The Bioscan 19(2): S.I (1), 250-257, 2024 www.thebioscan.com
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES

GCMS Profile, Antioxidant and Cytotoxic Properties of Sida acuta (Burm f.)

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DOI: https://doi.org/10.63001/tbs.2024.v19.i02.S.I(1).pp250-257

KEYWORDS

Sida acuta, Leaf, GCMS, Antioxidant, Bioactive compounds, Cytotoxicity

Received on:

04-08-2024

Accepted on:

23-11-2024

ABSTRACT

This study was designed to perform with the main purpose of determining the bioactive components of water (aq.) extract from *Sida acuta* leaves by GC-MS analysis and characterization. In this study identified 9,12,15-octadecatrienoic acid ethyl ester (Z,Z,Z), 4-hydroxy-e-methylacetophenone, 1,3-propanediol,2-(hydroxymethyl)-2-nitro, 9,12,15-octadecatrienoic acid ethyl ester (Z, Z, Z), alpha-tocopherol & beta D-mannoside, l-(+)-ascorbic acid 2,6-dihexadecanoate, 3-deoxy-d-mannolactone, hexadecanoic acid and 2-hydroxy-1-(hydroxymethyl) ethyl ester as the predominant compounds present in aq. leaf extract *Sida acuta* by GC-MS analysis and characterization. In conclusion, all parts of *Sida acuta* is used for therapeutic purposes, but the leaves are most widely used, and therefore further in-vitro and in-vivo research is recommended to evaluate the predominant pharmacological activities compounds identified in aq. *Sida acuta* leaf extract.

INTRODUCTION

Modern lifestyle influenced by sleeplessness, addicting to bad practices of alcohol, cigarettes, and usage of fast foods. Since, for attraction food colours are used and to enhance the taste of the food items they are adding Ajinomoto, the tasting salt which is highly carcinogenic. Canned foods with lot of preservatives are also causing lot of health hazards. The summation effect of all these were leading to cellular or physiological oxidative stress and production of free radicals. Thus, causing deleterious effects on the chromosomal materials, nucleic acids and thus leading to dangerous mutations and degenerative disorders like Alzheimer's, parkinsonism etc. Damage to lipids, proteins, and nucleic acids causes diseases like atherosclerosis, cancer, diabetes, inflammation, Alzheimer's, and other degenerative conditions [1]. Plant secondary metabolites, such as flavonoids, anthocyanins, carotenoids, glutathione, polyphenols, vitamins, and endogenous metabolites, have the capacity to scavenge free radicals. Free radical scavengers are antioxidants that absorb electrons from free radicals produced in vivo or in vitro. Plant secondary metabolites such as rutin, morin, quercetin, naringenin, catechin, retinol, tocopherol, and curcumin have been researched for their anti-cancer and free radical properties. Scavenging, anti-ulcer, and antibacterial activity. Flavanols, like catechins, quercetin, and kaempferol, can be found in green and black beverages. Tea and red wine. Onions and apples contain quercetin, and berries contain both myricetin and quercetin. These dietary components offer protection against oxidative stress. Plant secondary metabolites, including vinca alkaloids and taxol, can effectively treat cancer [2]. Throughout history, medicinal plants have been utilized for their nutritional and therapeutic benefits. Natural sources have been used for therapeutic purposes for thousands of years, and many contemporary medications have been isolated from them. Isolations were often depending on their intended uses.

Sida acuta Burm. f (Malvaceae), one of herbaceous indigenous plants used it for many application to treat specific health issues. This plant is an erect, branching tiny perennial herb or small shrub of approximately 1.5m height [3]. The plant has smooth, greenish bark, a thin, long, cylindrical, and rough root, lanceolate, nearly glabrous leaves with peduncles equal to the petioles, yellow flowers single or in pairs, and smooth, black seeds [4, 5]. This plant thrives in Cameroon's cultivated fields, waste areas, and roadsides, and is known as "sengh" in the western region. The common name is *Sida.* Once established, the plant becomes highly competitive, claiming and refusing locations to rival plants. The plant can be propagated both through seed and stem cuttings. Folkloric medicine uses all components of the tree, including leaves, bark, roots, seeds, and flowers. *Sida acuta* is recognized as astringent, tonic, and beneficial in urinary disorders.

