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Ramesh R and Dhanaraj T.S



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**RESEARCH ARTICLE**

**IDENTIFICATION OF BIOACTIVE COMPOUNDS IN THE ETHYL ACETATE EXTRACT  
OF TERMINALIA ARJUNA ROOT BY GC-MS ANALYSIS**

**Ramesh R\* and Dhanaraj T.S**

Department of Biochemistry, Marudhupandiyar Arts & Science College, Vallam, Thanjavur

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**ABSTRACT**

The aim of the present study is to evaluate the anticancer activity of ethyl acetate extract of *Terminalia arjuna* root. The present investigation was carried out to determine the possible bioactive components of *Terminalia arjuna* root using GC-MS analysis. Ten bioactive compounds were identified from *Terminalia arjuna* root. The identified compounds are majorly phenolic derivatives included flavone, 6-methoxy flavone, Pentadecanoic acid, methyl ester, Oleic acid, 4-methoxy-2-(1-Phenyl ethyl) phenol, 10-Octadecenic acid, elaidic acid, 3,5,7,2',4'-pentahydroxyflavone (Morin), Hydrocarbons, Alcoholic compounds, Flavanoids derivatives, Ketones and Fatty acids. The present study is therefore an effort to give detailed information on phytochemical studies and GC-MS analysis of *T. arjuna* root.

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**INTRODUCTION**

Medicinal plants are the local heritage with the global importance. World is endowed with a rich wealth of medicinal plants. Medicinal plants also play an important role in the lives of rural people, particularly in remote parts of developing countries with few health facilities. The present review reveals that *Terminalia arjuna* is utilized for the treatment of some common diseases. In the present review we have congregated information pertaining to botanical, phytochemical, pharmacological studies. The plant has been studied for their various pharmacological activities like antioxidant, antihyperglycemic, antihyperlipidemic, cardio protective, immune modulatory effects, hepato protective, inhyperthyroidism, hyperglycemia and lipid peroxidation, analgesic and anti-inflammatory, anthelmintics, antinoriceptive activity studies have also been studied. Therefore it is necessary to exploit its maximum potential in the field of medicinal and pharmaceutical sciences for novel and fruitful application.

*Terminalia arjuna* is well known for its medicinal properties. It was introduced in to Ayurveda as a treatment of heart disease by Vagbhata (7 century A.D). It is traditionally prepared as a

milk decoction. In the Ashtanga Hridayam, Vagbhata mentions *Terminalia arjuna* in the treatment of wounds, haemorrhages and ulcers applied topically as a powder.

From the Ayurvedic perspective, Arjuna is a lymph mover for the heart. Under the protective shiny layer of the bad lie reddish, more active constituents. If you have read my articles on lymph, you know that most of the herbs that were traditionally used to dye things red are considered to be natural lymph movers.

In many traditions, the heart is considered the ruler of the body. Ironically, it is often a body system that is overlooked until it is in crisis. Treat your heart like the ruler that it is by practicing a heart healthy lifestyle.

Flavanoids are important phytochemicals in plants. They act as antioxidant, hepato protective and anticarcinogenic agent in many parts of the body. So now day's flavonoids compounds are used as hemotheraphatic agent in medicinal field. In the present work *Terminalia arjuna* root was selected for many phytochemical work specially GC-MS work was done for identification of flavonoids from ethyl acetate extract.

\*Corresponding author: **Ramesh R**

Department of Biochemistry, Marudhupandiyar Arts & Science College, Vallam, Thanjavur

## MATERIALS AND METHODS

### Plant materials collection

*Terminalia arjuna* root were collected from Lagoon area of Muthupet, Thiruvavur district during the period of September – 2014 to October – 2014.

### Preparation of Plant material

*Terminalia arjuna* plant root was collected and cut into small piece dried under the shed for 3 weeks at room temperature. The plant root was shaded and dried for grinding to get crude powder.

### Preparation of plant extract using Soxhlet apparatus

10 g of crude powdered drug were taken and shifted into filter paper thimble. 250 ml of Ethyl acetate were poured into round bottom flask (1000 ml capacity) followed by fitting in on Soxhlet apparatus. The powdered drug was extracted with Ethyl acetate for 24 hours. A semisolid extract was obtained after completed elimination of ethyl acetate under reduced pressure. The extract was stored in refrigerator until use.

