FOOD AND HEALTH AT A CROSSROADS IN THE ULTRA-PROCESSED FOODS DEBATE

— THE RISE OF CLEAN LABELS DRIVEN BY REGULATORY TIGHTENING AND CONSUMER SENTIMENT —

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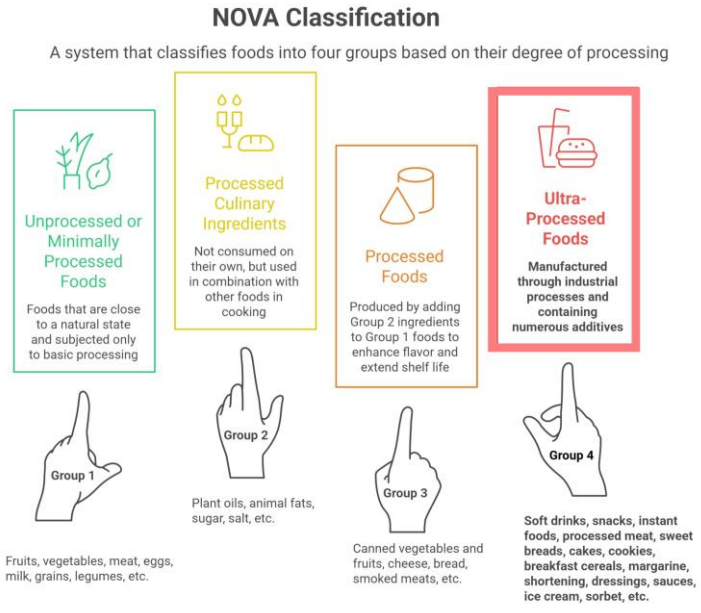
SUMMARY

- While chronic consumption of Ultra-Processed Foods (UPF) has been associated with health risks, given issues surrounding the current definition of UPF and the limitations of existing observational studies, it cannot be concluded that UPF are inherently bad.
- As food additive regulations tighten, primarily in Europe and the US, and litigation risks grow, food companies are advancing clean label initiatives, including the elimination of artificial colors, flavors, and preservatives, and development of alternative ingredients is accelerating.
- The essence of the UPF issue lies not in UPFs themselves, but in the fact that reliance on them leads to excessive energy intake and insufficient intake of micronutrients, thereby increasing the risk of obesity and lifestyle-related diseases. It is necessary for companies, governments, and consumers to work together to create food environments in which everyone can naturally achieve good health.

1. ARE ULTRA-PROCESSED FOODS (UPF) INHERENTLY BAD FOR HEALTH?

UPF refers to foods classified in Group 4, the highest level of processing, under the NOVA classification system,[1] which categorizes foods and beverages into four groups based on their degree of processing.[2] Specifically, it refers to foods and beverages that are highly processed and contain numerous additives, including soft drinks, snacks, instant foods, and processed meat (Figure 1).

Figure 1: NOVA classifications and examples of foods by group



Source: Compiled by MGSSI using outputs from Napkin AI

[1] A food classification and definition framework proposed in 2009 by Dr. Carlos A. Monteiro and colleagues in Brazil.
[2] The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing | PMC

In recent years, a growing number of studies have reported associations between UPF consumption and disease risk. For example, a February 2024 study reported that excessive intake of UPF is associated with increased risks of cardiovascular disease, diabetes, obesity, depression, and other conditions.[3] However, opinions remain divided on the validity of these findings (Figure 2). Critics point out that most existing studies are observational in nature and therefore cannot fully eliminate the influence of non-dietary lifestyle factors such as exercise habits, income level, and smoking history. They also argue that the NOVA classification itself does not fully reflect differences in nutritional value or national dietary cultures.[4] In fact, a literature review published in August 2025 indicated that while certain items, such as soft drinks and processed meat, are clearly linked to higher disease risk, there are also foods classified as UPF under the NOVA system, such as cereals and dairy products fortified with specific nutrients, including protein and dietary fiber, which have neutral or even positive health effects.[5]

In other words, it is premature at this stage to conclude that UPF is inherently bad.

