

The Possible Impact of Different Pack Sizes of Carbonated Soft Drinks on Sugar Intake in Nigeria

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Abstract

Background : According to WHO, in 2022, 16% of adults and 8% of children and adolescents globally were living with obesity. In Nigeria, the adult obesity prevalence was around 15%. Excessive intake of added sugars – particularly in the form of sugar-sweetened beverages – increases overall energy intake, obesity and the risk of non-communicable diseases (NCDs). WHO recommends reducing the intake of added sugars to $\leq 10\%$ of total energy intake, and further to $< 5\%$ for additional health benefits. The current trend of 600-ml bottles of carbonated soft drinks - being popularized in the Nigeria market - contributes to the “supersizing” phenomenon, which might be an important contributor to the rise in obesity rates in Nigeria. Although the National Policy on Food Safety and Quality - and its Implementation Plan 2023 seeks to address this concern through its development and implementation of a national strategic plan/guideline for the reduction/reformulation of sugar in packaged and processed foods, there is a gap in implementation due to lack of policies that regulate pack sizes of sugar-sweetened beverages. Controlling pack sizes and sugar content of carbonated soft drinks may be a public health regulatory measure that could contribute to placing Nigeria ‘on track’ towards achieving its target of reducing obesity.

Objective : This study estimates the possible impact of different pack sizes and the establishment of a maximum sugar level of carbonated soft drinks on sugar intake in Nigeria, based on the assumption that consumers entirely consume a single pack per day.

Methodology : The pack sizes and level of sugar in the carbonated soft drinks were estimated by this study from on-pack nutrition food labels of the 16 randomly selected brands in the open markets and supermarkets in Nigeria. An online questionnaire, which asked 42 correspondents in several States of the Federation about their consumption of carbonated soft drinks daily or weekly, was used to estimate intake daily. The assessment of sugar intake and its associated risk to health from different pack sizes was done according the Codex Nutritional Risk Assessment. Comparison of the estimated intakes were made based on the recommended maximum level of sugar intake from the WHO Sugar Guidelines.

Result and Discussion: The average sugar content of the carbonated soft drinks was 8.3-g per 100-ml. The estimated intake of sugar increased with pack size, from 16.6-g per day (200 ml pack) to 49.8-g per day (600-ml pack). The risk of excessive sugar intake from 200-ml to 250-ml pack was low, from 300-ml to 330-ml pack medium, and from 350-ml to 600-ml pack high. A high-risk score indicated the possibility to exceed the WHO-recommended maximum daily sugar intake and the need for risk management strategies. If the proposed maximum sugar level of 5-g per 100-ml of carbonated soft drinks was implemented, the estimated risk of excessive sugar intake from 200-ml to 450-ml pack became low, from 500-ml to 550-ml pack medium, and from 600-ml pack high. The estimated relative risk reduction was 40%. This suggests that the likelihood of exceeding the WHO-recommended maximum daily sugar intake is 40% less if maximum sugar level for carbonated soft drinks is set at 5-g per 100-ml. From the questionnaire, the estimated average intake of carbonated soft drinks daily was 335-ml. Using this value and the average sugar content estimated in this study, the estimated sugar intake from carbonated soft drinks was 27.8-g per day (which is more than 50% of the WHO-recommended maximum daily sugar intake).

Conclusion and Recommendation: The consumption of carbonated soft drinks increases the risk of excessive sugar intake and is likely to be a major reason behind the rise in obesity in Nigeria. The establishment of a pack-size cap of 450-ml with a maximum sugar concentration of 5-g per 100-ml of the product, would be expected to significantly reduce this risk.

Keywords: Dietary Intake Assessment, Added Sugars, Soft Drinks, WHO Sugar Guidelines, Pack Size Regulation.

Introduction

In 2022, 16% of adults and 8% of children and adolescents globally were living with obesity (WHO, 2022). In 2022, studies showed Nigeria's adult obesity rate was around 15% (Ramalan et al., 2023). There is increasing concern that the intake of added sugars – particularly in the form of sugar-sweetened beverages – increases overall energy intake and may reduce the intake of foods containing more nutritionally adequate calories, leading to an unhealthy diet, obesity and an increased risk of non-communicable diseases (NCDs). WHO recommends reducing the intake of added sugars to less than 10% of total energy intake, which translates to less than 50-g added sugar in a 2,000 kcal diet (WHO, 2015). In one study, nearly all (97.2%) adolescent Nigerians were found to be consuming at least 330-ml of soft drink a day (Victor et al., 2008). The current trend of 600-ml bottles of carbonated soft drinks in the market could contribute to the rise in obesity rates in Nigeria.

