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MEDICINAL PLANTS OF HIGH NUTRACEUTICAL VALUE IN NUEVO LEON NORTH-EAST OF MEXICO

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Abstract

From a survey of about 50 species authors finally selected three top species having high values for each of macronutrients (K,Mg, P, C, N, C/N) and high values of micronutrients (Cu, Fe, Zn). It is assessed that K ranged from 101 to 163 (mg/g dw), Mg from 693 to 854 (mg/g dw), P from 4 to 5 (mg/g dw), C about 51%, N 10%, C/N from 27 to 31, thereby revealing very high value of both nutritional and nutraceutical value. Among the three species selected for high micronutrients Cu about 33 (µg/g dw), Fe ranged from 1450 to 3973 (µg/g dw), Zn varied from 167 to 216 (µg/g dw). Therefore, all these species could serve as good source of both high nutritional and nutraceutical values apart from their respective use in alleviating particular disease.

Introduction

Medicinal plants are most important in traditional medicine all over the world. They play a significant role in providing primary health care services to rural people by about 80% of the marginal communities around the world (Prajapati and Prajapati 2002, Latif *et al*. 2003, Shinwari *et al*. 2006). Various health agencies have developed dietary recommendation for prevention of chronic diseases, cancer and atherosclerosis (Muñoz de Chávez and Chávez 1998). The intake of natural antioxidants commonly present in fruits and vegetables is popular indicating their consumption leading to lowering the risk of cardiovascular disease and cancer (Renaud *et al*. 1998, Temple 2000). These nutraceutical plants produce healthy phytochemicals that are formulated and intake is in the form of capsules, tinctures, or tablets. Functional foods are a component of nutraceuticals and are consumed as foods, and not in dosage form. Medicinal and nutraceutical plants offer a wide array of products utilized or can be utilized in the pharmaceutical and functional food industries (Padmavathi 2013).

Consumption of nutraceuticals derived from plants is highly recommended to improve health, and to prevent and treat diseases. A review has been made in better understanding of the phyto-nutraceuticals from different medicinal plants based on their disease specific indications (Pandey *et al.* 2011). Many plant species possess antioxidant properties. Ibrahim *et al*. (2010) reported that high peroxidation of secondary metabolites was produced in elicited plants with high C/N ratio and low nitrogen fertilization especially when exposed to elevated CO_2 levels. Under low nitrogen, the growth and photosynthesis in plant show increase in C/N ratio and increase the production of secondary metabolites. Therefore, high C/M ratio might be attributed to low nitrogen absorption of plants (Lindroth *et al.* 2002).

Nutraceuticals have the potential to reduce the risk of colon cancer and slow its progression. The medicinal importance of nutraceuticals and their ability to reduce the risk of colorectal carcinogenesis is discussed (Kuppusamy *et al.* 2014).

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Although various studies have been undertaken on the traditional use of medicinal plants in north east of Mexico to cure various diseases (Estrada *et al*. 2006, 2007, 2012, Estrada-Castillón *et al*. 2012, Macouzet-Pacheco *et al*. 2012), the nutraceutical/nutritional values of medicinal plants is not well documented. Therefore, the present study was undertaken on the nutraceutical values of a few selected medicinal plants in the north-eastern region of Mexico.

Materials and Methods

This study was carried out at the experimental station of the School of Forest Sciences, Universidad Autonoma de Nuevo Leon, located in the municipality of Linares. Medicinal plants traditionally used for diabetes and for the control of various disease in Nuevo Leon, northeast Mexico, were collected from botanical gardens at the School of Forest Sciences. The study was directed in two phases: (i) Analysis of micro and macronutrients of 18 medicinal plants and (ii) analysis of C, N, C/N of 18 medicinal plants used in diabetes. Medicinal plant samples were collected and placed to dry on paper bags for a week. The leaves were separated from the rest of the plant and were passed twice through a mesh of 1 mm × 1 mm using a mill Thomas Wiley and subsequently dried for more than three days at 65^{o}C in an oven to remove moisture from the sample and later these were placed in a desiccator. A 2.0 mg of the sample was weighed in a AD6000 balance Perkin Elmer using a vial of tin, bent perfectly. This was placed in a CHN analyzer Perkin Elmer Model 2400 for determining the carbon (C) and nitrogen (N) content on a percentage basis. For estimating the macro- (K, Mg, P; mg/g dw) and micro- (Cu, Fe, Zn; µg/g dw) nutrients the samples were incinerated in a muffle oven at 550^{o}C for 5 hrs. Ash sample was digested in a solution containing HCl and HNO_3, using the wet digestion technique (Cherney 2000).

Results and Discussion

From the analysis of a few macro- and micronutrients of 50 medicinal plant species used traditionally in Nuevo Leon, present authors selected top three species for each nutraceutical parameter. All the 50 species are shown in Table 1.

These species have various medicinal uses apart from having high values of macro- and micronutrients. The following species were selected for containing high values of reduced macro- and micronutrients serving as high nutraceuticals.

Macronutrients: K - *Opuntia ficus indica, Eruca sativa, Phalaris canariensis*, Mg - *Opuntia ficus indica, Acalypha monostachya, Mimosa malacophylla*, P - *Celtis laevigata, Salvia hispanica, Tillandsia usenoides*, C - *Rhus virens, Eugenia caryophyllata, Litsea glaucescens*, N - *Cnidoscolusa conitifolius, Olea europea, Ruta graveolens*, C/N - *Agave macroculmis, Arbutus xalapensis, Tillandsia usenoides*.

