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Phyto-pharmacological and GC-MS analysis of bioactive compounds presents in ethanolic extract *Solanum torvum* leaves

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Abstract
Salmonellosis stays a significant general medical condition in non-industrial nations, where it stays endemic because of the shakiness of way of life joined with the abuse and improper utilization of anti-microbials. In the contination to look for new enemy of salmonellosis substances, *in vitro* antisalmonellal and cell reinforcement properties of *Solanum torvum* leaves extricates were assessed. Phytochemical examination of quality of nonappearance *S.* torvum is primarily utilized for the treatment of fever, wounds, tooth rot, regenerative issues and blood vessel hypertension. GC-MS significant mixtures 12 Methyl 6-O-[1-methylpropyl]-á-d-galactopyranoside, R. Time-20.47. Natural movement of Antioxidant, Hypocholesterolemic. 1-Tetracosanol R. Time - 30.66, cell reinforcement, antimicrobial and subterranean insect diarrheal action. Numerous pharmacological investigations have shown the capacity of this plant to display Anti-oxidant movement, cardiovascular, immunomodulatory and nephroprotective action supporting its customary employments. This audit endeavors to feature the accessible writing on *S. torvum* concerning ethnobotany, compound constituents and synopsis of different pharmacological exercises.

Keywords: GC-MS, hypocholesterolemic, phytochemical, 1-methylpropyl *Solanum torvum*

1. Introduction
The class solanum family contains 1500 species. Natural grouping of *Solanum torvum*. Customary medication disseminated broadly in *Solanum torvum*. Leaves and blossoms of the plant are utilized to treat numerous illnesses like toothache, stomach-hurt, hack, fever and honey bee stings. This specific species has steroidal saponins and steroidal alkaloids that are helpful in the drug business as steroidal forerunners to deliver calming corticosteroids, preventative steroids and anabolic steroids [1]. Fundamental oils in the foods grown from the ground of *S. erianthum* have been read for their conventional uses in medication, particularly for skin infection and stomach related affliction. The berries are cooked and eaten in Southeast Asia and made into curry in Southern India [2]. A few bits of exploration led showed that turkey berries are a decent wellspring of iron. Concentrates of the natural product have high iron substance and consequently defending their utilization as hematinic. Cancer prevention agents are defensive substances that secure the body's phones against the impacts of free revolutionaries and some normally happening cell reinforcements incorporate flavonoids, tannins, phenols, and lignans-based food varieties are the best wellsprings of cell reinforcements [3]. Extraction is the principle cycle by which bioactive mixtures might be acquired from biomass materials. The goal of the extraction interaction is to expand the quantity of target compounds and acquire the most elevated natural movement of these concentrates [4]. Iron is a basic mineral in the body that is engaged with cycles like hemoglobin creation and oxygenation of red platelets, processing and flow among numerous others are completed in the human body [5]. They assume a significant part in the control of plant assets to biotic and abiotic stress. These exercises associate altogether with the degrees of phenolic mixtures and flavonoids. The more prominent the measures of these mixtures, the more noteworthy were the extremist rummaging impact. In human sustenance, flavonoids are considered as potential wellbeing elevating substances because of their enemy of oxidative, hostile to malignant growth, and cardiovascular defensive impacts. They likewise have against microbial, calming, hostile to maturing and neuroprotective impacts [6]. Among the concentrates tried, the methanolic extricate was the most powerful as far as upsides of DPPH rummaging action. Remarkably, methanolic extract of all samples exhibited a two-fold higher DPPH scavenging activity than that of ethanolic extracts.

