PHYSIO-ANALYTICAL STUDY AND TOTAL IRON CONTENT OF *MANGIFERA INDICA L.* (CHAUSA) USING SPECTROPHOTOMETRIC METHOD

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Abstract

Present study comprise on physio-anlytical study of mango (*Mangifera indica L.*). The variety of mango used here is Chausa. It contain 72±2% moisture. TDS and UDS were determined in aqueous and acidic (0.1M of HCl and HNO_3) extracts. Overall data of these mediums show that it contain 15% TDS and 11% UDS, so 2% will be the other constituents. Acidic environment is more favorable for extracting TDS within 6 hours. EDTA titration shows that HNO_3 can extract out maximum metal content as compare to aqueous and HCl extract. Present study is also helpful for the utilization of a cheap spectrophotometric method for iron determination (Fe-SCN) in the ash of Chausa. Results reveal that iron content of Chausa is 3.26 to 4.66 ppm which is within the tolerance limit.

Introduction

Fruits are very famous for their nutritional values because usually they contain fiber, moisture, sugar, vitamins, minerals and provide low calories. They also show different activities like anticancer etc. [Rui, 2003]. Even Mango seeds shows chelating and antioxidant activities [Pitchaon, 2011]. Mango the king of fruit is very famous all over the world and is cultivated in Asia from thousands of years. Pakistan is considered to be a top producer in mango and produces approximate 1.78milliions of tons [FDS, 2010]. Our county is produces different varieties of mango and famous are Chausa, Dasheri and Langra. Present study also comprise on Chausa. Chemical composition of mango shows that it contains vitamin C, A and B-complex, protein, fat, minerals, carbohydrates, calcium, magnesium sodium, potassium, phosphorous, and moisture etc. The heavy metals are copper, iron, manganese, lead and zinc [Othman and Mbogo, 2009].

Iron is an important trace element and it must be included in our diet. Women and teenage girls and children should required it to maintain their body functions. Breastfeeding is the best insurance against iron deficiency in babies [Institute of Medicine, 2011]. According to the World Health Organization iron deficiency create nutritional disorder because 80% of world's population may have iron deficiency [CDC Recommendations, 1998 and Stoltzfus, 2001]. There are two forms of dietary iron i.e. heme and non heme. Heme iron obtain from animal foods like red meats, fish, and poultry. Non heme iron obtained from plant foods like beans, vegetables, breads etc. The Heme form of iron can easily absorbed but our diet mostly contain non heme iron. [Hurrell, 1997 and U.S. Department of Agriculture, 2011]. Due to the importance of iron in our diet it is necessary to determine the level of iron in fruits. In the present study an easy and cheap method is applied for iron analysis in locally available mango (Chausa). Beside this moisture content, TDS, UDS and total metal content were also determined for this variety.

Materials and Methods

Sample collection: Fruits of *Mangifera indica L.* (Chausa) were purchase from local market of Karachi-Pakistan. Before analysis it was washed properly to remove dust and other material.
Chemicals of analytical grade (Merck and Sigma) were used without further purification. Glassware were washed properly and then rinsed with distilled deionized water. Distilled deionized water was used for preparation of different solutions.

Instrumentation: For the determination of total iron content Vis-7220 spectrophotometer was used for absorbance measurement at 480nm. The cell path length was 1cm.

Moisture content: 5 to 6 grams of mango with skin was dried in oven at 105±1°C. About 24 hours were required to obtain constant weight loss.

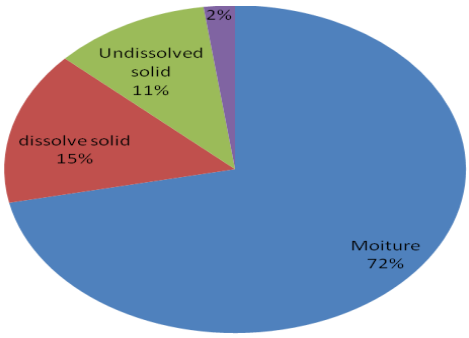

Fig.1. Moisture content, dissolved and nu-dissolved material and other constituent of *Mangifer indica L.* (Chausa)

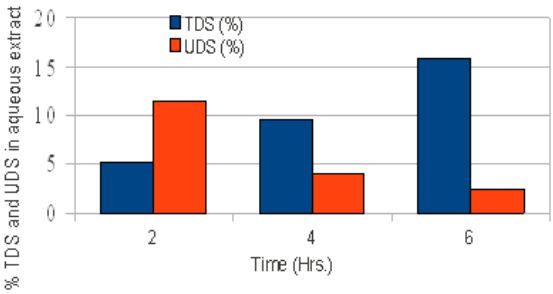

Fig. 2a. Effect of time on %TDS and %UDS of *Mangifer indica L.* (Chausa) in aqueous extract

