Analysis of complete nutritional profile and identification of bioactive components present in *Alocasia indica* tuber cultivated in Howrah District of West Bengal, India

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**ABSTRACT**

Objective: To assess the complete nutritional profile and identification of bioactive components present in the hydro–ethanolic extract of *Alocasia indica* tuber.

Methods: The proximate composition and vitamins were assessed from fresh tissue while mineral content was detected from the ash using inductively coupled plasma atomic spectrophotometer. For gas chromatography analysis, the tubers were shade dried and extracted with ethanol using Soxhlet apparatus for 72 h. The extract was dried using rotary evaporator and analyzed for active components.

Results: The tuber was rich in carbohydrate, but marginal in protein content. However, it showed moderate amount of dietary crude fibre, very low fat content and sufficient source of ascorbic acid and alpha–tocopherol. The tuber was also found to contain all the essential micro and macro mineral elements. It especially served as a good source of potassium and calcium while moderate source of iron, zinc and magnesium. Gas chromatography analysis also revealed the presence of several components of biological value in the ethanolic fraction of the extract. The extract was basically found to be a good source of poly–unsaturated fatty acids and some amount of polyphenols.

Conclusions: All the major compounds identified and characterized by spectroscopic method were of biological significance. Besides, the tuber also possesses high caloric value and source for low fat and moderate dietary fibre which is essential for maintaining proper health. Moreover, the mineral content of the tuber can be used as supplement for combating malnutrition especially among rural folk and the vitamin content can serve as good source of natural antioxidant. Thus identification of a good number of important compounds from *Alocasia indica* tubers can focus on its use for future therapeutic purpose apart from maintaining general health.

1. Introduction

The world population relies mainly on plants and plant extracts for health care. Plants are natural resources of a variety of biochemical products, many of which are extractable and found useful in a number of pharmaceutical preparations. The use of plants as medicines dates from the earliest years of man’s evolution[1]. Medicinal plants serve as therapeutic alternatives, safer choices or on some cases, as the only effective treatment due to their fewer side effects, easy accessibility and low cost[2]. People in different cultures and places have used particular plants to treat certain medicinal problems. Medicinal plants have always been part of man’s life on earth and there is a close relationship between plants and human beings[3]. Medicinal plant based drugs have the added advantage of being simple, effective and offering a broad spectrum of activity, especially with preventive action[4]. In the recent past there has been a tremendous increase in the use of plant based health products in developing as well as developed countries resulting in an exponential growth of herbal products globally.

A knowledge of the chemical constituents of plants is desirable not only for the discovery of therapeutic agents,
but also because such information may be of great value in disclosing new sources of economic phytochemicals for the synthesis of complex chemical substances and for discovering the actual significance of folklore remedies[9]. Hence a thorough validation of the herbal drugs has emerged as a new branch of science emphasizing and prioritizing the standardization of the natural drugs and products because several of the phytochemicals have complementary and overlapping mechanism of action. Mass spectrometry, coupled with chromatographic separations such as gas chromatography is normally used for direct analysis of components existing in traditional medicines and medicinal plants. Besides exploring the different phytoconstituents, it is also of equal importance to analyze plants and vegetables for their proximate and mineral compositions, to enrich knowledge on their nutritional health benefits.

*Alocasia indica* (A. indica), also called giant taro in English, is a member of the family Araceae. *Alocasia* is commonly grown in upland areas, high islands and drier areas. *Alocasia* grows year around and can be harvested at any time when it is needed. *Alocasia* is thought to have originated in Sri Lanka or India and is presently cultivated in the countries of India, Sri Lanka and Bangladesh[6]. In Bangladesh and many parts of India, *Alocasia* is grown for the leaves as well as the stems. The stems are cut into cubes and used in curry and the young leaves are used in soups or fritters. It forms a staple diet of the people of these countries.

According to Ayurvedic literature survey, different parts of this plant are traditionally used as hepatoprotective, antioxidant, analgesic, antiarthritic, anti-inflammatory, antitumour and antipyretic[7]. Alcoholic extract of leaves were evaluated for antimicrobial, antidiarrhoeal, antioxidant, anti-inflammatory and anthelminthic properties[8–11]. However, studies are lacking regarding the medicinal value of the tuber of *A. indica* in curing various ailments despite of its increasing popularity in various cuisines. So, the present study was undertaken to evaluate the proximate composition, mineral content and identification of the various bio–active components present in the ethanol extract of the tuber of *A. indica* Schott.

