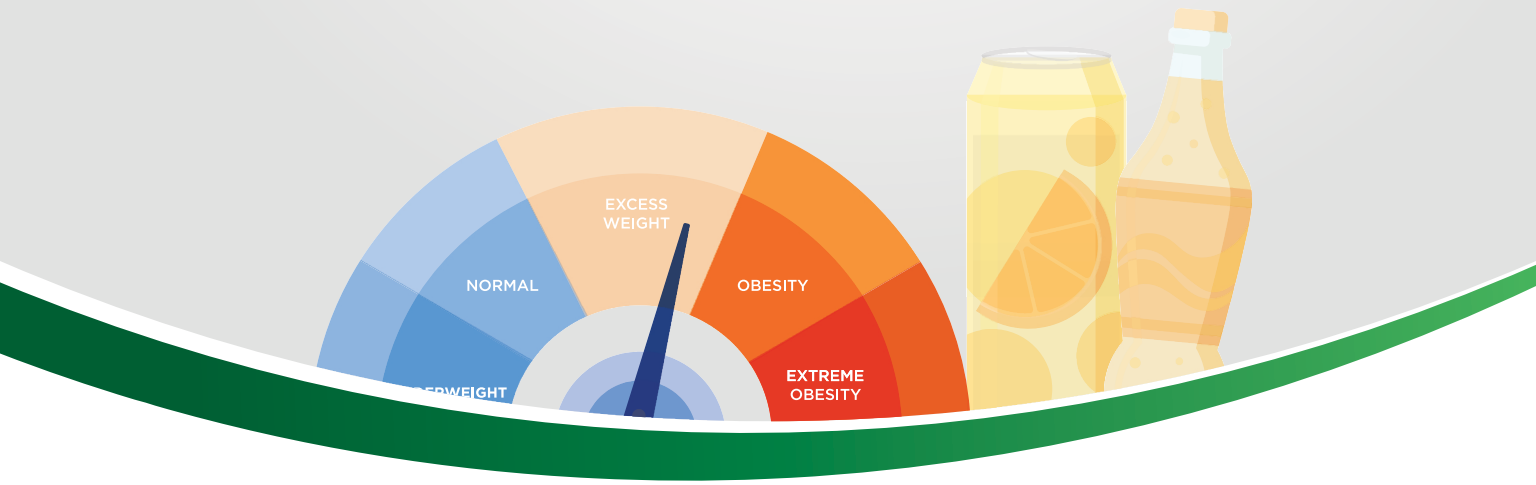
POTENTIAL FISCAL AND PUBLIC HEALTH EFFECTS OF **SUGAR-SWEETENED BEVERAGE TAX IN NIGERIA**



CAPPA
Corporate Accountability & Public Participation Africa

SUGAR SWEETENED BEVERAGES TAX COALITION

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About CAPPA

Corporate Accountability and Public Participation Africa (CAPPA) is a pan-African nongovernmental organization that works to advance human rights, challenge corporate abuse of natural resources, and build community power for inclusive development and participatory governance.

CAPPA is passionately devoted to nurturing movements of African communities and a new generation of leaders working shoulder to shoulder to demand democratic management and governance of natural resources, accountability from power structures, inclusive participation in development processes, and an end to all forms of corporate and state abuses.

CAPPA envisions a continent whose development path is designed, modelled, and executed by Africans – respecting and guaranteeing human rights, enabling social justice, and ensuring harmony with the environment.

Table of Contents

Acknowledgement

The Corporate Accountability and Public Participation Africa (CAPPA) extends its gratitude to the Centre for the Study of Economies of Africa (CSEA) for leading this study, which will contribute significantly to the improvement of Nigeria's health outcomes by enabling data-driven policy decisions and interventions to combat Non-Communicable Diseases (NCDs).

Many thanks to our partner, the Global Health Advocacy Incubator (GHAI), for their financial and technical support. Special thanks to Joy Amafah, the In-country Coordinator of GHAI, for her strategic guidance.

Our team appreciates all members of the National Sugar Sweetened Beverages Tax Coalition for garnering grassroots support and creating public awareness about the health impacts of consuming SSBs on Nigerians.

Executive Summary

In recent years, Sugar-Sweetened Beverages (SSBs) have gained prominence as a significant public health concern in Nigeria (Darsamo & Walbeek, 2023).

This report aims to provide a comprehensive overview of SSB consumption patterns, their profound health implications, fiscal considerations, and policy recommendations to address the growing health and economic challenges stemming from SSB consumption in Nigeria.

Using data from a dedicated survey conducted by the Centre for the Study of the Economies of Africa (CSEA) in 2023 on SSB consumption patterns in Nigeria, the report begins by examining SSB consumption trends, revealing noticeable gender and age disparities. Males consistently exceed females in SSB consumption across all age groups. The peak SSB consumption occurs among individuals aged 15 - 19, with carbonated drinks being the primary product of choice. These findings outline the vulnerability of Nigerian youth to excessive sweetened beverage intake, necessitating policy interventions to decrease consumption.

> *The peak Sugar-Sweetened Beverages consumption occurs among individuals aged 15 - 19*

For the simulation exercise, the study employs a mathematical model incorporating relevant parameters to demonstrate the effects of a proposed tax increase on SSBs. This model assesses how a tax increase would influence SSB prices, consumption, the prevalence of obesity and overweight, and government revenue. Our modelling tool leverages economic principles, such as price and cross elasticities, to simulate the consequences of increasing taxation.

SSB consumption is closely linked to various detrimental health outcomes, including

- obesity
- type 2 diabetes
- cardiovascular disease
- different types of cancers

In line with Section 17 of the Finance Act, 2021, the categories of SSBs covered in this simulation are soft drinks, energy drinks, and malt. This definition excludes 100% fruit and vegetable juices. Within the Nigerian context, where SSB consumption is also on the rise, the report emphasizes the urgency of addressing these health risks. An annual decrease of 29% is expected for aggregate consumption of SSBs in Nigeria following a practical implementation of the SSB Tax. The simulation results further indicate a significant reduction in BMI (Body Mass Index). Specifically, the tax is estimated to reduce BMI by 4% on aggregate over a 5-year period, thereby yielding a decline in the mean prevalence of overweight (0.42% for males and 0.37% for females) and obesity (0.46% for males and 0.53% for females) if effective SSB taxation at a rate of N130 is implemented. Such measures hold the potential to not only save lives but also curtail healthcare costs and enhance overall public health.

An annual decrease of 29% is expected for aggregate consumption of SSBs in Nigeria following a practical implementation of the SSB Tax

Beyond public health benefits, the SSB tax increase presents a unique opportunity to bolster government revenue. The report estimates that implementing an SSB tax in Nigeria could result in a substantial increase in tax revenue. Specifically, revenue from this excise tax is estimated to rise by 972% (amounting to N729 billion). This additional revenue could be strategically allocated through earmarking to strengthen the country's healthcare system, particularly basic healthcare, which currently grapples with inadequate funding. The potential to enhance healthcare infrastructure and address diet-related diseases through SSB taxation cannot be overstated.

Sequel to the findings, the report suggests a set of policy recommendations to address the growing SSB consumption crisis in Nigeria.

