



FCRN foodsource

A free and evolving resource to empower informed discussion on sustainable food systems

Building Block

**What is ultra-processed food?
And why do people disagree
about its utility as a concept?**

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Food Climate Research Network

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Why should you read this building block?

The increasing consumption of industrially processed convenience foods, soft drinks, and fast foods has been associated with a rise in non-communicable diseases, overweight and obesity.

This building block explores the concept of ultra-processed food: how it has been defined, and differing views as to whether it is a useful way of thinking about food and its relation to health and wider sustainability concerns.

Definitions

Ultra-processed food (UPF): Sometimes used loosely to refer to snacks and fast foods, UPF generally refers to one of the four categories of the NOVA food classification (see below). NOVA describes UPFs as 'industrial formulations' of food products, typically mass-produced, that contain few 'natural' ingredients. Advocates of NOVA point out that UPFs consist of many **additives** and food-derived ingredients such as whey, protein isolates and invert sugar, which are produced and combined through processes that are uncommon in domestic kitchens. They understand these foods to be designed so as to be so appealing that they displace the consumption of healthier, less processed foods, thereby generating high profits for their manufacturers. Foods in the UPF category include biscuits, mass-produced buns and breads, sweetened cereals, margarines and spreads, packaged snacks, ice cream, flavoured yogurts, soft drinks, powdered meals, ready-made meals, and instant sauces and stocks. Proponents of the concept have argued that the consumption of UPF is the primary driver of the global '**pandemic**' of overweight and obesity, while contributing to **non-communicable diseases** such as metabolic syndrome and certain cancers. It has been argued that the production and consumption of UPFs undermine social and environmental sustainability while perpetuating unequal power dynamics in the food system. Opponents of the concept have contested these claims. They argue that the concept is imprecise and groups together foods with different nutritional characteristics.

NOVA classification: is a system of food classification created by a team of nutrition and health researchers at the University of São Paulo led by Carlos Monteiro. NOVA categorises food products by the 'extent' and 'purpose' of food processing on the grounds that today this is the main determinant of a food's nutritional and environmental characteristics. NOVA has four categories: minimally processed food; processed culinary ingredients; processed foods; and ultra-processed foods. Introduced as a framework to measure the impacts of processed foods on human health, NOVA has also been promoted as an alternative to traditional government-approved dietary guidance such as the US MyPlate, the UK Eatwell plate or the Chinese Food Pagoda. While criticised, NOVA is increasingly used as a framework in nutrition science, especially in **nutritional epidemiology**. The dietary guidelines of Brazil (2014), Uruguay (2016), Ecuador (2018) and Peru (2019) and some reports from the **PAHO-WHO** have drawn upon the NOVA classification while the French (2019) dietary recommendations advise to reduce the consumption of 'ultra-transformed' foods.

Food processing: Defined by stakeholders in many different ways, food processing broadly refers to modifications made to raw food ingredients after they have been gathered or harvested and before they are consumed or prepared for consumption in a kitchen. Examples of food processing include the pickling of vegetables, smoking or mincing of meat, pasteurisation of milk, milling of wheat, and the **hydrogenation** of oils. By this definition, most foods are processed in some way (e.g. to improve their taste, extend their shelf-life, make them edible or increase their nutritional value), but there are growing concerns over the health impacts of industrially processed foods.

Minimally processed food: is a category of foods in the NOVA classification that have not been processed (e.g. fresh fruits and vegetables) or that have been modified only minimally by processes such as drying, roasting, boiling, freezing, and the removal of inedible parts. Advocates of NOVA understand minimally processed foods to be processed to extend their lifetime, enable their storage, make them easier to prepare, or to increase the number of ways they can be consumed. Examples include fresh meat and vegetables, whole wheat grains, wholemeal flour, ground coffee and pasteurised milk.

Processed culinary ingredients: is a category of food ingredients in the NOVA classification that result from the further treatment of unprocessed and minimally processed foods by processes such as pressing, refining, grinding, milling, and spray drying. Examples include salt, spices, cane sugar, flour, honey and olive oil. Processed culinary ingredients are added to other foods in the preparation of dishes. Advocates of NOVA understand their purpose to be enabling the preparation of more varied dishes from minimally processed foods and improving the taste and appearance of such dishes. Processed culinary ingredients are usually not consumed on their own.

Processed food: In public understanding, the concept of processed food is often used loosely to refer to mass-produced ready-to-eat foods such as instant flavoured noodles and soda drinks. The concept, however, also refers to one of the four categories of the NOVA classification, which classifies many of these foods as ultra-processed foods. Within NOVA's processed food category are minimally processed foods to which one or more processed culinary ingredient has been added, and which have been further modified by processes such as smoking, salting and canning. Advocates of NOVA understand processed foods to be produced primarily to increase the durability of minimally processed foods and to enhance the taste and appearance of such foods. Examples of processed foods include freshly made breads, pickled vegetables, salted nuts, smoked meats and canned fish.

1. Introduction

Globally, diets increasingly include more mass-produced products such as convenience foods, soft drinks, and fast foods (see our building block on the [nutrition transition](#))¹. These foods are now often referred to as 'ultra-processed foods' (UPFs).

The UPF concept was coined in 2009 by the Brazilian nutrition and health researcher Carlos Monteiro to refer to a specific group of industrially processed foods that are often energy dense and high in fat, salt, sugar and **additives**, while lacking dietary fibre and **micronutrients**². Monteiro and colleagues argue that since the 1980s, food systems have been increasingly dominated by these foods (see Figure 1)^{3,4}. They understand the increased consumption of UPFs to be a leading cause of the global '**pandemic**' of overweight, obesity and related **non-communicable diseases**, while their production and consumption is also thought to undermine sustainability and general human well-being^{2,3}.

The UPF concept is gaining traction in some academic and policy quarters and is increasingly used by NGOs and the media. The concept is used in different ways and the research on UPF is sometimes misinterpreted. Some question the overall usefulness of the concept and others suggest that the concept can be useful for health education or possibly for other purposes when further research and clarification are provided.

