Estimation of Sugar Content in Fruit Juices and Carbonated Sodas

Abstract

Sugar-sweetened beverages, particularly soda, provide little nutritional benefit and amplify weight gain and probably the risk of diabetes, fractures, and dental caries. The present study was undertaken to estimate the sugar content of various commonly available fruit beverages and soft drinks and will also check the validity of the labels. The sugar content was estimated in a total of 17 samples out of which 12 were of different fruit juices and 5 were of different carbonated sodas using the Fehling- Soxhlet method. Total sugar content of selected beverages was determined and highest total sugar content (gm/100ml) was found in packaged apple juice (16.33±0.47) while least was found in freshly extracted orange juice (7.01±0.60). Regular consumption of sugar sweetened beverages should not be encouraged and need to be replaced by other healthier options such as low fat milk, green tea etc, as it can cause weight changes and affect the BMI status of an individual which can ultimately increase the risk for various chronic diseases.

Keywords: Sugar-Sweetened Beverages, Carbonated Sodas, Diabetes, BMI.

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Introduction

Sugar-sweetened beverages may affect body weight through various behavioral mechanisms. Whereas the intake of solid food is characteristically coupled to hunger, people may consume sugar-sweetened beverages in the absence of hunger, to satisfy thirst or for social reasons. Sugar-sweetened beverages may also have chronic adverse effects on taste preferences and food acceptance (Brownell et al, 2009). The consumption of sugar-sweetened beverages has been linked and shown to increase the risks for obesity, diabetes, and heart disease; therefore, a compelling case can be made for the need for reduced consumption of these beverages (Malik et al, 2006; Vartanian et al, 2007). Given that global incidence rates of overweight and obesity are on the rise, particularly among children adolescents and young adults, it is imperative that existing public health strategies include education about beverage intake. In the present retail scenario, a young adult entering a shop has a wide variety of beverages to choose from. Therefore it is very important for an individual to know how much of extra sugar unknowingly he/she is consuming via these beverages in their daily life. However there is a scarcity of data on nutritive quality (sugar content) of these beverages, customer's perception about them and the factors which drive or influence customers to purchase them. This study will determine the sugar content of various commonly available fruit beverages and soft drinks and will also check the validity of the labels. The results for sugar content analysis will be interpreted in terms of standardized household measures, and therefore it will be of great help for the common man to check his sugar consumption and make dietary changes.

Methodology

The study focused on estimation of sugar content in fruit juices and carbonated sodas.

Selection of Beverages

The laboratory investigations were performed on selected fruit juices and beverages and carbonated drinks. The name of the brand of packaged drinks selected for investigation has not been revealed for reasons of confidentiality. In case of carbonated beverages the most saleable drinks were selected. The selected beverages were divided into four categories:

Category 1: Packaged fruit beverages-

1) Mixed fruit 2) Orange 3) Apple 4) Pineapple

Category 2: Packaged 100% fruit juices-

1) Mixed fruit 2) Orange 3) Apple 4) Pineapple

Category 3: Fresh fruit juices-

1) Mixed fruit 2) Orange 3) Apple 4) Pineapple

The reason for keeping the flavors in all the three categories of fruit beverages similar was to compare the results for total sugar content in each flavor.

Category 4: Carbonated drinks-

1) Cola soda A 2) Cola soda B 3) Diet cola A 4) Diet cola B 4) Orange soda

Period of Investigation:

1. The first phase of laboratory investigation (2 slots) was conducted in December 2013
2. Repetition phase of laboratory investigation (1 slot) was conducted in January 2014.

Locale of Investigation:

1. The samples were collected from two retail outlets i.e. Bengali Market, Mandi House, New Delhi and HUDA market, sector- 4, Gurgaon.
2. The analysis was conducted in nutrition laboratory II of Food and Nutrition Department, Lady Irwin College, New Delhi.

