EXHIBIT 42

LETTERS TO THE EDITOR

Response to "Sugar Content of Popular Sweetened Beverages Based on Objective Laboratory Analysis: Focus on Fructose Content"

Larry J. Hobbs[1] and Dana Krueger[2]

TO THE EDITOR: The article titled "Sugar Content of Popular Sweetened Beverages Based on Objective Laboratory Analysis: Focus on Fructose Content" by Ventura *et al.* indicate that 42 and 55 high-fructose corn syrup (HFCS) are composed of either 42 or 55% fructose with the remaining percentage of glucose (1). In the study they analyze 23 samples of sweetened beverage samples and report finding a mean level of fructose of 59% instead of 55%. They also reported finding no maltose or other higher sugars in the samples. The method used for this analysis was AOAC 977.20.

AOAC 977.20 is a method designed to separate sucrose, fructose, and glucose in honey. Although it is a good method for identifying levels of these sugars in solutions of sucrose or invert sugar as the sweetener source, the method is not sufficiently sensitive to accurately identify maltose or higher sugars if they are present.

It is well known and part of the Code of Federal Regulations 21 CFR Sec. 184.1866 that HFCS shall conform to the identity and specifications listed in ref. (2). This HFCS monograph in Codex describes 42% HFCS as containing not <92% monosaccharides and not >8% other saccharides while 55% HFCS shall contain not <95% monosaccharides and not >5% other saccharides.

Early work done by Wartman *et al.* (3–5) also identified the levels of these higher sugars present in HFCS. The studies done by Wartman and her colleagues clearly identify levels of higher sugars in 42% HFCS and in 55% HFCS. The ratios of sugar identified in the early work by Wartman are used today to prepare standards for saccharide analysis. One of the more common methods for analysis of HFCS is AOAC 979.23 (saccharides in corn syrup).

It was apparent that if a method selected that was not validated for the detection of maltose or higher sugars the results of an analysis of saccharide distribution would be inaccurate. To verify this, the International Society of Beverage Technologists looked at a series of commercial 42 and 55 HFCS samples which were analyzed by Krueger Food Laboratories, a private contract company.

Six samples of 55 HFCS were measured in duplicate by AOAC 979.23. The results of this analysis were an average of 55.9% fructose, 39.9% glucose, and 4.2% higher sugars. The same samples measured by AOAC 977.20 averaged 58.0% fructose, 40.9% glucose, and 1.1% maltose. It should be noted that although the method is not validated for maltose, occasionally a peak will be reported. This peak was not consistent even in duplicate runs. When looking at the samples showing only fructose and glucose, the average fructose level was 58.5% with a glucose level of 41.5%.

Likewise, the average of six samples of 42% HFCS was 43.2% fructose, 51.4% glucose, and 5.4% higher sugars when analyzed with AOAC 979.23 and were 44.5% fructose, 53.9% glucose, and 1.6% higher sugars when analyzed with AOAC 977.20. The average result of the AOAC 977.20 samples showing no higher sugars was 45.1% fructose and 54.9% glucose.

It is apparent from these results that analyzing solutions-containing HFCS using AOAC 977.20 will falsely inflate the apparent proportions of fructose and dextrose present compared to AOAC 979.23 which is validated to measure higher sugars in corn sweeteners. Whereas no beverage samples were analyzed during this study one would have to suspect that analysis done with a method that measured fructose and glucose to the exclusion of maltose and higher sugars would also result in artificially high levels of fructose and glucose.

DISCLOSURE

The International Society of Beverage Technologists is an independent society and received no financial support from any company or other organization for this study. The methods and guidelines established and recommended by the ISBT are widely used as standards and regulations by companies and governments around the world.

REFERENCES

1. Ventura EE, Davis JN, Goran MI. Sugar content of popular sweetened beverages based on objective laboratory analysis: Focus on fructose content. *Obesity (Silver Spring)* 2010; e-pub ahead of print 14 October 2010.
2. *Food Chemical Codex*. 4th edn. National Academy Press: Washington, DC, 1996 pp 191–192.
3. Wartman AM, Hagberg C, Eliason MA. Refractive index-dry substance relationships for commercial corn syrups. *J Chem Eng Data* 1976;21.
4. Wartman AM, Bridges AJ and Eliason MA. Refractive index-dry substance relationships for commercial high fructose corn syrups and blends. *J Chem Eng Data* 1980;25.
5. Wartman A, Spawn T, and Eliason M. Relationship between density, temperature, and dry substance of commercial corn syrups, high fructose corn syrups and blends with sucrose and invert sugar. *J Agric Food Chem* 1984;32:971–974.