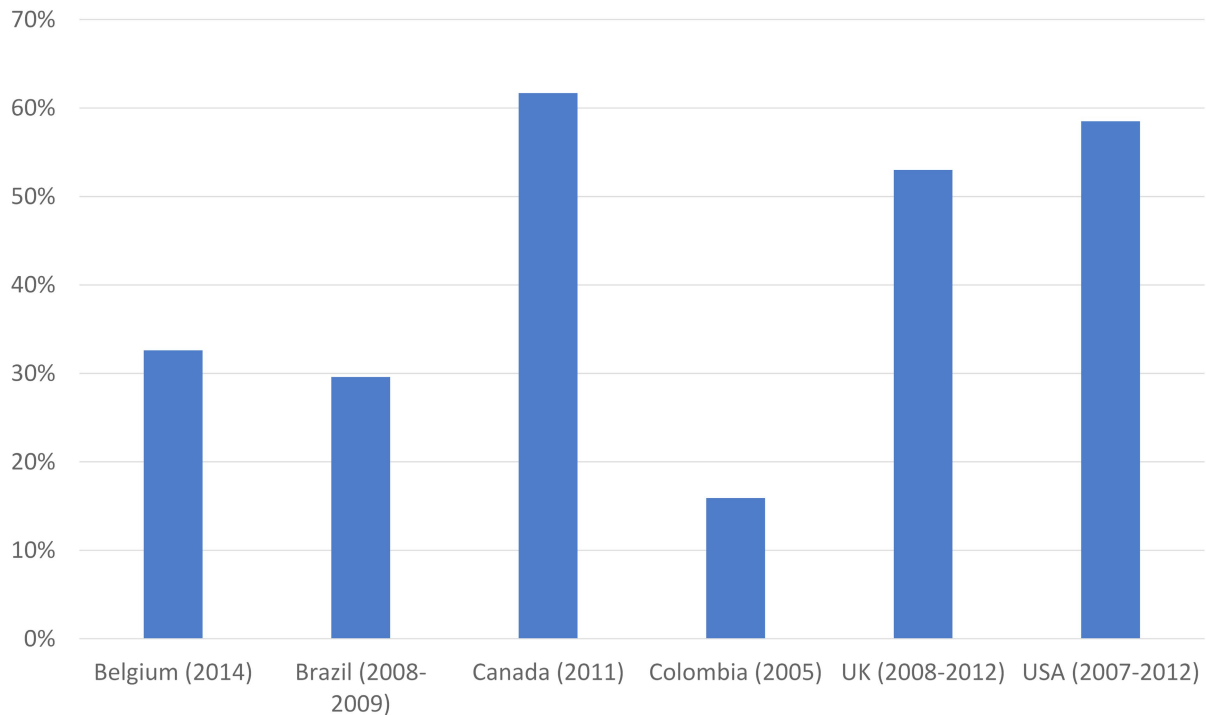


Figure 1: UPFs' share of the total food energy consumption in different countries. Figure developed by the FCRN and based on various NOVA studies⁵⁻¹⁰.

2. What is ultra-processed food?

Sometimes used loosely by commentators to denote food products such as fast foods and ready-made meals, UPF is also a category of the NOVA food classification developed by Monteiro and colleagues^{4,11}.

NOVA classifies food into four categories (see Figure 2) that are distinguished by the extent and purpose of food processing¹¹:

1. **Minimally processed food**
2. **Processed culinary ingredients**
3. **Processed food**
4. **Ultra-processed food**

Healthy dietary patterns, advocates of NOVA argue, consist of meals that are based on minimally processed foods and small quantities of processed culinary ingredients. The use of processed food is to be limited and UPFs avoided¹².

As to the purpose of food processing, it is argued that minimally processed foods are processed to extend their lifetime, enable their storage, make them easier to prepare, or increase the variety of their uses^{4,11,12}. Processed culinary ingredients are made to aid the preparation of a variety of dishes from minimally processed foods and to improve the taste and appearance of these dishes^{4,11,12}. Processed foods, produced by adding processed culinary ingredients to minimally processed foods, are produced to increase the durability of minimally processed foods and to enhance their taste and appearance^{4,11,12}. UPFs, in contrast, are thought to be made primarily to generate high profits for their manufacturers^{11,12}. These foods are understood to be generally cheap to make, attractive to buy, convenient to consume, and thereby likely to displace the consumption of other, less processed, foods.

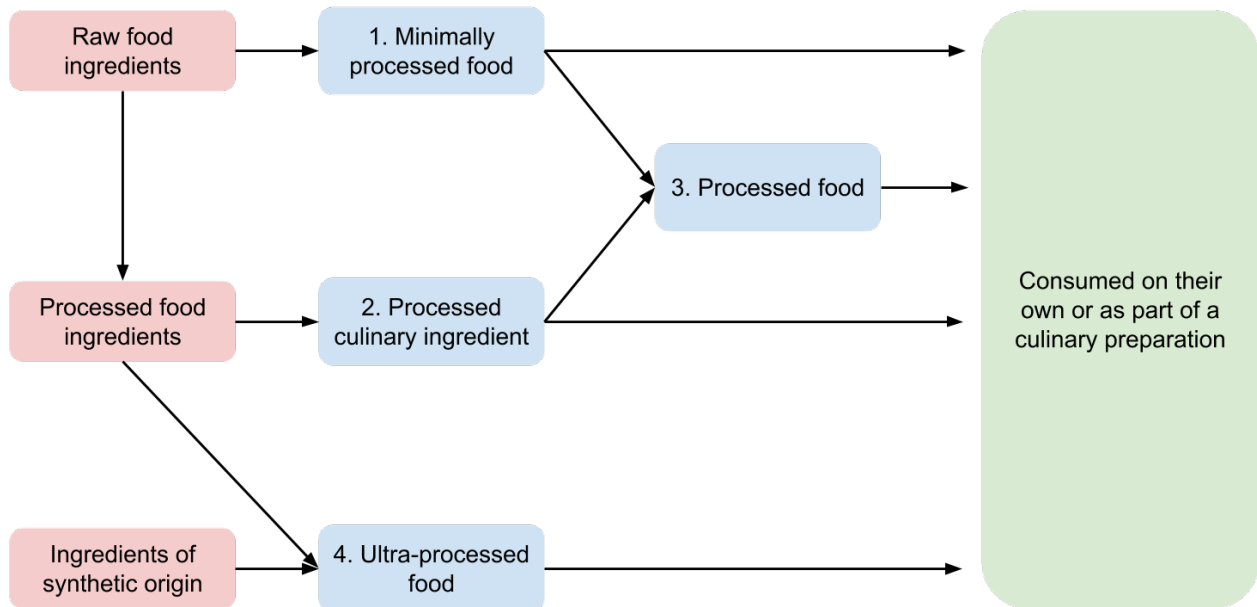


Figure 2: A graphical depiction of the NOVA classification as introduced by Monteiro and colleagues^{4,11}. Processed culinary ingredients are usually not consumed on their own but as part of 'culinary preparations'. UPFs are sometimes combined with other foods in 'culinary preparations' but often consumed on their own. Figure developed by the FCRN, 2019.

