Abstract

The modern food supply operates under an inverted burden of proof: substances are permitted in food until demonstrated harmful, rather than excluded until demonstrated safe. This paper argues that this inversion is ethically indefensible, scientifically unjustifiable, and causally linked to the epidemic-scale chronic disease burden of industrialized populations. Drawing on cross-cultural epidemiological evidence from traditional populations — including the Kitava study (n=1,200; zero acne, near-zero cardiovascular disease, diabetes, and cancer), Okinawan longevity data, Inuit disease profiles, and the Wai population — we demonstrate that Homo sapiens consuming species-appropriate diets do not develop the diseases currently treated as inevitable features of human aging. These populations are not genetically privileged; when they adopt Western diets, Western disease rates emerge within a single generation. The paper examines the regulatory capture of food safety agencies (FDA, FSANZ, EFSA) through industry self-certification mechanisms such as the United States GRAS (Generally Recognized As Safe) framework, the role of Advanced Glycation End-products (AGEs) as a specific mechanistic pathway linking processed food to chronic disease, and the function of marketing as the mechanism by which industrial food production determines human diet. We propose that New Zealand's Psychoactive Substances Act 2013 — which reversed the burden of proof for novel psychoactive substances, requiring manufacturers to demonstrate safety before market entry — provides a legislative template for food regulation. The central argument is simple: food should not contain anything not yet proven safe beyond reasonable doubt. The current system — add it, sell it, wait for damage, then maybe regulate — is not a precautionary framework. It is an experiment conducted on an unconsenting population. The results of that experiment are in: obesity, type 2 diabetes, cardiovascular disease, and cancer at epidemic scale. (271 words)

1. Introduction

Every animal on Earth eats what it evolved to eat. Lions eat what lions ate a hundred thousand years ago. Salmon eat what salmon ate a hundred thousand years ago. Every species in every ecosystem consumes the

food that its biology was shaped by, and the result is predictable: they develop the diseases appropriate to their species at the rates appropriate to their species.

Every animal except one.

Homo sapiens, in the last approximately seventy years, has undergone the most radical dietary transformation in the history of any species. The food consumed by a typical human in an industrialized nation in 2026 bears almost no resemblance to the food consumed by any human at any point in the preceding two hundred thousand years of the species' existence. The shift is not a matter of degree. It is categorical. The majority of calories consumed in the modern Western diet come from substances that did not exist in any human diet before the mid-twentieth century: refined seed oils, high-fructose corn syrup, synthetic emulsifiers, artificial preservatives, flavour enhancers, colorings, stabilizers, and ultra-processed food matrices that no human metabolism was ever exposed to during the evolutionary period in which human biology was formed (Monteiro et al., 2013).

The result of this experiment is not ambiguous. The industrialized world is experiencing epidemic-scale rates of obesity, type 2 diabetes, cardiovascular disease, cancer, autoimmune conditions, neurodegenerative diseases, allergies, and mental health disorders. These conditions are treated, culturally and medically, as though they are inevitable consequences of being human — as though getting cancer is something that happens to organisms of our type, as though type 2 diabetes is a feature of aging, as though heart disease is a natural cause of death.

It is not. The epidemiological evidence from traditional populations — populations of the same species, with the same genome, living on different diets — demonstrates conclusively that these diseases are not features of being human. They are features of eating what the modern food supply provides.

This paper argues for a simple principle: **food should not contain anything not yet proven safe beyond reasonable doubt.** The burden of proof must be reversed. Currently, any substance can be added to the food supply and sold to billions of people until sufficient evidence accumulates — usually over decades, usually through the suffering and death of those same people — to warrant regulatory action. This is not a precautionary system. It is a post-hoc damage assessment system. It treats the human population as an experimental cohort and waits for the data to arrive in the form of disease statistics.

The principle we propose is not radical. It is the default assumption in every other domain where substances interact with human biology. Pharmaceuticals must pass Phase I, II, and III clinical trials before market entry.

Novel chemicals require toxicological assessment before industrial use. Building materials must meet safety standards before installation. Only food — the substance that enters every human body multiple times daily, from birth to death, across every demographic — operates under the reversed assumption: permitted until proven harmful.

This paper synthesizes evidence across nine domains to construct the case for reversal: the precautionary principle and its inversion in food regulation (Section 2), the epidemiological evidence from traditional populations (Section 3), the regulatory capture of food safety agencies (Section 4), the mechanistic pathways linking processed food to disease (Section 5), the role of marketing in determining human diet (Section 6), the New Zealand legislative precedent (Section 7), the preventability of cancer and chronic disease (Section 8), and the seventy-year experiment of industrial food production (Section 9).

The paper connects to and extends conclusions established in prior work in this series: (Applebee & Combe, 2026, "*The Bullshit Jobs Phenomenon*"), demonstrating that cancer is overwhelmingly preventable through environmental and dietary modification; (Applebee & Combe, 2026, "*Wanted Attention for Unwanted Results*"), documenting that traditional diets produce fundamentally different health outcomes from industrial diets; (Applebee & Combe, 2026, "*Civic Proximity Response*"), examining the mechanisms by which marketing determines individual consumption patterns rather than reflecting them; and (Applebee & Combe, 2026, "*Swiss Direct Democracy*"), establishing that regulatory systems can be designed to serve populations rather than industries when the political architecture permits it.

---

2. The Precautionary Principle and Its Inversion

2.1 The Principle Stated

The precautionary principle, as formulated in the 1992 Rio Declaration on Environment and Development, states: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (United Nations, 1992). The principle has been adopted in various forms across international environmental law, public health policy, and chemical regulation. Its logic is straightforward: when the potential consequences of

an action are severe and the evidence base is incomplete, the default position should be caution rather than permission.

In food safety regulation, this principle is inverted. The default position is permission. A substance may be added to the food supply unless evidence demonstrates it is harmful. The burden falls not on the manufacturer to prove safety, but on regulators, researchers, and ultimately the consuming public to prove danger — after exposure has already occurred, often across decades and millions of people.

2.2 How the Inversion Operates

The practical operation of this inversion follows a predictable sequence:

Step 1: Introduction. A food manufacturer identifies a substance that reduces production costs, extends shelf life, improves visual appearance, or enhances a processing property. The substance is introduced into the food supply.

Step 2: Regulatory tolerance. The substance is either approved through an expedited review process (often relying on manufacturer-supplied safety data), self-certified as safe by the manufacturer under frameworks like GRAS, or simply used without formal approval in jurisdictions where regulation is reactive rather than proactive.

Step 3: Population exposure. The substance enters the food supply at scale. Millions or billions of people consume it daily. This exposure is not a clinical trial. There is no control group, no monitoring protocol, no informed consent, no adverse event reporting system, and no mechanism for correlating health outcomes with specific dietary exposures across the latency periods relevant to chronic disease (which may span decades).

Step 4: Signal accumulation. Over years or decades, epidemiological signals emerge. Researchers identify correlations between the substance and adverse health outcomes. These correlations are initially contested by the industries that profit from the substance. Doubt is manufactured. Alternative explanations are proposed. Methodological limitations of observational studies are emphasized — correctly, but selectively, since the same methodological limitations that complicate the detection of harm also complicate any claim of safety.

Step 5: Regulatory response (maybe). If the evidence base becomes sufficiently overwhelming to withstand industry opposition, regulatory action may follow. This action is typically incremental: reduced permitted levels, warning labels, restrictions in specific product categories, or voluntary industry reformulation. Outright

bans are rare and typically delayed by years or decades beyond the point at which the evidence warranted action.

Step 6: Continued exposure during deliberation. Throughout the regulatory process — which may take five, ten, or twenty years — the population continues to be exposed to the substance. The burden of the delay falls entirely on the consuming public.

This sequence has played out repeatedly: with trans fats (introduced in the early twentieth century, restricted beginning in the early twenty-first), with certain artificial sweeteners, with partially hydrogenated oils, with specific artificial colorings, and with numerous other substances whose safety profiles were assumed rather than demonstrated.

2.3 The Asymmetry of Evidence Requirements

The evidentiary asymmetry is stark. To introduce a substance into the food supply, a manufacturer needs relatively minimal evidence of safety — in many cases, as we will examine in Section 4, no independent evidence at all. To remove a substance from the food supply, regulators need overwhelming evidence of harm, sustained across multiple studies, sufficient to withstand legal challenge by well-resourced corporate defendants, and sufficiently specific to attribute harm to the particular substance rather than to "lifestyle factors" or "confounders."

This asymmetry is not accidental. It reflects the distribution of resources and incentives. The entities that profit from introducing substances into the food supply are concentrated, well-funded, and highly motivated. The entities that bear the cost — individual consumers — are dispersed, poorly informed, and have no mechanism for collective action on the timescale relevant to chronic disease. The institutional actors that might bridge this gap — regulatory agencies — are subject to the capture dynamics examined in Section 4.

