International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 26-05-2021, Accepted: 10-06-2021, Published: 25-06-2021
Volume 6, Issue 3, 2021, Page No. 828-831

Nutritional estimation from the tubers of *Decalepis hemiltonii and Dioscorea oppositifolia* with their radical scavenging activity

V Kadirvelmurugan[1*], V Karthik[2], Arul Kumar Murugesan[3], S Ravikumar[4]

[1] Post Graduate and Research, Department of Botany, Padmavani Arts and Science College for Women, Salem, Tamil Nadu, India

[2] Department of Botany, Kavitha's College of Arts and Science, Namakkal, Tamil Nadu, India

[3] Department of Botany, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India

[4] Post Graduate and Research, Department of Plant Biology and Plant Biotechnology, Presidency College (Autonomous), Chennai, Tamil Nadu, India

Abstract
Vital aim of this study was to evaluate the nutritional estimation like total Moisture content, Volatile matter, Ash content, Fixed carbon, Crude fiber, Total lipids, Total protein and Total Carbohydrates contents from the tubers of *Decalepis hamiltonii* and *Dioscorea oppositifolia*. The root tubers of *Decalepis hamiltonii* Wight & Arn. and *Dioscorea oppositifolia* L. were collected from Kathiri Hills, Erode district of Tamil Nadu during February, 2014. *Decalepis hamiltoni* belongs to family Apocynaceae commonly known as Magali kizhangu and *D. oppositifolia* belongs to the family Dioscoreaceae commonly known as Malaiyan kizhangu. On examination of the nutrient estimation data analyzed on the root tubers of *D. hamiltonii* and *D. oppositifolia*, they exhibit an extensive range of nutrition. Moreover, *D. hamiltonii* and *D. oppositifolia* have exhibited the highest antioxidant activity assessed by the DPPH method in comparison with ascorbic acid as a standard.

Keywords: antioxidant activity, *D. hamiltonii*, *D. oppositifolia*, nutritional estimation

Introduction

Medicinal plants have been extensively used for healing various diseases, since ancient times. Medicinal plants produce an important origin of well-organized natural products which diverge vastly in biochemical structures, mechanism of actions and biological properties (Chang *et al*., 2017) [7]. Nutrient databases provide food composition data that are used in a variety of ways (Rand *et al.*, 1991). Health researchers and epidemiologists use nutrient intake studies of individuals or groups to correlate food components with causes or prevention of disease. Dietitians counsel patients in dietary changes based on an analysis of their usual dietary habits. Food manufacturers determine the nutrient content of their products for food labels. Cookbook authors calculate nutrients in a serving of each recipe. Food service managers plan menu for schools, hospitals, and other institutions based on their nutrient contents. All of these uses of nutrient databases require that the nutrient profile for each food in the database be complete (i.e., have no missing values) so that the nutrient contents in a diet, a recipe or on a food label is not underestimated. While assessing the nutrient contents of diets, recipes, or commercial food products, a nutrient database should provide a complete nutrient profile for each food in the database. Chemical analyses for a wide range of nutrients in many food items included in a database are not always real. Quality control procedures and nutrient validation programs should be implemented to verify that appropriate data selection, calculation methods, and data entry were used. Estimated nutrient values should be identified in the database. Some referencing systems also indicate the method used to derive each estimated value (Sally *et al*., 1997) [18].

A study was undertaken to assess the nutritive value and mineral contents from *Vitex negundo* and *Adhatoda vasica*. These two plant species are fairly used as medicine throughout the greater part of India. *Adhatoda vasica* is used to control pain, inflammation and other related diseases. Leaves of *A. vasica* are used for the treatment of cold, cough, chronic bronchitis and asthma. It was also used by traditional midwivesat the time of delivery. The leaves of *A. vasica* are extensively used in indigenousremedies.Both the plants contained important macro and micro elements: K, Ca, Fe, Cu, Zn and Cr. These elements were found in more quantity in *V. negundo* than in *A. vasica*. The leaves of both the plants were analyzedfor ash content, moisture, crude fat, crude fiber, crude carbohydrate and crude protein content. The results for percentage of ash content, moisture content, crude fat, crude fiber, carbohydrate and protein (Manoj Kumar *et al*., 2013) [13]. In various medicinal plants, biological compounds have shown anti-inflammatory, antimicrobial, antioxidant, and antitumoral activities, along with diuretic, hypotensive, and anticarcinogenic effects (Roshanravan *et al*., 2018; Beeby *et al*., 2020; Kikowska *et al*., 2020; Conea *et al*., 2016) [16, 3, 12, 8] It is recognized that free radicals result in oxidative stress and thus they are able to induce worsening of DNA molecules, lipids and proteins in biochemical systems, causing various ailments such as inflammatory bowel, coronary artery diseases and rheumatism. Radical scavenging activity is exceedingly gifted to retard or prevent oxidation of main substances through free radical scavenging (Sanchez-Moreno *et al.*, 2002) [19]. Several phytochemicals particularly polyphenols