Regarding the extent of processing: the argument here is that while minimally processed foods, processed culinary ingredients, and processed foods are processed in varying degrees, they are all produced by applying at most a few processes – for example drying, salting, fermenting, canning or removing inedible parts – to raw food ingredients. These processes, moreover, are relatively uncomplicated; they are not based on advanced and large-scale technological processes and many of them are common in domestic kitchens.

UPFs, instead, are thought to be produced by applying sequences of processes to often already heavily processed food ingredients^{4,11,13}. UPF-ingredients such as whey, gluten, invert sugar, and **reconstituted meat** are mostly derived by heavily processing commodity crops (for example corn or wheat) and animals¹². UPFs often contain much fat, salt, and sugar but also additives such as flavour enhancers and emulsifiers as well as added micronutrients, all of which are not found in the processed culinary ingredients-category and are produced using advanced chemical techniques. Some of the processes that are used to produce UPFs, such as the hydrolysis of proteins or the manufacture of aspartame, cannot be undertaken in domestic kitchens.

3. UPFs, nutrition and health

3.1 How do UPFs impact upon health?

Proponents of the NOVA classification argue that UPFs impact upon health in many ways^{3,14,15}. They sometimes criticise what has been termed '**nutritionism**'^{16,17}, which refers to the idea that the healthfulness (or otherwise) of a food is determined by its constituent nutrients. This approach is seen to be prevalent in nutrition science, and to shape mainstream dietary recommendations and food industry policies.

Proponents of the UPF concept point out that UPFs generally have a poor nutrient profile as defined by the nutritionist approach (they are often high in sugar, salt, fat, or additive contents while lacking dietary fibre and micronutrients). But they also argue that a focus solely on these aspects is

inadequate as it ignores the health impacts of how foods are designed, produced, distributed, advertised, and consumed. The NOVA framework, accordingly, is not a nutrient profiling model that is based on maximum and minimum intake levels of nutrients, but a food classification that considers the function of a food in the wider context of meals and diets.

It is argued that UPFs are particularly liable to be overconsumed and, in addition, to accommodate and reinforce unhealthy dietary patterns^{3,4,13}:

- UPFs are often 'hyperpalatable'. Unlike food from the other NOVA categories, they have been designed to taste and look attractive; compare water or tea, for example, with a cola drink.
- Because they are often high in sugar, salt, colourants and flavourings, nutritionally poor UPFs may appeal to consumers more than healthier meals and dishes.
- UPFs often come in large portion sizes.
- They are generally convenient (requiring little preparation) and readily available. People may choose ready-to-eat or ready-to-heat UPFs over foods that are healthier but that require more preparation.
- They tend to be heavily marketed – sometimes using health claims that mask their unhealthy qualities (e.g. a soda beverage with added vitamins can still be rich in sugar).
- As a result of their dependence on UPFs, people may lose the knowledge, skills and interest to prepare healthy dishes themselves, leading to a situation where they become increasingly reliant on UPFs.

In current research on UPF, most of these reasons are not directly investigated but are supported by reference to other research.

3.2 Research on the health impacts of UPF consumption

To date, most research on UPFs consists of **epidemiological** studies that use the NOVA framework to study the associations between particular dietary patterns and overall health outcomes. Many of these studies have been conducted by Monteiro and his colleagues at the University of São Paulo, but the NOVA framework is increasingly being adopted by other research teams.

For the countries studied, NOVA studies conclude the following^{5,6,9,18–38}:

- UPFs account for a major share of total food energy (see Figure 2). This share has been increasing since the 1980s.
- Foods in the UPF category have, on average, higher fat, salt and sugar levels and fewer micronutrients compared to foods on average found in the other NOVA categories.
- Increases in the national consumption of UPF have been associated with a higher prevalence of obesity and overweight. For most countries studied, this association remains significant after adjusting for potential **confounding factors** such as physical exercise and smoking.
- Increased intake of UPFs is associated with a range of medical conditions. Most studies focus on overweight and obesity; some studies find significant associations with, for example, overall and breast cancer¹⁸, overall mortality¹⁹, hypertension²⁰, metabolic syndrome²¹, and cardiovascular diseases²². For most studies, these associations remain significant after adjusting for common confounding factors such as lack of physical exercise or smoking. Many of these studies are longitudinal **cohort studies** and suggest that these associations remain significant over time.

Although most UPF research is epidemiological, a 2019 clinical trial by Hall *et al.*³⁹ compared energy intake and weight gain among 20 participants who alternately followed a UPF diet and a minimally-processed diet with meals that were matched for energy density, **macronutrients**, sugar, sodium, and fibre. Participants were instructed to consume as much or as little as they desired. This study found

that participants on a UPF diet consumed more calories relative to a minimally-processed diet, and gained weight, while subjects on the unprocessed diet lost weight. It did not, however, establish the mechanisms through which this causal relation appeared.

3.3 Critiques and disagreements

To date, only a few peer-reviewed commentaries on the UPF concept and NOVA research have been published^{40–44}. Advocates of NOVA have responded to these criticisms and have questioned their authors' relationship with '**Big Food**'^{14,45}. Critics of the UPF concept can also be found in the media and on social media.

Criticisms can be broadly clustered into the following themes:

3.3.1 What defines the UPF category?

A major part of the criticism of the NOVA framework deals with how the UPF concept is defined, and with the nutritional characteristics of foods that belong to this category.

First, critics indicate that the UPF concept lumps together foods with different nutrient profiles while foods with similar nutrient profiles fall both in and outside the UPF category^{40,42}. For example, home-made brownies (made from minimally processed foods and processed culinary ingredients) and factory-made brownies (a UPF) are put in different categories. Mass-produced wholemeal bread, Quorn, **fortified** unsweetened soymilk, packaged crisps, and gummy candies, however, all get classed as UPFs. Many of these foods, critics argue, do not have a poor nutritional profile and can contribute to healthy diets^{40,41}. In any case, Gibney *et al.* note, it is difficult to see how they are 'hyperpalatable' and stimulate overconsumption⁴¹.

Second, Gibney argues that the definition of the UPF concept has changed since it was first coined and is open to multiple interpretations⁴². Older definitions emphasise salt and additive levels and the accessibility, convenience, and palatability of UPFs whereas newer definitions tend to be longer and highlight factors such as micronutrient fortification and ingredients that are not usually used in domestic food preparation (e.g. soy protein isolates). In addition, Gibney argues, different articles about the NOVA framework give different examples of foods from each category, leading to confusion and foods being classified in a subjective fashion⁴².

