COMMENTARY

# Introduction of "Sugar Tax" in South Africa: Placebo or panacea to curb the onset of cardio-metabolic diseases?

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## ABSTRACT

**During 2016 an announcement was made that South Africans will be obliged to pay a 20% "sugar tax" that will soon be implemented in order to help curb the rising prevalence of cardio-metabolic diseases. This announcement was met with mixed responses, with strong support from some quarters while others questioned whether it would indeed lead to improved health and well-being of South Africans. As sugar-sweetened beverages (SSBs) constitute a significant portion of added sugars in modern-day diets, it is firmly in the cross-hairs of the new taxation. This perspective article reflects on the proposed sugar tax by exploring the nature of SSB consumption patterns, evaluating epidemiological evidence associating SSB intake to cardio-metabolic diseases risk and by considering examples where a similar tax had previously been introduced. Here data reveal that there is robust evidence supporting a detrimental link between high SSB consumption patterns and the onset of cardio-metabolic diseases. It is therefore our strong opinion that the sugar tax option should be pursued in parallel with well-designed, long-term studies to evaluate whether it decreases SSB intake and lowers the prevalence of cardio-metabolic diseases within the South African context.** SAHeart 2017;14:148-153

The South African Minister of Finance noted in his 2016 budget speech that a 20% "sugar tax" would be introduced during 2017. This has since raised considerable debate with proponents welcoming the announcement as a measure to counter obesity-related diseases, while the beverage industry responded that it would come at significant costs to the South African economy. In light of such diverse views it is useful to reflect on the key question that emerges, i.e. would such a tax be an effective strategy to counter the effects of higher sugar intake if the latter is indeed the cause of increased disease onset? The intake of added sugars by South Africans has substantially increased over the last few decades.[1] This forms part of the so-called nutrition transition in especially developing countries where distinct changes in dietary patterns and nutrient intake occur with economic development and urbanisation.[2] Dietary sugars are derived from a range of foodstuffs, but sugar-sweetened beverages (SSBs) that include sodas, fruit juices, energy drinks and sweetened milk drinks provide a significant proportion of added sugars.[1,3] This perspective article will briefly consider trends in SSB consumption, its association with the onset of obesity, diabetes and heart diseases and the potential of a "sugar tax" to curb the pandemic of cardio-metabolic diseases.

The first SSB was produced and consumed in the 1800s, but only gained popularity during World War II when free Coca Cola™ products were donated to the US army. The consumption of all SSB types including carbonated, sports, fruit drinks and vitamin waters increased significantly between 1970 and 2000. In recent years the sales and consumption of SSBs have increased rapidly in non-Western and low- and middle income countries in particular. For example, in China the trading of Coca Cola™ and PepsiCo™ products rose by 145% and 127%, respectively, between 2000 and 2010.[4] In Mexico, SSB sales increased in a similar fashion between 1999 and 2012,[5] while annual sales in South Africa is also increasing.[6] This is possibly due to the fact that SSBs have became increasingly affordable, especially in low- and middle-income countries over the past decade.[7] The WHO makes a strong recommendation that the consumption of free sugars should strictly be kept below 10% of the total calorie intake, but that a limit of 5% could have added health benefits. The British Scientific Advisory Committee on Nutrition and American Heart Association made similar, or stricter, recommendations.[8] To put this into perspective, one 330ml can of soda contains ~7 - 9 teaspoons of sugar, i.e. a single serving already surpasses the daily recommendation.

Despite such recommendations, the role of SSB consumption in terms of disease onset remains controversial.[9] It is important to bear in mind that SSB intake can promote cardio-metabolic diseases onset through direct or indirect mechanisms. As SSBs are energy dense, their consumption is associated with excessive caloric intake and subsequent weight gain that may, in turn, result in the development of cardio-metabolic complications. However, increased SSB consumption may also elicit direct metabolic effects that occur independently of body weight and energy balance.