In Indian traditional medicine, diuretics and sedatives are used to treat blood problems, bile, liver, and nerve ailments [5, 6]. In Mexico, it is smoked as a substitute for marijuana and used to cure asthma, kidney inflammation, colds, and gonorrhoea. Symptoms

include fever, bronchitis, malaria, diarrhoea, headaches, dysentery, abortion, breast cancer, skin problems, haemorrhoids, insect bites, erectile dysfunction, elephantiasis, rheumatism, and ulcers [7, 8]. It is believed to have aphrodisiac effects [6]. The root juice is applied to wounds, while the barks are used to treat measles [9, 10]. In Nigeria, S. acuta's leaves, seeds, and stems are commonly used to treat hypertension through various formulations [11]. Although all parts of the plant are used for therapeutic purposes, the leaves are the most requested. The leaves are believed to have demulcent, diuretic, anthelmintic, and wound healing effects and are used to treat rheumatic ailments [12]. Hemorrhoids, azoospermia, oligospermia, and stomach discomfort are all treated with a decoction of leaves [13]. India also uses the leaf juice to treat stomach issues and vomiting [14]. The *S. acuta* species is known for its great adaptogenic and immunomodulator properties, general nutritive tonic, and lengthened life. Its roots are also thought to be helpful in treating tuberculosis and other conditions related to damage, heart disease, coughing, and respiratory disorders [15]. Londonkar et al., [16] reported for contraceptive property due to richness many phytochemicals in the plant parts.

Furthermore, it has been observed that the most harmful diseases in Sorghum (*Sorghum bicolor*) that cause significant losses in third-world nations are covered smut (*Sphacelotheca sorghi*). It has been discovered that sorghum is linked to seed-borne pathogens, such as *Ascochyta sorghina*, which causes rough leaf spot, *Fusarium moniliforme*, which causes seed rot, and *Gloecercospora sorgi*, which causes zonate leaf spot. Like rice and maize, sorghum is said to be extremely susceptible to *Fusarium moniliforme*. This pathogen causes mouldy ears, top rot, and stalk rot in sorghum stands. It might significantly reduce yield [18]. According to published findings, *Sida acuta* extracts have antifungal properties against *Candida albicans* [19]. *Aspergillus flavus* [21], *Aspergillus niger* [22]. *sorghi*), lead smut (*Sphacelotheca sorghi*), and long smut (*Tolyposporium ehrenbergii*) [17].

Therefore, *Sida acuta* extracts have been found to be useful as antimicrobial agents, particularly as antifungal agents, to regulate the growth and colonization of commercially important plants such as Sorghum species. Therefore, it's critical to separate phytoactives from plants. Before determining the active elements of a plant, the first steps involve extracting and separating its active phytochemicals [23]. Techniques for recognizing these substances must be straightforward and scalable. Gas chromatography–mass spectrometry (GC–MS), which can separate and analyse chemicals in a single step utilizing a mass detector and readily available GC–MS libraries, is one of the finest techniques for detecting these molecules [23]. Thus, our current goal was to discover the active compounds in the Sida acuta aqueous leaf extract by means of straightforward solvent extraction, GC-MS analysis, and characterisation.

Materials and methods

Sida acuta plant identification and collection of leaves was done from different localities of Bangalore. The method outlined by Jose and Radhamany for water extraction was applied to the freshly obtained *Sida acuta* leaves. 500 g of the fresh *Sida acuta* leaves were sampled, dried at 40ºC until completely dry, then powdered after being cleaned to eliminate any surface contaminants. These samples were put through a further water extraction process. A Whatmann filter paper was filled with 25 g of powdered sample and let to tumble. 200 millilitres of water were added gradually. Using a Soxhlet apparatus, the tumble was fitted into a round-bottom flask holding 700 ml of the solvent and operated for 6–8 hours at a temperature determined by the solvent's boiling point. Subsequently, the extract underwent distillation to distillation for two to three hours. For drying, these extracts were maintained in heated air at 60ºC. Thus, produced dry extracts were subjected to GC-MS analysis and characterisation.The sample was ground using methanol of GC grade, centrifuged, and the obtained supernatant was then introduced into the GC-MS apparatus.

Details of the GC-MS instrument setup: An Agilent 5977B GC/MSD System was used to conduct the GC-MS analysis.

A TG 5MS silica Capillary column (30m ×0.25mm ID) ×MDF made of 5% diphenyl/95% dimethyl polysiloxane with a 0.25 µm film thickness is part of the GC/MS system. An electron ionization device with an ionization energy of 70 eV was employed for GC/MS detection. The temperature of the oven was set to begin at 80^0C and hold for two minutes, followed by 200^0C at 90C/min and hold for four minutes, and finally 300^0C at 10 °C/min and hold for five minutes. As a carrier gas, helium was used at a flow rate of 1.5 millilitres per minute. With a spitless mode and an injection size of 1.0 needle, the injector temperature was 250 °C. Temperature of the injector was 250°C, and ion 230°C was the source temperature. The temperature of the MS ion source and the interface was kept at 230°C and 300°C, respectively. Mass spectra were obtained at 70 eV using fragments from samples having a mass scan range of 50-550 amu and a scan interval of 0.2 seconds. The GC ran for 35 minutes in total. Each component's relative percentage amount was determined by comparing its average peak area to the overall areas. With Xcaliber software, data handling was carried out. Comparing the mass spectra of the compounds with those from the NIST Libraries served as the basis for identification. Software updated to AMDIS v.2.72 Version in accordance with NIST 2014 (2.2.0.0).