Figure 2: Diverging views on the relationship between UPF consumption and disease risk

Year	UPF associated with adverse health outcomes	UPF not consistently associated with adverse outcomes
2019	**[Intervention (RCT)]Hall KD et al., Cell Metab, 30(1), 67-77.e3, 2019.** An UPF-centered diet led to increased energy intake and short-term weight gain (+0.9 kg).	
2020		**[Conceptual Critique] Drewnowski A et al., Nutr Today, 55(2), 75-81, 2020.** The NOVA UPF classification substantially overlaps with nutrient-based profiles (e.g., Nutri-Score), making it difficult to isolate the independent effect of processing level.
2021	**[Review (SR/Meta)] Pagliai G et al., Br J Nutr, 125(3), 308-318, 2021.** High UPF intake was associated with increased risks of all-cause mortality (+25%), cardiovascular disease (+29%), cerebrovascular disease (+34%), and depressive symptoms (+20%).	
2022	**[Observational Study] Bonaccio M et al., BMJ, 378, e070688, 2022.** High UPF intake group: All-cause mortality +19% and cardiovascular mortality +27%. The study suggests that the effect of food processing level persists even after adjustment for nutritional profiles.	**[Conceptual Critique] Braesco V et al., Eur J Clin Nutr, 76(9), 1245-1253, 2022.** The NOVA classification may lack consistency, with variability in how foods are categorized. **[Conceptual Critique] Astrup A et al., Am J Clin Nutr, 116(6), 1489-1491, 2022.** Summarizes arguments for and against the usefulness of the UPF concept. Presents opposing arguments (ambiguous definitions, confounding, misclassification, etc.).
2024	**[Observational Study/Meta/Umbrella Review] Lane MM et al., BMJ, 384, e077310, 2024.** The umbrella review indicates stronger evidence for increased risks, including cardiovascular mortality (+50%), type 2 diabetes (+12%), all-cause mortality (+21%), obesity (+55%), sleep disturbance (+41%), and anxiety (+48%).	**[Observational Study] Basile AJ et al., Am J Clin Nutr, 120(5), 1037-1042, 2024.** No association found between NOVA processing level (UPF or not) and GI/GL (glycemic index/load).
2025	**[Intervention (RCT)] Dicken SJ et al., Nat Med, 31(10), 3297-3308, 2025.** Even when both diets were aligned with dietary guidelines, minimally processed diets resulted in greater weight loss: Approximately −2.1% (minimally processed) vs. approximately −1.1% (UPF) over 8 weeks. **[Intervention (RCT)] Vaezi S et al., Clin Nutr, 55, 90-103, 2025.** The low-UPF diet group showed spontaneous reductions in energy intake and improvements in body weight, body fat percentage, and metabolic markers. Note: After one year, participants tended to revert to prior UPF consumption patterns.	**[Conceptual Critique] Louie JCY, Proc Nutr Soc. First View, pp.1–9 (Published online 04 Aug 2025)** UPF encompasses a wide range of products, making it difficult to argue that all UPF are uniformly harmful (emphasizing the heterogeneity of foods classified as UPF).

Source: Compiled by MGSSI based on various research reports (Image: smile/stock.adobe.com)

2. BEHIND THE SCENES OF THE CLEAN LABEL FOOD TREND

2-1. ACCELERATING REGULATORY TIGHTENING AND EXPANDING LITIGATION RISK IN EUROPE AND THE US

Under the prevention-focused policy agenda “Make America Healthy Again” (MAHA) advanced by the second Trump administration, the US government is tightening regulations by requiring the food industry to phase out artificial colors by the end of 2026 and by directing the Food and Drug Administration (FDA) to

[3] Ultra-processed food exposure and adverse health outcomes: umbrella review of epidemiological meta-analyses | PubMed

[4] Health impacts of ultra-processed foods | UK Parliament POST

[5] Are all ultra-processed foods bad? A critical review of the NOVA classification system | Proceedings of the Nutrition Society | Cambridge Core

review the self-GRAS, a self-certification framework for food additives. [6, 7]