People tend to consume more when they are presented with larger pack sizes. This is largely caused by “unit bias” - which meant that the pack size or quantity provided is automatically perceived to be the appropriate amount to consume (OECD, 2019). Studies have shown that pack size control alone can have an impact in promoting behaviour change and reducing obesity (Dobbs et al., 2014). A comprehensive analysis by the OECD confirmed this and favoured smaller portion (pack) sizes as a public health tool to reduce consumption of energy-dense foods (OECD, 2019). The German government already adopted this strategy in its approach to tackle diabetes and obesity among children and adolescents (Deutscher Bundestag, 2020).

Although the National Policy on Food Safety and Quality and its Implementation Plan 2023 seeks to address this concern through its key activity to develop and implement a national strategic plan/guideline for the reduction/reformulation of sugar in packaged and processed foods as well as spices, there is a gap in implementation due to a lack of policies that regulate the pack sizes of sugar-sweetened beverages (Federal Ministry of Health and Social Welfare, 2023). Yet controlling pack sizes and sugar content of carbonated soft drinks may be a highly effective public health regulatory measure that could contribute to placing Nigeria ‘on track’ towards achieving its target of reducing obesity. The present study estimates the possible impact of different pack sizes and a maximum sugar level cap on carbonated soft drinks on sugar intake in Nigeria.

Methods

Sugar content of carbonated Soft Drinks in Nigeria

Table 1 shows data on sugar content and pack sizes obtained from on-pack nutrition and food labels of randomly selected brands of carbonated soft drinks in open markets and supermarkets in Nigeria. Sixteen brands were included.

Table 1: Sugar content of carbonated Soft Drinks in Nigeria

S/No.	Brand Name	Sugar Content (g per 100-ml)
1	Royal crown (RC) Q orange	10.0
2	American cola	9.6
3	7 UP	6.9
4	Fayrouz	9.4
5	Chapman Schweppes	9.0
6	RC cola	9.0
7	Fanta	8.9
8	Sprite	8.9
9	Planet orange	8.9
10	Pop orange	8.5
11	Virgin Mojito Schweppes	8.4
12	Big	8.4
13	Coca-Cola (Coke)	7.5
14	Pepsi	7.1
15	Mirinda	7.0
16	Bigi	5.8
	Mean ± SD	8.3 ± 0.564

Using the information on sugar content and different pack sizes, dietary sugar intake from carbonated soft drinks was estimated according to a methodology developed by the Joint Expert Committee on Food Additives, as stated below (FAO and WHO, 2006). Table 2 shows the available pack sizes of carbonated soft drinks in Nigeria.

Table 2: Pack sizes of carbonated Soft Drinks in Nigeria

S/No.	Pack size (ml)
1	250
2	330
3	350
4	500
5	600

Some of the terms and methods used in this study are explained as follows:

- Sugar intake was calculated according to the formula:
- (Mean sugar content in grams per 100-ml of the soft drinks x pack sizes of soft drinks in-ml per day) / 100).
- The sugar intake goal was obtained from the WHO Population Intake Goals for preventing diet-related chronic diseases (WHO, 2003).
- The dietary risk was characterized by expressing the estimated dietary intake as a percentage of the WHO population intake goal for sugar.
- The intake or risk reduction formula (proposed) = (dietary intake or risk in the absence of a max. sugar level and pack size cap – dietary intake or risk when there is a max. sugar level and pack-size cap / dietary intake or risk in the absence of a max. sugar level and pack-size cap) x 100.

Result and Discussion

Table 1 showed that the estimated mean sugar content was 8.3-g per 100-ml. Although this falls within the Nigerian Industrial Standard (NIS) recommended range of 7 g/100 ml -14 g/100 ml for soft drinks [NIS 217:2008], it is classified as excessive by the Nutrient Profile Model for the WHO African Region (WHO, 2019). According to this model, the marketing of carbonated soft drinks to children should be prohibited.

