Ultra-processed foods
A global threat to public health

CONTENTS:

A revolution in food science and modern grocery retailing over the last 60 years has led to explosive growth in manufacturing and consumption of **ultra-processed foods (UPFs)**.[1-3] This shift began in high-income countries but has now reached countries at all income levels.[2,4-6] UPFs are a substantial factor affecting worldwide increases in the prevalence and incidence of obesity and other diet-related, non-communicable diseases.[7] UPFs' poor nutritional profiles, hyper-palatability, and content of biologically harmful compounds all wreak havoc on health, increasing risks for obesity and other non-communicable diseases. Policy interventions are needed to curb rising UPF consumption and lessen their associated negative health and environmental outcomes.[8-10]

What are ultra-processed foods?

Food processing generally refers to any action that alters food from its natural state, such as drying, freezing, milling, canning, or adding salt, sugar, fat, or other additives for flavor or preservation.[11,12] Most foods are processed in some way before purchase or consumption. Broadly speaking, the term "*processed foods*" encompasses everything from washed and peeled vegetables to canned, cooked beans to candy and sodas. Researchers developed the NOVA classification system[13] to categorize foods into one of four groups according to the extent and purpose of processing:

1 Unprocessed or minimally processed

Foods unaltered or altered by processes such as removing inedible parts, drying, grinding, cooking, pasteurization, freezing, or non-alcoholic fermentation. No substances are added to the original food. Processing aims to increase food stability and enable easier or more diverse preparation.

***Examples:** Fresh or frozen fruits/vegetables, pulses, grains, flours, nuts, pasteurized milk, chilled/frozen meat*

2 Processed culinary ingredients

Substances obtained directly from Group 1 foods or from nature, created by industrial processes such as pressing, centrifuging, refining, extracting, or mining. Processing aims to create products to be used in preparation, seasoning, and cooking of Group 1 foods.

***Examples:** Butter, vegetable oils, other fats, sugar, molasses, salt*

3 Processed foods

Products made by adding ingredients from Group 2 to Group 1 foods and preserved via methods such as non-alcoholic fermentation, canning, or bottling. Processing aims to increase stability and durability of Group 1 foods and to make them more enjoyable.

***Examples:** Canned vegetables in brine, fresh cheeses, freshly made breads, cured meats*

4 Ultra-processed foods

Formulations of edible ingredients (low-cost, derived from Group 1 foods) containing substances not used in home kitchens (e.g., protein isolates) and/or cosmetic additives (e.g., flavors, colors, emulsifiers). Multi-step processing can include intense physical, chemical, or biological processes (e.g., extrusion, hydrogenation). Manufactured to be convenient, durable, tasteful (often hyper-palatable), and profitable (using cheap ingredients).

***Examples:** Packaged crisps, puffs, cookies/biscuits, instant soups/noodles, ready-to-eat/ready-to-heat meals, candy, soft drinks*

UPFs (NOVA Group 4) are not simply foods that have been modified by cooking or adding ingredients, rather edible formulations that have been transformed from food-derived substances, along with additives that heighten their appeal and durability. UPFs contain low-cost ingredients, have long shelf-lives, are hyper-palatable, and are highly branded and aggressively marketed to consumers. UPFs are often high in calories, free sugars, refined starches, saturated and trans fats, and sodium.[14] Scholars are increasingly recognizing and calling attention to the addictive qualities of certain UPFs.[15-22]