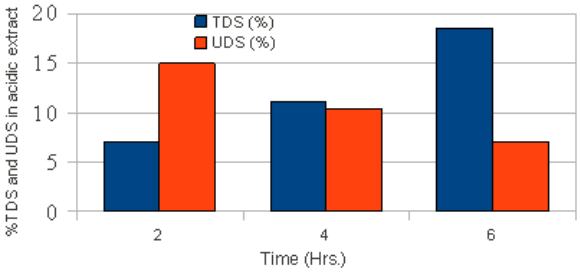

Fig. 2b. Effect of time on %TDS and %UDS of *Mangifer indica L.* (Chausa) in acidic extract

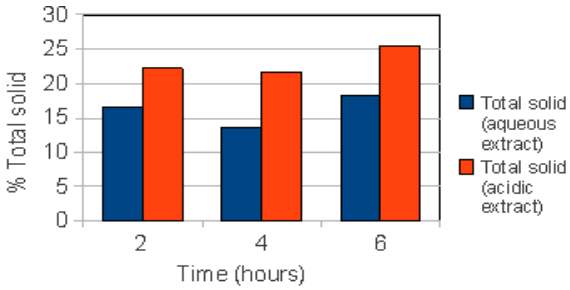

Fig.2c: Effect of time on % total solid of *Mangifer indica L.* (Chausa) in acidic and aqueous extract

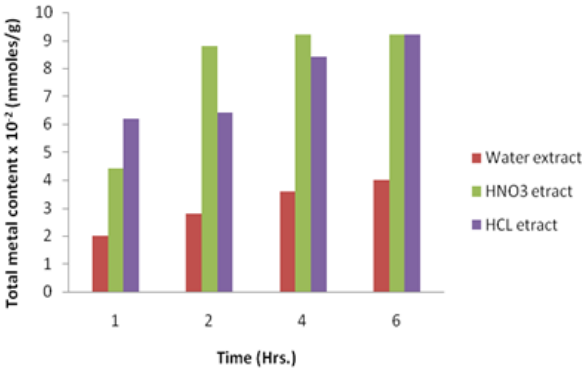

Fig.3. Effect of time on total metal content of different extracts of *Mangifer indica L.* (Chausa)

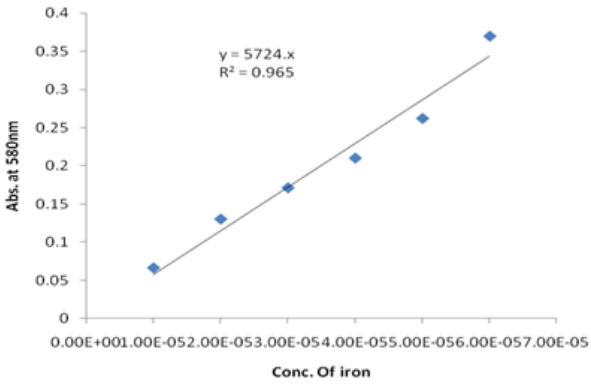

Fig. 4. Calibration curve for Fe-SCN

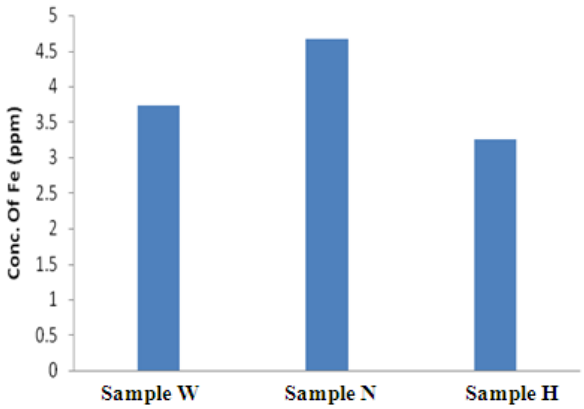

Fig. 5. Total iron in different digested samples of *Mangifer indica L.* (Chausa)

Sample preparation:
Soaked samples: Clean and chopped mango was accurately weighed and soaked in deionized water for different time intervals (1 to 6 Hours) at room temperature and after filtration made up to required volume. Same procedure was repeated for other mediums (0.1M HCl and 0.1M HNO_3).

Digestion of mango sample: For digestion accurately weighed 50-60 grams of pulp was made moisture free and then 5mL of (Conc., 69.5%) HNO_3 was added and heat up to dryness. 5mL of (Conc.) HNO_3 and 2mL H_2O_2 was added in it and heated to get clear solution and then filter and made up to distilled deionized water up to required volume (names as sample W). Same procedure was repeated except the solution was made up with other two mediums i.e. HCl (0.1M) and HNO_3(0.1M) (named as sample H and sample N respectively). These samples were analyzed for total iron content using Visible spectroscopy.

