Research Article

Nutritional Profile, Antinutritional Profile and Phytochemical Screening of Garhwal Himalaya Medicinal Plant *Dioscorea alata* Tuber

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ABSTRACT

The present study aimed at evaluating nutritional Profile, antinutritional profile and phytochemical screening of Garhwal Himalaya medicinal plant *Dioscorea alata* tuber. The plant has been found to rich in medicinal properties such as anticancer, antidibetic, antimicrobial activity. The plant tuber have been found to rich in nutrients and antinutrients such as crude protein 2.81(%), carbohydrates 6.80(%), crude fibre 4.01(%), crude fat 0.81(%) and antinutrients alkaloids 0.51(%), flavonoids 1.32(%), saponins 2.56(%) and tannins 0.66(%) respectively. This analysis revealed that the plants contained potent medicinal properties as compared to another medicinal plant.

Keywords: Nutritional value, Antinutritional value, Successive value, Thin Layer Chromatography, Phytochemical Screening.

INTRODUCTION

The Himalaya region of India in Uttarakhand represent the largest mountain chain covering approximately 8 million km in surface area and occupying a length of approximately 300 km[1]. India has great wealth of medicinal plants and their traditional uses. In Uttarakhand region the use of medicinal plants as a source for covers the major divisions of Garhwal and Kumaon[2]. India is one of the world's major exporters of raw herbal drugs and the Himalayas are renowned for their vast storehouse of medicinal plants. In recent years, India has been ranked as the second largest volume exporters of raw herbal.

Dioscorea alata belongs to the family of dioscoreaceae which is commonly known as Bebaru in Uttarakhand. *Dioscorea alata* tubers have variable shapes the majority being cylindrical. Its tubers are varying in number from one to five. The flesh of the tuber ranges in colour from white to purplish. The tubers used for the treatment of different diseases such as laxative and vermifuge, and as a treatment for fever, gonorrhea, leprosy, tumors, and inflamed hemorrhoids. The tubers are also believed to possess activities such as antimicrobial, antioxidant, anti-cough, anti-diabetic, anti-diarrhea, and anti-cancer activity[3]. Furthermore traditionally *Dioscorea alata* is used prophylatically for chronic liver pain diseases. Several studies indicated that some Indian wild medicinal plants possess more potent antioxidant activity than common tubers and fruits and phenolics compounds were a major contributor to the antioxidant activity of these plants[4].

Dioscorea alata tuber contains diosgenin, which is widely used as a precursor in the synthesis of steroid hormones such as progesterone, corticosteroids, and anabolic steroids. The most important sapogenins are diosgenin and yamogenin.

MATERIALS AND METHODS

Plant Material

The fresh parts of tuber of *Dioscorea alata* was collected from adjoining area of Mathur village Distt- Tehri Garhwal Uttarakhand) in the month of September– November 2012. The plant was authenticated by botanist Prof. R. D. Guar, Department of Botany and the voucher specimen number is GUH 7269. H. N. B. Garhwal (A Central University) Srinagar Garhwal, Uttarakhand India.

***Dioscorea alata* tuber**

Preparation of Plant Extract

The plant material was separated into its selected part tuber air dried ground to moderately fine powder and soxhlet extracted with increasing polarity solvent (Petroleum ether, chloroform, ethyl acetate, acetone, methanolic, ethanolic and water)[5]. Each extract was evaporated to dryness under reduce pressure using rotary

evaporator. The coarse powder of tuber were subjected to successive hot continuous extraction with various solvent each time before extracting with next solvent the powdered material will be air dried (weight of crude extract 500gm). The various concentrated extracts were stored in air tight container for further studies.

Nutritional, Antinutritional Value & Minerals Assay

The edible portion of tuber was analyzed for moisture, ash, fat[6], and fiber as per method reported in AOAC. Total nitrogen was analyzed by microkjeldhal method[7], and for crude protein the value was multiplied by 6.25. Total carbohydrates were obtained by subtracting the value moisture, crude protein, crude fat, crude fiber and ash from 100%[8]. The total energy value equal to addition of fat, protein and sugars calorie, each gram of fat give 9 kcal, protein and sugar give 4 kcal energy. The minerals analyzed were Potassium using atomic absorption spectrophotometer, calcium and phosphorus by flame photometer. Ascorbic acid in tuber was estimated by standard process[9].

Successive Value

Accurately weighed 500gm coarse and air dried drug material were subjected to hot successive continuous extraction in soxhlet apparatus with different solvents with increase in polarity petroleum ether, benzene, chloroform, methanol, ethanol and finally with water. The extracts were filtered in each step concentrated and the solvent was removed by vacuum distillation. The extracts were dried in the vacuum desiccator and the residues were weighed[10]. Which contain maximum chemical compound are these categories as depend upon solvent nature and types.

