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Colorimetric Method for Iron Content in Eugenia Jambolina and cordia sebastina Rare Fruits

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ABSTRACT The iron content in fruits in present study was determined by converting the iron to ferric form using saturated solution of oxidizing agent, potassium per sulphate solution (K2S2O8). The resulting ferric form of iron is then made to react with reagent solution of potassium thiocyanate (KSCN) having high concentration (3N) in presence of strong acid to form red coloured ferric thiocyanate complex, having formula [Fe(SCN)6]3-. The concentration of iron (mg/100g) present in fruit samples under study is determined colorimetrically by measuring the absorbance of iron thiocyanate sample complex at 480 nm against reagent blank iron thiocyanate standard complex. The present work is carried out for Eugenia Jambolina and cordia sebastina rare fruits seasonally grown in Latur Dist.

KEYWORDS : Rare fruits, Iron, Thiocyanate complex and Colorimeter.

1. Introduction:

Our body needs all the nutrients in proper properties for maintaining good health but a single food cannot provide all the nutrients in required proportions for the proper growth. Therefore our diet should contain all the nutrients in adequate quantity and in proper proportions by weight, according to our body needs such that diet becomes balanced this makes necessity of planning the meals and balanced diet. The balanced diet is one which contains different types of foods in such quantities and proportions that the need for all nutrients are adequately met and a small extra provision is made for extra nutrients as margin of safety. In other words a good adequate diet is known as balanced diet. A balanced diet which is needed to sustain good health yields daily nutrients in proper amounts and proportions required by body. However the nutritional requirement of individual may vary according to age, sex, physical activities and other physiological conditions. In the Indian context the Nutritional advisory comity of the Indian Council of Medical Research in an apex body which recommends nutritional requirements for formulating balanced diet for various age groups. The balanced diet must supply enough food to the body for deriving energy.

As per theIndian Council of Medical Research(ICMR) recommendation (1989), The foods are classified on the basis of care in planning balanced diet into five food groups:

Food Group 1: Cereals, Roots and Tubers.
Food Group 2: Pulses, Nuts and Oilseeds.
Food Group 3: Milk, Meat and their products.
Food Group 4: Fruits and vegetables.
Food Group 5: Fats and oils, Sugars and Jaggery etc.
The each of the above food group contain the same nutrient.

The fruits such as apple, banana, custard apple, pineapple, mango, grapes, melons, etc. along with ample quantity of water are rich source of vitamins, minerals, pectin and pentosans and contain reasonal amount of carbohydrates. Fruits are also rich source of organic acids and contain other constituents such as cellulose, woody fiber, gums, tannins, colouring matter and volatile oils. Fruits are poor source of proteins and fats 4.

Because of mineral rich content, the fruits apricots, dates, raisins and custard apple with rich calcium and iron help produce strong bones and good blood.

As a remedy for constipation, the fruit with fibrous matter i.e. cellulose, sugar and organic aids have a laxative effect there by the help in smooth passage of food in the digestive tract and easy bowel movement.

Iron is a compound of the complex protein hemoglobin, a haemoprotein component of red blood cells. It is the pigment of red blood cells. Of the 3 to 5 gms. of iron present in our body more than half of it is present in hemoglobin. The rest of it is stored in the liver, spleen, bone marrow and muscles. In the muscle it is present in the form of myoglobin. Iron is also present in some enzymes like cytochromes, catalase and perioxides3.

The most important function of iron is to form a constituent of hemoglobin which takes part in transportation of oxygen from the lungs to the tissues. This oxygen is used by the body for the process of metabolism. In its deficiency, the oxygen carrying capacity of the blood is reduced. In red muscles myglobin, a pigment substance, is formed with the participation of iron. This also has the same oxygen transporting function like the hemoglobin. During strenuous activity this muscle is involved. In our body there are certain cytochrome protein pigments with iron as an essential component. They act as respiratory enzymes. Certain flavin enzymes also contain iron in them. Anaemia is condition where the hemoglobin level is lowered in the blood. Shortage of iron in the diet is the most common cause of anemia. Iron, folic acid, proteins, vitamin B12, copper, cobalt, vitamin C and pyridoxine are the nutrients required for erythroporesis. Folic acid deficiency produces megaloblastic anemia. Liver, kidney, heart, lean meat, egg yolk and shellfish are the best sources of iron. Dried beans, legumes, dried fruits, nuts, green leafy vegetables, whole cereals, enriched grains and molasses are good sources, Milk is poor source of iron.

Taking into account these aspects, the researchers working in this field have not given much attention to the nutritional value of rare fruits and neglected vegetables grown in Maharashtra.

There are certain rare and neglected fruits and vegetables such as cordia sebestina, Jamun which are found in Maharashtra and other neighboring states are also found naturally in Latur and neighboring districts. There is not much literature related to the chemical composition, nutritional value, curative values, and medicinal values of these rare fruits.

A unique fruit rarely found in this region having property similar to barriers and only familiar in rural areas of latur is known as "shelwat". This fruit of around 1.0 to 1.5 cm. diameter with hard and tough seed at the centre has slightly sweet sticky fleshy mass around the seed. It is having orange cream colour in ripened condition, it is a fruit routinely consumed by cattle feeder boys and farmers without having any side effects.

