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UNDERSTANDING SUGAR BEYOND THE NARRATIVE

A Policy Framework for Smarter Prevention, Positive Nutrition, and Consumer Empowerment









Understanding Sugar Beyond the Narrative

Abstract

Sugar matters, but it should not become the whole story. This paper examines sugar in context: its different forms, food matrix, physiological role, patterns of consumption, place within the overall diet, and role across agricultural economies and global value chains.

It then asks a broader public health question: how should policymakers address the role of sugar in obesity, cardiovascular diseases (CVDs), diabetes, and non-communicable diseases (NCDs) when these are multifactorial conditions shaped by diet, energy balance, lifestyle, environment, and individual variability? Sugar intake can be relevant to health, but its effects depend on how much is consumed, how often, in what form, and within which diet.

The paper then asks a critical policy question: do interventions that change prices, purchases, products, or consumption also improve health? Sugar taxes, front-of-pack labels, warning systems, and reformulation can produce measurable intermediate outcomes, but these should not be confused with better long-term health. Effective policy assessment must also consider substitution, distributional effects, economic and social costs, proportionality, and unintended consequences.

The alternative to reductionism is not inaction, but better action: positive nutrition, food literacy, physical activity, innovation, cooperation, and consumer empowerment. The goal is a more effective approach to prevention, one that addresses sugar where evidence supports it while recognizing the broader complexity of human health.

Competere

Advancing Innovation, Trade and Human Development

We are an independent advocacy group that develops and promotes public policies to advance innovation, free trade, and real opportunities for individuals.

In today's unstable, emotional, and polarized world, you need solutions grounded in evidence and responsibility, not ideology.

That is why we combine science, critical thinking, and a liberal vision to tackle the major challenges of our time: from public health to sustainability, from food systems to emerging technologies.

We advocate for balanced, actionable policies that foster peaceful coexistence, economic growth, and individual freedom of choice.

We collaborate with international institutions, large and small businesses, the media, and civil society to transform ideas into tangible change.

This policy paper was developed with the support of UNALA, the Association of Latin American Sugar Producers.

UNALA

UNALA is a private, non-profit organization bringing together representatives of the sugarcane agro-industrial sector across Latin America. The idea of its creation emerged in 2017, and the organization was formally established in 2020. Today, UNALA brings together representatives from 15 countries and territories across the region. Its members are strongly committed to the sustainable production of sugar, renewable electricity, ethanol, and other sugarcane-derived products.

Collectively, UNALA members represent the world's largest sugar-producing and sugar-exporting region. More broadly, UNALA promotes sustainability, renewable energy, and economic development across the sugarcane value chain and the wider region.

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Scientific Panel

This policy paper was developed in collaboration with and validated by Competere's Scientific Committee, led by Prof. Michele Carruba, as well as by a select group of experts in nutrition, obesity, metabolism, food science, and public health.

Policy Snapshot

Toward smarter prevention:
understanding sugar, assessing policy, empowering citizens

Sugar has become a prominent target of prevention policy. Taxes, warning labels, front-of-pack schemes, and reformulation strategies can change prices, products, purchases, and consumption. But changing the market is not the same as improving health. Evidence of durable improvements in obesity, cardiovascular diseases (CVDs), diabetes, and the broader burden of non-communicable diseases (NCDs) remains limited.

Understanding sugar: context before simplification

1 » **Sugar matters, but context matters more.** Its health relevance depends on how much is consumed, how often, in what form, and within which diet.

2 » **Sugar is not one thing.** Total sugars, added sugars, free sugars, and intrinsic sugars differ by source, food matrix, and consumption context.

3 » **Health effects cannot be inferred from sugar content alone.** Quantity, frequency, food matrix, overall diet, energy balance, and individual variability all matter.

The problem: obesity is not a single-nutrient disease

4 » **Obesity, CVDs, diabetes, and NCDs cannot be reduced to sugar**. They are multifactorial conditions shaped by interacting biological, dietary, behavioral, social, economic, and environmental factors.

5 » **The evidence is nuanced, not absent.** The strongest concerns relate to excessive intake, particularly from sugar-sweetened beverages (SSBs), frequent consumption, excess energy intake, and poor dietary patterns.

The policy gap: intermediate outcomes are not health outcomes

6 » **Intermediate outcomes are not health outcomes.** Changes in prices, purchases, product composition, consumer awareness, or government revenue do not by themselves demonstrate better health.

7 » **Policy effectiveness must be measured beyond the marketplace.** Taxes, front-of-pack and warning labels, and reformulation can influence products and choices without necessarily producing durable improvements in obesity, CVDs, diabetes, or the broader burden of NCDs.

The assessment test: benefits must justify costs

8 » **Policy interventions have consequences beyond their intended targets.** They can generate substitution effects, distributional costs, market distortions, reformulation trade-offs, and broader economic and social consequences.

9 › **The smaller the benefit, the stronger the case for scrutiny.** Policy should be assessed against health outcomes, costs, proportionality, unintended consequences, and credible alternatives.

The alternative: smarter prevention, not inaction

10 › **Public health should build capacity, not only constrain choice.** Positive nutrition, food literacy, movement, cooperation, innovation, and consumer empowerment can complement targeted interventions while addressing the broader drivers of health.

> Sugar-related policies should be judged not by their **INTENTIONS,** but by their **OUTCOMES:** better health, better understanding, and more effective prevention.

FAQ

What this paper clarifies

1. Is this paper defending sugar?

No. The paper does not defend excessive sugar consumption. In line with the World Health Organization (WHO) guidelines, it argues that sugar should be understood in context: quantity, frequency, food matrix, overall diet, energy balance, lifestyle, and individual variability. The point is not to deny risk, but to avoid turning one nutrient into the sole explanation of obesity, cardiovascular diseases (CVDs), diabetes, and non-communicable diseases (NCDs).

2. Are all sugars the same?

No. Total sugars, added sugars, free sugars, and intrinsic sugars differ by source, food matrix, and consumption context. Sugars in whole fruit, milk, soft drinks, desserts, or confectionery do not have the same nutritional, behavioral, or social meaning. Policy that treats all sugars as equivalent risks weakening scientific precision and misleading consumers.

3. Is sugar harmful?

No, not inherently. Within recommended limits, sugar can be part of a balanced, complete, adequate, and sufficient diet. It may become harmful when consumed in excess, too frequently, in oversized portions, or within unhealthy dietary patterns and sedentary lifestyles – as is the case with many nutrients when consumed out of balance. Sugar is not a poison; it is a source of dietary energy. Carbohydrates, including sugars, provide glucose, an important fuel for the brain, muscles, and other physiological functions.

4. Why focus on sugar-sweetened beverages?

Sugar-sweetened beverages (SSBs) deserve specific attention because they are liquid, rapidly consumed, weakly satiating, and easy to add on top of total energy intake. But evidence on sugary drinks should not automatically be generalized to all sugars or all sweet foods. A soft drink, a yogurt, a pastry, and a piece of fruit may all contain sugar, but they do not play the same role in the diet.

5. Do sugar taxes work?

They can work on some intermediate outcomes. They may raise prices, reduce purchases of taxed beverages, encourage reformulation, and generate revenue. But these are not the same as improved health. The evidence is stronger on market effects than on durable reductions in obesity, CVDs, diabetes, or the broader burden of NCDs.

6. What is the main problem with sugar taxes and warning labels?

The main problem is not only the limited effectiveness. It is proportionality. If a policy produces marginal reductions in sugar intake but generates substitution effects, regressive burdens, market distortions, pressure on SMEs and producing countries, food anxiety, cultural

flattening, and weaker trust, then the policy case becomes much weaker.

7. Why does the paper insist on unintended consequences?

Because public policy should be judged by what it produces, not only by what it intends. In complex systems, simple tools often create secondary effects: consumption moves, firms reformulate for compliance, revenues drift, consumers become confused or anxious, and citizens may be treated as subjects to correct rather than people to empower.

8. What should policy do instead?

The alternative is not inaction. It is better action: positive nutrition, food literacy, movement, proportionate assessment, cooperation, innovation, and consumer empowerment. Prevention should help citizens understand food, manage portion and frequency, move more, interpret information, and build healthier lifestyles over time.

9. What is the core message of the paper?

Sugar matters, but it should not become the whole story. Obesity, CVDs, diabetes, and NCDs are complex conditions that require complex policy intelligence. Public health should not shrink complexity into a single prescriptive response. It should build knowledge, responsibility, balance, and freedom of choice.

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Executive Summary

Sugar matters. But it does not matter in the simplistic way it is often presented in public debate. This is not a defense of excess. It is a defense of proportion.

Sugar is used here as a case study of a broader policy problem: the tendency to address complex health challenges through simplified, single-nutrient narratives. Obesity, cardiovascular diseases (CVDs), diabetes, and other non-communicable diseases (NCDs) are not caused by one ingredient alone. They emerge from the interaction of biology, behavior, diet, movement, socio-economic conditions, food culture, digital habits, and daily environments.

The central argument is clear: sugar should not be ignored, but it should not be turned into a total explanation of modern disease. To do so, the paper first offers a clear framework for understanding sugar itself: the difference between types of sugars, the role of the food matrix, the way the body uses sugars, and the importance of portion, frequency, diet, movement, and context.

This is not an argument for less public health policy. It is an argument for better public health policy: positive nutrition, food literacy, movement, proportionality, and consumer empowerment.

The paper makes three claims.

1. The evidence is nuanced. Excessive sugar intake can matter, especially in specific forms and contexts, such as frequent consumption, excess calories, and poor overall dietary patterns. However, sugar alone does not determine health outcomes, which are influenced by multiple dietary and lifestyle factors. Its health relevance depends on factors such as quantity, frequency, food matrix, total diet, energy balance, lifestyle, and individual variability.

2. Science and policy do not always speak the same language. Science speaks in probabilities, contexts, and uncertainty. Policy often seeks clarity, speed, and visible intervention. In the case of sugar, a scientific signal can become a public narrative; the narrative becomes a symbol; the symbol becomes a policy target. Sugar is visible, measurable, taxable, and easy to communicate. But what is easy to target is not always what best explains the problem.

3. Prescriptive nutrition policies are politically attractive but often stronger on intermediate than on health outcomes. Sugar taxes, warning labels, front-of-pack labeling schemes, and reformulation may raise prices, change purchasing patterns, encourage product reformulation, and influence consumer choices. These are important intermediate outcomes, but they do not by themselves demonstrate improved public health. Across countries, the evidence is generally stronger for changes in markets, products, and consumer behavior than for durable reductions in obesity, CVDs, diabetes, or the broader NCD burden.

Prescriptive tools are also not neutral. They can shift consumption, burden lower-income households, distort markets, weaken trust, and encourage broader regulatory intervention. They may also affect SMEs, producing countries, food culture, and agricultural value chains. Policy should therefore be judged not only by what it intends, but by what it ultimately achieves.

The alternative to sugar taxes is not inaction. It is a better action. This paper argues for positive

nutrition and a balanced policy framework. The objective should not be simply “less sugar.” It should be better diets, nutritional security, dietary adequacy, overall dietary quality, food quality, physical activity, food literacy, prevention, and healthier lifestyles. This means moving from single-nutrient correction to balance: portion, frequency, variety, food matrix, culture, context, movement, and individual responsibility.

Citizens do not need more fear. They need the skills, tools, and environments to understand food, move more, interpret information, and make better choices over time. This requires serious, measurable policies in schools, workplaces, healthcare systems, communities, and digital environments, supported by responsible innovation, AI, wearable devices, and personalized prevention where appropriate.

The paper also calls for transparent and measurable cooperation with industry, producers, and producing countries. Cooperation is not deregulation. It means responsible innovation, portion strategies, protection of children, sustainable value chains, and continuous assessment of results and unintended consequences.

The goal is to promote evidence-based nutrition and effective public health policy, not to defend sugar.

A prevention agenda should be built on evidence, proportionality, continuous assessment, innovation, responsibility, and freedom of choice. It should move beyond fear-based food categories and toward positive nutrition. It should empower citizens rather than manage them through fiscal and regulatory pressure.

Complex health problems require complex policy intelligence. Sugar is part of the story. It should not become the whole story. Public health should not shrink complexity into prescriptive policies.

Introduction

Why this paper matters now

Globally, health has become a central societal priority. Persistent challenges such as obesity, cardiovascular diseases (CVDs), and non-communicable diseases (NCDs) coexist with growing attention to nutrition, prevention, and longevity. This dual dynamic is shaping consumer behavior, influencing markets, and accelerating the policy debate.

In this context, policymakers are under increasing pressure to act quickly and visibly.

As a result, the policy response has increasingly focused on specific dietary components, with sugar often placed at the center of regulatory attention. Measures such as taxation, front-of-pack labeling, and reformulation have been proposed or implemented to improve public health outcomes.

This reflects a legitimate demand for concrete and actionable solutions. However, it also carries a risk: public health urgency is driving simplified policy responses.

Scientific evidence shows that sugars, like any nutrient, play a role within a balanced dietary pattern and appropriate energy intake. The health impact of sugar depends on portions, frequency, and variety within an overall balanced lifestyle. Sugars are a natural component of many foods and play a role in human physiology as a key source of readily available energy. From an evolutionary perspective, humans have developed a natural preference for sweet taste, which signals the presence of readily available energy. Glucose is the primary fuel for the brain. Beyond physiology, sweet taste has also been embedded in food culture and social practices, often associated with reward and sharing.

The challenge, therefore, is not the presence of sugar per se, but the broader dietary and behavioral context in which it is consumed.

At the same time, translating scientific evidence into policy is inherently complex. Differences between types of sugars, food matrices, consumption patterns, and individual variability are difficult to capture within simplified regulatory frameworks. This creates a growing gap between the complexity of the science and the design of policy interventions. This gap matters.

Policies based on partial interpretations of the evidence may deliver limited or uncertain health benefits, while generating unintended economic, social, and behavioral consequences. These effects may impact consumers, shape innovation within the food system, and extend across global supply chains, including agricultural producers and local communities.

This paper aims to contribute constructively to the current debate by offering a broader and more integrated perspective.

It provides policymakers, media, and citizens with a clear and accessible framework to understand sugar before judging sugar policy: what sugars are, how they differ, how they are consumed, how the body uses them, and why their health relevance depends on food matrix, quantity, frequency, overall diet, movement, and lifestyle context. The goal is not only

to inform policy, but also to empower individuals.

Methodology

Complex systems, such as human health, nutrition, and lifestyle, cannot be fully explained through fixed, one-dimensional models. This is why the approach adopted is scientific, but not deterministic. It is grounded in a continuous process of observation, testing, and critical reassessment, recognizing that scientific knowledge evolves over time.

This perspective moves beyond rigid, nutrient-centric approaches that seek to explain health outcomes through single variables and instead reflects the multifactorial nature of real-world behaviors and lifestyles.

Individuals make decisions within a complex environment. This paper reflects that reality while providing a clear and practical framework to support informed decision-making.

By examining sugar as a case study, the paper highlights a broader challenge: the risk of addressing complex health issues through simplified, single-nutrient approaches.

The objective is to support a more balanced, evidence-based, and effective policy framework – one that recognizes the role of sugar within overall dietary and lifestyle patterns, promotes informed and responsible choices, and anticipates unintended consequences.

This paper is conceived as a position paper, not as a systematic review. For this reason, references have been deliberately selected and limited to a concise set of high-relevance scientific and institutional sources. The aim is not to provide an exhaustive review of the literature, but to offer a clear, evidence-based, and policy-oriented framework for interpretation.

The sugar narrative problem

In recent years, sugar has moved to the center of the public health debate. It is increasingly portrayed as a primary driver of obesity and NCDs and has become a key target of regulatory interventions. This is not accidental.

In complex public health contexts, there is a strong tendency to search for simple, identifiable causes. This reflects a broader deterministic impulse: the belief that complex outcomes can be traced back to a single factor, isolated, measured, and corrected. In nutrition policy, this often translates into the search for one culprit, one mechanism, and one solution.

Sugar fits this logic particularly well. It is widely present in the diet, easily measurable, and symbolically associated with excess. For this reason, it lends itself to simplified narratives that attempt to explain complex health outcomes through a single variable.

Short-form media tend to reward messages that trigger immediate emotional responses more than those that require reflection and nuance. This dynamic is amplified in digital environments, where visibility often depends on simplification. Nuance is harder to communicate than an alarm. Complexity is less shareable than blame. A message that identifies a clear culprit, something harmful, excessive, or morally suspect, is more likely to trigger attention, emotional reaction, and rapid circulation.