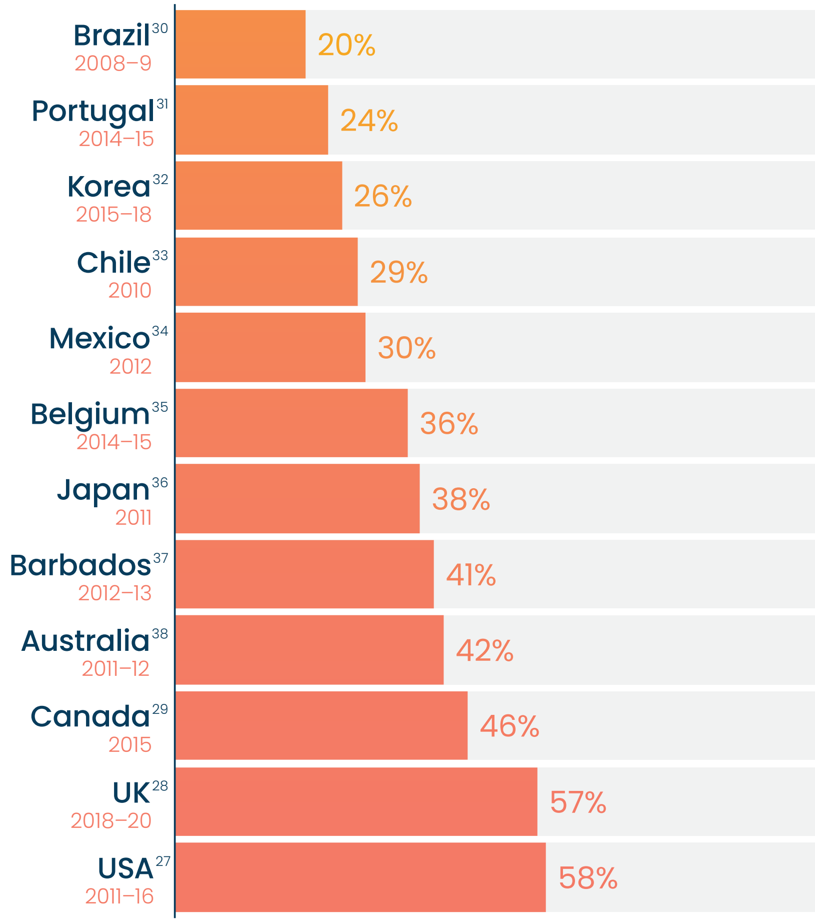
UPF consumption on the rise

UPFs have rapidly displaced unprocessed or minimally processed foods, freshly prepared meals, and traditional cooking in the diet in most countries, causing significant nutritional, social, economic, and environmental disruption worldwide.[4-6,23-26] UPFs, which largely did not exist before the mid-20th century, now account for over half of estimated total calories consumed in the United States,[27] United Kingdom,[28] and Canada (among children and adolescents),[29] and ≈20-40% of calories in other high- and middle-income countries[30-38] with sales growing rapidly every year.[5] In countries where intake has been estimated across different age groups, children are consuming more UPFs than older generations.[29,32-35,38-43] This worldwide shift towards greater consumption of UPFs coincided with global increases in prevalence of obesity and other nutrition-related diseases, and researchers have indeed found connections between these trends.[4] Proposed reasons or mechanisms for UPFs' detrimental health effects include:

UPF consumption worsens nutritional intake:

UPFs are often calorie-dense and disproportionately contribute sugar, sodium, saturated and *trans*-fats, and highly refined carbohydrates to the diet. They also displace consumption of traditional, less-processed and freshly prepared foods containing more beneficial nutrients.[36,44-51]

Estimated percent of total energy intake from UPFs



UPFs encourage overconsumption due to:

- **Convenience** (i.e., products are typically ready-to-eat or ready-to-heat);[52-55]
- **Hyper-palatability** (formulations are engineered to maximally please all the senses);[13,56-59]
- **Disrupted satiety signaling** (e.g., UPFs are often processed in ways that degrade foods' basic structure or "matrix," increasing rate of consumption and digestion and preventing or delaying normal feelings of fullness);[50,59-65] and
- **Marketing** that is highly pervasive and persuasive, often targeting children, as well as effective branding — both of which are largely absent for unprocessed and minimally processed foods.[66-74]
- **Addictiveness:** UPFs meet the scientific criteria used to label tobacco products as addictive substances. UPFs have been shown to: 1) cause highly controlled or compulsive use; 2) have mood-altering effects on the brain; 3) reinforce behavior; and 4) trigger strong urges or cravings.[21]

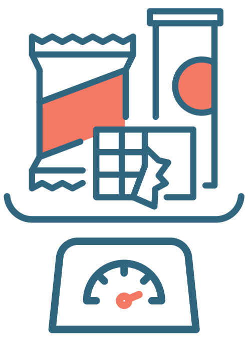
UPFs can contain harmful substances,[50,75] including:

- Contaminants formed during high-temperature cooking,[76-81]
- Industrial additives linked to inflammation and gut dysbiosis (imbalances in the diversity and composition of gut microbiota),[81-83] and
- Hormone-disrupting chemical compounds leached from plastics used in industrial food manufacturing and packaging materials.[84-89]

Health risks related to UPF consumption

A large and rapidly growing body of research has found significant associations between high UPF intake and a multitude of elevated health risks, including for overweight and obesity, type 2 diabetes, kidney and liver diseases, cardiovascular and cerebrovascular disease and mortality, cancers, and all-cause mortality. Many systematic and narrative scientific reviews have now assessed the evidence for UPFs' role in these and other health outcomes, and they are consistent in their findings: High consumption of UPF is significantly associated with one or more adverse health outcomes in nearly every study published to date.[7,90-99] (Note that in this research, "high intake" of UPFs is often based on the top fraction of intake among study participants and varies from study to study. The heightened health risks detailed below were found in studies with "high intakes" as low as 20–30% of calories from UPFs and as high as >70% of calories from UPFs.)