2. Materials and methods

2.1. Authentication of plant material

Fresh tubers of *A. indica* were purchased from the farmers of Santragachhi Village of Howrah District, West Bengal, India, from May to October. Authentication was done primarily by Dr. Krishnendu Sarkar, Associate Professor, Department of Botany, Rammohan College under University of Calcutta, West Bengal, India and finally by the Botanical Survey of India. A herbarium of the specimen was maintained in the institute library bearing the number RMC/PHY/SB/02/14.

2.2. Preparation of tissue homogenate

One gram of fresh tissue was crushed and homogenized with 10 mL of 1 mol/L phosphate buffer (pH 7.4). The homogenate was centrifuged at 10000 r/min for 30 min at 4 °C and the supernatant was collected for analysis.

2.3. Estimation of protein and soluble carbohydrate

Protein and soluble carbohydrate was estimated from the supernatant. Protein content was determined following the method of Lowry et al. and soluble carbohydrate by dinitrosalicylic acid method[12,13].

2.4. Estimation of total carbohydrate

For estimation of total carbohydrate, fresh tuber sample (1 g) was ground in mortar with 5 mL of 1 mol/L phosphate buffer (pH 7.4). Then 5 mL of 2.5 mol/L HCl was added to it and hydrolysed by keeping it in water bath for 3 h, cooled and neutralized with solid sodium carbonate[14]. The quantity of carbohydrate was determined after centrifugation according to dinitrosalicylic acid method.

2.5. Estimation of crude fibre

For estimation of crude fibre, 2 g of dried tissue was boiled in 200 mL of sulphuric acid (1.25% w/v) for 30 min. Then it was filtered through muslin and washed with boiling water until the filtrate was no longer acidic, further boiled with 200 mL of sodium hydroxide (1.25% w/v) solution for 30 min, filtered through muslin, washed with 25 mL of boiled 1.25% w/v sulphuric acid, then washed thrice with water and finally with 25 mL absolute alcohol. The residue was then transferred into pre weighed ashing dish and dried for 2 h at (130±2) °C. The dry weight was taken and the residue was ignited for 30 min at (660±15) °C cooled in a dissector and reweighed. The crude fibre was calculated according to the method of Maynard[15].

2.6. Estimation of moisture

Initially an amount (10 g) of fresh tissue sample was taken. The amount of moisture in the tissue material was taken determined by drying the tissue in an over drier at about 60 °C for 72 h. The dried sample was weighed again after 72 h and the moisture percentage (M0%) was calculated as following way.

\[ M_0\% = \frac{\text{Fresh wt} - \text{Dry wt}}{\text{Fresh wt}} \times 100 \]

2.7. Estimation of fat

Fat was estimated by homogenizing tissue in 20 mL chloroform: methanol (2:1 v/v) mixture for 10 min in a
tissue homogenizer. After vigorous shaking and filtering, the residue was again stripped with 25 mL chloroform; methanol mixture for 30 min. This combined filtrate was then shaken with 0.9% sodium chloride to remove nonfat contaminant[16]. The solvent layer was dried in vacuum and the total amount of fat was weighed according to the method of Itoch et al[17].

2.8. Analysis of mineral content

A total of 5 g of dry sample of A. indica was weighed carefully in clean porcelain crucibles and placed inside muffle furnace for incineration at temperature not more than 550 °C to obtain carbon free ash. The ash thus obtained was dissolved in 0.1 mol/L HCl and the resulted acid soluble ash solution was fed into inductively coupled plasma atomic spectrophotometer (Ametek Spectro Analytical Instruments GmbH, Germany) for detection of elemental content in the sample. The measured element intensities were evaluated by the Smart Analyzer Software.

2.9. Determination of ascorbic acid

Ascorbic acid content was determined by the well established method of Riemschneider et al. using 2, 4- dinitrophenyl hydrazine[18]. A total of 1 g fresh tissue was homogenized in 5% metaphosphoric acid and drops of bromine water were added into it. After some time, the bromine was removed by bubbling air through the solution and 0.5 mL of this solution was used to estimate the ascorbic acid content. Ascorbic acid was calculated from the calibration curve prepared with L-ascorbic acid.