This section will explore the link between SSB consumption and cardio-metabolic diseases. Although a vast number of studies were considered in the writing of this section, only studies published after 1 January 2013 will be cited here. There are ample large-scale (n>40 000) long-term (follow-up >5 years) epidemiological studies published during the early 2000s that provide considerable evidence to prove the positive

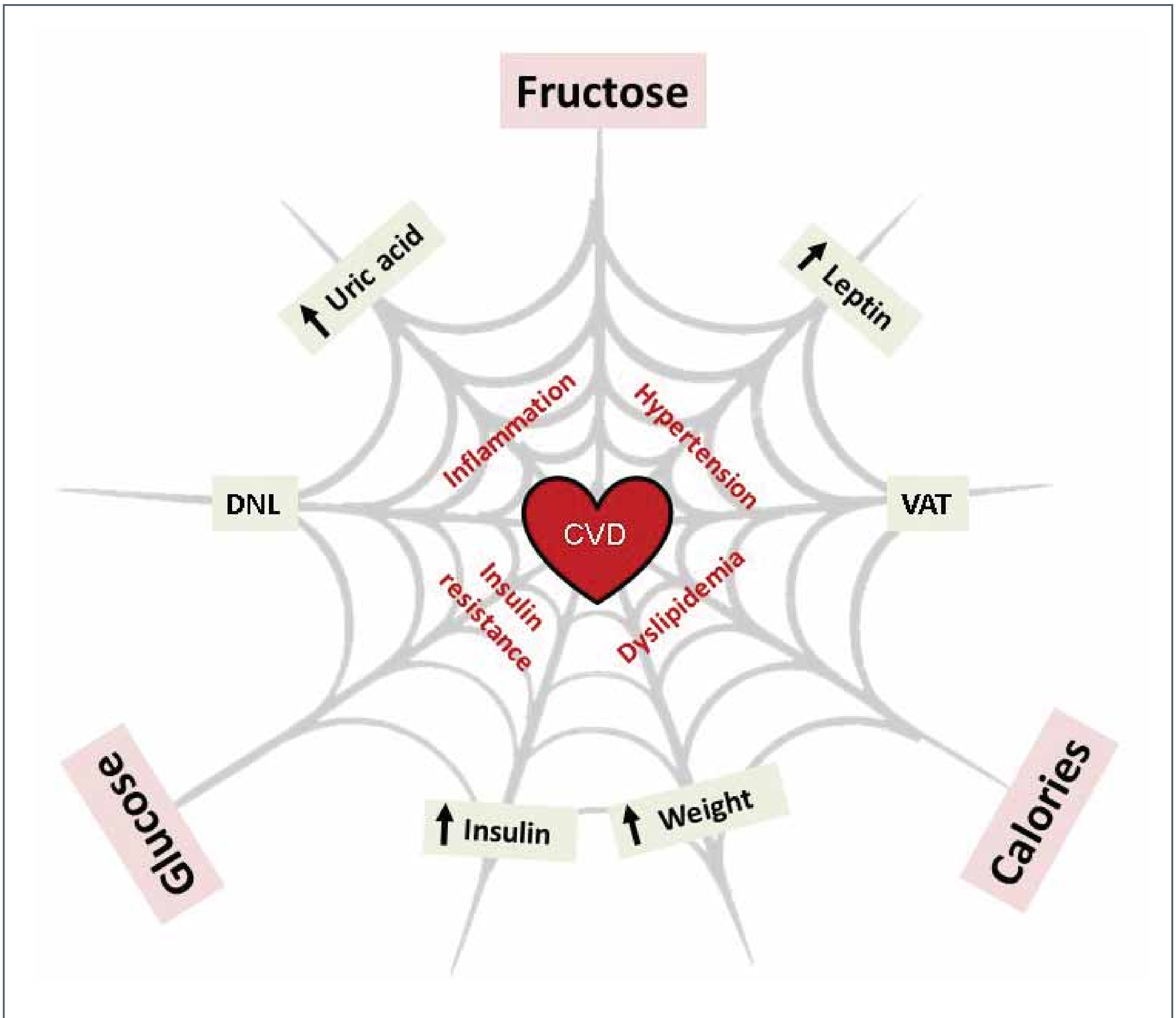


**FIGURE 1: Caught in a sugar web?**
Long-term, high SSB intake can elicit direct and indirect effects in the body. The glucose and fructose components making up SSBs can trigger perturbations that lead to downstream metabolic and functional effects. In addition, excess caloric intake – due to high SSB consumption – can lead to weight gain that indirectly contributes to metabolic alterations. Both routes elicit effects in especially the liver and adipose tissue depots and lead to alterations in circulating blood metabolites, e.g. insulin, uric acid and leptin. Together such changes can eventually manifest in hypertension, central obesity, dyslipidemia, insulin resistance and inflammation that ultimately increase the risk for cardiovascular diseases (CVD) onset. DNL – *de novo* lipogenesis, VAT – visceral adipose tissue.

