

The peaks that appeared in the GC-MS analysis are as follows:

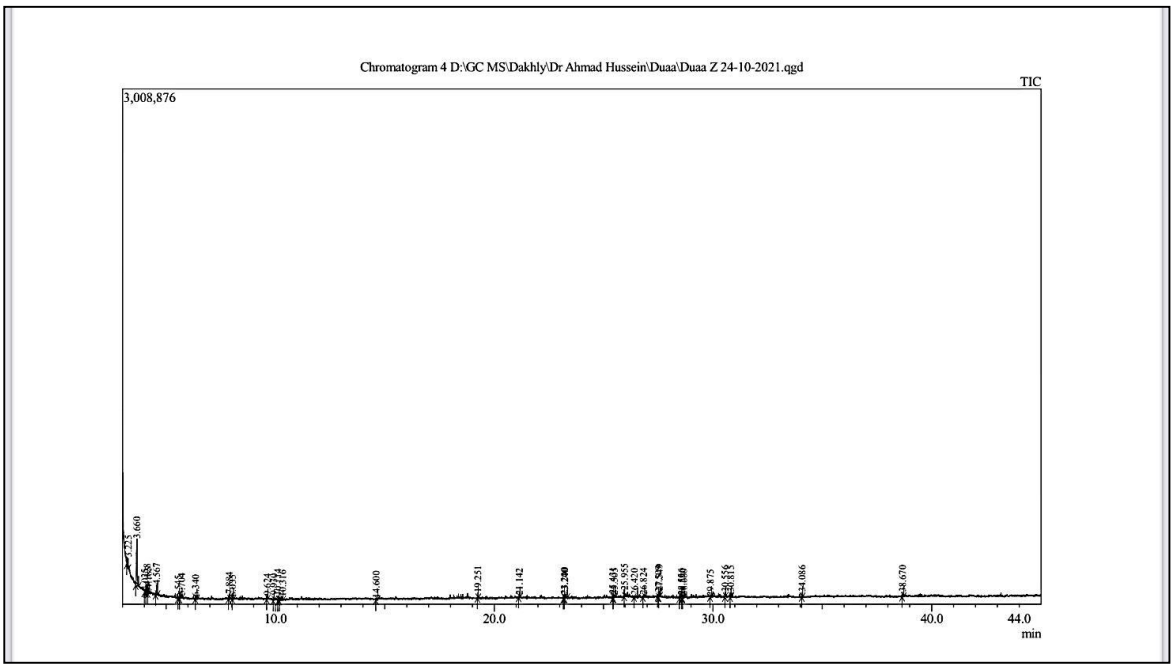
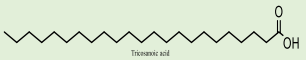
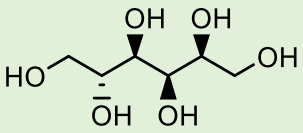
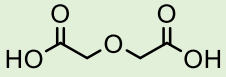
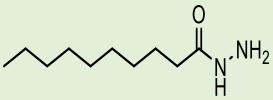
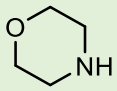
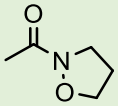
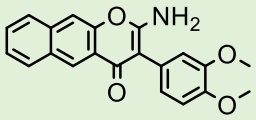
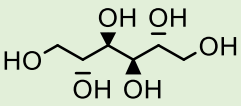
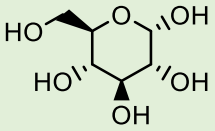
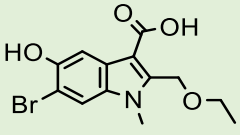
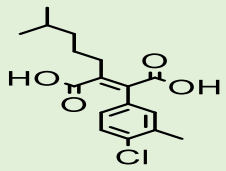
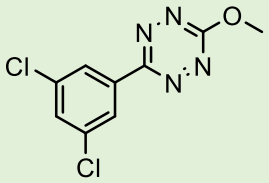
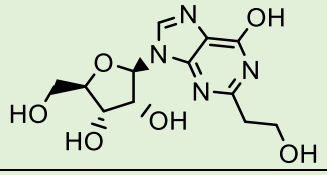
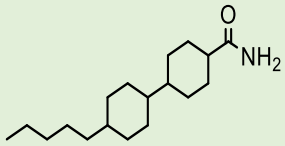
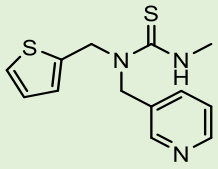
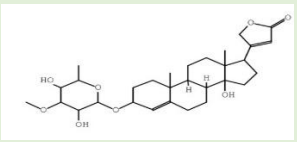
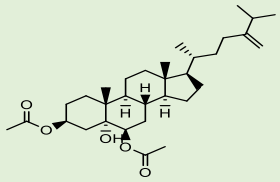
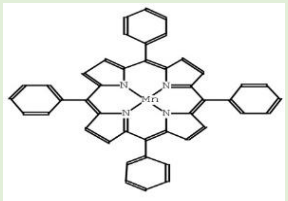
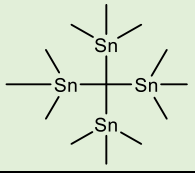
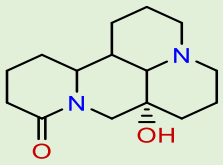
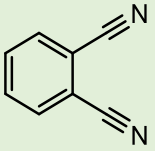
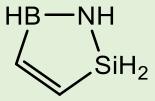
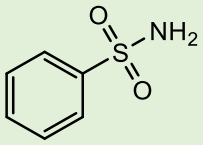
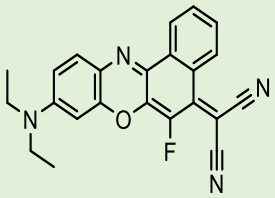
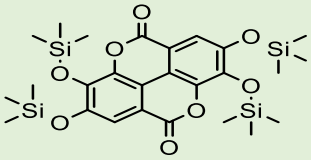
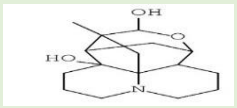
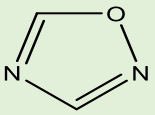
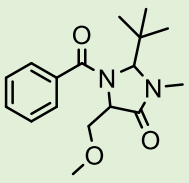
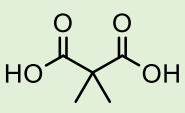
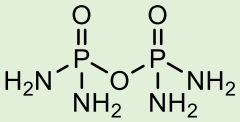