The result is a system in which the threshold for adding a substance to the food supply is vastly lower than the threshold for removing it. This produces a ratchet effect: substances accumulate in the food supply over time, with each addition facing low barriers and each removal facing high ones. The modern processed food supply, containing thousands of additives that did not exist a century ago, is the predictable output of this ratchet.

2.4 The Pharmaceutical Comparison

The contrast with pharmaceutical regulation illuminates the absurdity. Before a pharmaceutical compound can be administered to patients, it must pass through:

- Preclinical testing: Laboratory and animal studies to establish basic safety and mechanism of action.
- Phase I trials: Small-group studies (20-100 people) to establish safety, dosage, and side effects.
- Phase II trials: Larger studies (100-300 people) to assess efficacy and further evaluate safety.
- Phase III trials: Large-scale studies (1,000-3,000+ people) to confirm efficacy, monitor side effects, compare with existing treatments.
- Regulatory review: Comprehensive assessment by an independent agency (FDA, TGA, EMA).
- Phase IV (post-market surveillance): Ongoing monitoring after approval.

This process typically takes 10-15 years and costs $1-2 billion. It is considered the minimum acceptable standard for a substance that will be administered to patients under medical supervision, at specific doses, for defined durations, with informed consent.

Food additives — substances administered to every person in a population, without medical supervision, at uncontrolled doses, for a lifetime, without informed consent — face no comparable requirement. The disparity is not defensible on any rational basis. A substance consumed by a small population of patients under controlled conditions faces more stringent safety requirements than a substance consumed by billions of people under uncontrolled conditions from birth to death.

---

3. The Evidence from Traditional Populations

3.1 The Kitava Study

The most significant natural experiment in human nutrition was conducted by Staffan Lindeberg and colleagues on the island of Kitava, in the Trobriand Islands of Papua New Guinea. The Kitava study, spanning work from 1989 through the 2000s, examined a population of approximately 1,200 individuals consuming a

traditional diet consisting primarily of tubers (yam, sweet potato, taro), fruit, fish, and coconut (Lindeberg, 1993; Lindeberg et al., 1994; Lindeberg & Lundh, 1993).

The findings were extraordinary by Western epidemiological standards:

Zero acne. In a systematic examination of 1,200 Kitavans, including 300 aged 15-25 (the peak age for acne in Western populations), Lindeberg and colleagues found not a single case of acne vulgaris — not even a single comedone (Cordain et al., 2002). In Western populations, acne affects 79-95% of adolescents (Bhate & Williams, 2013). This is not a minor difference. It is a near-absolute presence versus a near-absolute absence. The same species, the same genome, the same age group, the same hormonal profile — and a different diet. The finding was replicated in the Ache population of Paraguay, where Cordain and colleagues similarly found zero cases of acne.

Near-zero cardiovascular disease. Lindeberg et al. (1994) found that Kitavans had significantly lower blood pressure, lower BMI, and electrocardiographic profiles indicating negligible atherosclerotic burden. There was no evidence of stroke or ischemic heart disease as causes of death. Sudden cardiac death, the leading killer in Western populations, appeared to be absent.

Near-zero type 2 diabetes. Despite a diet deriving approximately 70% of calories from carbohydrates (substantially higher than Western dietary guidelines recommend), the Kitavan population showed no clinical evidence of type 2 diabetes and maintained insulin sensitivity into old age (Lindeberg et al., 1999). This finding alone demolishes the simplistic dietary model that equates carbohydrate intake with metabolic disease. The variable is not macronutrient composition. It is food processing.

Near-zero obesity. Mean BMI among Kitavans was 20-22 across all age groups, with no age-related increase. The population was lean without caloric restriction — they ate to satiety. The food was satiating because it was food, not because it was engineered.

Cancer rates approaching zero for Western-type cancers. While comprehensive cancer epidemiology is difficult in populations without medical imaging, the absence of cancer-related deaths in the population was noted by Lindeberg and consistent with the broader pattern observed in pre-contact indigenous populations globally.

The Kitava findings are not anomalous. They are consistent with a pattern observed across every traditional population studied before and during the nutrition transition.

3.2 Okinawa

The Okinawan population, prior to the post-World War II dietary transition, represented the longest-lived population in recorded epidemiological history. The traditional Okinawan diet — centred on sweet potatoes, soy, vegetables, and small amounts of fish and pork — was associated with:

- The highest proportion of centenarians in any population (approximately 50 per 100,000, compared to 10-20 per 100,000 in most Western countries) (Willcox et al., 2004).
- Cardiovascular disease mortality rates 80% lower than the US population.
- Cancer mortality rates 50-80% lower than the US population (with specific cancers such as breast and prostate cancer being exceptionally rare).
- Type 2 diabetes rates a fraction of those in Western populations.
- Dementia rates substantially lower than Western populations (Shatenstein et al., 2015).

The Okinawan data is particularly valuable because it includes longitudinal tracking of what happened when the diet changed. As American military bases introduced Western processed food to Okinawa beginning in the 1960s, and as younger generations adopted Western dietary patterns, the health advantages collapsed. Okinawan males born after 1945 now have life expectancy and disease rates converging with the Japanese mainland and, increasingly, with Western norms (Willcox et al., 2004). The youngest generations of Okinawans, raised on convenience stores and processed food, are developing obesity and metabolic disease at rates their grandparents never experienced.

This is the critical observation: **the same genetic population, in the same environment, separated by one or two generations of dietary change, exhibits fundamentally different disease profiles.** This is not a genetic difference. The genome does not change in two generations. It is a dietary difference.

3.3 The Inuit

Traditional Inuit populations, consuming a diet composed almost entirely of animal products — seal, whale, fish, caribou — with minimal plant matter, exhibited near-zero rates of cardiovascular disease, type 2 diabetes, and many Western cancers despite a macronutrient profile that, by conventional Western dietary guidelines, should have been catastrophic: extremely high fat, high protein, near-zero fibre, minimal carbohydrate (Bjerregaard et al., 2004).

The Inuit data is particularly important because it demonstrates that the relevant variable is not macronutrient composition. The Kitavans eat a high-carbohydrate diet. The Inuit eat a high-fat diet. Both populations are largely free of Western chronic disease. The common variable is not what macronutrients they eat. The common variable is what they do not eat: processed food, refined sugars, seed oils, synthetic additives, and the thousands of novel chemical compounds that define the modern Western food supply.

When Inuit populations transitioned to Western store-bought food — beginning in earnest in the mid-twentieth century — rates of obesity, type 2 diabetes, cardiovascular disease, dental caries, and cancer increased rapidly, converging with Canadian national averages within approximately two generations (Bjerregaard et al., 2004; Sharma et al., 2010). This transition has been documented in detail and provides one of the clearest natural experiments available: same population, same environment, same genetics, different food, different disease profile.

3.4 The Wai

The Wai people of traditional Pacific Island societies, like the Kitavans, consumed diets based on tubers, fruit, coconut, and fish. The health patterns observed were consistent with the Kitava data: low rates of cardiovascular disease, obesity, diabetes, and Western-type cancers. The consistency across geographically dispersed populations eating different specific foods but sharing the common characteristic of consuming unprocessed, traditional diets strengthens the inference that the relevant variable is food processing and industrial additives, not any specific food item.

3.5 The Pattern

The pattern across traditional populations is not subtle:

POPULATION	DIET COMPOSITION	CVD	DIABETES	OBESITY	ACNE	CANCER (WESTERN TYPES)
Kitava	Tubers, fruit, fish, coconut	Near zero	Near zero	Near zero	Zero	Near zero
Okinawa (traditional)	Sweet potato, soy,	~80% lower	Much lower	Near zero	Very low	50-80% lower

	vegetables, fish					
Inuit (traditional)	Seal, whale, fish, caribou	Near zero	Near zero	Near zero	Very low	Near zero
Wai	Tubers, fruit, coconut, fish	Near zero	Near zero	Near zero	Very low	Near zero
Western (industrial)	Processed food, seed oils, refined sugar, additives	Leading cause of death	Epidemic	Epidemic	79-95% of adolescents	Second leading cause of death

These populations are not genetically privileged. They are not different subspecies. They are Homo sapiens consuming diets that Homo sapiens evolved to process. When they stop doing so — when they adopt the Western industrial diet — their disease profiles converge with Western populations within one to two generations.

The implication is direct: the Western disease burden is not a consequence of being human. It is a consequence of eating what the Western food supply provides. The difference between a population with near-zero heart disease and a population where heart disease is the leading cause of death is not genetics, not aging, not inevitable — it is food.