At the state and municipal levels, even more strict measures are emerging.[8] For example, the state of California (CA) enacted legislation in October 2023 to phase out the use of certain food additives, including artificial colors such as Red No. 3, within the state.[9] In addition, in October 2025, the state announced a policy to gradually eliminate UPF from school meals.[10] In March 2025, West Virginia (WV) passed a law banning the sale of food products containing seven types of artificial colors, including Red No. 40 and Yellow No. 5 and No. 6. In June of the same year, Texas (TX) also enacted legislation requiring warning labels on products containing specified food additives.[11, 12] Against this backdrop, the city of San Francisco has filed a lawsuit against 10 major food companies, including Coca-Cola, PepsiCo, and Nestlé, alleging that they intentionally marketed UPFs and thereby contributed to a public health crisis. The lawsuit demands improvements to business practices and compensation for healthcare costs.[13]

Meanwhile, Europe adopts a prior approval system, known as the positive list system, under which all food additives must undergo safety evaluation based on scientific evidence. Approval is determined by the European Commission and the member states following a risk assessment by the European Food Safety Authority (EFSA). Approved additives may be used, but they must meet strict requirements, including specifications and purity standards. Even after approval, the EFSA conducts periodic re-evaluations, and additives are subject to review if safety concerns arise. The white coloring agent titanium dioxide was banned in 2022. In addition, revisions to multiple food additive regulations were approved by the European Commission in April 2025, indicating that updates continue even within the EU, which has long maintained a strict regulatory framework.[14, 15] At present, there are no confirmed cases of governments or municipalities seeking compensation for medical costs from food companies. However, in Europe, a framework has been established under which government-certified consumer organizations are authorized to seek injunctions, compensation, or other remedies regarding corporate labeling and advertising[16]. As such, there remains a significant risk that such cases could develop into litigation in the future.

Against this backdrop of the ultra-processed foods debate, regulatory tightening and the emergence of litigation risk are progressing (Figure 3).

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6 HHS, FDA to Phase Out Petroleum-Based Synthetic Dyes in Nation's Food Supply | HHS.gov

7 HHS Secretary Kennedy Directs FDA to Explore Rulemaking to Eliminate Pathway for Companies to Self-Affirm Food Ingredients Are Safe | HHS.gov

8 MAHA and Blue States get behind Food Additive Bills in State Legislatures | Center For Health Law and Policy Innovation

9 To the Members of the California State Assembly

10 Governor Newsom signs first-in-the-nation law to ban ultra-processed foods from school lunches | Governor of California

11 HB 2354(West Virginia) | West Virginia Legislature Note: A federal court has temporarily enjoined this law on the grounds of constitutional vagueness.

12 Move Toward the Introduction of Food Additive Regulations in Texas (US) | Regional and Analytical Report – Overseas Business Information – JETRO

13 San Francisco sues Kraft Heinz, other food giants over ultraprocessed products | Food Dive

14 SANTE - Goodbye E171: The EU bans titanium dioxide as a food additive | European Commission

15 EU Approves New Regulation for Food Additives with 12 Significant Changes | ECHEMI.com

16 Representative Actions Directive | European Commission

Figure 3: Topics related to food additives and UPF in Europe and the US (Since 2021)

Year		
2021		May: **E171 (titanium dioxide): "Safety cannot be conclusively established" (Concerns regarding genotoxicity remain)**
2022		January: **EU decision to prohibit E171 (titanium dioxide), followed by a phased withdrawal** August: **Marketing of foods containing E171 no longer permitted in the EU** (Effective implementation of the ban)
2023	October: **CA: AB 418 (California Food Safety Act) enacted** (Banning Red No. 3, BVO, and other specified additives; effective January 2027)	June: **Stricter purity and impurity specifications introduced for certain food additives** (e.g., lower limits for heavy metals, upper limits for specific impurities, etc.) October: **Revision of conditions for nitrites and nitrates used as preservatives in processed meats, etc.** (including lower maximum impurity levels)
2024	August: **Revocation of BVO authorization** (Previously used as a stabilizer in beverages; grace period provided) September: **CA: AB 2316 enacted** (California bans six synthetic food colors in school meals) December: **UPF lawsuit (Martinez) filed** (Alleges that addictive product design and marketing to children caused health harm)	May: **Review of conditions for the use of tartaric acid, tartrates, etc.** (Withdrawal of authorization for uses lacking sufficient supporting data; clarification of conditions)
2025	January: **Revocation of authorization for Red No. 3** (Food products to be reformulated by 2027) March: **Review of the GRAS framework (company self-affirmed food safety route)** (Aims to close the "no notification required" loophole) **: WV: Ban on six synthetic colorings in school meals** (Effective August; future expansion to statewide sales ban. Note: temporarily enjoined) April: **HHS (Health and Human Services)/FDA: Phase out of petroleum-based synthetic food colors** (Policy to promote transition to natural colorants) June: **TX: Mandatory warning labels on foods containing specified additives** (Law enacted, labeling to begin in principle from 2027) August: **UPF lawsuit (Martinez) dismissed** (due to insufficient specificity regarding the products consumed and quantities involved) October: **CA: AB 1264 enacted** (Introduces a statutory definition of UPF and a phased elimination of UPF from school meals) December: **City of San Francisco files suit against 10 major food companies** (Raising issues related to medical and other social costs) **: FDA: Tracking and public disclosure of corporate commitments to reduce synthetic colorings** (Increased visibility of company responses)	April: **E466 (cellulose gum) prohibited for certain uses in infant-targeted products** **: Stricter specifications for cellulose derivatives (impurity limits, etc.)** (Stricter quality and impurity specifications)

