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ESTIMATION OF PRIMARY METABOLITES FROM VARIOUS PARTS OF *TERMINALIA CHEBULA* RETZ.

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ABSTRACT
In the present study the biochemical evaluation of primary metabolites (total soluble sugars, starch, lipids, proteins and phenols) from *Terminalia chebula* has been carried out from various parts viz., leaves, stems, seeds and fruits. The various plant parts of *T. chebula* varied in composition of primary metabolites. The leaves of *T. chebula* showed maximum content of sugar (6.65 mg/gdw), starch (7.12 mg/gdw) and protein (44.40 mg/gdw). Lipids were higher in fruits (72.20 mg/gdw) while the phenol content was maximum in seeds of *T. chebula* (72.46 mg/gdw).

INTRODUCTION

Plants have been used as an important element of indigenous medical systems since ancient times. The role of plants in medicine is expanding beyond their tradition and continuing its role as a pharmacopoeia. It has been confirmed by WHO that herbal medicines serve the health needs of about 80 percent of the world's population (Jones, 1996). Several important drugs used in modern medicine like taxol, vinblastine and vincristine have come from medicinal plant studies. Natural products play an important role in the field of new drugs research and development, because of their low toxicity, easy availability and cost-effective (Balandrinn *et al.,* 1985).

In plants as a result of metabolic processes, many different types of organic compounds or metabolites are produced. These metabolites are grouped into primary and secondary metabolites that provide an invaluable resource that have been used to find new drug molecules (Cowan, 1999). Secondary metabolites are synthesized by the plants as part of the defense system of the plant. Unlike secondary metabolites, primary metabolites are found throughout the plant kingdom (Taiz and Zeiger, 2006). The primary metabolites like chlorophyll, amino acids, nucleotides, simple carbohydrates or membrane lipids, play recognized roles in photosynthesis, respiration, solute transport, translocation, nutrient assimilation and differentiation. Primary metabolite also acts as a precursor for bioactive compounds used as therapeutic drugs (Tatsuta and Hosokawa, 2006).

Terminalia chebula Retz, commonly known as black myrobalan and haritaki, belongs to the family Combretaceae. It is a medium to large-sized tree, distributed in the tropical and sub-tropical region of India. Traditionally, *T. chebula* is used to cure several ailments such as fever, cough, diarrhea, gastroenteritis, skin diseases, candidiasis, urinary tract infection and wound infections (Kirtikar and Basu, 1987; Anonymous, 1999). *T. chebula* is reported to possess anti-cancerous, antioxidant, hypolipidemic, hepatoprotective, antidiabetic and immunomodulatory activity (Khanna *et al*., 1993; Lee *et al*., 2005, 2007; Tasduq *et al.,* 2006). The fruits from *T. chebula* appear to have evolved as complex antibiotic compounds that have shown activity against bacteria (Inamdar *et al.,* 1959; Phadke and Kulkarni, 1989; Kim *et al.,* 2006) and virus like Herpes simplex virus type-1 and Cytomegalovirus (Yukawa *et al*., 1996). Therefore, in the present study primary metabolites from leaves, stems, seeds and fruits of *Terminalia chebula* have been evaluated.

MATERIALS AND METHODS

Plants parts (stem, leaves, fruits and seeds) of *T. chebula* were collected from Jabalpur district in Madhya Pradesh, India. The plants were identified and a voucher specimen was deposited to the Herbarium, Botany Department, University of Rajasthan, Jaipur (RUBL No: 20823). The various plant materials were separately washed with running water to remove dust, shade dried and powdered with motar and pestle.

The quantitative estimation of primary metabolites was carried out using different protocols. The powdered plant parts *viz,* leaves, stems, seeds and fruits of *T. chebula* was used for analysis of carbohydrate (Dubois *et al.,* 1956), protein (Lowry *et al.,* 1951), lipids (Jayaraman, 1981), starch (Dubois *et al*, 1956) and phenol (Bray and Thorpe, 1954) respectively.

RESULTS AND DISCUSSION

In the present investigation, *T. chebula* was evaluated quantitatively for the analysis of total soluble sugar, starch, lipid, protein and phenol. The various plant parts (leaf, stem, fruit and seed) of *T. chebula* varied in composition of primary metabolites studied.

Carbohydrates, the products of photosynthetic activities are primary plant chemicals of complex organic nature and used in the metabolism of various organic reactions. Sugars are reported to possess freeze resistance in plants (Ashworth *et al.,* 1993). Some derivatives of sugars are even active against mutagenic cells (Terumocrap, 1985). In the present study, the leaves of *T. chebula* showed maximum content of sugar (6.65 mg/gdw), followed by fruit, stem and seed (Fig. 1). Similarly, higher content of sugar was reported in the leaves of *M. indica* (126 mg/gdw) (Vijayvergia and Shekhawat, 2009) and *S. anacardium* (56.33 mg/gdw) (Sharma *et al*., 2010) respectively.