MTT assay of *Sida acuta* aqueous extracts of leaves

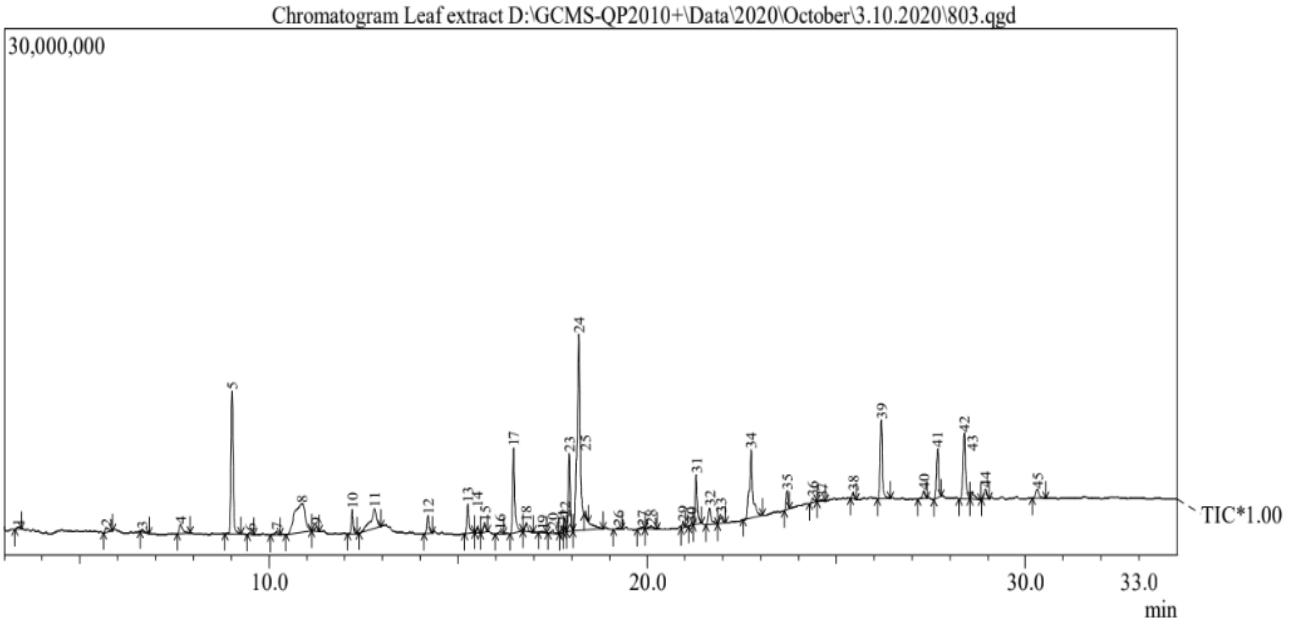
MTT Assay - A confluent cell line was taken in a flask and the cells were trypsinized. Cells were washed twice with Phosphate buffered saline (PBS) and centrifuged. The pellet was resuspended in a suitable medium (medium with 10 % fetal bovine serum).The cells were counted using a haemocytometer. The cells (3,000 to 10,000 cells /well) were plated to 96 well plates. The plate was incubated at 37º C in a CO_2 incubator for 24 hrs. After 24 hrs carefully discard the old medium (for adherent cells) from 96 well plates. Dissolve the different concentrations of the drug in a suitable serum-free medium and add it to the different test groups. Incubate for 24 hrs or 48 hrs at 37º C in a CO_2 incubator. After completion of incubation time add 20 µL of MTT dye (5 mg/mL in PBS) to all wells. Cover the plate with aluminum foil and incubate in a CO_2 incubator for 4 hrs. After 4 hrs add 100 µL of dimethylsulfoxide / acidified Isopropanol to all the wells and mix it by careful shaking. Using a multiwellplate reader record the absorbance at 540 nm (or 540 nm with reference to 630 nm) [40].

To calculate the percentage of viable cells, the following formula was used-

% of viable cells = [(Test sample-blank) / (Control-blank)] x 10

Results and Discussion

45 components were identified because of GC-MS analysis of the *Sida acuta* aqueous extract (Figure 1). The forty-five peaks detected account for 100% of the extract and are included in Table 1 along with the corresponding retention period and extract percentage of component.