But there is another reason why sugar has become such a powerful policy symbol. It is often framed not simply as a dietary component, but as part of a broader narrative in which consumers are seen primarily as passive subjects exposed to commercial forces, rather than as individuals capable of making informed and responsible choices. In this framing, sugar becomes the visible expression of a food environment shaped by commercial incentives, while the consumer is cast mainly as the vulnerable party to be protected.

This framing has strong political and cultural appeal. It offers a clear moral structure, simplifies the public debate, and legitimizes prescriptive interventions that appear both immediate and justified.

However, simplification is not the same as understanding.

HOW SUGAR IS PRESENTED IN THE MEDIA

Sugar is often framed through recurring media patterns:

- as a hidden **threat**: "Sugar is everywhere"
- as a **toxic substance**: "Sugar is poison"
- as an industry **tool**: "Companies use sugar to manipulate consumers"
- as a moral **issue**: "Good foods vs bad foods"
- as a single explanation for **complex** conditions such as obesity and NCDs

WHY THIS WORKS

- it **reduces** complexity to a simple conflict
- it **identifies** a visible and emotionally resonant target
- it **triggers** immediate reactions such as concern, blame, or fear
- it is highly compatible with fast, binary, and shareable **media environments**

EXAMPLE HEADLINE LOGIC:

"Sugar is the new tobacco"

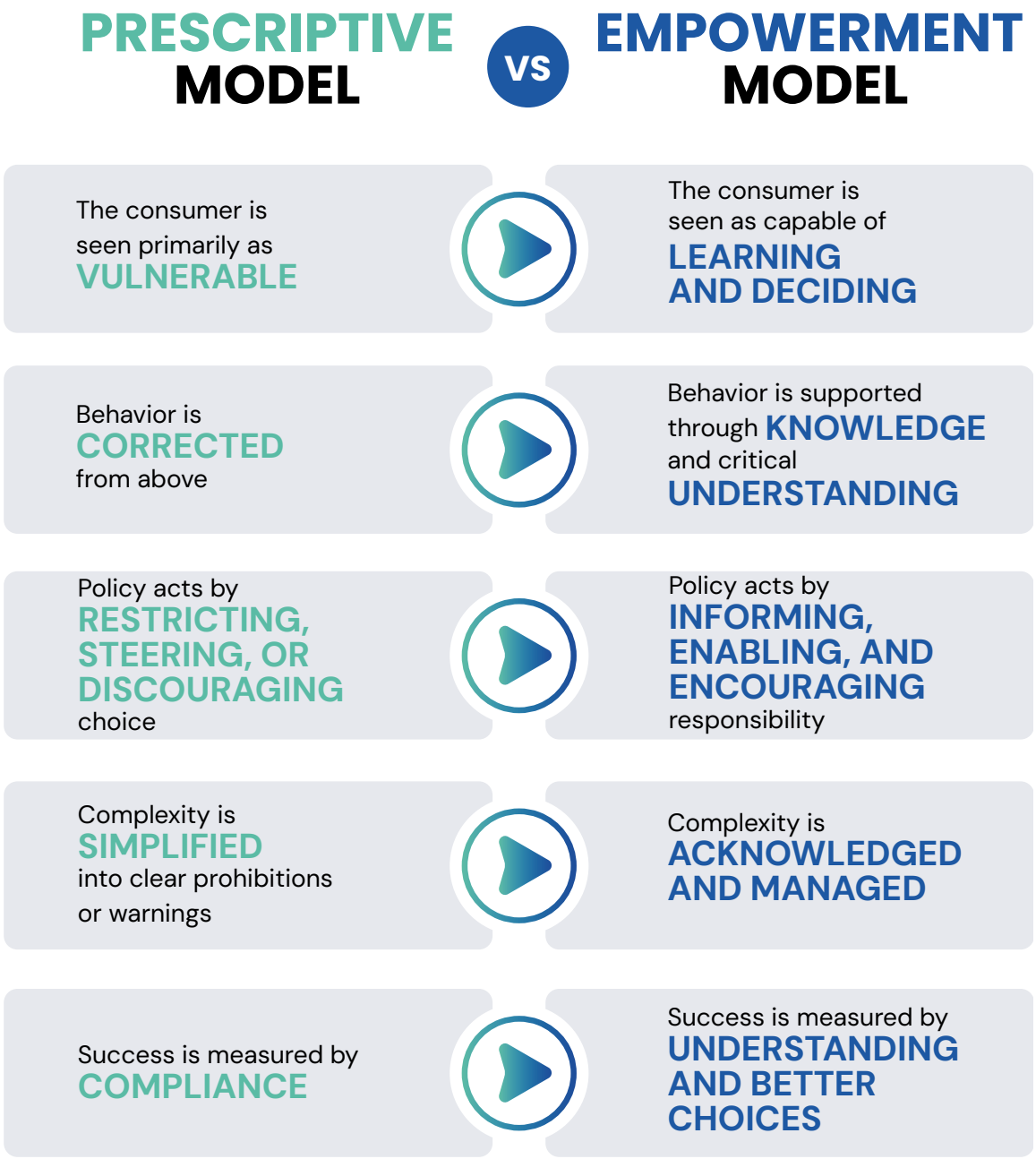
"The sweet poison behind modern disease"

"How Big Food uses sugar to drive profits"

What performs well in communication does not always improve understanding.

Nutrition and health outcomes are shaped by multiple, interacting variables: overall dietary patterns, physical activity, behavioral habits, socio-economic conditions, and individual variability. Isolating a single nutrient risk overlooks this reality. It also risks reducing citizens to the status of victims, rather than recognizing them as individuals capable of understanding, choosing, and adapting their behavior. This is a crucial point.

Policies built on prescriptive assumptions tend to protect the consumer by limiting choice. A more constructive approach seeks instead to empower individuals through knowledge, critical understanding, and responsibility. The difference is not marginal. It reflects two very different models of public health: one centered on correction, the other on emancipation.



This paper adopts the second perspective.

In addition, distinctions between different types of sugars, food matrices, and consumption contexts are often lost in public discourse. Sugars consumed in whole foods are frequently conflated with those in sugar-sweetened beverages (SSBs), and correlation is too often treated as causation.

As a result, the narrative around sugar moves from nuance to generalization, and from generalization to prescription. This matters for policy.

TO UNDERSTAND OBESITY, CVDs, AND NCDs, WE NEED TO LOOK BEYOND THE PLATE.

Scientific evidence consistently shows that these are multifactorial conditions, arising from the complex interaction of biological, social, economic, environmental, dietary, and physical activity-related factors.
They cannot be explained by individual nutrients or single foods alone.

Main drivers:

- overall dietary patterns
- physical inactivity
- sedentary lifestyles
- sleep quality and chronic stress
- behavioral habits and routines
- individual biological and metabolic variability

Social and contextual drivers:

- socio-economic conditions
- education and health literacy
- family and community environment
- urban design and opportunities for movement
- digital environments and screen-related routines

Additional factors:

- medication use
- air pollution
- environmental noise
- exposure to endocrine-disrupting chemicals and other pollutants

This complexity is particularly evident in countries facing the double burden of malnutrition, where undernutrition and micronutrient deficiencies can coexist with overweight, obesity, and diet-related NCDs, sometimes within the same communities or households. In these contexts, improving health requires attention to dietary quality, adequacy, and nutritional security alongside the prevention of excessive intake (FAO et al. 2026).

Looking beyond the plate does not mean ignoring diet. It means recognizing that obesity and CVDs emerge from the interaction between biology, behavior, environment, and context. Policies that focus too narrowly on one nutrient risk overlooking the broader drivers of health outcomes.

When complex health challenges are framed through simplified narratives, policy responses often follow the same logic. Interventions focused on single nutrients may be attractive from a regulatory perspective, but their real-world impact on health may be limited or uncertain. At the same time, they may reinforce a view of consumers as permanently in need of correction, rather than as individuals to be equipped and empowered.

The issue, therefore, is not whether sugar should be part of the policy discussion. It is how that discussion is framed.

Understanding the sugar narrative problem is essential to designing policies that are scientifically grounded, socially balanced, and effective in practice. It is also essential to build a public debate that helps citizens navigate complexity instead of reducing it to simplistic truths.

1. Understanding Sugar and Health

Before discussing sugar policy, we first need to understand sugar itself. In public debate, "sugar" is often treated as if it were a single substance with a single effect. It is not.

Sugars differ by type, source, food matrix, and context of consumption. Their health relevance depends on quantity, frequency, overall diet, energy balance, lifestyle, and individual variability.

The next sections explain these distinctions and why they matter for interpreting both the scientific evidence and the policies built upon it.

1.1 What you need to know about sugar

In everyday language, "sugar" often means table sugar or sweet foods in general. In science and policy, however, multiple distinctions matter.

Some sugars are naturally present in foods such as fruit, vegetables, and milk. Others are added during processing, preparation, or consumption. Some are consumed in solid foods; others in beverages. Some are embedded in more complex food matrices, while others are consumed in forms that are more rapidly absorbed and less satiating.

Food source matters, but it should not be interpreted in isolation. The health relevance of any source of sugar, including sugar-sweetened beverages, also depends on quantity, frequency, total energy intake, overall dietary patterns, lifestyle, and individual context.

These differences matter scientifically because sugars are not always consumed in the same physiological context. They matter politically because policy often targets broad categories without clearly distinguishing between type, source, quantity, frequency, food matrix, and overall diet.

A serious discussion of sugar policy must distinguish between what sugar is, where it comes from, whether it is naturally present or added, and how it is consumed.

SHORT GLOSSARY

To reduce confusion, it is useful to distinguish between key sugar categories and commonly confused terms.

TOTAL SUGARS

All sugars present in a food or diet, regardless of their source. They include both naturally occurring sugars and sugars added during processing or preparation.

ADDED SUGARS

Sugars added to foods or beverages during manufacturing, cooking, or at the table. This category typically includes sucrose, glucose, fructose, syrups, and other caloric sweeteners used to increase sweetness or improve texture and preservation.

FREE SUGARS

All added sugars, together with sugars naturally present in honey, syrups, fruit juices, and fruit juice concentrates. They do not include sugars naturally contained within intact fruit and vegetables or lactose naturally present in milk. This is the category used by the World Health Organization (WHO) in its 2015 guidelines on sugar intake.

INTRINSIC SUGARS

Sugars naturally incorporated within the cellular structure of foods such as whole fruit and vegetables, as well as lactose naturally present in milk and dairy products. They are generally consumed within a more complex food matrix that also provides other nutrients and may influence digestion and satiety.

COMMONLY CONFUSED TERMS

REFINED SUGARS

Sugar extracted from sugar cane or sugar beet and purified to separate sucrose from plant material, water, molasses, and other non-sugar components. Refining changes purity, color, texture, and commercial form, but it does not make sucrose an artificial molecule.

SUGAR SUBSTITUTES

Substances used to provide a sweet taste with fewer or no calories. They include low- or no-calorie sweeteners such as aspartame, sucralose, saccharin, acesulfame-K, and stevia-derived sweeteners, as well as sugar alcohols. They are not the same as sugar because they do not provide sweetness and energy in the same way.

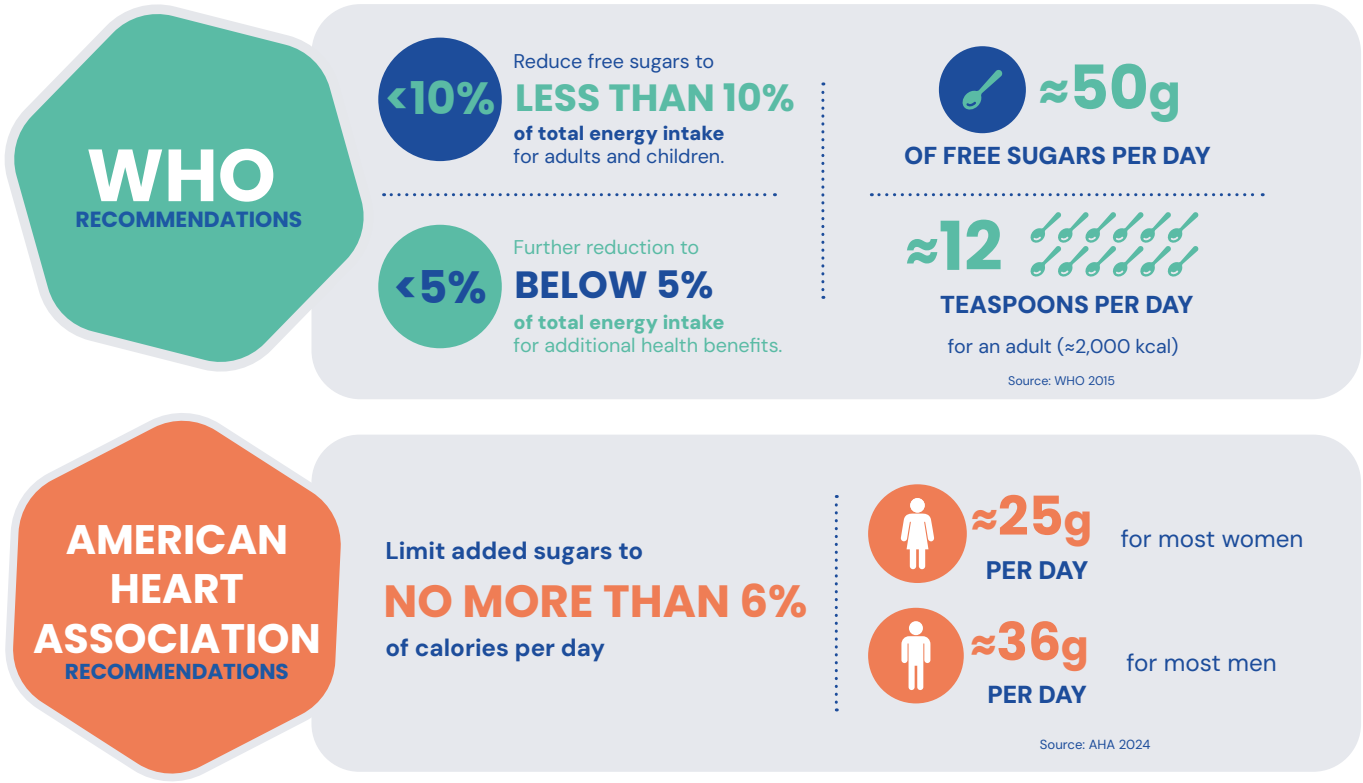
ARTIFICIAL SUGARS

Often used loosely in public debate to refer to refined sugar, added sugar, or sugar substitutes. It usually carries a negative or pejorative connotation, but it is not a precise scientific or nutritional category.

These categories are not merely technical. They shape dietary guidelines, public messaging, and the scope of policy. Treating all foods containing sugars as nutritionally or functionally equivalent can be misleading: a soft drink, a yogurt, a piece of fruit, and a fruit juice may all contain sugar, but they differ in food matrix, function, and dietary context.

HOW MUCH SUGAR DO GUIDELINES RECOMMEND?

International guidelines do not treat all sugars in the same way. WHO recommendations focus on free sugars, not on sugars naturally present in intact fruit and vegetables or lactose naturally present in milk (WHO 2015).



The European Food Safety Authority (EFSA) reached a different type of conclusion. In 2022, it stated that added and free sugars should be as low as possible within a nutritionally adequate diet, but it did not set a tolerable upper intake level for dietary sugars (EFSA 2022).

The Dietary Guidelines for Americans also move in a restrictive direction on added sugars, while focusing on added sugars rather than sugars naturally present in whole foods (HHS and USDA 2026).

Guidelines differ in categories, thresholds, and methods, but they increasingly converge on reducing free or added sugars. This reinforces the need for precision: recommendations should be interpreted within the broader context of diet quality, food matrix, energy balance, lifestyle, and individual needs.

What sugar is

Sugar belongs to the carbohydrate family. Sugars are the simplest carbohydrates: they include monosaccharides, such as glucose and fructose, and disaccharides, such as sucrose and lactose.

Carbohydrates are one of the main nutrients in the human diet. They include sugars, starches, and fiber. Sugars are absorbed relatively quickly; starches are longer chains of glucose that must be broken down during digestion; fiber is not digested in the same way and plays different physiological roles.

Carbohydrates are found in many everyday foods: fruit, vegetables, legumes, grains, milk, potatoes, rice, pasta, and bread. Sugars occur naturally in foods such as fruit and milk, but they may also be added during processing or preparation, for example, in soft drinks, confectionery, baked goods, breakfast cereals, and desserts.

THE MAIN SUGARS IN SIMPLE TERMS

1 GLUCOSE

THE BODY'S PREFERRED FUEL

Glucose is the **main sugar** found in the blood and a crucial source of energy for the body, serving as the brain's preferred fuel under normal physiological conditions.