4. Regulatory Capture and the GRAS Framework

4.1 The Structure of Capture

Regulatory capture — the process by which regulatory agencies come to serve the interests of the industries they are mandated to regulate — is well-documented across multiple sectors (Stigler, 1971; Carpenter & Moss, 2013). In food safety regulation, the capture is structural, not merely incidental.

The principal mechanisms include:

Revolving door employment. Senior staff move between regulatory agencies and the food industry in a pattern so systematic that it constitutes a career pathway rather than an anomaly. FDA commissioners, deputy commissioners, and senior reviewers routinely take positions in the food and pharmaceutical industries after leaving government service, and industry executives routinely take senior regulatory positions. This pattern creates a web of personal and professional relationships that blurs the boundary between regulator and regulated (Revolving Door Project, 2021).

Industry-funded science. The majority of safety studies submitted to regulatory agencies in support of food additive approvals are funded by the manufacturers seeking approval. The conflict of interest is structural: the entity paying for the research has a direct financial interest in its outcome. Meta-analyses consistently show that industry-funded studies are more likely to produce results favourable to the sponsor than independently funded studies (Lesser et al., 2007; Mandrioli et al., 2016). This is not necessarily fraudulent — it may reflect study design choices, outcome selection, publication bias, or the framing of ambiguous results — but the systematic skew is empirically established.

Lobbying expenditure. The food and beverage industry spends hundreds of millions of dollars annually on lobbying in the United States alone. The Center for Responsive Politics reports that the food and beverage sector consistently ranks among the top lobbying spenders. This expenditure purchases not merely access but influence over the legislative and regulatory frameworks that govern food safety (Center for Responsive Politics, 2023).

Advisory committee composition. Expert advisory committees that guide regulatory decisions frequently include members with financial ties to the industries affected by those decisions. Conflict-of-interest disclosure requirements exist but are routinely waived when the agency determines that the relevant expertise is only available from industry-connected researchers — a determination that reflects the industry's long-term strategy of funding and cultivating the expertise base itself.

4.2 The GRAS System

The United States GRAS (Generally Recognized As Safe) system represents perhaps the most extreme manifestation of inverted burden of proof in food regulation. Under the GRAS framework, a food manufacturer can determine — without notifying the FDA — that a substance is "generally recognized as safe" based on the manufacturer's own assessment.

The process operates as follows:

1. A manufacturer identifies a substance it wishes to add to food products.
2. The manufacturer conducts or commissions a safety evaluation (typically using its own funding and, frequently, its own scientists or consultants with financial ties to the company).
3. An expert panel — selected and paid by the manufacturer — reviews the evidence and determines whether the substance qualifies as GRAS.
4. The manufacturer may (but is not required to) notify the FDA of this determination.
5. If the FDA is notified, it may (but is not required to) review the submission. The FDA does not "approve" GRAS determinations; it merely indicates whether it has "no questions" about the manufacturer's conclusion.
6. If the FDA is not notified — and there is no legal requirement for notification — the substance enters the food supply with no regulatory review whatsoever.

A 2010 investigation by the US Government Accountability Office (GAO) found that the GRAS process was inadequate to ensure food safety, noting that the FDA did not systematically reconsider the safety of substances already designated as GRAS when new scientific information emerged, and that the voluntary nature of the notification process meant the FDA was unaware of many GRAS determinations being made by industry (GAO, 2010).

A landmark 2014 analysis by Neltner et al., published in *JAMA Internal Medicine*, found that of the approximately 10,000 substances permitted in the US food supply, the safety of a substantial proportion had been determined solely by the manufacturers, with no independent review. The study found that financial conflicts of interest were present in virtually all GRAS expert panels, that many substances designated as GRAS had never been reviewed by the FDA, and that the system lacked basic transparency (Neltner et al., 2014).

The GRAS system is not food safety regulation. It is industry self-certification with a regulatory veneer. The manufacturer decides, the manufacturer's consultants agree, and the public consumes. The fox does not merely guard the henhouse. The fox decides which animals are safe for the hens to live with.

4.3 International Parallels

The GRAS system is the most extreme case, but the underlying dynamics are not unique to the United States.

FSANZ (Food Standards Australia New Zealand) operates a more formal approval process but relies heavily on applicant-supplied data, has limited independent research capacity, and faces the same revolving-door and lobbying dynamics as other regulators. FSANZ's approval process for new food additives requires the applicant (typically the manufacturer) to supply the safety evidence — a structural conflict that parallels the GRAS framework in a more formalized wrapper.

EFSA (European Food Safety Authority) is generally considered the most rigorous of the major food safety regulators, with greater independence from industry and more systematic review processes. However, EFSA has been subject to recurring criticism regarding conflicts of interest on its scientific panels, reliance on industry-supplied data, and delays in acting on emerging safety concerns. The European approach is more precautionary than the American approach, but the gap between the precautionary principle as stated and as practiced remains substantial (Robinson et al., 2013).

Codex Alimentarius, the joint FAO/WHO food standards body, sets international standards that influence national regulation globally. Its processes have been criticized for excessive industry influence and for setting standards that reflect the lowest common denominator of political acceptability rather than the best available evidence on safety.

4.4 The Pattern of Delayed Action

The history of food additive regulation is a history of delayed action. In virtually every case where a substance was eventually restricted or banned, the following pattern is observable:

1. Independent researchers identify safety concerns.
2. Industry disputes the findings, funds counter-research, and emphasizes methodological limitations.
3. A period of regulatory paralysis ensues while "the science is debated."
4. During this period, the substance continues to be consumed by millions or billions of people.
5. The evidence base eventually becomes overwhelming.
6. Regulatory action is taken — typically years or decades after the evidence warranted it.
7. Industry reformulates, often replacing the banned substance with a novel substance whose safety profile is equally undemonstrated, and the cycle begins again.

Trans fats provide a paradigmatic example. Evidence linking partially hydrogenated oils to cardiovascular disease began accumulating in the 1990s. Regulatory action in the United States — a ban on partially hydrogenated oils — was not finalized until 2015, with a compliance date of 2018. During the intervening two-plus decades, the American population continued to consume trans fats. The estimated health cost of this delay — measured in cardiovascular events attributable to trans fat consumption during the regulatory lag — runs to tens of thousands of preventable deaths (Mozaffarian et al., 2006).

The trans fat case is not an exception. It is the norm. The system is designed to delay. The delay is not a bug. It is the predictable output of a regulatory architecture in which the burden falls on regulators to prove harm rather than on manufacturers to prove safety, and in which the regulated industries possess vastly greater resources than the regulatory agencies tasked with overseeing them.

---

5. Mechanistic Pathways: Advanced Glycation End-Products and the Maillard Reaction

5.1 The AGE Mechanism

Advanced Glycation End-products (AGEs) provide a specific, well-characterized mechanistic pathway linking processed food to chronic disease. AGEs are formed through the Maillard reaction — a non-enzymatic chemical reaction between reducing sugars and amino acids, proteins, or lipids that occurs during high-temperature cooking (frying, grilling, roasting, baking) and in the industrial processing of food (Uribarri et al., 2010).

The Maillard reaction is what produces the browning, flavour, and aroma compounds associated with cooked and processed food. It is also what produces a class of compounds that are biologically active, pro-inflammatory, pro-oxidant, and causally implicated in the pathogenesis of multiple chronic diseases.

5.2 Mechanisms of Harm

AGEs exert pathological effects through several established mechanisms:

RAGE activation. AGEs bind to the Receptor for Advanced Glycation End-products (RAGE), a pattern-recognition receptor expressed on endothelial cells, macrophages, smooth muscle cells, and neurons. RAGE activation triggers intracellular signalling cascades — primarily through NF-kB — that produce chronic inflammation, oxidative stress, and cellular dysfunction (Bierhaus et al., 2005). Chronic RAGE activation is implicated in atherosclerosis, diabetic complications, neurodegeneration, and cancer progression.

Protein cross-linking. AGEs cause irreversible cross-linking of structural proteins, particularly collagen and elastin. This cross-linking contributes to arterial stiffness, loss of vascular compliance, basement membrane thickening, and the progressive loss of tissue function associated with aging and chronic disease (Sell & Monnier, 2012).

Oxidative stress. AGE-RAGE interaction generates reactive oxygen species (ROS) through NADPH oxidase activation, contributing to systemic oxidative stress — a condition causally linked to virtually every major chronic disease (Cai et al., 2008).

Inflammation. AGE-mediated NF-kB activation drives the production of pro-inflammatory cytokines (TNF-alpha, IL-6, IL-1beta, CRP), creating a state of chronic low-grade inflammation — now recognized as a central feature of the pathogenesis of cardiovascular disease, type 2 diabetes, cancer, neurodegeneration, and autoimmune conditions (Vlassara & Striker, 2011).

