

Short Communication

Analysis of inorganic profile of *Tribulus terrestris*

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Tribulus terrestris belonging to the family Zygophyllaceae, grows in tropical climates. *T. terrestris* is used in treating sexual deficiencies. It has been used in Asia and Europe for years to treat libido and infertility problems. People from around the world used *T. terrestris* plant to promote overall health. *T. terrestris* has antimicrobial, anti-hypertension, diuretic, anti-actylcholine and hemolytic activity and to stimulate spermatogenesis and libido. Keeping in view the wide applications of *T. terrestris*, it is very important to know the inorganic constituents and its possible role in the body. For this purpose the plant was collected from two areas of Mardan and Peshawar, Pakistan. The inorganic constituents including total hardness, total alkalinity, Na⁺, K⁺, Mg²⁺, Cl⁻, CaCO₃²⁻, SO₄²⁻ were determined. It is also important to know the differences of the inorganic constituents while the plant is grown in different natural habitats.

Key words: Medicinal plants, *Tribulus terrestris*, inorganic constituents.

INTRODUCTION

Medicinal plants are used in traditional medicines for various types of diseases since ancient times. Recently the use of phytoterapics is considered to be safer and congenial to the human body. Medicinal plants are used for the preparation of various modern drugs are used as the principle sources of raw materials (Chen et al., 1993). In most of the Asian countries, these plants are easily available in local markets. These medicinal plants are found in the form of mixtures, extracts, capsules, oil forms and are easy to use and the pharmaceutical industries promises for more quick effects (Kaniyas et al., 1993). There is a great interest in elemental composition in medical science. It is believed that majority of elements act as key components of essential enzymes systems or vital biochemical functions. The various minerals or inorganic nutrients are required for healthy life (Jaffar and Masud, 2003).

Tribulus Terrestris is a prostrate, annual herb that grows up to 90 cm in length with paripinnate leaves. The flowers are small, yellowish, and solitary. The fruits of

Tribulus are typically five angled and spinous. The fruits of *Tribulus* contain alkaloids, resins, tannins, sugars, sterols, essential oil, peroxidase, diastase and glucoside.

T. terrestris is a herb that has been used in the traditional medicine of China and India for centuries. The fruit of *T. terrestris* is a famous traditional Chinese medicine. It is described as a highly valuable drug used to restore the depressed liver for the treatment of fullness in the chest and mastitis and also used to dispel the wind and clear the eyes for the treatment of acute conjunctivitis headache and vertigo (Xie and Huang, 1998). *T. terrestris* is a non-hormonal herb that restores and improves libido in men as well as improving and prolonging the duration of erections. *T. terrestris* increases the number of sperm and the mobility. The crude extract increase the body's natural testosterone levels and thereby improves male sexual performance and help build muscle. *T. terrestris* is also reported to have antimicrobial, anti hypertension, diuretic, anti actylcholine and hemolytic activity and to stimulate spermatogenesis and libido (Jit and Nag, 1985; Bose et al., 1963; Tomova, 1987; Sharma et al., 1977). *T. terrestris* contains steroidal saponins, alkaloids, and flavanoids. The active compounds in *Tribulus* are the

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steroidal saponins. Two types, called furostanol glycosides and spirostanol glycosides, appear to be mainly involved with the medicinal preparation of *Tribulus*. These saponins are found primarily in the leaf. Its protodioscins content is believed to be responsible for its effects on hormone, libido and body composition.

Keeping in view the importance of this herb, the present study is therefore an attempt to analyze the inorganic constituents and their possible role in various functions and performances in the body. Its role is very prominent but sometimes will make problems for those of high hypertensive because of the increase concentrations of the electrolytes particularly sodium (Na) or chloride beside other constituents. It is also very important for the public awareness, local practitioners and for the pharmaceutical industries to know their concentration level and to provide a scientific database to help the consumers.

MATERIALS AND METHODS

Experimental

All the reagents and chemicals used were of analytical grade procured from sigma and E. Merk. All the solutions of standard and samples were prepared in freshly prepared deionized water.

