

High Fructose Corn Syrup in the European Union: Regulatory Evolution, Public Health and Market Dynamics

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ARTICLE INFO

Received: 📅 August 31, 2026

Published: 📅 September 08, 2026

Citation: Erhan Oktay. High Fructose Corn Syrup in the European Union: Regulatory Evolution, Public Health and Market Dynamics. Biomed J Sci & Tech Res 66(4)-2026. BJSTR. MS.ID.010380.

ABSTRACT

High Fructose Corn Syrup (HFCS), often referred to as Isoglucose in the European Union (EU), is a sweetener derived from corn starch that has become a significant topic of discussion due to its regulatory standing, potential public health implications, and evolving market dynamics. In the EU, HFCS is commonly known as Isoglucose, distinguishing it from the terminology used in the United States. Its presence in processed foods and beverages has sparked debates regarding its role in metabolic health and the rising prevalence of chronic diseases. The global market for HFCS shows substantial growth, driven by various factors including consumer trends and technological advancements. While the provided search results do not detail the specific historical evolution of EU regulations concerning HFCS, they clearly establish the nomenclature difference, where HFCS is known as Isoglucose within the EU. This distinction implies specific regulatory frameworks or labeling requirements that differentiate it from other sweeteners. The European Commission has documents addressing the consumption and impact of these high fructose syrups, indicating a level of regulatory oversight and public health interest. HFCS is a sweetener produced by enzymatic processing of corn starch, converting glucose into fructose. It is widely utilized in processed foods and breakfast cereals. A significant public health debate surrounds fructose and HFCS, particularly concerning their association with metabolic health issues and the rising prevalence of type 2 diabetes. Studies suggest that the consumption of high-fructose syrups, especially in beverages, might play a role in the obesity epidemic. The increased use of HFCS aligns with observed increases in obesity and diabetes rates.

Keywords: High Fructose Corn Syrup; HFCS; Isoglucose; Regulatory Evolution; Public Health; Market Dynamics; Sweeteners; Obesity

Abbreviations: HFCS: High Fructose Corn Syrup; EU: European Union; CAP: Common Agricultural Policy; WHO: World Health Organization; EFSA: European Food Safety Authority; WTO: World Trade Organization

Introduction

High-fructose corn syrup (HFCS) has long occupied a contentious position in global food policy, sitting at the intersection of nutritional science, agricultural economics, and regulatory governance. Within the European Union (EU), its trajectory is particularly distinctive: unlike in North America, where HFCS became a dominant sweetener in processed foods, EU regulatory frameworks-shaped by production quotas, sugar market protections, and later liberalization-have constrained its diffusion while simultaneously maintaining a more

diverse sweetener landscape. This commentary examines HFCS from both a biochemical-functional perspective and within the evolving EU regulatory environment, with emphasis on post-2017 sugar market reform and its implications for food systems, public health policy, and industrial formulation strategies [1,2].

Biochemical and Technological Context of HFCS

HFCS is produced by enzymatic isomerization of glucose derived from corn starch, yielding a mixture of glucose and fructose in vary-

ing ratios, most commonly HFCS-42 and HFCS-55. These formulations differ in sweetness intensity, hygroscopicity, and functional properties such as browning capacity and freezing point depression. HFCS-55, for example, is widely used in soft drinks due to its sensory similarity to sucrose, while HFCS-42 is more common in baked goods and processed foods [1]. From a metabolic standpoint, fructose is primarily metabolized in the liver, bypassing key regulatory steps of glycolysis, which has led to hypotheses linking excessive HFCS consumption with *de novo* lipogenesis, hepatic steatosis, insulin resistance, and broader cardiometabolic risk profiles. However, the scientific literature remains nuanced: many comparative studies indicate that HFCS is metabolically similar to sucrose (which is a disaccharide composed of glucose and fructose), complicating attempts to single out HFCS as uniquely pathogenic. The consensus among major nutritional bodies increasingly emphasizes overall added sugar intake rather than HFCS-specific toxicity [2].