Firstly, it advises the Nigerian government to consider a significant increase in the existing SSB tax rate, potentially setting it at a minimum of N130 per litre. This tax increase is estimated to trigger a substantial price surge of 39% increase per litre, thereby discouraging consumption effectively by about 29% annually. In order to ensure persistent health gains from the SSB tax, it is very important to regularly review the tax rate upward while accounting for inflation effect.

Also, comprehensive awareness campaigns should be initiated to educate the public on the benefits of the tax and the health risks of excessive SSB consumption. These campaigns should highlight the fact that the increase in SSB price is a protective public health measure and not a "price burden", and consumers should be encouraged to embrace healthy alternative beverage choices.

In summary,

this research provides a thorough examination of Nigeria's SSB landscape, emphasizing the critical need to address SSB consumption trends and their far-reaching health and economic ramifications. If implemented and the tax rate is significantly increased over time to account for inflation, a N130 tax has the potential to significantly enhance public health, healthcare financing, and general well-being in Nigeria. Our study represents the first comprehensive analysis of the economic, health, and fiscal implications of an SSB tax in Nigeria, making it a pioneering contribution to the field of public health and taxation in the country.

List of Abbreviations and Acronyms

AUD	Australian Dollar
BMI	Body Mass Index
DALYs	Disability-Adjusted Life Years
DHS	Demographic and Health Surveys
GDP	Gross Domestic Product
NCDs	Non-Communicable Diseases
NOT	Net-of-Tax
RP	Retail Price
SSB	Sugar-Sweetened Beverage
USD	United States Dollar
VAT	Value-Added Tax
WHO	World Health Organization
WOF	World Obesity Federation
ZAR	South African Rand

1.0 »»

Introduction

The Sugar-Sweetened Beverage (SSB) tax is a levy on drinks high in sugar, such as soda or soft drinks, energy drinks, and sports drinks (UNICEF, 2022). Specifically, WHO defines Sugar-Sweetened Beverages (SSBs) as non-alcoholic drinks containing high-fructose corn syrup or sucrose. They include fruit beverages, soft drinks, energy drinks, and sweetened iced teas (WHO, 2022) The main goal of an SSB tax is to discourage the consumption of these unhealthy beverages, which can lead to obesity, diabetes, and other health problems (Yoshida, 2018). Over 100 governments worldwide are implementing SSB taxes to address the growing problem of obesity and related health issues (Hattersley, & Mandeville 2023). For example, in 2014, Mexico implemented a 1 peso/litre tax (equivalent to approximately 10%) on SSBs, including soda, energy drinks, and sweetened fruit drinks. The tax was increased to 12% in 2018 (Carriedo *et al.* 2021). Evidence shows that this tax has successfully reduced consumption of SSBs and generated revenue for public health initiatives (PAHO 2015; Le Bodo *et al.*, 2022).

The main goal of an SSB tax is to discourage the consumption of these unhealthy beverages, which can lead to obesity, diabetes, and other health problems

Also, in 2014, Berkeley, California, became the first city in the United States to implement a tax on SSBs. The tax applies to all SSBs, including soda, sports drinks, and energy drinks. The tax is earmarked to fund health promotion initiatives using the revenue generated from the tax, including improving access to healthy foods and physical activity programs (*Falbe et al., 2020*).

Some African countries have also implemented SSB taxes, and some are considering doing so to address the growing problem of obesity and related health issues. In 2018, South Africa implemented a sugar-content based tax on SSBs, which applies to all non-alcoholic beverages with added sugar, with the exception of fruit juices. The tax rate is 2.1 cents per gram of sugar for most beverages, with at least 4g per 100ml (Sulcas, 2021).

In 2021, Nigeria joined more than 100 other countries that have introduced taxes on SSBs. The SSB tax, embedded in the Finance Act 2021, levies a ₦10 tax on each litre of all non-alcoholic, sweetened, and carbonated drinks (Nwagboso, 2021).

Empirical evidence suggests that SSB taxes can effectively improve public health by reducing the consumption of sugary drinks, encouraging healthier beverage choices, and potentially generating revenue for health promotion initiatives (*Stacey et al., 2019*). Even small changes in dietary behaviour induced by taxes on SSBs can lead to reductions in the incidence of Non Communicable Diseases (NCDs), significant decreases in population-level morbidity and mortality, and reduction in the 'associated costs to society, the environment and the economy' (WHO 2022).

Modeling studies have consistently shown that effective taxes on SSBs can lead to significant reductions in Disability-Adjusted Life Years (DALYs). For instance, in South Africa, a 20% tax on SSBs was predicted to avert 8,000 type 2 diabetes-related premature deaths over 20 years (Saxena et al. 2019a). A 20% tax on SSBs was predicted to reduce obesity prevalence by more than 3% in men and more than 2% in women (Manyema et al. 2014).

Similarly, in Indonesia, a potential US¢30 per litre tax on SSBs was predicted to reduce cases

of overweight and obesity by 15,000 for women and 12,000 for men in the lowest-income quintile and by 417,000 for women and 415,000 for men in the highest-income quintile (Bourke and Veerman 2018). In addition, a tax could avert 63,000 cases of diabetes in the lowest quintile and 1,487,000 in the highest over 25 years (Bourke and Veerman 2018). Moreover, in the Philippines, a 13 % on SSBs was predicted to avert 5,913 deaths related to diabetes, 10,339 deaths from ischemic heart disease (IHD), and 7,950 deaths from stroke over 20 years (Saxena et al. 2019b) .

Beyond preventing poor health outcomes with taxes on SSBs, the fiscal measure can account for several market failures, including negative externalities imposed on society by the activities of sugar-sweetened beverage industries. When taxes are imposed on SSBs, it often results in a substantial increase in government revenue. For example, evidence on the fiscal impact of the SSB tax in Mexico shows that the tax policy generated approximately USD 1.2 billion in its first year (UNICEF 2022).

Evidence from several studies has also shown that SSB taxes effectively raise public revenue for health sector financing. Tonga (a middle-income country) generated T$8.4 million in SSB tax revenue in 2017/18 (Teng et al. 2020). Australia raises about AUD 642.9 million in SSB tax revenue annually (Veerman et al. 2016). Furthermore, simulation analysis shows that the Philippines raised PHP 41.0 billion (USD 813 million) in revenue per year, and South Africa raised ZAR 6 billion (USD 450 million) in tax revenue annually (Saxena et al. 2019a).

The initial evidence from other countries that have implemented SSB taxes suggests that the fiscal policy is an effective strategy for reducing the consumption of sugary drinks and the health and economic burden of the products.

To achieve the public health objective of increasing the SSB tax in Nigeria, empirical evidence on the likely fiscal and health impact of the SSB tax in Nigeria is provided in this study.