Monteiro *et al.* respond that these and similar criticisms fail to consider the key characteristic of the NOVA framework: it classifies foods by the extent and purpose of food processing, not by their nutrient profiles¹⁴. By this very definition, the UPF category is bound to contain foods with different nutrient compositions. Furthermore, they argue, the definition of UPF has not significantly changed since 2012 when the category of processed foods was added to the NOVA framework in order to better distinguish between different types of industrially processed foods. Very few NOVA studies had been published before this change in the model. In a 2019 article Monteiro and others point out that, in line with earlier definitions, UPFs can be readily identified by checking whether their ingredient labels mention one or more of the following ultra-processed ingredients¹²:

- a "food substance that [is] never or rarely used in kitchens"¹² (e.g. hydrolysed protein, soy protein isolate, gluten, whey, fructose, dextrose, or **hydrogenated** oil); or
- a "[food] additive whose function is to make the final product palatable or more appealing"¹² (e.g. flavour enhancers, colours, artificial sweeteners, gelling agents).

Slight differences in examples, moreover, originate from fine-tuning the classification to different contexts (e.g. 'sausages' may commonly be ultra-processed in one country but elsewhere be mainly consumed in a form that is merely processed).

It is not clear, however, whether the purpose of food processing is necessarily different for foods from different NOVA categories. For instance, whether a manufacturer's primary intention for producing a UPF is to generate high profits is difficult to measure. It is also not clear whether a producer of a food from another NOVA category would be any less motivated by profit or the desire to appeal to consumers. A further methodological challenge for research on UPF is that common **nutritional epidemiological** methods such as **24-hour recalls** and **food frequency questionnaires** do not generally measure whether a food was made at home or in a factory and thus cannot reveal whether a health outcome is associated with UPFs, home-made foods, or both⁴⁴.

3.3.2 Association does not equal causation

Commentaries on UPFs often emphasise that association does not equal causation (see for example [this NHS explainer](#) on UPFs and cancer and [this NHS explainer](#) and [this Science Media Centre commentary](#) on UPFs and overall mortality)⁴⁶. For instance, when a study finds that (A) an increase in UPF intake is associated with (B) an increase in the prevalence of non-communicable diseases or medical conditions such as obesity, the relationship between A and B does not have to be causal but could be coincidental, result from a reverse causation, or be influenced by other factors. A and B may for example share a common cause, or B can be caused by another factor that for some reason correlates with A.

Other factors that influence a certain association are called '**confounding factors**'. In relation to UPF intake and health, potential confounding factors include smoking, physical inactivity, or income, and other dietary factors (people with a high UPF intake could turn out to be eating more fatty foods such as (artisanally produced) meats and cheeses). Different factors may confound UPF's associations with specific health outcomes differently. Some argue that therefore a greater number of studies per individual health outcome is needed with attention to more confounding factors^{44,46}.

In clinical trials such as the study by Hall *et al.*, the influence of confounding factors is generally ruled out by randomly assigning participants to an intervention group and a control group⁴⁷. Due to the use of non-experimental methods such as **dietary surveys**, this is impossible in nutritional epidemiological research and confounding is therefore more likely. Most NOVA and other epidemiological studies measure and statistically control for the influence of potential confounding factors. An association is more likely to be causal when it remains significant after adjustment for many confounding factors. The number of potential confounding factors, however, is unlimited and it is impossible to adjust for all of them.

Hall *et al.* argue that their randomised clinical trial is the first to study and find a causal link between UPF intake, energy intake and body weight change. Their finding is significant because Jones⁴⁰ has suggested that UPF-consumers may be consuming excess dietary energy for reasons unrelated to UPF-intakes (see Figure 3). If this is the case, then the challenge is to reduce energy intakes and this could be achieved while still consuming UPFs if people ate UPFs that (for example) replaced sugar with artificial sweeteners (the relationship between artificial sweeteners and changes in body weight, is complex, contested and not discussed further here^{48,49}). The findings of Hall *et al.*, however, suggest that excess calorie intake is not separate from, but stimulated by, UPF consumption – the relationship is causal. This supports the view that UPFs induce overconsumption (see above). That said, Hall *et al.*'s study does not reveal the mechanisms underlying the causality and leaves open the question of whether **reformulation** could eliminate UPFs' contribution to weight gain. In a commentary, Ludwig *et al.*⁵⁰ also urge for caution about extrapolating Hall *et al.*'s finding, in particular because they are based upon short-term data on food intake and weight gain.

The question about reformulation relates to the more general point made by critics that even when UPF as a category is associated with poor health outcomes, particular UPFs such as mass-produced wholemeal bread, mycoprotein-based products (Quorn), or reformulated products (e.g. no added sugar granola with added whey powder) may contribute to improved public health. Monteiro and others question this reasoning on the ground that these foods can still contribute to unhealthy

dietary patterns while some of their ingredients might cause health impacts that have not yet been explored. Scrinis and Monteiro¹⁷ also point out that reformulation often includes the substitution of ingredients such as sugar for ultra-processed ingredients such as artificial sweeteners whose impacts on health are often little known. Besides, they note, people may still overconsume reformulated UPFs.