association between SSBs and weight gain and the eventual risk of developing obesity. Earlier observational data further show that a decrease in SSB intake can lead to significant weight loss. Epidemiological studies from across the globe also show that children and adolescents are especially vulnerable to weight gain due to SSB consumption.[10-13] Extensive reviews and meta-analyses have also been generated on the link between SSB consumption and weight gain and the bulk of these supports the direct association between SSB consumption and obesity, including the most recent meta-analysis.[14]

SSB consumption can also, directly or indirectly, promote the onset of hypertension,[15-18] dyslipidemia,[18,19] and impaired glucose tolerance (Figure 1).[20] Evidence from these studies suggests that the effects of SSB consumption occur partly through direct and indirect (increased calorie intake and weight gain) mechanisms (refer to Table I). The concurrent manifestation of such metabolic conditions is known as the metabolic syndrome (MetS) that serves as a prognostic tool to predict the future development of Type 2 Diabetes Mellitus (T2DM) and cardiovascular diseases (CVD).[21] Considering the strong association between SSB intake and the MetS, it is interesting to consider the evidence regarding SSB intake and T2DM and CVD risk. Accordingly, we identified longitudinal studies that explored the association between SSB intake and T2DM.[22-26] All but one of these studies found that frequent SSB consumption significantly increased the risk of developing T2DM in a dose-dependent manner. Two recent meta-analyses concurred that every additional daily SSB serving relates to a ~18 - 20% increase in the risk of developing T2DM.[27,28] There are less data available regarding the direct relationship between SSB consumption and CVD onset but there is some recent evidence that it may lead to a higher incidence of myocardial infarction,[29] stroke,[29] heart failure[30] and CVD mortality.[31,32]

By introducing a "sugar tax", South Africa is following in the footsteps of France, Mexico, the United Kingdom and some cities in the United States. The WHO recently endorsed the use of a sugar tax as a strategy to reduce SSB consumption and obesity. Moreover, researchers from across the globe are advocating the potential benefits of SSB taxing.[33-35] In South Africa researchers estimate that a 20% tax would lower the prevalence of obesity by 2.4% in females and 3.8% in males, that should result in 220 000 less obese adults in South Africa.[36] In addition, it is estimated that the incidence of stroke over the next 20 years will be reduced by 85 000.[37] It is,

**TABLE I: The direct and indirect effects of SSB consumption.**

| Author | Evidence of indirect effect of SSBs | Evidence of direct effect of SSBs |
|---|---|---|
| Kosova, et al.[18] | The influence of SSB intake on total calorie intake and unadjusted BMI is not reported. | Multivariate linear regression adjusting for energy intake and other factors show a positive association between SSB intake and components of the MetS. |
| Loh, et al.[20] | The frequency of SSB consumption did not have a significant effect on BMI. | Multivariate analyses showed that the significant association between SSB intake and all metabolic parameters persisted after the adjustment for BMI and dietary patterns. |
| Bhupathiraju, et al.[22] | Higher SSB intake was associated with increased BMI. | SSB intake is significantly associated with increased risk of developing T2DM after adjusting for BMI, total calorie intake and other factors. |
| Fagherazzi, et al.[23] | The influence of SSB intake on total calorie intake and unadjusted BMI is not reported. | The significant association between SSB intake and T2DM persisted after the adjustment for BMI, total calorie intake and other factors. |
| Sakurai, et al.[24] | The frequency of SSB intake was positively associated with BMI and total calorie intake. | After controlling for BMI, total calorie intake and other factors the hazard ratio for developing T2DM as a result of SSB intake was no longer significant. |
| Teshima, et al.[25] | The influence of SSB intake on total calorie intake and unadjusted BMI is not reported. | The logistic analysis did not consider BMI, weight or total calorie intake. |
| The Interact consortium[26] | The frequency of SSB consumption is associated with higher calorie intake. | Multivariate analyses showed that the significant association between SSB intake and T2DM persisted after the adjustment for BMI, total calorie intake and other factors. |
| Rahman, et al.[30] | The influence of SSB intake on total calorie intake and unadjusted BMI is not reported. | Multivariate analyses showed that the significant association between SSB intake and heart failure in males persisted after the adjustment for BMI, total calorie intake and other factors. |
| Yang, et al.[31] | The influence of SSB intake on total calorie intake and unadjusted BMI is not reported. | Sugar consumption is significantly associated with cardiovascular mortality after the adjustments were made for BMI, total calorie intake and other factors. |
| Micha, et al.[32] | The influence of SSB intake on total calorie intake and unadjusted BMI is not reported. | This analysis did not did not consider the role of BMI, weight or total calorie intake. |

