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Preliminary Studies on Proximate and Mineral Composition of Marchubeh Stem (*Asparagus officinalis*) Vegetable Consumed in the Behbahan of Iran

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Abstract: The proximate composition and mineral constituents of *Asparagus officinalis* stem were evaluated in order to standard methods. The stem contained a ashes: 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). Comparing the stem mineral contents with recommended dietary allowances (RDA), the results indicated that *Asparagus officinalis* stem could be a good supplement for some nutrients such as protein, potassium and carbohydrates. The stem could be promoted as a carbohydrate supplement for cereal-based diets in poor rural communities, while its high potassium content could be utilized for the management of hypertension and other cardiovascular conditions. *A. officinalis* is suitable for high-temperature food processes.

Key words: *Asparagus officinalis* DC. · Micronutrients · Proximate and Mineral composition · Iran

INTRODUCTION

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 Africa indicate that these, plant resources play a significant role in nutrition; food security and income generation [1].

Furthermore, FAO report, at least one billion people are thought to use wild foods in their diet [2]. 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 [3]. 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 [4]. 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 [5]. It is, therefore, worthwhile to note that the incorporation of edible wild and semi-cultivated plant resources could be beneficial to nutritionally marginal populations or to certain vulnerable groups within populations, especially in developing countries where poverty and climatic changes are causing havoc to the rural populace. In this context, analyses were carried out to evaluate the nutritional content of *Asparagus officinalis* stem with hope that it would be incorporated into the food basket of the country [6-9]. Aim of analysis of nutrients in the plant food is preliminary assessment of nutritional value of the plant-based diet.

Plant Material: *A. officinalis* stem 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 Material for Chemical Analyses: *A. officinalis* stem were washed with distilled water and dried at room temperature to remove residual moisture, then placed in paper envelope and oven-dried at 55°C for 24 hours[10,11]. The dried stem were ground into powder using pestle and mortar and sieved through 20-mesh sieve. The stem powder was used for the nutrients analyzes.

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Plant Food Chemical Analysis: The methods recommended by the Association of Official Analytical Chemists [12] were used to determine ash (#942.05), crude lipid (#920.39), crude fibre (#962.09) and nitrogen content (#984.13) [12].

Determination of Crude Lipid and Crude Fibre Content: Two grams of dried stem 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. 40-60°C). 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 100°C 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 130°C to constant weight and cooled in a dessicator. The residue was scraped into a pre–weighed porcelain crucible, weighed, ashed at 550°C for two hours, cooled in a dessicator and reweighed. Crude fibre content was expressed as percentage loss in weight on ignition[12,13].

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 stem 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 [12].

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 fruit 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 [12].

Mineral Analysis: The mineral elements Na, K, Ca, Fe and Zn were determined on 0.3g stem powder by the methods of Funtua. 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 [12].

RESULTS AND DISCUSSION

Proximate Analysis: The results of proximate composition of *A. officinalis* stem are shown in Table 1. The ash content, which is an index of mineral contents, for *Portulaca oleracia* stem the value of 10.70% DW was more than to the values reported for other edible leaves such as *Momordica balsamina* leaves (18.00±1.27% DW) [1,3,11]. It is apparent that *A. officinalis* stem are a good source of Potassium. The crude protein content (32.69%) was more than what is reported for some lesser known wild leafy vegetables such as *Momordica balsamina* (11.29±0.07%), *Moringa oleifera* (20.72%), *Lesianthera africana* leaves (13.10 –14.90%) and *Leptadenia hastate* (19.10%) [14,15], plant food that provide more than 12% of their calorific value from protein are a good source of

Table 1: Proximate composition of *Asparagus officinalis* stem

Parameters	Concentration (% DW) *
Ash	10.70± 0.80
Crude protein	32.69± 0.27
Crude lipid	3.44± 0.50
Crude fibre	18.50± 0.35
Carbohydrates	34.67±0.68
Calorific value(kcal/100g)	384.27±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) †			
Mineral	Available Quantity in mg/100gDW*	Children 7-10 Years	Adult male	Adult female	Pregnant and Lactating mother
Potassium	10.94±0.02	800	800	800	1200
Calcium	0.67±0.15	1600	2000	2000	2000
Sodium	1.840±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. † Sources: Thangadari et al.(2001)

protein. In that context, *A. officinalis* stem (32.69%) are a good source of protein. The crude lipid content (3.44%) of stem was less than the range (8.3 – 27.0% DW) reported for some vegetables consumed in Nigeria and Republic of Nigerian[16].

The e stimated carbohydrate content (34.67%) in *A. officinalis* stem was stand to be higher than that for *Senna obtusfolia* leaves (20%) and *Amaranthus incurvatus* leaves (23.7%). On the other hand, *A. officinalis* stem contain comparable amount of carbohydrate for *Momordica balsamina* (39.05±2.01%). The crude fibre content in *A. officinalis* stem (18.50 %) was more than the reported values (8.50–20.90%) for some Nigeria vegetables[16]. 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. The calorific value of *A. officinalis* stem was estimated to be 384.27 kcal/100g (DW), which is an indication that it could be an important source of dietary calorie. High calorific content of the stem could be attributed to high carbohydrates and protein contents.

Mineral Content: Table 2 shows the results of the mineral concentrations of *A. officinalis* stem. Nutritional significant of elements is compared with the standard recommended dietary allowance. When compared with standard values as showed in Table 2, *A. officinalis* stem less than adequate level of K, Fe, Zn, Ca and Na, but the plant stem could be good source of K.

Concluding Remarks: The results of the nutritional analysis shown that *A. officinalis* stem is good sources of plant potassium protein and carbohydrates. 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, *A. officinalis* stem are recommend for continues used 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, [17].

In conclusion, the edible plant suitable for different technological processes:

- *A. officinalis* plant is suitable for high-temperature food processes, because it has very low carbohydrate concentrations—thereby reducing the possibility of Maillard reaction and then acryl amide formation [18].
- *A. officinalis* should not be used in high-temperature processes and should be cooked without the peel. We suggest it's use for domestic purposes and home cooking.

Abbreviations Used: AOAC, Association of Official Analytical Chemists; FAO, Food and Agricultural Organization; RDA, recommended dietary allowances; DW, dried weight.

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