EFFECTS OF SSB TAX IN OTHER COUNTRIES

Simulation analysis shows that the Philippines raised PHP 41.0 billion (USD 813 million) in revenue per year

$813m SSB tax generated

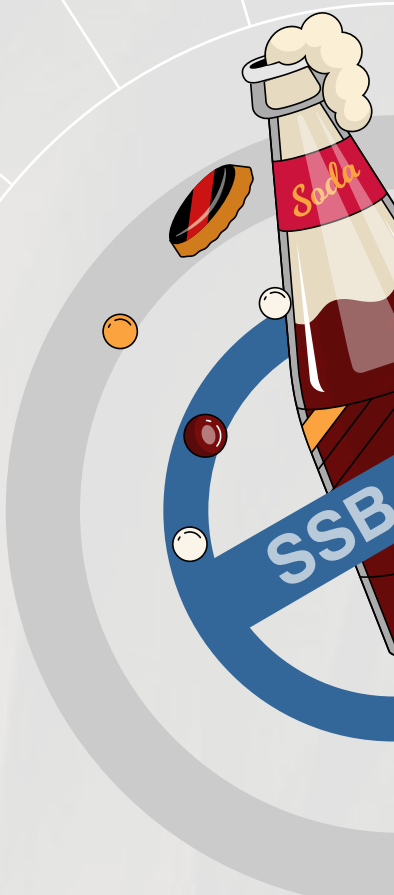
$1.2b tax generated

In Mexico, evidence on the fiscal impact of the SSB tax in Mexico shows that the tax policy generated approximately USD 1.2 billion in its first year

In Berkeley, California, United States, it was earmarked to fund health promotion initiatives using the revenue generated from the tax, including improving access to healthy foods and physical activity programs

In Mexico, SSB tax successfully reduced consumption of SSBs and generated revenue for public health initiatives

In Indonesia, a potential US¢30 per litre tax on SSBs was predicted to reduce cases of overweight and obesity by **15,000** for women and **12,000** for men in the lowest-income quintile and by **417,000** for women and **415,000** for men in the highest-income quintile



South Africa raised ZAR 6 billion (USD 450 million) in tax revenue annually

$450m SSB tax generated

Australia raises about AUD 642.9 million in SSB tax revenue annually

AUD642.9m SSB tax generated

Tonga (a middle-income country) generated T$8.4 million in SSB tax revenue in 2017/18

T$8.4m SSB tax generated

In South Africa, a 20% tax on SSBs was predicted to avert 8,000 type 2 diabetes-related premature deaths over 20 years

8000 type 2 diabetes-related premature deaths to be averted

to reduce obesity prevalence by more than 3% in men and more than 2% in women

1.1 Background to SSB consumption patterns in Nigeria

In the 2018 Demographic Health and Surveys (DHS) data, we gain valuable insights into the consumption patterns of SSBs in Nigeria, with a specific focus on malt, carbonated drinks, and fruit juice, broken down by gender and age groups. The average volume, measured in litres, and consumed by individuals who partake of these beverages, reveal some interesting trends.

For malt consumption, it is evident that males tend to consume slightly more than females across all age groups. The peak consumption of malt occurs in the 20–24 age group for both genders, after which it notably decreases among individuals aged 45 and above. Moving on to carbonated drinks (Coca-Cola products, energy drinks), males consistently outpace females in their consumption. The highest average consumption is seen among individuals aged 15–19, followed by a relatively steady trend for males. Among females, there is a decline in consumption after the 15–19 age group, with a subsequent increase observed in those aged 65 and over. Fruit juice consumption patterns show more gender similarity, with males and females displaying comparable trends. The age group with the highest average consumption of fruit juice is 25–29, and consumption wanes among individuals aged 40 and above for males and 35 and above for females.

In general, these data highlight that, younger individuals, particularly those in their late teens and early twenties, tend to be more significant consumers of SSBs, including malt, carbonated drinks, and fruit juice.

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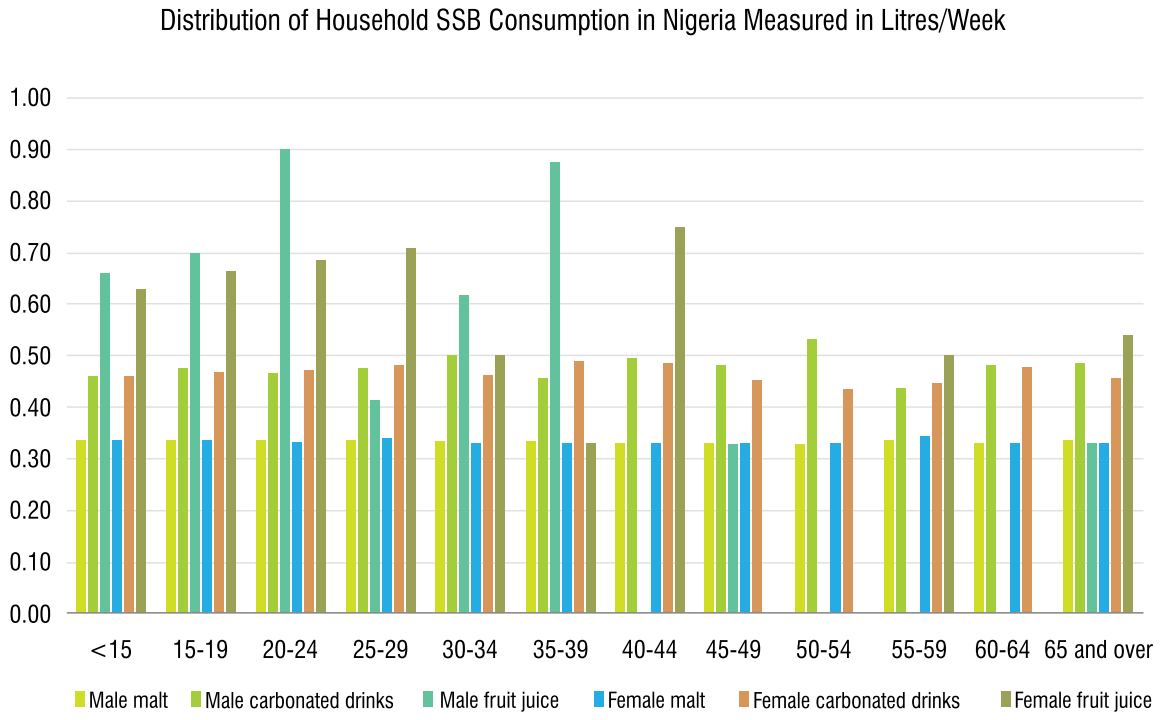
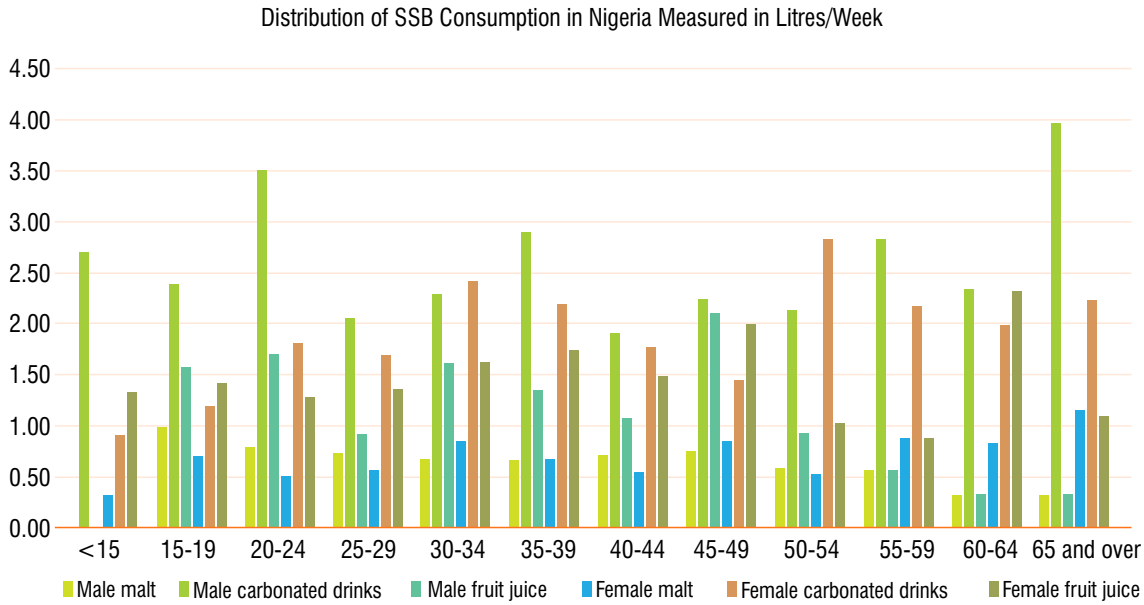