2.10. Determination of alpha–tocopherol

Vitamin E was determined by method of Baker and Frank[19]. A total of 2.5 g fresh tissue was weighed and homogenized in 0.05 mol/L H2SO4 and kept overnight to digest out the fibrous plant materials. The day following, the homogenate was filtered and used for estimation of alpha–tocopherol. Vitamin–E reduced ferric to ferrous ions, which then formed a red colored complex with α, α’dipyridyl. Tocopherols and carotenes were first extracted into xylene and the absorbance was read at 460 nm to measure the carotenoids. A correction for the carotenoids was made after adding ferric chloride and reading at 520 nm using UV–vis spectrophotometer at 517 nm (Systronics, India UV–vis 118). Alpha–tocopherol was calculated from the calibration curve prepared with alpha–tocopherol acetate.

2.11. Separation and identification of bioactive components

2.11.1. Gas chromatography–mass spectrometric (GC–MS) analysis: preparation of extract

The dried ethanol extract of A. indica was dissolved in absolute ethanol (1 mg/mL). A total of 10 µL of this sample was then injected for gas chromatography–mass spectrometric (GC–MS) analysis.

2.11.2. Instruments and chromatographic conditions

GC–MS technique was used to identify the phytoconstituents present in the extract[20]. The plant extract was analyzed using Agilent Technologies 6890 N Network GC system and interfaced to Agilent Technologies 5973 Inert Mass Selective Detector employing the following conditions: column DB–1 ms fused silica capillary column (30 m×0.25 mm I.D., 0.1 µm film, composed of 100% Dimethylpolysiloxane) chosen for improved signal to noise ratio for better sensitivity and mass spectral integrity, operating in electron impact mode; helium (99.999%) was used as carrier gas at a constant flow of 1 mL/min. The injector, MS Source and MS Quadrupole temperature were fixed at 250 °C, 230 °C and 150 °C respectively and turbo speed of the pump was 100%. The oven temperature was programmed from 50 °C (isothermal for 5 min), with an increase of 10 °C/min to 100 °C (isothermal for 2 min), then 10 °C/min to 300 °C (isothermal for 5 min). For tuning of the MSD in EI mode perfluorotributylamine was used as tuning compound. Mass spectra were taken at 2235 EM volts and fragments from 69 to 502.

2.11.3. Identification of components

Interpretation on mass spectrum of GC–MS was done using the database of National Institute Standard and Technology/ National Bureau of Standard and having more than 62,000 patterns. The mass spectrum of the unknown component was compared with the spectrum of the known components stored in the National Institute Standard and Technology/ National Bureau of Standard and Wiley libraries. The name, molecular weight and structure of the components of the test materials were ascertained.

2.12. Statistical analysis

Results were subjected to statistical analysis. In all the cases, results are the mean±SD of at least three individual experimental data, each in triplicate. Statistical analysis was done using SPSS software version 20.0.

3. Results

3.1. Proximate composition

A. indica is a rich source of carbohydrates, both soluble and insoluble in comparison to other proximate components. Being tuberous in nature the vegetable shown higher proportion of carbohydrate than that of protein, which is one of the characteristic features of tubers. The results revealed marginal protein content in
the tubers of *A. indica*. However, rich carbohydrates in the vegetable can provide important source of calorie in diet. Besides, the tuber also possesses moderate amount of crude dietary fibre and very low amount of fat. The proximate composition of the tubers of *A. indica* was shown as follows: protein: (3.034 ± 0.570) g/100 g dry weight; soluble carbohydrate: (8.84 ± 1.45) g/100 g dry weight; total carbohydrate: (45.58 ± 0.59) g/100 g dry weight; fat: (1.426 ± 0.550) g/100 g dry weight; fibre: (2.95 ± 0.69) g/100 g dry weight; moisture: (42.48 ± 0.49) g/100 g dry weight.

### 3.2. Mineral content

*A. indica* was found to be good source of all essential dietary minerals. It served to be an important source for potassium, sodium and calcium, the most common among macroelements, and the order decreases as K > Ca > Na. Table 1 depicts the different mineral contents of *A. indica* in mg/100 g dry tissue along with the reference daily intake based on older recommended dietary allowance from 1968, Council for Responsible Nutrition, and biological importance of the respective elements.

Besides, evaluating the different macro and micro elements in the sample, screening for the presence of heavy metals were also achieved as their presence in soil is an obvious outcome of geo-climatic conditions and environmental pollution. It is noteworthy to mention that no detectable trace of toxic heavy metals like arsenic, cadmium, lead and mercury were found in the sample.