5.3 Dietary AGE Exposure

The dietary AGE burden of modern processed food is orders of magnitude higher than that of traditional, minimally processed diets. Uribarri et al. (2010) compiled a comprehensive database of AGE content (measured as carboxymethyllysine, CML) across 549 commonly consumed foods. The findings demonstrated that:

- Dry-heat cooking methods (frying, grilling, broiling, roasting) produce AGE levels 10-100 times higher than wet-heat methods (boiling, steaming, poaching).
- Processed foods — particularly processed meats, fried foods, baked goods, and industrial snacks — contain AGE levels vastly exceeding those of whole, unprocessed foods.

- The typical Western diet delivers an estimated 15,000-25,000 kU of AGEs per day, while diets composed of minimally processed foods cooked at low temperatures deliver approximately 5,000-8,000 kU per day.
- The traditional diets consumed by populations with low chronic disease rates — boiled tubers, steamed vegetables, raw fruit, poached fish — are precisely the diets that minimize AGE formation.

5.4 Clinical Evidence

Intervention studies have demonstrated that reducing dietary AGE intake produces measurable improvements in inflammatory markers, oxidative stress, and metabolic parameters:

- Vlassara et al. (2009) showed that a low-AGE diet (prepared from the same foods but using low-temperature cooking methods) reduced circulating AGE levels, inflammatory markers (CRP, TNF-alpha), and oxidative stress markers (8-isoprostanes) in both healthy subjects and patients with diabetes.
- Uribarri et al. (2011) demonstrated that dietary AGE restriction improved insulin sensitivity and reduced inflammatory markers in overweight individuals.
- Cai et al. (2012) showed in a mouse model that dietary AGE restriction extended lifespan and reduced the incidence of cardiovascular disease, diabetes, and kidney disease.

The AGE mechanism does not explain all of the health differential between traditional and industrial populations. Other factors — including the displacement of nutrient-dense whole foods by energy-dense, nutrient-poor processed foods; the effects of specific additives such as emulsifiers on gut barrier function (Chassaing et al., 2015); the metabolic effects of refined sugars and seed oils; and the disruption of the gut microbiome by food additives (Suez et al., 2014) — contribute independently and synergistically. But AGEs provide a concrete, measurable, mechanistically well-characterized example of how the processing of food creates novel compounds that drive disease.

5.5 The Additive Burden

Beyond AGEs, the modern food supply contains thousands of intentionally added substances whose long-term safety profiles are poorly characterized:

Artificial colorings. McCann et al. (2007), in a landmark randomized controlled trial published in *The Lancet*, demonstrated that artificial food colorings and the preservative sodium benzoate increased hyperactive

behaviour in children in the general population — not only in children diagnosed with ADHD, but in a general population sample. The study was commissioned by the UK Food Standards Agency and its findings led to voluntary removal of several artificial colorings from products in the UK and EU, though the same colorings remain permitted in the United States. The substances in question — sunset yellow (E110), carmoisine (E122), tartrazine (E102), ponceau 4R (E124), quinoline yellow (E104), allura red (E129) — contribute nothing to nutrition, nothing to taste, and nothing to food safety. They exist to make food a colour it is not. They are permitted because they are cheap and because the regulatory system requires proof of harm rather than proof of safety.

Emulsifiers. Chassaing et al. (2015), published in *Nature*, demonstrated that common food emulsifiers — carboxymethylcellulose and polysorbate-80, present in a vast range of processed foods — altered the gut microbiome, induced low-grade inflammation, and promoted metabolic syndrome and colitis in mouse models. These emulsifiers are permitted as GRAS and are present in ice cream, salad dressings, baked goods, and numerous other processed foods consumed daily by billions of people. Their function is textural — they keep oil and water from separating. They contribute nothing to nutrition.

Artificial sweeteners. Suez et al. (2014), published in *Nature*, demonstrated that artificial sweeteners (saccharin, sucralose, aspartame) altered the gut microbiome in ways that impaired glucose tolerance — the very metabolic parameter they were marketed as protecting. Subsequent human intervention studies have confirmed that artificial sweeteners produce measurable changes in the gut microbiome and metabolic responses (Suez et al., 2022). These substances were introduced as "safe" alternatives to sugar. Their long-term safety was assumed, not demonstrated.

Titanium dioxide (E171). Used as a whitening agent in candy, chewing gum, and toothpaste, titanium dioxide was classified as "possibly carcinogenic to humans" (Group 2B) by the International Agency for Research on Cancer. France banned it in food products in 2020. The EU followed with a ban effective 2022, citing concerns about genotoxicity (EFSA, 2021). It remains permitted in the United States. Its function in food is purely cosmetic: it makes things white. It contributes nothing to nutrition, taste, or safety. It existed in the food supply for decades before any comprehensive genotoxicity assessment was conducted.

In each of these cases, the substance was permitted first and evaluated later. In each case, the evidence of potential harm emerged after years or decades of population-wide exposure. In each case, the substance contributed nothing essential to the food — no nutritional value, no taste benefit, no safety function. They existed because they were cheap and because the regulatory system did not require proof that they were safe before they were sold to billions of people.

6. The Zookeeper: Marketing as Dietary Determinant

6.1 The Market Determines What Humans Eat

In every other species, diet is determined by ecology: the organism eats what is available in its environment, filtered through its evolved feeding behaviours and digestive physiology. The organism's biology determines what it eats. For Homo sapiens in industrialized societies, this relationship is inverted. The market determines what humans eat, and marketing determines what the market provides.

This inversion is not hyperbolic. Consider the decision architecture of a typical food purchase. A consumer enters a supermarket. The products available for purchase have been determined by manufacturers, distributors, and retailers based on profitability, shelf life, production cost, and consumer demand — where "consumer demand" is itself substantially shaped by advertising, product placement, pricing strategy, and habit. The physical layout of the store, the positioning of products on shelves, the pricing structure, the promotions, and the packaging are all designed — at considerable expense, with the full apparatus of behavioural psychology — to influence purchasing decisions (Nestle, 2002; Moss, 2013).

The consumer does not decide what to eat and then seek it out. The consumer is presented with a curated environment of options, shaped by profit calculations, and makes choices within that constrained space while subject to psychological manipulation techniques refined over decades.

6.2 Advertising Expenditure and Its Effects

The food and beverage industry spends approximately $11-14 billion annually on advertising in the United States alone (Federal Trade Commission, 2012). The majority of this spending promotes processed food, fast food, sugary beverages, and snack products. The advertising of fruits, vegetables, whole grains, and minimally processed foods constitutes a negligible fraction of total food marketing expenditure.

The targeting of children is particularly significant. The average American child sees approximately 10,000-13,000 food advertisements per year on television alone, with the overwhelming majority promoting nutritionally poor products (Harris et al., 2009). This exposure begins before children can distinguish

advertising from editorial content and continues through developmental periods when food preferences and eating habits are being formed.

The Institute of Medicine concluded in 2006 that food marketing directed at children influences their food preferences, purchase requests, and consumption patterns, and that these effects are sufficient to contribute to unhealthful dietary patterns (IOM, 2006). This is not a contested finding. The industry's own internal research confirms it — the entire purpose of the expenditure is to influence behaviour, and the expenditure would not continue at this scale if it were ineffective.

6.3 The Zookeeper Analogy

The relationship between the food industry and the consuming public maps precisely onto the relationship between a zookeeper and the animals in the zoo. The zookeeper does not ask the animals what they want to eat. The zookeeper determines what the animals eat based on the zookeeper's interests — cost, convenience, availability, and (in the best zoos) some consideration of the animals' actual nutritional needs.

In a well-run zoo, the zookeeper feeds the animals species-appropriate diets because the zoo's interests (healthy animals, long-lived exhibits, low veterinary costs) are partially aligned with the animals' interests. In a poorly-run zoo — or one where the financial incentives are misaligned — the zookeeper feeds the animals whatever is cheapest, whatever is most readily available, whatever requires the least effort, regardless of long-term health consequences.

The modern food industry is the zookeeper. The consuming public is the collection. The diet provided is determined not by what Homo sapiens needs but by what is profitable to produce and sell. Marketing is the mechanism by which the zookeeper decides what the animals eat while maintaining the illusion that the animals are choosing.

As documented in the Applebee's Report health chapter, the structural position of the consumer in the industrial food system is not that of an autonomous agent making free choices among neutral options. It is that of a managed population whose consumption patterns are shaped by entities whose interests are financial, not nutritional. The consumer's "choice" is constrained by what is manufactured, what is advertised, what is priced attractively, what is available, and what has been normalised through decades of marketing. The freedom is nominal. The determination is structural.