### Preparation of extract for GC-MS Analysis

Take 2µl of the ethyl acetate extract of *Terminalia arjuna* was introduced for GC-MS analysis.

### Required Conditions for operating GC-MS

GC-MS analysis was carried out on a GC Clarus 500 Perkin Elmer system comprising a AOC – 20i auto sampler and gas chromatograph interfaced to a mass spectrometer (GC-MS) instrument employing the following conditions, column Elite – 1, fused silica capillary column ( 30 X0.25 mm ID X 1 µMdf, composed of 100% Dimethyl poly siloxane), operating in electron impact mode at 70 eV, helium gas (99.99%) was used as carrier gas at a constant flow rate 1mL/min and an injection volume of 2 µL was employed (split ratio of 10:1) injector temperature 250 C. The oven temperature was programmed from 110 C (isothermal for 2 min), with an increase of 10 C /min, to 200 C/ min to 280C/min, ending with a 10 min isothermal at 280 C. Mass spectra were taken at 70 eV, a scan interval of 0.5 s and fragments from 250 to 1100 Da. Total Gas Chromatogram running time was 28 minutes. The relative percentage amount of each component was calculated by comparing its average peak area to the total areas, software adopted to handle mass spectra and chromatograms.

### Identification of components

Interpretation of mass spectrum of GC- MS was done using the database of 1 ml/min and an injection volume of 0.5 EIhaving more than 10,00,000 patterns. The mass spectrum of the unknown component was compared with the spectrum of the known components stored in the National Institute of Standard and Technology (NIST) library. The name, molecular weight and structure of the components of the test materials were ascertained.

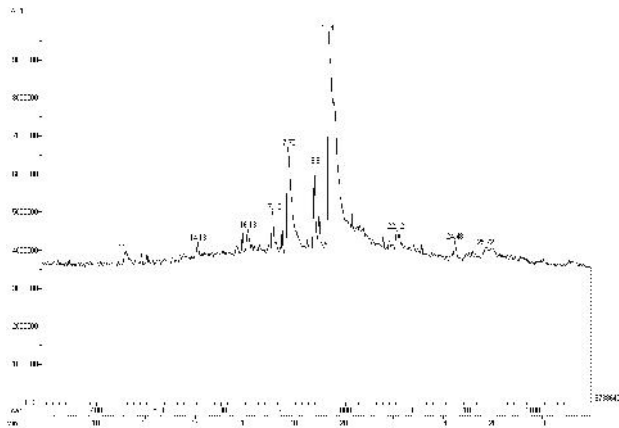
**Table 1** Phytocomponents identified in the ethyl acetate extract of *Terminalia arjuna* root

S.No.	RT	Plant part	Name of the Compound	Molecular formula	Molecular weight	Peak area %
1	11.23	Root	Flavone	C <sub>15</sub> H <sub>10</sub> O <sub>2</sub>	222.0	18
2	14.13		4-methoxy-2-(1-Phenylethyl) Phenol	C <sub>16</sub> H <sub>17</sub> O <sub>2</sub>	241.0	17.5
3	16.13		6-methoxy flavone	C <sub>16</sub> H <sub>12</sub> O <sub>3</sub>	252.26	17.5
4	17.15		Pentadecanoic acid, 14-oxo, methyl ester	C <sub>15</sub> H <sub>30</sub> O <sub>2</sub>	242.40	25
5	17.75		Estra-1,3,5 (10)-trien-17 a-ol	C <sub>19</sub> H <sub>26</sub> O <sub>2</sub>	286.0	26.5
6	18.8		10-Octadecanoic acid, methyl ester	C <sub>19</sub> H <sub>36</sub> O <sub>2</sub>	296.48	25
7	19.43		Oleic Acid	C <sub>18</sub> H <sub>34</sub> O <sub>2</sub>	282.46	49.8
8	22.12		Morin	C <sub>15</sub> H <sub>10</sub> O <sub>7</sub>	302.23	22.2
9	24.48		Elaidic acid, isopropyl ester	C <sub>18</sub> H <sub>34</sub> O <sub>2</sub>	282.46	16.7
10	25.72		Alfaxalone	C <sub>21</sub> H <sub>32</sub> O <sub>3</sub>	332.47	16.4