### 3.3. Vitamin content

*A. indica* shown the presence of two most common antioxidant vitamins ascorbic acid and alpha-tocopherol in the amount of (76.65 ± 4.03) and (69.54 ± 2.06) mg/100 g dry weight respectively. Both the vitamins act synergistically as potent antioxidants thus preventing cellular damage caused by free radicals and reactive oxygen species. Figure 1 represents the ascorbic acid and alpha-tocopherol content in the tubers of *A. indica*.

### 3.4. Bioactive components

The results pertaining to the GC–MS analysis leads to the identification of number of pharmacologically important compounds from the GC fractions of the ethanol extract of *A. indica*. These compounds were identified through mass spectrometry attached with GC. Table 2 enlists the different bioactive components along with retention time, percentage peak area and pharmacological significances obtained from Dr. Duke’s phytochemical and ethnobotanical databases by Dr. Jim Duke of the Agricultural Research Service/USDA[21].

The ethanol extract of *A. indica* was found to...
Table 2
The compounds isolated from ethanol extract of A. indica with retention time, area (\%) and pharmacological importance.

<table>
<thead>
<tr>
<th>Retention Time (min)</th>
<th>Name of compound</th>
<th>Area (%)</th>
<th>Pharmacological importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.44</td>
<td>2-(3H)-Furanone, 5-methyl-</td>
<td>1.40</td>
<td>Flavouring agent</td>
</tr>
<tr>
<td>18.31</td>
<td>Pentadecane</td>
<td>2.03</td>
<td>Not reported</td>
</tr>
<tr>
<td>18.57</td>
<td>2,4-bis(1,1-dimethylethyl)phenol</td>
<td>0.15</td>
<td>Antioxidant</td>
</tr>
<tr>
<td>19.32</td>
<td>Pentadecane, 3-methyl-</td>
<td>0.98</td>
<td>Not reported</td>
</tr>
<tr>
<td>19.79</td>
<td>Hexadecane</td>
<td>16.44</td>
<td>Not reported</td>
</tr>
<tr>
<td>21.02</td>
<td>Pentadecane, 2,6,10,14-tetramethyl</td>
<td>0.36</td>
<td>Not reported</td>
</tr>
<tr>
<td>21.57</td>
<td>Tetradecanoic acid</td>
<td>0.74</td>
<td>Antioxidant, cancer preventive, nematicide, lubricant, hypocholesterolemic</td>
</tr>
<tr>
<td>21.94</td>
<td>1-Pentadecane</td>
<td>0.11</td>
<td>Not reported</td>
</tr>
<tr>
<td>22.87</td>
<td>1,2-Benzenedicarboxylic acid, b</td>
<td>0.15</td>
<td>Antimicrobial, anti fouling</td>
</tr>
<tr>
<td>23.18</td>
<td>Hexadecanoic acid, methyl ester</td>
<td>0.16</td>
<td>Antioxidant, hypocholesterolemic nematicide, pesticide, anti-androgenic, flavor, hemolytic, 5-alpha reductase inhibitor</td>
</tr>
<tr>
<td>23.34</td>
<td>Dibutyl phthalate</td>
<td>1.04</td>
<td>Antimicrobial, anti fouling</td>
</tr>
<tr>
<td>23.38</td>
<td>9-Hexadecanoic acid</td>
<td>0.48</td>
<td>Not reported</td>
</tr>
<tr>
<td>23.71</td>
<td>Hexadecanoic acid</td>
<td>8.82</td>
<td>Antioxidant, hypocholesterolemic nematicide, pesticide, anti-androgenic flavor, hemolytic, 5-alpha reductase inhibitor</td>
</tr>
<tr>
<td>23.84</td>
<td>Tetradecanoic acid, ethyl ester</td>
<td>2.35</td>
<td>5-alpha reductase inhibitor, anti-androgenic, anti-arthritis, anti-cornary, insectifuge</td>
</tr>
<tr>
<td>23.94</td>
<td>1-Octadecane</td>
<td>0.23</td>
<td>Not reported</td>
</tr>
<tr>
<td>25.21</td>
<td>9,12-Octadecadienoic acid (Z,Z)2,3</td>
<td>5.89</td>
<td>Antiinflammatory, hypocholesterolemic cancer preventive, hepatoprotective, anti-histaminic, antiaesthethical, antiinflammatory, antioxidant, antiandrogenic, antiartrhetic, anticorony</td>
</tr>
<tr>
<td>25.25</td>
<td>2-Hexen-4-one, 6-hydroxy-2-methyl</td>
<td>2.42</td>
<td>Not reported</td>
</tr>
<tr>
<td>25.36</td>
<td>Linoleic acid ethyl ester</td>
<td>2.30</td>
<td>Antiinflammatory, hypocholesterolemic cancer preventive, dermatitigenic, hypocholesterolemic, 5-alpha reductase inhibitor, anemiogenic, insectifuge, flavor</td>
</tr>
<tr>
<td>25.42</td>
<td>Ethyl oleate</td>
<td>1.69</td>
<td>Anti-inflammatory, hypocholesterolemic cancer preventive, hepatoprotective, anti-histaminic, antiarthritis, antiartrhetic, anticorony, 5-alpha reductase inhibitor, anti-androgenic, anti-arthritis, anti-cornary, insectifuge</td>
</tr>
<tr>
<td>25.66</td>
<td>Octadecanoic acid, ethyl ester</td>
<td>11.40</td>
<td>Anti-inflammatory, hypocholesterolemic cancer preventive, hepatoprotective, anti-histaminic, antiarthritis, antiartrhetic, 5-alpha reductase inhibitor, anti-androgenic, anti-arthritis, anti-cornary, insectifuge</td>
</tr>
<tr>
<td>29.57</td>
<td>Vitamin E</td>
<td>2.83</td>
<td>Antiaging, analgesic, antiinflammatory, antioxidant, antiandrogenic, antiartrhetic, antiaesthethical, antieczemal, antiperoxidative, anti-inflammatory, hepatoprotective, antiinflammatory, antitumor, antiinflammatory, antifungal</td>
</tr>
<tr>
<td>33.40</td>
<td>Campesterol</td>
<td>14.53</td>
<td>Antiinflammatory, hypocholesterolemic, hypoglycemic, thyroid inhibitory and antiperoxidative, anti-inflammation, hepatoprotective, antiinflammatory, antifungal</td>
</tr>
<tr>
<td>33.66</td>
<td>Stigmasterol</td>
<td>12.25</td>
<td>Antioesteoartheritic, hypocholesterolemic, antihistaminic, antiinflammatory, anticeemal, antiacne, 5-alpha reductase inhibitor, anti-androgeneic, antiartrhetic, anti-cornary, insectifuge</td>
</tr>
<tr>
<td>34.18</td>
<td>Beta-sitosterol</td>
<td>7.40</td>
<td>Anti-bacterial, antiacne, anti-cornea, anti-inflammation, antioxidant, hepatoprotective, hypocholesterolemic, hypoglycemic, hypercholesterolie, anti-atherosclerotic, anti-inflammatory, anti-arthritis, anti-cornary, insectifuge</td>
</tr>
</tbody>
</table>

