Studies on Nutritional Values of Some Wild Edible Plants from Iran and India

Ali Aberoumand and S.S. Deokule

1Department of Food Science and Technology, Natural Resources College of Behbahan, Shahid Chamran University, Ahvaz, Iran
2Department of Botany, University of Pune, Pune 411007, India

Abstract: The most important nutrients present in plants are: carbohydrates, such as the starch and free sugars, oils, proteins, minerals, ascorbic acid, and the antioxidant phenols. The Plants Alocacia indica Sch., Asparagus officinalis DC., Chlorophyntum comosum Linn., Cordia myxa Roxb., Eulophia ochreata Lindl., Momordica dioica Roxb., Portulaca oleracia Linn. and Solanum indicum Linn. are widely wild in many regions of Iran and India. These are consumed as fruits and vegetables. Therefore, to analyze the nutritional values in them, these plants are selected. Association of the Official Analytical Chemists Methods and Folin-Ciocalteau micro method are used for nutritional analysis of the plants. Results indicated that Portulaca oleracia Linn. and Asparagus officinalis DC have high amounts of proteins, fats and calorie values. Therefore, these plants are recommended for consumers as vegetables in their diet. The most of the Iranian and Indian people are using these plants in their daily diet.

Kew words: Nutritional values, edible plants, India, Iran

Introduction

Fruits are important sources of minerals, fiber and vitamins, which provides essential nutrients for the human health. In addition, it is known that some fruits have the so-called ‘anti-nutritional’ factors (e.g. Phytic acid and Tannins) that can diminish the nutrient bioavailability, especially if they are present at high levels (Spiller, 2001). Nevertheless, it has been reported that these anti-nutritional factors could help to prevent and treat several important diseases; remarkably, the anticarcinogenic activity of Phytic acid has been demonstrated by in vitro and in vivo assays.

The most important nutrients present in plants are: carbohydrates, such as the starch and free sugars, oils, proteins, minerals, ascorbic acid, and the antioxidant phenols, such as Chlorogenic acid and its polymers. These molecules are involved in pathogen resistance in plants, and the Chlorogenic acid concentration represents about the 90% of the total phenolic compounds in plants (Ekanayake and Nair, 1998).

Protein malnutrition is a major public health problem in the developing world. The major food crops being roots and tubers hence the diets in these parts are predominantly starchy. The trace elements, together with other essential nutrients, are necessary for growth, normal physiological functioning, and maintaining of life; they must be supplied by food, since the body cannot synthesize them. The exact classification of trace versus macro minerals is not clear cut, but traces are often considered as minerals required by the body in amounts less than 100mg daily. While some of them are vitally important for health, the roles of others are unclear. Recommended intakes have been set for some trace elements and their deficiency can lead to disease, but a lack of others does not cause any recognized problems. To decide whether a micro-nutrient is “essential” or not, several criteria are used, such as the presence of the nutrient in healthy tissue, if it appears in the fetus and newborns and if the body maintains homeostatic control over its uptake in the bloodstream or tissue and its excretion (Janab and Thompson, 2002; Reddy, 2002).

Plants, which are sources of Phytochemicals with strong antioxidant activity, have attracted a great deal of attention in recent years. Antioxidants, which inhibit the oxidation of organic molecules, are very important, not only for food preservation, but also for the defense of living systems against oxidative stress (Masuda et al., 2003). Phenolic antioxidants interrupt the propagation of the free radical autoxidation chain by contributing a hydrogen atom from a phenolic hydroxyl group, with the formation of a relatively stable free radical that does not initiate or propagate further oxidation processes (Kaur and Kapoor 2001).

Dietary fiber (DF) plays an important role in decreasing the risks of many disorders such as constipation, diabetes, cardiovascular diseases (CVD), diverticulosis and obesity (Spiller, 2001). Plant foods are the only sources of DF. All the fractions (cellulose, lignin, hemi cellulose, pectin, gums and mucilage) of DF are the major constituents of plant cell wall (Robertfroid and Sel vendran, 1984). Dietary fiber is subdivided into Insoluble (IDF) and soluble (SDF) dietary fiber depending on their solubility in water. However, the DF can be grouped into two major types (a) soluble/viscous/fermentable and (b) insoluble/non-viscous/slowly fermentable. Recently, FAO/WHO
Mineral content: Mineral content was analyzed with a Perkin-Elmer (optima) 3000 DV analyzer with induction coupled plasma atomic emission spectroscopy (ICPAES) (Eknayake and Nair, 1998). The sample (2g) was digested with 20ml concentrated nitric acid (BDH-Aristar) until a transparent solution was obtained. The instrument was calibrated with known standards and samples analyzed at corresponding wavelengths. Five-point standard curves were made for all analyzed minerals using reference materials. Linear regression analysis of the standard curves indicated they were linear with correlation coefficients in the range of 0.997–0.999. Selenium was determined as hydride using a hydride generator (VGA-76). The samples digested in HNO3 were mixed with concentrated HCl and heated to 70 to 90EC for 10min and cooled before injection into hydride generator followed by NaBH4.