2. Materials and Methods:

2.1 Preparation of reagents :

For the determination of iron in fruit and vegetable colorimetrically, the required reagent are prepared as follow.

1. Concentrated H2SO4: The C.P Grade and iron free concentrated H2SO4 was used.

2. Saturated potassium per sulphate (K2S2O2) solution: 8 g of AR grade iron free potassium per sulphate was dissolved with constant shaking I 100 mL glass distilled waster. The prepared solution was shaken properly before use.

3. 3N potassium thiocyanate (KSCN) Solution: 146 g of reagent grade potassium thiocynate was dissolved and diluted to 500 ml in distilled water so that the resultant solution becomes 3N. 20 ml of pure acetone was added to improve the keeping quality.
Standard iron solution:

0.702 g of reagent grade crystalline ferrous ammonium sulphate [FeSO4 (NH4)2SO4.6H2O] was dissolved in 100 mL of distilled water and 5 mL of concentrated H2SO4 was added in it and warmed slightly and then concentrated solution of potassium permanganate, reagent grade was added drop by drop untill one drop produces a permanent colour. This solution was transferred into one litter volumetric flask and marked to one litter with the help of distilled water. This resultant solution contains 0.1 mg of ferric (iron) per mL and stable indefinitely.

2.2 Preparation of sample:
Sample of fruit and vegetable under study were collected after selection, randomization by suitable plucking, sorting and surface cleaning method. The representative sample were then prepared by standard procedure.

2.3 Experimental procedure for Determination of Iron:
Preparation of coloured complex and measurement of optical density:

The iron in the ash solution was determined colorimetricaly by first converting the iron into ferric form using oxidizing agent potassium per sulphate and the converting the ferric into red ferric thiocynate complex [Fe (SCN)6]3- exhibiting λmax at 480 nm27 by treatment with potassium thiocynate reagent.

A 5 mL aliquot of the above obtained ash solution, an aliquot of standard iron solution (1.0 mL = 0.1 mg of Fe) and 5 mL of distilled water as blank were taken in separated three big test tubes. The solution in each test tube was then treated with 0.5 mL of conc. H2SO4 , 1.0 mL Of saturated potassium per sulphate solution and 2.0 mL of 3N potassium thiocynate solution and the solution in each tube was then made up to the volume of 15 mL by using distilled water as shown in table 4.6 to 4.8 in chapter 4. After proper equilibrium the optical density of each solution was measured at 480 nm wavelength by setting the blank at 100% transmission.

The amount of iron (mg/100g) in the fruit and vegetable was then calculated by applying the formula given below:

3. Formula:

$$\text{Iron} = \frac{\text{O.D. of sample} \times 0.1 \times \text{total volume of ash solution} \times 100}{\text{mg/100g O.D. of standard} \times 5 \times \text{Wt. of Sample Taken for Ashing}}$$

4. Result and dissection:
Iron is an essential part of the red blood corpuscles and is an essential element in the body.

Its best sources are legumes, whole grains, enriched food, food products, spinach, lettuce, cabbage, peas, beans and tomatoes.

Indrayan, A.I.et.al.has studied the chemical composition of fruit Eugenia jombolina seed and reported 0.003, 1.82, 16.7, 0.54, 10.2, and 0.0018 percent concentration of Cr, Na, K and Cu respectively.

The rare fruits Eugenia Jambolina and Cordia sebestina used for investigative work were found to contain 1.82 and 1.26 mg/100 g iron respectively.

The observed value of iron content of 1.82 mg/100g is found to be that higher than the literature value (1.2 mg/100 mg) reported for the said fruit

5. Conclusion:
The experimental value of 1.82mg/100g found in case of iron content of Jamun in the present study is comparable to that of literature value of iron content of common fruits raspberry, Mango and Indian goose berry (2.3, 1.3 and 1.2 mg/100 g respectively).

The iron content of cardia sebestina rare fruits observed experimentally (1.260mg/ 100g) in the present study is also comparable with that of iron contents of common fruits like mango (1.3 mg/100 g), Indian goose berry (1.2mg/100g) and raspberry (2.3mg/100g).

Therefore of conclusion on the basis of results of present investigation it may be suggested that the rare fruit cardia sebestina is best recommendation as nutrient rich fruit source for treatment of mineral, iron and calcium deficiency diseases and also for good health.

7. Table 1 : Analytical data for Iron content of rare fruits

Sr. No.	Name of Rare fruits (local)	Botanical name	Observation Table								
				Volume taken (mL)	Concentration (mg/mL)	Volume of conc. H_2SO_4 (mL)	Volume of $K_2S_2O_8$ (mL)	Volume of 3N KSCN (mL)	Final Solution (mL)	optical density at 480 nm	Amount of iron (mg/100g)
1	Jambhul	Eugenia Jambolana	Standard iron solution	1.0	0.1	0.5	1.0	2.0	15	0.57	1.82
			Sample ash solution	5.0	-	0.5	1.0	2.0	15	1.03	
			Blank solution	-	-	0.5	1.0	2.0	15	0.17	
2	Shelvat	Cordia Sebestina	Standard iron solution	1.0	0.1	0.5	1.0	2.0	15	0.52	1.26
			Sample ash solution	5.0	-	0.5	1.0	2.0	15	0.47	
			Blank solution	-	-	0.5	1.0	2.0	15	0.10	

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