Historical Divergence Between the Eu and Us Sweetener Markets

The divergent trajectories of HFCS use in the United States and the EU are rooted less in nutritional science than in agricultural policy. In the US, corn subsidies and technological efficiencies in corn wet milling enabled HFCS to become a cost-effective substitute for sucrose in the late 20th century. In contrast, the EU historically maintained strict sugar production quotas under the Common Agricultural Policy (CAP), which supported domestic beet sugar producers and effectively constrained HFCS expansion [3]. Until 2017, EU producers of isoglucose (the EU regulatory term for HFCS) faced production caps-initially set at around 5% of total sweetener production. This quota system structurally limited HFCS penetration, preserving beet sugar as the dominant sweetener in European markets. Consequently, HFCS consumption in the EU has remained significantly lower than in North America, with important implications for both dietary exposure and industrial formulation practices [4].

Post-2017 Sugar Market Liberalization and Regulatory Recalibration

A major inflection point occurred in October 2017, when the EU abolished sugar production quotas and minimum price guarantees. This reform, driven by CAP modernization objectives, fundamentally altered the competitive landscape for both sugar and isoglucose producers. The removal of quotas was expected to increase market efficiency, enhance EU competitiveness in global sugar markets, and reduce price distortions [5]. In theory, this liberalization should have enabled HFCS production to expand more freely within the EU. However, the actual outcome has been more restrained. Several structural and regulatory factors continue to limit rapid HFCS growth:

1. **Cost competitiveness of beet sugar:** EU beet sugar production remains highly efficient, particularly in France, Germany, and the Netherlands. In many cases, beet sugar remains price-competitive or

even cheaper than isoglucose, limiting substitution incentives.

2. **Industrial inertia and formulation lock-in:** Food manufacturers have long optimized recipes around sucrose. Reformulation costs, sensory consistency requirements, and supply chain contracts reduce incentives to switch to HFCS.

3. **Regulatory and labeling frameworks:** EU food labeling regulations require clear identification of glucose-fructose syrup or isoglucose, which may influence consumer perception and manufacturer choices in markets sensitive to “processed ingredient” framing.

4. **Public health positioning:** While the EU has not singled out HFCS as uniquely harmful, broader sugar reduction policies indirectly constrain its growth. The World Health Organization (WHO) recommendation to reduce free sugar intake to below 10% of total energy intake has been operationalized through national sugar taxes and reformulation targets across member states.

Role of the European Food Safety Authority and Risk Assessment Paradigms

The European Food Safety Authority (EFSA) plays a central role in evaluating the safety of food additives and ingredients, including sweeteners. EFSA's assessments have consistently concluded that there is no specific toxicological hazard associated with HFCS compared to other nutritive sugars. Instead, EFSA emphasizes dose-dependent risk associated with total sugar intake, particularly in relation to obesity, type 2 diabetes, and dental caries. This risk-framing approach is important: rather than regulating HFCS as a distinct chemical entity of concern, EU policy treats it within the broader category of added sugars. This contrasts with public discourse, particularly in the United States, where HFCS has often been singled out as a discrete dietary risk factor [6].

Nutritional Epidemiology and the HFCS Debate

Epidemiological studies examining HFCS-specific effects are complicated by dietary confounding variables. Populations with high HFCS consumption typically also exhibit higher intake of ultra-processed foods, calorie-dense diets, and lower dietary fiber intake. This makes causal attribution difficult. Meta-analyses comparing HFCS and sucrose show no consistent differences in body weight outcomes or metabolic risk markers when calories are matched. However, some studies suggest that liquid sugars-irrespective of source-may promote incomplete satiety signaling and increased caloric intake. This has led to a conceptual shift in EU nutrition policy away from ingredient-specific regulation toward structural dietary patterns and ultra-processed food consumption [7].