Plant sample preparation

The plants after collection from Peshawar area of Khyber Pakhtunkhwa were cleaned visually to remove the dust particles, washed with tape water and then with deionized water and dried at 120 °C to a constant weight. The dried plants were grinded to fine powder and then used for dry ashing. The pre-cleaned silica crucible was heated at 600°C to a constant weight before putting the samples. The powdered plant material in the crucible was heated in a muffle furnace at 600°C, until there was no evolution of smoke. The crucible containing plant ash was cooled in desiccator at room temperature and moistened with deionized water to keep it over night. The undissolved particles were filtered and make up the volume to 100 mL. This solution was used as sample solution (Kabata, 1986).

Methods

Sodium and potassium were determined by flame photometer model coning-40. Calcium and magnesium were determined by complexometric titration. Phosphate was determined by calorimetric method using ammonium dihydrogen phosphate as standard solution and molybdate as complexing agent. Sulphate and bicarbonate were determined by titrimetric method and chloride was determined by the standard argentometric method using potassium chromate indicator (Bassett et al., 1978).

RESULTS AND DISCUSSION

The analytical results obtained are shown in Table 1. *T. terrestris* collected from Mardan region has the concentration of Na 0.7 mg/kg in the roots, 1.40 mg/kg in

the stem, 1.00 mg/kg in the leaves, and 1.7 mg/kg in the seeds. The concentration level of K 15.0 mg/kg in the roots, 117.00 mg/kg in the stem, 92.00 mg/kg in the leaves and 55.00 mg/kg in the seeds in the sample procured from Mardan. The concentration of Na in the sample collected from Peshawar 3.96 mg/kg in the roots, 4.82 mg/kg in the stem, 5.81 mg/kg in the leaves and 4.85 mg/kg in the seeds. The potassium level 17.80 mg/kg roots, 114.5 mg/kg in the stem, 70.0 mg/kg in the leaves and 85.0 mg/kg was found in the seeds sample of *T. terrestris* from Peshawar region. Sodium concentration of 139 mg/liter and K 5 mg/litre is present in the blood plasma of human being. High concentration of Na leads to hypertension while high concentration of K leads to the dilation of arteries. Extensive level of K leads to the failure of heart (Chouhan et al., 2002; Harold, 1970; Hewitt and Smith, 1970).

Chloride

The concentration level of chloride in the sample obtained from Mardan region has 4.71 in the roots, 15.88 mg/kg in the stem, 18.86 mg/kg in the leaves and 12.92 seeds. A similar concentration 5.96 mg/kg was found in the roots, 24.00 mg/kg in the stem, a considerably high amount of Cl^{-1} was found 25.81 mg/kg in the leaves while in the leaves its concentration was 19.86. Chloride is essential in water balance, osmotic pressure regulation as well as acid base equilibrium. Mostly it is required for cell division in leaves and roots.

Calcium

The amount of calcium varies from all the studied plant samples. For example the sample collected from Mardan has high amount of Ca 28 mg/kg in the seeds followed by 24.00 mg/kg in the stem, while lower concentration 16 mg/kg was found in the leaves. The sample collected from Peshawar, has very high concentration in the leaves 120 mg/kg while lower concentration 16 mg/kg was recorded in the seeds. Calcium is very important constituent used in the synthesis of new cell walls. 5 mg/liter of calcium is present in the blood plasma of human (Chouhan et. al., 2002; Hewitt and Smith, 1970).

Sulphate

The concentration level of SO_4^{-2} was found high in the sample collected from Mardan region. 103.68 mg/kg in the stem while equal amount 99.84 16 mg/kg was found in the leaves and seeds samples. Very low concentration 19.20 mg/kg was recorded in the roots. In case of the sample from Peshawar, high amount 157.44 mg/kg was recorded in the leaves followed by 138.24 mg/kg in the

Table 1. Concentration of inorganic constituents in *Tribulus terrestris* (mg/kg).