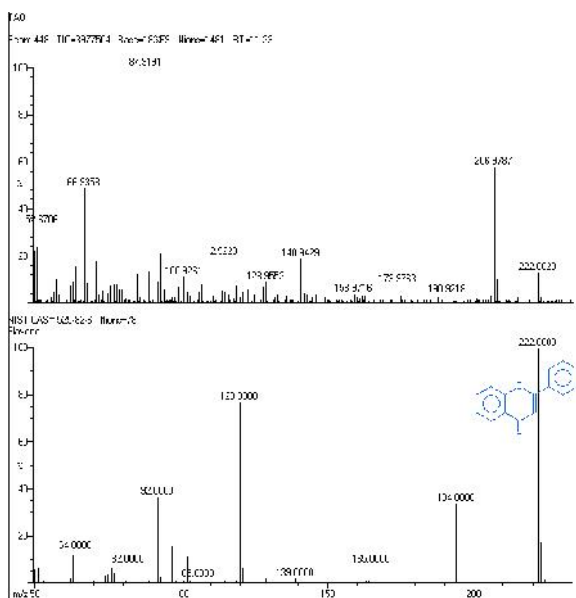
**Table 2** Activity of phyto-components identified in the ethyl acetate extract of *Terminalia arjuna* root

S.No	Name of the compound	Biological activity
1	Flavone	Potential therapeutic agents
2	4-methoxy-2-(1-Phenylethyl) Phenol	Antimicrobial
3	6-methoxy flavone	Anticarcinogenic, Antioxidant, anti-inflammatory,cardioprotective, high cholesterol,Cataracts
4	Pentadecanoic acid, 14-oxo, methyl ester	Antioxidant, nematocide, pesticide,hypocholesterolemic
5	Estra-1,3,5 (10)-trien-17 a-ol	Antimicrobial
6	10-Octadecanoic acid, methyl ester	5- reductase inhibitor, hypocholesterolemic, suppository, cosmetic, lubricant, surfactant & softening agent, perfumery, flavour
7	Oleic Acid	Protects cells from free radical damage, reduces blood pressure, prevents ulcerative colitis, increases fat burning, may prevent type-2 diabetes
8	Morin (3,5,7,2',4'-pentahydroxyflavone)	Antioxidant,anti-inflammatory, antineoplastic, cardioprotective,Chemopreventive agent
9	Elaidic acid, isopropyl ester	Antiinflammatory, hypocholesterolemic, cancer preventive, hepatoprotective, anticoronary, antiacne,antieczemic, insectifuge
10	Alfaxalone	Sedation, General anaesthetics, allosteric modulator,