Peak Report TIC

Peak#	R.Time	I.Time	F.Time	Area	Area%	Name
1	3.360	3.283	3.458	624670	0.18	dl-Glyceraldehyde dimer
2	5.689	5.617	5.858	1806549	0.52	Maltol
3	6.644	6.592	6.833	577622	0.17	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-
4	7.657	7.575	7.917	3379731	0.97	Benzofuran, 2,3-dihydro-
5	9.020	8.833	9.258	31812383	9.12	4-Hydroxy-2-methylacetophenone
6	9.496	9.425	9.600	586536	0.17	Phenol, 2,6-dimethoxy-
7	10.188	10.042	10.292	896719	0.26	2H-Indeno[1,2-b]furan-2-one, 3,3a,4,5,6,7,8,8b-octahydro-8,8-dimethyl
8	10.870	10.450	11.133	33221435	9.52	1,3-Propanediol, 2-(hydroxymethyl)-2-nitro-
9	11.246	11.133	11.333	1305108	0.37	4-(2,4,4-Trimethyl-cyclohexa-1,5-dienyl)-but-3-en-2-one
10	12.200	12.075	12.325	5126552	1.47	3',5'-Dimethoxyacetophenone
11	12.783	12.375	12.958	13329600	3.82	3-Deoxy-d-mannoic lactone
12	14.198	14.100	14.325	4315891	1.24	4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol
13	15.253	15.167	15.442	7117390	2.04	3,7,11,15-Tetramethyl-2-hexadecen-1-ol
14	15.506	15.442	15.592	849630	0.24	3,7,11,15-Tetramethyl-2-hexadecen-1-ol
15	15.705	15.600	15.783	2502259	0.72	3,7,11,15-Tetramethyl-2-hexadecen-1-ol
16	16.108	15.975	16.200	720147	0.21	Hexadecanoic acid, methyl ester
17	16.463	16.375	16.717	21781890	6.24	l-(+)-Ascorbic acid 2,6-dihexadecanoate
18	16.802	16.717	16.983	2079208	0.60	Benzenemethanol, 2,5-dimethoxy-, acetate
19	17.228	17.117	17.342	515732	0.15	cis,cis,cis-7,10,13-Hexadecatrienal
20	17.498	17.375	17.658	836859	0.24	1-(1-Ethyl-2,3-dimethyl-cyclopent-2-enyl)-ethanone
21	17.759	17.675	17.775	1194871	0.34	9,12-Octadecadienoic acid (Z,Z)-, methyl ester
22	17.819	17.775	17.875	2746272	0.79	9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-
23	17.941	17.875	18.042	15132117	4.34	Phytol
24	18.192	18.042	18.833	77205312	22.12	9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-
25	18.365	18.333	18.442	761838	0.22	Octadecanoic acid
26	19.240	19.108	19.333	538250	0.15	9-Hexadecenoic acid, phenylmethyl ester, (Z)-

Peak#	R.Time	I.Time	F.Time	Area	Area%	Name
27	19.865	19.733	19.933	517182	0.15	9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-
28	20.092	19.933	20.258	1354907	0.39	Benzyl .beta.-d-glucoside
29	20.937	20.883	21.017	1117742	0.32	Ethanamine, 2,2'-oxybis[N,N-dimethyl-
30	21.160	21.100	21.217	512219	0.15	(Z)-14-Tricosenyl formate
31	21.292	21.217	21.433	11151293	3.20	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester
32	21.647	21.550	21.858	5084575	1.46	1H-Benzimidazole, 1-(1H-inden-2-yl)-
33	21.936	21.858	22.058	2303395	0.66	Benzo[b]naphtho[2,3-d]furan
34	22.743	22.542	23.042	26803733	7.68	9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-
35	23.694	23.617	23.767	3654126	1.05	2,6,10,14,18,22-Tetracosahexaene, 2,6,10,15,19,23-hexamethyl-, (all-E)-
36	24.377	24.283	24.483	1219673	0.35	Cyclohexane, 1,2,3,5-tetraisopropyl-
37	24.624	24.483	24.708	598793	0.17	Docosanedioic acid, dimethyl ester
38	25.437	25.367	25.533	1413932	0.41	.gamma.-Tocopherol
39	26.182	26.092	26.425	19154693	5.49	.alpha.-Tocopherol-.beta.-D-mannoside
40	27.313	27.158	27.392	1913197	0.55	Ergost-5-en-3-ol, (3.beta.)-
41	27.674	27.575	27.775	12152983	3.48	Stigmasterol
42	28.380	28.242	28.533	20104447	5.76	.gamma.-Sitosterol
43	28.582	28.533	28.825	2939188	0.84	Fucosterol
44	28.938	28.833	29.042	2679176	0.77	4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a,6b,7,8,8a,9,10,11,12,12a,14,14a,14b-oc
45	30.308	30.183	30.542	3346276	0.96	11(alpha),17(alpha)-Dihydroxyprogesterone
				348986101	100.00	

Figure 1. *Sida acuta* aqueous extract GC-MS analyses led to the identification of 45 distinct components. For all the extract, the 45 peaks were accepted as the record. 45 chemicals were found in the *Sida acuta* aqueous extract.

1,3-Propanediol, 2-(hydroxymethyl)-2-nitro (9.52%), 9,12,15-Octadecatrienoic acid, ethyl ester (Z,Z,Z) (7.68%), alpha, and 4-hydrocy-e-methylacetophenone (9.12%) were the most common bioactive compounds, according to the RT and peak area of each individual bioactive compound.-Beta-tocopherol-mannoside (5.76%), ascorbic acid (l-(+) Hexadecanoic acid, 3-Deoxy-d-mannoic lactone (3.82%), 2-hydroxy-1-(hydroxymethyl) ethyl ester (3.2%), and 2,6-dihexadecanoate (6.24%). By utilizing the mass spectra, their chemical structures were anticipated based on their fragmentation, which produces peaks with varying mass-to-charge ratios.

