SCIENTIFIC NOTE

Determination and Comparison of Potential Nutritive Values and Mineral Elements of Three Important Food Edible Plants from Southern Part of Iran

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Summary

Medicinal edible plants viz; Asparagus officinalis (Marchubeh), Cordia myxa (Sepestan), Momordica dioica are very important for treatment of various diseases. These plants have great importance due to their nutritive value and major source of medicines as they have been found through out human history. Evaluation of Nutritive value and mineral elements of Asparagus officinalis (Marchubeh), Cordia myxa (Sepestan), Momordica dioica. The nutrients were analyzed by using different biochemical methods while the mineral elements were analyzed by Flame photometry and by using various titration methods. The stem contained an ash: 10.70%, crude protein: 32.69%, crude lipid 3.44%, crude fiber: 18.50%, and carbohydrates 34.67%. Stem also have high energy value (384.27kcal/100g)dry weight. Mineral ranges (mg/100g dry weight, DW) were K (10.94), Na (1.84), Ca (0.67), Fe (0.19), and Zn (2.60). The Momordica fruits contained ashes 9.1%, crude protein: 5.44%, crude lipid: 3.25%, crude fiber 22.9%, and carbohydrates 59.31%. The Momordica fruit also have high energy value (288.25kcal/100g)dry weight. Mineral ranges (mg/100g dry weight, DW) were K (4.63), Na (1.62), Ca (7.37), Fe (5.04), and Zn (3.83). The cordia fruits contained ashes—6.7%, crude protein—8.32%, crude lipid—2.2%, crude fibre—25.7% and carbohydrates—57.08%. on dry matter basis these medicinal plants shows high nutritive value with maximum percentage of important minerals, which can be used for health care during anemic condition and as food and fodder for livestock.

Keywords: Asparagus officinalis; Momordica dioica ; Cordia myxa, Mineral elements and Nutritive value.

Introduction

Common medicinal plants have been compiled from translations of ancient Iranian tents on health and healings (Aberoumand and Deokule 2008). Plants have great importance due to their nutritive value and continue to be a major source of medicines as they have been found through out human history (Abuye et al. 2000). All human beings require number of complex organic compounds as added caloric requirements to meet the need for their muscular activities, carbohydrates, fats and proteins, while minerals and vitamins from comparatively a smaller part, plant materials form major portion of the diet; their nutritive value is also important Asibey-Berko and Tayie 1999). Human body comprises chemical compounds such as water, proteins, fatty acids, nucleic acids and carbohydrates, these in turn consist of elements such as carbon, hydrogen, oxygen, nitrogen and phosphorus and may or may not contains minerals such as calcium, iron, magnesium and zinc (Burlingame, 2000).

In developing nations, numerous types of edible wild plants are exploited as sources of food hence provide an adequate level of nutrition to the inhabitants. Recent studies on agro pastoral societies in Iran indicate that these, plant resources play a significant role in nutrition; food security and income generation. Furthermore, FAO report, at least one billion people are thought to use wild foods in their diet. In Ghana along, the leaves of over 300 species of wild plants and fruits are consumed. In Swaziland, wild plants provide a greater share of the diet than domesticated cultivars. In India, Malaysia and Thailand, about 150 wild plants species have been identified as sources of emergency food. Similarly, in South Africa about 1400 edible plant species are used, In Sahel region of Africa, over 200 wild foods were identified to be used by the rural communities. In most of these reports, it was emphasized that nutritionally, these unconventional plants foods could be comparable to or even sometimes superior to the introduced cultivars. Aim of this study was analysis of nutrients in the plant foods for preliminary assessment of nutritional value of the plant-based diets. In this context, analysis ere carried out to evaluate the nutritional content of *Asparagus officinalis* stem and *Momordica dioica* fruit.

Experimental

Plant material

Asparagus officinalis stem, *Cordia myxa* fruits and *Momordica dioica* fruits used as experimental material were collected from farm and Agricultural lands (garden) in around Behbahan, South Iran, in October 2007. The collected plant material was placed in a polyethylene bag to prevent loss of moisture during transportation to the laboratory.

Preparation of the plant materials for chemical analyses

Asparagus officinalis stem, *Cordia myxa* fruits and *Momordica dioica* fruits were washed with distilled water and dried at room temperature to remove residual moisture, then placed in paper envelope and oven-dried at 55ºC for 24 h. The dried stem were ground into powder using pestle and mortar, and sieved through 20-mesh sieve. The dried samples powder was used for the nutrients analyzes.