Source: Compiled by MGSSI

2-2. CLEAN LABEL FOODS GAINING ATTENTION AMID GROWING CONSUMER PREFERENCE FOR HEALTH AND NATURAL PRODUCTS

The movement among consumers to seek safe, reliable, and natural foods is expanding. According to research firm Innova Market Insights (Netherlands), approximately 75% of consumers globally state that they reconsider their purchase after checking ingredient labels, and about 30% indicate an intention to reduce their intake of processed foods.[17] Against this backdrop, clean label foods are attracting increasing attention, as they are formulated without food additives that consumers may perceive as unhealthy and prominently feature on their packaging claims such as "no additives," "no artificial colors or preservatives," and "naturally derived."

[17] Global clean label trends. Nearly 1 in 2 consumers globally | Innova Market Insights

For example, in November 2025, PepsiCo (US) announced Simply NKD, a new line of its Doritos and Cheetos flagship snacks that uses no artificial colors and flavorings (Figure 4)[18]. The company emphasizes that while the products have a plain appearance, their taste and texture are equivalent to conventional versions. In addition, companies including Nestlé USA (US), Kraft Heinz (US), General Mills (US), and Danone (France) have also announced plans to progressively eliminate artificial colors from their products.[19, 20, 21, 22]

Figure 4: PepsiCo's (US) Simply NKD line of Cheetos and Doritos containing no synthetic colorings or flavorings

Source: Compiled by MGSSI based on information from FOODDIVE (Accessed December 25, 2025: https://www.fooddive.com/news/cheetos-doritos-nkd-no-artificial-dyes-pepsico/806541/#:~:text=Cheetos%20and%20Doritos%20are%20stripping,conscious%20consumers)

2-3. NATURALLY DERIVED ALTERNATIVE INGREDIENTS SUPPORTING CLEAN LABEL FOODS

Food companies are being compelled to seek enough quantities of alternative ingredients to replace food additives derived from inexpensive and readily available synthetic chemical substances. However, identifying naturally derived alternatives that offer equivalent functionality and can be supplied stably is not easy. In fact, in 2012, when Nestlé UK and Ireland decided to eliminate artificial colors, flavors, and preservatives from all of its chocolate confectionery products, it was unable to find a suitable blue coloring for its popular chocolate candy, Smarties, and temporarily replaced the blue ones with white (Figure 5).

Figure 5: Nestlé UK and Ireland temporarily replaced blue Smarties (right) with white following the elimination of synthetic colorings

Source: Compiled by MGSSI based on information from Nestlé (Accessed December 25, 2025: https://www.nestle.co.uk/en-gb/stories/how-nestle-kicked-arts-out-of-confectionery#:~:text=Steve%20Tolliday%2C%20Principal%20Product%20Technologist,%E2%80%9D)