EDTA titration of soak samples: pH of soak sample was maintained up to 10 using ammonia/ammonium chloride buffers and then titrated against EDTA (sodium salt) using indicator Erochrome Block T until color changed to green. EDTA titration was performed for all soak samples of different medium and at different time intervals.

Preparation of standards:
Preparation of standards and blank: Standards of iron were prepared from 0.001M solution of $FeCl_3.6H_2O$ (acidified with HCl). Different dilution from 1 to $6x10^{-5}$M were prepared. For the preparation of different standards required volume of iron was transferred in 25mL volumetric flask and then 5mL of 2M solution of KSCN was added to obtain red colored solution and absorbances were recorded at 480nm.
Before noting absorbaces of sample and standards, instrument was calibrated with blank (KSCN+ water/HCl/HNO_3).

Spectrophotometric determination of iron in digested samples: 20mL of ammonia was added in 10mL ash sample to precipitate out iron content of sample. These ppt. were filtered and as a result of which iron precipitate out as $Fe(OH)_3$. The ppt. were dissolved with HCl (Conc.) in 25mL volumetric flask. For chelation 5mL of KSCN was added and made the solution up to mark with distilled deionized water. The red color is obtained due to chelation which gave maximum absorbace at 480nm. This method is adopted for the removal of interfering metals from iron.

Results and Discussion

Moisture content: Locally available mango (Chausa) contain a huge amount of moisture i.e. 72±2% (Fig. 1) so it can easily help to fulfill the moisture content of consumer.

%TDS and UDS: Study of %TDS and UDS in aqueous and acidic extract (0.1M HCl) represent those materials which are soluble/insoluble in these mediums. Results show that in both mediums % TDS increases with time and up to 6.0 hours maximum dissolved material can be obtained (Fig. 2a & 2b). On the other hand %UDS decreases in both of the mediums and percentage of undissolved materials are least up to 6 hours (Fig. 2a & 2b). Comparative study (Fig. 2c) of acidic and aqueous extract shows that acid (0.1M HCl) can extract out more total dissolved solid. Stomach also contains 0.1M HCl so an individual can get more soluble portion of mango when this fruit contact with the acidic environment of the stomach (Fig. 2a-2c).

Total metal content by complexometric titration: EDTA titration is an easy tool for the determination of total metals present in mango. This study was performed in different extracts i.e. aqueous, HNO_3 and HCl with respect to time (1 to 6 hours). Results revealed that water can extract least while HNO_3 can extract maximum amount of total metal content. The ability of HNO_3 can be due to its strong oxidizing property. HCl can extract out medium amount of total metal content as compare to both of the mediums and within 4 to 6 hours maximum amount of metal can be obtain (Fig. 3).

Total iron content: Digested sample was used for the determination of total iron content by using a cheap spectrophotometric method i.e. Fe-SCN method. KSCN form red colored complex with Fe(III) and high concentration of ligand form stable complex. So after digestion when whole iron convert into its higher oxidation state i.e. Fe(III) the total iron in terms of Fe(III) can be analyze at 480nm. For this Purpose calibration curve method was adopted and different standard of Fe-SCN from $1x10^{-5}$ M to $6x10^{-5}$M were prepared (Fig. 4). After blank correction absorbances of digested samples of mango were recorded and their concentration were determine using calibration curve (Fig. 4). Results revealed that the ash which was made up in HNO_3 provide maximum iron content as compare to aqueous and HCl. (Fig. 5, Table 1).

Table 1. Determination of total iron in different digested samples of *Mangifera indica L.* (Chausa)

Digested Sample	Conc. (ppm) of total iron
Sample W	3.73
Sample N	4.66
Sample H	3.26
*Recommended daily intake of iron (mg/70Kg/body weight)	8-18 (mg/recommended dose/day)

* [Institute of Medicine, 2001]

Conclusion: The iron content of mango (Chausa) is found to be 3.26 to 4.66 ppm and it can be correlated with the work of Akhtar et al. (2010) who reported the Fe content of Chausa from 2.79 to 3.91ppm in different variety of mango obtained from different districts of Pakistan. The daily recommended dose for iron is 8 to 18 mg by institute of medicine, (2001) so present study shows that mango can be helpful to obtain the iron content (Table 1). In the present study a cheap and easy spectrophotometric method is adopted to analyze iron. It may be concluded that Chausa can be a source of moisture and iron to fulfill daily requirement of a body but not a good source of iron although other constituents make it a valuable fruit.

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