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Proximate and Elemental Analyses of *Tinospora cordifolia* Stem

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Abstract: *Tinospora cordifolia* also known as Giloy or Guduchi, is an indigenous climber plant indigenous to tropical areas of India, Myanmar and Sri Lanka. Its stem is used for treatment of fever, jaundice, emaciation, skin ailments, diabetes, anaemia and various infectious diseases. The study was undertaken to evaluate the proximate and elemental analysis of the stems of *Tinospora cordifolia*. The proximate analyses were carried out using standard methods, while mineral elements were analyzed using Atomic Absorption Spectrophotometer, equipped with air acetylene flame. The proximate analysis of the stems of *Tinospora cordifolia* showed that it contained moisture 34.39%, ether extract 0.912%, crude protein 7.74%, crude fibre 56.42%, total ash 7.96%, nitrogen free extract 26.97%, cellulose 23.02% and hemicellulose 3.70%. The mineral analysis of the stems showed that they contain the following essential minerals: Calcium (102.23 ppm), phosphorous (24.81 ppm), iron (26.058 ppm), copper (3.733 ppm), zinc (7.342 ppm) and manganese (12.242 ppm). The study revealed that *Tinospora cordifolia* stems to be a potential source of nutrition and minerals for man as well as animals.

Key words: *Tinospora cordifolia*, nutritional composition, proximate analysis, mineral analysis, atomic absorption spectrophotometer

INTRODUCTION

Medicinal plants are widely used in various industries like pharmaceuticals, cosmetic, agricultural and food (Nasreen *et al*., 2010; Nair *et al*., 2012; Mahima *et al*., 2013a). Rigveda, which was written between 4500-1600 BC is the first record of use of herbs or plants as medicine. India has a wide biodiversity including the rich botanical wealth and considered as goldmine of herbal medicines and popularly called as 'medicinal garden of the world' (Archana *et al*., 2011; Mahima *et al*., 2012; Dhama *et al*., 2013). As an estimate, approximately 25,000 effective herbal preparations are used in traditional medicine by more than 1.5 million traditional medicinal practitioners for preventive, promotional and curative applications in India.

Tinospora cordifolia also known as Giloy or Guduchi, is an indigenous climber shrub commonly found in various Asian countries including India, Sri Lanka and Myanmar. Its stem has been used by traditional practitioners for various therapeutic purposes like treating jaundice, emaciation, skin ailments, diabetes, anaemia, dyspepsia, chronic diarrhoea and dysentery, urinary problems and various infectious diseases (Sinha *et al*., 2004; Mahima *et al*., 2012). It has excellent immunomodulatory properties thus widely used for treatment of bacterial and viral infections (Mahima *et al*., 2013b). Despite of its use in traditional and folk medicine, the plant is not very much studied scientifically for its biological assessment. Recently, there is much focus on herbal products especially in curative as well as preventive measures. So, this has created interest to explore the biological properties of *Tinospora cordifolia* in terms of its nutritional composition and mineral content in stems of the plant by proximate and elemental analysis. Despite of its wide therapeutic importance it is worthwhile to obtain its nutritional composition and mineral content. Thus, the present study was conducted to assess the various contents and their concentration in *Tinospora cordifolia*.

MATERIALS AND METHODS

Plant materials: Fresh samples of stems from healthy plants (Fig. 1) were collected from Amroha, Moradabad and Mathura districts of Uttar Pradesh, India and then identified and confirmed by a plant taxonomist. All the

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Table 1: Plant, its active principles and pattern of local use

Species name	Family name	Local name	Part used	Active principles	Status
Tinospora cordifolia	Menispermaceae	Giloy, Guduchi, Gurcha, Amrita, Amritavalli, Cinnodbhava Gulvel, Guluchi	Stems and roots	Tinosporone, tinosporic acid, berberine, giloin, alkaloids, diterpenoids, flavanoids and lignin	Wild/ cultivated

Fig. 1: *Tinospora cordifolia* plant

plants were packed in kraft paper and prepared a herbarium. The stems were washed and air dried in the laboratory for two weeks and then grounded with mixer grinder and sieved with a mesh of size 0.5 mm and stored in clean air tight containers at room temperature till further use. The detail of plant with respect to its common and local names, parts used, active principles and status are given in Table 1.