[18] Cheetos, Doritos go colorless as PepsiCo launches versions without artificial dyes | Food Dive
[19] Nestlé USA to Eliminate Use of FD&C Colors by Mid-2026 | Nestlé
[20] Kraft Heinz Commits to Remove FD&C Colors From Its U.S. Portfolio Before the End of 2027 and Will Not Launch New Products in the U.S. With FD&C Colors, Effective Immediately | The Kraft Heinz Company
[21] General Mills Announces Plans to Remove Certified Colors from All U.S. Cereals and All Foods Served in K-12 Schools by Summer 2026 | General Mills, Inc.
[22] Yogurt Maker Danone Working to Remove Artificial Dyes From Products Sold in US | U.S. News

To resolve these issues, startups developing naturally derived alternative ingredients that enhance color, flavor, shelf life, and texture have been emerging in recent years (Figure 6).

Figure 6: Startups contributing to clean labeling

Category	Country	Company	Overview
Color	Israel	Phytolon	Produces naturally derived red, yellow, orange, and purple pigments using precision fermentation with baker's yeast
	Denmark	Chromologics	Produces natural red pigments via fungal fermentation, ensuring acceptance in the EU market through the use of non-GMO strains
Flavor	Chile	Done Properly	Produces naturally derived umami components from mycelium, edible fungi, and brewing yeast
	Denmark	REDUCED	Produces natural umami and flavors through fermentation using food byproducts such as surplus vegetables
Preservative	Canada	Chinova Bioworks	Produces mushroom-derived chitosan with natural antimicrobial activity
	US	BioVeritas	Produces naturally derived preservatives (alternatives to calcium propionate) through mixed-culture fermentation using non-food biomass
Texture improvement	Netherlands	Revyve	Extracts proteins from bread and beer yeast to produce ingredients that provide foaming, emulsifying, and binding properties
	US	Plantible Foods	Extracts RuBisCo protein from the aquatic plant duckweed and supplies it as a binding and emulsifying agent

Source: Compiled by MGSSI based on data from Lux_Research--The_State_of_Innovation_and_Consumer_Alignment_on_Clean_Label_Additi_CLIENT-CONFIDENTIAL

For example, Chromologics (Denmark) has developed Natu.Red, a red pigment derived from fungal fermentation (Figure 7). This pigment is water-soluble, stable across a wide range of pH levels and heating conditions, and is odorless and tasteless, enabling application to a broad range of foods and beverages without affecting flavor. With support from investors including Novo Holdings (Denmark), the company is currently applying for regulatory approval in Europe and the US while advancing efforts toward commercialization.[23]

Figure 7: Chromologics (Denmark) fungal fermentation-derived red pigment Natu.Red and application examples

Source: Compiled by MGSSI based on information from Chromologics (Accessed January 6, 2026: https://www.chromologics.com/press-kit)

[23] Chromologics raises €7 million to bring its natural colour ingredients closer to market | Chromologics

Revyve (Netherlands) has developed multifunctional protein ingredients, Revyve Adventure and Revyve Vitality. These are derived from yeast, a byproduct of bread production and beer brewing, and can replace eggs and synthetic additives (Figure 8). Extracted using proprietary technology, these ingredients provide functionalities such as emulsification, binding, foaming, and water retention, enabling application across a wide range of foods, including baked goods, dressings, and meat alternative products. As they can deliver texture and stability without the need for multiple food additives, they are well-suited to clean-label formulations. The company is currently operating a commercial production plant in the Netherlands and is accelerating efforts to expand into European and US markets with investment and support from AB InBev (Belgium), the world's largest brewer.

Figure 8: Revyve (Netherlands) beer yeast-derived protein ingredients and application examples

Source: Compiled by MGSSI based on information from Revyve
(Accessed January 6, 2026: https://revyve.bio/textures-solutions/, https://revyve.bio/technology/)

Looking ahead, technologies such as biomass fermentation, precision fermentation, and upcycling (effective use of waste and byproducts) are expected to play an increasingly important role in ensuring the stable supply of naturally derived alternative ingredients.

