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Comparative study of total sugar content among selected fruits using standard protocol

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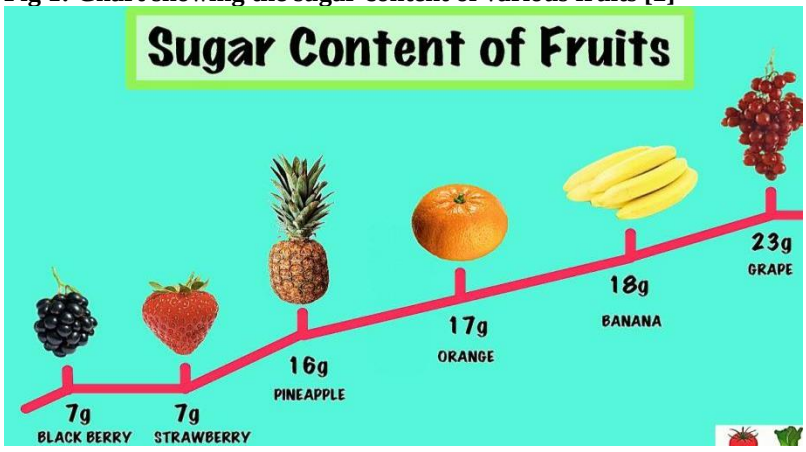
Abstract
Nature based foods are always known to be most healthy and nutritive without any adverse effects on the metabolism. This makes the vegetable and fruit based foods to be universally acceptable without much concern. However one of the major concern related to the consumption of fruits is their high sugar content which is not suggestible for diabetic individuals. Different fruits have different sugar content and may influence the blood sugar levels variably. The objective of the current work is to study and compare the total sugar content, in particular to glucose in selected varieties of fruit samples. This study may serve as a standard reference to understand the sugar content among various fruits to be selected for consumption. The study involves, selection, processing and extracting the juice from fruits followed by the estimation of total sugar content in then using standard methods. Several known methods like, titrimetry, colorimetry etc are available for this purpose. One of the methods is utilized in the study.

Keywords: Metabolism, Glucose, Diabetes, Spectrophotometer, Total glucose estimation

Introduction
Fruits are the Nature's gift for living world. They severe to be most delicious and healthy sweeteners which can highly satisfy the nutritious and vitamin requirement by the body. Different fruits contain different flavour and variable sweetness. In addition to sweetness fruits also posses a natural touch of various tastes like sour, bitter, neutral etc [5]. Some of the Indian fruits known to posses very sweet taste include Mangoes, Custard apple, Sugar palm, Litchis etc. These fruits not only satisfy the taste needs of an individual but also nourish the body. There are some rear fruits or local fruits available in only localized areas [6] like Nanjanagud Banana from Karnataka, Allahabad Surkha Guava of UP, Shahi Litchi from Bihar, Gir Kesar – Gujarat, Banaganapalle Mangoes – Andhra Pradesh, Nashik Grapes – Maharashtra, Nagpur Orange – Maharashtra, Mahabaleshwar Strawberry – Maharashtra, Solapur Pomegranate – Maharashtra, Ratnagiri Alphonso – Maharashtra, Tezpur Litchi – Assam, Beed Custard Apple – Maharashtra, Purandar Fig (Anjeer) – Maharashtra, Banarasi Langra – Uttar Pradesh and Kiwi Fruit- Arunachal Pradesh.

Fig 1: Chart showing the sugar content of various fruits [2]



Inference: Above picture shows the average sugar content of different fruits

Apart from the nutritional value of fruits several fruits are known to poses high medicinal values and may be used in therapeutics. There are several fruits with medicinal values, pomegranate being one among them [7]. It is considered as the tonic for heart [8]. It is a food medicine of great importance. All the parts of the tree like fruits, leaves, stem, roots etc have vital medicinal values [1]. The fruit is rich in vitamin B and C. Blue berries are known for their high efficiency in acting as antioxidants and anti inflammatory sources [4]. Neuritis and anemia are best treated with a couple of bananas in diet. Blackberry's are known to posses good anti diabetic activity. One of the store houses of vitamin C is Custard Apple which is not only an antioxidant food but also helps in removing the free radicals generated in the body [3]. Dates are rich in dietary fibre and prevents the absorption of LDL cholesterol from the gut. Other medicinal fruits include: Figs, Gooseberry, Grapes, Kiwi, Guava, Lemon, Litchi, Jackfruit etc.

Some of the fruits that are preferably consumed to regulate the blood sugar levels include: Grape, Kiwi, Goose berry, Plums, Cherries, Peaches, Apple, Pears etc. The fruits that are to be avoided by diabetic include: Mango, Banana, Papaya, Pineapple etc.