This could be as attributed to the reason that this extract contains the highest level of phenolics, flavonoids, alkaloids, and terpenoid compounds, etc. Those compounds possess powerful antioxidant activity and subsequently protect the human body against oxidative damage [7]. Also, from the results, it was evident that DPPH radical scavenging activity of species varied significantly at different maturity/ripening stages. It was obvious from the table that the pre/early matured stage of *S. erianthum* recorded the highest activity followed by the matured stage of *S. macrocarpon* and finally the late/post matured stage of *S. torvum*. The mean yield of ethanol extract of methanol was different from the findings [8]. It was observed from Table 1 that the ABTS•+ scavenging activity varied significantly with both methanol and ethanol extraction. Values for methanolic extract recorded higher values than that of the ethanolic extract and values also showed variation at different maturity stages. For *S. macrocarpon*, it was observed that ABTS•+ scavenging activity for both ethanol and methanol increased as fruit/berries matured from one stage to another [9]. Subsequently, for *S. torvum* and (ethanol), activity did not show consistency from one maturity stage to another. Most plants have medicinal properties due to the presence in their tissues of simple chemical elements like selenium or chromium, or of phytochemicals, thousands of which have been isolated and characterized some of these have no effect on human health, others can be dangerous. But for most of them, many beneficial biological activities such as anti-cancer, antimicrobial, anti-oxidant, antidiarrheal, analgesic and wound healing activities have been reported.

2. Materials and Methods

2.1 Plant collection

The berries of *Solanum torvum* were procured from Saliyamangalam (post), Thanjavur (Dt), Tamil Nadu, India.

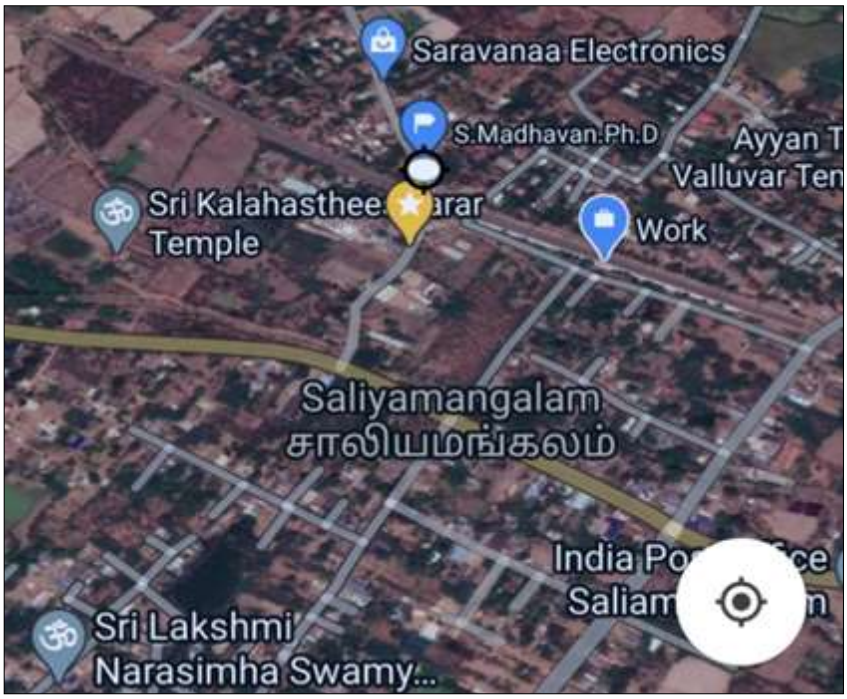


Fig 1: Study Area

2.2 Preparation of extract

The berries were dried in shade at room temperature. The dried berries were coarsely powdered and 1000 gm of coarsely powder was extracted by macerating with absolute ethanol (3000 mL) for 72 h. The extract was filtered and concentrated under vacuum and the concentrated syrupy mass was lyophilised and made as powder. The powder was used for the further experiments.

2.3 Preliminary phytochemical analysis

The ethanol extract of the *S. torvum* berries was subjected to preliminary phytochemical analysis [10]. The presence of tannins, terpenes, flavones, alkaloids, quinone, sterol, phenol, coumarin, proteins, sugar, saponin, and gum [11].

2.4 Gas Chromatography – Mass Spectrometry Analysis

Perkin Elmer Clarus 500 GC-MS instrument was used for analyzing the compounds present in plant extract under study. Capillary column made of Elite- 5MS (5% phenyl 95% dimethyl polysiloxane) was used. The oven program was fixed to 50 ºC @ 8 ºC/min to 220 ºC (2min) @ 7 ºC/min to 280 ºC (10min) and Injector temperature was 290 ºC. The carrier gas used is Helium at the flow rate of 1mL/min. Sample was injected and the compounds obtained were matched using the library NIST 2005 [12].