From long back many medicinal plants have been an amazing source of both food and healing. Many studies have reported that indigenous people from tropical countries use various parts of *Sida acuta* to treat a variety of health issues, including rheumatic affections, azoospermia, oligospermia and spermatorrhoea, leucorrhoea, wounds, sciatica, nervous system disorders, heart diseases, cold, cough, asthma, tuberculosis and respiratory diseases, blood, bile, and liver disorders, elephantiasis, haemorrhoids, ulcers, gastric disorders, fever, malaria, skin diseases, worms, diarrhoea, dysentery, venereal diseases, renal inflammation, toothache, and snake bites.

Several pharmacological features of *Sida acuta*, include antioxidant, antimicrobial, antibacterial, antimalarial, cardiovascular, antiulcer, analgesic, anti-inflammatory, antipyretic, hepatoprotective, hypoglycaemic, insecticidal, and anticancer, have made it the focus of research analysis. The various therapeutic attributes and functions of *Sida acuta* in traditional medicine can be related to its bioactive ingredients, which include sesquiterpene, flavonoids, cardiac glycosides, alkaloids, the saponins the coumarins steroids, tannins, and phenolic compounds [12] thereby, the goal of this present study was to discover the active substances in the *Sida acuta* water-soluble leaf extract by means of simple solvent extraction, GC-MS analysis, and characterization. Many studies have been attempted to identify *Sida acuta*'s chemical composition. These studies focus on nearly every component of the plant, although the leaves and roots are the most investigated. Alkaloids including vasicine, ephedrine, and cryptolepine (the primary alkaloid in the plant) were found in *Sida acuta* species through phytochemical screening [24, 25]. Other alkaloids included scopolets, coumarins, steroids (ecdysterone, ß-sistosterol, epesternerol, ampesterol), tannins, phenolic compounds (evofolin-A and B, scopoletin, loliolid, and 4-ketopinoresinol), polyphenol, sesquiterpene, and flavonoids [26]. Nwankpa et al. assessed the phytochemical and micronutrient composition of *Sida acuta* in a different study by applying conventional analytical techniques. Tannins, alkaloids, saponins, flavonoids, steroids, terpenoids, and cardiac glycosides are among the phytoconstituents. The mineral content was determined to be calcium, magnesium, and zinc, whereas the vitamin composition was thiamin, niacin, ascorbic acid, tocopherol, and riboflavin [27]. In our investigation, the main chemicals found by GC-MS analysis were 4-hydrocy-e-methylacetophenone, 1,3-propanediol, 2-(hydroxymethyl), and 9,12,15-Octadecatrienoic acid ethyl ester (Z,Z,Z).2-nitro, Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) ethyl ester, alpha-tocopherol & beta-D-mannoside, l-(+)-Ascorbic acid, 2,6-dihexadecanoate, 3-Deoxy-d-mannoic lactone, 9,12,15-Octadecatrienoic acid ethyl ester (Z, Z,Z). The GC-MS analysis of the study by Muneeswari et al. revealed the existence of 35 distinct chemicals, each of which belonged to a different class, including phenols, fatty acids, vitamins, alkaloids, sesquiterpenoids, sterols, flavonoids, and terpenes.Because of the abundance of its secondary metabolites, the ethanolic extract of *Sida acuta* leaves, which were collected from the Tuticorin District of Tamil Nadu, has the potential to be used as a natural antioxidant and is an effective scavenger of free radicals [28].

Studies on the antibacterial and antifungal properties of *Sida acuta* leaf extracts were conducted by Akilandeswari et al. Studies on the antibacterial and antifungal properties of *Sida acuta* leaf extracts were conducted. Two typical solvents, 95% ethanol and chloroform, were employed in turn to extract active ingredients from the powdered dry leaves. Two Gram +ve (*Bacillus subtilis* NCIM 2063, *Staphylococcus aureus* NCIM 2079) and two Gram–ve (*Escherichia coli* NCIM 2065, *Pseudomonas aeruginosa* NCIM 2036) bacteria and fungi (*Candida albicans* NCIM 3102, *Aspergillus niger* NCIM 1054) were used as test microorganisms for the antimicrobial screening. Both extracts under investigation had a significant impact on all three bacteria, with the highest activity observed against gram negative *Escherichia coli* and gram-positive *Staphylococcus aureus*, respectively.

Under the same tests, these effects were equal to that of commercially available antibiotics [21]. Oboh et al. accomplished a similar result [31]. In a different study, the agar well diffusion method was utilized to determine the antimicrobial activity of *Sida acuta* leaf extracts in ethanol and solutions of water against 45 clinical isolates of *Staphylococcus aureus*, a Gr-am-negative that were isolated from the nasal passages of HIV/AIDS patients at the University of Nigeria Teaching Hospital in Enugu [32]. Using the agar well diffusion technique, the extracts' minimum inhibitory concentration (MIC) and each extract's mortality were additionally determined at intervals from 0 to 90 minutes.

