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The Illusion of "Less Sugar": How Regulatory Loop-Hole in Carbonated Soft Drink Labeling Sustains Non-Communicable Disease (NCD) Risks in Nigeria

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Abstract

Background

The escalating burden of Non-Communicable Diseases (NCDs) in Nigeria, compounded by high out-of-pocket healthcare costs, has raised public health concern over excessive free sugar consumption from Carbonated Soft Drinks (CSDs). In response, manufacturers market "Less Sugar" variants leveraging relative comparison standards. However, the Codex Alimentarius guideline permits "Less Sugar" labels for a modest **25% relative reduction** from original formulations. This study examines why this standard fails biologically within the Nigerian market and models a safer alternative threshold.

Methodology:

A cross-sectional profiling of major commercial CSDs in Nigeria was conducted, segmenting them into Less Sugar (e.g., 7 Up, Coca-Cola Less Sugar, American Cola) and Original Taste cohorts (e.g., Coca-Cola Original, Pop Cola). A deterministic intake simulation model analyzed the absolute metabolic load of a single **500mL PET bottle** package standard per day over 365 days against the **World Health Organization (WHO) threshold** bounding free sugars to **< 10% of total daily calories** (50g/day).

Results and Discussion

The original taste cohort averaged 10.17g/100mL of sugar, while the less sugar cohort averaged 7.30g/100mL (a 28.2% relative reduction). Simulation modeling revealed that a single 500mL serving of a "Less Sugar" beverage delivers **34.5g to 37.5g of absolute sugar**, consuming a hazardous **69% to 75% of an individual's entire daily safe sugar allowance**. Mathematical proofs demonstrate that due to high initial baseline sugar levels, the 25% relative reduction allows products to carry a "health halo" while sustaining severe NCD risks. To restrict a 500mL serving to 40% of the daily limit (20g), sugar density must drop to **4.0g/100mL**, mandating a **minimum 60% relative reduction** threshold. Macroeconomic and trade impact analyses indicate that while a 60% requirement triggers supply chain friction under the Nigeria Sugar Master Plan, it prevents substantial out-of-pocket NCD medical costs and builds systemic compliance with the African Continental Free Trade Area (AfCFTA) by blocking the dumping of high-sugar formulations.

Conclusion and Policy Recommendations:

The traditional 25% relative Codex standard fails to protect consumer biology in developing economies dominated by expanded pack sizes. The National Agency for Food and Drug Administration and Control (NAFDAC) must urgently review local regulations to abolish the 25% benchmark for liquid formats,

mandate a strict **60% reduction threshold (capping density at 4.0g/100mL)**, and introduce mandatory Front-of-Package Warning Labels (FOPL) to eliminate fiscal policy evasion.

Background

The global surge in Non-Communicable Diseases (NCDs), including Type 2 diabetes, cardiovascular complications, and metabolic syndrome, represents a major public health challenge [1]. In Nigeria, NCDs place heavy financial burdens on households and stretch an underfunded healthcare system heavily reliant on out-of-pocket spending [2]. A primary driver of this crisis is the excessive intake of free sugars through carbonated soft drinks (CSDs). To mitigate these risks, public health policies and consumer demand have incentivized beverage manufacturers to produce "Less Sugar" or "Reduced Sugar" variants.

However, a critical public health vulnerability lies within global and national regulatory frameworks, such as the FDA guidance on food labeling and Codex Alimentarius standards [3–4]. Current statutes govern comparative nutrient claims based on relative reductions—requiring at least **25% less sugar** than the reference comparison product under Codex guidelines—rather than absolute biological safety thresholds.

Consequently, if an original beverage has an exceptionally high sugar base, a 25% to 30% reduction allows the "Less Sugar" variant to carry a health-conscious halo while still delivering a biologically hazardous dose of sugar. Even with the reduction, these products still pose significant health risks. This paper exposes this regulatory loophole, specifically analyzing why the Codex relative reduction standard fails in the **Nigerian public health context**, evaluates the trade and economic impacts of shifting regulations, and validates this crisis using an intake assessment and risk reduction simulation modeling.