2.5 Identification of Compounds

Understanding of the mass spectrum of GC-MS was conduct using the mass spectral database of the National Institute of Standard and Technology (NIST) having more than 62,000 patterns. The range of the obscure segment was contrasted and the range of the realized segments put away in the NIST library. The name, sub-atomic weight, and structure of the parts of the test materials was determined.

3. Results and Discussion

The phytochemical trial of concentrates of *S. torvum* uncovered the presence of anthocyanins, saponins, steroids, tannins, anthraquinone, alkaloids, flavonoids, triterpenes, phenols [13]. Accordingly the primer screening test might be

helpful in the recognition of the bioactive standards and in this manner may prompt the medication disclosure and advancement. S. torvum phytochemicals show a wide scope of natural properties, among which the counter oxidant capacity gives off an impression of being focal, accordingly, regular to the vast majority of them [14]. Receptive oxygen and nitrogen species (ROS/RNS) are fundamental to biochemical cycles and address a fundamental piece of vigorous life and digestion [15-17]. Natural frameworks are secured from free extremist prompted cell harm by cancer prevention agents which might be proteins or nonenzymatic mixtures. Most plants have therapeutic properties, which they accomplish from certain optional metabolites. Phytochemicals are compounds delivered by plants. They may influence wellbeing however are not-fundamental supplements as our eating regimen doesn't expect them to support life similarly as nutrients and minerals.

Table 1: Phytochemical factors Secondary metabolides *Solanum torvum* ethanolic extracts leaves

S. No	Analysed Phytochemicals factor	Ethanol	Methanol	Water
1.	Tannin	++	+	-
2.	Phlobatannins	-	+	+
3.	Saponin	-	+	-
4.	Flavonoids	++	-	-
5.	Steroids	+	-	+
6.	Terpenoids	+	+	+
7.	Triterpenoids	+	+	-
8.	Alkaloids	+	-	+
9.	Carbohydrate	+	-	-
10.	Protein	-	-	-
11.	Anthraquinone	+	-	+
12.	Polyphenol	++	+	+
13.	Glycoside	+	+	-

Presences (+) Absences (--)

The major compounds 12 obtained from the GC-MS analysis of ethanol extract of Leaves *Solanum torvum*. Calotropis gigantea white blossoms have recognized by GC-MS examination ranges showed a sub-atomic particle top at m/e 150.434, 167.490, 295.080, and 150.468 follow a sub-atomic equations of C9H10O2 (MW 150.00), C9H12O3 (MW 168.00), C19H36O2 (MW 296.00), C16H15BrN2O3 (MW 151.00) have distinguished three mixtures in the chloroform separate in particular (1) 2-methoxy-4-vinylphenol (RT 10.43), (2) Phenol-4-methoxy-3-(methoxy methyl) (RT 11.38), (3) 8-octadecenoic corrosive, methyl ester (E) (RT 19.00) and just one compound in the ethyl acetic acid derivation extricate to be specific (4) Benzhydrazide, 4-methoxy-N2-(5-bromo-2-methoxy benzylideno) (RT 2.37) [19-21]. The synthetic mixtures saw in just latex were 1-[(T-butyl) dimethyl silyl thin] butane, 1-Hexadecyne, Hexadecane, L-Glutamic corrosive, Phenol-3-isoproxy-5-methyl, Trocosane and Z-1, 6-Tridecadiene [22]. Recognized from leaf and latex of *C. gigantea* which upholds that the plant have incredibly and adjusted drug esteem. Albeit, extra examination is important to filter those mixtures which are liable for restorative exercises. Additional research is necessary to purify those compounds which are responsible for therapeutic activities.

