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# Screening of some nutrients and anti-nutrients components in some plant foods of Iran and India

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The nutritional properties of eight edible plant foods: *Alocacia indica* Sch. , *Asparagus officinalis* D.C., *Portulaca oleracia* Linn. , *Momordica dioicia* Roxb., *Eulophia ochreata* Lindl., *Solanum indicum* Linn. were examined. *Cordia myxa* Roxb. *and Chlorophytum comosum* Linn. The foods were analyzed with standard analysis methods in order to detect several nutrient and anti-nutrient compounds present in each. These included: water, starch, free sugars, such as glucose, fructose and sucrose, and, phytic acid and trypsin inhibitors. The eight edible plants formed three groups according to their nutritional properties, each being suitable for different technological processes. *Cordia myxa* had the highest concentration of sucrose (29.09 g/100g) probably due to a better storage process. Three plants (*Momordica dioicia*, *Eulophia ochreata* and *Portulaca oleracia)* are suitable for high temperature food processes, because they have very low free sugars concentrations; thereby reducing the possibility of Maillard reaction and subsequent acrylamide formation.

**Key words:** anti-nutrients, edible plants, nutrients, technological processes

## Introduction

The most important nutrients present in edible plants are: carbohydrates, such as the starch and free sugars, organic acids, ascorbic acid, and the antioxidant phenols, such as chlorogenic acid and its polymers. These molecules are involved in pathogen resistance in edible plants, and the chlorogenic acid concentration represents about the 90% of the total phenolic compounds in the potatoes (Bell,1980; Friedman, 2003; Mondy and Gosselin, 1988). These compounds are important, not only for human nutrition but also in food processing. The concentrations of these parameters can be influenced by different cultivars, farming system techniques and climatic conditions. In order to evaluate the nutritional quality of different plants it is also important examined the concentrations of anti-

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nutrients, such as phytic acids and trypsin inhibitors. They appear to be unaffected by food processing (baking, cooking and frying) (Friedman *et al.*, 2003; Souci, 2000). Heat-labile anti nutritional factors, such as trypsin inhibitors, are less important in human diets as cooking and processing are normally carried out before consumption. However, nutritional components are often degraded during prolonged processing methods (Savage and Elliott, 1993). Inositol hexakisphosphate ($InsP_6$), commonly known as phytate is a major component of plant storage organs such as seeds, roots and tubers, where it serves as a phosphate source for germination and growth. Due to its ability to chelate and precipitate minerals, Phytate can decrease the bioavailability of critical nutrients such as zinc, iron, calcium and magnesium in foods such as whole grains, nuts and legumes (Thompson and Erdman, 1982).

In our opinion, nutritional quality is the balance between nutritional and anti-nutritional compounds. For this reason we have studied, the concentration of: water, starch, free carbohydrates (glucose, fructose and sucrose), protein and oil. The anti-nutrients measured included phytic acid and trypsin inhibitors in eight edible plants widespread, in order to find if there are nutritional quality differences between them and, if possible, to choose appropriate cultivars for different food processes. We choose these plant foods because they were consuming in India and Iran, we decided to propose some of them for food heating processing in the can after composition analysis of all plant foods in future time.

## Materials and methods

The edible plants samples were kindly provided by Quality Seed s.r.l. (Minervio, Bologna, Iran) and harvested during the same period. The samples were stored at 4°C. Some were lyophilized and stored at room temperature in a vacuum dryer. The determinations of water, protein and oil were performed on fresh samples. The concentrations of starch free carbohydrates, phytic acid and trypsin inhibitors were obtained on the lyophilized samples. Water amount was determined according to AOAC (Spell out) methods at 105°C (Nancy and Wendt, 2003). Total starch content was determined, using 100 mg dry samples, by a Diffchamb Enzy plus Starch kit (Diffchamn AB Sweden) (Beutler, 1984). One g of fresh plant sample was extracted by 10 ml of acetonitrile/water (80:20 v/v), the sample was stirred and centrifuged at 3000 rpm for 10 min. Aliquots of this solution were filtered through a 0.45 µm Millex filter (Millipore) prior to injection into the HPLC. A Beckman 342 HPLC model (Palo Alto, Ca USA), equipped with R.I. detector and an INERTSIL NH2 4 × 250 mm (GL Sciences Japan) column was used. Fifty microliters were injected into the column. An isocratic mode elution with a mobile phase of acetonitrile/water (80:20 v/v) at a flow rate of 0.5 ml/min was used.