2 FRUCTOSE

NATURALLY PRESENT IN FRUIT AND HONEY

Fructose is naturally present in **fruit and honey** and is one of the sweetest sugars found in nature.

3 SUCROSE

THE "TABLE SUGAR"

Sucrose is what people usually mean by **"table sugar."** It is made of one molecule of glucose and one molecule of fructose. It occurs naturally in sugar cane and sugar beet and, to a lesser extent, in fruits and vegetables.

4 LACTOSE

NATURALLY PRESENT IN MILK AND DAIRY

Lactose is the sugar naturally present in **milk and dairy products.** It is composed of glucose and galactose.

5 MALTOSE

FROM STARCH BREAKDOWN

Maltose is composed of **two glucose molecules** and is produced during the breakdown of starch; it is commonly associated with cereals such as barley.

Where sugar comes from: crops, countries, and circularity

Sugar is produced in 108 countries from cane and beet. Brazil, India, and Thailand are central to global production, while several countries in Latin America, Africa, and Asia depend on sugar as part of their agricultural, industrial, and export economies. Sugar supply chains connect farmers, smallholders, cooperatives, mills, processors, exporters, food manufacturers, retailers, and consumers (ISO 2026; OECD-FAO 2025).

WHERE DOES SUGAR COME FROM?



SUGAR CANE

WHERE IT GROWS
Mostly in tropical and subtropical regions.

WHAT IT STORES
Sucrose in the stalk.

SHARE OF GLOBAL PRODUCTION
Around **80%.**

LEADING PRODUCERS
Brazil, India, and Thailand are among the world's leading sugarcane producers, while Latin American countries play a smaller but important role in regional exports, rural employment, and agricultural value chains.



SUGAR BEET

WHERE IT GROWS
Mostly in temperate regions.

WHAT IT STORES
Sucrose in the root.

SHARE OF GLOBAL PRODUCTION
Around **20%.**

LEADING PRODUCERS
The European Union is the world's leading producer of beet sugar, accounting for around half of global beet sugar production.

Sugar is not only a commodity. In many producing regions, it supports income, employment, rural infrastructure, export revenue, and community life. Sugarcane cultivation and processing support the livelihoods of more than 100 million people in 120 countries. This does not mean that health concerns should be ignored. It means that sugar policy also affects livelihoods, rural economies, and producing countries (IISD 2023).

Sugar crops can also support circular agricultural and industrial systems. Co-products from cane and beet can be used for animal feed, renewable ethanol, electricity generation, bio-based products, fertilizers, and soil inputs. In several producing regions, sugarcane residues such as bagasse are used to generate energy for mills and, in some cases, electricity for the grid. In the EU beet sugar sector, co-products are also used for food ingredients, animal feed, renewable ethanol, lime fertilizer, and other agricultural or industrial uses (CEFS 2024).

A policy that stigmatizes or structurally reduces demand for sugar does not affect an abstract nutrient. It affects land, crops, workers, mills, communities, and producing countries. If transitions are needed, they should be managed with evidence, proportionality, and support. Poorly designed pressure on sugar value chains could push land and livelihoods toward alternatives that are not automatically more productive, more sustainable, or less environmentally impactful.

1.2 How the body processes sugar

The next step is to understand how the body handles sugars. Glucose and fructose are metabolized differently, but metabolic differences do not automatically translate into real-world health risk. They need to be interpreted in the context of real diets and real habits.

Glucose: the body's immediate fuel

Glucose is the main sugar circulating in the blood and a crucial source of energy for the human body, serving as the brain's preferred fuel under normal physiological conditions. After digestion, glucose enters the bloodstream and is delivered to cells, where it is used to produce energy. Inside the cells, glucose is broken down through a series of biochemical steps that generate adenosine triphosphate (ATP), the molecule the body uses to store and transfer usable energy. ATP works like the cell's immediate energy carrier: it stores energy in chemical bonds and releases it when the body needs to think, move, and perform essential functions. Glucose is therefore one of the body's most direct and efficient fuels (MedlinePlus 2024; NIDDK 2025).

This is why glucose plays a central role in normal physiology. The brain depends heavily on glucose, and muscles use it continuously during both movement and exercise. When glucose is available, the body can use it immediately. When more is available than is needed in that moment, part of it can be stored for later use, mainly as glycogen in the liver and muscles (MedlinePlus 2024).

When carbohydrate-containing foods are consumed, blood glucose levels rise, and the pancreas releases insulin. Insulin acts as a regulatory signal: it helps glucose move from the bloodstream into the cells, where it can be used for energy or stored for later. In this sense, glucose is part of a normal and tightly regulated energy system, not an abnormal or problematic substance (MedlinePlus 2024; NIDDK 2025).

This helps explain why carbohydrates, including sugars, have long been part of the human diet. As a broader family of nutrients, carbohydrates provide energy, while their digestion and metabolic effects are shaped by the food matrix, fiber content, other nutrients consumed alongside them, and the composition of the overall meal.

HOW INSULIN WORKS AND WHY DIABETES MATTERS

Insulin is a hormone produced by the pancreas. Its main role is to help regulate blood **glucose concentration** and to move glucose from the bloodstream into the cells, where it can be used for energy or stored for later use (MedlinePlus 2024; NIDDK 2025).

In a healthy system:

- food is **digested**, and glucose enters the **blood**
- the **pancreas** releases insulin
- insulin helps **cells** absorb **glucose**
- glucose is used for **energy** or stored as **glycogen**

Diabetes develops when this system does not work properly.
In **type 1** diabetes, the body produces little or no insulin. In the early stages of **type 2** diabetes, the body still produces insulin but does not use it effectively; this is often referred to as insulin resistance (NIDDK 2025; CDC 2026).

The result is that too much glucose remains in the blood, while not enough enters the cells efficiently. Over time, persistently high blood glucose can **damage** blood vessels, nerves, kidneys, eyes, and the heart (NIDDK 2025; CDC 2026).

Important clarification: diabetes is not caused by **one nutrient alone**. It is a complex condition shaped by genetics, body weight, physical activity, overall diet, broader lifestyle, and metabolic factors.

Fructose: context matters more than slogans

Fructose is metabolized slightly differently from glucose, being processed mainly in the liver. This has made it a frequent target in nutrition debates, where it is sometimes portrayed as uniquely harmful – often overstating the evidence. Fructose is naturally present in fruit and honey, and it is usually consumed alongside other nutrients and other sugars, not in isolation. The way the body handles fructose depends not only on its biochemical pathway, but also on the quantity consumed, the food matrix in which it is found, and the overall energy balance of the diet. At very high levels of intake, especially in hypercaloric diets and in forms that are rapidly consumed, fructose may contribute to adverse metabolic effects. But this does not justify treating all fructose-containing foods as equivalent, nor does it support the idea that fructose is, by itself, the defining problem of modern diets.

WHY METABOLISM SHOULD NOT BE TURNED INTO IDEOLOGY

1 **Metabolic pathways matter, but they do not speak for themselves.**

A biochemical difference can help explain physiological mechanisms; it should not automatically be turned into a political conclusion or a moral judgment.

2 **This is particularly important in the sugar debate,**

where metabolic arguments are sometimes used to support broad claims that go far beyond the available evidence. Yet metabolism does not eliminate the need to consider real-world diets, behavioral patterns, substitution effects, and individual variability.

3 **The policy lesson is straightforward:**

evidence is essential, but it must be interpreted within the broader context of how people eat and live.

1.3 The food matrix and consumption context

Sugars are not consumed in isolation. They are consumed within foods and beverages with different food matrices, and as part of meals and broader dietary patterns. Food matrices differ in structure, texture, nutrient composition, and effects on satiety.

The food matrix matters because it influences how quickly sugars are absorbed, how full people feel after eating, and how easily consumption can exceed energy needs.

Sugar in whole fruit is not consumed in the same way as sugar in a soft drink. Fruit provides fiber, water, texture, and chewing resistance – all of which slow down consumption and contribute to satiety. It also delivers vitamins, minerals, and bioactive compounds within a more complex nutritional package.

By contrast, sugars in beverages are typically consumed quickly, require no chewing, and may produce weaker satiety signals than sugars consumed in solid foods. These characteristics are not inherently problematic; their nutritional relevance depends largely on portion size, frequency of consumption, total energy intake, and the broader dietary context. When consumed frequently or in larger amounts, liquid calories may contribute to total daily energy

intake without being fully compensated for later. These characteristics help explain why SSBs often occupy a distinct place in the scientific literature and in policy discussions.

The same principle applies more broadly. In milk and dairy products, naturally occurring lactose is consumed alongside protein, fat, and other nutrients that can influence digestion and metabolic response. Even among processed foods, the nutritional context and food matrix can vary considerably.

SAME SUGAR, DIFFERENT CONTEXT

The nutritional meaning of sugar depends on the food or beverage in which it is found:

- **whole fruit:** sugar + fiber + water + chewing + micronutrients
- **milk and yogurt:** sugar + protein + minerals + a different food matrix and metabolic response
- **soft drinks:** sugar in liquid form, can be rapidly consumed, with some research suggesting weaker satiety signals
- **confectionery and desserts:** sugar is often combined with fat, flavor, and high palatability

Focusing only on sugar quantity is only part of the picture. Quantity matters, but so do form, context, and frequency. The policy implication is important: regulatory approaches that treat all sugars as equivalent risk overlooking how foods are consumed and how they shape dietary patterns.

UNDERSTANDING SUGAR REQUIRES CONTEXT

What matters is not only what we consume, but how much, how often, in what form, and within which diet and lifestyle.

2. What the Evidence Shows – and What It Does Not

The relationship between sugar and health is often presented in overly simple terms. Scientific evidence is more nuanced: different study designs answer different questions, and associations do not automatically establish causation.

The key question is not whether sugar can matter, but when, how much, in what form, and within which dietary context.

The following sections examine the main areas of evidence, together with their strengths, limitations, and relevance for public health policy.

2.1 What science says about sugar and health

Nutrition research relies on two main approaches: controlled trials and observational studies.

Controlled trials are useful because they allow researchers to compare dietary changes under more defined conditions. They do not answer every question, especially over the long term, but they help clarify whether sugar has effects that go beyond its caloric contribution.

When people reduce free sugars in diets, without replacing the calories with something else, body weight tends to decrease modestly (Chiavaroli et al. 2023). When intake increases, body weight tends to increase. This suggests that sugar can matter in practice, but largely through its contribution to total energy intake. In contrast, when sugars are replaced isocalorically (i.e., with an equal amount of energy from other carbohydrates) with other carbohydrates, body weight tends to remain broadly unchanged. In other words, under controlled calorie conditions, sugar does not consistently behave as a unique driver of weight gain (Te Morenga et al. 2013; WHO 2015).

This distinction is essential. The experimental literature does not clearly establish a unique effect of sugar independent of total energy intake. Rather, the strongest evidence suggests that sugar may contribute to excess energy intake when consumed in forms and contexts that facilitate overconsumption.

The limits of this evidence should also be recognized. Many trials are short in duration, conducted under constrained conditions, and often involve relatively high doses. They also do not typically measure long-term clinical endpoints, such as cardiovascular events or diabetes incidence. As a result, they are informative, but not definitive for broad public health claims (Te Morenga et al. 2013; WHO 2015).

WHAT CONTROLLED TRIALS SHOW BEST

- **reducing free sugars** without replacing the calories they provide with other foods (subtraction trials) can modestly **reduce** body weight
- **adding extra calories** from free sugars to the usual diet, without reducing calories from other foods ("addition" trials) can modestly **increase** body weight
- when calories are kept **constant**, replacing sugars with other carbohydrates usually **does not** substantially change body weight
- long-term clinical outcomes remain much harder to establish

Observational studies look at what people eat and drink over time and compare these patterns with health outcomes. Their strength lies in capturing real-world behavior over long periods and across large populations. But their limits are equally important: they can detect associations, not prove causation.

The observational literature does not point to one simple conclusion. Associations between total sugar intake and obesity are often weak, inconsistent, or highly dependent on how intake is measured and which confounding factors are taken into account. This helps explain why public claims about sugar as a unique and universal driver of obesity often go beyond what the evidence can firmly support (Te Morenga et al. 2013; WHO 2015).

The picture is somewhat different for sugar-sweetened beverages. Here, observational studies tend to show more consistent associations with weight gain, type 2 diabetes, and some cardiometabolic outcomes. But even in this case, caution is needed. SSBs may act not only as a source of rapidly consumed calories, but also as markers of broader dietary and lifestyle patterns, including lower diet quality, sedentary behavior, and other social or behavioral factors. In other words, the association may be real, but its interpretation is not always straightforward (Lane et al. 2024; Choi et al. 2026).

This is why observational evidence needs to be read carefully. It can reveal useful signals, but it does not justify turning correlations into deterministic narratives. A stronger association is not the same as a complete explanation.

From a policy perspective, this matters a great deal. If observational evidence is used without sufficient caution, the debate can quickly shift from "this may be associated with risk" to "this is the cause of the problem." That leap is scientifically weak and politically consequential.

The broader lesson is simple: observational studies are valuable, but they do not support reducing the complexity of obesity, cardiovascular disease, or metabolic risk to one nutrient alone.

ASSOCIATION IS NOT CAUSATION

Observational studies can show that two things occur together. They cannot, on their own, prove that one directly causes the other.

In the sugar debate, this means:

- **higher intake** may be associated with **worse** outcomes, but the relationship may also reflect broader dietary patterns
- lifestyle, socio-economic, and behavioral factors may **influence** the result
- **stronger associations** deserve attention, but not automatic simplification

2.2 Uncertainties, contradictions, and methodological limitations

Even after decades of research, important questions about sugar and health remain open. This does not mean that evidence is absent. Evidence is substantial for some research questions, but limited or inconclusive for others, and further research is needed to fully understand the potential health effects of sugars. Policy should reflect these differences in the strength and certainty of the evidence rather than reduce them to a single, simplified conclusion (WHO 2015; WHO Regional Office for Europe 2022a).

Some associations in the literature are statistically significant but modest in size. This matters for policy. A small relative risk does not automatically translate into a large or decisive real-world effect. Evidence should therefore be read by considering both relative and absolute risk, and by asking whether the association is large enough, consistent enough and causally robust enough to justify broad policy conclusions (Zeraatkar et al. 2024).

Long-term clinical endpoints remain difficult to establish. Much of the available evidence concerns body weight, intermediate metabolic markers, or associations with disease risk. Long-term controlled trials measuring hard clinical endpoints – such as cardiovascular events, diabetes incidence, or mortality – are rare, costly, and difficult to conduct in nutrition science. As a result, much of the policy debate relies on indirect evidence, observational associations, or extrapolations from shorter interventions rather than long-term randomized trials with clinical outcomes (WHO 2015; Te Morenga et al. 2013).

Dose-response relationships are not always clear-cut. Public debate often implies that sugar becomes problematic at a clear and universally applicable threshold. In reality, risk may increase gradually, depending on total energy intake and the form in which sugar is consumed, and may vary across individuals and dietary contexts. Broad numerical targets can be useful for public guidance, but they should not be mistaken for precise biological cut-offs that apply identically to everyone (WHO 2015; SACN 2015). Ultimately, the health implications of sugar

intake should be considered within the context of total energy balance and the broader lifestyle context, as a relatively high energy intake may have different consequences when matched by high energy expenditure than when it contributes to a sustained energy surplus.

Substitution effects are often underestimated. Reducing sugar intake does not automatically improve health if calories are replaced by other highly energy-dense foods, or if the broader diet remains unbalanced. A policy may lower the intake of one component while failing to improve the overall dietary pattern. This is consistent with evidence showing that, under isocaloric conditions, replacing sugars with other carbohydrates does not consistently produce meaningful changes in body weight (Te Morenga et al. 2013; WHO 2015).

Individual variability matters. Not all individuals respond to carbohydrate-rich meals in the same way. Glycemic responses can vary substantially across people, influenced by metabolic status, body composition, activity patterns, and other biological and behavioral factors. This does not make population-level guidance irrelevant, but it does highlight the limits of one-size-fits-all interpretations (Wu et al. 2025; WHO 2015).

Real-world diets are more complex than isolated exposures. People eat meals, follow habits, live within routines, and make substitutions. Sugars are consumed alongside fats, proteins, fiber, and other carbohydrates; they are also embedded in cultural, economic, and behavioral patterns. This makes it difficult to isolate the long-term effect of one nutrient while holding everything else constant. Policy should therefore avoid presenting partial evidence as final certainty (WHO 2015; WHO Regional Office for Europe 2022a; Lane et al. 2024).