Determination of phytate content: The phytate content was determined by the method of (Wheeler, and Ferrel, 1971), based on the ability of standard ferric chloride to precipitate phytate in dilute HCl extracts of the vegetables.

Determination of total phenolic compounds: Total phenols were extracted by heating a weighed portion (50–500mg) of dried sample with 5ml of 1.2M HCl in 50% aqueous methanol for 2h at 90EC and analyzed by Folin-Ciocalteau micro method (Slinkard, and Singleton, 1977). Results were expressed as mg of Gallic acid per 100g of dried plant material.

Determination of calorie: The first total sugars content will be calculate, then total calorie value will be calculate. total calorie value is equal with fat calorie + protein calorie + sugars calorie. Each gram fat give 9 kcal, each gram protein give 4 kcal and each gram sugar give 4 kcal.

Results and Discussion

Many studies have been done by various research workers all over the world by selecting one or more plants particularly leaves, fruits, roots, stem, food plants and so on but rarely by selecting a particular family. In this investigation works pertaining to seven different families (Araceae, Liliaceae, Boraginaceae, Orchidaceae, Cucurbitaceae, Portulacaceae and Solanaceae) are selected. Sodium values of eight samples in this study in order to mg/g were obtained 4.4, 1.84, 3.95, 1.62, 1.62, 1.51, 7.17 and 1.51 respectively (Fig. 1). Calcium values of eight samples in order to mg/g were obtained 0.88, 0.67, 13.14, 0.46, 7.37, 0.46, 18.17 and 4.48 respectively (Fig. 1). Potassium values of eight samples in this research in order to mg/g were obtained 3.4, 10.94, 4.29, 7.83, 4.63, 8.25, 14.71and 8.32 respectively (Fig. 1).

Iron values of eight samples in this research in order to...
Fig. 1: Amounts of macro elements of edible plants.

Fig. 2: Amounts of micro elements of edible plants.

mg/g were obtained 0.48, 0.19, 1.89, 0.51, 5.04, 0.14, 0.48 and 1.56 respectively (Fig. 2).

Zinc values of the eight samples in this study in order to mg/g were obtained 1.21, 2.60, 0.76, 0.35, 3.83, 1.34, 3.02 and 0.95 respectively (Fig. 2).

If protein, Fat, and calorie values of eight samples in this research are compared, it is observed that Asparagus (32.69%) and Portulaca (23.47%) have the highest protein values. Chlorophytm (4.54%), Eulophia (5.44%) and Alocacia (5.7%) have the least protein values.

Sodium amount of Portulaca oleracia Linn. was maximum and sodium amounts of Momordica dioica Roxb. or Solanum indicum Linn. were minimum. Sodium amount of Alocacia indica Sch. was medium. Potassium amount of Portulaca oleracia Linn. was maximum and potassium amount of Eulophia ochreata Lindl. was minimum. Potassium amount of Cordia Myxa Roxb. was medium.

If Asparagus officinalis DC. was medium. Iron amount of Eulophia ochreata Lindl. was maximum and iron amount of Momordica dioica Roxb was minimum. Iron amount of Chlorophytm comosum Linn. was medium.

Zinc amount of Eulophia ochreata Lindl. was maximum and Zinc amount of Cordia myxa Roxb. was minimum. Zinc amount of Asparagus officinalis DC. was medium. Portulaca oleracia Linn has high nutritional value from view of point of macro-elements because, the plant contains the macro-elements high amounts such as sodium, potassium, calcium and especially ash high amount in comparison with others plants. The Eulophia
Aberoumand and Deokule: Studies on Nutritional Values of Some Wild Edible Plants from Iran and India

Fig. 3: Values of protein and fat of edible plants.