Starch is an essential component of food providing a large proportion of the daily calorific intake. Starch has been used in both food and non-food products for centuries. The major sources of starch for man's use are the cereals, but roots and tubers are also important (Tester and Karkalas, 2001). It is important in non-food uses such as in adhesives, cosmetic formulation and as diluents (Patel and Hopponen, 1966). In *T. chebula*, starch content was maximum in leaves (7.12 mg/gdw) as compared to other parts studied (Fig. 2). In similar investigation by Vijayvergia and Shekhawat (2009), starch was reported to be higher in stems of *M.indica* (54 mg/gdw).

The maximum amount of lipids was observed in fruits of *T. chebula* (72.20 mg/gdw) while minimum content was observed in stems (21.36 mg/gdw) (Fig. 3). In earlier studies, lipids were reported to be higher in the leaves (46.0 mg/gdw) of *M. oleifera* (Sharma *et al*., 2010) and the roots (39.0 mg/gdw) of *C. quadrangularis* (Vijay and Vijayvergia, 2007). Lipids have been

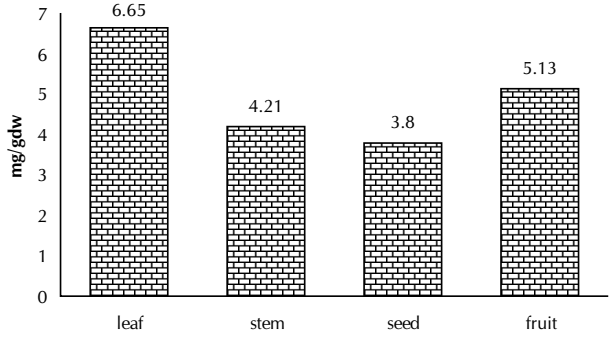

Figure 1: Yield content od sugar from various parts of *T. chebula*

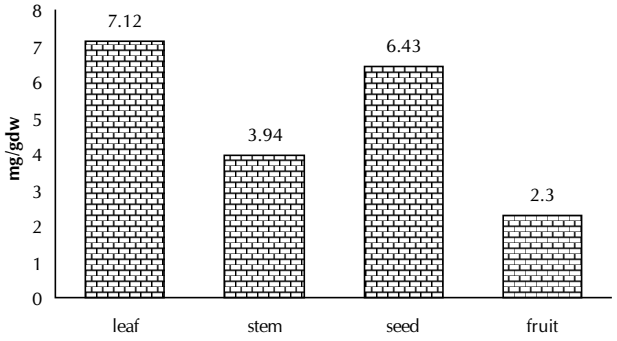

Figure 2: Yield content of starch from various parts of *T. chebula*

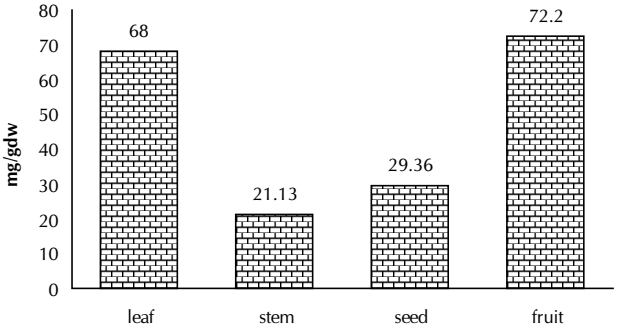

Figure 3: Yield content of lipid from various parts of *T. chebula*

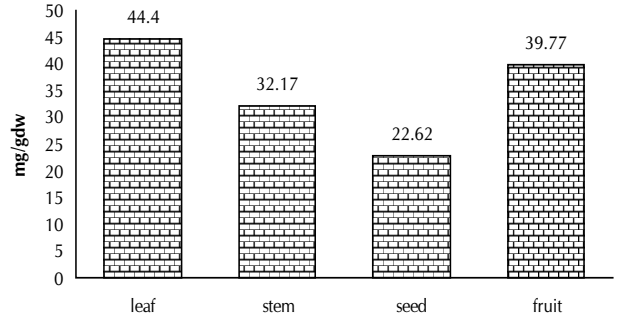

Figure 4: Yield content of protein from various parts of *T. chebula*

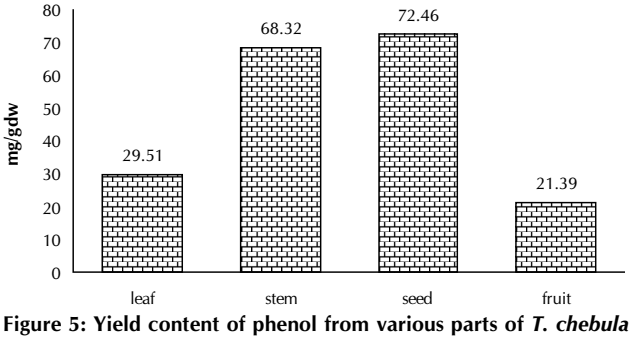

Figure 5: Yield content of phenol from various parts of *T. chebula*

Table 1: Yield content (mg/gdw) of primary metabolites of *T. chebula*

S.No.	Plant parts used	Carbohydrates	Starch	Lipid	Protein	Phenol
1	Leaf	6.65	7.12	68.00	44.40	29.51
2	Stem	4.21	3.94	21.13	32.17	68.32
3	Seed	3.80	6.43	29.36	22.62	72.46
4	Fruit	5.13	2.30	72.20	39.77	21.39

used in the compounding of pharmaceutical and cosmetic preparations since the beginning of recorded history. In modern therapeutic treatments, nanoparticles and liposomes are being used to develop delivery systems that are convenient and effective for tackling problems in disease treatments (Khurana *et al*., 2009). Various lipids and related compounds have been extensively studied for their growth inhibitory effect on pathogenic strains (Meng *et al*., 2000; Deans and Svoboda, 1989).

Proteins are complex nitrogenous organic substances that are one of the most important plant products to man. Apart from this, the protein hydrolysates from various sources are reported to possess antioxidant activity (Pena- Ramos and Xiong, 2003; Suetsuna, 2000). Higher content of protein was observed in leaves of *T. chebula* (44.40 mg/gdw) followed by fruit, stem and seed (Fig. 4). This is in agreement with Vijayvergia and Shekhawat (2009), were higher content of protein was reported in leaves of *M.indica* (64 mg/gdw).