The amount of energy (kcal) from added sugars in 100 ml of the drinks was estimated in this study to be 33.2 kcal, which is higher than 10% of 230 kcal set as the energy threshold for snack in the Nutrient Profile Model (WHO, 2019) as shown in table 3. When the proposed maximum sugar level was used, the amount of energy (kcal) reduced to 20 kcal, which is lower than 10% of the energy threshold. This suggests that its implementation could lead to a significant reduction in product's sugar content. Table 4 shows the average sugar content of different pack sizes of carbonated soft drinks in Nigeria (without maximum sugar level).

Table 3: Nutrient Profile Model for the WHO African Region (WHO, 2019)

Food Category	Water- based flavoured and unflavoured drinks
Examples of food items	Sport and energy drinks, electrolyte drinks, carbonated and non-carbonated water-based flavoured drinks (i.e. soft drinks), powdered juices, concentrates (liquid or solid) calculated as or in ready-to-drink form, flavoured waters (sparkling), reconstituted chocolate or malted powdered drinks, syrups, sugar cane juices
Codex Food Category code	14.1.4
Total fat (g)	No threshold provided
Saturated fat (g)	No threshold provided
Total sugars (g)	0.0
Added sugars (g)	No threshold provided
Sodium (g)	0.1
Energy (kcal)	No threshold provided

Note: Marketing is prohibited if products exceed the threshold values in this model per 100 g

Source: World Health Organization, 2018. 'Nutrient Profile Model for the WHO African Region: a tool for implementing WHO recommendations on the marketing of foods and non-alcoholic beverages to children'

Table 4: Average sugar content of different pack sizes of the carbonated Soft Drinks in Nigeria (without maximum sugar level)

Pack size (ml)	Average sugar intake (g) per pack per day	Risk of excessive sugar intake – expressed as a percentage of the not more than 50 g per day (in a 2,000 kcal diet)
200	16.6	33.2%
250	20.8	41.6%
300	24.9	49.8%
330	27.4	54.8%
350	29.1	58.2%
400	33.2	66.4%
450	37.4	74.8%
500	41.5	83.0%
550	45.7	91.4%
600	49.8	99.6%

Note: risk category is based on the probability line concept (proposed)

0% = No risk
 $\leq 45\%$ = Low risk
 $> 45\% - \leq 55\%$ = Medium risk
 $> 55\%$ = High risk
 $\geq 100\%$ = Certain

(Daily consumption of 200-ml to 250-ml packs falls under the low risk category, while 300-ml to 330-ml packs falls under medium risk. However, 350-ml to 600-ml packs falls under high risk, indicating the likelihood of exceeding the recommended maximum and highlighting the need for risk management strategies. The risk of excessive sugar intake is greatest with 600-ml pack consumption).

The estimated intake of sugar increased with pack size, from 16.6-g per day (200-ml pack) to 49.8-g per day (600-ml pack). This suggests that the consumption of a 330-ml is associated with a significant risk of excessive sugar intake and explains the rise in obesity among adolescents (Victor et al., 2008). The consumption of a 600-ml pack makes it most likely for the diet to be excessive not only in added sugars but also in energy (kcal). This pack contributes significantly to the total dietary intake of sugar. The amount of energy (kcal) from added sugars in a 600-ml pack was estimated in this study to be approximately 200 kcal, which is equal to 10% of the average total daily energy intake. Table 5 shows the average sugar content of different pack sizes of carbonated soft drinks in Nigeria (with proposed maximum sugar level).

Table 5: Sugar content of different pack sizes of the carbonated Soft Drinks in Nigeria with Proposed maximum sugar level

Pack size (ml)	Proposed maximum sugar level (5-g per 100-ml)	Average sugar intake (g per day)	Risk of excessive sugar intake – expressed as a percentage of the not more than 50 g per day (in a 2,000 kcal diet)
200	10.0	10.0	20%
250	12.5	12.5	25%
300	15.0	15.0	30%
330	16.5	16.5	33%
350	17.5	17.5	35%
400	20.5	20.0	40%
450	22.5	22.5	45%
500	25.0	25.0	50%
550	27.5	27.5	55%
600	30.0	30.0	60%

Note: risk category is based on the probability line concept (proposed)

0% = No risk

≤ 45% = Low risk

> 45% - ≤ 55% = Medium risk

> 55% = High risk

≥ 100% = Certain

(Daily consumption of 350-ml to 450-ml packs falls within the low risk category, indicating an unlikely chance of exceeding the recommended maximum. Consumption of 500-ml to 550-ml packs falls within the medium risk category, whereas 600-ml pack falls within the high risk category. This demonstrates a predicted reduction in risk through the proposed sugar content regulation).