1.2 Improved survey data

This study focuses on individual SSB consumption patterns in Nigeria; the primary weakness observed in the 2018 DHS survey data is its focus on households rather than individuals. Household heads responded on behalf of all household members, making it challenging to gauge individual-level SSB consumption patterns accurately. This study included a dedicated supplemental survey of individual consumers, specifically targeting the required age categories and genders. The survey accounted for variations within households, and considered factors that influence consumption.



The survey data provides insights into the consumption of SSBs, including malt, carbonated drinks (soft drinks and energy drinks), and fruit juice, based on gender and age groups in Nigeria. Regarding malt consumption, males have the highest average consumption in the 15–19 age group, gradually declining as they age. In contrast, females peak in malt consumption in the 45–49 age group. This reveals gender-specific variations in malt consumption trends. Carbonated drinks consumption trends are somewhat different. Both males and females tend to consume the most carbonated drinks in the 65 and over age group, suggesting a preference for these beverages among older demographics. However, it is notable that males consistently consume more Carbonated drinks than females across all ages. Our findings are consistent with recent findings by Lara-Castor *et al*. (2023) which show that by age and region, from 1990 to 2018, SSB intakes increased most in Sub-Saharan African adults, Nigeria inclusive.

Fruit juice consumption patterns exhibit variations as well. Among males, the 30–34 age group shows the highest average consumption, followed by a gradual decline. For females, the 65 and over age group has the highest fruit juice consumption. These findings emphasize the complexity of SSB consumption habits in Nigeria, with distinct patterns emerging for malt, carbonated drinks, and fruit juice.

2.0 »»

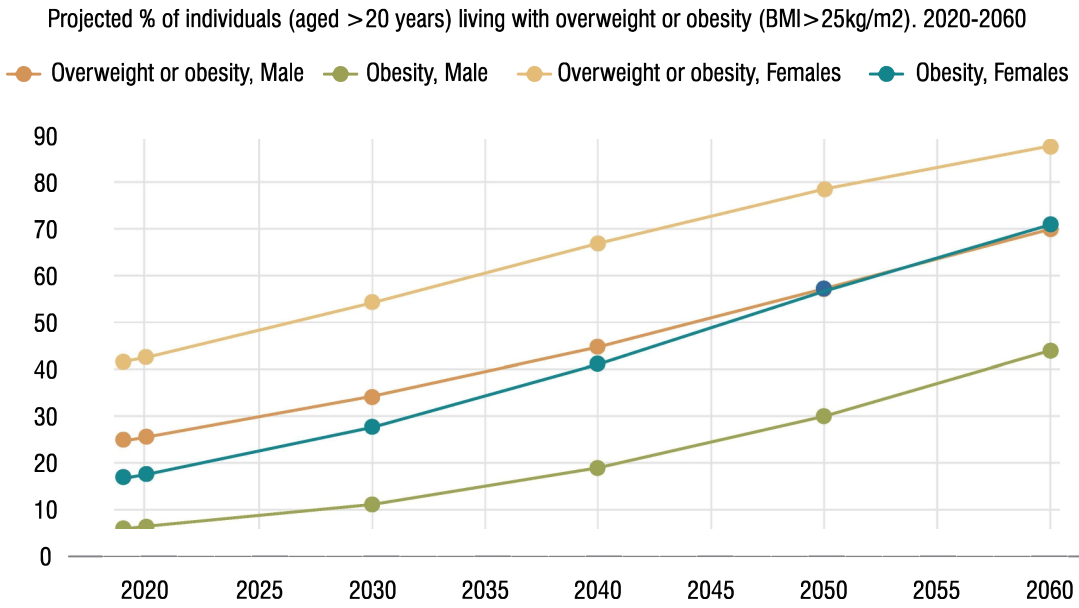
Diseases induced by SSB consumption

Globally,

184,000^{+} deaths

are associated with the consumption of sugar-sweetened beverages (SSBs) every year (Alcaraz et al. 2021)

According to a WHO report in 2022, regular consumption of sugar-sweetened drinks is linked to an increase in the risk of obesity and weight gain, type 2 diabetes, dental cavities , stroke, heart disease and different types of cancer. While the number in Nigeria is not known, the trajectory in SSB consumption suggests a higher health burden in future. The World Obesity Federation (WOF) forecasts a higher rate of obesity and overweight in Nigeria which is associated with high health risks. The WOF data also shows that Nigeria has a high national obesity risk with a score of 7.5/10. The WOF also shows that Nigeria's chance of meeting the UN adult obesity targets for 2025 is very poor for both men and women.



2.1 Policy on SSB consumption in Nigeria

Nigeria ranks fourth globally in SSB consumption, with an annual sale of approximately 38.6 million litres in a market valued at US$16.87 billion in 2023, projecting a notable annual growth rate of 16.63% (Iwelunmor, 2023).

The World Health Organization (WHO), and the World Bank recognize taxation as one of the most cost-effective strategies to globally reduce SSB consumption, drawing inspiration from successful implementations in countries such as South Africa, the United Kingdom, and Mexico (WHO, 2022).

As an attempt to discourage the intake of sugar-sweetened beverages, the Nigerian government introduced a tax of N10 per litre on all non-alcoholic and SSBs in 2021 as part of the Finance Act. The tax aims to prevent and discourage excessive consumption of sugar, which contributes to obesity, diabetes, and other diseases, while also raising government revenue.

Nigeria ranks 4th in SSB consumption

38.6 million litres
in annual sales (US$16.87 billion)

N10 tax per litre
introduced by the Nigerian government to discourage excessive consumption

3.0 »»

Methodology

3.1 Sources of health, pricing and tax data

For the BMI (Body Mass Index) baseline data, this study relied on Adeloye et al, (2020), which estimated the absolute number of obese and overweight persons in Nigeria, aged 15 years or more in 2020. We gathered baseline pricing information for SSBs by conducting an internet search across popular retail stores and supermarkets in Nigeria. Although there were minor price variations among these products due to differences in retail locations, size, and brand, we converted the sizes to litres (for instance, a 50cl Coca-Cola product becomes 0.5litres) and calculated the average price for each product category.