Plant phenols are a group of natural products with variable structures that are well known for their beneficial effects on health long before their isolation. They have been reported from various plant species to possess significant antimicrobial and antioxidant activities (Ruberto *et al*., 2000). The phenol content was maximum in seeds of *T. chebula* (72.46 mg/gdw). The fruits of *T. chebula* showed minimum amount of phenols (21.39 mg/gdw) (Fig. 5). Vijayvergia and Vijay (2007) reported higher content of phenols in roots (45 mg/gdw) of *C.aegtptiaca* .

REFERENCES

Anonymous. 1999. Indian Herbal Pharmacopoeia. Regional Research Laboratory, Jammutwai and Indian Drug Manufactures Association, Mumbai. **2:** 51.

Ashworth, E. N., Stirm, V. E. and Volenec, J. J. 1993. Seasonal variations in soluble sugars and starch within woody stems of *Corms sericea* L. *Tree Physiology*. **13:** 379-388.

Balandrin, M. F., Klocke, J. A., Wutule, E. S. and Bollinger, W. H. 1985. Natural plant chemicals: Sources of industrial and medicinal materials. *Their Science*. **228:** 1154-1160.

Bray, H. C. and Thorpe, W. V. 1954. Analysis of phenolic compounds of interest in metabolism. *Meth.Biochem.Anal*. **1:** 27-52.

Cowan, M.M. 1999. Plant products as antimicrobial agents. *Clinical Microbiology Review*. **12:** 564–582.

Deans, S. G. and Svoboda, K. P. 1989. Antibacterial activity of summer savory (*Satureja hortensis* L.) essential oil and its constituents. *J. Hort. Sci*. **64:** 205-210.

Dubois, M., Gills, K. A., Hamilton, J. K., Rebers, P. A. and Smith, F. 1956. Colorimetric method for determination of sugar and related substances. *Anal. Chem*. **28:** 350-356.

Inamdar, M. C., Khorana, M. L. and Rao, M. R. R. 1959. Antibacterial and antifungal activity of *Terminalia chebula* Retz. *Indian J. Pharm*. **21(12):** 333-335.

Jayaraman, J. 1981. Laboratory manual in biochemistry. Wilsey Eastern Limited, New Delhi. pp. 96-97.

Jones, F. A. 1996. Herbs-useful plants. Their role in history and today. *Europ. J. Gastroenterol. Hepatol*. **8:** 1227-1231.

Khanna, A. K., Chander, R., Kapoor, N. K., Singh, C. and Srivastava, A. K. 1993. Hypolipidemic activity of *Terminalia chebula* in rats. *Fitoterapia*. **64(4):** 351-356.

Khurana, S., Utreja, P., Tiwary, A. A., Jain, N. K. and Jain, S. 2009. Nanostructural lipid carriers and their applications in drug delivery. *Int. J. Biomed. Engi. Technol*. **2(2):** 152-171.