Materials and Methods

Collection of fruit samples

The fruits selected for the study are based on their role in diabetes. Some are favorable and some are hazardous to diabetic. The selected fruits include: Kiwi, Grape, Apple, Mango, Watermelon and Chiku. All the fruits were bought from a local market in Kothapet, Hyderabad. Fruits were washed and cleaned, they were subjected for juice extraction using regular juicer. The pulp was removed by filtration and juice collected. The juice was directly used for further study.

Extraction of sugars and amino acids

The fruit juice obtained was preserved in refrigerator which cab be ued for separation of sugars from free amino acids to specifically analyze the sugar contents in the samples. The fruit juice obtained is subjected for ion exchange chromatography to separate amino acid from sugars. Ion exchange cinematographic set up was prepared using 75cms long column which is packed with amberlite resin of grade 120. The resin is prepared by making a slurry with water. The resin would absorb all the protons of sulphonic acid. This acid will not effect the sugars in the juice. The fruit juice was added and column was allowed stand for 6 hours to allow the sample separation followed by intermittent elute collection. The elute would contain the sugars in water which were collected at a steady flow rate of 200ml per hour. Elute collection was limited to 5 fractions of 100ml each.

Qualitative test for sugars

All the fractions collected n the previous step of ion exchange chromatography initially were subjected for Molish test to detect the presence of sugars in the elute. Molish test is based on the principle of formation of aldehydes of sugars in the presence of acid and molish reagent which can be detected by the formation of purple complex. All the fractions showing positive tests for the presence of sugars and mixed togather into a common beaker which was than subjected for quantitative determination of sugars. The total sugar content of the extracts was quantitatively measured using Anthrone method.

Quantitative determination of sugars

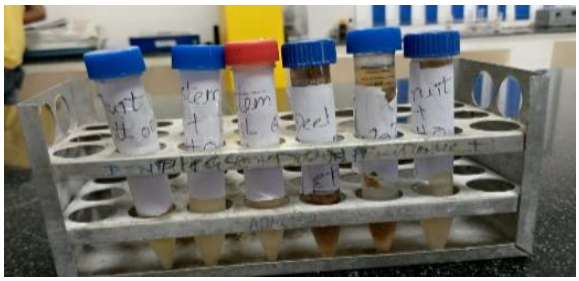
Anthrone reagent is a main chemical used in this test. The principle of this procedure lies in the fact that the sugars initially get reduced with concentrated sulphuric acid to form furfural. These compounds further react with anthrone reagent to yield green to blue colored complex depending on the concentration of the sugars. The intensity of the color can be read using spectrophotometer at 620nm.

Qualitative analysis of sugars

Ascending paper ion exchange chromatography was used along with standard sugars as cross reference for the identification of all the sugars present in the juice. The mobile phase used for compound separation was a mixture containing isopropanol, butanol and water in the ratio of 7:1:2. Chromatogram was developed after an incubation of 48hrs. After air drying the chromatogram it was floaded with the spray of aniline-phthalate. It was further dried in air and incubated at 110^0C for a period of 15 minutes. The developed chromatogram was used to calculate the RF values based on spots and compared with standard RF values for identification of sugars.

Results and Discussion

Fig 2: Extraction of juice from 6 selected fruits



Inference: The figure above shows all the 6 fruit juice samples collected and ready for further study

Qualitative detection of Sugars:

Table 1: Quantitative determination of sugars:

SNo	Sample	Total Sugar Contents as per Anthrone method in gms/ml
1	Kiwi	2.12
2	Grape	1.24
3	Apple	1.9
4	Mango	4.9
5	Chiku	5.0
6	Watermelon	2.5

Inference: The above table shows the calculation of total sugar content in different fruit sample. Highest sugar content was reported in Chiku and Mango

Table 2: Qualitative identification of sugars based on chromatography

SNO	SAMPLE	TYPE OF SUGARS IDENTIFIED
1	Kiwi	Fructose, Glucose, Sucrose
2	Grape	Fructose, Glucose, Sucrose, Galactose, Arabinose
3	Apple	Fructose, Glucose, Sucrose, Arabinose
4	Mango	Fructose, Glucose, Sucrose, Maltose, Xylose, Lactose
5	Chiku	Fructose, Glucose, Sucrose, Lactose, Mannose
6	Watermelon	Fructose, Glucose, Sucrose, Arabinose, Rhamnose

Inference: The above table shows the list of fruits selected and the type of sugar present in them. All of the fruits show a common profile especially for the presence of glucose, sucrose and fructose however there are even other sugars whose composition may vary.

Conclusion

Extraction and chromatographic analysis of various selected fruit samples was performed. The total sugar content in the selected fruit juice extracts was calculated which was fallowed by analysis of the types of sugars present in the samples. All the results reveal that the common sugars present in the samples was glucose, fructose and sucrose, however other sugars may also be present in the samples in variable amounts. Further it can be confirmed from the results that the total sugar content is highest among the samples of chiku and mango respectively followed by watermelon, grapes, kiwi and apple. Thus diabetic individuals can preferably avoid eating high sugar content fruits like chiku and mango and replace them with fruits of low sugar content.

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