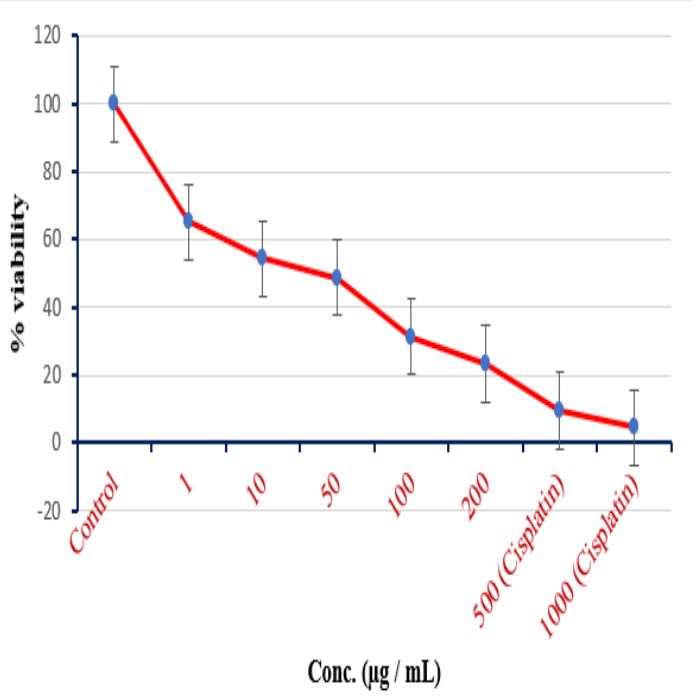
The most potent antimicrobial activity was obtained by ethanol extracts (86%), followed by hot water extracts (61%) and cold-water extracts (48%), according to the results of the agar well

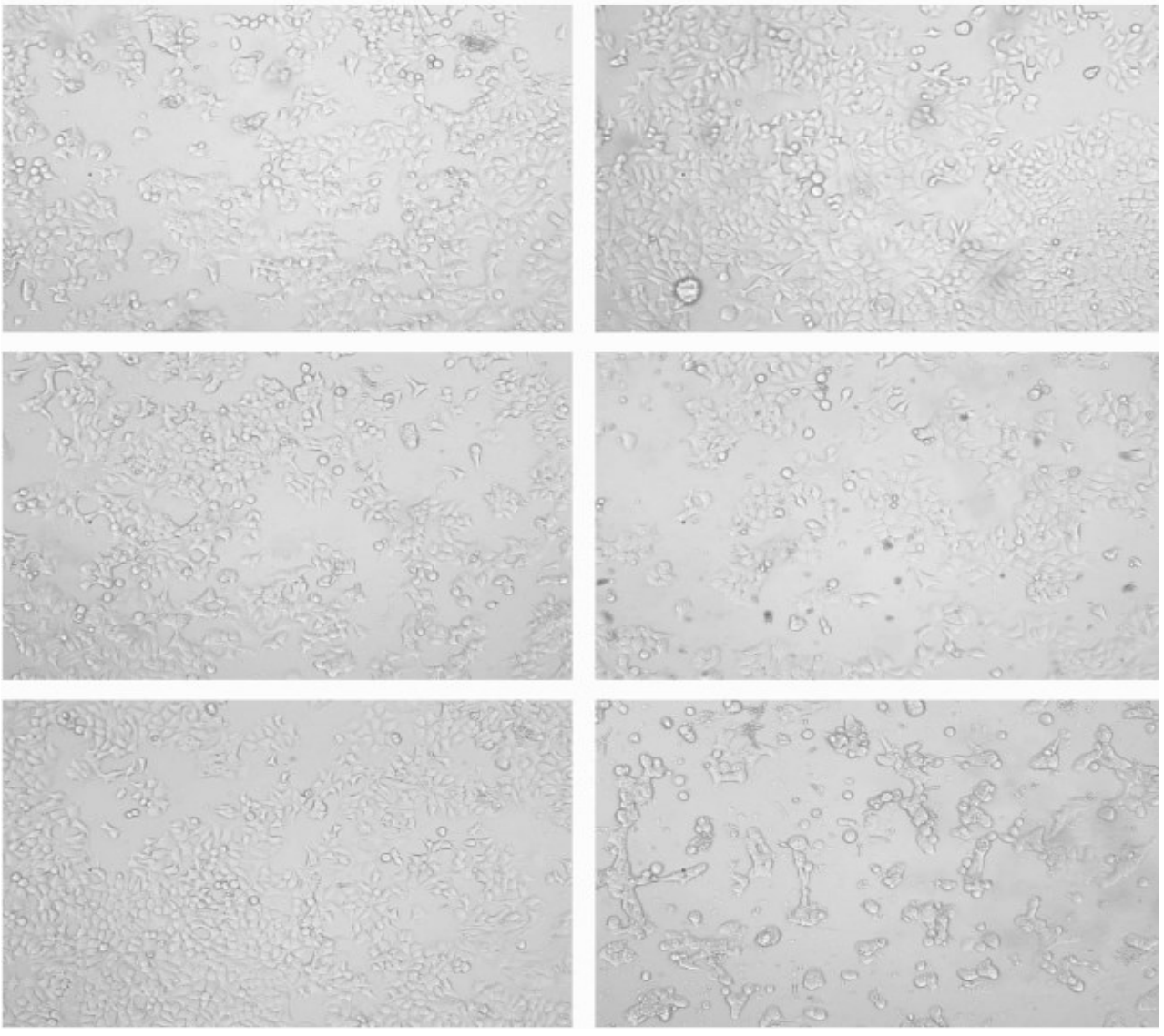
diffusion investigation. The minimum inhibitory concentration (MIC) levels obtained for ethanol extracts were 0.9625-1.8125 µg/mL, hot water extracts were 7.8125-31.25 µg/mL, and cold-water extracts was 15.625-31.25 µg/mL. The test organisms were killed in 0–10 min for ethanol and hot water extracts and 5–60 min for cold water extracts, according to the results of killing rate studies. Overall, the research results proved that *Sida acuta* extracts had significant antibacterial action against isolates of *Staphylococcus aureus* from HIV/AIDS patients. The results of these research reveal the potential benefits of *Sida acuta* in addition to supporting its conventional use in the treatment of common diseases. The methanol extract of *Sida acuta* was found to have hepatoprotective effects against liver damage caused by paracetamol overdose. This was demonstrated by the fact that the *Sida acuta* treated groups showed lower serum levels of bilirubin, glutamate pyruvate transaminase, and glutamate oxaloacetate transaminase than the intoxicated controls [5].