6.4 The Feedback Loop

The marketing-consumption loop is self-reinforcing:

1. The industry manufactures products optimised for palatability, shelf life, and production cost — not for nutritional quality.
2. Marketing creates demand for these products.
3. Consumer purchases validate the product line.
4. Revenue funds further marketing.
5. Consumption patterns become habitual.
6. Habitual consumption creates physiological adaptations (altered taste preferences, gut microbiome changes, metabolic adaptations) that reinforce the pattern.
7. The cycle deepens.

Breaking this loop requires intervention at the regulatory level, because the loop is sustained by a power asymmetry that individual consumer choice cannot overcome. The industry has billions of dollars in marketing resources. The consumer has a grocery list and whatever nutritional literacy they have managed to acquire from an information environment dominated by that same industry's messaging.

---

7. The New Zealand Precedent: Reversing the Burden of Proof

7.1 The Psychoactive Substances Act 2013

New Zealand's Psychoactive Substances Act 2013 (PSA) provides a direct legislative precedent for reversing the burden of proof in the regulation of substances that interact with human biology. The Act was passed in response to the proliferation of novel psychoactive substances ("legal highs") that exploited the traditional regulatory model: manufacturers would introduce new compounds, sell them to the public, and continue

selling until regulators could demonstrate harm and schedule the specific compound — at which point the manufacturer would modify the molecule slightly and begin again.

The traditional model — ban substances after demonstrating harm — was failing for the same structural reasons that food additive regulation fails: the burden of proof was on the regulator, the latency between exposure and demonstrated harm was long, and the regulated entities could move faster than the regulatory apparatus.

New Zealand's response was to invert the burden. The PSA established that:

1. All novel psychoactive substances are prohibited by default. The default position is not permission. It is prohibition.
2. A manufacturer seeking to sell a psychoactive substance must apply for approval. The applicant bears the burden.
3. Approval requires the applicant to demonstrate, through clinical trials and toxicological assessment, that the substance poses no more than a low risk of harm. The standard of evidence is not "no evidence of harm" (which could simply reflect insufficient study). It is affirmative evidence of safety.
4. The cost of generating this evidence is borne by the applicant, not by the regulator or the public.

The logic of the PSA is directly transferable to food regulation: if a substance has not been conclusively demonstrated to be safe for human consumption through independent, pre-market testing, it should not be in food. The burden should fall on the entity that profits from adding the substance, not on the public that consumes it.

7.2 Application to Food Additives

Under a PSA-modelled food safety framework, the regulatory architecture would be:

Default position: No novel substance may be added to food unless it has been affirmatively demonstrated to be safe through independent pre-market testing.

Burden of proof: The manufacturer or proponent bears the cost and burden of demonstrating safety. "Safety" is defined as the absence of significant risk at the levels of exposure anticipated in the food supply, over the duration of exposure anticipated (which, for food additives, is a lifetime).

Evidence standard: Safety evidence must come from independent research — not from studies funded by the manufacturer or conducted by researchers with financial ties to the manufacturer. The conflict-of-interest problem identified in the GRAS system (Section 4.2) is addressed by requiring independence of the evidence base.

Temporal scope: Safety must be demonstrated over timeframes relevant to chronic disease — years or decades, not the 90-day animal studies that currently form the evidentiary basis for many food additive approvals. Where long-term data is unavailable, the precautionary default applies: the substance is not permitted until the data exists.

Existing substances: The framework would apply not only to novel substances but would require retrospective review of substances currently in the food supply. Substances that were approved through inadequate processes (including GRAS self-certification) would be required to meet the new evidentiary standard within a defined transition period, or be removed from the food supply.

7.3 The Objection from Practicality

The anticipated objection is that this standard is impractical — that requiring pre-market safety demonstration for all food additives would be prohibitively expensive and would paralyze the food industry.

This objection deserves a direct response: it is an argument that profits are more important than safety. Rephrased honestly, the objection states: "It would cost the food industry too much money to prove that the things it puts in food are safe for the people who eat them." If a substance cannot be demonstrated to be safe, it should not be in food. The cost of demonstrating safety is a cost of doing business — no different from the cost of clinical trials in the pharmaceutical industry, the cost of safety testing for consumer products, or the cost of environmental impact assessment for industrial activities.

The food industry generates approximately $9 trillion in global revenue annually. It can afford to demonstrate that its products are safe. If a specific additive cannot justify the cost of safety testing — because its profit contribution is marginal — then it should not be in food. This is exactly how the system should work: substances that cannot justify the cost of proving safety are, by definition, substances whose contribution is not important enough to warrant the risk of undemonstrated safety.

8. Cancer and Chronic Disease: The Preventability Evidence

8.1 The Scale of Preventability

The proposition that cancer is a largely preventable disease is not a fringe position. It is the conclusion of the mainstream epidemiological literature, stated with increasing confidence over the past two decades.

Anand et al. (2008), in a comprehensive review published in *Pharmaceutical Research*, concluded that only 5-10% of all cancers are attributable to genetic defects, while the remaining 90-95% are rooted in environment and lifestyle — with diet accounting for 30-35%, tobacco for 25-30%, infections for 15-20%, obesity for 10-20%, and other environmental exposures for the remainder. This finding has been substantiated by subsequent analyses, including the landmark study by Wu et al. (2016) published in *Nature*, which estimated that 70-90% of cancers are caused by extrinsic factors.

The traditional population data reinforces this estimate. If cancer were primarily a genetic disease — an inevitable consequence of the human genome — it would occur at similar rates across all populations of Homo sapiens. It does not. The populations described in Section 3 — Kitava, traditional Okinawa, traditional Inuit — exhibit cancer rates for major Western cancer types (breast, colon, prostate, lung in non-smokers) that approach zero or are dramatically lower than Western rates.

When these same populations adopt Western diets and lifestyles, cancer rates converge with Western norms within one to two generations. This convergence cannot be explained by genetics — the genome does not change on this timescale. It can only be explained by environmental factors, of which diet is the most consistent correlate.

8.2 Migration Studies

Migration studies provide additional evidence. When populations move from low-cancer-rate countries to high-cancer-rate countries and adopt the host country's diet and lifestyle, their cancer rates converge with the host country's rates within one to two generations. Japanese immigrants to the United States develop colorectal and breast cancer at rates approaching US norms by the second generation — rates far higher than those in Japan (Kolonel et al., 2004). This effect has been documented for multiple cancers across multiple

migrant populations and is among the strongest evidence that cancer incidence is primarily environmentally determined.

8.3 The "Genetic Disease" Fallacy

The cultural framing of cancer, cardiovascular disease, and type 2 diabetes as "genetic diseases" deserves direct challenge. These conditions have genetic risk factors — polymorphisms that modify susceptibility. But a genetic risk factor is not a genetic cause. A genetic predisposition to type 2 diabetes that manifests at 95% prevalence in a population eating a Western diet and at near-zero prevalence in a population eating a traditional diet is not a genetic disease. It is an environmental disease with genetic modifiers.

The distinction matters because the framing determines the response. If cancer is "genetic," the appropriate response is research into gene therapy, screening programmes, and treatment advances — all of which are important but accept the disease burden as given. If cancer is environmental, the appropriate response includes removing the environmental causes — which, for diet-related cancers, means removing the dietary factors that drive them. This includes removing unproven additives from the food supply.

8.4 Specific Dietary Risk Factors

The epidemiological literature identifies several dietary factors associated with increased cancer risk:

Processed meat. Classified as a Group 1 carcinogen (carcinogenic to humans) by the International Agency for Research on Cancer (IARC) in 2015 — the same classification as tobacco and asbestos. The classification was based on sufficient evidence that processed meat causes colorectal cancer, with associations also observed for stomach cancer (Bouvard et al., 2015). Processed meat is distinguished from unprocessed meat by the addition of preservatives (nitrites, nitrates), salt, and smoking or curing processes — all of which are processing steps that generate known carcinogenic compounds (N-nitroso compounds, polycyclic aromatic hydrocarbons).

Ultra-processed foods. A growing body of evidence links ultra-processed food consumption to increased cancer risk. Fiolet et al. (2018), in a large prospective cohort study published in *The BMJ*, found that a 10% increase in the proportion of ultra-processed food in the diet was associated with a 12% increase in overall cancer risk and an 11% increase in breast cancer risk. Ultra-processed foods are defined by their degree of industrial processing and their content of additives — precisely the substances whose safety this paper argues should be demonstrated before, not after, population exposure.

AGE-rich foods. As discussed in Section 5, foods high in Advanced Glycation End-products — particularly those cooked at high temperatures using dry-heat methods — contribute to the inflammatory and oxidative stress milieu that promotes carcinogenesis.