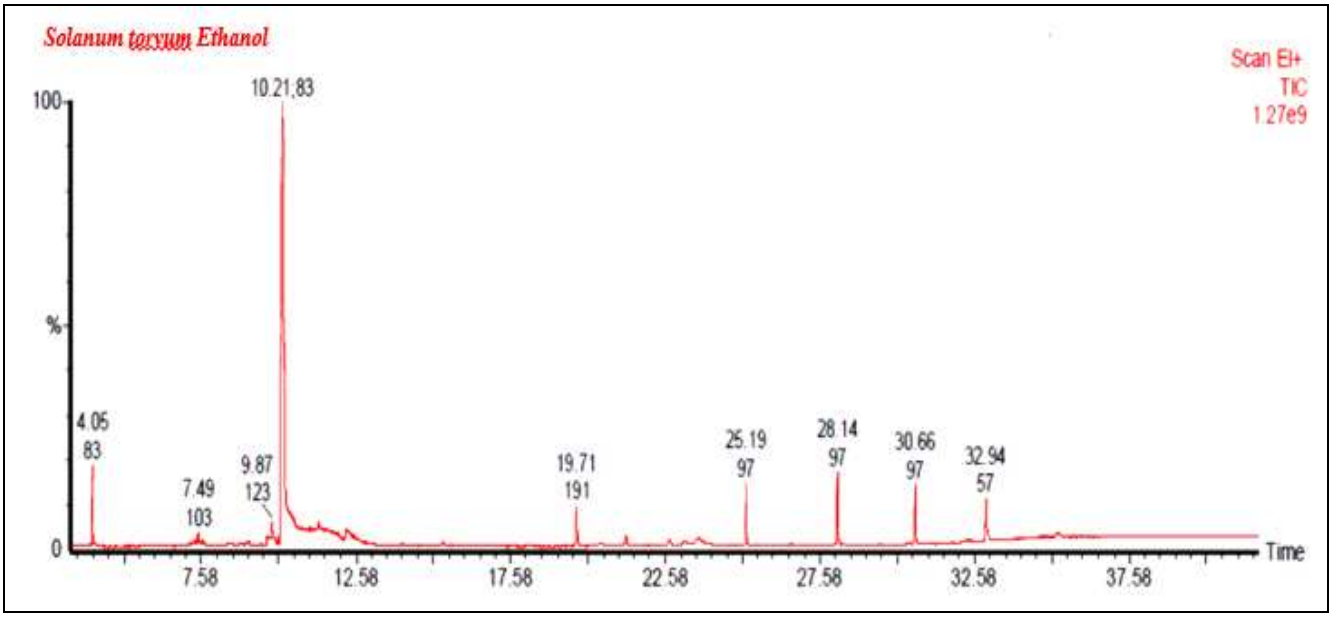
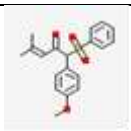
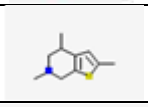
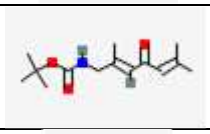
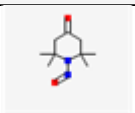
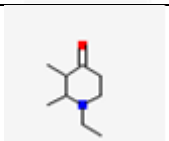
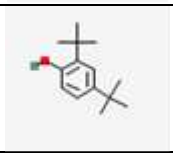
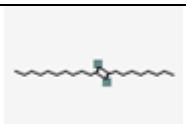
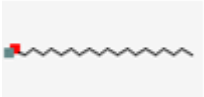
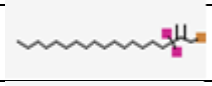
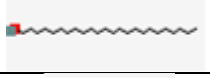
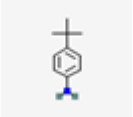