Kim, H. G., Cho, J. H., Jeong, E. Y., Lim, J. H. and Lee, S. H. 2006. Growth inhibitory activity of active component of *Terminalia chebula* fruits against intestinal bacteria. *J. Food Prot*. **69(9):** 2205-2209.

Kirtikar, K. R. and Basu, B. D. 1987. Indian Meteria Media, International Book distributors, Dehradun, India. **3:** 333-335.

Lee, H. S., Won, N. H., Kim, K. H., Lee, H., Jun, W. and Lee, K. W. 2005. Antioxidant effects of aqueous extract of *Terminalia chebula* in vivo and in vitro. *Biol. Pharma. Bulletin*. **28(9):** 1639-1644.

Lee, H. S., Jung, S. H., Yun, B. S. and Lee, K. W. 2007. Isolation of chebulic acid from *Terminalia chebula* Retz. and its antioxidant effect in isolated rat hepatocytes. *Archieves Toxicol*. **81(3):** 211-218.

Lowry, O. H., Rosebrough, N. J., Far, A. L. and Randall, R. J. 1951. Protein measurement with the folin-phenol reagent. *J. Biol. Chem*. **193:** 265-275.

Meng, J. C., Zhu, Q. X. and Tan, R. X. 2000. New antimicrobial mono and sesquiterpenes from *Soroseris hookeriana* subsp. *erysimoides*. *Planta Medica*. **66:** 541–544.

Patel, N. R. and Hopponen, R. E. 1966. Mechanism of action of starch as a tablet disintegrant: factors that effect swelling of starch grains at 37°. *J. Pharm. Sci*. **56:** 614-617.

Pena-Ramos, E. A. and Xiong, Y. L. 2003. Whey and soy protein hydrolysates inhibit lipid oxidation in cooked pork patties. *Meat Sci* . **64:** 259–263.

Phadke, S. A. and Kulkarni, S. D. 1989. Screening of in vitro antibacterial activity of *Terminalia chebula*, *Eclapta alba* and *Ocimum sanctum*. *Indian J. Med. Sci*. **43(5):** 113-117.

Ruberto, G., Baratta, M. T., Deans, S. G. and Dorman, H. J. D. 2000 . Antioxidant and antimicrobial activity of *Foeniculum vulgare* and *Crithmum maritimum* essential oils. *Planta Medica*. **66:** 687 693.

Sharma, A., Barman, N. and Malwal, M. 2010. Biochemical estimation of primary metabolites from *Semecarpus anacardium*. *The Bioscan*. **5(2):** 235-237.

Sharma, A., Yadav, A., Barman, N. and Malwal, M. 2010. Quantification of primary metabolites of *Moringa oleifera* Lam. *The Bioscan*. **5(3):** 403-405.

Suetsuna, K. 2000. Antioxidant peptides from the protease digest of prawn (*Penaeus Japonicus*) muscle. *Marine Biotech*. **2:** 5–10.

Taiz, Q. L. and Zeiger, E. 2006. Plant physiology, 4th Edn. Ch. 13. pp. 315-344. Sinauer Associates, Inc., Publishers, Massachusetts.

Tasduq, S. A., Singh, K., Satti, N. K., Gupta, D. K., Suri, K. A. and Johri, R. K. 2006. *Terminalia chebula* (fruit) prevents liver toxicity caused by sub-chronic administration of rifampicin, isoniazid and pyrazinamide in combination. *Human Exp. Toxicol*. **25(3):** 111-118.

Tatsuta, K. and Hosokawa, S. 2006. Total syntheses of bioactive natural products from carbohydrates- A Review. *Sci. and Technol. Adv. Mat*. 397-410.

Terumocrap, P. 1985. Preparation of antitumor polysaccharides (NGI) from *Melia azedirechta* Japan Kokaki- Tokkyo. *Koho. Jp*. **60:** 723-728.

Tester, R. F. and Karkalas, J. 2001. The effects of environmental conditions on the structural features and physico-chemical properties of starches. *Starch*. **53:** 513–519.

Vijayvergia, R. and Shekhawat, N. 2009. Biochemical estimation of primary metabolites of *Madhuca indica* GMEL. *The Bioscan*. **4(2):** 321-324.

Vijay, P. and Vijayvergia, R. 2007. Biochemical analysis of primary metabolites of some medicinal plants. *The Bioscan*. **2(3):** 203-206.

Vijayvergia, R. and Vijay, P. 2007. Quantification of primary metabolites of *Balanitis aegyptiaca*. *Asian J. Exp. Sci*. **21(2):** 329-336.

Yukawa, T. A., Kurokawa, M., Sato, H., Yoshida, Y., Kageyama, S., Hasegawa, T., Namba, T., Imakita, M., Hozumi, T. and Shiraki, K. 1996. Prophylactic treatment of cytomegalovirus infection with traditional herbs. *Antiviral. Res*. **32(2):** 63-70.