WHAT UNCERTAINTY DOES NOT MEAN

Scientific uncertainty does not mean that nothing is known.

It means that:

- some relationships are **stronger** than others
- some outcomes are **easier** to measure than others
- some effects **depend** heavily on context and substitution
- policy should be **proportionate** to the strength of the evidence

Uncertainty is not a weakness of science.
It is part of scientific honesty.



EVIDENCE CAN IDENTIFY A RISK.
It cannot turn one nutrient into the whole explanation of disease.

3. From Science to Policy: Where the Gap Emerges

Scientific evidence does not become policy automatically. It passes through interpretation, communication, categorization, and policy decisions – and scientific nuance can be reduced along the way.

In the case of sugar, evidence becomes a category, the category becomes a public message, and the message becomes a policy target.

The following sections examine this process and how policymakers can preserve scientific integrity without sacrificing clarity or effective action.

3.1 Evidence is translated, not simply transferred

Science rarely provides a single instruction. It produces estimates, associations, probabilities, confidence intervals, competing explanations, and findings that apply under specific conditions. It distinguishes between populations, exposure levels, dietary sources, outcomes, and degrees of certainty. Policy requires something different. It must define a problem, identify a target, choose an instrument, assess its expected benefits, costs, trade-offs, and unintended consequences, and explain the decision to the public. The gap begins when this necessary translation becomes excessive simplification.

Evidence that excessive intake of free sugars in an unbalanced diet can contribute to adverse outcomes may be translated into the broader claim that sugar is a principal cause of obesity, CVDs, and NCDs. Limited evidence concerning SSBs may be extended to sugar in general. An association observed in a particular context may become a population-wide causal narrative. At that point, a conditional finding has become a categorical message.

This distinction matters because evidence on sugar does not support the same conclusions for every source, dose, dietary pattern, population, or health outcome. As discussed in the previous chapter, scientific reviews and official assessments recognize important associations while also identifying variation in evidence quality, effect size, and causal interpretation (Te Morenga et al. 2013; SACN 2015; WHO 2015).

Evidence-informed policymaking therefore requires more than citing scientific studies. It requires discipline in deciding which evidence is relevant, how far it can be generalized, and what kind of intervention it can reasonably support (Parkhurst 2017; Cairney and Oliver 2017).

3.2 Why policy shortcuts become attractive

Simplified narratives are politically powerful because they reduce cognitive and institutional complexity.

- a single nutrient creates a recognizable cause
- a numerical threshold creates a measurable boundary
- a warning creates an immediate message
- a tax creates visible action
- a reformulation target creates an observable result

These instruments are easier to communicate than a strategy built around dietary patterns,

physical activity, education, culture, individual variability, and long-term behavioral change. They also offer a compelling political sequence:

identifying a harmful exposure

▼

reducing consumption

▼

improving health

This sequence is cognitively intuitive and travels especially well on social media. It can be reduced to a headline, repeated across campaigns, and quickly carried into public debate and the political agenda. It frames the issue around a clear problem, a responsible actor, and an available solution. But intuitive clarity is not evidence of causal completeness.

Simplified communication and the policies that follow can create a psychologically reassuring sense that the problem has been identified and addressed. Once a clear cause and a visible intervention are established, consumers and institutions may feel that meaningful progress has been made. Yet obesity, CVDs, diabetes, and other NCDs remain complex conditions, and emotional resolution should not be confused with effective prevention.

3.3 From scientific signal to policy intervention

The translation of sugar evidence often follows a recognizable sequence.

HOW THE POLICY GAP IS CREATED

1

A SIGNAL EMERGES FROM PART OF THE EVIDENCE

For example, studies identify associations between high consumption of SSBs and particular health outcomes.

THE SIGNAL IS CATEGORIZED

Different sources, quantities, and contexts are grouped under a broader category such as free sugars, added sugars, or high-sugar products.

2

3

THE CATEGORY BECOMES A PUBLIC NARRATIVE

Scientific qualifications are compressed into a simpler message: sugar causes obesity, diabetes, or other NCDs.

THE NARRATIVE BECOMES A SYMBOL

Sugar comes to represent excess, manipulation, poor diet, or preventable disease.

4

5

THE SYMBOL BECOMES A POLICY TARGET

Governments and advocacy organizations call for numerical reduction targets, taxes, warning labels, advertising restrictions, or mandatory reformulation.

THE POLICY TARGET BECOMES AN INDICATOR OF SUCCESS

Lower sales, reduced sugar content, increased prices, or tax revenues are treated as evidence of public health progress.

6



At every step, the message becomes easier to communicate, while the distance from the original evidence may increase. Meanwhile, evaluation often remains focused on visible intermediate outcomes rather than on whether obesity, CVDs, or broader NCD trends have actually improved, why results have or have not materialized, and what unintended consequences may have emerged.

Eventually, health trends reassert themselves. When obesity and CVD indicators remain unfavorable, the response should be renewed scientific assessment. Instead, disappointing results may trigger another cycle of urgency and simplification, leading to broader or more restrictive policies that appear more decisive without necessarily addressing the underlying complexity.

What begins as a meaningful scientific signal can end as a prescriptive intervention whose symbolic force exceeds its demonstrated health impact. This progression can be seen in international sugar policy.

WHO recommendations established the category of free sugars and clear numerical intake targets (WHO 2015). Later guidance encouraged Member States to consider fiscal measures intended to alter purchasing and consumption through prices (WHO Regional Office for Europe 2022b; WHO 2024a).

Other public health organizations and advocacy networks have supported similar approaches. The World Cancer Research Fund (WCRF) International has developed resources promoting sugar-sweetened beverage taxation and tracks nutrition policies through the NOURISHING database (WCRF International 2018; WCRF International 2024). The World Heart Federation, UNICEF, and the NCD Alliance have also supported or promoted fiscal measures directed at SSBs (World Heart Federation 2015; NCD Alliance 2015; UNICEF 2022).

The issue is not that these institutions provide guidance or advocate action. Both are legitimate functions. The methodological concern arises when a policy recommendation is presented as the direct and inevitable result of science rather than as a political choice made among different possible interpretations, objectives, instruments, and trade-offs. Science can inform that choice. It cannot eliminate the need to justify it.

3.4 A discipline for policy translation

The alternative to simplification is not paralysis. Policymakers cannot wait for perfect evidence, because perfect evidence rarely exists. They must nevertheless distinguish between the urgency to act and the pressure to appear decisive. Before translating a scientific signal into a policy intervention, they should ask:

- What exactly does the evidence establish?
- Does it concern sugar generally or a specific dietary source?
- Is the evidence causal, associative, experimental, or modeled?
- Which populations, doses, and outcomes does it cover?
- What remains uncertain?
- Is the proposed policy targeting the exposure examined in the evidence?
- Are intermediate outcomes being confused with final health outcomes?

- What substitution, distributional, economic, cultural, or behavioral effects may follow?
- What alternative interventions could address the same problem?
- How will intended and unintended outcomes be assessed?

These questions are not obstacles to public health action. They are safeguards against bad policy. They also help policymakers resist three recurring traps.

1

THE HEADLINE TRAP

A striking title or relative-risk estimate may attract attention while concealing small absolute effects, methodological limits, heterogeneous outcomes, or uncertainty.

2

THE CATEGORY TRAP

A category created for research or guidance may be treated as if it described every product, exposure, and individual with equal precision.

3

THE ACTION TRAP

A policy may be judged by how decisive it appears rather than by whether it improves long-term health.

Good policy does not simply follow the loudest interpretation of the evidence. It tests the strength of the signal, preserves relevant distinctions, compares alternatives, and remains open to correction. This discipline is essential if policy is to remain connected to evidence, responsive to results, and proportionate to the complexity of the problem.

Evidence-informed policy should therefore do more than identify a target. It should protect citizens and policymakers from oversimplification, preserve proportionality, and ensure that visible action is not mistaken for effective prevention.

> When scientific nuance disappears, a signal can become a **NARRATIVE,** and a narrative can become **POLICY.**

4. Policy Tools: Promises and Limits

Sugar policy increasingly relies on a limited set of prescriptive tools, including taxes, front-of-pack labels, warning systems, reformulation targets, and behavioral steering measures. These instruments differ in design but share the aim of reducing sugar consumption and improving public health.

The central question is whether they improve overall diets and long-term health outcomes, and whether their benefits justify their costs and unintended consequences.

The following sections examine these tools, while the real-world outcomes of sugar taxes are assessed in greater detail in the next chapter.

4.1 Sugar taxes: what they promise

Sugar taxes, especially taxes on SSBs, are among the most visible fiscal measures in nutrition policy. Their promise is straightforward: increase prices, reduce purchases, encourage reformulation, and generate revenue for public health priorities.

This is why they are often presented as practical and evidence-informed policy tools. WHO has recommended SSB taxation within its fiscal policy guidance, and the World Bank has published implementation-oriented material on the design, administration, and expected effects of such taxes (WHO 2024a; World Bank 2020; World Bank 2024).

The basic mechanism is simple. If sugary drinks become more expensive, consumers may buy less, producers may reduce sugar content, and consumption may shift toward lower-sugar alternatives. In theory, this creates a pathway from taxation to lower sugar intake and, ultimately, better health outcomes.

Sugar taxes are also often presented as purpose-driven fiscal measures. In principle, revenues can be used to fund health promotion, nutrition education, obesity prevention, or access to healthier foods. This makes the policy more politically appealing. However, its credibility depends on whether revenues are earmarked, transparently allocated, and used for interventions with measurable impact.

But the pathway is longer than the policy message suggests. Reducing purchases of taxed products is not the same as demonstrating lower total calorie intake, better diet quality, or measurable improvements in obesity, CVDs, diabetes, or NCD burden. Consumers may switch to untaxed products, cheaper alternatives, or other foods. Producers may reformulate, but a reformulated product is not necessarily healthier in a broader nutritional sense.

Sugar taxes should therefore be evaluated not only by their ability to reduce purchases or generate revenue, but by their demonstrated impact on overall diet, health outcomes, consumer welfare, and the wider food system.

WHAT TYPES OF SUGAR TAXES EXIST?

1

EXCISE TAX

Applies a fixed amount per liter or per volume of product. It is usually easier to administer and can be designed to target SSBs specifically.

2

AD VALOREM TAX

Applies a percentage of the product price. It may raise prices, but it does not necessarily create a strong incentive to reduce sugar content.

3

TIERED TAX

Applies different rates depending on sugar concentration. Products with higher sugar content face higher tax rates. This design is often used to encourage reformulation.

4

SUGAR-CONTENT TAX

Applies the tax directly according to the grams of sugar. In theory, it is more closely linked to the nutrient being targeted, but it may be more complex to administer.

DESIGN MATTERS

A tax aimed at reducing purchases is not the same as a tax aimed at encouraging reformulation, and neither should automatically be treated as evidence of improved health outcomes (World Bank 2020; World Bank 2024).

4.2 Front-of-pack labels and warning systems: information or prescription?

Front-of-pack nutrition labeling has become one of the most visible tools in contemporary nutrition policy. Its stated objective is simple: to help consumers identify nutritional characteristics quickly at the point of purchase and, in some cases, encourage producers to improve product composition. WHO describes front-of-pack labeling as an important policy tool to support healthier food choices, while also emphasizing the need for government-led design, implementation, monitoring, and evaluation (WHO 2019; WHO Regional Office for Europe 2023; European Commission, Joint Research Centre 2022).

Depending on the model, front-of-pack labels may discourage excessive consumption of products high in sugars, salt, saturated fats, or calories, or highlight products with more favorable nutritional profiles. In both cases, the logic is to translate complex nutritional information into a simplified signal that can guide behavior quickly (PAHO 2020; European Commission, Joint Research Centre 2022). This is their strength, but also their limitation: labels work through standard categories and thresholds that may not capture portion, frequency, food matrix, individual needs, cultural context, or overall lifestyle.

Front-of-pack labels are not neutral instruments. Different systems communicate different ideas of nutrition. Some provide numerical information. Others use colors, scores, stars, traffic lights, or warning symbols. Some are interpretive and evaluative; others are more descriptive. Some compare products within categories; others create broader signals of "better" or "worse" foods (European Commission, Joint Research Centre 2022; WHO Regional Office for Europe 2023; Kelly et al. 2024).

This matters because the label does not merely transmit information. It frames the way consumers understand food. A warning label may alert consumers to high sugar, salt, or saturated fat content, but it does not explain portion, frequency, food matrix, overall dietary pattern, physical activity, or context. A color-coded score may make comparison easier, but it may also encourage consumers to treat food as a ranking system rather than as part of a balanced lifestyle.

The evidence suggests that front-of-pack labeling can influence attention, understanding, product comparison, purchasing intentions and, in some cases, reformulation. However, as with sugar taxes, the strongest evidence often concerns intermediate outcomes rather than durable improvements in obesity, CVDs, diabetes, or broader NCD burden (European Commission, Joint Research Centre 2022; Ganderats-Fuentes et al. 2023; Kelly et al. 2024). A label may change perception or selection. That is not the same as demonstrating better long-term health outcomes.

This does not mean that labels should be rejected in principle. It means that they should be assessed carefully: what they help consumers understand, what they oversimplify, how they affect food culture, how producers respond, and whether they improve actual diets rather than merely shifting purchases toward products that perform better under a scoring model. Without food literacy, labels risk becoming shortcuts. With food literacy, they can become tools for better understanding.

TYPES OF FRONT-OF-PACK LABELS & WARNING LABELS

TYPE OF LABEL	EXAMPLES	WHAT IT DOES	MAIN POLICY PROMISE	MAIN LIMITATION
Nutrient-specific warning labels	Chile-style black warning labels; "High in sugar," "High in sodium," "High in saturated fat"	Alerts consumers when a product exceeds thresholds for selected nutrients	Fast, visible warning; discourages products high in nutrients of concern	Can create fear-based categories; may ignore portion, frequency, food matrix, and diet context; works poorly if not applied consistently across products
Traffic light labels	UK-style red/amber/green system	Uses colors to indicate low, medium or high levels of nutrients	Simple comparison across nutrients	May reduce food to color signals and encourage nutrient-by-nutrient thinking
Summary interpretive scores	Nutri-Score	Converts multiple nutritional elements into an overall grade or color	Easy, rapid comparison between products	Can oversimplify nutritional complexity into a single score and does not account for portion size, frequency of consumption, or the overall diet
Positive endorsement logos	Keyhole, choices-style logos	Identifies products meeting certain criteria	Encourages better options within categories	May imply approved products are broadly healthy, without addressing overall diet
Numeric nutrient labels	Energy, sugar, fat or salt per serving / per 100g	Provides factual information	More transparent and less moralizing	Harder to interpret without food literacy
Hybrid systems	Combinations of scores, colors, warnings or nutrient data	Mixes information and interpretation	More complete than one signal alone	Can become complex or confusing if not clearly designed

4.3 Reformulation: product improvement or regulatory compliance?

Reformulation is often presented as the most pragmatic response to concerns about sugar, salt, saturated fat, and energy density. Unlike taxes or warning labels, it does not require consumers to change their behavior consciously. The product is changed before the consumer chooses. This makes reformulation attractive: it promises population-level change through the food supply itself.

WHO describes reformulation as a policy option to reduce energy per portion and lower levels of sugars, salt, saturated fats, and industrial trans fats in food and beverage products (WHO 2022). In practice, reformulation may involve reducing sugar, replacing it with low- or no-calorie sweeteners, changing portion sizes, modifying recipes, adjusting texture, flavor, or shelf life, and redesigning products to meet tax thresholds, label criteria, or voluntary commitments (WHO 2022; Reynolds et al. 2023).

Reformulation can produce measurable changes. It may reduce sugar content in specific product categories, especially when regulatory or fiscal thresholds create strong incentives. The UK Soft Drinks Industry Levy is often cited in this regard: between 2015 and 2018, the sales-weighted mean sugar content of soft drinks fell substantially, while the volume of sugars sold from soft drinks also declined (Bandy et al. 2020; UK Government 2025). For this reason, reformulation should not be dismissed.

But reformulation has limits. Reducing sugar in a product does not automatically improve the overall diet. A reformulated product may remain highly palatable, frequently consumed, energy-dense, nutritionally weak, or disconnected from healthier dietary patterns. It may also rely on substitutes or technical changes that help the product meet a threshold without improving consumer understanding or long-term behavior (WHO 2022; Reynolds et al. 2023).