possess wide range of saturated and unsaturated aliphatic hydrocarbons like pentadecane, hexadecane, 1-pentadecane, 1-octadecane; saturated and unsaturated fatty acids and their esters like tetradecanoic acid and its ethyl ester, hexadecanoic acid and its methyl ester, octadecanoic acid ethyl ester, 1,2-benzenedicarboxylic acid, 9-hexadecenoic acid, dodecanoic acid, linoleic acid and its ester, oleic acid, ethyl oleate, etc., phenolic compounds and plant sterols like stigmasterol, \(\beta\)-sitosterol, campesterol.

4. Discussion

Root and tuber crops have been an essential constituent of diet among the rural folk. Tuberous vegetables are generally more starchy and marginal in protein content. Tubers serve to be good source of carbohydrates and hence provide high calorific value. According to previous research[22], carbohydrates are pivotal nutrients required for adequate diet. Their prime role is to produce energy required for the smooth functioning of the body. In this study, it is shown that A. indica tubers are rich sources of both soluble and total carbohydrate. However, one prime disadvantage of tuber crops is their low marginal protein content, which is reflected in this study too. The tubers of A. indica are very poor in protein content and cannot be consumed as alternate source of animal protein. Despite of this major drawback, other nutritional importance of this tuber lies in its low fat and high fibre content. Fibre cleanses the digestive tract, by removing potential carcinogens from the body and prevents the absorption of excess cholesterol. Fibre also adds bulk to the food and prevents the intake of excess starchy food and may therefore guard against metabolic conditions such as hypercholesterolemia and diabetes mellitus. Fiber can also help to keep blood sugar levels under control. Fiber binds to cancer–causing chemicals, keeping them away from the cells lining the colon, providing yet another line of protection from colon cancer. A number of studies have indicated that components of plants such as dietary fiber have beneficial effects in lowering blood cholesterol levels aside from the decreased intake of saturated fat and cholesterol that occurs with high intakes of plant foods[23].