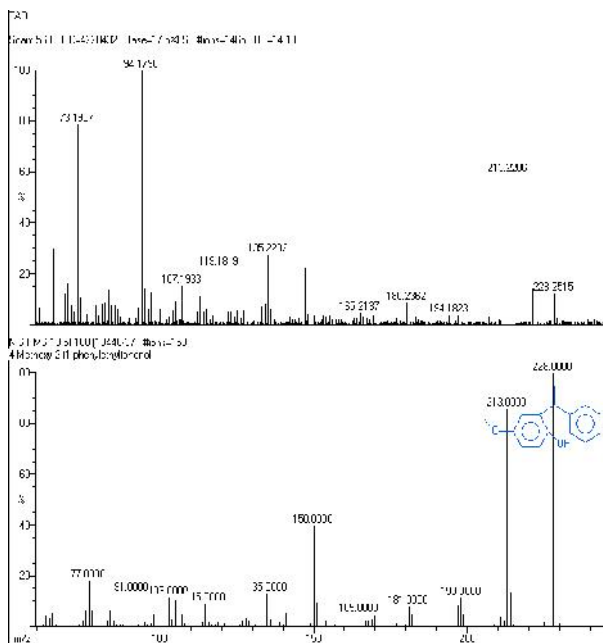
**RESULT**



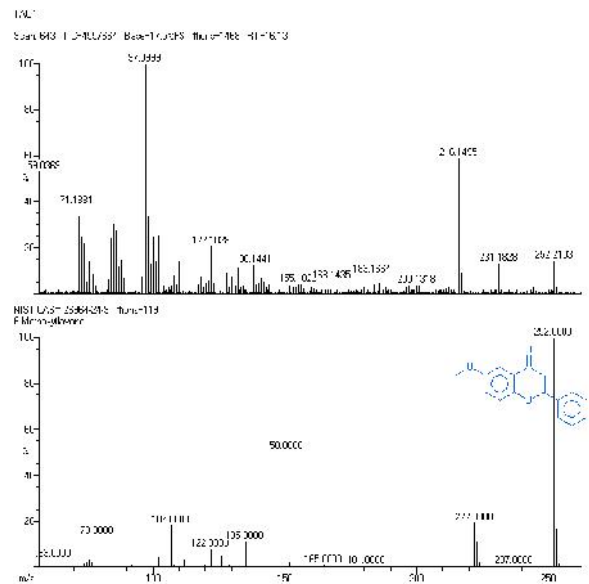
**Graph 1** GC-MS Chromatogram of ethyl acetate extract of *Terminalia arjuna* root



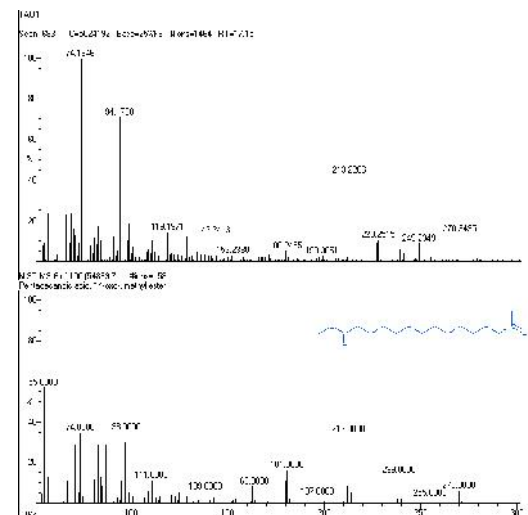
**Figure 1** Mass spectrum of Flavone (2-phenyl-1,4-benzopyrone)



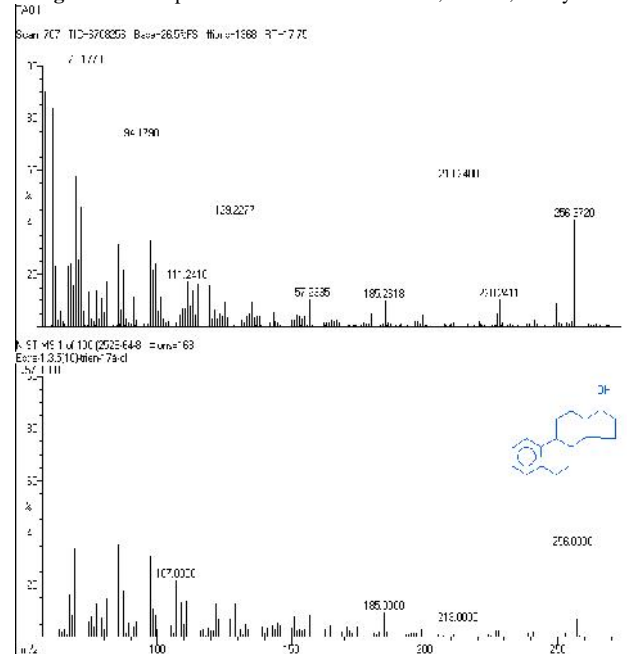
**Figure 2** Mass spectrum of 4-methoxy-2-(1-Phenylethyl) Phenol