Detection of Chemical Compound through TLC

Thin layer chromatography (TLC) is a chromatography technique used to separate unknown chemical compound mixtures. Thin layer chromatography is performed on a sheet of glass, which is coated with a thin layer of adsorbent material usually silica gel G. This layer of adsorbent is known as the stationary phase. After the sample has been applied on the plate, a solvent or solvent mixture (known as the mobile phase) is drawn up the plate via capillary action. Thin Layer Chromatographic plates are prepared by spreading silica gel G on glass plate using distilled water as solvent these plates are activated in oven at 110^{O}C for 1 hour. All six extracts are applied separately and run in different solvent system of varying polarity. These plates are developed in UV-Visible chamber, Iodine chamber and spraying reagent for different spots and Rf value of chemical constituent[11].

Preliminary Phytochemical Studies

Preliminary phytochemical test of all various extracts of tubers powder of *Dioscorea alata* were performed for phytochemical analysis of alkaloids, glycosides, carbohydrates, steroids, flavonoids, polyphenols, saponins, resin and tannins. However, alkaloids were absent. The qualitative test of all extracts showed significant indication about the presence of metabolite which was detected by using standards methods[12].

RESULTS AND DISCUSSION

Plants are important source of potentially bioactive constituents for the development of new chemotherapeutic agents. The first step towards this goal is the nutritional profile, antinutritional value, TLC analysis, successive extraction and phytochemical screening. The results of nutritional & antinutritional value, mineral value, TLC analysis, successive extraction and phytochemical screening provided in tables 1-5 and figures 1-3.

Nutritional Value

The level of nutrients such as crude protein, carbohydrates, crude fiber and ash content (2.81%, 6.80%, 4.05% and 3.20%) and also minerals as calcium, magnesium, potassium and phosphorus (0.75, 0.95, 1.18 and 1.08 mg/100gm) respectively.

Successive Value

Dioscorea alata tuber contains significant value 66.54%, 19.30% and 14.23% against ethanolic, water and methanolic solvent extract with 500gm plant sample.

Phytochemical Screening

The Preliminary phytochemical screening of plant *Dioscorea alata* tuber for the presence of glycosides, flavonoids, phenols, resin and tannins.

Table 1: Nutritional value and antinutritional value of *Dioscorea alata* tuber

Nutrients	Value	Nutrients	Value
Moisture (%)	82.80 ± 0.10	Insoluble ash (%)	9.46 ± 0.10
Ash (%)	3.20 ± 0.15	Soluble ash (%)	7.54 ± 0.10
Crude fat (%)	0.32 ± 0.20	Insoluble acid (%)	85.0 ±0.05
Crude fibre (%)	4.05 ± 0.14	Soluble acid (%)	15.0±0.10
Total nitrogen (%)	0.45 ± 0.05	Insoluble base (%)	60.0±0.15
Total protein (%)	2.81 ± 0.08	Soluble base (%)	40.0±0.08
Carbohydrate (%)	6.80± 0.10	Water insoluble (%)	86.0±0.10
Organic matter (%)	96.80± 0.15	Water soluble (%)	14.0±0.05
Total saponins (%)	2.56±0.40	Total phenolic (%)	0.53±0.05
Total flavonoid (%)	1.32±0.50	Total tannins (%)	0.66±0.25
Total alkaloid (%)	0.51±0.10		

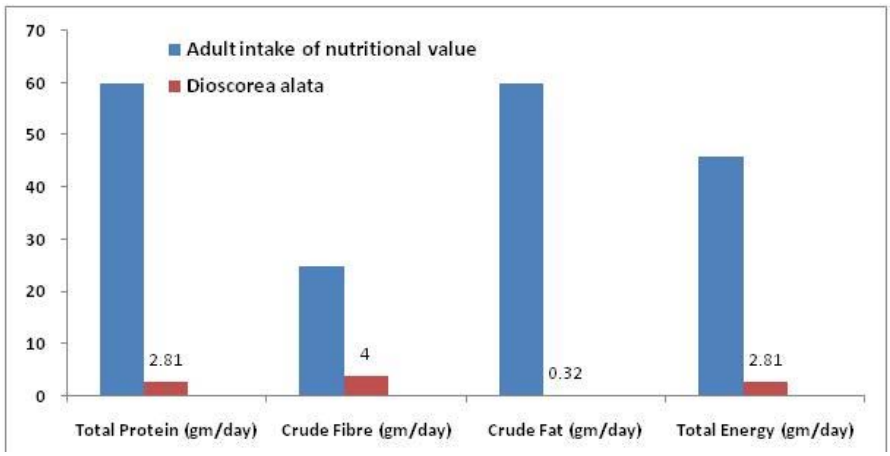

Figure 1: Comparison of per day intake of nutrients by Adults with the nutrients present in the tuber of *Dioscorea alata*.