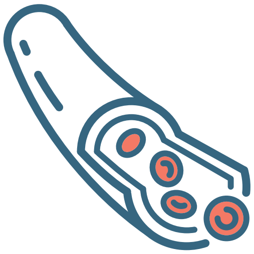
Overconsumption and weight gain



- A U.S. National Institutes of Health randomized controlled crossover trial wherein participants ate freely from provided, nutrient-matched ultra-processed vs. minimally processed menus for two weeks each found that during the ultra-processed weeks, participants consumed roughly 500 more calories per day and gained 0.9 kg (of mostly fat mass).[100] This study is the first to provide experimental evidence that a UPF-based diet directly causes **greater calorie intake** and subsequent **weight gain**.
- In meta-analyses of studies comparing groups with the highest vs. lowest UPF consumption, highest UPF intake was significantly associated with: 36% greater odds of **overweight**;[91,97] over 50% greater odds of **obesity**;[91,97] and 39–49% greater odds of riskier **abdominal obesity**.[90,91,97]
- Increasing UPF intake over time is associated with rising risk of **overweight/obesity**:[101-104]
    - A study that followed more than 110,000 French adults for 10 years found that every 10% increase in UPF intake was associated with 11% greater risk of developing **overweight** and 9% greater risk of developing **obesity**.[102]
    - A similar study among 6,000 adults in the UK found that a 10% increase in UPF consumption was associated with significant increases in **waist circumference** (+0.87 cm), **BMI** (+0.38 kg/m2), and odds of having **obesity** (+18%).[103]
- While fewer long-term studies have examined UPF consumption and obesity risk among children and adolescents, the majority to date have found a positive association between UPF intake and overweight/obesity in childhood.[105-108]
- A longitudinal study looking at intake among children and adolescents in seven countries found UPF intakes ranging from 18% of total calories consumed (children in Colombia) to 68% (adolescents in the United Kingdom).[42] In almost all countries and age groups, increased UPF dietary share was associated with greater energy density and free sugar intake as well as decreased fiber, suggesting that higher UPF consumption could heighten risk for obesity in children and adolescents.

Vascular diseases and risk factors

- In studies that combined results from multiple long-term studies comparing participants who consumed the most vs. least UPFs, high intake was significantly associated with a pooled:
    - 23% greater risk of developing **hypertension**,[109]
    - 35% greater risk of **cardiovascular events**,[110]
    - 29% greater relative risk of **cardiovascular disease** and/or mortality,[90] and
    - 34% greater relative risk of **cerebrovascular disease** and/or mortality.[90]
- Individuals with highest UPF intake in a large prospective cohort in the United Kingdom had 10–21% higher risk of experiencing a **venous thromboembolism** during follow-up compared to those with lowest UPF intake.[111]



- Among Spanish adults over age 60, those in the highest third of UPF consumption had over twice the odds of developing **high triglycerides** or **low HDL cholesterol**, compared to those in the lowest third of UPF consumption.[112]
- Among Brazilian adults in a long-term study, high intake of UPFs was significantly associated with 26% greater odds of developing **high triglycerides**, **high total cholesterol** (28% greater odds), **low HDL** (good) cholesterol (18% greater odds), and **mixed hyperlipidemia** (38% greater odds), compared to participants who consumed lower amounts of UPFs.[113]
- Among children and adolescents, studies have found significant associations between high UPF intake and increases in **total and LDL cholesterol**[114] from preschool to school age as well as increased cardiovascular disease risk into early adulthood.[115]
- A meta-analysis of several large studies in the United States, Italy, and Spain found the risk of **dying from cardiovascular disease** to be 50% greater for participants in the highest vs. lowest groups of UPF intake during the studies.[116] The pooled risk from two studies of **dying from heart disease** was 68% greater for highest UPF consumers.[116]

Cognitive and mental health

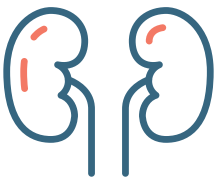
- **Dementia:** A United Kingdom study that followed 72,000 people for over 10 years found that the group with highest UPF intake had a 51% greater risk of developing dementia and over double the risk of developing vascular dementia, compared to the group with lowest UPF intake.[117] For every 10% increase in UPF consumption, risk of dementia increased 25% (28% for vascular dementia). Conversely, replacing 10% of UPF in the diet with an equivalent portion of unprocessed or minimally processed foods and drinks was associated with a 19% lower risk of developing dementia.[117]
- A U.S. study that followed nearly 3,000 adults for an average of 14 years found that participants who consumed the most UPFs had 61% higher risk of developing **all-cause dementia** and 75% higher risk of developing for **Alzheimer's disease** compared to people in the study who consumed the least UPFs.[118]
- **Depression:** Longitudinal studies examining UPF and depression have found that participants in the highest group of UPF consumption have 13–49% greater risk for depression or depressive symptoms relative to consumers in the lowest group,[119-122] and that for every 10% increase in UPF consumption, participants faced 21% greater relative risk of depressive symptoms.[123] One study also found that the highest UPF consumers experienced 13% greater risk of developing **anxiety** during study-follow-up, compared to lowest consumers.[121]

Cancers

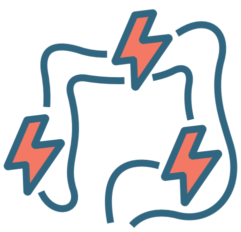
- Large, prospective studies in the United Kingdom[124] and France,[125] found that every 10% increase in the proportion of UPF in the diet was associated with:
  - Up to 13% greater **overall cancer** risk;[124,125]
  - 19% greater risk of developing **ovarian cancer**;[124]
  - 30% greater risk of cancer-related mortality from **ovarian cancer**;[124]
  - 11% greater risk of developing **breast cancer**;[125]
  - 16% greater risk of cancer-related mortality from **breast cancer**;[124]
- A long-term study of nearly 100,000 U.S. adults found that participants reporting the highest UPF consumption at baseline had 49% greater risk of being diagnosed with pancreatic cancer during follow-up than those reporting the lowest UPF consumption.[126]
- A study using data from three large U.S. prospective cohorts found that men in the highest fifth of UPF consumption had 72% higher risk of developing distal colon cancer than those in the lowest fifth. No significant association was found between UPF consumption and colorectal cancers in women.[127]