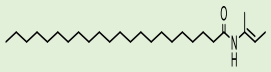
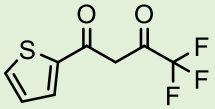
Figure 3. GC-MS Chromatogram extract of ginger plant.

Table 2. Several peaks were obtained, summarized in the following:

Chromatographic Peak	Chemical Name	Molecular Formula	Molecular Weight	The Chemical Composition
1.	Tricosanoic acid	$C_{26}H_{52}O_2$	396.69	
2.	Sorbitol	$C_6H_{14}O_6$	182	
3.	Dimethyl Sulfoxide	C_2H_6OS	78	
4.	Diglycolic acid	$C_{20}H_{38}O_5$	358	
5.	Decanohydrazide	$C_{10}H_{22}N_2O$	186	
6.	Morpholine	$C_5H_{11}NO_2$	87.12	
7.	2-Acetylisoxazolidine	$C_5H_9NO_2$	115	
8.	2-Amino-3-(3,4-dimethoxyphenyl)-4H-benzo[g] chromen-4-one	$C_{21}H_{17}NO_4$	298.3	
9.	d-Mannitol	$C_6H_{12}O_5$	164	
10.	alpha-D-Glucose	$C_6H_{12}O_6$	180	
11.	6-Bromo-2-ethoxymethyl-5-hydroxy-1-methyl-1H-indole-3-carboxylic acid	$C_{15}H_{18}BrNO_4$	328	