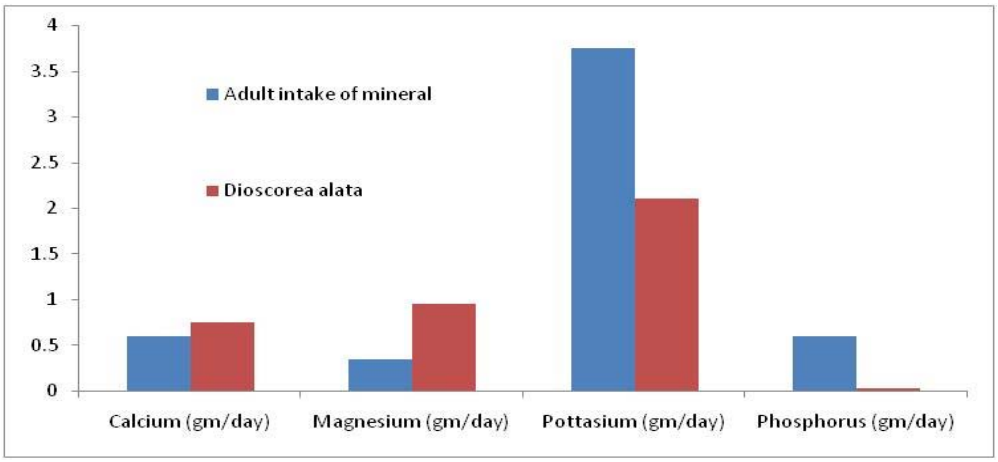

Figure 2: Comparison of per day intake of minerals by Adults with the mineral present in the tuber of *Dioscorea alata*

Figure 3: Thin layer chromatography qualitative analyses of six fractions against *Dioscorea alata* plant tuber extract.

Table 2: Mineral value of *Dioscorea alata* tuber

Mineral	Value (gm/100gm)	Mineral	Value (gm/100gm)
Zn	0.05	Fe	0.50
Pb	0.03	Cr	0.01
Cu	0.03	Mn	0.02
Co	0.01	Ca	0.75
Ni	0.03	Mg	0.95
Cd	0.01	Sr	0.05

Table 3: Observations of thin layer chromatographic (TLC) studies of tuber of *Dioscorea alata*, W: C: M (Water: Chloroform: Methanol, 10:64:28-36).

Extract	Mobile phase (C:M:W)	No. of spot	Rf. value	hRf. Value
Pet. Ether Extract	64:30:10 64:28:10	1 2	(0.15) (0.26, 0.32)	(15) (26, 32)
Benzene Extract	64:28:10	1	(0.15)	(15)
Chloroform Extract	64:26:10 64:28:10 64:30:10	2 3 2	(0.80, 0.93) (0.65, 0.74, 0.82) (0.72, 0.92)	(80, 93) (65, 74, 82) (72, 92)
Methanolic Extract	64:26:10 64:28:10 64:30:10	2 3 5	(0.19, 0.68) (0.19, 0.54, 0.68) (0.19, 0.30, 0.42, 0.53, 0.68)	(19, 68) (19, 54, 68) (19, 30, 42, 53, 68)
Ethanolic Extract	64:26:10 64:28:10 64:30:10	2 3 6	(0.19, 0.68) (0.19, 0.54, 0.68) (0.19, 0.30, 0.42, 0.53, 0.68, 0.74)	(19, 68) (19, 54, 68) (19, 30, 42, 53, 68, 74)
Water Extract	64:30:10	3	(0.54, 0.68, 0.74)	(54, 68, 74)

Table 4: Extractive values of *Dioscorea alata* tuber

Method of extraction	Values of three replicates (%w/w)	Mean (% w/w) ± SEM
Cold maceration:		
1) Water soluble	(13.90,13.10 & 12.80)	(13.26±0.20)
2) Alcohol soluble	(9.10,10.20 & 10.50)	(9.93±0.12)
Hot Extraction:		
1) Pet. Ether soluble	(1.20,0.90 & 1.10)	(1.06±0.05)
2) Benzene soluble	(3.40, 2.96 & 3.10)	3.15 ± 0.20
3) Chloroform soluble	(1.90,1.60 & 1.80)	(1.76±0.34)
4) Methanol soluble	(14.80, 13.80 & 14.10)	(14.23±0.50)
5) Ethanol soluble	(65.92, 66.57 & 67.13)	66.54 ± 0.85
6) Water soluble	(18.90, 19.80 & 19.20)	(19.30±0.90)

Table 5: Phytochemical screening of tuber extracts of *Dioscorea alata*, (+) – Present, (-) – Absent.