This is the central ambiguity: reformulation can improve products, but it can also turn innovation into compliance. Firms may design products to avoid a tax, improve a score, escape a warning label, or meet a nutrient threshold. In that case, policy may reshape the market around regulatory criteria rather than around genuine dietary improvement, food quality, or consumer empowerment. Evidence on front-of-pack labels also shows that labeling systems can influence industry reformulation, but this should be assessed as a broader shift in incentives, not only as product change (Ganderats-Fuentes et al. 2023; Brogaard 2025).

Reformulation can also affect firms and supply chains unequally. Large companies usually have more capacity to reformulate, test, relabel, and adapt products across markets. SMEs, traditional producers, and local manufacturers may face higher relative costs. Producing countries and agricultural value chains may also be affected when reformulation reduces demand for specific ingredients.

A more balanced approach would promote structured dialogue between institutions, companies, SMEs, producers, and value-chain actors, as illustrated by the Italian case discussed below. The objective should not be to redesign food only to satisfy regulatory criteria, but to improve products where useful while helping citizens consume them better: in the right quantity, with the right frequency, and within a balanced lifestyle.

Reformulation can be part of better public health policy when it responds to consumer demand and improves product quality. It becomes more problematic when it is imposed from above as a technical redesign of recipes to meet regulatory targets. If limited results lead to ever-stricter reformulation mandates, policy risks moving from product improvement to social engineering.

> **CHANGING PRICES,PRODUCTS,** or **CHOICES** is not the same as **IMPROVING** health.

5. Sugar Taxes in Practice: From Promises to Outcomes

Sugar taxes deserve closer attention as the most visible test case of sugar policy. They are intended to influence prices, purchases, reformulation, and ultimately health outcomes.

The key question is whether changes in the market produce sustained improvements in diets and public health.

The following sections examine the evidence on prices, purchases, reformulation, substitution, revenue, distributional effects, and long-term health outcomes.

5.1 Where the evidence is strongest

The strongest evidence concerns prices, sales, and reformulation. A systematic review and meta-analysis published in JAMA Network Open found that implemented SSB taxes were associated with higher prices and lower sales of taxed beverages, although effects varied across countries, tax designs, and consumer groups (Andreyeva et al. 2022). The Tax Foundation report also cites evidence of an average pass-through rate of about 82%, with estimates ranging from 68% to 98%.

What is a pass-through rate?

It is the share of a tax that is passed on to consumers through higher prices. If a €1 tax increases the retail price by €0.80, the pass-through rate is 80%.

For sugar taxes, this matters because the policy works through price: no price increase, weaker behavioral effect. Producers and retailers may pass part of the tax on to consumers, absorb part of the cost, or reformulate products to reduce sugar content and avoid the tax.

Taxes can also reduce purchases of taxed beverages. The Tax Foundation report notes that studies commonly find that a 10% tax-induced price increase is associated with roughly a 10% decline in SSB purchases. However, effects vary by market and tax design.

They can also encourage reformulation, especially when taxes are tiered or linked to sugar content. The UK is the most frequently cited case. Between 2015 and 2020, the sales-weighted average sugar content of retailer own-brand and manufacturer-branded soft drinks within the scope of the UK Soft Drinks Industry Levy (SDIL) fell from 3.8 g/100 ml to 2.1 g/100 ml, a 46% reduction, while total sugar sales from these drinks declined by 34.3% (OHID 2022). But a subsequent controlled analysis, accounting for pre-existing trends, estimated that the UK SDIL was associated with a 2.7% reduction in sugar purchased from all soft drinks one year after implementation (Rogers et al. 2023).

These findings matter. They show that sugar taxes can change prices, purchases, and product formulation. But they do not settle the public health question. Lower sales of taxed beverages do not automatically demonstrate lower total sugar intake, lower calorie intake, better diet quality, or improved outcomes for obesity, CVDs, diabetes, or NCD burden.

HOW SUGAR TAXES ARE SUPPOSED TO WORK

A sugar tax usually follows this logic:

1. the **government** taxes a product category, usually SSBs
2. retail prices **increase** if the tax is passed on to consumers
3. consumers **buy less** because the product becomes more **expensive**
4. producers **reformulate** to **reduce** sugar content or **avoid** the tax
5. sugar intake **falls** if consumers do not **compensate** elsewhere
6. health **improves** if lower sugar intake leads to a **better** overall diet and reduced risk

The critical point is the distance between step 3 and step 6. Reducing purchases of taxed products is not the same as demonstrating improved public health outcomes.

5.2 What happens to sugar consumption?

More than one hundred countries have adopted some form of tax on SSBs or sugary drinks. According to the World Bank database cited by Hoffer and Macumber-Rosin (2025), 117 countries had adopted some form of sugary drink tax as of 2023. This shows policy momentum. It does not, by itself, demonstrate policy effectiveness.

This paper does not aim to review all existing cases. It focuses on selected examples that are relevant globally, politically, or methodologically because they show different policy designs, market responses, implementation challenges, and limits of interpretation.

The pattern is clear: sugar taxes can affect prices, purchases, and reformulation. The evidence that they reduce overall sugar consumption, obesity, CVDs, diabetes, or broader NCD burden is far less conclusive.

Some taxes change purchases

Mexico is one of the most cited cases globally. The 2014 peso-per-liter tax on SSBs was associated with a reduction in household purchases of taxed beverages, with studies reporting an average decline of around 6% in the first year and around 7.6% over the first two years (Colchero et al. 2016; Colchero et al. 2017; Sánchez-Romero et al. 2020). This makes Mexico an important example of a tax that can change purchasing behavior. However, the evidence is not that strong on long-term health outcomes. Mexico shows that taxes can affect specific market behaviors, but it does not by itself demonstrate durable reductions in obesity, CVDs, diabetes, or NCD burden.

The Mexican case also illustrates why context matters. In some communities, high SSB

consumption cannot be understood only through price or individual choice. Water insecurity, poor trust in tap water, and intermittent supply can make substitution for safe drinking water more difficult. In such contexts, taxation without investment in safe, accessible water risks treating a structural problem as if it were only a consumer behavior problem.

The United States offers a different lesson. SSB taxes have mostly been adopted at the local level, including Berkeley, Philadelphia, Oakland, San Francisco, Boulder, and Seattle. Evidence from U.S. cities shows that local taxes can increase prices and reduce sales of taxed beverages; one multi-city evaluation found a 33.1% increase in SSB prices and a 33.0% decline in purchase volume after implementation (Kaplan et al. 2024). However, local taxes also raise questions about scale, substitution, cross-border shopping, and whether changes in beverage purchases are sustained over the long term and translate into measurable health outcomes.

What is the substitution effect?

It occurs when consumers reduce purchases of a taxed product but replace it with another product. For example, they may buy untaxed beverages, cheaper brands, fruit juices, snacks, or other caloric foods. In that case, sales of taxed drinks may fall, but total sugar or calorie intake may not fall in the same way.

What is cross-border shopping?

It occurs when consumers avoid a local tax by buying the same or similar products in a nearby area where the tax does not apply. This is especially relevant for city-level or regional taxes. It can reduce local sales of taxed products without necessarily changing overall consumption.

Both effects matter because they weaken the link between lower sales of taxed beverages and improved health outcomes.

Some taxes shape reformulation

The UK is the strongest case for a tax as an industry-shaping tool. The Soft Drinks Industry Levy was associated with substantial reformulation and lower sugar sold through soft drinks. However, UK sugar consumption had already been declining before the levy, and the broader sugar reduction program also contributed to the trend.

Market change should not be confused with demonstrated health improvement. Adult obesity in England has not declined: the Health Survey for England reported that 29% of adults were living with obesity in 2022, while UK government data show an upward trend in adult overweight and obesity since 2015/16 (NHS Digital 2024; Office for Health Improvement and Disparities 2024).

The UK also illustrates a broader policy trajectory. The levy became part of a wider regulatory environment that includes sugar reduction programs, restrictions on the promotion and

placement of High in Fat, Salt, and Sugar (HFSS) products, and advertising restrictions for less healthy food and drink, including TV and online restrictions from January 2026 (UK Government 2025). This does not mean that the levy failed. It shows that, when reformulation does not clearly improve obesity and NCD trends, policy may expand toward increasingly prescriptive tools.

Chile also illustrates the importance of tax design and intensity. In 2014, Chile modified its soft drink tax by increasing the rate on higher-sugar beverages and reducing it on lower-sugar beverages. Studies found changes in prices and affordability, and one evaluation reported a reduction in purchases of higher-sugar beverages, although effects varied by model and product category (Caro et al. 2018; Nakamura et al. 2018; Cuadrado et al. 2020). The Chilean case shows that differentiated taxes may influence purchasing and reformulation incentives, but modest tax changes may produce modest and uneven effects.

Some cases show limited or mixed effects

France and Ireland illustrate another important point. Market changes do not necessarily translate into better population health. In France, despite the introduction and subsequent redesign of the soda tax, the Tax Foundation review reports that per capita sugar consumption remained broadly stable over the following decade, while obesity continued to rise over the longer term (Hoffer and Macumber-Rosin 2025).

Ireland presents a similar pattern. The tax was associated with reformulation and lower sugar in soft drinks, but these changes largely continued pre-existing trends. Sugar from soft drinks reportedly fell from 5 kg per person in 2018 to 3.8 kg in 2022, while total sugar consumption remained broadly stable. At the same time, adult obesity increased from about 23% in 2015 to around 29.5% in 2022 (Hoffer and Macumber-Rosin 2025). These examples do not show that sugar taxes are ineffective. They show that changes in one product category do not automatically translate into measurable improvements in population health.

Poland illustrates the limits of beverage-focused taxation. The tax is more recent, and robust health evaluation remains limited. The Tax Foundation report notes that total per capita sugar consumption increased from 41.33 kg in 2010 to 46.33 kg in 2022. A recent ecological study examining trends after the 2021 sugar tax found a modest decline in per-capita sugar purchases and an initial reduction in SSB consumption, followed by a partial rebound. At the same time, sweets consumption increased, suggesting possible substitution effects, while overweight and obesity rates continued to rise (Seweryn et al. 2026).

Australia adds a broader trend-based caution. Reviews of national dietary data have reported that sugar intake declined or remained stable in several populations during periods in which overweight and obesity continued to rise. This does not prove that sugar plays no role. But it challenges the idea that sugar alone can straightforwardly explain obesity trends and reinforces the need to interpret tax outcomes within broader dietary, behavioral, and lifestyle changes (Barclay and Brand-Miller 2011; Wittekind and Walton 2014).

Some cases show policy expansion before health evidence

Colombia is politically important but still too recent for strong outcome claims. Its tax on sugary drinks and ultra-processed foods began in 2023, with rates scheduled to increase

over time. For now, Colombia is best treated as a case of policy expansion and regulatory ambition, not as evidence of demonstrated health impact (Global Food Research Program 2023; Cárdenas-Torres et al. 2024).

Denmark, Norway, and Hungary illustrate why tax design and political sustainability matter. Denmark abolished its soft drink tax, and Norway significantly reduced its tax on non-alcoholic beverages after concerns around economic costs, consumer resistance, and cross-border shopping. Hungary adopted a broader Public Health Product Tax covering several categories of foods and drinks, with evidence suggesting some reductions in consumption of taxed products over time. Yet even broader tax models do not clearly establish durable improvements in obesity or NCD outcomes (Pfinder et al. 2020; Berezvai et al. 2024; Pineda et al. 2024; Hoffer and Macumber-Rosin 2025).

Is Singapore a success story?

Singapore is often cited as an ambitious strategy to reduce sugar intake from beverages. However, it is not a standard sugar tax case. Its Nutri-Grade system combines front-of-pack labeling, advertising restrictions for less favorable grades, and incentives for reformulation.

This matters because Nutri-Grade is only one component of a broader public health strategy that also includes physical activity promotion, health education, preventive care, and wider lifestyle measures. Any positive trend, therefore, cannot be attributed automatically to one single instrument.

Evidence from a randomized trial suggests that Nutri-Grade labels may reduce sugar purchased from beverages. However, the same study found no significant improvement in overall diet quality (Shin et al. 2023). Singapore is therefore a useful lesson: targeted tools may influence specific choices, but they do not automatically transform the broader diet or solve obesity and NCDs.

The relevant question is not whether one tool can change one purchasing decision. It is unclear whether a broader strategy can help citizens adopt healthier and more balanced lifestyles.

5.3 When market outcomes are not health outcomes

Sugar taxes can influence markets. They may increase prices, reduce purchases of taxed beverages, and encourage reformulation. These are measurable outcomes. The public health question, however, is different: do these market changes translate into lower obesity, CVDs, diabetes, or NCD burden?

Current evidence provides a much less certain answer. Systematic reviews consistently find stronger evidence for changes in prices, sales, and purchases than for improvements in long-term health outcomes (Teng et al. 2019; Andreyeva et al. 2022).

This distinction matters. Lower sales of taxed beverages are not the same as lower sugar

intake. Lower sugar intake is not the same as lower calorie intake. And lower calorie intake is not the same as lower obesity or better health.

Some argue that obesity trends would have been even worse without sugar taxes. Early UK counterfactual analyses offer partial support, linking the levy to lower free-sugar intake and less obesity in older girls (Rogers et al. 2024), though evidence remains limited in scope and duration.

The broader context reinforces this caution. Obesity continues to rise worldwide despite very different policy approaches. According to the WHO, global obesity prevalence more than doubled between 1990 and 2022, while the World Obesity Federation projects a continued increase over the coming decade (WHO 2025; NCD-RisC 2024; World Obesity Federation 2024).

This does not prove that sugar taxes are ineffective. It simply means that improvements in prices, purchases, or reformulation should not be interpreted as evidence of improved population health. Public health policies should therefore be evaluated not only by what they change in the marketplace, but by what they change in people's lives. This includes intended benefits as well as unintended consequences, which are often overlooked in policy evaluation.

> **A TAX CAN CHANGE THE MARKET.**
> The real test is whether it changes **HEALTH.**

6. Unintended Consequences: When Simple Tools Meet Complex Systems

Prescriptive sugar policies do not operate in isolation. Taxes, reformulation targets, warning labels, advertising restrictions, and portion-size rules can affect consumers, markets, businesses, public finances, and society beyond their immediate objective.

A policy may achieve its stated target while creating new costs, distortions, or inequalities elsewhere. Its effectiveness must therefore be assessed across the wider system, including how consumers and businesses adapt.

The following sections examine the main economic, social, behavioral, and institutional consequences of these policies.

6.1 Why unintended consequences matter

Public policies should be judged not only by their intentions, but by their real-world effects. This is especially true in nutrition policy, where interventions operate within complex systems involving consumers, producers, markets, social norms, supply chains, and individual behavior. A policy designed to change one variable rarely changes only that variable.

Sugar taxes illustrate this well. Their intended pathway is simple: increase prices, reduce purchases, encourage reformulation, and improve health. In practice, however, consumers and producers adapt. They substitute products, change purchasing habits, reformulate recipes, adjust prices, or shift consumption in ways that are difficult to predict.

This is why evaluating sugar taxes cannot stop at prices, sales, or reformulation. Evidence is generally stronger for these intermediate outcomes than for substitution, overall diet quality, calorie intake, or long-term health outcomes (Teng et al. 2019; Andreyeva et al. 2022). The Cochrane review reached a similar conclusion, finding very low-certainty evidence for taxes on unprocessed sugar and sugar-added foods and highlighting the need for stronger evidence on consumption, obesity, and health outcomes (Pfinder et al. 2020).

The broader lesson extends beyond sugar taxes. In complex systems, every intervention creates intended and unintended consequences. Effective policy therefore requires looking beyond the immediate target and evaluating the full chain of effects.

6.2 Substitution effects: consumption moves, it does not disappear

When the price of a taxed product increases, consumers may buy less of that product. This does not necessarily mean that the underlying demand for sweetness, calories, convenience, or reward disappears. Consumption may shift rather than vanish.

Consumers may move toward untaxed beverages, cheaper brands, fruit juices, milk-based drinks, sweets, snacks, or other foods. Lower sales of taxed beverages should therefore not automatically be interpreted as lower total sugar or calorie intake.

This issue is particularly relevant because many sugar taxes apply only to selected beverages. A narrow tax base may change the composition of purchases without substantially improving

the overall diet.

Evidence on substitution remains weaker than evidence on prices, purchases, and reformulation, making its impact on overall dietary intake and long-term health difficult to quantify (Teng et al. 2019; Andreyeva et al. 2022; Pfinder et al. 2020).

Poland provides a recent illustration. Following the introduction of the 2021 sugar tax, sugar-sweetened beverage consumption initially declined but later partially rebounded, while sweets consumption increased, suggesting possible substitution effects (Seweryn et al. 2026). Although an ecological study cannot establish causality, the case illustrates how consumption may shift rather than disappear.