Survey study area

In the case of the SSB consumption patterns baseline data, the study area encompasses three distinct Nigerian cities: Lagos, Onitsha and Kano. According to Statista (2022), Lagos, situated in Southwest Nigeria, was projected to have a population of 15.388 million in 2022, making it the most populous urban centre in the country. In Northern Nigeria, Kano city was home to an estimated 4.103 million individuals in the same year, contributing significantly to the region's demographic landscape. Onitsha, located in Southeast Nigeria within Anambra state, accommodated a projected population of 561

thousand individuals in 2022. These cities were purposively selected to provide a diverse representation of urban centres within major regions of the country. The choice was made to capture variations in SSB consumption patterns across different geographic locations.

3.2 Sampling technique and procedure

To facilitate the selection of a representative sample, a stratified random sampling technique was employed. This method involved stratifying the population solely by city. We targeted individuals residing in these three distinct cities across three major regions. The population of these cities is quite large, estimated at millions of residents collectively. The sampling frame included all individuals who consume SSBs, spanning various age groups, genders, and socio-economic backgrounds. Within each stratum, random sampling was employed to select survey participants.

3.3 Sample size

The survey employed a sample size of 1200 individuals, including males and females, across various age categories, and evenly distributed across the cities. This sample size is sufficient for achieving a margin of error of +/-5% with a 95% confidence level, and robust to reveal statistically significant distinctions between various subgroups.

Sample Size

1200 individuals

3.4 Model specification

The model for this study consists of an initial equilibrium or baseline period, which is the current SSB tax structure and a level of 10 Naira (N) on each litre (US$0.02 /litre) of sugar-sweetened beverages. Through simulations, new equilibria will emerge that capture the effects of policy changes on baseline tax structure and level of the key outcomes.

i. The impact of a tax change on the price

An increase in the excise tax is expected to increase the retail price of SSBs. However, the degree to which the tax will increase the retail price depends on the industry's price response. This could be over-shifting of the tax, under-shifting of the tax, or full tax pass-through. The industry response is accounted for in our model through changes in the net-of-tax (NOT) price. If the retail price in the base period is represented as

$$RP_{baseline} = (NOTP_{baseline} + EX_{baseline})(1 + VAT_{baseline})$$

Assuming the SSB industry has increased the NOT price by 100 ά % as a result of the tax, this will be represented as:

$$RP_{new} = [NOTP_{baseline}(1 + \alpha) + EX_{baseline} + EX_{new}](1 + VAT_{baseline})$$

The alpha can be negative (if the tax is under-shifted), positive (if the tax is over-shifted), or zero (if there is a full tax pass-through).

ii. Impact of price on consumption

The modelling also reveals how the increased price could affect the consumption of SSBs. The magnitude of this effect will depend on two key parameters: (a) the own-price elasticity, which is the responsiveness of changes in consumption of SSBs to changes in the price of the product, and (b) the cross-price elasticity, which shows the strength of the substitution away from SSBs to other relatively cheap substitutes.

(a) The own-price elasticity

We used the midpoint or arc formulation of the own-price elasticity for the model as follows:

$$Arc\ \epsilon_d = \frac{Q_2 - Q_1}{Midpoint\ Q} \div \frac{P_2 - P_1}{Midpoint\ P}$$

(b) The cross-price elasticity

Unlike own-price elasticity, cross-price elasticity measures how the consumption of a good changes when the price of another good changes. Like the specification of the own-price elasticity, the cross-price elasticity can be mathematically specified in either point and midpoint (or arc) form. We use the midpoint specification for this model.

To solve for the new level of consumption, we use the price elasticity formula and re-arrange the formula to calculate forQ_new. The impact of income elasticity or the change in GDP then adjusts this.

$$Q_{new} = Q_{baseline}\left[1 + \varepsilon_P\left(\frac{RP_{new} - RP_{baseline}}{RP_{baseline} + RP_{new}}\right)\right] / \left[1 - \varepsilon_P\left(\frac{RP_{new} - RP_{baseline}}{RP_{baseline} + RP_{new}}\right)\right] * \left[1 + \varepsilon_I\left(\frac{GDP_{new} - GDP_{baseline}}{0.5\,(GDP_{baseline} + GDP_{new})}\right)\right]$$

Where: Q refers to the quantity consumed, ε_P refers to price elasticity, ε_I refers to income elasticity, and RP refers to the retail price.

We will quantify the impact of substitution effects using the cross-price elasticities. This will involve estimating the change in the consumption of SSBs due to a change in the price of substitutes for SSBs. We will apply the following formula:

$$Q^X_{new} - Q^X_{baseline} = Q^X_{baseline}\left[2\,\varepsilon_{XY}\,\frac{(P^Y_{new} - P^Y_{baseline})}{(P^Y_{new} + P^Y_{baseline})}\right] / \left[1 - \varepsilon_{XY}\,\frac{(P^Y_{new} - P^Y_{baseline})}{(P^Y_{new} + P^Y_{baseline})}\right]$$

The superscripts X and Y refer to products X and Y, and whereε_(XY) is the cross-price elasticity of demand (defined as the percentage change in the quantity consumed of product X due to a 1% change in the price of product Y). If the cross-price elasticity is positive, it shows that the products are substitutes, which implies that an increase in the price of product Y will cause an increase in the consumption of product X. It is essential to note that the model will be programmed in a way that it first accounts for the impact of the change in the own price of product Y.

iii. Fiscal impact

The impact of the tax on revenue is also examined in this study. The revenue effects of the tax will be calculated as the difference between the tax revenue generated under the simulation and baseline scenarios. The revenue effect is, therefore, the sum of the changes in the excise revenue from the SSB tax and changes in tax revenue collected/lost on SSB and related beverages such as 100% juice.

iv. Health impact

Empirical evidence shows that well-implemented SSB taxes effectively increase the retail price of SSBs, thus making them less desirable to purchase. Consequently, consumption of SSBs will reduce, and potentially, the disease risk factors associated with SSB consumption will also subsequently reduce.

In our simulation model, the health effects of sugar-sweetened beverages are mediated primarily through increased body mass index (BMI). This is in line with previous empirical studies such as Bardach *et al.* (2023), La Foucade *et al.* (2023), Alcaraz *et al*. (2021), Walbeek and Mthembu (2022), Hangoma *et al.* (2020), and Saxena *et al.* (2019). More precisely, we compute the impact of SSB consumption on BMI regarding overweight and obesity as a proxy for the negative health consequences.

In doing this, our guiding question is '*How many kilograms of sugar (in SSBs) must an average person consume in a year to increase (or reduce) their BMI by 1 kg/m2?* We note that an annual 10-kilogram decrease in sugar is required to reduce BMI by one unit (Walbeek and Mthembu (2022), using a rule of thumb drawn from empirical medical literature.