Fig. 4: Values of Total phytic acids and Total phenolic compounds of edible plants.

has high nutritional value from view of point of trace(micro)elements, because it has micro-elements maximum amounts such as iron and zinc in comparison with others plants. Momordica dioica Roxb. or Cordia myxa Roxb have the minimum nutritional value, because they have ash minimum amounts, Momordica dioica Roxb. have minimum values of sodium and calcium, but Cordia myxa Roxb. has minimum value of zinc. Alocasia indica Sch., Asparagus officinalis DC., Chlorophytum comosum Linn., Cordia Myxa Roxb., Eulophia Ochreata Lindl. have medium nutritional values, from view of point of each element.

Minerals in the diet are required for proper growth and good health. Those needed in macro, or major quantities are calcium, phosphorus, magnesium, potassium, sulfur, sodium, and chlorine, and those needed in micro(trace) amounts are iron, iodine, copper, cobalt, chromium, manganese, selenium, zinc, fluorine, and molybdenum. The cruciferous and many other vegetables are excellent sources of minerals, particularly of calcium, phosphorus, magnesium, potassium, iron, sodium, and most of these minerals are present in the available form. The trace mineral content of fruits and vegetables depends on the amount present in the soil in which the plant was grown. The diverse geographical sources of fruits and vegetables and modern systems of transporting produce to market reduce the chance of a low intake. Calcium intake from fruits and vegetables is small compared to that from the milk group but will assume more importance if milk intake is low. Vitamins and minerals present in the diet are necessary for normal growth and metabolism and influence the utilization of other nutrients such as protein. The deficiency of essential vitamins or minerals leads to several physiological disorders and diseases, slowed growth, and lack of deposition of proteins in tissues. An adequate supply of B-complex vitamins is necessary for critical protein utilization. The deficiency of minerals such as potassium, phosphorus, sodium, calcium, and magnesium also influences the capacity of the body to utilize amino acids and proteins (Ekanayake and Nair, 1998).

Portulaca oleracea Linn. and Asparagus officinalis DC plants have high proteins, therefore, they have high enzymatic activity and also high metabolic products. In addition, Portulaca plant has high hormones, so that these components control genetic activity in plant and therefore, amino acids amounts and proteins will be increased. Therefore, we can conclude that plants that have high proteins amount, these proteins will increase nutritional values directly and indirectly. Solanum (13.76%) has the highest of Fat value and Chlorophytum (2%) has the least of Fat value. Portulaca (5.26%) Fat value was medium approximately and the others samples have low fat values. Momordica (4125/83Kcal/Kg) and Cordia (4067/94 Kcal/Kg) have maximum Calorie values and Portulaca (2913/82 Kcal/Kg) has minimum Calorie value and the others samples have medium Calorie values (3514/4Kcal/Kg to 3647/23Kcal/Kg). (Fig.6). Therefore, Asparagus and Portulaca have maximum nutritional value from standpoint of proteins values.

Plants such as vegetables and fruits have satisfactory edible proteins with high quality so that we can use them in food industries and as nutrition. Total proteins and nitrogen is related to Albumins, globulins, free Amino acids, enzymes, hormones, peptides and other nitrogen components. The proteins that contain essential amino acids have high nutritional values therefore they are suitable for consumption because body cells need such proteins.
Therefore, *Portulaca* and *Asparagus* have maximum enzymatic activity and also high amount of metabolic products. In addition, *Asparagus* and *Portulaca* plants have high hormones, so that these components control genetic activity in plant and therefore, amino acids amounts and proteins will be increased. We can conclude because protein amount of the plants were high, therefore their nutritional values will be increased directly or indirectly.

*Solanum indicum* has the maximum nutritional value from view of point of fat. Quality of plant oil is better than animal oil, because plants oils have essential fatty acids such as linoleic and linolenic acids and T-3 and T-6 fatty acids, therefore, they are useful for body tissues. *Solanum indicum* has maximum nutritional values from view of point of oil, in comparison with other plants, because the plant has the best oil (fat) from view of point of quality and quantity.

