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ASSESSMENT OF SUGAR LEVELS IN DIFFERENT SOFT DRINKS

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ABSTRACT

Sugar levels in ten different soft drink bottles from three manufacturers in Enugu, were determined. The ten soft drinks were labeled S1, S2, S3, S4. S5, S6, S7, S8, S8, S9, S10. The soft drinks were analyzed using densitometer (DMA 5000 Model) and refractometer (RFM 740 Model – Bellinghant Stanly Ltd), respectively. The results show that S3 and S5 over shot the standard (7.0-14.0% brix value) by 0.08% and 0.10%, respectively. But these are just marginal and hence insignificant; while other soft drinks analyzed gave results, which were fully within range of specification. Health implications of sugar consumption were highlighted.

Key words: Sugar, Soft drinks, Analysis, Health implications.

INTRODUCTION

Sugar is a white crystalline carbohydrate used as a sweetener and preservative. Sugars are used extensively in food industries and at home as a sweetener and as a source of energy particularly in non-alcoholic beverages[1]. Sugars are the most abundant and widely distributed food component in the form of carbohydrate.

Carbohydrates provide most of the energy in almost all human diets. In the diets of poor people, especially in the tropics, upto 90 percent of the energy may come from this source. On the other hand, in the diets of the rich in many countries the figure may be as low as 40 percent[2].

Green plants can synthesize carbohydrates from water and carbon dioxde under the influence of sunlight; a process known as photosynthesis. The major product of photosynthesis is the six-carbon sugar, D-glucose:

$$6H_2O + 6CO_2 \longrightarrow C_6H_{12}O_6 + 6O_2$$

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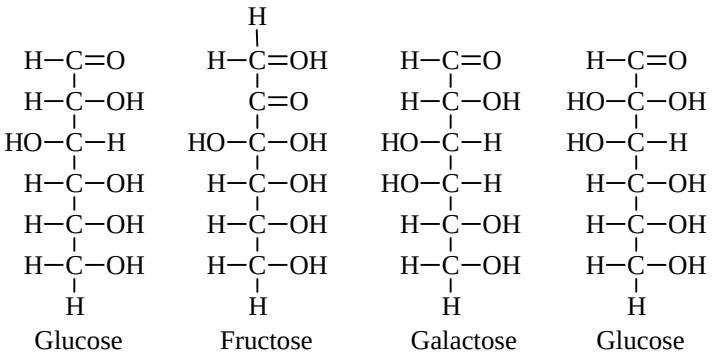
Types of sugar

All carbohydrates are made up of units of sugar (also called saccharide units). Carbohydrates that contain only one sugar unit (monosaccharides) or two sugar units (disaccharides) are referred to as simple sugars. Simple sugars are sweet in taste and are broken down quickly in the body to release energy.

Sugars can be divided into three major groups: monosaccharides, oligosaccharides and polysaccharides.

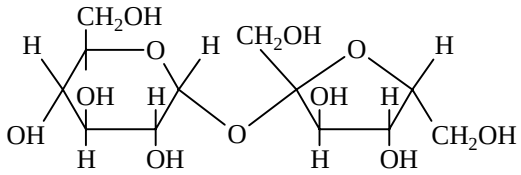
Monosaccharides

These are the simplest forms of sugar and cannot be broken down any further by hydrolysis. They contain from 3-6 atoms of carbon in each molecule. They include trioses, tetroses pentoses and hexoses, according to whether they contain 3, 4, 5 or 6 carbon atoms respectively. Only the hexoses occur in appreciable amount in human foods. Below are examples of hexoses with their structures.



Oligosaccharides

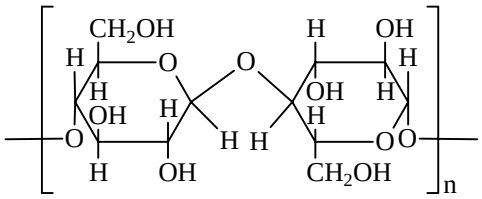
These are relatively low molecular weight sugars, which contain from 2-10 monosaccharides joined by glucosedic likages. They include the disaccharides, trisaccharides, tetrasaccharides, etc.



Sucrose (disaccharide)

Polysaccharide

These are colloidal molecules of many molecules of monosaccharides. They are the most complex and the least sweet. They have high relative molecular mass corresponding to a general molecular formular, $(C_6H_{10}O_5)_n$. They include cellulose and starch[3].