like phenolic acids, flavonoids, tannins and anthocyanins are familiar to be liable for the free radical scavenging and antioxidant activities (Salehi *et al*., 2018; Alonso *et al*., 2017; Dalukdeniya *et al*., 2017) [17, 1, 9]. Hence, the main objective of the present research was to evaluate the potential of nutrition and antioxidant activities of the two medicinal plants namely, *D. hamiltonii* and *D. oppositifolia* from Kathiri Hills, Erode district of Tamil Nadu.

Materials and methods

Collection of the plants

The leaves of *D. hamiltonii* and *D. oppositifolia* were collected from Erode district of Tamil Nadu state during February, 2014. *Decalepis hamiltonii* belongs to family Apocynaceae, commonly known as Magali kizhangu and *D. oppositifolia* belongs to the family Dioscoreaceae, commonly known as Malaiyan kizhangu.

Decalepis hamiltonii is a large, aromatic shrub; with typical tri foliate leave pattern found throughout the greater part of India at warmerzones and ascending to an altitude of 1500 feet in Western Ghats of Tamil Nadu. The shrub is one of the endangered plants used in Indian medicines. It has been claimed topossess many medicinal properties. It contains various chemical compounds of various classes such as alkaloids, tannins, flavonoids, carbohydrates and tannins.

Fig 1: *Decalepis hamiltonii* Wight &Arn. (A) and *Dioscorea oppositifolia* L. (B).

Powder Preparation

The plant tubers were washed with Deionised water and disinfected with 0.1% HgCl solution for 5 min and dried in shade to prepare the sample formineral analysis, the washed and dried materials wereground to fine powder with mortar and pestle and used for dried ashing (Jonani and Sondhi, 2002) [11].

Proximate Analysis

Proximate analysis reveals the quality and precise chemical composition of the samples. This analysis examines four factors: moisture, volatile compounds, ash content and fixed carbon. For each factor, the procedure was repeated for four trials and the average of the four values was taken as the corresponding factor value of the given sample. The proximate analysis is carried out as per IS: 1350 (Part 1) – 1984.

Moisture content

Two grams of sample was placed in the crucible that has been previously washed, dried and weighed. The crucible with sample was placed in the drying oven at 110 ^{0}C, with the crucible covered by lid for 5 hours. It was then removed, cooled and weighed. The moisture content was then found using the following Equation.

$$PMC = \frac{(M_2 - M_3)}{(M_2 - M_1)} \times 100$$

Where, $M_1$is mass in gram of the empty crucible

M_2 is mass in gram of the crucible with sample

M_3 is mass in gram of the crucible with moisture free sample

PMC is the percent moisture content.

Volatile Matter

To determine the volatile matter, the crucible with 2g of sample was placed for 7 minutes in a muffle furnace which was preheated to 700°C. It was then weighed after cooling. The volatile matter was then calculated using the below Equation.

$$PVM = \left(\frac{(M_2 - M_3)}{(M_2 - M_1)} \times 100\right) - M_0$$

Where, M_0 is the percentage of moisture in the sample

M_1 is the mass in gram of the empty crucible

M_2 is mass in gram of the crucible with sample

M_3 is mass in gram of the crucible with moisture free sample

PVM is the percent Volatile matter.

Ash Content

The ash content was also determined by taking 2g of the sample in the crucible and heating the crucible and the specimen in a muffle furnace at a temperature of 700°C for 6 hours. Then the crucible with the ash was cooled and weighed to obtain the weight of ash. The PAC was determined using the Equation.

$$PAC = \frac{(M_3 - M_4)}{(M_2 - M_1)} \times 100$$

Where,

M_1 is the mass in gram of the crucible

M_2 is mass in the in gram of the crucible with sample

M_2 is mass in gram of the crucible and ash

M_3 is mass in gram of the crucible after brushing out the ash and on reweighing

PAC is the percent Ash content.