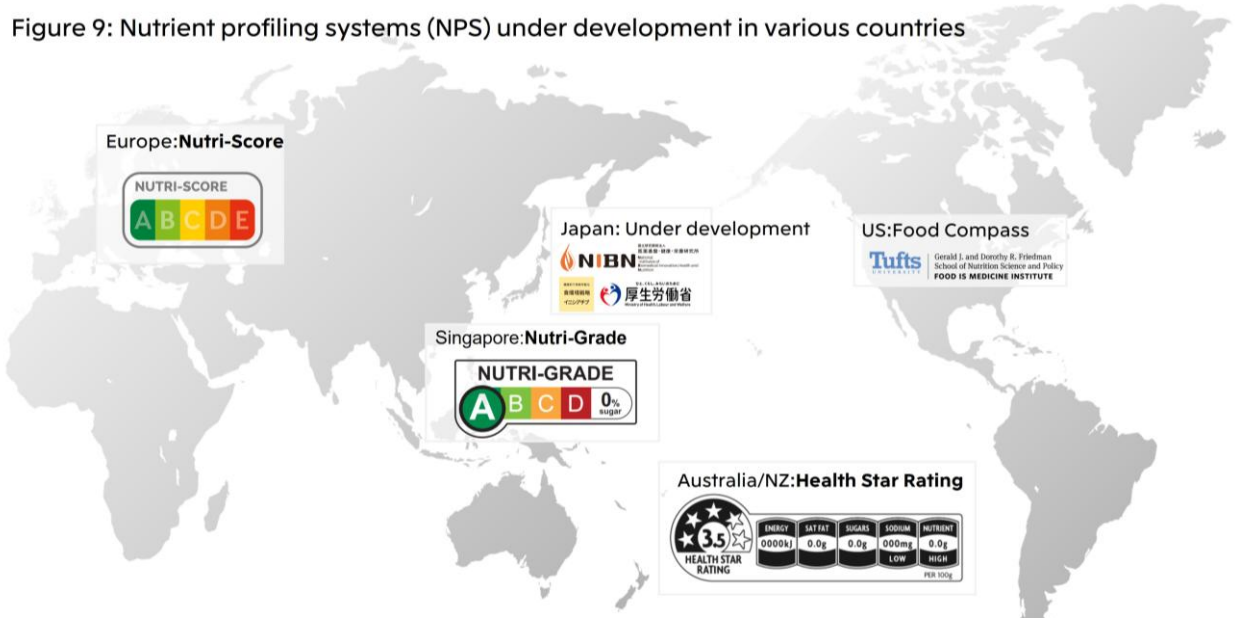
3. CREATING FOOD ENVIRONMENTS THAT NATURALLY SUPPORT GOOD HEALTH FOR ALL

Given the issues surrounding the current definition of UPF and the limitations of existing observational studies, it is not possible to conclude that UPF is inherently bad. The author considers that the essence of the UPF issue lies not in UPFs themselves but in the fact that reliance on UPFs leads to chronically excessive energy intake and insufficient intake of dietary fiber and protein, along with micronutrients such as vitamins and minerals, thereby increasing the risk of obesity and lifestyle-related diseases.

In this context, what is required of food companies is not merely reducing additives or pursuing marketing strategies that emphasize image through clean labeling. It is important to review the formulation of sugar, fat, and salt in products and to fortify products with nutrients that are commonly lacking, thereby promoting product designs and information disclosure that are less likely to encourage overeating. In addition to strengthening additive regulations, governments need to enhance transparency through the development of rules on food labeling and information disclosure, thereby supporting consumers in making better food choices. For their part, consumers are called upon not to judge foods solely by their degree of processing, but to use labeling and other information as a guide to consistently make better choices in their daily lives.

In advancing such initiatives, nutrient profiling systems (NPS)[24] have attracted increasing attention in recent years. An NPS is a system that integrates components requiring caution against excessive intake and components to be actively consumed to generate a score for the nutritional quality of each food and facilitate comparison. Representative examples include Europe's Nutri-Score[25] and Australia's Health Star Rating[26]. Consideration of a Japan-specific model is also underway in Japan[27] (Figure 9). Global companies such as PepsiCo and Nestlé, and major food manufacturers in Japan, including Ajinomoto and Meiji, are developing their own NPS frameworks and applying them to product improvements and information disclosure.[28, 29, 30, 31]

Figure 9: Nutrient profiling systems (NPS) under development in various countries