Cellulose

Sugar (especially sucrose) can be obtained from natural sources such as sugar cane, beet sugar, honey, etc. It is difficult to determine when sugar (*saccharim officinarum*) first became known to mankind, but there is an indication that it came from New Guinea to India many centuries before Christ. Today, table sugar (sucrose) is obtained commercially from only two plants, sugar cane and beet sugar, which provide 56% and 44%, respectively of the world's total.

Methods for extracting and purifying the sugar from the cane or beet were slow in being developed. Use of granular activated carbon and ion exchange processes to remove colour has become common. Evaporation, adsorption, centrifugation, filtration, crystallization and affination were from the beginning the important steps in the manufacturing sequence[4-7]. Much of our knowledge of these methods came from their applications in the sugar industry.

Soft drinks

A soft drink is a beverage that does not contain alcohol. The term "soft drink" originally referred exclusively to carbonated drinks, and is still commonly used in this manner. The name "soft drink" specifies lack of alcohol by way of contrast to the term "hard" (i.e. drinks with alcoholic content). Many carbonated soft drinks are optionally available in versions sweetened with sugar or with low caloric sweeteners[8-9]. ln Nigeria Standards Organization of Nigeria (SON) sets the standards for regulating the quantity of sugar and other ingredients in soft drinks.

Soft drinks are heavily consumed mainly because of their nutritional value, as

companies promote them vigorously and market them everywhere. Their sweetness endears them to lovers of sweet foods, especially for their ability to give quick energy owing to their high calorific content[10].

Sugar, one of the major contents of soft drinks is a paradox. In as much as it plays vital roles in food technology and medicine, it is also toxic to the body when it is above normal levels in human blood (4.5-5.5 g/dm^3). High blood sugar levels have been found to promote heart failure and stroke. High sugar levels can poison the body and destroy the organs unless kept in check by an agent called insulin. Health problems caused by high sugar intake include: diabetes, hypoglycemia, dental caries and obesity.

To be able to watch the sugar level in one's blood for healthy living, it is helpful to know the low and high sugar food items. This work, therefore, focuses on assessing the sugar levels in some commonly consumed soft drinks, to alert the general public to beware of their consumption pattern.

EXPERIMENTAL

Sample collection

Ten soft drink samples, labeled S1-S10, collected for analysis were randomly purchased at the local market in Enugu township. The samples chosen represent the types of soft drinks that are often consumed in homes, occasions, hospitals, schools and offices in Enugu metropolis.

Apparatus

The apparatus used for the test include: refractometer, densitometer, syringe, beaker, conical flask, magnetic rod and magnetic stirrer.

Sample analysis

Each sample was analyzed by first degassing and then its density and brix value were determined, using densitometer (DMA 5000 Model) and refractometer (RFM 740 Model-Bellinghant Stanley Ltd.) respectively.

(i) Degassing: A good quantity of the sample was poured into a 500 mL beaker. Magnetic rod was dropped into it. The beaker was placed on the magnetic stirrer and then turned on. It was left to stir for 5-10 minutes by what time the degassing process was completed.

(ii) Brix test: The refractometer was calibrated with distilled water or standard brix solution. The prism was cleaned to dryness and then the degassed sample was put on the prism (enough to cover the prism) and was allowed to undergo temperature stabilization for 30 seconds. The reading was taken at steady value. Brix value is a specification parameter for beverages.

(iii) Density test: The densitometer was calibrated with distilled water. The sample compartment was flushed with the sample at least three times, to remove strange bodies. Then the sample was introduced into the tube gradually, to remove bubbles. The reading was taken at steady value. It is assumed that densities of soft drinks depend on the amount of sugar dissolved in them.

Calculations

The mass of sugar in a bottle of soft drink is calculated as follows[9]:

Volume of soft drink (from label and direct confirmatory measurement) = v

Density of soft drink (from desnitometer) = y

% sugar (brix value from refractometer) = z

Mass of soft drink (a) = y x v

$$\% \text{ of sugar in soft drink (z)} = \frac{\text{Mass of sugar}}{\text{Mass of soft drink (a)}} \times 100 \quad \ldots(1)$$

All values in Eq. (1) are known except mass of sugar.

$$\therefore \text{ Mass of sugar} = \frac{a \times z}{100}$$

$$\text{i.e. Mass of sugar} = \frac{\text{Mass of soft drink} \times \% \text{ of sugar in soft drink}}{100} \quad \ldots(2)$$

This equation (2) was used to obtain the mass of sugar in each sample bottle.