Determination of Crude Fibre

Moisture and fat free sample was treated with 0.255 NH_2SO_4 and 0.313NNaOH and washed with ethanol and ether. It was then transferred to a crucible, dried overnight at 80- 100^0C and weighed (W1) in an electric balance (KEY1: JY-2003; China). The crucible was heated in a muffle furnace (Nebertherm: Mod-L9/11/c6; Germany) at 600^0C for 6 hours, cooled and weighed again (W2). The difference in theweights (W1-W2) represents the weight of crude fibre (Raghuramulu *et al*., 2003).

Fixed Carbon

The fixed carbon is estimated by the Equation (3.8)

.

$$FC = 100 - (PMC + PVM + PAC)$$

Where,

FC is the Fixed Carbon (%)

PMC is the Percentage Moisture Content

PVM is the Percentage Volatile Matter

PAC is the Percentage Ash Content

Determination of total protein

Five gram of each sample was taken with 50ml of 1N NaOH and boiled for 30 minutes. The solution was cooled in room temperature and centrifuged at 1000g by a table centrifuge machine (*DIGISYSTEM: DSC-200T; Taiwan*).The supernatant was collected and total protein content was measured according to the Biuret method (Burtis and Ashwood, 2006).

Determination of total lipid

Total lipid was determined by slight modified method of Folch *et al.*, (1957) [10]. Five gram of each sample was suspended in 50ml of chloroform: methanol (2:1 v/v) mixture then mixed thoroughly and let stand for 3 days. The solution was filtrated and centrifuged at 1000g by a table centrifuge machine. The upper layer of methanol was removed by Pasteur pipette and chloroform was evaporated by heating. The remaining was the crude lipid.

Determination of total carbohydrate

The content of the available carbohydrate was determined by the following equation (Raghuramulu *et al.*, 2003).

Carbohydrate (%) = [100- (Moisture + Fat + Protein + Ash + Crude Fiber]

Antioxidant activity

Antioxidant capacity DPPH methodology (Arul Kumar *et al*., 2020) was carried out for *D. hamiltonii* and *D. oppositifolia*. The absorbance at 734 nm was measured, and a Trolox curvepattern was prepared using TAEC mmol/g DM.

Statistical analysis

The analysis of proximate analysis and antioxidant contents in each plant species was carried out six times (n = 3) and the results expressed as mean values ± standard deviation (SD).

Results and discussion

Proximate Analysis

The nutrient values of the roots of *D. hamiltonii* and *D. oppositifolia* are summarized in Table 1. On examination of data the nutrient valuesanalyzed in the tubers of *D. hamiltonii* and *D. oppositifolia* are in an extensive range. The highest total volatile matter is 70.19±0.4 and 77.70±0.1 respectively, followed by protein 32.21±1.51 and 26.41±1.41; carbohydrate 24.46±1.21 and 43.28±1.22; lipids 22.61±2.12 and 15.89±1.78; fixed carbon content 11.40±0.5 and 11.14±0.4; the amount of moisture content was found as 11.26±0.4 and 08.40±0.2 and least amount of ash contents has been 06.33±0.5 and 03.20±1.0respectively. The results reveal that the root tubers of *D. hamiltonii* and *D. oppositifolia* are found rich in volatile matter followed by protein, carbohydrates, lipids, fixed carbon, Moisture and ash contents.

Table 1: Determination of nutrient values of *Decalepis hamiltonii* and *Dioscorea oppositifolia*

Plant sample	Parameter	Nutritional value (%)
Decalepis hemiltonii	Moisture content	11.26±0.4
	Volatile matter	70.19±0.4
	Ash content	06.33±0.5
	Fixed carbon	11.40±0.5
	Crude fiber	03.13±1.22
	Total lipids	22.61±2.12
	Total protein	32.21±1.51
	Total Carbohydrates	24.46±1.21
Dioscorea oppositifolia	Moisture content	08.40±0.2
	Volatile matter	77.70±0.1
	Ash content	03.20±1.0
	Fixed carbon	11.14±0.4
	Crude fiber	02.72±1.21
	Total lipids	15.89±1.78
	Total protein	26.41±1.41
	Total Carbohydrates	43.28±1.22