Proximate analyses: Moisture, crude protein, crude fibre, ether extract, nitrogen free extract, total ash and acid insoluble ash contents of the stem of *Tinospora cordifolia* were determined as per the standard methods described by the Association of Official Analytical Chemists (AOAC, 1996). Fibre fractions viz., Nutrient Detergent Fibre (NDF), Acid Detergent Fibre (ADF), Acid Detergent Lignin (ADL), hemicellulose and cellulose were determined by the method given by Van Soest *et al.* (1991).

Moisture content: For determination of moisture content, hot air oven method was used. The percentage of dry matter was measured using electronic balances and moisture content was calculated as:

$$\text{Moisture (\%)} = \frac{\text{Weight of sample before drying-weight of sample after drying}}{\text{Weight of sample before drying}} \times 100$$

Ash content: To determine the ash content, oven method was used. Ten grams of the sample were added to a preweighed crucible and weighed. Then, the sample were placed in a muffle furnace at 550°C for 4 h, cooled in desiccators and reweighed. The ash content was determined by using the following Equation:

$$\text{ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

Acid insoluble ash (AIA): AIA was estimated by dissolving inorganic portion of total ash mainly represent sand and silica:

$$\text{AIA (\%)} = \frac{\text{Weight of acid insoluble ash}}{\text{Weight of sample}} \times 100$$

Fat content (ether extract): Soxhlet method was used to determine the fat content. One hundred and fifty milliliters of petroleum ether was poured over 5 g of plant extracts in an extraction thimble. The thimble was placed in an extractor covering anti-bumping cotton, fixed the extractor to a preweighed oil flask and placed in the soxhlet for 8 h after which the oil flask was dried in an oven, cooled and reweighed. The fat content of each sample was calculated by using the following Equation:

$$\text{Crude fat (\%)} = \frac{\text{Weight of dried oil flask+fat-Weight of dried oil flask+Granules}}{\text{Weight of sample}} \times 100$$

Protein content (CP): Crude protein content was determined using the Kjeldahl method. Nitrogen content was calculated using the following Equation:

$$\text{CP (\%)} = \frac{\text{Vol. of digested sample} \times (\text{Titrant of N/7 } H_2SO_4 \text{ for sample-Titrant for blank})}{\text{Aliquot taken for distillation} \times \text{Weight of sample}} \times 0.002 \times 6.25 \times 100$$

The crude protein content of sample was calculated by the following Equation:

Protein (%) = N×6: 25 (protein factor specific to sample)

Crude fibre (CF): Crude fiber was determined using fat-free samples. Crude fiber content was determined using the following Equation:

$$\text{CF (\%)} = \frac{\text{(Crucible+residue weight left after acid and alkali digestion)-(Crucible+ash weight)}}{\text{Sample weight}} \times 100$$

Nitrogen free extract (NFE): NFE was calculated by difference between actual sample weight and sum of weight of moisture , EE, CP, CF and ash:

NFE (%) = 100-(CP+EE+CF+Total ash+Moisture)

Fibre fractions: For the determination of NDF, 1 g air dried sample taken into a beaker of the refluxing apparatus and refluxed with neutral detergent solution for 60 min then, filtered in preweighed sintered glass crucibles, dried and reweighed:

$$\text{NDF}(\%) = \frac{(\text{Crucible+cell wall constituents})-(\text{Crucible weight})}{\text{Sample weight}} \times 100$$

For the estimation of ADF, procedure was same as NDF but the solution used was acid detergent solution. Hemicellulose content was calculated by difference of NDF and ADF. ADF residue was treated with 72% H_2SO_4 and ashing of the residue determined the crude lignin (ADL):

$$\text{ADL}(\%) = \frac{(\text{Crucible+lignin})-(\text{Crucible+ash weight})}{\text{Sample weight}} \times 100$$

Cellulose was calculated by the difference of ADF and ADL.