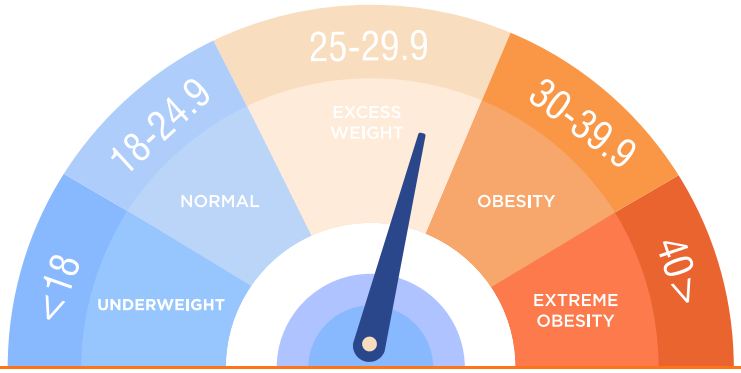
The World Health Organization (WHO) asserts that adults with a BMI greater than or equal to 25 kg/m2 but less than 30 kg/m2 are considered overweight, while people with a BMI greater than or equal to 30 kg/m2 are considered obese. In our modelling, the percentage of people who cross this BMI threshold (i.e., from $\geq$ 25 kg/m2 to $<$ 25 kg/m2 and from $\geq$ 30 kg/m2 to $<$30 kg/m2) will be regarded as the public health benefit from the intervention. Note that while this study focuses on BMI-mediated risks, it is possible to model non-BMI-mediated risks from SSB consumption in subsequent studies.

Our guiding question is 'How many kilograms of sugar (in SSBs) must an average person consume in a year to increase (or reduce) their BMI by 1 kg/m2?

[1]https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Adults with a BMI greater than or equal to 25 kg/m2 but less than 30 kg/m2 are considered overweight

Adults with a BMI greater than or equal to 30 kg/m2 are considered obese



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Results

4.1 The impact of a tax change on the price

The price increase caused by an SSB tax shows the potential of the policy measure to reduce the consumption of sugary beverages, which, in turn, could improve public health by reducing intake and preventing health issues like obesity and diabetes. The effectiveness of the tax in achieving these goals can depend on several factors, including the tax rate, consumer behaviour, and the availability of healthier options, particularly water. Nigeria currently has a tax of N10 per litre of SSB. Assuming this is increased to at least N130 per litre, an optimal price we arrived at based on scenario analysis, our findings (Table 1) show that this could significantly increase the price of SSBs by approximately 39% per litre.

Table 1: Effect on Prices

Decomposition of the retail price (per litre) before the excise tax is imposed	Malt	Carbonated Drinks	Fruit juice
Net-of-tax price	687.67	315.58	580.70
Existing excise tax	10.00	10.00	10.00
VAT	52.33	24.42	44.30
Average Retail price	750.00	350.00	635.00

Decomposition of the retail price (per litre) after the excise tax is imposed	Malt	Carbonated Drinks	Fruit juice
Net-of-tax price	687.67	315.58	580.70
Existing excise tax	10.00	10.00	10.00
New excise tax	180.00	130.00	216.00
VAT	65.83	34.17	60.50
Average Retail Price	943.50%	489.75%	867.20%

Increase in SSB tax will significantly increase the price of SSBs by approximately 39% per litre

4.2 Impact of price on consumption

In line with the law of demand, we hypothesized that increasing the retail prices of SSBs would decrease product consumption. Table 2 shows the simulated per capita consumption estimates after the tax is imposed. We observe that the per capita consumption of SSBs is expected to decrease by 30% for males and 9% for females due to the tax-induced increase in the retail price. An annual decrease of 29% is expected for aggregate consumption of SSBs in Nigeria following a practical implementation of the SSB tax. Lower consumption of sugary beverages can lead to a decrease in calorie intake and potentially a decrease in the prevalence of diet-related diseases.

Table 2: Effect on Consumption

	Baseline				After the tax change				Perc. Change
	Carbonated Fruit				Carbonated Fruit				
	Malt	Drinks	Fruit juice	Total	Malt	Drinks	Fruit juice	Total	
Per capita consumption (litres per year)									
Male	4.9	30.3	0.6	35.9	3.9	20.9	0.4	25.3	**-30%**
Female	4.9	21.3	1.5	27.7	3.9	20.9	0.4	25.3	**-9%**
Total	4.9	25.8	1.1	31.9	3.9	20.9	0.4	25.3	**-21%**
Aggregate consumption (million litres per year)									
Male	533	3268	70	3871	424	2257	48	2729	**-30%**
Female	520	2248	160	2928	411	1559	110	2080	**-29%**
Total	1053	5516	230	6799	835	3816	158	4809	**-29%**

An annual decrease of 29% is expected for aggregate consumption of SSBs in Nigeria following a practical implementation of the SSB Tax.

4.3 Fiscal impact

In addition to promoting healthier choices, SSB taxes can generate government revenue. For each SSB category, the model calculates the post-tax volume of the beverage, taking cognizance of the demand effects, i.e., the impact of the change in the price of that SSB category and the change in the price of other SSB categories. The Nigeria SSB tax would be expected to have positive fiscal effects. The results of the tax simulation, as presented in Table 3, show that the excise tax revenue is projected to increase by about 972% (amounting to N729 billion). Such fiscal revenue should be earmarked for improving Nigeria's health system.

In addition to promoting healthier choices, SSB taxes can generate government revenue.

Nigeria currently spends only 5.75 per cent of its national budget on healthcare, which is not enough to meet the health needs of its population. Earmarking SSB taxes for health in Nigeria is a crucial step towards achieving the National Multi-Sectoral Action Plan (NMSAP) for preventing and controlling Non-Communicable Diseases (NCDs) in Nigeria 2019 – 2025 (Ajisegiri et al. 2021).

Table 3: Fiscal impact (per year)

	Carbonated			
Baseline	Malt	Drinks	Fruit juice	Total
Quantity (million litres)	1052.9	5516.0	230.0	6799
Net-of-tax revenue (billion Naira)	724.0	1740.8	133.7	2599
Excise taxes (billion Naira)	10.5	55.2	2.3	68
VAT (billion Naira)	52.33	134.7	44.30	200
Total expenditure by consumers (billion Naira)	789.7	1930.6	146.2	2867
	Carbonated			
After the tax is imposed	Malt	Drinks	Fruit juice	Total
Quantity (million litres)	835.0	3815.6	158.4	4809
Net-of-tax revenue (billion Naira)	574.2	1204.1	92.0	1870
Excise taxes (billion Naira)	158.7	534.2	35.8	729
VAT (billion Naira)	55.0	130.4	9.6	195
Total expenditure by consumers (billion Naira)	787.9	1868.7	137.4	2794

Percentage change	Carbonated Malt	Carbonated Drinks	Carbonated Fruit juice	Total
Quantity	-21%	-31%	-31%	-29%
Net-of-tax revenue	-21%	-31%	-31%	-28%
Excise taxes	1407%	868%	1455%	972%
VAT	0%	-3%	-6%	-3%
Total expenditure by consumers	0%	-3%	-6%	-3%

4.4 Health impact

The burden of SSB-related diseases such as obesity and diabetes is a growing health problem in Nigeria, and the associated healthcare costs are increasing. Evidence from a recent systematic review and meta-analysis (Chukwuonye et al. 2022) shows that as of 2020, there were more than 21 million overweight and 12 million obese 'persons in the Nigerian population aged 15 years or more, accounting for an age-adjusted prevalence of about 20% and 12% respectively' (Adeloye et al. 2021). In addition, a systematic review and meta-analysis by Uloko et al. (2018) shows that at least 11.2 million people live with diabetes in Nigeria.