Other diseases and health risks

- Large prospective studies in the United Kingdom,[128] Spain,[129] China,[130] the Netherlands,[131] the United States,[132] France[133] have found 40–56% greater odds or risk of developing **diabetes** among people in the highest vs. lowest groups of UPF consumption[128-132] as well as a significant dose-response relationship, wherein every 10% increase in absolute UPF intake was associated with 12–17% greater risk of developing **type 2 diabetes**.[128,131-133]
- In the three large U.S. studies, increased **type 2 diabetes** risk was driven largely by animal-based products and ready-to-eat/ready-to-heat meals, followed by sweetened beverages.[132] Interestingly, ultra-processed cereals, dark and whole grain breads, packaged snacks, and fruit products were all associated with slightly lower risk of developing type 2 diabetes. Researchers attributed some of this effect to the higher fiber and mineral content of these foods.
- Several longitudinal studies suggest a link between UPF intake and **kidney function**: In these studies, groups with the highest UPF consumption experienced significantly greater risk of **declining kidney function** and/or developing **chronic kidney disease** compared to those in the lowest UPF-consuming groups.[134-137]
  - One study found that increasing UPF intake was even riskier for people with diabetes: For those participants, every 10% increase in UPF intake was associated with 11% higher risk of developing chronic kidney disease during study follow-up (vs. 3% greater risk for people without diabetes).[137]



- High UPF intake among nearly 2,000 older adults in Spain was associated with tripled risk of **frailty** in a study that compared highest and lowest groups of intake over 3.5 years.[138] Another longitudinal study among over 5,000 middle-aged and older Chinese adults found significantly greater annual declines in **grip strength** — a predictor for physical disability in later life — with every 10% increase in UPF proportion of the diet.[139]
- Higher UPF intake is associated with increased risk of **Crohn's disease**:
  - A meta-analysis that pooled results from five studies with over 1,000,000 participants from 30 countries found that those with highest reported UPF intake had a 70% greater risk of developing Crohn's disease compared with those with the lowest intake.[140] Conversely, participants with highest vs. lowest consumption of unprocessed or minimally processed foods had a 29% lower chance of developing Crohn's disease during the study.
  - A study in the United Kingdom that followed over 180,000 participants for an average of 10 years found that those who consumed the highest percentage of calories from UPFs had double the risk of developing Crohn's disease compared to those who consumed the lowest.[141] Highest UPF intake was also associated with three to four times the likelihood of needing IBD-related surgery during study follow-up.



- UPF consumption was associated with 71% greater risk of having **dental caries** for highest vs. lowest UPF intake in a meta-analysis of seven longitudinal studies and one non-randomized trial.[142]
- Among Spanish older adults with overweight or obesity and metabolic syndrome, increasing UPF consumption over one year was associated with significantly worse biomarkers for **non-alcoholic fatty liver disease**.[143]

Premature death from any cause

- Meta-analysis of results from seven large, long-term studies found 21% greater risk of **all-cause mortality** for consumers with the highest UPF intake compared to the lowest.[110]
  - Prospective studies published after this review have similarly found that groups with highest UPF intake experienced 19%[144]and 28%[145] higher risks of all-cause mortality during study follow-up, compared to groups with lowest UPF intake.
- Among stable renal transplant recipients, every doubling by weight of UPF content in the diet was associated with greater than twice the risk of **dying from any cause** in a prospective cohort study in the Netherlands, independent of overall diet quality.[146]

It remains to be determined which specific UPF additives, formulations, industrial processing techniques, or particular food/beverage categories may be contributing the most harm leading to these heightened health risks.[147] Almost all research in this area is observational and cannot account for every possible factor beyond UPF intake that might contribute to disease risks and occurrences, though most studies do account for participants' overall dietary intake, BMI, and other health and lifestyle factors. Notably, UPFs' associations with health risks remained even in studies that controlled for nutritional quality or composition, indicating that something beyond poor nutritional profiles is contributing to UPFs' harm. Another limitation of these studies is that they often rely on dietary data that is self-reported and may not reflect changes in UPF intake (increases or decreases) over the entire follow-up period. **Despite these challenges, the current large and growing body of evidence consistently suggests that higher UPF consumption is associated with many negative health outcomes and warrants further attention and exploration.**

Environmental impacts related to UPFs

The full environmental impact of UPFs is still being understood, however research to date indicates that increased production and consumption of UPFs is contributing to pollution, biodiversity loss and associated threats to food security, increased exposure to toxic byproducts from the buildup of plastics in the environment, and water loss.[148,149] UPFs also utilize additional energy in overall processing, but no studies have yet examined total greenhouse gas emissions from farm to fork relative to those for unprocessed or minimally processed foods.