RESULTS AND DISCUSSION

The results of analysis of the assorted soft drink samples are given in Table 1.

Table 1: Sugar contents of assorted soft drinks

Label of soft drink	Volume per bottle (mL)	% Sugar (Brix value)	Sugar content per bottle (g)
S1	300	11.10	38.19
S2	300	10.47	35.94
S3	300	14.10	49.10
S4	300	13.82	48.08
S5	300	14.08	49.03
S6	300	12.76	44.19
S7	500	10.77	56.07
S8	500	12.65	66.35
S9	500	13.02	68.36
S10	500	11.05	57.58

The assessment of the ten soft drink samples using densitometer and refractometer showed that the sugar levels are virtually within the range for soft drinks as specified by standard (7-14% -brix value) except S3 and S5. Over shot the standard by 0.08% and 0.10%, respectively; but these are just marginal and hence negligible. Nonetheless, care should be taken by the manufacturers to ensure full compliance to standard at all times.

Although sugar is a source of energy in human diet and it is also deleterious to health[12]. lt is a long term chemical poison. When we talk about sugar, we include bad nutrition as a whole, since anyone who indulges in sugar has bad dietary habits per se.

Damages caused by sugar include the following[12]

- ❖ Sugar is by far the leading cause of dental deterioration-cavities in the teeth, bleeding gums, failure of bone structure, and loss of teeth.
- ❖ Sugar is the main cause of diabetes, hyperglycemia and hypoglycemia.
- ❖ It is either a significant or contributory cause of heart disease, arteriosclerosis, mental illness, depression, senility, hypertension and cancer.

- ❖ It has an extremely harmful effect in unbalancing the endocrine system and injuring its component glands such as the adrenal glands, pancreas and liver, causing blood sugar level to fluctuate widely. It has a number of other extremely damaging effects on the human body. The above enumerated consequences of sugar underlie the need to consume sugar with moderation and caution. Most of the body damages highlighted start to manifest after years of accumulations.

The bar chart in Fig. 1 summarizes the sugar levels in the assorted soft drinks, S1-S10 analyzed.

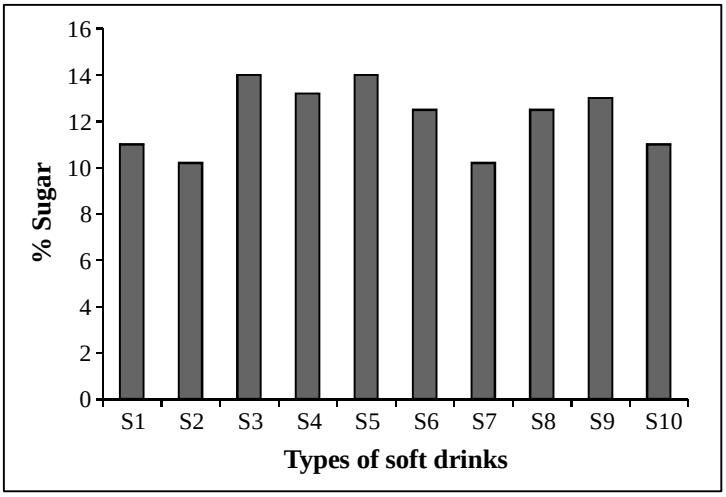


Fig. 1: Percentage sugar per bottle of soft drink

CONCLUSION

This work has established that the levels of sugar in the soft drinks sample are within the accepted limits stipulated by standards. Assessment of percentage sugar in the ten soft drink samples (as listed in Table 1) can be summarized as follows:

S3 > S5 > S4 > S9 > S6 > S8 > S1 > S10 > S7 > S2

It is recommended that people with less need for sugar can take S2 while those in need of high or quick energy, like sports men and women who have no medical restrictions, should go for S3. To prevent negative cumulative effects of sugar in the body, soft drinks should be taken sparingly and if possible, even avoided. Natural food/drink sources of energy should be preferred.

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