The tuber of A. indica is also found to be rich in two most common antioxidant vitamins: ascorbic acid and alpha-tocopherol. These are the most common non–enzymatic endogenous antioxidant defense of the body. Alpha–
tocopherol and ascorbic acid act synergistically in the body to combat membrane lipid peroxidation during oxidative stress[24]. The tuber being good source of both the vitamins can enhance the body’s antioxidant capacity and can be well recommended in daily diet in order to combat the daily stress generated in the body due to its own metabolic activities. Nowadays antioxidants from natural sources are much more preferred than synthetic antioxidants, because of lesser side effects.

The study also reveals the presence of several micro and macro elements in the tuber. In this study, when compared with the recommended dietary allowance, the mean value for zinc, copper, potassium and sodium was low, iron, magnesium and manganese was average while chromium was at par. Thus it is found that the tuber possesses sufficient amount of essential micronutrients and its consumption thereby can be considered nutritionally valuable and healthy. These nutrients may not be strictly medicinal but could be valuable in preventing diseases that are related to malnutrition. Minerals are required for normal growth, activities of muscles and skeletal development (such as calcium), cellular activity and oxygen transport (copper and iron), chemical reaction in the body and intestinal absorption (magnesium), fluid balance and nerve transmission (sodium and potassium), as well as the regulation of acid–base balance (phosphorus). Iron is useful in prevention of anemia and other related diseases[25]. Manganese plays a role in energy production and in supporting the immune system. It also works with vitamin K to support hemostasis as well as with B complex vitamins to control the effects of stress. Zinc is useful for protein synthesis, normal body development and recovery from illness[26]. It is also noteworthy to mention that no detectable trace of toxic heavy metals like arsenic, cadmium, lead and mercury were found in the tuber. Hence its consumption can be considered safe without the hazard of mankind being exposed to heavy metal toxicity.

Moreover, the result of this study is not only limited to the proximate, vitamin and mineral content of the tuber, but also enlightens the presence of bioactive components in the extract by GC–MS analysis. The chromatogram highlights the presence of several compounds of biological significance. The hydroethanolic extract of A. indica is especially rich in several of the polyunsaturated fatty acids and essential fatty acids which possesses anti-inflammatory, insectifuge, hypocholesterolemic, cancer preventive, nematicide, hepatoprotective, antiasthmatic, antieczemic, antiacne, 5–alpha reductase inhibitory, antiinflammatory, antiarthritic and antiplatelet properties. Dietary linoleic acid serves as a precursor for biosynthesis of arachidonic acid, the substance for eicosanoid synthesis through activity of the enzyme cyclooxygenase and 5–lipoxigenase. It has long been accepted as having hypocholesterolemic effects[27]. Among saturated long chain fatty acids, n–hexadecanoic acid, octadecanoic acid, tetradecanoic acid, pentadecanoic acid, heptadecanoic acid and some of their esters have been identified in both the ethanol and aqueous extracts, and they can exhibit antioxidant, hypocholesterolemic, nematicide, pesticide, lubricant and 5–alpha reductase inhibitory activities. The sterol components in the extract also possess hypolipidemic property and mainly help to lower blood triglyceride level and cholesterol level by reducing their absorption from gut tissue. Apart from this, in previous study reported by us, the hydroethanolic extract of A. indica was found to have significant in vitro antioxidant property[28]. This can be attributed to the presence of these several bioactive components as well as others like plant polyphenols and flavanoids. Because of their chemical structure, plant polyphenols can scavenge free radicals and inactive other pro–oxidants and also interact with endogenous antioxidant defense system[29].

The use of leaf extracts of A. indica have long been used for treatment of various ailments and the plant has its mention in the ancient system of medicine, Ayurveda. Though the tubers of the plant are edible and form a common diet among people of eastern region, its bioactive ingredients and complete nutritional profile were not evaluated so long. This study establishes the complete nutritional profile and reveals the presence of several pharmacologically active components in the tuber extract for the first time. Hence, the results of this study can lead to the isolation of the active ingredients for future therapeutic purpose. Lastly, keeping in mind its nutritional profile, the tuber of A. indica can be encouraged to be incorporated in daily diet for better health.

Conflict of interest statement

We declare that we have no conflict of interest.

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