Plastic waste and pollution

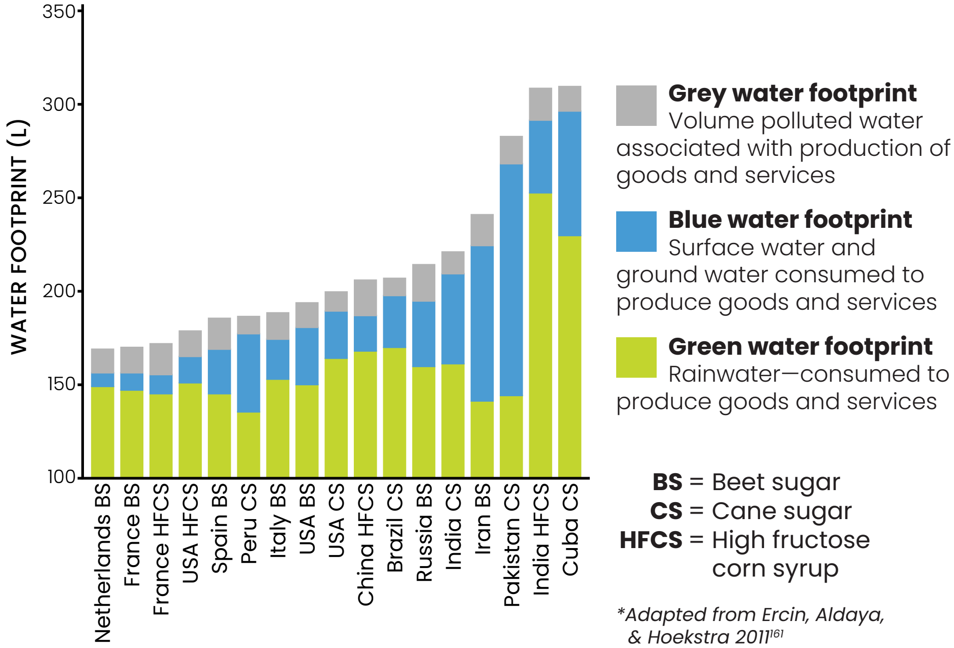
- UPFs are frequently packaged in single-use plastic wrappers, bottles, or containers. As UPF consumption increases globally, the amount of waste generated to package, transport, and sell UPFs will also increase, exacerbating plastic pollution and its downstream effects.
- A study on beach debris in Brazil found that plastic was the most abundant source of pollution, with food packaging comprising about 90% of plastic found.[150]
- An estimated 21–34 billion plastic drink bottles ended up in the world's oceans in 2018, alone — the equivalent of up to 1.1 million metric tons of plastic bottle waste.[151]
- By 2025, global-solid waste is expected to reach 6 million tons per day.[150]
- **Downstream effects of plastic waste:** Plastics can take hundreds of years to degrade in marine environments.152 Exposure to light can cause plastics to crack and break into smaller particles, leading to the creation of **microplastics** — small particles that can negatively impact marine life and food safety.[153]
  - Microplastics are increasingly being found throughout the food system, including in the digestive tracks of various marine animals.[153] As a result, humans ingest microplastics by eating commercial seafood such as fish, mussels, and crustaceans.[154]
  - Microplastics have been found in beer, honey, sugar, salt, and both tap and bottled water.[154]
  - It is estimated that more than 80% of the world's urban tap water is contaminated with microplastics.[155]
  - People living in the European Union are estimated to consume up to 4,000 microplastic particles per year from tap water and up to 1,000 microplastic particles from sea salt.[154]
  - Ingestion is the primary means of microplastic exposure in humans; however, there is evidence of microplastic exposure through air pollution, as well.[156]
  - The impact of ingestion on human health is still being researched, however, some plastic polymers have been found to have an impact on human health. For example, PET (polyethylene terephthalate) — commonly used for carbonated drink bottles, microwavable meal trays, and peanut butter jars — has been identified as a potential human carcinogen.[149] Toxicology research has also shown that absorption of ultrafine microplastic particles led to toxicity and intestinal damage in zebrafish.[157]
- Packaging for UPFs may contain additional compounds with carcinogenic or endocrine disrupting properties that can leach into foods before consumption.[9]

Water footprint

UPFs and particularly ultra-processed beverages such as sweetened soft drinks require large amounts of water for production and thus create a substantial "water footprint."[26] Measures of water footprint can include direct and indirect water use in hydration of crops and animals, UPF formulation and processing, packaging (creation and disposal), distribution and retailing, and consumer preparation.[26,158]

- A study in Australia found that production and consumption of discretionary foods, made up mostly of UPFs, had the largest impact on water scarcity from foods in adult daily diets (24.6%).[159]
- The water footprint attributable to UPFs in the Brazilian diet increased 233% from 1987 to 2018.[160]
- An estimated 336-618 liters of water are used to produce a single 1-liter regular sugary drink (varies depending on sugar source and inclusion of ingredients such as caffeine or vanilla extract).[161-163]
- Beverage companies' exploitation of water resources is a global concern — for example, the practice of taking water from water-scarce countries for use in production of exported beverages.[164-166]

Total water footprint of 0.5 L bottle of sugar-containing carbonated beverage by sugar type & origin*



*Adapted from Ercin, Aldaya, & Hoekstra 2011[161]

Stress on food systems and ecosystems

Another major consequence of increased consumption on UPFs is diminishing worldwide agrobiodiversity, or the loss of "variety and variability of animals, plants, and microorganisms that are used directly or indirectly for food and agriculture."[167] Out of an estimated 7,000 edible plant species on Earth, 150 are significantly produced for agriculture, but only three — rice, wheat, and corn — now account for the majority of the world's caloric intake.[168] Promotion of a select few high-yield food crops for UPF production has resulted in the loss of traditional crops and increased monocultural agriculture practices.[168]