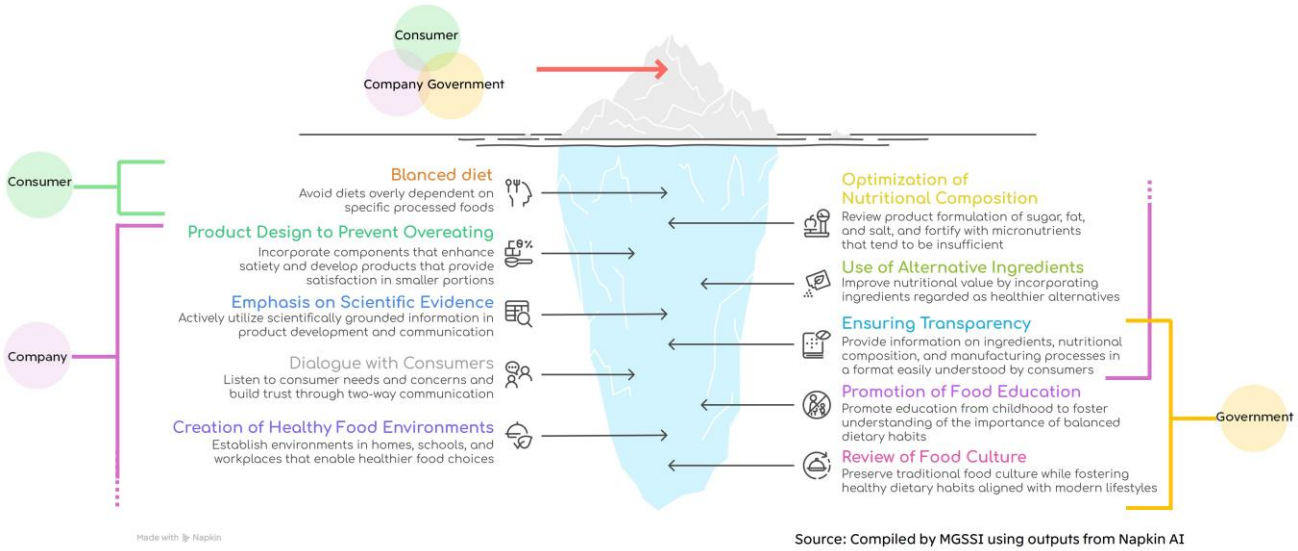


Source : https://www.campagnetoolkits.nl/documenten/2024/03/22/nutri-score-logo, https://www.healthstarrating.gov.au/sites/default/files/2025-12/Health%20Star%20Rating%20System%20Implementation%20Guide%20v9.pdf, https://www.hpb.gov.sg/healthy-living/food-beverage/nutri-grade, https://www.nibn.go.jp/eiken/npmj/, https://tuftsfoodismedicine.org/project/food-compass/（Accessed January 26, 2026), Image:rrice/stock.adobe.com

If the essence of the UPF issue lies not in the degree of processing but in imbalance, then creating environments that encourage people to naturally adjust what they eat, how much they eat, and how frequently they eat it is the key. By approaching this issue in a coordinated manner, companies, governments, and consumers can move closer to realizing food environments that naturally support good health for all (Figure 10).

[24] The science of classifying or ranking foods according to their nutritional composition for the purposes of disease prevention and health promotion
Use of nutrient profile models for nutrition and health policies: meeting report on the use of nutrient profile models in the WHO European Region ｜World Health Organization（WHO）
[25] Nutri-Score｜Santé Publique France
[26] Health Star Rating System｜Commonwealth of Australia
[27] A Japan-Specific Nutrient Profiling Model That Takes into Account the Nutritional Challenges of the Japanese Population | National Institute of Health and Nutrition
[28] A progressive nutrient profiling system to guide improvements in nutrient density of foods and beverages | PepsiCo Health and Nutrition
[29] A nutrient profiling system for the (re)formulation of a global food and beverage portfolio | PMC
[30] Ajinomoto Group Develops Japan's First Nutrient Profiling System for Meals | Press Releases | Ajinomoto Co., Inc.
[31] Characteristics and evaluation methods of Meiji NPS | Meiji NPS | Meiji Co., Ltd.

Figure 10: A tripartite approach by the government, businesses, and consumers to "Realizing a diet that naturally promotes health for everyone"



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