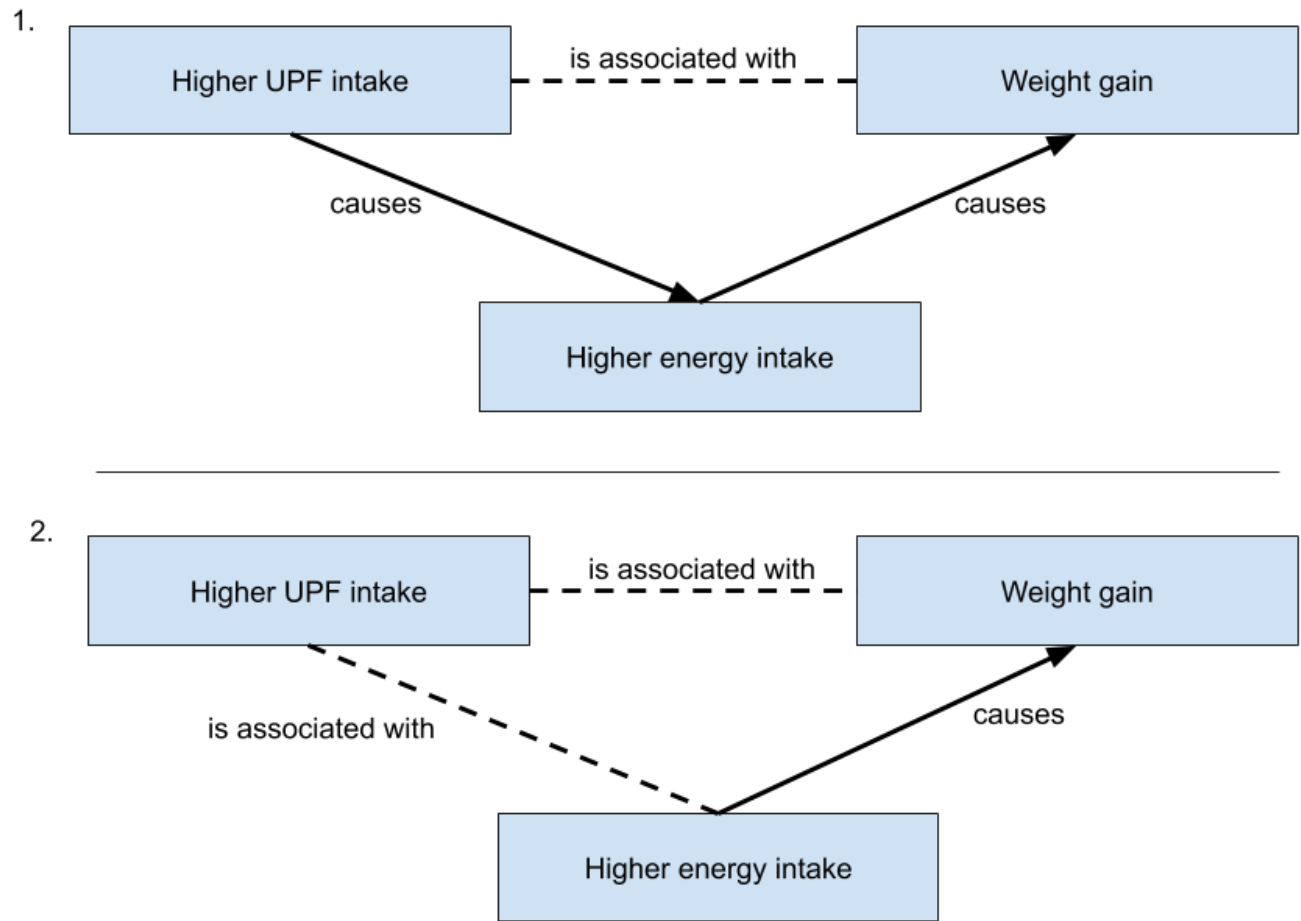


Figure 3: The nature of the association between UPF intake and overweight is contested. Some consider (1) ‘higher energy intake’ to be an intermediate variable through which ‘higher UPF intake’ relates causally to ‘weight gain’. Others suggest (2) that ‘higher energy intake’ may confound the association between UPF intake and ‘weight gain’ because UPF-consumers could appear to generally consume more dietary energy for reasons not caused by the characteristics of UPFs.

3.3.3 Underlying disagreements

Underlying debate on UPF and poor health outcomes is the question of how this association relates to other well-known associations, for example between a varied diet and health or between dietary sugar and bodyweight. Opponents may think that the UPF concept is too general and of limited use because it provides little additional detail in understanding the relations between food and health. Proponents, however, may find UPF relevant as an overarching concept that groups a wide range of foods and their associations with different health outcomes. To a certain extent, this difference may be rooted in a preference for ‘lumping’ or ‘splitting’: for UPF proponents, lumping foods into four broad categories sheds light on a general trend in the food system, whereas for opponents, the presence of inevitable exceptions invalidates the framework. The simplicity of NOVA is sometimes also understood to make the framework especially helpful for health education and the model has been used by several governments as the basis for national dietary guidelines.

Linking to the concept of the **nutrition transition**, the general trend advocates of the UPF concept speak of is an undesirable change in diets that has been driven by the food industry. Through the design, production and marketing of UPFs, traditional diets are shifting towards those that are

associated with poor health outcomes such as overweight, obesity and diabetes. The NOVA classification thus blends in with a political ideology that understands companies to be reaping large profits at the expense of people's health, thereby evading a moral responsibility. Critics of the UPF concept, however, may see this political framing as driving the development of the UPF concept and the NOVA framework in the first place. As such, they understand the research on UPF to be pervaded, and therefore invalidated, by an ideological prejudice against profit making and big businesses. Monteiro *et al.*, in response, are careful to note that their problem is not with the food industry *per se*, but only with that part that enables and encourages the consumption of UPFs.

4. UPFs and social and environmental sustainability

Besides impacting upon health, it is argued that UPFs undermine social and environmental sustainability^{2,11}. For example, the 2014 Brazilian dietary guidelines⁵¹, which used the NOVA classification system, drew attention to the links between UPFs and concerns such as the loss of traditional food cultures and smallholder farmers' **livelihoods**, the environmental impacts of monocultural farming, and the power of 'Big Food' in determining what sits on our plates. The dominance of UPFs in today's food system can be seen as a proxy indicator for many of the social, ethical and environmental harms that this system causes (see Figure 4).

At present, since the main advocates of the UPF concept have been health professionals, there is as yet limited research into these non-health dimensions of UPFs. Some of the main arguments and questions raised on the environmental impacts of UPFs are, however, summarised here.