- Ultra-processed meat products (e.g., hot dogs, deli meats, chicken nuggets) also exacerbate agrobiodiversity loss via feeding requirements for livestock operations. The same monoculture crops used to make other UPFs are used in feedlot rations for confined animals, further diverting farmlands away from more diverse crops.[10]
- In Brazil, between 2008 and 2019, production of staple crops such as rice and beans has dropped 43% and 30%, respectively.[10] During this same time period, soy production (used in livestock feed and to make UPFs) has increased 70%.[10]
- Coupled with the impacts of climate change, loss of agrobiodiversity threatens sustainable food systems. Diverse agricultural yields act as insurance against climatic fluctuation and as a coping mechanism in times of scarcity. Climatic events can strain food supply by decreasing agricultural productivity, leading to increased food prices and consequently, a reduction in foods available for consumption.[169] This, in turn, could accelerate greater shifts toward UPF consumption due to food safety or availability concerns.

Policy approaches to reduce UPF purchase and consumption

Many countries and smaller jurisdictions around the world have already begun enacting policies to improve populations' dietary quality and health by disincentivizing production, purchase, and consumption of unhealthy foods and beverages. While most of these policies do not specifically target foods based on degree of processing, the nutritional criteria used in many regulations inherently capture and target UPFs given their generally poor nutritional profiles. More recent policies and proposals are beginning to explicitly target UPFs.[170] Regulatory approaches include:

Fiscal policies

At least 50 countries and 16 smaller jurisdictions have instituted taxes on sugary drinks or non-essential foods that can harm health.[171] In November 2023, Colombia will become the first country to implement taxes specifically targeting UPFs.[170] Studies show that taxes work to reduce purchases and intake of unhealthy products and to increase purchases and intake of healthier alternatives.[172-179] Evidence also strongly supports a tax design that raises sugary drink prices 20% or higher to have a truly meaningful impact.[180-184]

Other fiscal policies can improve access to healthier food options by increasing their affordability. These include but are not limited to subsidies to lower the cost of unprocessed or minimally processed foods such as whole grains, fruits, vegetables, and legumes; nutrition assistance programs that provide vouchers for purchasing these foods; and cash transfer programs that increase overall household financial security.[185,186] In many cases, UPFs are priced lower and/or offer lower time-cost than unprocessed or minimally processed foods.[3,187-190] For example, in the randomized controlled trial that found clear weight gain on a two-week UPF diet compared to a two-week minimally processed diet, the UPF meals provided to participants were $45 less expensive per week than the minimally processed meals (USD 2019).[100] Fiscal policies that complement UPF taxes by increasing affordability of healthier alternatives could maximize behavior change and shifts in consumer demand back towards unprocessed or minimally processed foods.[180,191-195]

Learn more about sugary drink taxes ➜

Front-of-package (FOP) warning labels

Simple, mandatory nutrient warning labels such as those adopted in Chile (*right, implemented* 2016), Peru (2019), Israel (2020), Mexico (2020), Uruguay (2021), Argentina (2022), Brazil (2022), Colombia (2022), and Canada (by 2026) help consumers to identify unhealthy foods quickly and easily and make healthier choices from the vast array of products available to them. Studies show that FOP warning labels can reduce purchases of unhealthy products and concerning nutrients, ingredients, or additives, and that consumers better understand warning labels compared to other common FOP labeling systems such as "traffic lights" or "Facts up Front"/Guideline Daily Amounts labels.[196-209] Real-world evalutions from Chile show that these policies can be very impactful.[210-214]

To date, these labels have been based primarily on products' nutritional content, but some researchers and health advocates are now calling for UPFs to carry FOP warning labels indicating they are ultra-processed.[215-218]

Learn more about FOP labeling ➜

School food environment protections

Schools should provide a healthy, safe place for students to learn and grow. They are often an important food source for children via school meal programs. Implementing policies that restrict sales of UPFs, ban marketing for UPFs, and strengthen the nutritional standards for school meal programs can all lead to healthier food intake for kids at school and influence their choices beyond school grounds.[227,239-245]

Brazil's National School Meals Program offers an example of how countries can regulate food procurement to limit the availability of UPFs in schools. Public schools in Brazil must use at least 75% of federal funds to purchase fresh or minimally processed foods, and at least 30% of procured foods must come from family farmers.[246,247] In addition, certain UPFs may only appear on school menus a limited number of times per month, and funds may not be used to buy soft drinks, ultra-processed cereals, cereal bars, confectioneries, cakes, and other UPFs.

Learn more about the school food environment ➜

Marketing restrictions: Pervasive marketing for unhealthy foods and drinks is widely recognized as a key contributor to obesity and other non-communicable diseases[219-221] and a driving factor behind the rapid growth of UPF consumption in markets worldwide. Reducing exposure to unhealthy food marketing during childhood and adolescence is a key prevention measure recommended by health leaders worldwide.[222-226] Recognizing this imperative, some jurisdictions have begun to implement and strengthen regulations that address both the ubiquity and persuasive power of UPF marketing.[227-229]