Significant antiulcer activity was observed by Akilandeswari et al. against each of the three experimental models that caused ulcers, lowering the models' ulcer index [20]. Malairajan et al. [32] ethanol extract of the complete *Sida acuta* plant demonstrated antiulcer properties. *Sida acuta* has been extensively researched in science due to its wide range of pharmacological properties, including cardiovascular, antiulcer, hypoglycaemics, antibacterial, antimicrobial, anti-inflammatory, antipyretic, hepatoprotective, antioxidant, antimicrobial, antibacterial, and anticancer properties.

demonstrated how different naturally occurring fatty acids contributed to the promotion of optimal health. These fatty acids not only played a significant role in heart protection but also had anti-cancer and free-radical scavenging properties; as a result, the extract showed promise as a natural source of anticancer material [33]. It has been shown that plant-based sterols play a variety of roles in preventing human diseases [34, 35]. Molecules with potential biological action that are present in high concentrations require further investigation. We intend to separate substances from various *Sida acuta* sections in the future and assess their pharmacological properties. Additionally, we intended to assess *Sida acuta*'s phytoactives' antifungal properties against fungus species linked to Kharif Sorghum becauseAlpha-tocopherol &Beta-D-mannoside, l-(+)-Ascorbic acid, 4-hydrocy-e-methylacetophenone, 1,3-Propanediol, 2-(hydroxymethyl)-2-nitro, 9,12,15-Octadecatrienoic acid ethyl as shown how different naturally occurring fatty acids contributed to the promotion of optimal health. These fatty acids had anti-cancer and free-radical scavenging properties in addition to their primary function in cardio protection, therefore the extract may be utilized as a promising natural supply of medicinal uses, *Sida acuta* is used in all sections. However, the most often sought item is the leaves. Nine, twelve, and fifteen-octadecatrienoic acid ethyl ester (Z, Z, Z), Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) ethyl ester, 3-Deoxy-d-mannoic lactone, and 2,6-dihexadecanoate were found to be the main constituents in the *Sida acuta* aqueous leaf extract by GC-MS analysis and characterization. Therefore, it is advised to conduct additional in-vitro and in-vivo research studies to assess the pharmacological properties, particularly antifungal properties, of the chemicals found in *Sida acuta* aqueous extract of leaves.

MCF-7 cell line		% viability		
Plant extract	Conc. (µg /ml)	Mean	SD	SE
	Control	100	0	0
	1	65.174	6.472	4.576
	10	54.317	6.283	4.443
	50	48.803	14.043	9.930
	100	31.273	3.946	2.790
	200	23.304	2.551	1.804
	500 (Cisplatin)	9.603	0.468	0.331
	1000 (Cisplatin)	4.508	0.209	0.148