**Figure 3** Mass spectrum of 6-methoxy flavones



**Figure 4** Mass spectrum of Pentadecanoic acid, 14-oxo, methyl ester



**Figure 5** Mass spectrum of Estra-1,3,5 (10)-trien-17 a-ol

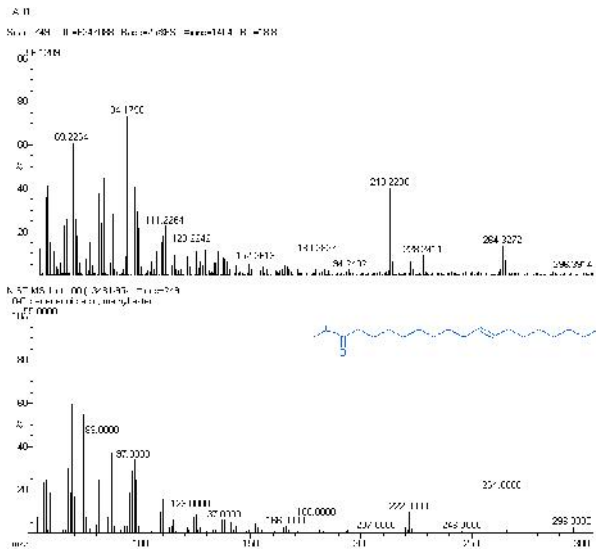


Figure 6 Mass spectrum of 10-Octadecanoic acid, methyl ester

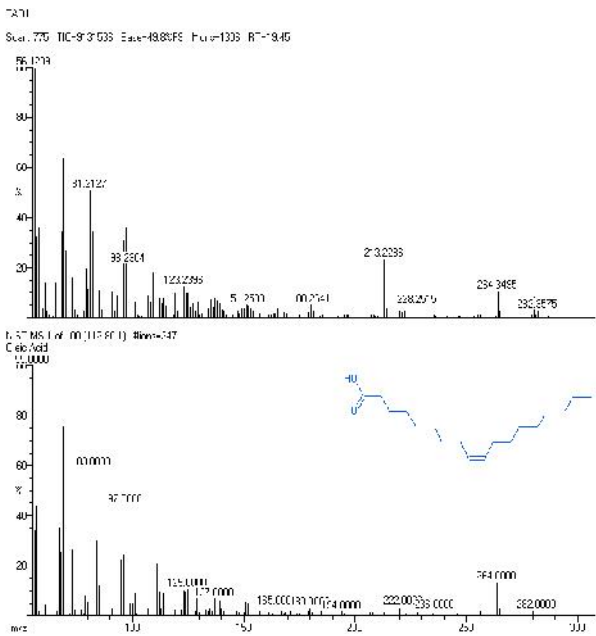


Figure 7 Mass spectrum of Oleic Acid

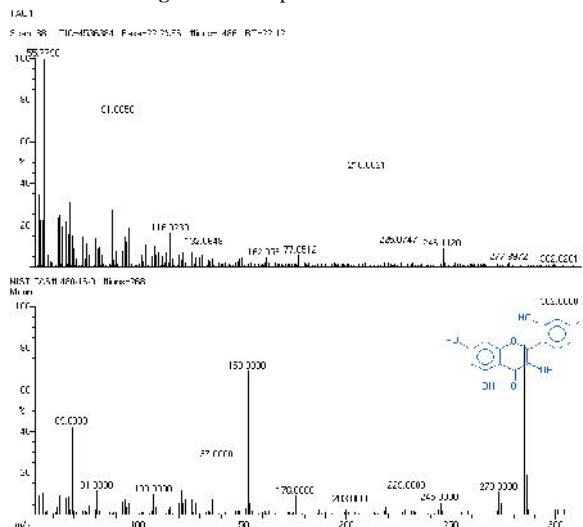


Figure 8 Mass spectrum of 3,5,7,2',4'-pentahydroxyflavone (Morin)