Learn more about marketing restrictions ➜

In 2016, Chile began prohibiting the use of creative techniques appealing to children in any marketing for unhealthy foods or sugary drinks, banning their sale or promotion in schools, and restricting TV advertising for these products to programming not aimed at children.[230,231] Children were still viewing unhealthy food advertising during unrestricted TV programming (e.g., during family primetime TV or on sports channels),[232] so in 2019 Chile took the step to further ban any advertising for regulated products on TV from 6 am to 10 pm.[233] Results from early evaluations suggest these laws are already improving the marketing landscape for children growing up in Chile.[213,234-237] For example, by 2019, children's exposure to TV ads for regulated foods and drinks (that exceeded thresholds for calories, sugar, salt or saturated fat) dropped by 73%, and 67% fewer ads for these products were using child-directed creative appeals such as cartoons, characters, toys, or contests — all of which are also prohibited under the law.[237]

Cereal box before (left) and after (right, with cartoon character removed and warning label added) Chile's law began

To reduce the harms caused by UPF marketing, more countries will need to adopt mandatory regulations that cover all marketing to which children and adolescents are exposed as well as the power of these marketing messages via use of creative techniques and appeals.[222,238]

A comprehensive approach: Evidence supports approaches including multiple, mutually-reinforcing regulations that can synergistically improve the food environment and shift social and cultural norms around UPFs, reducing demand for and consumption of these products and ultimately improving the dietary intake of individuals and entire populations.[248-251]

- **Policy gaps:** In addition to reducing UPF consumption, increasing access to and consumption of healthy foods is needed. In some places and among certain socio-demographic groups, UPFs make up the majority of available, accessible, affordable foods. To address this, policy options aimed at increasing consumption of healthy foods could add or include:
  - Targeted subsidies on less-processed foods such as whole grains, fruits, vegetables, and legumes;[180,191]
  - Nutrition assistance programs that provide money or vouchers for healthy foods;[185]
  - Setting nutrition standards for procurement in schools, daycares, prisons, and other public institutions.[252]
- **Nutrient profiling:** Well-designed nutrient and ingredient profiling models (NPMs) are key to determining which foods and beverages should be subject to regulation. The chosen model can be used to harmonize multiple regulations, including across fiscal, labeling, marketing, and school food policies.[253-258] To date, most NPMs use criteria based primarily on products' nutrient or ingredient content (e.g., how much sugar, sodium, or saturated fat a food or beverage contains).[4,259] The Pan American Health Organization (PAHO) NPM is the first to include additional measures to capture UPFs. The PAHO model is only applied to processed or ultra-processed products, and in addition to setting thresholds for nutrients of concern, the model identifies products that contain any amount of non-sugar sweeteners as UPFs that should be subject to regulation.[255] This is relevant for limiting potential unintended consequences of policies. For example, a policy that requires warning labels on high-sugar drinks but does not consider that non-calorically sweetened drinks (e.g., diet sodas) are also ultra-processed could have limited impact on reducing overall ultra-processed beverage intake, even while reducing sugar consumption.[260-263]

  While NOVA classification has been a useful tool for harmonizing scientific research in this area, a practical definition of UPFs is still needed for policymakers, regulators, and food companies to apply to products in the food supply. The most rigorous definition proposed to date identifies UPFs using 12 classes of additives defined in the Codex Alimentarius (international food code).[261,264] This approach has been shown to capture nearly all UPFs in the U.S. food supply.[261] Simpler criteria using only food additives with cosmetic functions (e.g., additives used to make a product taste or look more appealing) has also been shown to capture nearly all UPF products.[260,261,265] In setting criteria to define UPFs, policymakers will need to balance comprehensiveness, practicality, and evidence on the components of UPFs that contribute the most health harm to select an approach to ensure the greatest benefit to public health.

These and other policy options aimed at reducing UPF consumption and promoting healthier eating around the world are examined in depth in a 2021 paper in Lancet Diabetes and Endocrinology and in several other works from scholars and international organizations.[8,266,267]

Countering industry claims

Industry claim

Policies that reduce UPF consumption will cause job loss.

Reality

These policies do not affect employment and positively impact health and the economy.

Economic impacts

Improvements in health from policies that reduce UPF consumption benefit the economy rather than harming it. Evidence from jurisdictions that have evaluated employment or economic changes following introduction of nutrition-related policies includes:

- Eighteen months after Chile implemented a comprehensive policy that included front-of-package warning labels, marketing restrictions, and banned sales and promotions in schools for junk foods and sugary drinks, researchers found no reductions to employment or average wages in the food and beverage sector compared to other sectors not impacted by the law.[268]
- In Mexico, total employment did not decrease following introduction of sugary drink and junk food taxes in 2014.[269] The country experienced significant reductions in purchases of taxed foods[270,271] and drinks — particularly among lower-income and high-volume consumers, two groups facing the greatest health risk[272-274] — and increases in bottled water purchases.[272]
- A 10% reduction in sugary drink consumption among Mexican adults from 2013 to 2022 was predicted to result in an estimated 189,300 fewer cases of type 2 diabetes, 20,400 fewer strokes and heart attacks, and 18,900 fewer deaths, which could lead to $983 million international dollars saved.[275]
- A sweetened drink tax in the city of Philadelphia, Pennsylvania, was associated with a drop in taxed beverage purchases of up to 38%,[276,277] with a net positive impact on the city's employment and economy.[278-280] Philadelphia's tax has generated $385 million in total revenue since it began,[281] and in 2020–2022, roughly half of this went towards funding a universal pre-kindergarten program for Philadelphia children. This provision of free, quality childcare using beverage tax revenue has created an estimated 800–1,350 new jobs and $28–60 million in additional labor income, as parents were able to join the labor market or increase productivity.[280] These gains primarily impacted low-income families.
- Peru's food and beverage industry experienced no significant job or wage losses after the country increased its sweetened beverage tax for drinks containing six or more grams of sugar per 100 mL in 2018 and in 2019 began requiring warning labels on the front of unhealthy food and beverage packages.[282]

Industry claim

UPFs can simply be reformulated to be less harmful.