The primary purpose of implementing an SSB tax is to reduce the consumption of these sugary beverages and address public health concerns related to obesity, diabetes, and other health issues associated with excessive sugar intake. Imposing an SSB tax could effectively raise the price of sugar-sweetened beverages for consumers. Higher prices tend to discourage people from buying products, including SSBs. As a result, some consumers may reduce their consumption of sugary beverages, and this decrease in SSB consumption, in turn, could decrease the mortality risks associated with SSB intake.

To assess such expected health impact, this study focused on body mass index (BMI) as a proxy for the negative health consequences. More specifically, we zero in on the percentage of people who are either overweight (BMI ≥ 25 kg/m2 but < 30 kg/m2) or obese (BMI ≥ 30 kg/m2). The percentage of people who cross this threshold (i.e., from ≥ 25 kg/m2 to < 25 kg/m2 and from ≥ 30 kg/m2 to <30 kg/m2) due to the intervention are regarded as the public health benefit from the SSB tax policy intervention.

Table 4 shows the projected health impact of the SSB tax. The SSB tax simulation results show a reduction in BMI of 0.04 for males and likewise 0.04 for females. The SSB tax was estimated to reduce the mean prevalence of overweight by 0.42% for males and 0.37% for females. In addition, the SSB tax was estimated to reduce the mean prevalence of obesity by 0.46% for males and 0.53% for females. The estimate shows that if the SSB tax is effectively implemented, we could prevent a substantial number of cases of overweight and obesity for both the male and female population in Nigeria. The impact of the tax on health outcomes is further disaggregated by age and presented in the appendix of this report.

The primary purpose of implementing an SSB tax is to reduce the consumption of these sugary beverages and address public health concerns related to obesity, diabetes, and other health issues associated with excessive sugar intake.

The change in BMI reflects a positive health outcome in response to the reduced consumption of SSBs. Our findings corroborate similar research such as Walbeek and Mthembu (2022), which found a 2% reduction in obesity in Kenya (Manyema et al. 2014) and a 3% decrease in obesity in South Africa.

Table 4: Health impact

Baseline	Average BMI	Overweight percentage	Obese percentage	Number of people overweight (millions)	Number of people overweight (millions)
Male	20.85	18.95%	10.08%	11.55	6.14
Female	21.92	21.29%	13.11%	12.78	7.88
Total	21.38	20.11%	11.58%	24.34	14.02

After the tax increase	Average BMI	Overweight percentage	Obese percentage	Number of people overweight (millions)	Number of people overweight (millions)
Male	20.67	18.53%	9.62%	11.55	6.14
Female	21.75	20.92%	12.59%	12.78	7.88
Total	21.20	19.71%	11.09%	24.34	14.02

Absolute changes	Average BMI	Overweight percentage	Obese percentage	Number of people overweight (millions)	Number of people overweight (millions)
Male	-0.184	-0.42%	-0.46%	-0.255	-0.279
Female	-0.174	-0.37%	-0.53%	-0.223	-0.317
Total	-0.179	-0.39%	-0.49%	-0.478	-0.595

Percentage changes	Average BMI	Overweight percentage	Obese percentage
Male	-0.885%	-2.206%	-4.536%
Female	-0.795%	-1.745%	-4.019%
Total	-0.839%	-1.964%	-4.246%

4.5 Discussions

The findings of this study present the potential impact that an increase in the SSB tax could have on both consumer behaviour and public health in Nigeria. The core objective of such a tax is to discourage the consumption of sugary drinks, ultimately addressing the rising concerns related to diet-induced diseases, particularly obesity and type 2 diabetes. The tax has the potential to act as a powerful deterrent by increasing the price of these beverages, thereby influencing consumer choices.

Considering the price dynamics, it becomes evident that the SSB tax is a critical lever for determining consumption patterns. The substantial price increase of at least 39% per litre following the tax implementation is projected to yield a noteworthy reduction in per capita SSB consumption. This aligns with the basic economic principle of demand and price elasticity. As expected, consumers tend to respond to higher prices by reducing their consumption, and this reduction holds potentially true across different age groups and genders, albeit to varying degrees.

The core objective of such a tax is to discourage the consumption of sugary drinks, ultimately addressing the rising concerns related to diet-induced diseases, particularly obesity and type 2 diabetes.

One of the significant findings from this study is the potential health impact of increasing the SSB tax relative to the current rate of 10 Naira/litre. By reducing BMI and curbing the prevalence of overweight and obesity, this policy, if implemented, can make a significant difference in the lives of millions of Nigerians. As the data suggest, even a modest reduction in BMI could translate to a substantial decrease in cases of overweight and obesity, which are linked to various health complications. This underlines the vital role that fiscal policies like SSB taxes can play in improving public health outcomes.

> *Furthermore, the fiscal implications of SSB taxes cannot be overlooked. Beyond promoting healthier choices, these taxes offer the government an opportunity to generate substantial revenue. This revenue can be earmarked for strengthening Nigeria's healthcare system, a vital move given the healthcare challenges the country faces. Therefore, the potential revenue from SSB taxes can be a valuable resource for enhancing healthcare infrastructure and services.*

4.6 Policy implications/Recommendations:

Findings from this study offer valuable insights into the potential of SSB taxes as a policy tool to address diet-related health challenges and enhance fiscal sustainability in Nigeria. These implications extend to multiple domains, including public health, government revenue generation, and healthcare system strengthening. Based on this study's, findings, the following policy implications and recommendations emerge:

I. **Optimising SSB tax rates:** The study highlights the importance of setting SSB tax rates at levels that effectively drive behaviour change. The tax rate of N10 per litre is a positive step; however, there is room for revision, which is essential to have a more significant impact from a public health perspective. To maximize the health and fiscal benefits, policymakers should consider gradually increasing the tax rate to at least N130 per litre through policy review, as our findings suggest that this could lead to a substantial reduction in SSB consumption. This step must be complemented by rigorous monitoring and periodic adjustments to ensure continued effectiveness.

II. **Targeted health promotion campaigns:** Public awareness campaigns are crucial for the success of SSB taxes. Policymakers should invest in targeted health promotion campaigns to educate the population about the adverse health effects of excessive SSB intake. These campaigns should emphasize the benefits of reducing SSB consumption and promote healthier beverage alternatives, including water, and fruit.

Study limitations:

While this study provides valuable insights into the consumption patterns, health impacts, and economic implications of Sugar-Sweetened Beverages (SSBs) in Nigeria, it is essential to acknowledge certain limitations.

I. **Data limitations:** The study relies on data from surveys and secondary sources, which are subject to inherent limitations such as recall bias and reporting errors. Additionally, the data used for this study has a cutoff date; for example, data on BMI prevalence in Nigeria were extracted from Adeloye et al. (2020), while the consumption pattern survey was conducted in 2023 due to a lack of individual-level data on SSB consumption. Besides, an individual-level or self-reported data on SSB consumption habits, especially in terms of quantities consumed, may be susceptible to social desirability bias, leading individuals to either underreport or overreport their consumption habits .

II. **Assumptions in economic analysis:** The economic analysis, particularly regarding the impact of SSB taxation, is based on certain assumptions about price elasticity, consumer behaviour, and tax pass-through. Real-world effects may differ due to unforeseen factors.