12.	Fumaric acid, 4-chloro3-methyl phenyl isohexyl	$C_{17}H_{21}ClO_4$	324	
13.	3-[3,5-Dichlorophenyl]-6-methoxy-1,2,4,5-tetrazine	$C_9H_6Cl_2N_4O$	256	
14.	2-[2-Hydroxyethyl]-9-[.beta.-d-ribofuranosyl] hypoxanthine	$C_{12}H_{16}N_4O_6$	312	
15.	4'-Pentylbicyclohexyl-4-carboxamide	$C_{18}H_{33}NO$	279	
16.	Thiourea,1-methyl-3-(3-pyridylmethyl)-3-(2-thienylmethyl)-	$C_{13}H_{15}N_3S_2$	277	
17.	Carda-4,20(22)-dienolide	$C_{23}H_{28}O_5$	384.5	
18.	24-Methylenecholestane-3.beta.,5.alpha.,6.beta.-triol-3.beta.,6.beta.-diacetate	$C_{32}H_{52}O_5$	516	
19.	Manganese, [5,10,15,20-tetraphenyl-21H,23H-porphinato(2-)-N21,N22,N23,N24]	$C_{44}H_{28}Mn_4$	667	
20.	Stannane, methane tetryl tetrakis [trimethyl-	$C_{13}H_{36}Sn_4$	672	

21.	Sophoranol	$C_{15}H_{24}N_2O_2$	264	
22.	1,2-Benzenedicarbonitrile	$C_8H_3N_3O_2$	173	
23.	1-Aza-2-sila-5-boracyclopent-3-ene	$C_9H_{20}BNSi$	181.16	
24.	Benzene sulfonamide	$C_6H_5ClN_2O_4S$	236	
25.	5-Dicyanomethylene-9-diethylamino-6-fluorobenzo[a]phenoxazine	$C_{23}H_{17}FN_4O$	384	
26.	2,3,7,8-Tetrakis[(trimethylsilyl)oxy] chromeno [5,4,3-cde] chromene-5,10-dione	$C_{26}H_{38}O_8Si_4$	590	
27.	Annotinol	$C_{16}H_{25}NO_3$	279	
28.	1,2,4-Oxadiazole	$C_{15}H_{13}N_5O_5$	343	
29.	1-Benzoyl-2-t-butyl-5-methoxymethyl-3-methyl-imidazolium-4-one	$C_{17}H_{24}N_2O_3$	304	
30.	Dimethyl malonic acid	$C_{15}H_{18}O_5$	**132**	
31.	Diphospho ramide	$H_8N_4O_3P_2$	**174**	

32.	N-(2-chlorophenyl) docosanamide	$C_{28}H_{48}ClNO$	449	
33.	4,4,4-Trifluoro-1-thiophen-2-yl-butane-1,3-dione	$C_8H_6F_3NO_2S$	237	

From the above table, it is noted that there is a group of compounds, most of which are carbohydrates, steroids, flavonoids, amino acids, and phenols, which were proven by the qualitative statements mentioned previously, and many other compounds that have many applications and benefits that will be discussed in the next lines.

3.5. Antioxidant Activity

Our body's natural defensive mechanism against free radicals is a diet rich in antioxidants. To estimate the amount of material that can prevent 50% of the consumed DPPH, the IC50 value is useful. A higher scavenging potency is indicated by a lower IC50 value. The current findings demonstrate the scavenging activity of dried ginger in comparison to a standard of vitamin C. The anti-DPPH activity of vitamin C is strong, as shown in figure (4), with an IC50 value of 19 µg/mL.