---

9. Seventy Years Against Two Hundred Thousand

9.1 The Temporal Argument

Homo sapiens has existed as a species for approximately 200,000-300,000 years (Hublin et al., 2017). Throughout this period, every human who lived consumed food that was, by definition, compatible with human biology — because it was the food that human biology evolved alongside. The specific composition varied enormously — from the high-fat, high-protein diets of Arctic populations to the high-carbohydrate, plant-based diets of tropical populations — but in all cases, the food was unprocessed, unadulterated, and free of synthetic chemical additives.

Industrial food production — the addition of synthetic preservatives, colorings, emulsifiers, flavour enhancers, and other novel compounds to the food supply; the industrial processing of food into forms unrecognizable from their raw ingredients; the refinement of sugars and oils to concentrations not found in nature — has existed for approximately 70 years at scale. The post-World War II era, beginning in the late 1940s and accelerating through the 1960s and 1970s, marks the transition from food-as-food to food-as-industrial-product.

Seventy years is nothing in evolutionary terms. It is approximately three human generations. It is 0.03% of the time Homo sapiens has existed. The human genome has not changed. The human digestive system has not changed. The human microbiome has not had time to adapt. Human metabolism, evolved over hundreds of thousands of years to process specific categories of chemical inputs, is now processing chemical inputs that did not exist during the entire period of its development.

9.2 The Results of the Experiment

The experiment ran. The results are in:

Obesity. Global obesity has nearly tripled since 1975. More than 1.9 billion adults were overweight in 2016, of whom 650 million were obese (WHO, 2021). Obesity was effectively unknown in traditional populations.

Type 2 diabetes. The global prevalence of diabetes has risen from 4.7% in 1980 to 8.5% in 2014, with projections reaching 10-12% by 2035 (NCD Risk Factor Collaboration, 2016). Type 2 diabetes was effectively unknown in traditional populations.

Cardiovascular disease. Cardiovascular disease remains the leading cause of death globally, killing approximately 17.9 million people per year (WHO, 2021). In traditional populations consuming traditional diets, cardiovascular disease ranged from near-zero to dramatically lower than Western rates.

Cancer. Cancer is the second leading cause of death globally, with approximately 19.3 million new cases and 10 million deaths in 2020 (Sung et al., 2021). The cancers most closely linked to diet and lifestyle — colorectal, breast, prostate — were rare to absent in traditional populations.

Autoimmune conditions. The prevalence of autoimmune diseases has been increasing in industrialized countries over the past several decades, a trend temporally correlated with dietary changes and too rapid to be explained by genetic drift (Bach, 2002; Lerner et al., 2015).

Allergies. Food allergies have increased dramatically in industrialized countries, with some estimates suggesting a doubling or tripling of prevalence over the past two to three decades (Prescott et al., 2013). The hygiene hypothesis explains part of this increase, but dietary factors — including the effects of food additives on gut barrier function and immune development — are increasingly implicated.

9.3 Every Other Animal

The comparison with other species is instructive. No wild animal population on Earth exhibits the chronic disease burden of industrialized human populations. Wild animals eat what they evolved to eat, and they develop the diseases appropriate to their species at the rates appropriate to their species. The only animal populations that develop Western-type chronic diseases are those fed by humans: domesticated animals given processed feed, laboratory animals given experimental diets, and zoo animals given inappropriate diets.

When zoo nutritionists design diets for captive animals, they attempt to replicate the animal's natural diet as closely as possible, because decades of veterinary experience have demonstrated that departures from species-

appropriate diets produce disease. A zoo that fed its gorillas on processed human food would be cited for animal welfare violations. The irony requires no elaboration.

9.4 The Experiment Was Not Consented To

The transformation of the human food supply was not presented to the population as an experiment. No one asked whether it was acceptable to replace traditional food with industrial products containing thousands of novel chemical compounds. No one obtained informed consent. No one established monitoring protocols. No one designed a control group.

The experiment happened because it was profitable. The food industry discovered that processing food — extending shelf life, reducing production costs, enhancing visual appeal, engineering palatability — was more profitable than selling food in its natural state. The transformation was driven by economic incentives, not by any assessment of what the transformation would do to the health of the consuming population.

Seventy years later, the data is available. The population that served as the experimental cohort — every person who has eaten industrialized food — has generated the outcome data. Obesity, diabetes, cardiovascular disease, cancer. The experiment produced its results. The appropriate response is not to continue the experiment. It is to read the data, acknowledge the outcome, and change the protocol.

---

10. Discussion

10.1 Synthesis

The argument presented across these sections converges on a single conclusion: the regulatory framework governing food safety is inverted, and this inversion is causally linked to the chronic disease burden of industrialized populations.

The precautionary principle, as applied to food, would require that no substance be added to the food supply until it has been affirmatively demonstrated to be safe for human consumption at the levels and durations of

exposure anticipated. This is not a radical principle. It is the principle applied in pharmaceutical regulation, in chemical safety regulation, and in the regulation of building materials. It is radical only in food regulation, because food regulation has been captured by the interests of the food industry.

The evidence from traditional populations demonstrates that Homo sapiens, consuming species-appropriate diets, does not develop the diseases that define the Western health burden. The same species, eating different food, produces different health outcomes. The variable is food, not genetics. When the food changes — when traditional diets are replaced by industrial diets — disease rates change. The change occurs within one to two generations, far too rapidly for genetic adaptation.

The regulatory capture of food safety agencies ensures that the evidentiary asymmetry persists: it is easy to add substances to the food supply and difficult to remove them. The GRAS system in the United States allows manufacturers to self-certify safety without independent review. The result is a food supply containing thousands of substances whose long-term safety has never been independently demonstrated.

The specific mechanisms by which processed food drives disease — including AGE formation, gut microbiome disruption, chronic inflammation, and oxidative stress — are increasingly well-characterized. The evidence is not speculative. It is published in *Nature*, *The Lancet*, *The BMJ*, and *JAMA Internal Medicine*. The mechanisms are established. What is lacking is not evidence but regulatory will.

Marketing functions as the mechanism by which the food industry determines what the population eats. Consumer "choice" operates within a constrained option space shaped by advertising, pricing, availability, and decades of normalisation. The zookeeper determines what the animals eat, and the animals believe they are choosing.

10.2 The Moral Argument

Beyond the empirical case, there is a moral argument. The current system treats the human population as an experimental cohort. Substances are added to the food supply without adequate safety demonstration, and the population bears the cost of any resulting harm. The profits accrue to the manufacturers. The health costs accrue to the consumers. The regulatory delay between the identification of harm and the implementation of restriction means that even when harm is demonstrated, the population continues to be exposed for years or decades.

This is not a system designed to protect public health. It is a system designed to protect commercial interests while maintaining the appearance of regulatory oversight. The fact that it is legal does not make it ethical. The fact that it is normalised does not make it acceptable.

10.3 Connections to the Broader Research Programme

This paper extends and connects to several other papers in this series:

(Applebee & Combe, 2026, "*The Bullshit Jobs Phenomenon*") (Cancer Preventability) established that 90-95% of cancers are attributable to environmental and lifestyle factors rather than genetics. The present paper identifies the food supply as a primary environmental exposure vector and proposes a regulatory mechanism — reversed burden of proof — for addressing dietary contributions to cancer.

(Applebee & Combe, 2026, "*Wanted Attention for Unwanted Results*") (Traditional Diets) documented the health outcomes of populations consuming traditional, unprocessed diets. The present paper uses this evidence as the foundation for a specific policy proposal: that the traditional diet evidence base defines the boundary of demonstrated safety, and that substances not present in any traditional human diet should face the reversed burden of proof.

(Applebee & Combe, 2026, "*Civic Proximity Response*") (Marketing to Self) examined the mechanisms by which marketing shapes individual behaviour and consumption patterns. The present paper applies this analysis to food specifically, arguing that marketing is the mechanism by which the food industry — the zookeeper — determines what the population eats.

(Applebee & Combe, 2026, "*Swiss Direct Democracy*") (Direct Democracy) demonstrated that regulatory systems can be designed to serve populations rather than industries when the political architecture permits meaningful citizen input. The present paper argues that food safety regulation, currently captured by industry interests, requires structural reform to realign regulatory incentives with public health outcomes.

10.4 Limitations

This paper acknowledges several limitations:

Causation versus correlation. The epidemiological evidence from traditional populations is observational. The health differentials between traditional and industrial populations are not solely attributable to food —

differences in physical activity, stress, environmental toxin exposure, social cohesion, and other factors contribute. However, the consistency of the dietary signal across populations with very different lifestyles, climates, and activity levels — and the speed with which health profiles change when diet changes while other factors remain relatively constant — supports diet as a primary determinant.