Values are mean of three replicates (*Mean ± SD; n=3)

Antioxidant activity

The antioxidant ability of root tubers of *D. hamiltonii and D. oppositifolia* were evaluated by the DPPH method. Considering the data in Figure 2, *D. hamiltonii* exhibited the highest antioxidant activity assessed by the DPPH methods in comparison with *D. oppositifolia.* The highest antioxidant activity by DPPH assay was recorded in *D. hamiltonii* followed by *D. oppositifolia* while it was the lowest in *D. oppositifolia*. Comparable results were gained from the reducing power assay; *D. hamiltonii* exhibited a better reducing power activity than the *D. oppositifolia*. *D. hamiltonii* exhibited strong potential to act as a metal chelator while *D.oppositifolia* showed lower capacity for metal ion chelation. Bustamante *et al*. reported that pomegranate peels extract of Wonderful cultivar from Chile exhibited antioxidant activity of 99.4 mg trolox equivalent (TE)/g under ideal conditions of extraction (Bustamante *et al*., 2017) [6]. According to Bendary *et al* from the results of the present study that there is a correlation between the antioxidant adequacy and the chemicalstructure of phenolic compounds. The evidence for this compositional requirement is supported (Bendary *et al*., 2013).

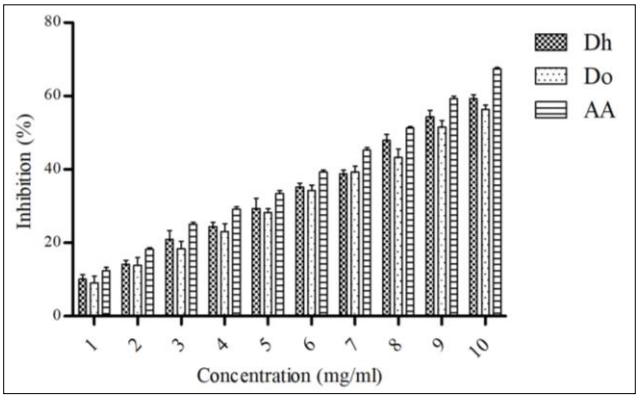

Fig 2: Radical scavenging activity of *Decalepis hamiltonii* (Dh) and *Dioscorea oppositifolia* (Do). Ascorbic acid served as reference. Values are mean of three replicates (*Mean ± SD; n=3)

Conclusion

In the present study, the nutritional composition of theplant tubers revealed rich sources of total Moisture content, Volatile matter, Ash content, Fixed carbon, Crude fiber, Total lipids, Total protein and Total Carbohydrates. The nutritive values of *D. hamiltonii* was higher that of *D. oppositifolia*. These plants can be recommended as agood source of nutrients (Volatile matter, Carbohydrate and Protein), which support their use as healthyfood and a good source of various important nutrients. *Dioscorea oppositifolia* root tubers have comparatively high Volatile matter, Protein and Carbohydrates contents. Sufficientamount of Ash content and Crude fiber contents are present in *D. hamiltonii* but the amount of carbohydrate is higher as compared to *D. oppositifolia*. With a good nutrition values, these plants serve asconstituents of human diet supplying the body with minerals, proteins and energy.

Both the tubers seem to be good for younger and anemic people of our society as a supplement. The outcome ofthis study suggests that the plants can be incorporated in different varieties of foodproducts to make them more nutritious, healthier as well as consumer-oriented, dueto the presence of biologically important compounds, they contribute better nutritive values. Hence, conservation and wise use of these wild medicinal plants for having good nutritional values are being given a better attention in recent years. Mostly nutritious food products are very costly in the mark etsto access for all sections of people due to their economic problems. In that case, theycan consume these plants as a complementary nutritious food, which are easily available and economicaltoo.These plant derived extracts have greater potential to be industrialized intoresource food and other health products.

Conflict of interest

The authors declare no conflict of interest.