Industrial Implications of EU Regulatory Evolution

The post-quota EU sweetener market has entered a phase of competitive equilibrium between beet sugar and isoglucose. Industry analysts note that HFCS production is primarily concentrated in regions

with strong starch-processing infrastructure, such as France, Hungary, and parts of Central Europe. However, growth remains modest compared to initial projections. Instead, the more significant industrial trend has been sugar reduction and substitution with non-nutritive sweeteners (e.g., steviol glycosides, sucralose) in response to consumer demand and taxation policies in countries such as the United Kingdom, France, and Spain. This shift raises a broader regulatory paradox: while HFCS is often politically framed as a public health concern, EU policy has indirectly created a market environment where both sucrose and HFCS face downward pressure, while high-intensity sweeteners gain relative prominence [8].

Trade Policy and Global Competitiveness

The EU's evolving stance on HFCS also intersects with international trade dynamics. The removal of quotas has increased the EU's potential to act as a more flexible exporter of sugar-based products. However, global HFCS markets remain dominated by the United States due to entrenched corn subsidies and large-scale industrial capacity [9]. Trade agreements and World Trade Organization (WTO) frameworks further shape the EU's regulatory latitude. Import tariffs on sugar and sweeteners, along with sanitary and phytosanitary standards, continue to protect domestic producers while limiting volatility in sweetener markets.

Public Perception and Policy Communication Challenges

One of the most persistent challenges in HFCS regulation is the gap between scientific consensus and public perception. HFCS is frequently portrayed in media and consumer advocacy discourse as a "synthetic" or "engineered" sugar, despite being chemically and metabolically similar to sucrose. This perception has influenced labeling debates and reformulation strategies, even in jurisdictions where regulatory bodies do not distinguish HFCS as a uniquely harmful substance [10]. EU policy communication has generally avoided sensational framing, instead embedding HFCS within broader sugar reduction strategies. Nonetheless, the complexity of regulatory terminology-such as "isoglucose"-can itself contribute to consumer confusion.

Future Directions in Eu Sweetener Regulation

Looking forward, several trajectories are likely to shape HFCS regulation in the EU: Continued convergence of sugar types under total sugar reduction policies, reducing the relevance of HFCS-specific regulation. Expansion of fiscal measures, including sugar taxes that apply uniformly across nutritive sweeteners [9,10]. Greater emphasis on ultra-processed food frameworks, which may indirectly affect HFCS use by targeting product categories rather than ingredients. Technological innovation in sweetener alternatives, including enzymatically modified starches and novel plant-derived sweeteners. Potential sus-

tainability considerations, as EU agricultural policy increasingly integrates carbon footprint and land-use efficiency metrics, which may influence relative competitiveness of beet sugar versus corn-derived isoglucose [11].

Conclusion

HFCS in the European Union represents less a singular regulatory target than a case study in how agricultural policy, industrial economics, and nutritional science interact over time. While its biochemical profile is well characterized and its metabolic effects broadly aligned with other added sugars, its regulatory identity has been shaped more by market structures and historical policy decisions than by intrinsic health hazards. The post-2017 liberalization of the EU sugar market has not led to an HFCS expansion comparable to that observed in North America, largely due to sustained competitiveness of beet sugar, regulatory labeling environments, and broader public health-driven reductions in added sugar consumption. As EU nutrition policy continues to evolve toward holistic dietary frameworks, HFCS is likely to remain one component within a broader regulatory landscape focused less on ingredient substitution and more on systemic dietary risk reduction [12].

Acknowledgement

I would like to express my sincere gratitude to Tuğçe OKTAY GÜNEŞ, General Manager of TOG Engineering and Electrical-Electronics Engineer, for her financial support and contributions.

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ISSN: 2574-1241

DOI: [10.26717/BJSTR.2026.66.010380](https://doi.org/10.26717/BJSTR.2026.66.010380)

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