S/No.	Plant 1 part	Na ⁺	K ⁺	Cl ⁻	Ca ²⁺	Mg ²⁺	SO ₄ ⁻²	Total alkalinity	Hardness
1	Root	0.70	15.00	4.71	20.00	4.00	19.20	32.00	24.00
2	Stem	1.40	117.00	15.88	24.00	8.00	103.68	44.00	32.00
3	Leaves	1.00	92.00	18.86	16.00	48.00	99.84	28.00	64.00
4	Seeds	1.70	55.00	12.90	28.00	32.00	99.84	44.00	60.00
Plant 2 part									
5	Root	3.96	17.80	5.96	24.00	32.00	42.24	40.00	56.00
6	Stem	4.82	114.5	24.82	16.00	40.00	138.24	80.00	56.00
7	Leaves	5.81	70.00	25.81	120.00	12.00	157.44	76.00	132.00
8	Seeds	4.85	85.00	19.85	16.00	4.00	69.12	44.00	20.00

Plant 1, Mardan; **Plant 2**, Peshawar, *Tribulus Terrestris*.

stem and a double concentration of 42.24 mg/kg was found in the leaves compared to the sample from Mardan region.

Total alkalinity

Among the sample obtained from Mardan region, equal amount 44 mg/kg was found in the stem and seeds samples and 28, 32 and 28 mg/kg was found in the leaves and roots sample, respectively. While the total alkalinity was found high in the stem, 80 mg/kg and 76 mg/kg in the leaves samples collected from Peshawar.

Total hardness

The total hardness was found high in the sample collected from Mardan 64 mg/kg in the leaves followed by 60 mg/kg was found in the seeds while low concentration was found in the root 24 mg/kg and 32 mg/kg in the stem. In case of sample collected from Peshawar a high amount 132 mg/kg was found in the leaves while very low concentration was detected in the seeds sample 16 mg/kg.

Conclusion

From the above study, it is quite interesting to know the concentration level of the inorganic constituents. The difference in the concentration of these constituents may create problems in the human health and can lead to serious consequences. For example, high concentration of Na leads to hypertension while high concentration of K leads to the dilation of arteries. Thus in conclusion, *T. terrestris* plant for pharmaceutical consumption or for other formulation or for local use should be collected from environmentally uncontaminated area and the concentration level should also be checked before use in order

to make it safe for human utilization. Beside this scientific database was also provided for the local practioners.

REFERENCES

- Bassett J, Denney RC, Jeffery GH, Mendham J (1978). Vogel's Text Book of Quantitative Inorganic Analysis, The English Language Book Society and Longman, New York, pp: 325-6, 335-338.
- Bose BC, Saifi AQ, Vijavargiya R, Bhatnagar JN (1963). Some aspects of chemical and pharmacological studies of *Tribulus terrestris* Linn. Indian J. Med. Sci., 17: 291.
- Chen K, Tseng C, Lin T (1993). Analysis of some Indian medicinal herbs by J. Radional Nuclear Chem., 170: 265.
- Chouhan MHS, Wattoo S, Tirmizi A (2002). Analytical investigation of selected inorganic nutrients of desert growing Aloes Nucleus, 39: 195
- Harold V (1970). Practical clinical biochemistry, 4th Ed. Vazirani for Arnold Heineman Pvt. Ltd. p. 256.
- Hewitt EJ, Smith TA (1970). Plant Mineral Nutrition. The Engineering University Press Ltd. London.
- Jaffar M, Masud K (2003). Dietary phytoestrogens - a role in women's health. Nutr. Food Sci., 9: 33.
- Jit S, Nag TN (1985). Antimicrobial principles from *in vitro* tissue culture of *Tribulus alatus*. Indian J. Pharmaceut. Sci., p. 47.
- Kabata PA (1986). Trace Elements in Soils and Plants. CRC, Inc. Florida
- Kanias GD, Tsita E, Loukis A, Kilikoglou V (1993). Determination and statistical analysis of trace element and active constituent concentrations in the medicinal plant *Eucalyptus camaldulensis* Dehnh (*E. rostratus* Schlecht). J. Radional. Nucl. Chem., 97: 169.
- Sharma HC, Norula JL, Varadarajan R (1977). Chemical investigations of the fruit of *Tribulus Alatus* Del. Chem. Era, 13: 261.
- Tomova M (1987). Farmastiya, 37: 40.
- Xie ZF, Huang XK (1998). Dictionary of Traditional Chinese Medicine, Commercial Press, ltd, Hong Kong, p. 205.