A similar consideration applies to interpretive front-of-pack labels. Choosing a product with a more favorable nutritional profile does not necessarily improve the overall diet if it leads to higher consumption, substitution toward other products, or if the apparent improvement mainly reflects reformulation rather than meaningful changes in dietary patterns. The central policy question is therefore not only whether consumption changes, but where it moves and what replaces it.

Can substitution be regulated away?

Some argue that substitution can be addressed by expanding taxes, warning labels, and reformulation requirements to cover more products. But this changes the nature of the intervention. A targeted measure gradually becomes a broader attempt to redesign the food environment through regulation.

This raises difficult questions. Can public authorities define the best diet for millions of people with different needs, cultures, incomes, lifestyles, and metabolic profiles? What happens to competition when only larger firms can absorb compliance costs and reformulate at scale? And what happens to freedom of choice when policy moves from informing consumers to correcting their behavior?

The question is not simply how to eliminate substitution. It is a question of how far public policy should go in trying to eliminate it.

6.3 Cross-border shopping and tax avoidance

Taxes may change not only what consumers buy, but also where they buy it. This is particularly relevant when measures are introduced locally, in border regions, or where neighboring jurisdictions apply different tax regimes.

Consumers who can purchase the same products elsewhere at a lower price may avoid the tax without reducing consumption. Local sales may fall, creating the appearance of behavioral change, while purchases are simply displaced to another jurisdiction.

This weakens the public health rationale of the measure and creates economic distortions. Retailers operating within the taxed area may lose business, while nearby untaxed markets benefit.

Evidence from local beverage taxes in the United States shows that some consumers respond by shopping outside the taxed jurisdiction (Seiler et al. 2021; Andreyeva et al. 2022). Research on Oakland found increased purchasing outside the city but no substantial change in overall SSB consumption or added sugars from beverages among adults or children (Cawley et al. 2023).

Similar incentives have been observed in Europe. As noted earlier, Norwegian consumers have traveled to Sweden to purchase cheaper sweets and soft drinks, while Denmark and Norway have revised earlier beverage-tax policies amid concerns that included cross-border shopping, consumer resistance, and economic costs (Henley 2019a; Henley 2019b; Hoffer and Macumber-Rosin 2025).

The lesson is straightforward: a tax may reduce recorded sales within one jurisdiction without reducing actual consumption. Broader international coordination could limit some forms of tax avoidance, but it would not eliminate substitution within the diet or resolve the wider limitations of nutrient-centric policy.

6.4 Regressivity and social impact

Sugar taxes can also have unequal distributional effects. Consumption taxes are generally regressive because they absorb a larger share of disposable income among lower-income households. Their social impact therefore requires careful evaluation, especially when they are presented as measures intended to protect vulnerable consumers.

A systematic review of SSB taxes by socio-economic position found that studies examining the amount paid generally identified a regressive fiscal pattern, although the absolute differences were often small (Backholer et al. 2016). Lower-income households may also respond more strongly to price increases. In Mexico, reductions in purchases of taxed beverages were larger among lower socio-economic groups, while purchases of untaxed beverages increased (Colchero et al. 2016; Colchero et al. 2017).

Supporters therefore argue that a tax can be regressive in fiscal terms but progressive in health terms. If lower-income consumers reduce consumption more and obtain greater health benefits, the policy could contribute to reducing health inequalities. UNICEF similarly argues that the impact may be greater among lower-income households, particularly where consumption is higher, and revenues are reinvested in health and well-being programs (UNICEF 2022).

This argument deserves serious consideration, but it depends on several conditions. Lower purchases must reduce total sugar or calorie intake rather than shift consumption elsewhere. The expected health benefits must materialize and be large enough to justify the unequal financial burden. Without evidence that these conditions are met, fiscal regressivity remains observable while health progress remains assumed.

Are sugar taxes unfair to low-income consumers?

They can be. Lower-income households generally spend a larger share of their disposable income on consumption goods, making the fiscal burden proportionally greater even when the absolute amount paid is limited (Backholer et al. 2016).

Supporters respond that these consumers may reduce purchases more and could therefore receive greater health benefits. Evidence from Mexico supports the first part of this argument, but the second depends on whether lower purchases produce better diets and measurable health improvements (Colchero et al. 2016; Colchero et al. 2017).

The key question is whether the health benefits are sufficiently clear and substantial to justify the unequal financial burden.

6.5 Fiscal drift: from health measure to revenue tool

Sugar taxes are often presented both as tools to discourage consumption and as sources of funding for public health. Over time, however, a tax introduced for health reasons may become valued primarily for the revenue it generates. This process can be described as fiscal drift.

The tension is straightforward. If the tax succeeds in substantially reducing consumption, its tax base, and therefore its revenues, should decline. If governments become dependent on the revenue, the fiscal objective may begin to compete with the health objective.

Revenue use is therefore central to the policy's legitimacy. Funds should be transparently allocated and evaluated against the health objectives used to justify the tax.

The UK illustrates this ambiguity. The Soft Drinks Industry Levy was initially linked to funding for children's health and school activities, but its revenues were later absorbed into general funding. The levy still generated £338 million in the 2023–2024 financial year, although less than originally projected (Hoffer and Macumber-Rosin 2025).

Ireland presents a similar case. Revenues from the Sugar Sweetened Drinks Tax are not earmarked for sugar-related health programs but flow into the general fund. France also shows that public support may be stronger when revenues are associated with health purposes, even when their eventual allocation is broader and less directly connected to measurable health outcomes (Hoffer and Macumber-Rosin 2025).

Raising public revenue is not inherently problematic. Governments need resources for prevention, education, and healthcare. But when a tax is justified on public health grounds, its revenues should be transparently allocated and evaluated against the health objectives used to defend it. Otherwise, the measure risks becoming ordinary taxation with public health branding.

6.6 Reformulation ambiguity: less sugar does not always mean better health

Reformulation is often presented as one of the clearest benefits of sugar taxes and front-of-pack labeling systems. Whether based on sugar thresholds, warning symbols, or traffic-light scores, these policies can encourage manufacturers to change recipes to avoid higher taxes or unfavorable classifications.

The UK Soft Drinks Industry Levy provides one example. As discussed earlier, it was followed by substantial reductions in the average sugar content of soft drinks and in the volume of sugar sold through them (Bandy et al. 2020; UK Government 2025). Similar responses have been observed under front-of-pack labeling systems, including Chile's warning-label policy, where manufacturers reformulated products to reduce nutrients exceeding regulatory thresholds (Roberto et al. 2021; Ganderats-Fuentes et al. 2023). These examples show that regulatory incentives can reshape product composition. They do not, however, establish that reformulation translates into healthier diets or better long-term health outcomes.

First, reformulation changes the products covered by the policy, not the diet as a whole. Less sugar in a beverage or food does not necessarily mean lower total sugar intake, lower calorie intake, or a healthier dietary pattern. Consumers may compensate through other products, larger portions, or more frequent consumption.

Second, reducing one nutrient may require broader changes to the formulation. Manufacturers may adjust the recipe to preserve taste, texture, shelf life, and consumer acceptance. The product may contain less sugar without materially changing its energy density, sweetness, or overall nutritional profile.

The same caution applies when sugar is replaced with non-sugar sweeteners (NSS). Such substitution can reduce sugar and energy intake and may be useful in specific contexts, but it should not be treated as evidence of improved long-term health. WHO found some short-term benefits in randomized trials but no clear long-term benefit for weight control, and its 2023 guideline recommends against using NSS as a strategy for weight control or NCD prevention (WHO 2022b; WHO 2023; Johnson et al. 2018).

Third, taxes and labeling systems can create a compliance-driven model of innovation. Products may be reformulated primarily to fall below a tax threshold, remove a warning symbol, or obtain a more favorable color or score. This is particularly relevant for traffic-light systems, which reduce complex nutritional profiles to a limited number of visible indicators. Small changes in selected nutrients may improve the label without materially improving the product.

This can also shape consumer perception. A reformulated product may appear healthier because it contains less sugar, carries fewer warnings, or receives a better score. Yet nutritional quality still depends on portion size, frequency of consumption, food matrix, total energy, the wider diet, and individual needs.

Reformulation can contribute to better products, but it is an intermediate outcome, not proof of better health. Its value should be assessed by examining the whole product, actual consumption patterns, and measurable health effects rather than changes in a single nutrient



or regulatory score.

The policy risk is that public health becomes reduced to recipe optimization. When success is defined by lower sugar content, fewer warnings, or better label scores, companies learn to design products for the regulatory system rather than for the complexity of human health.

6.7 Market distortions and impact on firms

Sugar taxes, labeling systems, and reformulation requirements do not affect all firms in the same way. Their impact depends on company size, product category, margins, technical capacity, and ability to manage regulatory change.

Large companies often have dedicated regulatory teams, broader product portfolios, and greater resources for research, consumer testing, ingredient sourcing, packaging changes, and supply-chain adjustment. Smaller producers and local brands face similar regulatory pressure with fewer financial and organizational resources.

A measure that appears neutral may therefore favor firms able to adapt quickly and at scale. Reformulation and compliance costs may be manageable for multinational companies but proportionally much greater for small and medium-sized enterprises. Over time, this can reinforce market concentration and reduce product diversity.

The effects are not only economic. Food and beverages also reflect taste, tradition, technical know-how, local identity, and consumer expectations. Sugar may contribute not only to sweetness but also to texture, preservation, fermentation, color, and mouthfeel. Reformulating a product can therefore change more than its nutrient profile.

This is especially relevant for traditional or occasionally consumed foods associated with festivals, religious celebrations, seasonal customs, or regional identity. Traditions can evolve, but policies based solely on nutrient thresholds may fail to distinguish between habitual overconsumption and moderate consumption within a broader cultural context.

Regulation also changes the direction of innovation. When products are assessed primarily through tax thresholds, warning symbols, or label scores, firms may optimize recipes for regulatory compliance rather than overall quality, consumer value, or meaningful nutritional improvement.

The UK Soft Drinks Industry Levy illustrates this effect. Evidence from the Institute for Fiscal Studies suggests that approximately 8% of soft drink volumes are now sold with sugar content just below the 5 g per 100 ml tax threshold, compared with around 2% before the levy was introduced (Brogaard 2025). This indicates that producers have reformulated products partly to avoid the tax.

Such reformulation may be considered successful when the objective is to reduce sugar content. It also shows, however, how product design can become organized around the architecture of the regulation. A product becomes more compliant without necessarily becoming better in a broader nutritional or consumer sense.

The Netherlands provides a different example. An exemption originally designed for milk and buttermilk also covered some sweetened or flavored drinks containing only a limited dairy

component. The government subsequently moved to revise the rules, while media reported cases of producers adding small amounts of dairy to avoid the beverage tax (Government of the Netherlands 2025; NL Times 2024).

These examples show how firms respond rationally to regulation. They may reduce sugar, reformulate around thresholds, or redesign products to qualify for exemptions. The outcome depends not only on the public health objective, but also on the detailed incentives created by the policy.

Recent UK developments point in the same direction. The government has decided to lower the Soft Drinks Industry Levy threshold from 5 g to 4.5 g of sugar per 100 ml and to extend the levy to certain pre-packaged milk-based and plant-based drinks with added sugar from 2028 (UK Government 2025; The Guardian 2025). When firms adapt to one threshold, governments may lower it or extend the policy to additional categories.

This creates an escalation dynamic. More detailed rules may correct individual loopholes, but they also increase regulatory complexity and compliance costs. Nutrient-centric regulation gradually reorganizes markets around an expanding set of thresholds, exemptions, and classifications.

UN ENFOQUE DIFERENTE: COMPROMISOS VOLUNTARIOS EN ITALIA

Italia ofrece un ejemplo de un enfoque más **cooperativo.** En el marco nacional ***Guadagnare Salute,*** el Ministerio de Salud trabajó con sectores de la industria alimentaria para identificar **oportunidades voluntarias de reformulación** en bebidas, productos lácteos, cereales, confitería y helados (Ministerio de Salud de Italia 2015).

Un acuerdo posterior con la Asociación Italia de la Industria de Bebidas sin Alcohol (**ASSOBIBE**) se centró en **reducir** el aporte calórico de las bebidas no alcohólicas, promover un consumo más consciente y reforzar la protección de los consumidores más jóvenes. Según datos reportados por la industria, el sector **redujo** en 27% la cantidad de azúcar puesta en el mercado italiano durante la década anterior y logró una reducción adicional del 13% entre 2020 y 2022 (ASSOBIBE 2021; ASSOBIBE 2023).

Los compromisos voluntarios **no** eliminan la necesidad de monitoreo independiente, transparencia y metas medibles. Sin embargo, muestran que la reformulación también puede promoverse mediante **cooperación, cambio** gradual y **responsabilidad** compartida, y no únicamente a través de impuestos y clasificaciones obligatorias.

Tax design can reduce individual distortions, but it cannot eliminate the structural tension. When regulation defines the preferred product through increasingly detailed thresholds, innovation risks becoming compliance rather than creativity.

The objective of public health should not be to make all products converge toward a single regulatory ideal. It should be to provide consumers with clear information and the skills to understand portion, frequency, context, and balance.

6.8 Global value chains and producing countries

Nutrition policy does not stop at the supermarket shelf. It travels through supply chains. Sugar is not only a nutrient listed on a product label. It is also an agricultural commodity, an industrial input, a source of rural employment, and part of value chains connecting farmers, cooperatives, mills, manufacturers, exporters, retailers, and consumers. Policies that influence sugar demand can therefore produce effects far beyond individual purchasing behavior.

This productive dimension is often overlooked in public health debates. When sugar is treated only as a health risk, the farmers, workers, businesses, investments, and communities behind it become largely invisible.

Central America illustrates why these wider effects matter. In countries such as Guatemala, El Salvador, Nicaragua, Costa Rica, and Panama, the sugar sector supports agricultural and industrial employment, export revenues, local suppliers, infrastructure, renewable energy, and investment in rural communities.

The region has also become an increasingly important part of the global sugar economy. Between 2001 and 2014, sugar production in Central America increased by 64%, while its exportable surplus reached 3.7 million tons in 2019 (International Sugar Organization 2023).

The importance of the sector therefore extends well beyond the value of the final commodity. It is embedded in national economies and in the livelihoods of rural communities, making producing countries particularly exposed to changes in global demand.

At the regional level, UNALA reports that the Latin American sugar sector supports more than 6.7 million jobs and produces around 58.4 million tons of sugar, 37.35 billion liters of ethanol and 28.45 TWh of renewable electricity cogenerated from sugarcane biomass. These figures should be further disaggregated by country and independently validated, but they demonstrate the scale of the livelihoods connected to the value chain (UNALA 2026).

This creates a development trade-off that nutrition policy should not ignore. Measures introduced in consumer markets, including taxes, warning labels, unfavorable scoring systems, advertising restrictions, and reformulation targets, can alter demand signals throughout the value chain. The effects may reach producers through lower prices, reduced contracts, delayed investment, changes in processing capacity, or pressure to shift toward other crops or activities.

FROM GRAMS TO GLOBAL VALUE CHAINS

The scale of these effects can be illustrated through a simple **scenario**. If average sugar intake across the European Union declined by **5 grams** per person per day, the individual change would appear **modest**. Applied to approximately **452 million** residents over one year, however, it would correspond to around **825,000 tons** of sugar (Rogers et al. 2024; Eurostat 2026).

This volume is equivalent to approximately **5%** of annual EU sugar production and around **0.46%** of global production (European Commission 2026; International Sugar Organization 2025).
The calculation is illustrative and assumes that the reduction applies across the population, is sustained over time, and translates into lower aggregate demand. The same exercise can be applied to any market by comparing the expected reduction in consumption with domestic production, trade flows, and global output, making the wider economic implications of nutrition policy more visible.

5 grams per person per day
452 million EU residents

▼

≈ 825,000 tons per year

▼

≈ 5% of EU production
≈ 0.46% of global production

A small change in consumption within a large consumer market may appear marginal from an individual health perspective. Aggregated across millions of consumers, however, it can represent a material change in demand. The economic effects may then be concentrated in a relatively small number of producing regions, rural communities, and export-dependent economies.

This asymmetry is central to a proportionality assessment. Health benefits may be gradual, diffuse, difficult to attribute, or limited to intermediate outcomes such as purchases and product composition. Economic effects on producers can be more immediate, measurable, and geographically concentrated.

Lower revenues can also reduce the capacity of producers and processors to invest in productivity, worker training, environmental programs, water management, renewable energy, community services, and technological modernization. The relationship is not automatic: lower demand does not always produce lower social or environmental investment. But policies that structurally weaken a sector can reduce the resources available for such investments,

particularly where firms and producers operate with narrow margins.