Micronutrients: Cu - *Arbutus xalapensis, Celtis laevigata, Phalaris canariensis*, Fe - *Dyssodia setifolia, Gnahalium canescens, Tragiar amosa*, Zn - *Salix lasiolepis, Equisetum hyemale, Ocimum basilicum*.

From initial analysis of macro- and micronutrients, out of 50 species three having high values for each of macronutrient (K, Mg, P, C, N, C/N) and high values of micronutrients (Cu, Fe, Zn) were selected. Among the three species selected for each element, K ranged from 101 to 163 (mg/g dw), Mg from 693 to 854 (mg/g dw), P from 4 to 5 (mg/g dw), C 51%, N 10%, C/N 27 to 31 revealing very high value of both nutritional and nutraceutical value. Among the three species selected for high micronutrients, Cu about 33 (µg/g dw), Fe ranged from 1450 to 3973 (µg/g dw), Zn varied from 167 to 216 (µg/g dw). Therefore, all these species could serve as good

Table 1. Macro- (K, Mg, P, C, N) and micro- (Cu, Fe, Zn) nutrients content of top three species selected for high values of each nutrient.

Medicinal use	Nutrient (units)	Scientific name	Family	Growth habit	Value
Diabetes	K (mg/g dw)	*Opuntia ficus-indica* (L.) Mill.	Cactaceae	Bush	101.47 ± 9.19
Stomach		*Eruca sativa* Mill.	Brassicaceae	Herb	144.23 ± 2.30
Arterial pressure		*Phalaris canariensis* L.	Poaceae	Grass	163.35 ± 6.88
Diabetes	Mg (mg/g dw)	*Opuntia ficus-indica* (L.) Mill.	Cactaceae	Bush	6.39 ± 0.90
Cancer		*Acalypha monostachya* Cav.	Euphorbiaceae	Herb	8.11 ± 0.88
Kidney		*Mimosa malacophylla* Gray	Fabaceae	Sub-bush	8.64 ± 0.99
Diabetes	P (mg/g dw)	*Celtis laevigata* Willd.	Ulmacae	Tree	4.03 ± 0.29
Cancer, coagulation		*Salvia hispanica* L.	Lamiaceae	Herb	5.79 ± 0.75
Antitumor		*Tillandsia usenoides* (L.) L.	Bromeliacae	Caulescent	4.45 ± 0.17
Fat removal	C (%)	*Rhus virens* Lindh. ex A. Gray	Anacardiaceae	Bush	50.34 ± 0.59
Burning		*Eugenia caryophyllata* (L.) Merrill & Perry	Myrtaceae	Tree	51.66 ± 1.85
Diabetes		*Litsea glaucescens* Kunth	Lauraceae	Bush	51.34 ± 0.28
Circulation, digestion	N (%)	*Cnidoscolus aconitifolius* (Mill.) I.M. Johnst.	Euphorbiaceae	Bush	9.87 ± 0.65
Cholesterol		*Olea europea* L.	Oleaceae	Tree	10.33 ± 0.74
Earache, pressure		*Ruta graveolens* L.	Rutaceae	Herb	10.27 ± 0.99
Diabetes	C/N	*Agave macroculmis* Todaro	Agavaceae	Rosetophyllous	31.05 ± 5.11
Diabetes		*Arbutus xalapensis* Kunth	Ericaceae	Bush	26.94 ± 3.72
Burning		*Tillandsia usenoides* (L.) L.	Bromeliaceae	Caulescent	31.32 ± 8.20
Diabetes	Cu (µg/gdw)	*Arbutus xalapensis* Kunth	Ericaceae	Tree	33.40 ± 20.18
Diabetes		*Celtis laevigata* Willd.	Ulmaceae	Tree	33.88 ± 12.60
Circulation, arterial pressure		*Phalaris canariensis* L.	Poaceae	Grass	33.78 ± 8.95
Fever	Fe (µg/gdw)	*Dyssodia setifolia* (Lag.) B.L. Rob.	Asteraceae	Herb	3540.19 ± 557.14
Expectorant		*Gnaphalium canescens* (DC.) W.A.Weber	Asteraceae	Herb	3973.55 ±1342.28
Bronchitis, blood purification		*Tragia ramose* Torr.	Euphorbiaceae	Herb	1450.25 ± 273.89
Diabetes	Zn (µg/g dw)	*Salix lasiolepis* Benth.	Salicaceae	Tree	216.31±10.83
Kidney, cancer		*Equisetum hyemale* L.	Equisetaceae	Stem erect	107.44 ± 17.64
Earache		*Ocimum basilicum* L.	Lamiaceae	Herb	118.77 ± 5.93

sources of both high nutritional and nutraceutical values apart from their respective use in alleviating particular disease. The results of the present study agree with the previous findings of various authors revealing the importance of medicinal plants in health care in the rural and urban areas in the world as well as functioning as nutraceuticals serving as sources of nutrients to health, reported by various authors around the world (Prajapati and Prajapati 2002, Latif *et al*. 2003, Shinwari *et al.* 2006). In the present study, *Rhus virens, Eugenia caryophyllata,* and *Litseaglaus cesens* posed very high value of carbon fixation demonstrating excellent source of energy of these medicinal species. In addition, species such as *Agave macroculmis, Arbutus xalapensis* and *Tillandsia usenoides* contained high value of C/N which may serve as good source of secondary metabolites, antioxidant and flavonoids as reported by Ibrahim *et al*. (2010) and Ibrahim and Jaafar (2011) in *Labisia pumila* possessing high production of secondary metabolites and antioxidants. This needs to be confirmed in future studies.

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