Chemical Technique

The Fehling- Soxhlet method (Lane – Eynon Method) was followed. (Ranganna, 1984). The literature reviewed, indicated that the method mostly selected for sugar estimation was the Fehling- Soxhlet method. Hence the selection of this method for laboratory investigations was used and also logistics and availability of instruments in the college laboratory was a prime criterion for selection.

Results

Total Sugar content of selected samples was estimated in triplicates. In each test titration was performed three times to obtain concurrent readings. The results are shown in table1:

Table 1: Total Sugar Content of Selected Samples

Sample	Total Sugar Content(gm)/100ml			Mean ±SD
	Test 1	Test 2	Test 3	
Packaged orange juice	13.09	13.27	13.83	13.39±0.38
Packaged apple juice	16.06	16.06	16.89	16.33±0.47
Packaged pineapple juice	13.92	13.09	13.92	13.64±0.47
Packaged mixed fruit juice	13.87	13.87	12.87	13.53±0.57
Packaged 100% orange juice	12.19	12.18	12.18	12.18±0.00
Packaged 100% apple juice	12.06	11.87	12.06	11.99±0.10
Packaged 100% pineapple juice	13.47	12.53	13.27	13.53±0.57
Packaged 100% mixed fruit juice	12.11	11.98	11.98	12.02±0.07
Freshly extracted orange juice	6.32	7.36	7.36	7.01±0.60
Freshly extracted apple juice	8.82	8.82	8.46	8.70±0.20
Freshly extracted pineapple juice	9.32	9.49	9.32	9.37±0.09
Freshly extracted mixed fruit juice	8.24	8.24	9.07	8.51±0.47
Cola soda A	11.92	11.92	11.62	11.82±0.17
Cola soda B	12.04	11.56	12.04	11.88±0.27
Orange soda	13.67	14.14	14.14	13.98±0.27
Diet Cola A	-	-	-	-
Diet Cola B	-	-	-	-

The highest total sugar content (gm) was found in packaged apple juice (16.33±0.47) while least was found in freshly extracted orange juice (7.01±0.60).

Comparison of Total Sugar Content in Different Types of Juices and Carbonated Sodas

The total sugar content of freshly extracted fruit juices was comparatively lower than the packaged fruit juices. Hence, they are a better option for consumption as they do not contain any added sugars. Diet Cola A and Diet cola B contained zero sugar content and hence are a much healthier option in terms of sugar as compared to other carbonated sodas which contained a considerably high amount of added sugar. But only occasional consumption of these carbonated beverages should be encouraged because of the high caffeine content and other related health concerns.

Comparative Values of Total Sugars in Selected Samples

The total sugar values obtained by the investigator were compared with values mentioned on labels of packaged fruit juices and carbonated sodas and with those mentioned in the literature for fresh fruit juices in order to find if there was any significant difference between them.

The results obtained are shown in the table 2:

Table 2: Comparative Values of Total Sugars in Selected Samples (grams/100ml)

Sample	Mean±sd	Test value	*p* value
Packaged orange juice	13.39±0.38	13.5	0.073^{NS}
Packaged apple juice	16.33±0.47	15	0.040^{*}
Packaged pineapple juice	13.64±0.47	14.1	0.241^{NS}
Packaged mixed fruit juice	13.53±0.57	14	0.300^{NS}
Packaged 100% orange juice	12.18±0.00	12	0.001^{*}
Packaged 100% apple juice	11.99±0.10	11.5	0.015^{*}
Packaged 100% pineapple juice	13.53±0.57	13.5	0.293^{NS}
Packaged 100% mixed fruit juice	12.02±0.07	12.5	0.008^{*}
Freshly extracted orange juice	7.01±0.60	8.25 (Kelebek et al.,2009)	0.071^{NS}
Freshly extracted apple juice	9.37±0.09	9.44 (Camara et al.,1996)	0.397^{NS}
Freshly extracted pineapple juice	8.51±0.47	8.93 (Fuleki et al.,1994)	0.271^{NS}
Cola soda-A	11.82±0.17	11	0.014^{*}
Cola soda -B	11.88±0.27	11	0.031^{*}
Orange soda	13.98±0.27	13.1	0.031^{*}

NS= Not Significant (*) =Significant at p<0.05

The significant differences obtain between the estimated total sugar content and the value mentioned in the literature or on the labels may be attributed to the possible differences in the burettes used and the individual errors in the titration.