Reality

Swapping ingredients (e.g., replacing sugar with other sweeteners) or adding "healthy" ingredients to improve or mask a poor nutrient profile (e.g., adding fiber to ultra-processed snacks or protein isolates to ice creams) does not address all the ways in which UPFs harm health.

Product formulations

- UPFs are detrimental to health for many reasons, poor nutritional profile only being one. Tweaking product formulations to achieve a more appealing nutrition facts panel does not address the problems of UPFs' hyper-palatability and addictive nature, content of harmful contaminants, or displacement of healthier, minimally processed foods in the diet.[283,284]
- Studies have repeatedly found that associations between UPF consumption and negative health-related outcomes persist even when adjusting for diet quality or pattern.[285] This suggests that the processing, itself, and/or the many additives used in UPF formulations contribute significantly to UPFs' health risks. Reformulating UPFs in a way that only reduces calorie density or nutrients of concern (sugar, sodium, and saturated or trans fats) is a start, but it will not solve their negative impact on health.
- Industry has been reformulating UPFs since their inception. Evidence connecting UPFs to disease and mortality is based on consumption of UPFs that were already undergoing continuous reformulation. While reformulation could mitigate the harmfulness of some UPFs (e.g., replacing sodium chloride salt with potassium chloride), it is not a solution that will make UPFs less detrimental, on the whole.

Industry claim

We're just giving consumers what they want.

Reality

Industry aggressively cultivates consumer demand for UPFs.

Demand for UPFs

- The UPF industry has, for decades, generated consumer demand and brand loyalty by investing in business infrastructure in untapped markets and through highly integrated marketing campaigns, promotions, product placement, and formulations engineered to get customers hooked on their products.[15] For example:
  - In 2010, Nestlé launched a "floating supermarket" in Brazil stocked with Nestlé products, "to service the riverside populations of the Amazon…extending the presence of Nestlé brands in the Brazilian homes."[286] This followed the company's "Nestlé Comes to You" program launched in 2006, wherein Nestlé employed over 7,000 resellers and hundreds of micro-distributors to go door-to-door distributing Nestle products. In 2010, the company estimated they would visit over 3 million households, specifically targeting "poor neighborhoods."[286]
  - In the late 1990s, Coca Cola began investing heavily in market expansion into Africa, building bottling plants across the continent, offering free or subsidized branded coolers to businesses, acquiring large stakes in smaller African beverage companies, and marketing the brand and its products widely.[287] By 2014, the company projected to invest $17 billion in Africa.[288]
  - In the United States, a recent study highlights how the largest tobacco companies — after buying into the U.S. food industry to diversify their portfolios — drew on their experience maximizing the addictiveness of cigarettes as well as a library of artificial flavors to create, market, and profit hugely from hyper-palatable UPFs in the 1980s and '90s.[289] Tobacco companies selectively disseminated these products and paved the way for other companies to follow suit, giving rise to a market now dominated by hyper-palatable UPFs.
  - Industry capitalized on the COVID-19 pandemic as an opportunity to further engage in highly orchestrated marketing campaigns, including positioning UPFs as "essential products" and donating UPFs to vulnerable populations already disproportionately suffering from added risks associated with obesity and other chronic diseases — all while actively lobbying against healthy food policies.[290-295]
- Transnational food and beverage corporations leverage their massive market power to alter entire food systems to their benefit: They control the price, availability, nutritional quality, and desirability of their products, and the outcome seen throughout the world is rapid growth in UPF consumption.[3,4,296]

Imperative for action

UPFs are the fastest-growing segment of the global food supply and a major driver of increasing diet-related, noncommunicable diseases worldwide.[4] Transnational corporations continue to shape food systems on all levels and expand UPF markets at the expense of traditional foodways and public health. Momentum is building worldwide to implement evidence-based policies, including targeted taxes, front-of-package labels, marketing restrictions, and protections for the school food environment, however most regulations to date have not yet explicitly targeted UPFs. Doing so will not be without major challenges, including:

- **Reaching consensus on a practical regulatory definition of ultra-processed products;**
- **Identifying and addressing factors other than sensory appeal that contribute to increasing reliance on UPFs, including higher cost of less-processed foods, lack of time for food preparation, and other barriers to accessing healthier foods — especially among low-income or low-resource households;**
- **Overcoming industry interference in evidence-based policymaking; and**
- **Coalescing political will around forward-thinking, coordinated policies that simultaneously enhance equitable access to healthier, less-processed foods and clean water, and support human and planetary health.**

While researchers must continue examining the exact mechanisms by which UPFs heighten health risks to inform future policies, evidence to date of UPFs' harms overwhelmingly supports the imperative for governments to act now to shift consumption away from UPFs and towards healthier, minimally processed diets.

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