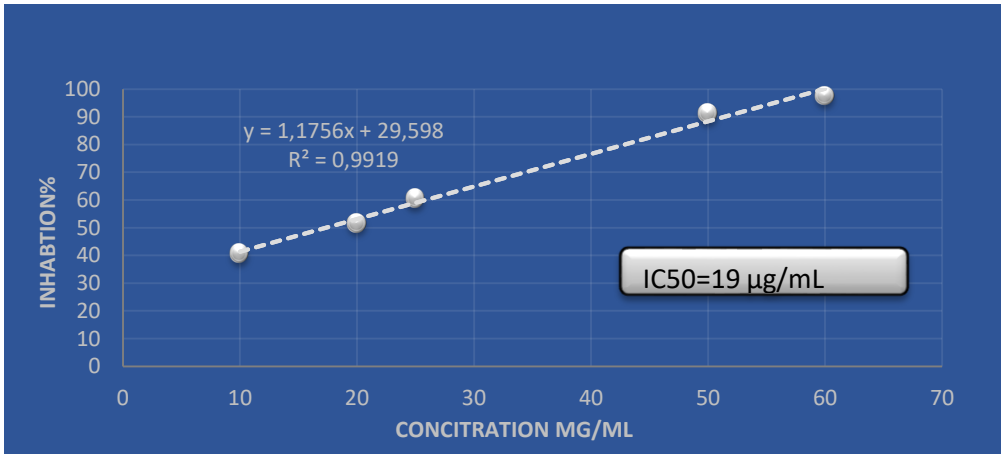


Figure 4. Vitamin C antiradical inhibition plot against DPPH.

It is well-known that plant extracts rich in polyphenols can neutralize free radicals and transfer electrons or hydrogen atoms, giving them antioxidant properties. The DPPH assay is a simple method for the antioxidant activity of the components of the ginger extract. The ginger extract had a substantial inhibitory impact on DPPH, reaching up to 85% at a concentration of 200 µg/ml and its IC50 was 20.56 µg/ml, this study is convergent and practically identical to that of Stoilova et al [17]. The obtained results are shown in Figure (5).

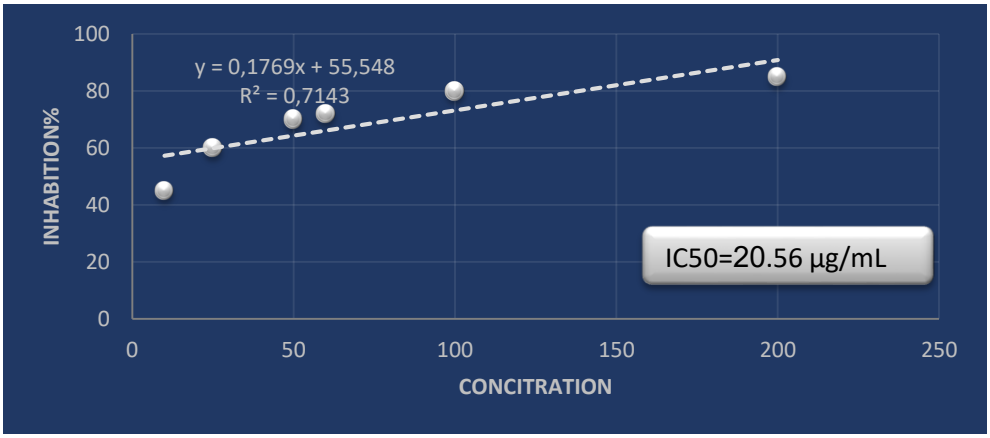


Figure 5. Ginger plant antiradical inhibition plot against DPPH.

The results showed that ginger extract had a very good percentage of antioxidants, but it was lower than that of ascorbic acid. Our research showed that the ginger plant (Zingiberene) has antioxidant properties, is inexpensive, readily available, and has a pleasant flavor. that can be utilized extensively in the contemporary cosmetics, nutraceutical, food, and pharmaceutical sectors [18].

4. Conclusion

An analytical study of the aqueous ginger extract revealed the presence of different phytochemicals in the extract, which confirms the ability to provide a source of natural medicines. The results of the free radical scavenging capabilities of the dried roots of the ginger plant showed that the dried samples contain a high number of antioxidants (33). The GC-MS analysis of the Zingiber officinale extract revealed the presence of some chemicals. Qualitative detections revealed that the extract contains flavonoids, sugars, proteins, and phenols, among other active components.

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