Fig 2: *GC-MS* Chromatogram *Solanum torvum* Ethanolic extract leaves

Table 2: GCMS analysis - Bioactive compounds

S. No.	Name of the Compounds	Molecular weight g/mol	Molecular Formula	Retention time	Peak area
1	3-Penten-2-one, 4-methyl-	98	C6H10O	4.05	7364015
2	Pyridine, 2,4,6-trimethyl-	121	C8H11N	7.61	817133
3	2,5-Heptadien-4-one, 2,6-dimethyl-	138	C9H14O	9.86	2418008
4	4-Piperidinone, 2,2,6,6-tetramethyl-	155	C9H17NO	10.21	159102640
5	Piperidin-4-one, 1-ethyl-2,3-dimethyl-	155	C9H17NO	12.25	6397074
6	Phenol, 2,4-bis(1,1-dimethylethyl)-	206	C14H22O	19.71	7206650
7	Methyl 6-O-[1-methylpropyl]-á-d-galactopyranoside	250	C11H22O6	20.47	3595918
8	9-Eicosene, (E)-	280	C20H40	21.30	2887065
9	1-Nonadecanol	284	C19H40O	25.19	6920269
10	1-Nonadecene	266	C19H38	28.14	8949107
11	1-Tetracosanol	354	C24H50O	30.66	7563971
12	4-tert- Butylaniline	149	C10H15N	9.12	1098093

Table 3: GC-MS Analysis of Activities/Uses of bioactive compounds

S. No.	Name of the Compounds	Structure	Activity / Uses
1	3-Penten-2-one, 4-methyl-		Anti-seizures
2	Pyridine, 2,4,6-trimethyl-		Antioxidant, antihyperglycemic
3	2,5-Heptadien-4-one, 2,6-dimethyl-		Antioxidative activity
4	4-Piperidinone, 2,2,6,6-tetramethyl-		Antimicrobial, anti-inflammatory
5	Piperidin-4-one, 1-ethyl-2,3-dimethyl-		Antimicrobial and anti-inflammatory
6	Phenol, 2,4-bis(1,1-dimethylethyl)-		Anti-inflammatory, nematicide, pesticide, lubricant, antiandrogenic, flavor, haemolytic 5-alpha reductase inhibitor, antioxidant, hypocholesterolemic [23].
7	Methyl 6-O-[1-methylpropyl]-á-d-galactopyranoside		Antioxidant, Hypocholesterolemic.
8	9-Eicosene, (E)-		Antimicrobial, anti-inflammatory, anticancer, diuretic
9	1-Nonadecanol		Antioxidant, anti- inflammatory
10	1-Nonadecene		Potent antifungal, antimicrobial, antibacterial
11	1-Tetracosanol		antioxidant, antimicrobial and ant diarrheal activity
12	4-tert- Butylaniline		Antibacterial, antioxidant, antitumor, cancer preventive immunostimulant, chemo preventive, lipoxygenaseinhibitor, pesticide

GC-MS assessment uncovered the presence of α.-Caryophyllene, 2-phenyl-4-quinolinecarboxamide, Phenanthrene, 10H-Phenoxaphosphine, 1,5-Diformyl-2,6-Dimethoxy-Anthracene. Care in examination the enormous pharmacological presentation of its constituents, M. koenigii in India hence makes it an appealing objective for additional

pre-clinical and clinical exploration [24]. In this GC-MS examination was asserted with past insights and improved the regular utilization of the *Murraya Koenigii* [25-27]. By unraveling these blends, it is found that *Murraya Koenigii* has diverse helpful applications. The heights of the apex show the overall groupings of the parts present in *Murraya Koenigii* [28-30]. *S. torvum* berries were 4-Piperidinone, 2,2,6,6-tetramethyl-, Piperidin-4-one, 1-ethyl-2,3-dimethyl-, Phenol, 2,4-bis(1,1-dimethylethyl)-, Nonadecanol, Nonadecene, 1-Tetracosanol, 1-Tricosene.Medicinal employments of Solanum torvum Anti-incendiary, nematicide, pesticide, oil, antiandrogenic.

4. Conclusion

S. torvum health benefit properties and related phytochemicals, which merit future research for developing pharmacological drugs aimed at curing ailments or diseases, and for possible use in preventive medicine. The plant have huge clinical applications, yet the broad investigation utilizing creature models and clinical preliminaries to investigate the specific sub-atomic instrument of activity, viability examination against organisms and harmfulness tests ought to be completed in journey of lead mixes from normal archive for powerful medication advancement. The auxiliary metabolites detailed before, the leaves are rich with phenolic parts which are accounted for to have promising antibacterial action.

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