however, important to remember that such projections are based on certain assumptions.[34] For example, the assumption is made that a 10% tax will result in a corresponding 10% increase in the retail price, i.e. that retailers and manufacturers will not absorb the cost of the added tax.[38] It is a useful exercise to consider how taxation has actually impacted on SSB sales and consumption in countries where such measures have been adopted. For example, in Berkley (California) a penny per fluid ounce (1¢/oz.) taxation on beverages with added caloric sweeteners was approved at the end of 2014.[39] Here they found that >100% of the SSB tax was passed on to consumers by gas stations and grocery chain stores, but less so by pharmacies and independent corner shops or gas stations. Overall, there was a 67% "pass-through" of tax. There are also questions regarding the potential of a price increase to induce a sustained decrease in SSB intake and whether the food industry will attempt to counter this, e.g. by employing more aggressive marketing strategies.[38,40] Here Mexico is a valuable example to consider as they implemented a 1 peso-per-liter SSB tax in January 2014 in an attempt to curb the high prevalence of overweight, obesity and diabetes. Early data indicated that there was an average decrease of 6% in sales during the first year after the tax implementation.[40] A follow-up study showed that the decrease in SSB sales was not only sustained, but declined even further during the second year after the tax implementation.[41] A final concern regarding the projections above is that it makes assumptions regarding the extent to which SSB-derived calories will be replaced by the consumption of alternative (untaxed) food or beverages. Although this does not exclude the possibility that SSBs might be replaced with other unhealthy dietary options, the decrease in SSB sales was accompanied by a substantial increase in the purchase of bottled water in Berkeley and Mexico, respectively.[39,42,43]

Despite all the evidence that supports the notion that a sugar tax has the potential to bring a significant and sustained reduction in SSB consumption, there is not agreement that it would be the correct strategy for South Africa. The Beverage Society of South Africa also projects that the introduction of a sugar tax will lead to the loss of around 60 000 jobs in the beverage industry and also cut their contribution to the South African GDP by approximately R14 billion.[44] However, the National Treasury has opposed this argument, claiming the job losses as a result of the sugar tax will be 5 000, at most.[45] Additionally it was argued that the significant economic burden of non-communicable diseases should also be taken into account. Although the net effect of the sugar tax on the South African economy remains to be seen, there may be reason for concern. Denmark repealed its long-standing SSB tax in 2014 after deeming it ineffective and detrimental to the economy.[46] Berkeley, on the other hand, observed a substantial increase in tax revenue without a significant decrease in store revenue per purchase (compared to non-Berkeley stores).[39]

To conclude, there is robust evidence that high SSB consumption contributes to the onset of cardio-metabolic diseases. Early data from Mexico and Berkeley suggest that a sugar tax may be an effective strategy to reduce SSB intake and counter the rising prevalence of non-communicable diseases. In light of all the evidence here reviewed, it is our strong recommendation that it is worth pursuing the "sugar tax" option in South Africa as part of a multi-pronged strategy to reduce SSB consumption and curb the onset of cardio-metabolic diseases. It is, however, clear that the potential benefits (or detrimental outcomes) of a sugar tax within the South African context is not entirely predictable yet. Thus additional well-designed, long-term studies are required to determine the true impact of such a tax in South Africa. Such a study should include a large, representative sample and complete data sets on beverage sales and consumption over a long pre-tax period. In addition, it would be important to determine other changes in dietary patterns that are encouraged, or discouraged, by the sugar tax, e.g. increased consumption of artificially sweetened beverages. The impact on unemployment and gross domestic product should also be evaluated and compared against the projected savings that should accrue due to improved public health and well-being.

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