Practical implementation. Reversing the burden of proof for all existing food additives simultaneously would be disruptive. A phased approach — beginning with substances that contribute no nutritional or taste value (colorings, some emulsifiers, some preservatives) and expanding to more complex categories — would be more practical. The New Zealand PSA included transitional provisions, and a food safety equivalent would need to do the same.

Evidence base for traditional diets. The epidemiological studies of traditional populations, while consistent, are limited by sample size, ascertainment bias (not all diseases may be detected in populations without modern diagnostic equipment), and survivor bias. These limitations are real but do not undermine the central finding: disease rates for major chronic conditions are dramatically lower in traditional populations, and this difference reverses when the diet changes.

Economic interests. The food industry will oppose any regulatory change that increases costs or restricts product formulation. This opposition will be well-funded, politically connected, and sustained over years. The history of tobacco regulation, trans fat restriction, and sugar taxation demonstrates that industry opposition can delay beneficial regulation for decades. Acknowledging this political reality does not weaken the argument; it explains why the argument needs to be made.

---

11. Recommendations

11.1 Immediate Actions

1. Mandatory independent safety review for all GRAS-designated substances. All substances currently designated as GRAS through manufacturer self-certification should be required to undergo independent

safety review within a defined timeframe (e.g., 10 years). The cost of this review should be borne by the manufacturers, not by the regulator or the public.

1. Prohibition of food additives that serve no nutritional or functional safety purpose. Artificial colorings, which contribute nothing to nutrition, taste, or food safety, should be the first category addressed. The evidence of harm (McCann et al., 2007; behavioural effects in children) already exceeds the threshold for regulatory action. The absence of any benefit removes the need for risk-benefit analysis: the risk, however small, exceeds the benefit, which is zero.

1. Mandatory disclosure of all additives. Food labelling should be required to disclose every substance present in the product, in plain language, with an indication of the purpose of each additive and the level of independent safety evidence supporting its use. "Contains substances not independently demonstrated to be safe for long-term human consumption" would be a factual statement for many processed foods.

11.2 Structural Reforms

1. Reversed burden of proof for novel food substances. Following the New Zealand PSA model, any novel substance proposed for addition to the food supply should be prohibited by default and permitted only after the manufacturer has demonstrated safety through independent, pre-market testing at levels and durations of exposure relevant to actual dietary patterns. The standard should be equivalent to that applied in pharmaceutical regulation, adjusted for the fact that food exposure is universal, lifelong, and without informed consent.

1. Independent funding of food safety research. The structural conflict of interest in manufacturer-funded safety research should be addressed through the establishment of an independent research fund, financed by industry levies, but administered by an independent body with no financial ties to the food industry. Safety studies should be conducted by researchers selected by the independent body, not by the manufacturer.

1. Elimination of revolving door employment. Mandatory cooling-off periods of at least five years should be imposed between senior regulatory positions and industry employment, in both directions. This is standard practice in some jurisdictions for financial regulation and should be extended to food safety.

1. Restriction of food marketing to children. Following the models already implemented in Chile, Mexico, and several other countries, advertising of processed food to children should be prohibited. Children

cannot give informed consent to dietary manipulation, and marketing to children creates consumption patterns that persist into adulthood.

11.3 Long-Term Vision

1. Treat food as medicine, not as commerce. The recognition that food is the primary determinant of human health outcomes — more influential than any pharmaceutical intervention, any medical procedure, any healthcare system — should drive a fundamental reorientation of regulatory priorities. If the health system spends trillions treating diseases caused by food, the most cost-effective intervention is fixing the food, not treating the diseases.

1. Research investment in traditional diets. The epidemiological evidence from traditional populations should be used to inform dietary guidelines and food regulation. Specifically, the principle that substances not present in any traditional human diet represent undemonstrated risks should be embedded in regulatory frameworks. The traditional diet evidence base represents two hundred thousand years of safety data. The industrial food supply represents seventy years of uncontrolled experimentation. The relative weight of these evidence bases should be reflected in regulatory defaults.

---

12. Conclusion

The argument of this paper reduces to a question that should not need to be asked: should food be required to be safe?

The current system says no. The current system says food is assumed to be safe until proven dangerous, that the burden of proving danger falls on the public and on underfunded regulatory agencies, that the entities profiting from food additives may certify their own products as safe, and that the population serves as the test cohort for an ongoing experiment in which novel chemical compounds are introduced into the food supply and the results are assessed retrospectively through disease statistics.

This paper argues that the answer should be yes. Food should be required to be safe. The burden of demonstrating safety should fall on the entity that profits from adding a substance to the food supply, not on the public that consumes it. The standard of evidence should be comparable to that required for pharmaceuticals — because the exposure is more universal, more prolonged, and less voluntary than pharmaceutical exposure. Substances that have not been independently demonstrated to be safe for long-term human consumption should not be in food.

The evidence from traditional populations — Kitava, Okinawa, the Inuit, the Wai — demonstrates what human health looks like when humans eat food compatible with human biology. The evidence from industrialized populations demonstrates what human health looks like when they do not. The difference is not subtle. It is the difference between near-zero chronic disease and epidemic-scale chronic disease. Between near-zero obesity and a third of the population being obese. Between near-zero type 2 diabetes and one in ten adults having it. Between near-zero acne and 79-95% of adolescents having it.

Same species. Different food. Different outcomes.

The experiment ran for seventy years. Every other animal on Earth eats what it evolved to eat. We eat what the market sells. The results are in.

Food should not contain anything not yet proven safe. The burden of proof must be reversed. The alternative — continuing to use the human population as an experimental cohort while the food industry certifies the safety of its own products — is not precaution. It is negligence at civilisational scale.

References

Anand, P., Kunnumakkara, A. B., Sundaram, C., Harikumar, K. B., Tharakan, S. T., Lai, O. S., ... & Aggarwal, B. B. (2008). Cancer is a preventable disease that requires major lifestyle changes. *Pharmaceutical Research*, 25(9), 2097-2116.

Bach, J. F. (2002). The effect of infections on susceptibility to autoimmune and allergic diseases. *New England Journal of Medicine*, 347(12), 911-920.

Bhate, K., & Williams, H. C. (2013). Epidemiology of acne vulgaris. *British Journal of Dermatology*, 168(3), 474-485.

Bierhaus, A., Humpert, P. M., Morcos, M., Wendt, T., Chavakis, T., Arnold, B., ... & Nawroth, P. P. (2005). Understanding RAGE, the receptor for advanced glycation end products. *Journal of Molecular Medicine*, 83(11), 876-886.

Bjerregaard, P., Young, T. K., Dewailly, E., & Ebbesson, S. O. (2004). Indigenous health in the Arctic: an overview of the circumpolar Inuit population. *Scandinavian Journal of Public Health*, 32(5), 390-395.

Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., Ghissassi, F. E., Benbrahim-Tallaa, L., ... & Straif, K. (2015). Carcinogenicity of consumption of red and processed meat. *The Lancet Oncology*, 16(16), 1599-1600.

Cai, W., He, J. C., Zhu, L., Chen, X., Striker, G. E., & Vlassara, H. (2008). AGE-receptor-1 counteracts cellular oxidant stress induced by AGEs via negative regulation of p66shc-dependent FKHRL1 phosphorylation. *American Journal of Physiology-Cell Physiology*, 294(1), C145-C152.

Cai, W., He, J. C., Zhu, L., Lu, C., & Vlassara, H. (2012). Advanced glycation end product (AGE) receptor 1 suppresses cell oxidant stress and activation signaling via EGF receptor. *Proceedings of the National Academy of Sciences*, 103(37), 13801-13806.

Carpenter, D., & Moss, D. A. (Eds.). (2013). *Preventing Regulatory Capture: Special Interest Influence and How to Limit It*. Cambridge University Press.

Center for Responsive Politics. (2023). *Lobbying Data: Food & Beverage Industry*. OpenSecrets.org.

Centers for Disease Control and Prevention. (2023). *National Diabetes Statistics Report*. US Department of Health and Human Services.

Chassaing, B., Koren, O., Goodrich, J. K., Poole, A. C., Srinivasan, S., Ley, R. E., & Gewirtz, A. T. (2015). Dietary emulsifiers impact the mouse gut microbiota promoting colitis and metabolic syndrome. *Nature*, 519(7541), 92-96.

Cordain, L., Lindeberg, S., Hurtado, M., Hill, K., Eaton, S. B., & Brand-Miller, J. (2002). Acne vulgaris: a disease of Western civilization. *Archives of Dermatology*, 138(12), 1584-1590.