Methodology

Nutritional profile data per 100mL was extracted from a cross-sectional sample of popular commercial carbonated soft drinks, categorized into **Less Sugar** variants and **Original Taste** references:

- **Less Sugar Cohort**: 7 Up Less Sugar (6.9g sugar), Coca-Cola Less Sugar (7.5g sugar), and American Cola (7.5g sugar).
- **Original Taste Cohort**: Fanta (8.9g sugar), Coca-Cola Original Taste (10.6g carbohydrate/sugar), and Pop Cola (11g sugar).

Intake Assessment and Risk Simulation Model

To evaluate the real-world physiological impact, a deterministic intake simulation model was constructed [5]. The model simulated the consumption of a standard single commercial unit (a **500mL bottle**, which is highly prevalent in the Nigerian retail ecosystem) per day over an annualized period (365 days).

The primary health benchmark utilized was the **World Health Organization (WHO) strong recommendation for free sugars**, which limits free sugar intake to **less than 10% of total daily energy intake** (approximately **50 grams per day** based on a standard 2,000-calorie diet for an adult) [6]. Absolute risk exposure was quantified by calculating total annual mass accumulation (kg) of sugar and tracking binary exceedance of the daily 50g threshold.

Result and Discussion

Nutritional Profile Comparison

The statistical aggregate of the sample data reveals that while "Less Sugar" formulations lower baseline metrics, their absolute sugar concentrations remain profoundly elevated.

Beverage Profile	Sugar (g/100mL)	Sugar per 500mL Serving (g)	% of WHO Daily Limit (50g)*	Annualized Sugar Intake (kg/year)**	Exceeds Daily WHO Limit (> 50g)?
7 Up Less Sugar	6.9	34.5	**69.0%**	12.59	NO (Single Bottle)
Coca-Cola Less Sugar	7.5	37.5	**75.0%**	13.69	NO (Single Bottle)
American Cola	7.5	37.5	**75.0%**	13.69	NO (Single Bottle)
Fanta	8.9	44.5	**89.0%**	16.24	NO (Single Bottle)
Coca-Cola Original	10.6	53.0	**106.0%**	19.35	**YES**
Pop Cola	11.0	55.0	**110.0%**	20.08	**YES**

**Percentage based on a single 500mL serving against the 50g WHO maximum allowance.*

***Calculated based on the simulation metric of one 500mL bottle consumed daily for 365 days.*

Simulation Modeling Analysis

The simulation models yielded a striking epidemiological finding regarding absolute metabolic load:

├── Original Taste Cohort: 10.17g

└── Less Sugar Cohort: 7.30g (A ~ 28.2% relative reduction)

Absolute Sugar Exposure from a Single 500mL Serving:

├── Original Taste Average: 50.83g (101.7% of the daily 10% WHO maximum)

└── Less Sugar Average: 36.50g (73.0% of the daily 10% WHO maximum)

The risk reduction simulation demonstrates that while a single bottle of a "Less Sugar" beverage does not individually break the 50g ceiling, it claims an alarming **69% to 75% of an individual's entire daily allowance of free sugar**. This leaves almost zero margin for sugar intake from everyday Nigerian dietary staples (e.g., bread, sauces, beverages, or processed tubers).

Consequently, standard daily consumption habits ensure that consumers still face significant health risks. Chronically ingesting **12.59 kg to 13.69 kg of pure liquid sugar annually** from "healthier" variants still induces hepatic de novo lipogenesis, visceral adiposity, systemic inflammation, and rapid insulin resistance [7].

Mathematical Proof: Why the Codex 25% Standard Fails

The 25% relative standard governed by Codex Guidelines (CAC/GL 23-1997) fails catastrophically when applied to high-baseline matrices typical of the Nigerian market [3]. The failure can be mathematically modeled using the industry standard reference (S_{ref} = 10.6 g/100 mL for original Cola) and the minimum standard bottle size (V = 500mL) [8]:

Maximum Allowed Sugar Density under Codex = $S_{ref} \times (1–0.25) = 10.6 \times 0.75 = 7.95$g/100 mL

Absolute Sugar Payload per Serving = (7.95g ÷ 100mL) × 500mL = 39.75 g

Exhaustion of Total Daily WHO Budget = (39.75g ÷ 50.0g) × 100mL = 79.5%

This mathematical proof demonstrates that the 25% standard acts as a regulatory shield for high-sugar products. It permits a drink to sweep away nearly **80% of an adult's entire safe metabolic budget** in a single 500 mL serving while bearing an officially sanctioned nutrition marketing label. The Codex standard is architecturally blind to pack/portion size inflation, ignoring the reality that the Nigerian retail landscape has transitioned from 250mL cans to high-volume, hyper-affordable **500mL and 600mL PET bottles**.