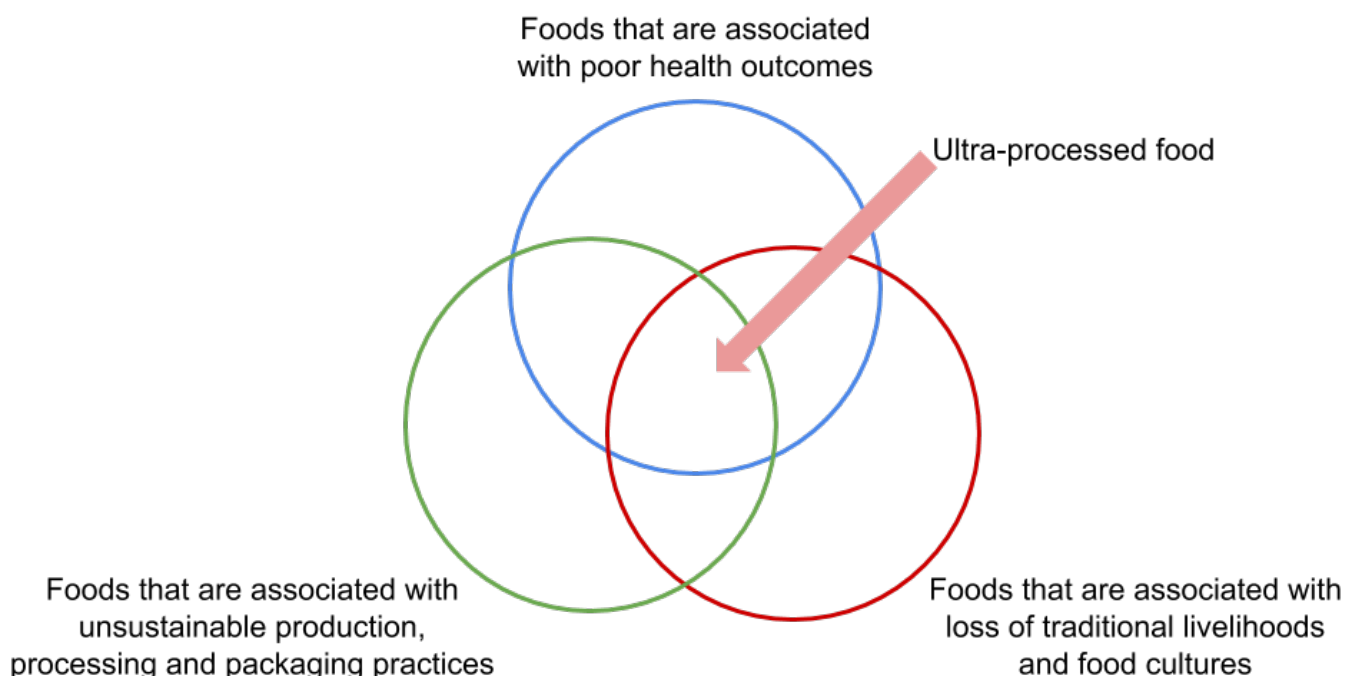


Figure 4: UPFs can be seen as a proxy indicator for many health, social, and environmental issues, of which the circles show three examples. Figure for illustrative purposes only; people may disagree about the extent to which the circles actually overlap and associate with UPFs. Figure developed by the FCRN, 2019.

4.1 Environmental impacts

The 2014 Brazilian dietary guidelines suggest that UPFs are interlinked with unsustainable forms of **intensive agriculture**, whereas minimally processed foods are often produced on small farms in environmentally benign ways. Currently, more research is needed to explore the connections between foods from the different NOVA categories and the agricultural systems on which they are based. That said, the production of crops sold as minimally processed foods does not necessarily generate fewer environmental impacts than the production of crops that end up being made into UPFs. Compare, for example, intensive almond production leading to the sale of raw, unprocessed nuts and intensive wheat production leading to the production of biscuits. The relative environmental impacts of large scale vs. small scale farming are also the subject of much disagreement (see our building block on [the land sparing-sharing continuum](#)).

When it comes to food preparation, several **life-cycle** assessment (LCA) studies comparing **GHG** emissions from (ultra-processed) ready-made meals and home-made meals with similar ingredients, show that on balance the ready-made foods that were studied generate about 30-50% higher emissions than the home-made meals^{52,53}. This mainly results from higher energy use during the processing of these UPFs, their dependence on the **cold chain**, and higher levels of food waste in the stages before consumption. While these figures will differ depending on the UPF (and alternative home cooked product) in question, it is unlikely that people exactly substitute home-made foods with their UPF equivalents and vice versa^{53,54}. Accordingly, the relative environmental impacts of diets based on UPFs or on minimally processed foods are difficult to determine.

The Brazilian dietary guidelines also state that UPFs cause higher transport-related emissions and pollute the environment through their plastic packaging, whereas minimally processed foods are associated with the seasonal consumption of locally produced foods. Many fruits and vegetables, however, are also imported and exported and have long supply chains that depend upon refrigeration and require a great deal of primary and secondary packaging. In the case of seasonal surpluses, some processed and ultra-processed foods could potentially help to limit food waste because they have long shelf-lives and do not need to be refrigerated⁵⁴. In many developed countries, minimally processed foods are generally packaged. It is unclear whether overall reliance on packaging is inherently lower in diets that are less dependent on UPFs.

Finally, NOVA's engagement with the debate on the environmental impacts of meat and dairy consumption is currently minimal. The 2014 Brazilian dietary guidelines, for example, do not mention meat or dairy in their concluding 'ten steps to healthy diets'⁵¹.

5. UPF, health and sustainability

In summary, the UPF concept is gaining traction in some academic and policy quarters, and it is also increasingly used by NGOs and the media. Overall, the concept and the accompanying NOVA classification offer a different way of thinking about food that focuses less on nutrients and nutrient profiling, and more on the processing of foods and ingredients; on overall dietary patterns and the contexts in which we eat food; on the concentration of power in the hands of corporations; on the environmental impacts of food systems; and on food's centrality to people's social and cultural lives. Several governments – from Latin American countries in particular – have found utility in adopting NOVA and the UPF concept for health education in their national dietary guidelines.

The UPF concept, however, has also been criticised as imprecise and for encouraging oversimplified views about the food industry's influence on dietary health, while adding little that is new to the idea that the consumption of certain processed foods (e.g. processed meats or soft drinks) may link to certain medical conditions, or to existing dietary advice to reduce the consumption of foods high in

fat, sugar and salt. To date, most of the focus – by advocates and critics alike – has been on the link between UPFs and health outcomes. More work is needed to establish what, if any, relationship UPFs have with the wider social and environmental dimensions of food systems (Figure 5).