Plant foods chemical analysis

This work was carried out as project in Food Chemistry Lab of Isfahan Technology University in Iran. The methods recommended by the Association of Official Analytical

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Chemists were used to determine ash (#942.05), crude lipid (#920.39), crude fibre (#962.09) and nitrogen content (#984.13)(AOAC. 1990).

Determination of crude lipid and crude fibre Content

2 g of dried stem or fruit were weighed in a porous thimble of a Soxhlet apparatus, with its mouthed cotton wool plugged. The thimble was placed in an extraction chamber which was suspended above a pre-weighed receiving flask containing petroleum ether (b.p. 40-60ºC). The flask was heated on a heating mantle for eight hours to extract the crude lipid. After the extraction, the thimble was removed from the Soxhlet apparatus and the solvent distilled off. The flask containing the crude lipid was heated in the oven at 100ºC for 30 minutes to evaporate the solvent, then cooled in a dessicator, and reweighed. The difference in weight was expressed as percentage crude lipid content.

Crude fibre was estimated by acid-base digestion with 1.25% H_2SO_4 (prepared by diluting 7.2 ml of 94% conc. acid of specific gravity 1.835g ml-1 per 1000 ml distilled water) and 1.25% NaOH (12.5 g per 1000 mL distilled water) solutions. The residue after crude lipid extraction was put into a 600 mL beaker and 200 mL of boiling 1.25% H_2SO_4 added. The contents were boiled for 30 minutes, cooled, filtered through a filter paper and the residue washed three times with 50 mL aliquots of boiling water. The washed residue was returned to the original beaker and further digested by boiling in 200 mL of 1.25% NaOH for 30 minutes. The digest was filtered to obtain the residue. This was washed three times with 50 mL aliquots of boiling water and finally with 25 mL ethanol.

The washed residue was dried in an oven at 130ºC to constant weight and cooled in a dessicator. The residue was scraped into a pre–weighed porcelain crucible, weighed, ashed at 550ºC for two hours, cooled in a dessicator and reweighed. Crude fibre content was expressed as percentage loss in weight on ignition (AOAC. 1990).

Determination of nitrogen content and estimation of crude protein

Macro–Kjeldahl method was used to determine the nitrogen content of the stem 2g of dried plants were digested in a 100 mL kjeldahl digestion flask by boiling with 10 mL of concentrated tetraoxosulphate (VI) acid and a Kjeldahl digestion tablet (a catalyst) until the mixture was clear. The digest was filtered into a 100 mL volumetric flask and the solution made up to 100 mL with distilled water. Ammonia in the digest was steam distilled from 10 mL of the digest to which had been added 20 mL of 45% sodium hydroxide solution. The ammonia liberated was collected in 50 mL of 20% boric acid solution containing a mixed indicator. Ammonia was estimated by titrating with standard 0.01 mol L-1 HCl solution. Blank determination was carried out in a similar manner. Crude protein was estimated by multiplying the value obtained for percentage nitrogen content by a factor of 6.25(AOAC. 1990).

Estimation of carbohydrates and energy values

Available carbohydrate was estimated by difference, by subtracting the total sum of percent crude protein, crude lipid, crude fibre and ash from 100% DW of the plant the plant calorific value (in kJ) was estimated by multiplying the percentages of crude protein, crude lipid and carbohydrate by the factors 16.7, 37.7 and 16.7 respectively (AOAC. 1990).

Mineral analysis

The mineral elements Na, K, Ca, Fe, and Zn were determined on 0.3g plant powder by the methods of Funtua (Funtua, 2004; Funtua, and Trace 1999).using Energy Dispersive X-ray Fluorescence (EDXRF) transmission emission spectrometer carrying an annuar 25 mCi 109Cd isotopic excitation source that emits Ag-K X-ray (22.1 keV) and a Mo X-ray tube (50KV, 5mA) with thick foil of pure Mo used as target material for absorption correction. The system had a Canberra Si (Li) detector with a resolution of 170eV at 5.9keV line and was coupled to a computer controlled ADCCard (Trump 8K). Measurements were carried out in duplicate. Na was analyzed after wet digestion of one gramme of the stem powder with nitric/perchloric/sulphuric acid (9:2:1 v/v/v) mixture. Sodium was analyzed with a Corning 400 flame photometer (AOAC. 1990).

Results and Discussions

Proximate analysis

The results of proximate composition of *Asparagus officinalis* stem, *Momordica dioica* fruits and *Cordia myxa* fruits are shown in Table 1. The ash content, which is an index of mineral contents, for *Asparagus officinalis* stem, was higher in comparison with the values reported for other edible leaves such as *Momordica balsamina* leaves where as for *Momordica dioica* fruit the value of 6.7% DW was less than the reported values (Funtua 2004). The crude protein content of both edible plants was higher instead of more than what is reported for some lesser known wild leafy vegetables such as *Momordica balsamina* (11.29 ± 0.07%), and *Lesianthera africana* leaves (13.10 –14.90%) (Funtua and Trace 1999).