5.0 »»

Conclusion

This study provides the first empirical evidence about the likely health and fiscal impact of SSB tax in Nigeria. While the tax of N10 per litre on SSB in Nigeria is a good beginning, the tax rate must be improved to have a significant impact. This will help to account for inflation and ensure significant reduction in affordability of SSBs and achieve significant health gains. Should Nigeria decide to increase the tax rate to significantly more effective rate, the model indicates that it would significantly increase the retail price of these products, and subsequently lead to a reduction in consumption, and greater revenue generation. The model further shows that the reduced consumption of SSBs will result in reduced average body mass index across all gender and age groups, and, as a result, the percentage of people classified as either overweight or obese is expected to decrease. Moreover, the magnitude of the decrease in overweight and obesity rates dramatically depends on the magnitude of the tax. Conclusively, SSB tax rate affects both the amount of revenue that will be generated and its overall impact on consumption. This research suggests that higher tax rates are more effective in reducing consumption of SSBs and achieving the goals of the pro-health tax policy. Therefore, the SSB tax rate in Nigeria should be significant enough to reduce affordability and deter consumption of SSBs.

- *Reduce SSB Consumption*
- *Reduce Diabetes*
- *Reduce Obesity*
- *Reduce Overweight*

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Appendixes

Disaggregated simulation results

CONSUMPTION EFFECTS

Consumption Analysis	Carbonated Fruit Malt Male	Carbonated Fruit Drinks Male	Carbonated Fruit Juice Male	Carbonated Fruit Malt Female	Carbonated Fruit Drinks Female	Carbonated Fruit Juice Female	Carbonated Fruit Malt Total	Carbonated Fruit Drinks Total	Carbonated Fruit Juice Total
Per capita consumption at the outset (litres per year)	4.94	30.31	0.65	4.92	21.29	1.52	4.93	25.85	1.08
Per capita consumption after tax is imposed (litres per year)	3.93	20.93	0.45	3.90	14.76	1.04	3.91	17.88	0.74
Aggregate consumption per year at the outset (millions of litres)	533.0	3268.3	70.0	519.9	2247.7	160.3	1052.9	5516.0	230.3
Aggregate consumption per year after the tax is imposed (millions of litres)	423.7	2256.9	48.1	411.4	1558.7	110.3	835.0	3815.6	158.4
Per capita consumption of beverage-based sugar at the outset (kg per year)	0.49	3.03	0.08	0.49	2.13	0.18	835.0	2.58	0.13
Per capita consumption of beverage-based sugar after the tax is imposed (kg per year)	0.35	1.36	0.05	0.35	0.96	0.11	0.35	1.16	0.08
Aggregate consumption of beverage-based sugar at the outset (million kg per year)	53.30	326.83	8.40	51.99	224.77	19.23	105.3	551.6	27.6
Aggregate consumption of beverage -based sugar after the tax is imposed (million kg per year)	38.13	146.70	5.20	37.20	100.89	11.89	75.3	247.6	17.1
Percentage changes									
Per capita consumption of the beverage	-21%	-31%	-31%	-21%	-31%	-31%	-21%	-31%	-31%
Aggregate consumption of the beverage	-21%	-31%	-31%	-21%	-31%	-31%	-21%	-31%	-31%
Per capita consumption of beverage-based sugar	-28%	-55%	-38%	-28%	-55%	-38%	-28%	-55%	-38%
Aggregate consumption of beverage-based sugar	-28%	-55%	-38%	-28%	-55%	-38%	-28%	-55%	-38%

Per capita consumption of malt, carbonated drinks and fruit juice, litres per year

After the tax is imposed

Age group	Carbonated Malt Male	Fruit Drinks Male	Juice Male	Carbonated Malt Female	Fruit Drinks Female	Juice Female
<15	2.10	21.40	0.05	2.25	6.98	0.73
15 - 19	7.04	11.58	0.95	4.74	17.31	0.86
20 - 24	6.06	31.91	0.92	3.87	34.42	1.00
25 - 29	5.56	20.61	0.56	4.75	28.84	1.20
30 - 34	5.38	23.14	0.99	7.96	27.87	2.31
35 - 39	5.23	28.44	0.99	6.08	22.15	2.76
40 - 44	5.76	15.50	0.69	3.98	13.25	2.00
45–49	5.35	16.40	1.02	5.36	8.29	1.10
50–54	3.09	13.00	0.26	3.23	15.37	0.28
55 - 59	2.62	17.96	0.18	6.08	10.53	0.21
60 - 64	1.58	14.00	0.09	5.33	9.38	0.82
65 and over	1.97	25.95	0.13	6.08	10.53	0.21
Weighted average	3.93	20.93	0.45	3.90	14.76	1.04

BMI expressed as kg/m2

Age group	Baseline		After tax increase		Std Dev	
	Male	Female	Male	Female	Male	Female
<15						
15 - 19	17.68	18.68	17.50	18.61	7.06	7.06
20 - 24	18.67	19.67	18.55	19.51	7.22	7.22
25 - 29	19.75	20.75	19.47	20.46	7.14	7.14
30 - 34	20.77	21.77	20.58	21.55	6.99	6.99
35 - 39	21.69	22.29	21.48	22.42	6.82	6.82
40 - 44	22.56	23.56	22.30	23.34	6.59	6.59
45–49	23.33	24.33	23.18	24.20	6.36	6.36
50–54	24.04	25.04	23.88	24.95	6.09	6.09
55 - 59	24.70	25.70	24.59	25.57	5.82	5.82
60 - 64	25.30	26.30	25.14	26.19	5.56	5.56
65 and over	26.35	27.35	26.24	27.25	4.99	4.99
Weighted average	20.85	21.92	20.67	21.75		

Percentage of people overweight
(BMI > 25 kg/m2 and < 30 kg/m2) and obese (BMI > 30 kg/m2)

	Overweight (BMI > 25 kg/m2 and < 30 kg/m2)				Obese (BMI > 30 kg/m2)			
Age group	Baseline		Baseline		Baseline		Baseline	
	Male	Female	Male	Female	Male	Female	Male	Female
<15								
15 - 19	10.9%	13.1%	10.9%	12.9%	4.0%	5.4%	3.8%	5.3%
20 - 24	13.2%	15.4%	12.9%	15.0%	5.8%	7.6%	5.6%	7.3%
25 - 29	15.6%	17.8%	14.9%	17.2%	7.6%	9.8%	7.0%	9.1%
30 - 34	17.9%	20.3%	17.5%	19.7%	9.3%	12.0%	8.9%	11.3%
35 - 39	20.2%	22.5%	19.7%	21.9%	11.1%	14.2%	10.6%	13.3%
40 - 44	22.6%	24.9%	22.0%	24.4%	12.9%	16.4%	12.1%	15.6%
45–49	24.9%	27.2%	24.6%	26.9%	14.7%	18.6%	14.2%	18.1%
50–54	27.4%	29.5%	27.0%	29.3%	16.4%	20.8%	15.8%	20.3%
55 - 59	29.8%	31.8%	29.6%	31.6%	18.1%	23.0%	17.6%	22.3%
60 - 64	32.2%	33.9%	31.9%	33.8%	19.9%	25.3%	19.1%	24.7%
65 and over	37.5%	38.4%	37.3%	38.3%	23.2%	29.8%	22.5%	29.1%
Weighted average	18.9%	21.3%	18.5%	20.9%	10.1%	13.1%	9.6%	12.6%

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