According to AOCS 2005, used solutions contain Sodium hydroxide, Trypsin, Acetic acid and BAPA, by method colorimetric in Absorption at 410 nm. Phytate was determined by the methods of Early and DeTurk (1944) by method colorimetric in Absorption at 420 nm. The solution containing 1.2% HC1 and 10% Na2S04, 0.6% HCl containing 5% Na2S04, 3 ml of sulfuric and 3 ml of nitric acid was used.

## Results and discussion

The value of water, glucose, fructose, sucrose and starch was shown in Table 1. All values found are in accordance with literature data (Souci, 2000). In particular, the *Portulaca oleracia* plant showed the lowest values of water, glucose and fructose, the *Asparagus officinalis* and *Momordica dioicia* and *Eulophia ochreata* plants showed low values of all free carbohydrates, and the *Asparagus officinalis* and *Momordica dioicia* and *Eulophia ochreata*, *Portulaca oleracia* and *Solanum indicum* showed a low concentration of sucrose. The free sugars involved in the Maillard reaction form acrylamide. They are potential precursors for acrylamide formation and the cultivars with low sugar concentrations are more suitable than others in high temperature food processes. The *Cordia myxa* has the highest value of sucrose probably due to a better storage process as similar to the work of Amrein *et al*. (2003).

The values of total Phytic acid and Trypsin inhibitor was shown in Table 2. The *Eulophia ochreata* and *Cordia myxa* plants had the lowest total Phytic acid concentrations. Phytate can decrease the bioavailability of critical nutrients such as zinc, iron, calcium and magnesium in foods, because of its ability to chelate and precipitate minerals. These two plants are more suitable, than others, for use in high temperature food processes. Other plants had different amounts of total Phytic acid with highest values in *Portulaca oleracia* and *Solanum indicum*. The same Table also shows the amounts of Trypsin inhibitor in each plant studied. The sum of both inhibitors, in all edible plants studied, was acceptable for human nutrition as stated by Morgan and Coxon (1987. The nutrition parameters, such as water, starch and free sugars, in the edible plants studied, are in accordance with those found in previous studies as Amrein *et al*. (2003). The free sugars concentrations appear to be high in the *Solanum indicum*, *Cordia myxa*, and *Chlorophytum comosum* plants. The starch concentration is low in the *Cordia myxa* plant. The *Eulophia ochreata* and *Cordia myxa* plants shown the lowest values of total Phytic acid and Cordia myxa and *Asparagus officinalis* had very low concentrations of Trypsin inhibitor. Even if all plants reveal a safe concentration of total Phytic acid and

Trypsin inhibitor, the gap between storage and the processing could imply passage of time and the amount of these compounds could increase.

**Table 1**. Water and sugars (g/100 g of dried product).

| Edible Plants | Water | Glucose | Fructose | Sucrose | Starch |
|---|---|---|---|---|---|
| *Alocacia indica Sch* | 6.19 | 2.1 | 8.06 | 2.09 | 60.41 |
| *Asparagus officinalis DC* | 6.48 | 1.53 | 6.86 | N.D | 26.28 |
| *Portulaca oleracia Linn* | 3.7 | 0.01 | 0.86 | N.D | 39.8 |
| *Momordica dioicia Roxb* | 7.1 | 1.47 | 3.97 | 0.23 | 42.25 |
| *Eulophia ochreata Lindl* | 5.33 | 1.48 | 1.62 | 0.46 | 55.75 |
| *Solanum indicum Linn* | 5.01 | 3.19 | 5.21 | 0.59 | 29.5 |
| *Cordia myxa Roxb* | 6.21 | 12.75 | 9.38 | 29.09 | 5.86 |
| *Chlorophytum comosum Linn* | 5.34 | 3.41 | 7.82 | 3.07 | 51.54 |

Each value is the mean of three determinations.

**Table 2**. Total Phytic acid compound and amount of Trypsin inhibitor of eight edible plants obtained from India and Iran.

| Edible plants | Phytic acid mg/100g | Trypsin Inhibator (TIU/g) |
|---|---|---|
| *Alocacia indica Sch* | 312.4 | 7.9 |
| *Asparagus officinalis DC* | 340.8 | 0.8 |
| *Portulaca oleracia Linn* | 823.6 | 16.9 |
| *Momordica dioicia Roxb* | 284.2 | 9.3 |
| *Eulophia ochreata Lindl* | 255.6 | 3.1 |
| *Solanum indicum Linn* | 695.8 | 10.6 |
| *Cordia myxa Roxb* | 248.0 | 1.39 |
| *Chlorophytum comosum Linn* | 468.8 | 4.7 |

Each value is the mean of three determinations.


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