EFSA Panel on Food Additives and Flavourings. (2021). Safety assessment of titanium dioxide (E171) as a food additive. *EFSA Journal*, 19(5), e06585.

Federal Trade Commission. (2012). *A Review of Food Marketing to Children and Adolescents: Follow-Up Report*. Washington, DC.

Fiolet, T., Srour, B., Sellem, L., Kesse-Guyot, E., Allès, B., Méjean, C., ... & Touvier, M. (2018). Consumption of ultra-processed foods and cancer risk: results from NutriNet-Santé prospective cohort. *The BMJ*, 360, k322.

Government Accountability Office. (2010). *Food Safety: FDA Should Strengthen Its Oversight of Food Ingredients Determined to Be Generally Recognized as Safe (GRAS)*. GAO-10-246.

Harris, J. L., Pomeranz, J. L., Lobstein, T., & Brownell, K. D. (2009). A crisis in the marketplace: how food marketing contributes to childhood obesity and what can be done. *Annual Review of Public Health*, 30, 211-225.

Hublin, J. J., Ben-Ncer, A., Bailey, S. E., Freidline, S. E., Neubauer, S., Skinner, M. M., ... & Gunz, P. (2017). New fossils from Jebel Irhoud, Morocco and the pan-African origin of Homo sapiens. *Nature*, 546(7657), 289-292.

Institute of Medicine. (2006). *Food Marketing to Children and Youth: Threat or Opportunity?* Washington, DC: National Academies Press.

Kolonel, L. N., Henderson, B. E., Hankin, J. H., Nomura, A. M., Wilkens, L. R., Pike, M. C., ... & Nagamine, F. S. (2004). A multiethnic cohort in Hawaii and Los Angeles: baseline characteristics. *American Journal of Epidemiology*, 151(4), 346-357.

Lerner, A., Jeremias, P., & Matthias, T. (2015). The world incidence and prevalence of autoimmune diseases is increasing. *International Journal of Celiac Disease*, 3(4), 151-155.

Lesser, L. I., Ebbeling, C. B., Goozner, M., Wypij, D., & Ludwig, D. S. (2007). Relationship between funding source and conclusion among nutrition-related scientific articles. *PLoS Medicine*, 4(1), e5.

Lindeberg, S. (1993). Apparent absence of cerebrocardiovascular disease in Melanesians. *Risk Management*, 4, 12-14.

Lindeberg, S., & Lundh, B. (1993). Apparent absence of stroke and ischaemic heart disease in a traditional Melanesian island: a clinical study in Kitava. *Journal of Internal Medicine*, 233(3), 269-275.

Lindeberg, S., Nilsson-Ehle, P., Terént, A., Vessby, B., & Scherstén, B. (1994). Cardiovascular risk factors in a Melanesian population apparently free from stroke and ischaemic heart disease: the Kitava study. *Journal of Internal Medicine*, 236(3), 331-340.

Lindeberg, S., Eliasson, M., Lindahl, B., & Ahrén, B. (1999). Low serum insulin in traditional Pacific Islanders — the Kitava study. *Metabolism*, 48(10), 1216-1219.

Mandrioli, D., Kearns, C. E., & Bero, L. A. (2016). Relationship between research outcomes and risk of bias, study sponsorship, and author financial conflicts of interest in reviews of the effects of artificially sweetened beverages on weight outcomes: a systematic review of reviews. *PLoS ONE*, 11(9), e0162198.

McCann, D., Barrett, A., Cooper, A., Crumpler, D., Dalen, L., Grimshaw, K., ... & Stevenson, J. (2007). Food additives and hyperactive behaviour in 3-year-old and 8/9-year-old children in the community: a randomised, double-blinded, placebo-controlled trial. *The Lancet*, 370(9598), 1560-1567.

Monteiro, C. A., Moubarac, J. C., Cannon, G., Ng, S. W., & Popkin, B. (2013). Ultra-processed products are becoming dominant in the global food system. *Obesity Reviews*, 14(S2), 21-28.

Moss, M. (2013). *Salt Sugar Fat: How the Food Giants Hooked Us*. Random House.

Mozaffarian, D., Katan, M. B., Ascherio, A., Stampfer, M. J., & Willett, W. C. (2006). Trans fatty acids and cardiovascular disease. *New England Journal of Medicine*, 354(15), 1601-1613.

NCD Risk Factor Collaboration. (2016). Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants. *The Lancet*, 387(10027), 1513-1530.

Neltner, T. G., Alger, H. M., Leonard, J. E., & Maffini, M. V. (2014). Data gaps in toxicity testing of chemicals allowed in food in the United States. *Reproductive Toxicology*, 42, 85-94.

Nestle, M. (2002). *Food Politics: How the Food Industry Influences Nutrition and Health*. University of California Press.

Prescott, S. L., Pawankar, R., Allen, K. J., Campbell, D. E., Sinn, J. K., Fiocchi, A., ... & Lee, B. W. (2013). A global survey of changing patterns of food allergy burden in children. *World Allergy Organization Journal*, 6(1), 1-12.

Revolving Door Project. (2021). *The Revolving Door at the FDA*. Center for Economic and Policy Research.

Robinson, C., Bottjer, W., Pistorius, T., & Gyorffy, B. (2013). Conflicts of interest at the European Food Safety Authority erode public confidence. *Journal of Epidemiology and Community Health*, 67(9), 717-720.

Sell, D. R., & Monnier, V. M. (2012). Molecular basis of arterial stiffening: role of glycation – a mini-review. *Gerontology*, 58(3), 227-237.

Sharma, S., Cao, X., Roache, C., Buchan, A., Reid, R., & Gittelsohn, J. (2010). Assessing dietary intake in a population undergoing a rapid transition in diet and lifestyle: the Arctic Inuit in Nunavut, Canada. *British Journal of Nutrition*, 103(5), 749-759.

Shatenstein, B., Ferland, G., Belleville, S., Gray-Donald, K., Kergoat, M. J., Bherer, L., ... & Bherer, L. (2015). Diet quality and cognition among older adults from the NuAge study. *Experimental Gerontology*, 51, 85-91.

Stigler, G. J. (1971). The theory of economic regulation. *The Bell Journal of Economics and Management Science*, 2(1), 3-21.

Suez, J., Korem, T., Zeevi, D., Zilberman-Schapira, G., Thaiss, C. A., Maza, O., ... & Elinav, E. (2014). Artificial sweeteners induce glucose intolerance by altering the gut microbiota. *Nature*, 514(7521), 181-186.

Suez, J., Cohen, Y., Valdés-Mas, R., Mor, U., Dori-Bachash, M., Federici, S., ... & Elinav, E. (2022). Personalized microbiome-driven effects of non-nutritive sweeteners on human glucose tolerance. *Cell*, 185(18), 3307-3328.

Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021). Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians*, 71(3), 209-249.

United Nations. (1992). *Rio Declaration on Environment and Development*. United Nations Conference on Environment and Development.

Uribarri, J., Woodruff, S., Goodman, S., Cai, W., Chen, X., Pyzik, R., ... & Vlassara, H. (2010). Advanced glycation end products in foods and a practical guide to their reduction in the diet. *Journal of the American Dietetic Association*, 110(6), 911-916.

Uribarri, J., Cai, W., Ramdas, M., Goodman, S., Pyzik, R., Chen, X., ... & Vlassara, H. (2011). Restriction of advanced glycation end products improves insulin resistance in human type 2 diabetes: potential role of AGER1 and SIRT1. *Diabetes Care*, 34(7), 1610-1616.

Vlassara, H., Cai, W., Goodman, S., Pyzik, R., Yong, A., Chen, X., ... & Striker, G. E. (2009). Protection against loss of innate defenses in adulthood by low advanced glycation end products (AGE) intake: role of the antiinflammatory AGE receptor-1. *The Journal of Clinical Endocrinology & Metabolism*, 94(11), 4483-4491.

Vlassara, H., & Striker, G. E. (2011). AGE restriction in diabetes mellitus: a paradigm shift. *Nature Reviews Endocrinology*, 7(9), 526-539.

Willcox, B. J., Willcox, D. C., Todoriki, H., Fujiyoshi, A., Yano, K., He, Q., ... & Suzuki, M. (2004). Caloric restriction, the traditional Okinawan diet, and healthy aging: the diet of the world's longest-lived people and its potential impact on morbidity and life span. *Annals of the New York Academy of Sciences*, 1114(1), 434-455.

World Health Organization. (2021). *Noncommunicable Diseases: Key Facts*. Geneva: WHO.

Wu, S., Powers, S., Zhu, W., & Bhatt, D. K. (2016). Substantial contribution of extrinsic risk factors to cancer development. *Nature*, 529(7584), 43-47.