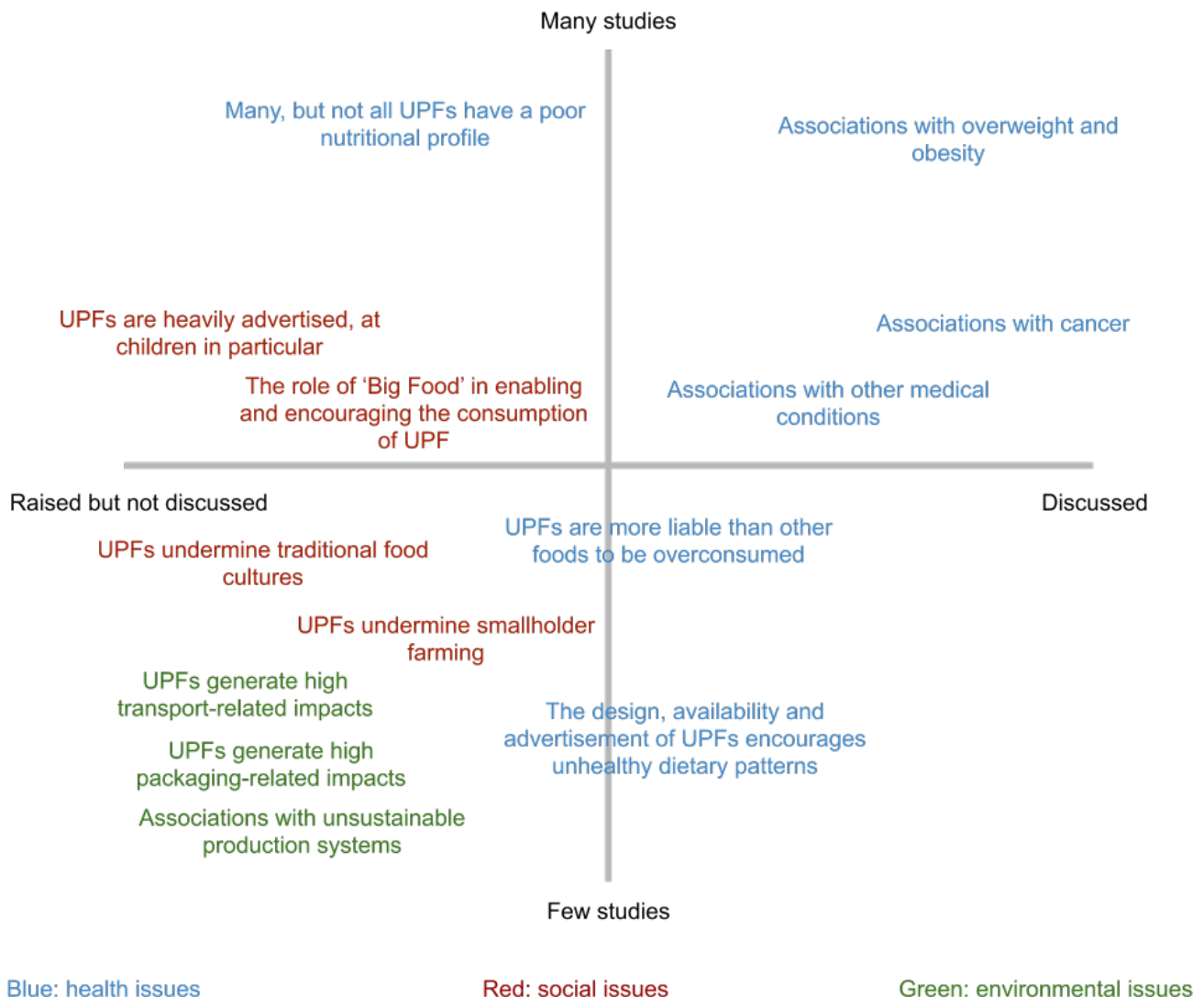


Figure 5: Current research and debate on UPFs mainly focuses on health whereas attention to social and environmental sustainability remains limited. Figure produced by the FCRN, 2019.

Recommended resources

- The commentary in which Carlos Monteiro coined the UPF concept: **Nutrition and health. The issue is not food, nor nutrients, so much as processing**
- A critical review of the UPF concept and a reply from Monteiro and others:
 - Gibney *et al.* (2017): **Ultra-processed foods in human health: a critical appraisal**
 - Monteiro *et al.* (2018): **Ultra-processing. An odd 'appraisal'**
- A commentary by Monteiro *et al.*: **Ultra-processed foods: what they are and how to identify them**
- A randomised clinical trial by Hall *et al.*: **Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain: An Inpatient Randomized Controlled Trial of Ad Libitum Food Intake**

- A commentary by Ludwig *et al.* on the study by Hall *et al.*: [Ultra-Processed Food and Obesity: The Pitfalls of Extrapolation from Short Studies](#)
- A commentary by Monteiro *et al.* on the study by Hall *et al.*: [Freshly Prepared Meals and Not Ultra-Processed Foods](#)
- An [English translation of the 2014 Brazilian dietary guidelines](#), which draws upon the work of Monteiro *et al.*
- The Open Food Facts-website runs a [searchable database](#) with many foods classified according to the NOVA classification.

Glossary

24-hour recalls

Commonly used in nutrition research, a 24-hour recall is a dietary assessment tool that consists of a structured interview or standardised questionnaire in which participants are asked to recall all the food and drink they have consumed during the previous 24 hours. In comparison to other common methods such as food frequency questionnaires, 24-hour recalls provide relatively detailed information about participants' food intakes. Important limitations include the inability to account for day-to-day variations and reliance on participants' ability to accurately remember the food and drink they have consumed.

Big food

Big food is generally used as a term of criticism, to refer to the most powerful global food industry players. Most commonly it denotes large companies from the food manufacturing, processing and retailing sectors, but can also be used to refer to large agricultural producers as well as companies that provide agricultural inputs such as seeds, fertilisers and pesticides.

Cohort study

Commonly used in medical and nutritional epidemiology, a cohort study is a longitudinal study that samples a cohort (a group of people that is defined by having experienced the same event, e.g. birth or graduation, in a selected time period) and follows it over time to investigate people's exposure to certain factors (e.g. the consumption of certain foods) and the occurrence of particular health outcomes. For example, a cohort study may measure the dietary patterns over time of a group of people who were born between 1960 and 1970 to find out which dietary patterns are associated with the development of diabetes or particular cancers. There are two types of cohort studies. Prospective studies follow a cohort of people who differ by certain factors (e.g. smokers and non-smokers) to study which medical conditions appear in what part of the cohort (e.g. after 20 years more smokers than non-smokers have developed lung cancer). Retrospective studies study a cohort after a medical condition (e.g. lung cancer) has occurred in a part of the group to trace back which factors (e.g. smoking) may have contributed to this.

Cold chain

A cold chain is a supply chain or part of a supply chain where products and raw materials are stored or transported at low temperatures (either frozen or refrigerated at a temperature generally lower than 8°C).

Confounding factor

A confounding factor is a factor that influences the relationship between variables that are investigated. In dietary research, for example, a lack of physical exercise may potentially confound the association between the consumption of soda beverages and overweight: when those who drink the most soda beverages are generally more overweight, but also exercise less, the association between the consumption of soda beverages and overweight may be caused partly or entirely by a lack of

exercise. Other common confounding factors include age, gender, whether people smoke or drink alcohol, occupation, educational attainment, or income. Confounding factors are a potential bias in statistical research and may lead to over- or under-estimating the relationship between variables. While theoretically their number can be infinite, statistical research often accounts for a set of known potential confounding factors.