Smaller actors may be especially exposed. Large international companies can diversify portfolios, change suppliers, reformulate products, and distribute regulatory costs across markets. Farmers, cooperatives, local mills, and smaller manufacturers usually have fewer options. They may bear the consequences of policies designed and adopted far from the places where sugar is grown.

Recognizing these effects does not mean protecting every production model or exempting the sector from health, labor, or environmental scrutiny. Markets evolve, consumption patterns change, and producers must continue improving their social and environmental performance.

It does mean that evidence-based policy must evaluate the full chain of consequences. A measure should not be judged only by whether it marginally reduces purchases in a consumer market. It should also be assessed according to the livelihoods, investments, regional economies, and development opportunities it may affect.

The relevant question is therefore not simply whether sugar demand should decline. It is whether the demonstrated health benefits are sufficiently clear and substantial to justify the economic and social costs created across producing countries, and whether less disruptive alternatives could achieve better outcomes. Public health cannot claim to promote equity while making the people at the beginning of the supply chain invisible.

6.9 From demonization to disordered relationships with food

Nutrition policy also shapes how people think and feel about food. When taxes, warning labels, front-of-pack scores, and public campaigns present one ingredient as the enemy, nutrition can become a binary system: good or bad, clean or unhealthy, permitted or guilty. This may simplify communication, but it does not necessarily improve understanding.

Sugar has a place within a balanced diet, while excessive intake should be discouraged. The problem begins when policies and public messages turn moderation into prohibition and divide foods into good or bad, healthy or unhealthy.

This binary language can become even more powerful when amplified by social media. Repeated messages to eliminate sugar, fat, or entire food categories can encourage unnecessary restriction, obsessive food rules, and anxiety around eating. In vulnerable individuals, they may also contribute to nutritional inadequacy and disordered eating (Wu et al. 2024).

The risk does not come from advising people to limit excessive intakes of free sugars or saturated fats. It comes from turning that advice into a demand for dietary purity, in which foods are treated as forbidden, and every choice becomes a test of health or self-control.

This is particularly important for people who already have or are vulnerable to eating disorders and disordered eating. Food moralization can turn everyday choices into tests of purity, virtue, or self-control. Research on clean eating and orthorexia shows how an interest in healthy food can become rigid, exclusionary, and obsessive, although orthorexia is not yet universally recognized as a distinct clinical diagnosis (Ambwani et al. 2020; Horovitz and Argyrides 2023).

Food labels can reinforce this pattern when they communicate danger without context. A 2025 systematic review found that people with eating disorders or disordered eating were more likely to notice nutrition labels, focus on calorie information, change their behavior in response to them, and experience distress around eating. The available evidence relates mainly to calorie labeling outside the home, so it does not prove that every warning or front-of-pack label causes eating disorders. It does, however, justify caution when policies repeatedly direct attention toward individual nutrients, thresholds, and "bad" choices (Trompeter et al. 2025).

The objective should not be less information, but better information. Public health should help people understand proportion, frequency, context, and balance without turning food into a moral judgment. Fear may attract attention. It does not necessarily build knowledge, healthier habits, or trust.

6.10 The nanny-state effect

Sugar taxes and prescriptive nutrition policies do more than change prices, labels, advertising, or product composition. They also redefine the relationship between institutions and citizens.

Their unintended effect may be to expand a nanny-state model in which consumers are treated less as individuals capable of learning and choosing, and more as subjects whose behavior must be corrected from above.

Taxes, warnings, restrictions, and reformulation may influence what people buy. But they can also limit personal agency by making certain choices more expensive, more difficult, or socially unacceptable.

This may produce compliance without improving knowledge, critical thinking, judgment, or long-term responsibility.

The alternative is consumer empowerment. A liberal democratic approach should give citizens the information and tools needed to understand choices, assess trade-offs, and act responsibly. It should promote nutritional literacy, critical thinking, and freedom of choice rather than relying primarily on pressure, stigma, or constraint.

The distinction is fundamental. A nanny-state approach seeks to steer citizens toward predefined outcomes. An empowerment-based approach helps them make better-informed decisions and remain responsible for their consequences.

Public health should not be passive. It should provide reliable information and make healthier choices easier. But it should not replace individual judgment with prescriptive control, especially when the evidence is limited, uncertain, or context-dependent. The objective should not be to choose for citizens, but to equip citizens to choose well.

6.11 When limited results lead to more intervention

Limited results do not always lead policymakers to reconsider an intervention. They may instead be used to justify more of the same. A tax on soft drinks can be followed by broader sugar-reduction programs, advertising bans, promotion restrictions, reformulation targets, portion-size rules, and new measures targeting fat, salt, or other nutrients. Each intervention

creates the rationale for the next.

The United Kingdom illustrates this progression. The traffic light labeling system and the Soft Drinks Industry Levy have been followed by restrictions on product placement, volume promotions, television and online advertising, reformulation targets, and the strengthening of the levy itself (Department of Health and Social Care 2022; Department of Health and Social Care 2025; HM Treasury 2025).

The result is an increasingly complex regulatory framework that progressively shapes product formulation, retail practices, and consumer choice. Its cumulative effects on public health, consumer behavior, innovation, and the food system have yet to be fully evaluated.

This produces a policy escalation loop:



The original health problem may remain unresolved while regulation becomes more intrusive, complex, and difficult to reverse. Citizens are increasingly steered through prices, warnings, product design, and restrictions, without necessarily gaining greater knowledge or responsibility.

The unintended consequence is not only more regulation. It is the progressive replacement of prevention with behavioral control. When every disappointing result becomes an argument for stronger intervention, public health risks turning into social engineering.

SUMMARY

of potential unintended consequences of sugar taxes and prescriptive nutrition policies

	Policy objective	Potential unintended consequence
1	Reduce sugar consumption	Consumption may shift rather than disappear.
2	Improve dietary choices	Consumers may substitute products without improving overall diet quality.
3	Protect vulnerable populations	Low-income households may bear a disproportionate economic burden.
4	Encourage healthier products	Reformulation may prioritize regulatory compliance over nutritional quality.
5	Improve consumer information	Simplified labels may promote food moralization and binary thinking.
6	Reduce obesity and NCDs	Vulnerable individuals may experience greater food anxiety, restrictive eating, or disordered eating.
7	Promote healthier markets	Smaller producers may face higher adaptation costs and reduced competitiveness.
8	Improve population health	Producing countries, rural communities, and global value chains may be disproportionately affected.
9	Increase public trust	Fear-based communication may reduce trust in institutions and nutritional advice.
10	Encourage healthier choices	Consumers may become less empowered and more dependent on behavioral steering.
11	Strengthen prevention	Limited results may justify progressively broader and more restrictive interventions.



In complex systems, **SOLVING** one problem can **CREATE** another. Good policy **MEASURES** both.

7. Why Policy Assessment Matters

The unintended consequences discussed in the previous chapter do not justify inaction. They justify better policy design and assessment.

Before introducing taxes, warning labels, advertising restrictions, or reformulation targets, policymakers should assess whether they can deliver meaningful and durable health benefits, what costs they may create, who will bear them, and whether more proportionate alternatives are available.

The following sections present a framework for assessing the effectiveness, costs, distributional effects, and proportionality of prescriptive sugar policies.

7.1 Assessing more than intentions

We have seen that a fall in sales of a taxed product does not necessarily translate into lower total sugar intake or better health outcomes. Consumers may switch products, compensate elsewhere, or respond differently across social and economic contexts.

Assessment must therefore follow the entire pathway:



Stopping at the first measurable change can create the illusion of success.

7.2 Benefits, costs, and proportionality

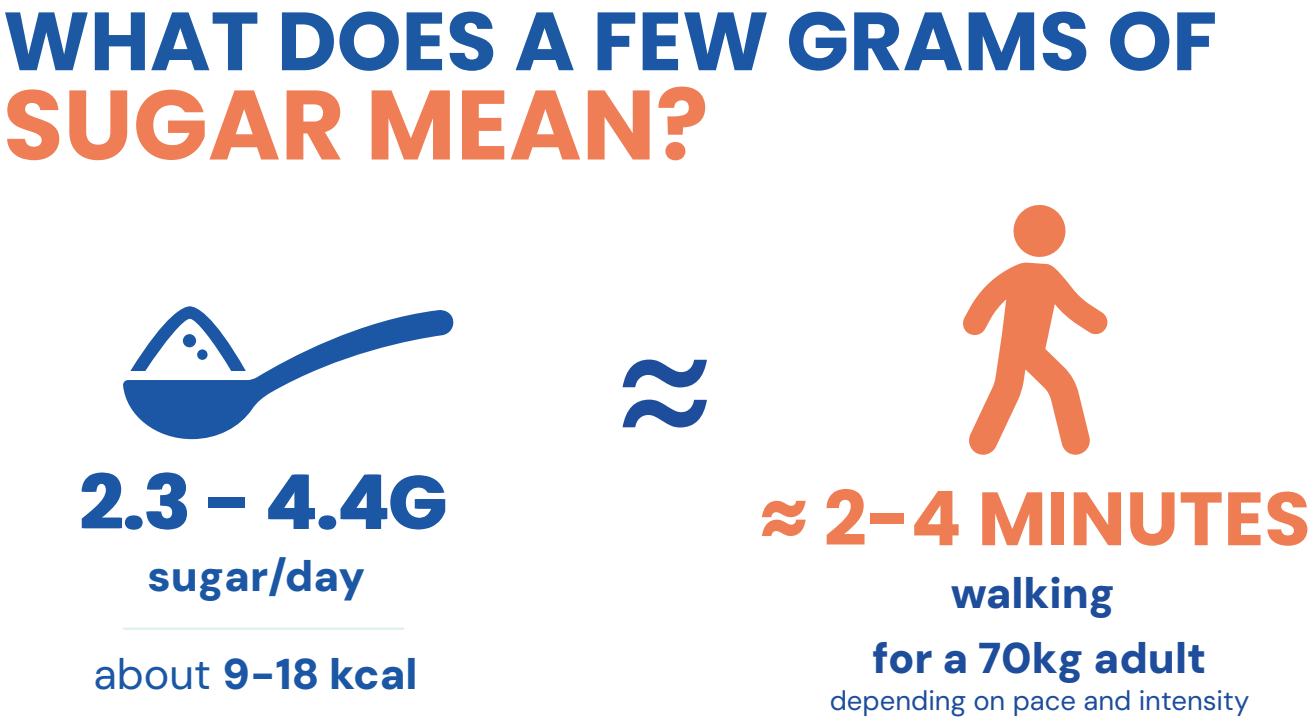
Public health interventions should be proportionate to the benefits they can realistically achieve.

Some estimates suggest that sugar taxes may reduce sugar intake by only a few grams per person per day. One modeling study estimated that a sugar-content tax could reduce sugar intake from SSBs by 2.3 grams per adult per day compared with a volumetric tax (Grummon

et al. 2019). A broader review estimated reductions of approximately 4.0 grams per day in low- and middle-income countries and 4.4 grams in high-income countries following a 20% tax (Hajishafiee et al. 2023).

These reductions may still matter when they are widespread, sustained, and achieved without major unintended effects. But their relevance must be assessed against the full costs of the intervention.

A modest or uncertain benefit requires stronger evidence when a policy also creates regressive burdens, market distortions, substitution, administrative complexity, reduced consumer choice, or weaker institutional trust. Proportionality asks a simple question: Are the demonstrated health benefits large enough to justify the economic, social, and behavioral costs?



7.3 Comparing policy alternatives

Assessment should not examine one instrument in isolation. It should compare available alternatives.

Depending on the objective, policymakers may consider:

- nutritional education and food literacy
- physical activity and prevention programs
- portion awareness
- voluntary agreements with producers
- digital tools and personalized guidance
- improved access to balanced food
- targeted support for vulnerable groups

Reducing portion size, for example, may lower energy intake without taxation, although compensation and long-term effects must still be evaluated (Hollands et al. 2015; Robinson et al. 2023).

Voluntary cooperation may also produce measurable changes. The Italian soft-drinks sector has reported reductions in the amount of sugar placed on the market following agreements with public authorities. These are industry-reported figures and do not prove that voluntary action is always sufficient. They do show why different instruments should be compared rather than assuming that taxation is the only credible response.

No instrument is perfect. The relevant question is which combination can produce measurable health benefits with the least social, economic, and behavioral distortion.

7.4 A practical assessment framework

A serious assessment should examine:

- changes in total sugar intake, not only taxed products
- changes in total calorie intake and diet quality
- effects on obesity, diabetes, CVDs, and other NCD outcomes
- substitution and compensation
- distributional effects on low-income households
- affordability and availability of balanced alternatives
- effects on SMEs, producers, employment, and supply chains
- use and transparency of tax revenues
- effects on consumer understanding, trust, and freedom of choice
- the availability of less restrictive alternatives

Assessment should take place before implementation, during the policy, and after sufficient time has passed to measure health outcomes. It should also include clear criteria for revising, suspending, or withdrawing measures that fail to deliver proportionate results.

A policy that changes markets without improving health should not be considered successful merely because its effects are visible.

IF TAXES AND FRONT-OF-PACK LABELS ARE THE ANSWER, WHY STOP AT SUGAR?

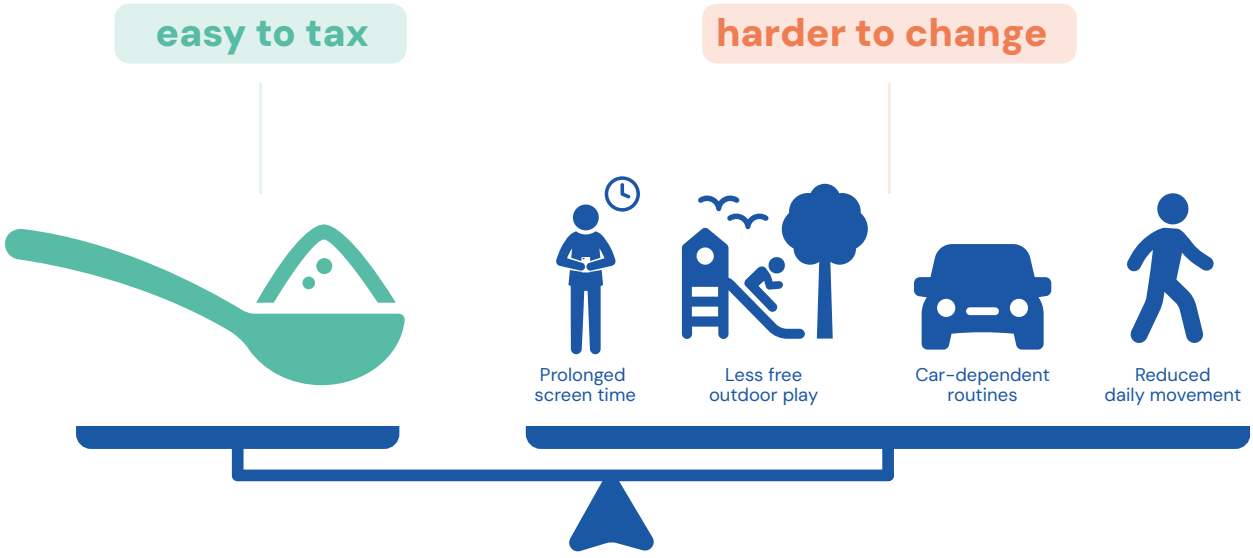
This is a provocation, not a policy proposal.

It is intended to test the **consistency** of approaches that **tax** or **label sugar** and saturated fat because they are associated with **obesity, CVDs,** and **NCDs.**

These conditions are also shaped by **physical inactivity, sedentary routines, poor sleep, stress, mental health, urban design, and socio-economic conditions.** Yet these determinants are rarely addressed through comparable fiscal or warning-based tools.

Sugar is **visible, measurable,** and **easy** to tax or place on a front-of-pack label.
Movement, sleep, free play, stress, and healthier urban environments are **harder** to restore.

WHY ONLY SUGAR?



The point is not that screens, cars, or inactivity should carry taxes or warning labels.
It is that **ease** of regulation **should not** be confused with importance.

By **extending** the logic applied to sugar to other determinants of obesity, the **inconsistency** becomes visible. Public health often targets what is **easiest** to measure and regulate, rather than what may be most **important** to **improve**.



A POLICY should not be judged by what it intends to **CHANGE,** but by what it ultimately **ACHIEVES.**

8. Beyond Reductionism: Toward a Balanced Policy Framework

Critiquing existing policies is useful only if it helps build better ones. This paper does not argue against public health action. It argues for a different way of designing it.