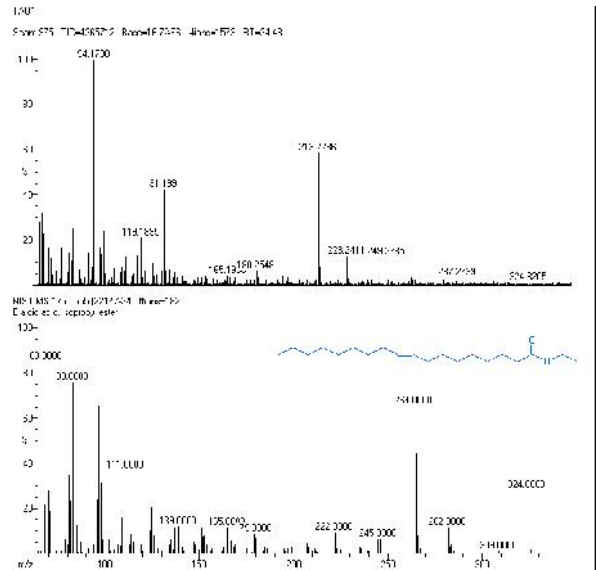


Figure 9 Mass spectrum of Elaidic acid, isopropyl ester

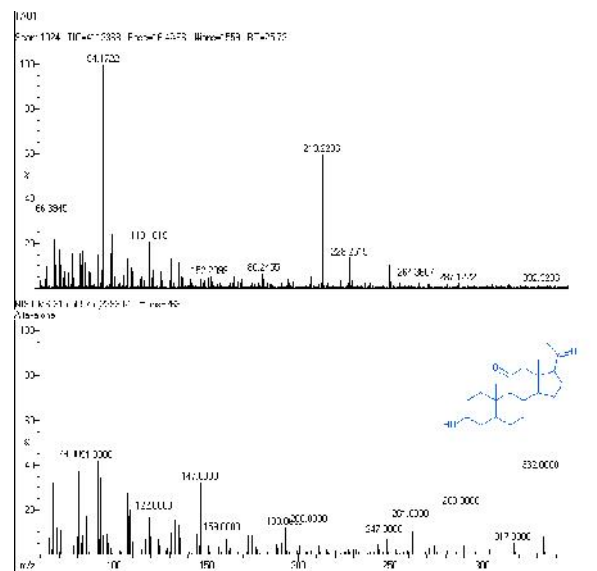


Figure 10 Mass spectrum of Alfaxalone

The compounds present in the ethyl acetate extract of Terminalia arjuna root by GC-MS analysis as shown Graph: 1 The active principles with their retention time (RT), Molecular Formula, Molecular Weight and percentage of Concentration in the ethyl acetate extract of Terminalia arjuna root.

## DISCUSSION

In the present study chemical constituents have been identified from ethyl acetate extract of Terminalia arjuna root by GC-MS analysis. GC-MS chromatogram of ethyl acetate extract of Terminalia arjuna root showed 10 peaks indicating the presence of phytochemical constituents. On comparison of the mass spectra of the constituents with the NIST library the phytoconstituents were characterize and identified (Table -1).

Table: 2 shown the activity of phytocomponents identified in the ethyl acetate extract of Terminalia arjuna root. From the results, it was observed that Flavone, 4-methoxy-2-(1-

Phenylethyl) Phenol, 6-methoxy flavone, Pentadecanoic acid, 14-oxo, methyl ester, Estra-1,3,5 (10)-trien-17 a-ol, 10-Octadecanoic acid, methyl ester, Oleic Acid, Morin (3,5,7,2',4'-pentahydroxyflavone), Elaidic acid, isopropyl ester and Alfaxalone were the major components in the ethyl acetate extract.

The compound Morin (3,5,7,2',4'-pentahydroxyflavone) are used as anti-oxidant, anti-inflammatory, anti-neoplastic, cardioprotective, Chemopreventive agent. And 6-methoxy flavone are used for anti-carcinogenic, anti-oxidant, anti-inflammatory, cardioprotective, high cholesterol, Cataracts and also inhibits NFAT translocation into the nucleus and suppresses T cell activation. The Oleic Acid are used for protects cells from free radical damage, reduces blood pressure, prevents ulcerative colitis, increases fat burning, may prevent type-2 diabetes. The compounds 4-methoxy-2-(1-Phenylethyl) Phenol and Estra-1,3,5 (10)-trien-17 a-ol both are used for antimicrobial activity, Elaidic acid, isopropyl ester were used as an anti-inflammatory, hypocholesterolemic, hepatoprotective, anticoronary, antiacne, antieczemic, insectifuge, cancer preventive agent, Flavone compounds are used as potential therapeutic agents, 10-Octadecanoic acid, methyl ester compounds are used for 5- reductase inhibitor, hypocholesterolemic, suppository, cosmetic, lubricant, surfactant & softening agent, perfumery, flavor, Pentadecanoic acid, 14-oxo, methyl ester are used as antioxidant, nematocide, pesticide, hypocholesterolemic, Alfaxalone are used as general anaesthetics, allosteric modulator and Sedation.

The presence of various bioactive compounds justifies the use of plant root for isolation of individual phytochemical constituents and subjecting it to biological activity will definitely give good results. The present study, which reveals the presence of components in *Terminalia arjuna* root suggest that the contribution of these compounds on the pharmacological activity should be evaluated.

## CONCLUSION

The plant root of *Terminalia arjuna* screened for bioactive compounds seemed to have the potential to act as a source of useful drug and also to improve the health status of the consumers as a result of the presence of a various compounds that are vital for good health.

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