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doi:10.1038/oby.2011.4

Response to the "Letter to the Editor by LJ Hobbs"

Michael I. Goran[1], Emily E. Ventura[1] and Jaimie N. Davis[1]

TO THE EDITOR: We are pleased to respond to the letter to the editor entitled "Response to 'Sugar Content of Popular Sweetened Beverages Based on Objective Laboratory Analysis: Focus on the Fructose Content'" from Larry Hobbs (1), Executive Director of the International Society of Beverage Technologists, relating to our recent paper. This letter points out a possible methodological limitation of our study and

that high fructose corn syrup (HFCS) is not a simple mixture of glucose and fructose. This letter is therefore helpful in correcting a commonly held assumption and clarifies that HFCS is a complex mixture of mono-, di-, and oligo-saccharides, and may contain up to 5% complex oligosaccharides as well as other sugars such as maltose. Since we did not specifically measure these sugars, our estimates of total sugar content may actually be underestimated. In addition, we are not disputing the sugar composition of HFCS but rather we are questioning the sugar composition of popular drinks in terms of gaining more insight into the sugar content of what is actually consumed.

However, since the method we used (Association of Analytical Communities (AOAC) 977.20) was specific for assaying glucose, fructose, and sucrose (and was verified for this purpose through the use of external blinded standards), we are unsure how our results could have overestimated the fructose content or the fructose:glucose ratio. The letter by Hobbs suggests that the presence of maltose was falsely detected, specifically as fructose, by our methodology, but this seems unlikely given the chemical/structural differences between fructose and maltose, and an assertion that was not directly tested. A much better comparison would have been to assay blinded standards and beverage samples by the two methods to see how the results would compare. Regardless of potential methodological limitations of the AOAC 977.20 method, our results still point to a potentially higher level of fructose in some popular beverages. For example, according to the findings of the Hobbs letter, a HFCS of 55% fructose tested at 58% using AOAC 977.20, suggesting that our method may have slightly overestimated fructose content. In contrast, we found that three of the major soft drink brands we tested had a fructose:glucose mixture in the ratio of 65:35, still much higher than would be expected even accounting for a possible overestimation of fructose. Given the very close chemical structures of fructose and glucose it seems unlikely that any methodological overestimation of sugars due to presence of maltose or other disaacharides, would be falsely detected only as fructose as asserted in the letter.

We certainly acknowledge that our results are exploratory and should be used as a starting point for future research. A more detailed and thorough analysis is required. Future studies should use the most sophisticated assay methods possible since both of the methods in discussion (AOAC 977.20 and AOAC 979.23) have limitations and could be improved upon for greater specificity. In addition, future studies should determine the influence of factors such as batch differences, storage, and where the product was made on sugar content and composition. Taken together, our study and the letter from Hobbs point to a common need for more detailed labeling of products in terms of sugar composition (including disclosure of fructose content) and more disclosure from the corn syrup industry regarding type of HFCS used as well as HFCS composition. These requirements can only be helpful to the research community as well as to consumers.

DISCLOSURE

The authors declared no conflict of interest.

REFERENCE

1. Hobbs L, Krueger D. Response to "Sugar content of popular sweetened beverages based on objective laboratory analysis: focus on fructose content." *Obesity*, this issue.

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doi:10.1038/oby.2011.37

Response to "Response to the Letter Regarding 'Sugar Content of Popular Sweetened Beverages'"

Larry J. Hobbs[1] and Dana Krueger[2]

TO THE EDITOR: In the response of Goran *et al.* (1) we appreciate acknowledgement that there is no longer a dispute regarding the sugar composition of high-fructose corn syrup (HFCS) and that there were errors caused by the limitations of the method used in the study. It is important to note that the levels of saccharides in HFCS are not misrepresented and conform to the Food Chemical Codex specifications for High Fructose Syrups.

We believe that there is a simple mathematical error at the root of this issue. Both Association of Official Analytical Chemists (AOAC) 977.20 and AOAC 979.23 correctly measure the individual sugars in percentage by volume of the sample. They do not necessarily measure the percentage of individual sugars as a percentage of total sugars in the sample. Exclusion of the undetected 5% of maltose and degree of polymerization (DP3+) sugars typically present in HFCS 55 results in an overestimation of the fructose content of the ingredient syrup when calculated on a percent of total sugar basis. Thus, in our studies of 55% HFCS, the average fructose content was 55.9% on a percent of total sugars basis. However, it increased to 58% or greater when maltose and DP3+ sugars were excluded.

We would point out that the 65:35 fructose to glucose ratio referred to in the response implies that no other sugars are present. In their response, Goran *et al.* already acknowledged this not to be the case for beverage samples using HFCS. For a beverage sweetened with 55 HFCS, the proper ratio of sugars would be 55.6 fructose: 40.1 glucose: 4.3 maltose and higher sugars based on the average of our 55 HFCS analysis using a method which accounts for the higher sugars that are present.

We would agree that further study using appropriate methods is warranted. The flaws created in this study by the exclusion of maltose and higher sugars make it difficult to draw conclusions in the current form and we believe that the application of rigorous methodology that includes all the saccharides present will resolve the current uncertainties.

DISCLOSURE

The authors declared no conflict of interest.

REFERENCE

1. Goran M, Ventura E, Davis J. Response to the "Letter to the editor by Larry Hobbs." *Obesity*, this issue.

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doi:10.1038/oby.2011.35