The previous chapters have shown how taxes, front-of-pack labels, warning systems, aggressive reformulation, and other prescriptive measures can produce modest or uncertain health benefits while generating unintended social, economic, behavioral, and institutional consequences. They have also shown why these policies require rigorous assessment before they are expanded or replicated.

The question is therefore not whether governments should act, but how. A balanced policy framework starts from a different premise. Instead of correcting behavior from above, it helps people understand, choose, and take responsibility for their health. Instead of reducing prevention to one nutrient or product, it addresses the broader conditions that shape healthier lifestyles over time.

Balance is not a vague aspiration.
It is a policy method.

It means moving:

- from isolated nutrient control to healthier dietary and lifestyle patterns
- from punishment to education
- from fear to understanding
- from behavioral steering to consumer empowerment
- from prescriptive intervention to proportionate, evidence-based support

The following framework proposes five complementary pillars for a more effective, proportionate, and empowering public health strategy.

8.1 Balance as a policy method

Balance means considering the full context in which people eat, move, sleep, work, and make decisions. It looks beyond a single nutrient to portions, frequency, dietary patterns, physical activity, energy balance, stress, education, culture, socio-economic and environmental conditions, and individual needs.

This does not weaken public health. It makes prevention more realistic. A balanced framework recognizes that excessive sugar intake can be harmful without treating sugar as the complete explanation for poor health. The relevance of consumption changes with quantity, frequency, overall diet, lifestyle, and individual circumstances.

The policy question should therefore move from:

How can we reduce sugar?

to

How can we help people build healthier and more balanced lives?

This requires a different approach. Policy should provide knowledge and practical tools before relying on punishment, warnings, or restrictions. It should help citizens understand context, make informed choices, and take responsibility for their health.

THE DEEP ROOTS OF BALANCE

Balance is not a modern invention. It has deep roots in medicine, ethics, and the study of human behavior.

> **The Hippocratic tradition** connected health with diet, movement, sleep, and daily habits. **Galen, Avicenna, and Maimonides** also emphasized moderation and the broader regimen of life.

> **Aristotle** described virtue as a balance between excess and deficiency, developed through **judgment** and **habit.**

> **Paracelsus** later expressed a central principle of toxicology: health effects depend on **dose.**

> **Modern science** is far more advanced, but the underlying lesson remains relevant: health **cannot** be understood by isolating one substance from quantity, behavior, vulnerability, and context.

8.2 Putting balance into practice

The principles discussed above can be summarized through three interconnected dimensions:

MOVEMENT, MEALS, AND MINDFULNESS

Together, the **3Ms** translate balance from an abstract principle into an everyday practice.



MOVEMENT

Health depends not only on what people consume, but also on how they use energy. Regular movement supports metabolic health, physical capacity, mental well-being, and long-term independence.



MEALS

Food is more than the intake of nutrients and calories. Meals engage the senses, create pleasure, express culture, and provide opportunities for social connection. They bring together quantity, variety, preparation, rhythm, and conviviality within a broader way of life.



MINDFULNESS

Healthier choices require awareness. Mindfulness means recognizing hunger, habits, emotions, routines, and personal needs rather than eating automatically or reacting to fear-based messages. It also means being present during meals, appreciating food, and recognizing when, why, and with whom we eat.

Within meals, balance can be applied through four practical dimensions:

PORTION, FREQUENCY, VARIETY, AND CONTEXT.

These dimensions shift attention from what a product **contains** to how it is **consumed** and how it fits within **everyday life** (FAO & WHO 2019; Dietary Guidelines Advisory Committee 2020).

1

PORTION

Quantity matters. A small dessert within a meal is not equivalent to repeated large portions throughout the day.

2

FREQUENCY

Patterns, not isolated occasions, shape health. Occasional consumption differs from constant and automatic exposure.

3

VARIETY

A healthy diet is not created by removing one ingredient. It emerges from the combination of different foods, nutrients, tastes, and traditions.

4

CONTEXT

The same food may have different implications depending on the individual, the situation, and the overall lifestyle.

These four dimensions are not fixed rules. They interact and vary across individuals, lifestyles, and health conditions (Ordovas et al. 2018). Sugar can fit within a balanced diet when its consumption remains proportionate and conscious. Problems arise when sweetness becomes constant, oversized, and automatic. Public policy should therefore help people interpret food, not simply instruct them to avoid ingredients.

UN MÉTODO QUE TRASCIENDE CULTURAS

La dieta mediterránea ofrece uno de los ejemplos más claros del equilibrio como método y no como un menú fijo.

Su valor no reside únicamente en alimentos específicos. Reside en la forma en que la alimentación se organiza mediante **moderación, variedad, estacionalidad, movimiento, placer, preparación y vida social.**

Principios similares pueden encontrarse en otras culturas alimentarias tradicionales. El **Washoku japonés,** por ejemplo, también hace énfasis en la variedad, la estacionalidad, la preparación, la proporción y el significado social de las comidas.

Los alimentos son diferentes.
El método es similar.
Las culturas alimentarias saludables no dependen de declarar enemigo a un nutriente. Dan significado a los alimentos mediante la proporción, el ritmo, el contexto y el hábito (Carruba and Paganini 2024)..

MÉTODO, NO MENÚ

proporción, no exceso

frecuencia, no prohibición

variedad, no monotonía

placer, no miedo

convivencia, no aislamiento

movimiento, no sedentarismo

responsabilidad, no prescripción

8.3 From information to empowerment

In an age of abundance, balance must be supported by knowledge, critical thinking, and conscious choice. But not all information empowers.

Prescriptive information warns, ranks, and steers consumers toward predefined choices. It may attract attention, but it can also replace understanding with compliance.

Empowering information works differently. It helps people interpret food, compare options, understand their habits, and make choices that fit their health, culture, resources, and daily lives.

FROM INFORMATION TO EMPOWERMENT

INFORMATION

“This product contains sugar.”

WARNING

“Be careful.”

EMPOWERMENT

“Here is how to understand this food within your overall lifestyle.”

Food literacy turns information into practical judgment. It includes the ability to understand portions, plan meals, cook, compare products, interpret marketing, and recognize how eating patterns connect with movement, health, and well-being.

Its purpose is not to turn every citizen into a nutrition expert. It is to give people the knowledge and confidence to ask better questions and make better decisions over time. This also makes prevention more responsive to human diversity. A label gives the same signal to everyone. Food literacy helps individuals adapt information to their needs, circumstances, and goals (Ordovas et al. 2018).

Responsibility, however, cannot be placed on individuals alone. Schools, healthcare systems, workplaces, families, communities, and businesses all shape the environments in which choices are made. Their role should be to make informed, balanced choices easier while strengthening, rather than replacing, individual agency.

Public policy should therefore treat food literacy as essential infrastructure for prevention. It should be developed through education, healthcare, community programs, public communication, and practical experience (Bailey et al. 2019; Smith et al. 2022).

This takes time. Food literacy cannot be built through a single label, warning, or campaign. It develops through learning, repetition, practice, and adaptation.

New technologies can support this process. AI, wearable devices, digital food diaries, meal-recognition tools, and personalized or precision nutrition systems can help people understand their activity, habits, dietary patterns, and individual responses (Ordovas et al. 2018; Arshad et al. 2025; Wu et al. 2025).

These technologies do not replace education or responsibility. They must also be designed around privacy, accessibility, and reliable data. Used well, however, they can move prevention from standardized instructions toward better self-knowledge and more informed choices.

Empowerment is therefore not soft policy. It is a demanding policy. It may be slower than taxation or regulation, but it builds capability rather than compliance.

8.4 Restoring movement: the forgotten side of prevention

A balanced prevention strategy must address not only what people consume, but also how much energy they expend. Public debate on obesity, CVDs, diabetes, and other NCDs often focuses on food, nutrients, and products. These factors matter, but they are only one side of the equation. Health is also shaped by physical activity, sedentary behavior, sleep, work, transport, and the environments in which people live.

Modern societies have transformed this balance. Calories are easier to access, while movement has become easier to avoid. Work is increasingly sedentary, transport more automated, leisure more screen-based, and daily life requires less spontaneous physical effort. The result is not only greater food availability, but lower everyday energy expenditure (Church et al. 2011).

This is why obesity cannot be understood through food alone. Prevention should restore balance between intake and expenditure rather than focusing exclusively on reducing one nutrient or one product category. WHO estimates that 31% of adults and 80% of adolescents do not achieve recommended levels of physical activity, while recent global estimates indicate that physical inactivity has continued to increase, affecting approximately 1.8 billion adults worldwide (WHO 2020; WHO 2024b; Strain et al. 2024).

Restoring movement does not simply mean encouraging people to exercise more. It means creating environments where movement becomes a normal part of everyday life. Schools, cities, workplaces, healthcare systems, communities, and digital technologies can all contribute by making physical activity easier, safer, and more accessible.

FROM CALORIE REDUCTION TO ENERGY BALANCE

A sugar tax or a label asks:

"How can we reduce intake from one product category?"

A balanced prevention strategy asks:

"How can we improve the overall energy balance of daily life?"

This includes:

- healthy eating
- regular movement
- reduced sedentary behavior
- adequate sleep
- stress management
- environments that support healthier choices

Prevention should therefore move beyond a food-only strategy. Restoring movement is more difficult than taxing sugar, but it addresses one of the fundamental drivers of modern health.

8.5 Prevention requires partnerships

Public health cannot succeed without the participation of those who produce, process, distribute, and sell food.

Governments define public health objectives, but companies, agricultural producers, processors, retailers, and producing countries all influence the food environment through innovation, product development, portions, marketing, information, and consumer experience.

A balanced policy framework should therefore encourage cooperation rather than treating every actor primarily as the target of regulation.

Cooperation does not replace public policy. Governments remain responsible for setting objectives, monitoring outcomes, protecting consumers, and ensuring transparency. Industry, in turn, should contribute through responsible innovation, clearer information, balanced portions, appropriate marketing practices, and support for food literacy.

Producing countries also deserve a place in this dialogue. Public health policies increasingly influence agricultural production, international trade, rural livelihoods, and global value chains. Effective prevention should therefore consider not only consumers, but also the broader economic and social systems that sustain food production.

Voluntary commitments can contribute when they are measurable, transparent, independently monitored, and publicly accountable. As the Italian experience discussed above illustrates, cooperation can support reformulation and consumer protection alongside other policy instruments. The objective is not to replace regulation with voluntary action, nor to treat industry as an adversary. It is to identify the combination of policy tools that delivers the greatest public health benefit while preserving innovation, consumer choice, competition, and sustainable value chains.

COOPERATION, NOT DEREGULATION

A cooperative approach still requires:

1. clear public health objectives
2. measurable commitments
3. transparent reporting
4. independent evaluation
5. responsible innovation
6. protection of children
7. support for food literacy
8. engagement of producers and value-chain actors where policies affect livelihoods and trade



BALANCE IS NOT A SLOGAN.
It is a policy method.

9. Policy Recommendations

After examining the evidence, the policy gap, the limits of sugar prescriptive tools, and their unintended consequences, one conclusion emerges clearly: obesity, CVDs, diabetes, and other NCDs cannot be prevented through a single-nutrient focus.

A more effective agenda must move beyond targeting sugar and empower people by addressing diet, movement, knowledge, behavior, innovation, and responsibility within a balanced policy framework.

1. Do not reduce obesity policy to sugar policy

Obesity, CVDs, diabetes, and other NCDs are complex conditions. They cannot be effectively addressed by isolating one nutrient and turning it into the main policy target.

Sugar matters, but it must be understood within the broader context of diet, physical activity, sleep, stress, socio-economic conditions, food culture, and individual variability.

2. Assess health outcomes, not only intermediate indicators

Policy success should not be measured only through price increases, lower purchases of taxed products, reformulation, or revenue generation. These are intermediate outcomes.

Public policy should be judged by its impact on overall diet quality, calorie intake, obesity, CVDs, diabetes, NCD burden, consumer understanding, and long-term behavioral change.

3. Apply proportionality and full cost-benefit assessment

Before introducing taxes, warning labels, or prescriptive reformulation targets, policymakers should assess expected benefits against social, economic, cultural, and behavioral costs.

This includes substitution effects, regressivity, market distortions, impacts on SMEs, supply chains and producing countries, culinary traditions, trust in institutions, and freedom of choice.

4. Put food literacy at the center of prevention

Food literacy should become a core public health priority from childhood to adulthood.

Schools, healthcare systems, workplaces, communities, and digital tools should help citizens understand portions, frequency, variety, dietary patterns, movement, and lifestyle context.

This requires clear objectives, adequate resources, effective implementation, and continuous evaluation – not abstract education campaigns.

5. Restore movement as a public health priority

Prevention should address energy expenditure as seriously as energy intake.

Governments should invest in physical education, free play, active transport, walkable cities, sport, community movement, workplace activity, and less sedentary daily routines.

This requires measurable programs with clear targets, funding, implementation, and evaluation.

A serious obesity strategy cannot focus on sugar while neglecting physical inactivity and sedentary lifestyles.

6. Promote positive nutrition and balanced dietary patterns

Policy should promote positive nutrition: better dietary patterns, nutrient adequacy, food quality, appropriate portions, variety, culture, and context.

The objective is to build healthier lifestyles, not simply to reduce sugar.

7. Encourage cooperation with industry and producing countries

Governments should not rely only on punitive tools. They should encourage transparent, measurable, and accountable cooperation with companies, SMEs, producers, and producing countries.

This can include voluntary commitments, responsible reformulation, portion strategies, clearer information, protection of children, support for food literacy, and sustainable value-chain transitions.

8. Use innovation and personalization to empower citizens

AI, wearable devices, digital health tools, personalized nutrition, and data-driven prevention can help citizens better understand their habits, activity levels, dietary patterns, and metabolic responses.

These tools must be used responsibly, with attention to privacy, equity, and scientific quality. Their purpose should be empowerment, not surveillance or manipulation.

9. Replace correction with empowerment

The ultimate objective of public health policy should not be to manage citizens through fiscal and regulatory pressure.

It should be to strengthen their capacity to understand, choose, adapt, and take responsibility for their health. Effective prevention should move from correction to empowerment, from fear to knowledge, and from one-size-fits-all prescriptions to informed, personalized, and balanced choices.

These recommendations are not shortcuts. They require time, effort, experimentation, adjustment, and continuous assessment of both intended results and unintended consequences.

That is precisely why they are more credible than policies that promise quick results by targeting one nutrient. Taxes, warning labels, and aggressive reformulation may appear decisive, but when they displace education, movement, food literacy, innovation, and empowerment, they risk creating the illusion of action.

A credible prevention agenda should instead be built on knowledge, proportionality, responsibility, innovation, freedom of choice, and constant evaluation: the foundations of public health in a free and mature society.



SMARTER PREVENTION does not mean doing less. It means doing what works **BETTER.**

Conclusion

Sugar is first a nutrient and an ingredient. This paper has shown that sugar should not be reduced to a policy target. It has explained what sugars are, how the body uses them, the differences between naturally occurring, added, and free sugars, and how their effects depend on dose, frequency, food form, overall diet, energy needs, and individual circumstances.

Sugars can form part of a balanced diet. Their health effects cannot be understood in isolation, but depend on quantity, frequency, food matrix, overall dietary patterns, physical activity, individual circumstances, and context. The relevant question is therefore not whether sweetness should be eliminated, but how it fits within a balanced lifestyle.

For this reason, sugar should not become the primary target of prevention policies. Taxes, warning labels, and aggressive reformulation may change prices, purchases, and products, but changing markets is not the same as improving health. Evidence is generally stronger for intermediate outcomes than for lasting reductions in obesity or NCD burden.

These policies may also produce unintended consequences, including substitution, regressivity, market distortions, food anxiety, weaker trust, and pressure on smaller businesses and producing countries. Public policy should therefore be judged not only by its intentions, but by its overall results.

The alternative is not inaction. It is a more demanding form of action. A balanced prevention agenda should move beyond single-nutrient correction and help people build healthier lives through food literacy, movement, informed choice, responsible innovation, supportive environments, and continuous assessment.

Ultimately, the sugar debate is also a debate about how public policy understands citizens. One approach treats people as passive subjects to be corrected through taxes, warnings, labels, and restrictions. The other treats them as capable of learning, adapting, and taking responsibility when given knowledge, tools, and supportive conditions.

This paper argues for the second approach. Prevention through empowerment is slower and less politically visible than prescription. But it builds capability rather than compliance and offers a more credible path toward durable health outcomes.

Public health should therefore be built on evidence, proportionality, responsibility, innovation, and freedom of choice. Its purpose should not be to manage citizens, but to help them live healthier and more balanced lives.

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