Mineral content: Mineral analysis was carried out after acid digestion of 2 g of the grounded sample with 10 mL of a mixture of nitric acid, sulphuric and perchloric acid (4:1:1 v/v) until a clear solution was obtained. The digest was allowed to cool and then transferred into a 100 mL volumetric flask and made up to mark with de-ionized water. The mineral elements like calcium, copper, iron, zinc and manganese were analysed using atomic absorption spectrophotometer (Perkin elmer) equipped with air-acetylene flame, while phosphorous was determined by titremetric method (Chen *et al*., 1956).

Statistical analysis: The study was repeated three times and data obtained were presented with their Mean±standard error using Microsoft excel software.

RESULTS AND DISCUSSION

Data on proximate and mineral analyses of *Tinospora cordifolia* stem were shown in Table 2 and 3, respectively. The results revealed that *Tinospora cordifolia* possess low water content (34.39%) in its stem. The stem contains high crude fibre which is 56.42%. Other substances like protein (7.74%), ether extract (0.912%), total ash (7.96%) etc., are found to be in low concentration. Calcium is found at the highest level (102.233 ppm), followed by iron (26.058 ppm) and phosphorous (24.816 ppm). Other trace elements such as magnese (12.242 ppm), zinc (7.342 ppm) and copper (3.733 ppm) are available at a very low proportion.

Table 2: Proximate analysis of *Tinospora cordifolia* stem

Parameters	Weight (w/w%)
Moisture	34.390±4.412
Ether extract	0.912±0.013
Crude protein	7.740±0.632
Total ash	7.960±0.943
Acid insoluble ash	0.130±.0102
Crude fibre	56.420±2.211
Nitrogen free extract	26.970±1.012
NDF	58.310±2.451
ADF	54.610±1.861
ADL	30.590±0.741
Hemicellulose	3.700±0.391
Cellulose	23.020±1.183

All values are expressed on dry matter basis except moisture

Table 3: Mineral analysis of *Tinospora cordifolia* stem

Constituents	Parts per million (ppm)
Calcium	102.233±0.0385
Phosphorous	24.816±0.1120
Iron	26.058±0.0451
Copper	3.733±0.0064
Zinc	7.342±0.0127
Manganese	12.242±0.0127

Values are expressed as Mean±SE

Hussain *et al.* (2009) reported that *Tinospora cordifolia* contains 13.32% crude protein, 23.30% fibre and 1.99% fat. However, the iron concentration reported by these researchers is at par with our findings. In recent years, there is an increasing interest for quality control in research and production of medicinal plants particularly those of imported or raw materials procured from traditional herbal producers (Nasreen *et al*., 2010). Proximate and elemental analysis helps us in determining the nutritive value of the medicinal plants. The crude protein composition of a plant is of great value due to its nutritive values (Ajibade and Fagbohun, 2010). Hussain *et al*. (2009) also reported the high concentration of protein (13.32%) in this plant. The elemental analysis revealed the presence of calcium, phosphorus, iron, manganese, zinc and copper in significant quantities. This precludes that the *Tinospora cordifolia* could be a rich source of nutrition for body building and boosting the immune response. Calcium and Phosphorus are good for formation of bones and teeth. They also help in production of energy by helping in breakdown of carbohydrate, protein and fat, which is necessary for growth and maintenance of tissues (Harbinger, 1994). Plant also contain significant amount of iron, which plays pivotal role in erythropoiesis and oxygen transport. Deficiency of iron may cause behavioural and biochemical changes in brain (De Oliveira *et al*., 2001).

The variations in the proximate parameters in medicinal plants might be due to the conditions on which the plant species are harvested along with other environmental conditions parameters (Nordeide *et al*., 1996; Kutbay and Ok, 2001). The present study

supplements the available information with respect to carrying out further research and use of *Tinospora cordifolia* in ayurvedic system.

CONCLUSION

Recently, there is an increasing interest in use of herbal or plant products for treatment and preventive purposes. Earlier medicinal plants were used by indigenous and marginal communities for treating different diseases. The present study is an effort to know the biological properties of plants by proximate and mineral analysis. From this study, we observed that *Tinospora cordifolia* contains important nutrients and minerals that are useful for human as well as animal health. Furthermore, a thorough research would be helpful to further investigate the anti-nutritive, enzymatic and molecular effect on human as well as animal health of this plant.

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