Test	Pt. ether Extract	Benzene Extract	Chloroform Extract	Methanolic Extract	Ethanolic Extract	Water Extract
Carbohydrates/ glycosides						
(1) Molish test	(-)	(-)	(-)	(+)	(+)	(+)
(2) Fehling test	(-)	(-)	(-)	(+)	(+)	(+)
(3) Benedict test	(-)	(-)	(-)	(+)	(+)	(+)
Alkaloids						
(1) Mayer's test	(-)	(-)	(-)	(-)	(-)	(-)
(2) Dragondroff test	(-)	(-)	(-)	(-)	(-)	(-)
Flavonoids						
(1) Shinoda/pew	(-)	(-)	(-)	(+)	(+)	(+)
(2) Ammonia	(-)	(-)	(-)	(+)	(+)	(+)
Saponins	(-)	(-)	(-)	(-)	(+)	(+)
Tannins						
(1) Pyrogoll & catechol	(-)	(-)	(-)	(-)	(+)	(-)
(2) Gallic acid	(-)	(-)	(-)	(-)	(+)	(-)
Unsaturated sterol/triterpenes						
(1) Liebermann Burchard test	(-)	(-)	(-)	(-)	(+)	(-)
(2) Salkowiskis test	(-)	(-)	(-)	(-)	(+)	(-)
Resin	(-)	(-)	(-)	(-)	(+)	(-)
Phenolics compound						
(1) Ferric chloride	(-)	(-)	(-)	(+)	(+)	(-)
(2) Nitric acid	(-)	(-)	(-)	(+)	(+)	(+)
Protein and amino acid						
(1) Xanthoprotien	(-)	(-)	(-)	(+)	(+)	(+)

CONCLUSION

The tuber of *Dioscorea alata* contain phytoconstituents like alkaloids, steroids, fats & fixed oil, flavonoids, tannins, proteins and carbohydrates. The TLC results of the ethanolic, methanol and water extract show that at least six different phytoconstituents were present in each extract of *Dioscorea alata* tuber. More detailed study must be done for farther isolation leading to the pure compounds.

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REFERENCES

1. Chatterjee, D., Studies on the endemic flora of India and Burma. Jour. Asiat. Soc. Bengal, 5, 1980, 19-67.
2. Saklani Sarla, Chandra Subhash and Mishra A. P. "Evaluation of Nutritional profile, medicinal value and quantitative estimation in different parts of Pyrus pashia, Ficus palmata and Pyracantha crenulata", JGTPS, 2(3), July - Sept 2011, 350-354.
3. Shui, G., & Leong, L. P. "Separation and determination of organic acids and phenolic compounds in fruit juices and drinks by HPLC". Journal of Chromatography A, 977(1), 2002, 89–96.
4. Maga, J. A. "Simple phenol and phenolic compounds in food flavor". CRC Critical Review in Food Science and Nutrition, 10, 1978, 323–372.
5. Lin J, Opak War, and Geheeb-Keller M. Preliminary screening of some traditional Zulu medicinal plants for anti-inflammatory and antimicrobial activities. Journal of Ethnopharmacology, 68, 1999, 267–274.
6. Iswaran,V, A Laboratory Handbook for Agreeculural Analysis. New Delhi Today and Tomorrow's Prienters and Publisher, 1980, 209-222.
7. Ward G. M, Chemical Methods of plant Analysis; Canada: Department of Agriculture Publication, 1064, 1962, 19-20.
8. Negi, Y. S, Rawat M. S. M, Pant-Joshi G, and Badoni S, Biochemical Investigation of Fruits of Some Common Ficus Species J. Food Science and Technology, 25, 1992, 582-584.
9. Jayaraman J. Laboratory Manual in Biochemistry. New Dehli, India: Wiley Estern Ltd, 56.
10. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 559, 1998, 10-24.
11. P. K. Mohanty, Neha Chourasia, Preliminary Phytochemical Screening of Cajanus cajan Linn. Asian J. Pharm. Tech. 1(2), 2011, 49-52.
12. Kokate C. K. Purohit A. P. and Gokhale S. B, Pharmacognosy, Nirali prakashan, 33 edition, 2005, 108-109.

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