References

1. Alonso-Castro AJ, Domínguez F, Ruiz-Padilla AJ, Campos-Xolalpa N, Zapata-Morales JR, Carranza-Alvarez C *et al*. Medicinal Plants from North and Central America and the Caribbean Considered Toxic for Humans: The Other Side of the Coin. Evidence-Based Complementary and Alternative Medicine, 2017, 1-28. doi:10.1155/2017/9439868
2. Arul Kumar Murugesan, Balashanmugam Pannerselvam, Anand Javee, Murugan Rajenderan, Devasena Thiyagarajan, Facile green synthesis and characterization of *Gloriosa superba* L. tuber extract-capped silver nanoparticles (GST-AgNPs) and its potential antibacterial and anticancer activities against A549 human cancer cells, Environmental Nanotechnology, Monitoring & Management,15,2021, 100460.
3. Beeby E, Magalhaes M, Poças J, Collins T, Lemos MFL, Barros L *et al*. Secondary ~ metabolites (essential oils) from sand-dune plants induce cytotoxic effects in cancer cells. J Ethnopharmacol,2020:258:112803.
4. Bendary E, Francis RR, Ali HMG, Sarwat MI, Hady SEl. Antioxidant and structure–activity relationships (SARs) of some phenolic and anilines compounds, Fluid Dynamics Research,2004:35:229-236.
5. Burtis CA, Shwood A, Teitz ER. Fundamentals of Clinical Chemistry (5th Ed.). Reed Elsevier India Private Limited, New Delhi, India, 2006, 348-349.
6. Bustamante A, Hinojosa A, Robert P, Escalona V. Extraction and microencapsulation of bioactive compounds from pomegranate (*Punica granatum* var. wonderful) residues, Int. J. Food Sci. Technol,2017:52(6):1452-1462.
7. Chang HY, YL Ho, Sheu MJ, Lin YH, Tseng MC, Wu SH *et al*. Antioxidant and free radical scavenging activities of *Phellinus merrillii* extracts, Bot. Stud,2017:48:407-417.
8. Conea S, Vlase L, Chirila I. Comparative study on the polyphenols and pectin of three Eryngium species and their antimicrobial activity. Cell Chem Tech,2016:50:473-481.
9. Dalukdeniya DACK, Rathnayaka RMUSK. Comparative study on antibacterialand selected antioxidant activities of different Eryngium foetidum extracts. J Appl Lif Sci Int,2017:12:1-7.
10. Folch J, Lees M, Sloane-Stanely GH. A simple method for the isolation and purification of total lipids from animal tissues. J. Biol. Chem,1957:226:497-509.
11. Jonani GK, Sondhi SM. Determination of minerals elements in some Ayurvedic bhasmas used for the cure of various elements. Phytother. Res,2002:16:774-747.
12. Kikowska M, Thiem B, Szopa A, Ekiert H. Accumulation of valuable secondary metabolites: phenolic acids and flavonoids in different in vitro systems of shoot cultures of the endangered plant species *Eryngium alpinum* L. Plant Cell Tissue Organ Cult,2020:141:381-391.
13. Manoj Kumar, Sukumar Dandapat, Amit Kumar and M.P. Sinha. Determination of Nutritive Value and Mineral Elements of Five-Leaf Chaste Tree (Vitex negundo L.) and Malabar Nut (Adhatoda vasica Nees). Academic Journal of Plant Sciences,2013:6(3):103-108.
14. Raghuramulu N, Madhavan NK, Kalyanasundaram S. A Manual of Laboratory Techniques. National Institute of Nutrition. Indian Council of Medical Research, Hyderabad, India, 2003, 56-58.
15. Rand WM, Pennington JAT, Murphy SP, Klensin JC. Compiling Data for Food Composition Data Bases. United Nations University Press, Tokyo, 1991.
16. Roshanravan N, Asgharian P, Dariushnejad H, Alamdari NM, Mansoori B, Mohammadi A *et al*. Eryngium billardieri induces apoptosis via Bax gene expression in pancreatic cancer cells. Adv Pharm Bull,2018:8:667-674.
17. Salehi B, Sharopov F, Martorell M, Rajkovic J, Ademiluyi AO, Sharifi M *et al*. Phytochemicals in Helicobacter pylori infections: what are We doing now? IntJ Mol Sci,2018:19:1-34.
18. Sally F, Schakel I. Marilyn Buzzard., and Susan E. Gebhardt. Procedures for Estimating Nutrient Values for Food Composition Databases. Journal of food composition and analysis,1997:10:102-114.
19. Sanchez-Moreno C, Review: methods used to evaluate the free radicalscavenging activity in foods and biological systems, Food Sci. Technol. Int,2002:8(3):121-137.