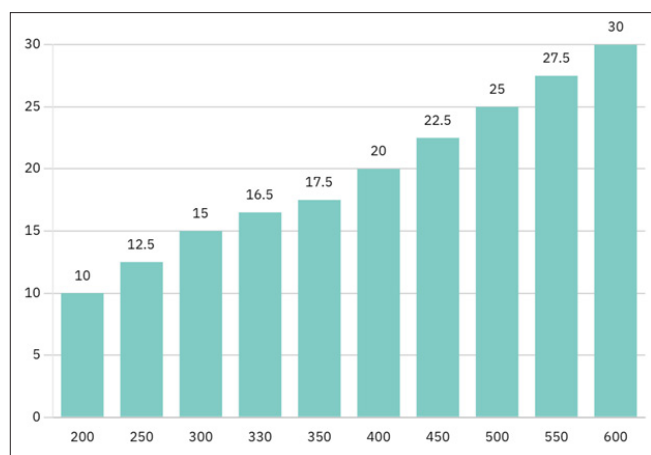


Figure 1: Maximum sugar intake of different pack sizes of the carbonated Soft Drinks in Nigeria when the recommended maximum sugar level is implemented

This chart shows a significant reduction in sugar intake when a maximum sugar level of 5-g per 100-ml was implemented as a strategy for managing the risk of excess sugar intake from carbonated soft drinks. It shows that the maximum sugar

intake from a 600-ml pack falls below the WHO-recommended maximum daily sugar intake for a 2000 kcal diet. This suggests that benchmarking at 450-ml with a maximum sugar content of 5-g per 100-ml would mitigate the risk of excessive sugar intake.

The estimated risk of excessive sugar intake from 200-ml to 250-ml packs was low, 300-ml to 330-ml packs was medium, and 350-ml to 600-ml packs was high. A high-risk score indicates a high risk of exceeding the WHO-recommended maximum daily sugar intake and highlights a need for risk management strategies (WHO, 2003). Implementing a pack size cap of 450-ml, without the proposed maximum sugar level of 5-g per 100-ml of carbonated soft drinks, still places consumers at a high risk. When the proposed maximum sugar level of 5-g per 100-ml of carbonated soft drinks was used, it was estimated that the risk of excessive sugar intake from 200-ml to 450-ml packs was low, 500-ml to 550-ml packs was medium, and 600-ml pack was high. This also suggests that the current trend of a 600-ml pack in the market poses a high risk to health. Recent study has shown that sugar-sweetened beverage (SSB) intake was linked to a 10% increased cardiovascular disease (CVD) mortality risk (Jamali et al., 2025). The elimination of a 600-ml pack from the market would have a significant positive health impact on the population.

The risk reduction was estimated to be 40% using the formula explained under the methodology of this study. This reduction suggests that the likelihood of exceeding the WHO-recommended maximum daily sugar intake was 40% less if the proposed maximum sugar level for carbonated soft drinks was set at 5-g per 100-ml. The implementation of the proposed maximum sugar level and pack size cap was estimated to significantly reduce the sugar intake from the carbonated soft drinks, and subsequently, the risk of obesity. A recently published modelling study measured the impact of reducing the serving size of all “single serve” sugar sweetened beverages (SSB) to a maximum size of 250-ml. It was shown that such a 250-ml cap on “single serve” SSB could be an effective contribution to obesity prevention (Raghoobar et al., 2019).

Conclusion and Recommendation

This study concluded that an increase in the pack sizes of carbonated soft drinks correlates positively with sugar intake. This increases the risk of excessive sugar intake and is likely to be one of the major factors contributing to the rise in obesity in Nigeria.

We recommend the implementation of policies that support 450-ml pack size and 5-g sugar per-100 ml caps. There was an unlikely chance of exceeding the WHO-recommended maximum daily sugar intake when the carbonated soft drink environment was regulated by these caps. In addition, the marketing of these drinks to children should be prohibited. This would contribute significantly to national efforts to reduce the population burden of obesity and related chronic diseases, such as Type 2 diabetes and achieving WHO global diet-related non-communicable disease targets.

Assumption

1. The on-pack sugar content data reflect the correct analytical data.
2. The estimation of added sugars is based on the total amount of sugars declared on the product packaging. The product is a food with no or minimal amounts of naturally occurring sugars.

Conflict of Interest

No conflict of interest.

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