Sugar Content in Terms of Household Measures

Laboratory values obtained by the investigator were converted into calories and household measures (teaspoons). The results are depicted in table 3. Packaged apple juice contained the maximum amount of sugar. The healthiest choice that emerged was freshly extracted orange juice that contained approximately, 3 teaspoons of sugar in 250 ml of the beverage.

Table 3: Sugar Content in Terms of Household Measures

Sample	Amount (ml)	Sugar (gms)	Calories from Sugar	Sugar (tsp) 1 tsp= 5gm
Packaged orange juice	250	32.50	130	6.5
Packaged apple juice	250	40	160	8
Packaged pineapple juice	250	34.1	136	7
Packaged mixed fruit juice	250	33.82	135	7
Packaged 100% apple juice	250	29.97	119	6
Packaged 100% pineapple juice	250	33.82	135	7
Packaged 100% mixed fruit juice	250	30.05	120	6
Freshly extracted orange juice	250	17.52	70	3.5
Freshly extracted apple juice	250	21.75	87	4
Freshly extracted pineapple juice	250	23.42	93	5
Freshly extracted mixed fruit juice	250	21.27	85	4
Cola soda A	250	29.55	118	6
Cola soda B	250	29.70	118	6
Orange soda	250	34.95	139	7
Diet Cola A	250	0	0	0
Diet Cola B	250	0	0	0

Summary and Conclusion

Total sugar content of selected beverages was determined using Fehling- Soxhlet method and highest total sugar content (gm/100ml) was found in packaged apple juice (16.33±0.47) while least was found in freshly extracted orange juice (7.01±0.60). Freshly extracted juices had comparatively lower sugar content when compared with packaged fruit juices. Hence, they are a better option for consumption as they do not contain any added sugars. In case of carbonated sodas, diet colas contained zero sugar content and hence are a much healthier option in terms of sugar content as compared to other carbonated sodas which contained a considerably high amount of added sugar. But only occasional consumption of these carbonated beverages should be encouraged because of the high caffeine content and other related health concerns. Comparison was done for total sugar content values of selected samples obtained by the investigator with the values mentioned on labels or those mentioned in literature was done. The results indicated that total sugar content values obtained by the investigator were significantly higher than the values mentioned on labelsor in literature in case of packaged apple juice($p=0.015$), packaged 100% orange juice ($p=0.001$) and packaged 100% apple juice ($p=0.015$), cola soda A ($p=0.014$), cola soda B ($p=0.031$) and orange soda ($p=0.031$). It was also seen that total sugar content values obtained by the investigator were significantly lower than the values mentioned on labels or in literature in case of packaged 100% mixed fruit juice($p=0.008$). The results for rest of the samples indicated that total sugar content values obtained by the investigator were analogous with the values mentioned on labels/literature. Laboratory values obtained by investigator were converted into calories and household measures (teaspoons) and the healthiest choice that emerged was freshly extracted orange juice that contained approximately 3 teaspoons of sugar in 250 ml of the beverage. Awareness regarding the amount of excessive sugars present in these beverages which is unknowingly consumed is very important. Since sugar is addictive, the recommended allowance of 4 teaspoons of sugar is easily exceeded. For example an intake of 250ml of carbonated soda results in the intake of 6 teaspoons of sugar which is well above the recommended allowance. Thus it is evident that a regular consumption of sugar sweetened beverages should not be encouraged, as it can cause weight changes and affect the BMI status of an individual which as can increase the risk for various chronic diseases such as diabetes and metabolic syndrome.

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