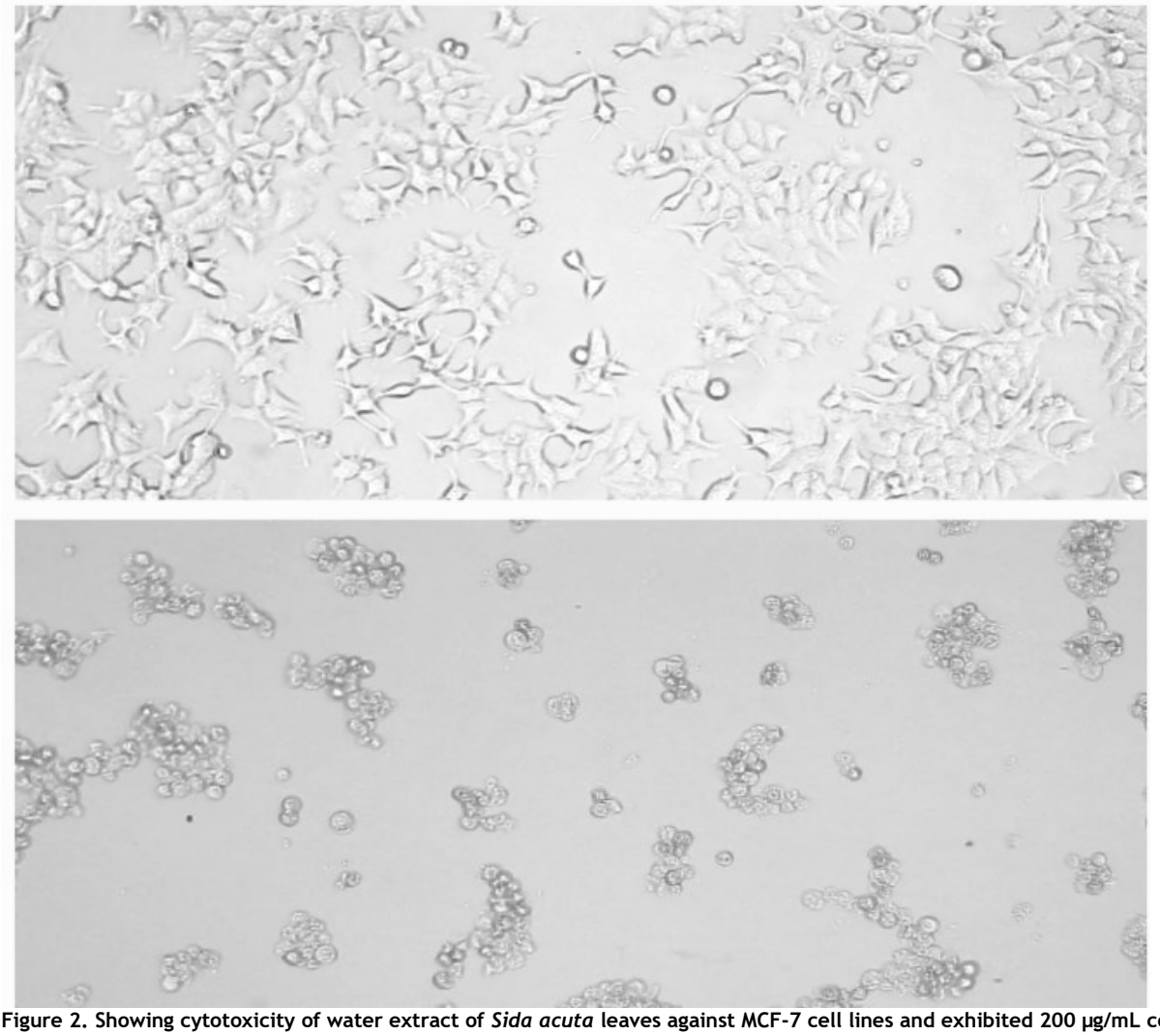


Figure 2. Showing cytotoxicity of water extract of *Sida acuta* leaves against MCF-7 cell lines and exhibited 200 µg/mL concentration.

Extracts derived from *Sida acuta* demonstrate cancer-selective cytotoxic effects on breast cancer cells by triggering apoptosis. The antioxidant characteristics of Sida acuta have not been explicitly examined in the publication (36). The thrombolytic and antioxidant properties of *Sida acuta* leaves, which were extracted with petroleum ether. The crude extract was then used to investigate the potentiality of 1, 1-Diphenylpicrylhydrazyl (DPPH) as a source of free radicals and to reduce power capacity (37). Sida acuta extracts show cancer-selective cytotoxicity on breast cancer cells, inducing apoptosis (38-40).

CONCLUSION

Current findings are highly remarkable and reported useful application for various diseases. Water extract of *Sida acuta* leaves is an important medicinal plant and it was known from last 3 decades by working on pharmacological and biological properties. In our study identified 45 active key molecules by GCMS analysis and also it has been observed with many of these molecules showing various therapeutic properties. To know the cytotoxicity of water extract of *Sida acuta* leaves assayed against MCF-7 cell line and found significant at 200 µg/mL concentration and it is almost nearer to standard cisplatin. In future by separation of these molecules by chromatography can attribute more efficacy in pharmacological and biological studies and became potent therapeutic product for the various physiological issues.

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