The results showed that ash content, which is an index of mineral contents, for *Cordia myxa* fruits, with the value of 6.7% DW was lower than the values reported for other edible fruits as *Cordia myxa* (18.00±1.27% DW Asibey- Berko and Tayie 1999. It is apparent that *Cordia myxa* are a good source of sodium and potassium. Protein content (8.32%) was lower for some lesser known wild fruits such as *Cordia myxa* (11.29±0.07; Sena et al. 1998; Asibey- Berko and Tayie 1999; Plessi et al. 1999). In that context, *Cordia myxa* fruits (8.32%) are a relatively good source of protein. The crude lipid content (2.2%) of the fruits was less than the range (8.3–27.0% DW) reported for some vegetables consumed in Nigeria and Republic of Niger (Sena et al. 1998; Isong and Idiong 1997). Amounts of protein, lipid, carbohydrates and fibre in *Cordia myxa* in instead of our study were compared with the results of the study of Duke and Ayensu, and it is observed that amounts of macronutrients, in instead of our study were less than the results of the study of Duke and Ayensu (1985). The estimated carbohydrate content (57.08%; Fig. 1,a)in *Cordia myxa* fruits was considered to be higher than that for Senna obtusfolia leaves (20%) and Amaranthus incurvatus (23.7%). The crude fibre content in *Cordia myxa* fruits (25.7%) was higher than the reported values (8.50–20.90%) of some Nigerian vegetables (Ifon and Bassir 1980; Mottram et al.2002). One discussed drawback to the use of vegetables in human nutrition is their high fibre content, which may cause intestinal irritation and a decrease of nutrient bioavailability (Funtua and Trace 1999). The fibre-recommended dietary allowance values for children, adults, pregnant and breast-feeding mothers are 19–25%, 21–38%, 28% and 29%, respectively. Thus, the *Cordia myxa* fruits could be a valuable source of dietary fibre in human nutrition. The calorific value of *Cordia myxa* fruits was estimated to be 281.4 kcal/ 100 g DW, which is an indication that it could be an important source of dietary calorie. High calorific content of the fruits could be attributed to high lipid content.

Cordia myxa fruits contain less than adequate level of K, Fe, Zn, Ca and Na, but the plant fruit could be the good source of K and Na. Duke and Ayensu (1985) reported amounts of ash, calcium, iron, potassium and sodium in *Cordia myxa* fruits to be 20 mg/100 g, 1,500 mg/100 g, 29 mg/100 g, 1,800 mg/100 g and 55 mg/ 100 g, respectively. It is observed that amounts of minerals except ash in our study were very less compared with the results of the study of Duke and Ayensu (1985).

Plant foods that provide more than 12% of their calorific value from protein are a good source of protein. In that context,

Table 1. *Proximate composition of selected edible plants*

Parameters	***Asparagus officinalis* stem**	***Momordica dioica* fruit**	***Cordia myxa* fruits**
	Concentration (%)*		
Ash	10.70 ± 0.80	6.7 ± 5.17	6.7 ± 0.80
Crude protein	32.69 ± 0.27	19.38 ± 0.27	8.32 ± 0.27
Crude lipid	3.44 ± 0.50	4.7 ± 0.50	2.2 ± 0.50
Crude fibre	18.55 ± 0.35	21.3 ± 0.35	25.7 ± 0.35
Carbohydrates	34.69 ± 0.68	47.92 ± 0.68	57.08 ± 0.68
Calorific value(kcal/100g)	384.27.52 ± 5.31	311.5 ± 5.31	281.4 ± 5.31

* The data are mean values ± deviation(SD) of three replicates.
* Values expressed as % wet weight.

Table 2. *Mineral composition of Asparagus officinalis stem*

	Recommended Dietary Allowances(mg/day)				
Minerals	**Available quantity in mg/100gDW***	**Children 7-10years**	**Adult Male**	**Adult Female**	**Pregnant & lactating Mothers**
Potassium	10.94 ± 0.02	800	800	800	1200
Calcium	0.67 ± 0.15	1600	2000	2000	2000
Sodium	1.84 ± 0.08	400	500	400	500
Iran	0.19 ± 0.01	10	10	15	13
Zinc	2.60 ± 0.07	10	15	12	19

* The data are mean values ± deviation(SD) of three replicates.