Flavonoids and other Polyphenolic compounds have powerful antioxidant effects *in vitro* in many test systems, but can act as pro-oxidants in some others. Whether pro-oxidant, antioxidant, or any of the many other biological effects potentially exerted by flavonoids account for or contribute to the health benefits of diets rich in plant-derived foods and beverages is uncertain. Phenolic compounds may help to protect the gastrointestinal tract against damage by reactive species present in foods or generated within the stomach and intestines. The overall health benefit of flavonoids is uncertain, and consumption of large quantities of them in fortified foods or supplements should not yet be encouraged (Kaur and Kapoor, 2001; Slinkard and Singleton, 1977).

Because nutrients of *Solanum indicum Linn.*, *Cordia Myxa Roxb.*, *Momordica dioica Roxb.*, and *Asparagus officinalis DC.* wouldn't destroyed in stages of post-harvesting and harvesting therefore, their nutritional values were high. *Portulaca oleracia Linn.* and *Asparagus officinalis DC.* have maximum nutritional values and therefore, these edible vegetables are recommended for consumption, because they have proteins, fat high amounts and calorie high values. The most of Iranian and Indian peoples consume the plants in daily diet.

Duke and Ayensu (1985) reported that *Asparagus officinalis* stem (Fresh weight) contain 26 calories per 100g, water: 91.7%, Protein: 2.5g; Fat: 0.2 g; Carbohydrates: 5g; Fibre: 0.7g; Ash: 0.6g; Calcium: 22mg; Iron: 1mg; Sodium: 2mg; Potassium: 278mg; Zinc: 0mg. Protein and Zinc amounts in our study are more than obtained results by Duke and Ayensu (1985). Difference between two results depends on other condition such as plants growth places and analysis methods. They also reported *Portulaca oleracia* analysis: Leaves (Dry weight) of *Portulaca oleracia*. In gram per 100g weight of food: Water: 0 Calories: 270 Protein: 26 Fat: 4 Carbohydrate: 50 Fibre: 11.5 Ash: 20 In mg per 100g weight of food: Calcium: 1500; Iron: 29; Sodium: 55; Potassium: 1800. Fat and Ash amounts in our study are more than obtained results by Duke and Ayensu (1985). Difference between two results depends on plants growth places. Studies on Analysis of other edible plants has not been reported by other researchers yet.

**Acknowledgements**

The authors are grateful to the Head Department of Botany University of Pune for providing necessary laboratory facilities and for encouragement. The first author is thankful to Head Department of Food Science Technology of Ahvaz University of Iran.

**References**

Aberoumand and Deokule: Studies on Nutritional Values of Some Wild Edible Plants from Iran and India


Captions
Macro elements (sodium, potassium and calcium) levels (mg/g) of plant sources such as Alocacia indica Sch., Asparagus officinalis DC., Portulaca oleracia Linn., Momordica dioicia Roxb., Eulophia Ochreata Lindl., Solanum indicum Linn., Cordia Myxa Roxb. and Chlorophytum comosum Linn.

Micro elements (Iron and Zinc) levels (mg/g) of plant sources such as Alocacia indica Sch., Asparagus officinalis DC., Portulaca oleracia Linn., Momordica dioicia Roxb., Eulophia Ochreata Lindl., Solanum indicum Linn., Cordia Myxa Roxb. and Chlorophytum comosum Linn.

Protein levels (%) of plant sources such as Alocacia indica Sch., Asparagus officinalis DC., Portulaca oleracia Linn., Momordica dioicia Roxb., Eulophia Ochreata Lindl., Solanum indicum Linn., Cordia Myxa Roxb. and Chlorophytum comosum Linn.

Total phytic acids and Total phenolic compounds (mg/g) of edible plants such as Alocacia indica Sch., Asparagus officinalis DC., Portulaca oleracia Linn., Momordica dioicia Roxb., Eulophia Ochreata Lindl., Solanum indicum Linn., Cordia Myxa Roxb. and Chlorophytum comosum Linn.

Amounts of Total Ash (%) of edible plants such as Alocacia indica Sch., Asparagus officinalis DC., Portulaca oleracia Linn., Momordica dioicia Roxb., Eulophia Ochreata Lindl., Solanum indicum Linn., Cordia Myxa Roxb. and Chlorophytum comosum Linn.

Calories values of edible plants such as Alocacia indica Sch., Asparagus officinalis DC., Portulaca oleracia Linn., Momordica dioicia Roxb., Eulophia Ochreata Lindl., Solanum indicum Linn., Cordia Myxa Roxb. and Chlorophytum comosum Linn.