Proposing a Biologically Viable Threshold

To push these beverages out of the biological danger zone, Nigeria must abandon the 25% paradigm. If a "Less Sugar" drink should consume no more than **40% of the daily limit** (20g of sugar per 500mL bottle), the target maximum sugar density must drop to 4.0g/100mL.

Calculating the necessary relative reduction from the baseline:

Required Reduction Percentage = ((1 – (4.0g ÷ 10.6g)) × 100 ≈ 62.26%

To protect consumer biology within standard packaging architectures, NAFDAC must institute a **minimum 60% relative reduction threshold** for comparative claims on liquid products.

Macroeconomic and Trade Implications of Regulatory Restructuring

Local Manufacturing and Supply Chain Friction

Enforcing a 60% reduction standard introduces significant short-term macroeconomic adjustment costs for the Nigerian manufacturing sector. Altering product formulations requires heavy capital expenditure to re-engineer production lines, adjust shelf-life stabilization methods, and manage supply chains.

A steep decline in industrial sugar procurement will strain domestic sugar refineries and backward integration investments under the Nigeria Sugar Master Plan (NSMP) [9]. However, these industrial adjustments are offset by the dramatic reduction in national health expenditures. NCD management currently demands heavy out-of-pocket spending from citizens, draining household savings and reducing the country's labor productivity.

International Trade and AfCFTA Alignment

Under World Trade Organization (WTO) rules, strict domestic regulations can be challenged as Technical Barriers to Trade (TBT) if they disadvantage imported goods. However, Article XX of the General Agreement on Tariffs and Trade (GATT) explicitly permits exceptions necessary to protect human life and health, provided the rules apply equally to domestic and foreign manufacturers [10–11].

Crucially, within the **African Continental Free Trade Area (AfCFTA)** framework, Nigeria serves as a major consumer market [12]. Establishing strict absolute sugar limits protects the country from becoming a dumping ground for high-sugar beverage formulations rejected by Western nations with progressive front-of-pack labeling laws. While it may create temporary trade frictions with regional exporters like Ghana or North African trading hubs, it sets a strong public health standard for the continent and encourages a unified African approach to food safety regulations.

The Fiscal Policy and Tax Evasion Problem

The National Agency for Food and Drug Administration and Control (NAFDAC) and the Standards Organisation of Nigeria (SON) currently align closely with Codex standards. This alignment creates an economic distortion.

As Nigeria implements progressive sugar-sweetened beverage (SSB) taxes, the lack of an absolute nutrient-profile index allows manufacturers to use the 25% Codex loophole to claim a "healthier" status [13]. This helps them capture market share from health-conscious consumers while continuing to sell high-sugar, NCD-driving products without undergoing true, biologically meaningful product reformulations.

Conclusion and Policy Recommendations

The 25% relative reduction framework established by Codex is an insufficient mechanism for public health preservation in Nigeria. While legally sound on paper, intake simulation modeling proves that standard 500mL consumer packs of "Less Sugar" CSDs exhaust the vast majority of the WHO 10% daily total calorie limit for free sugars, sustaining massive NCD risks.

To rectify this vulnerability, NAFDAC and the Federal Government of Nigeria should implement the following targeted structural reforms:

1. **Abolish the 25% Standard for Liquids**: Mandate an immediate regulatory review of the *Regulations* that align with the Codex 25% relative reduction framework [3]. Raise the bar to a **minimum 60% reduction requirement** for any comparative sugar claim on soft drinks.
2. **Impose Mandatory Front-of-Package Warning Labels (FOPL)**: Introduce clear, mandatory front-of-pack warning seals (e.g., black octagons) on any retail container that utilizes more than 50% of the WHO 50g daily limit in a single retail unit.
3. **Harmonize Fiscal and Health Policies**: Calibrate the national SSB tax framework to scale dynamically based on absolute grams of sugar per milliliter, rather than a retail price-based levy, removing any tax advantages for products that fail to meet absolute safety limits.

Declarations

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- **Conflicts of Interest:** The author declares no competing financial, professional, or personal interests that could influence the execution or integrity of this study.

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