Table 3. *Mineral composition of Momordica dioica fruit*

	Recommended Dietary Allowances(mg/day)				
Minerals	**Available quantity in mg/100gDW***	**Children 7-10years**	**Adult Male**	**Adult Female**	**Pregnant & lactating Mothers**
Calcium	**0.46 ± 0.02**	800	800	800	1200
Potassium	**8.25 ± 0.15**	1600	2000	2000	2000
Sodium	**1.51 ± 0.08**	400	500	400	500
Iron	**0.14 ± 0.01**	10	10	15	13
Zinc	1.34 ± 0.07	10	15	12	19

* The data are mean values ± deviation(SD) of three replicates.

Asparagus officinalis stem and *Momordica dioica* fruits are good sources of protein. The crude lipid contents of both plant foods were less than the range (8.3–27.0% DW) reported for some vegetables consumed in Nigeria and Republic of Nigerian.

The estimated carbohydrate contents in *Asparagus officinalis* stem and in *Momordica dioica* fruit were stand to be higher than that for *Senna obtusfolia* leaves (20%) and *Amaranthus incurvatus* leaves (23.7%). On the other hand, *Asparagus officinalis* stem contain comparable amount of carbohydrate with *Momordica balsamina* (39.05 ± 2.01%). The crude fibre content in both plant foods were more than the reported values (8.50– 20.90%) for some Nigeria vegetables. One discussed drawback to the use of vegetables in human nutrition is their high fibre content, which may cause intestinal irritation and a decrease of nutrient bioavailability. The fibre RDA values for children, adults, pregnant and breast-feeding mothers are 19 –25%, 21 – 38%, 28% and 29% respectively.

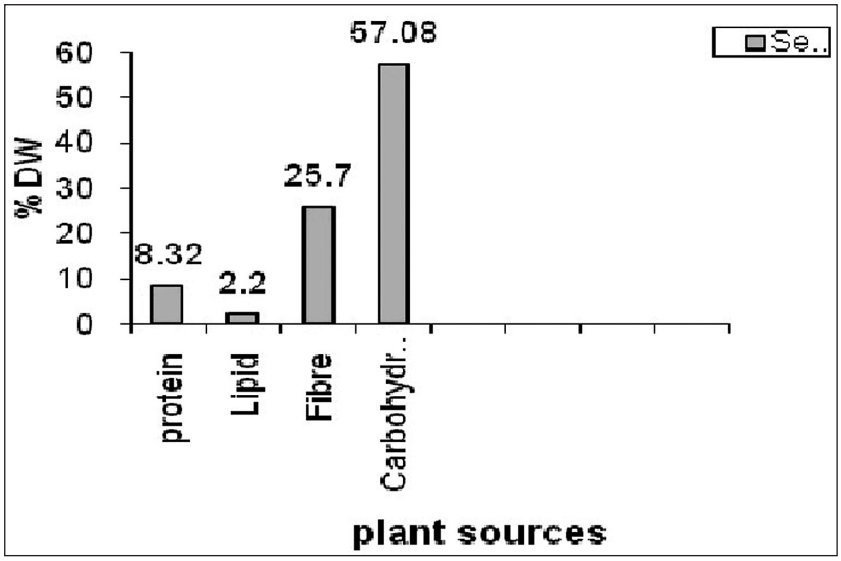

Figure 1 *Proximate composition of Cordia myxa fr*

Mineral content

Tables 2 and 3 show the results of the mineral concentrations of *Asparagus officinalis* stem and *Momordica dioica* fruit. Nutritional significant of elements is compared with the standard recommended dietary allowance. When compared with standard values, *Asparagus officinalis* stem and *M. dioica* fruits contain less than adequate level of K, Fe, Zn, Ca, and Na, but the plant stem could be good sources of K.

Concluding remarks

The results of the nutritional analysis shown that *Asparagus officinalis* stem could be a good supplement for some nutrients such as protein, lipid, potassium and zinc, fibre and carbohydrates while *Momordica dioica* fruit was good source of lipid, crude fiber, carbohydrates, Fe and zinc. The results suggests that the plant fruits if consumed in sufficient amount could contribute greatly towards meeting human nutritional requirement for normal growth and adequate protection against diseases arising from malnutrition. From the result, *Asparagus officinalis* stem and *Momordica dioica* and *Cordia myxa* fruits are recommend for continues used instead for nutritional purposes, considering to the amount and diversity of nutrients it contains. Chemical analysis alone however, should not be the exclusive criteria for judging the nutritional significance of a plant parts. Thus, it becomes necessary to consider order aspects such as presence antinutritional/ toxicological factors and biological evaluation of nutrient content.

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