Dietary survey

This term refers to a group of methods that are used to collect food consumption data to study the diets of individuals or groups. Common methods in dietary surveys are food frequency questionnaires, food diaries, and 24-hour recalls. These are often combined with the weighing and analysis of food to determine its nutritional properties. Dietary surveys are sometimes combined with other methods (e.g. the measurement of BMI or blood values) to study the relations between certain dietary patterns and health outcomes. National dietary surveys, conducted and commissioned by national and international health authorities, study national dietary patterns and are often an important input for the development of food policy.

Epidemiology

Epidemiology is a scientific discipline that uses data and mathematical tools to understand the patterns of disease found in human populations and changes therein. It seeks to explain exactly how these patterns are caused in order to identify ways to control and treat health problems.

Food additives

Including colourants, flavour enhancers, sweeteners, emulsifiers, and preservatives, food additives are substances that are added to foods to preserve them or to enhance their taste and appearance. A food additive may have nutritional value but is not normally consumed as a food by itself. Generally not considered to be food additives are herbs, spices and substances such as micronutrients (for example iron or vitamin B12) that are added solely to improve a food's nutritional qualities. Many food additives have a long history and are derived from food ingredients or non-food substances that have traditionally been used for processing foods (e.g. chalk or beetroot juice colourant). Others are produced using chemical synthesis (e.g. aspartame and synthetic vitamins). Some question the health impacts of certain additives from this latter group. Many national and international health authorities regulate additives by banning their use and by defining intake limits.

Food frequency questionnaire

Commonly used in nutrition research, a food frequency questionnaire is a dietary assessment tool that consists of a questionnaire in which participants are asked to answer questions relating to the frequency with which they consumed certain foods and drinks during a selected time period, e.g. a week, month or year. Food frequency questionnaires can be long or short and interviewer- or self-administered. They are commonly used to investigate the dietary patterns of large populations, and unlike 24-hour recalls, they can measure the consumption of foods that are eaten incidentally or occasionally. Limitations of food frequency questionnaires include their reliance on participants' ability to accurately recall the foods and drinks they have consumed over a relatively long period, and the possibility of social desirability bias (e.g. people may over-report their consumption of foods they think are healthy or sustainable).

Food preservation

Food preservation encompasses the processes and techniques that are used to prevent food from spoiling, including canning, pickling, salting, drying, smoking, chilling, fermenting, pasteurising, and the addition of chemicals such as sodium benzoate (which dissolves in food as an acid). These measures inhibit the growth and survival of microorganisms that spoil food. Food preservation can be understood as a form of food processing.

Fortification

Fortification refers to the addition of micronutrients to foods to improve their nutritional quality. For

example, micronutrients such as iron, zinc, or vitamins A and B may be added to rice or white bread. Fortification is seen as a way of improving the nutritional status of a population.

Hydrogenation

Hydrogenation is a chemical reaction between a hydrogen molecule (H₂) and another molecule or element in the presence of a catalyst such as palladium, platinum or nickel. In the food industry, hydrogenation is often used to turn liquid oils into solid fats. The partial hydrogenation of oils is used to produce trans-fats. Hydrogenated fats and trans-fats are contested for their health impacts.

GHGs

GHGs is an abbreviation for greenhouse gases. These include gases such as carbon dioxide, methane, and nitrous oxide, which affect outgoing radiation, leading to global warming.

Intensive agriculture

Often used synonymously with the terms industrial agriculture and conventional farming, IA is generally used to denote farming systems that use modern technologies and economies of scale to maximise yields relative to land use and production costs (e.g. costs of labour, technology, seeds, fertilisers, and pesticides). IA is associated with high use of chemical fertilisers, agrochemicals, and irrigation. This combination of agricultural technologies became common during the Green Revolution in the mid-20th century, and has long been criticised for its high social and environmental impacts.

Life cycle

In life-cycle assessment and carbon footprint analysis, the concept of life cycle refers to the entirety of phases a product or system passes through from its development, through to its use and, eventually, how it is managed as waste. A life cycle is generally understood to start at the growing and harvesting or mining of raw materials and to end when a product is disposed of as waste. While waste management is thought to be a part of a product's life cycle, potential recycling is generally considered to be part of the life cycles of other, new products. For example, the life cycle of a loaf of bread may be thought to consist of the following phases: the growing and harvesting of corn and other ingredients (including pre-production of inputs such as fertilisers), their transport to a bakery, bread production, transport and retail, consumption and waste.

Livelihood

A livelihood is a person's, household's, or group of people's means of making a living. It encompasses people's capabilities, assets, income, and activities that are required for securing the necessities of life, such as food, water, medicine, shelter and clothing.

Macronutrients

Fats, proteins and carbohydrates (starch, fibre, sugar) that are needed for a wide range of bodily functions and processes.

Micronutrients

Micronutrients are minerals (e.g. iron) and organic compounds (e.g. vitamin A) found in food, which the body requires in very small amounts to produce substances such as enzymes and hormones. They are essential for proper growth, development and bodily functioning. Essential micronutrients are those that cannot be synthesised by the body and so must be obtained through diet.

Non-communicable diseases

Non-communicable diseases are diseases which are not passed from person to person. They are often long lasting and generally progress slowly. Examples include cardiovascular diseases, cancer, chronic respiratory diseases and diabetes. Unhealthy diets are one of the major risk factors for non-communicable diseases.

Nutritional epidemiology

A sub-branch of epidemiology, nutritional epidemiology is a field of study that focuses on the distribution and determinants of diseases and other medical conditions in a population. It studies the relationships between dietary patterns, nutrient intake and their impacts upon public health. Common methods in nutritional epidemiology include dietary surveys and cohort studies, by which statistical associations between (say) food consumption and medical conditions such as cancer or obesity are studied.

Nutritionism

Coined by the Australian academic Gyorgy Scrinis and popularised by the US journalist and food writer Michael Pollan, nutritionism is a term used to describe and critique the dominant assumption of much nutrition science research - and often of mainstream dietary recommendations - that it is possible to understand the health implications of individual food products as well as dietary patterns in terms of their micro and macronutrient profiles. From this nutritionist perspective, foods are primarily viewed as interchangeable vehicles for the delivery of specific and isolated nutrients. Criticising 'Big Food' and the food products it provides, users of the concept tend to highlight the role of food in social and cultural life and argue that healthy dietary patterns mostly consist of home-made meals and dishes that are largely based on unprocessed food ingredients. Scrinis also argues that nutritionism has contributed to the food industry's use of reformulation and nutrient fortification, which are aimed at improving a food's nutrient profile.

PAHO-WHO

PAHO-WHO is an abbreviation for the Pan American Health Organisation of the World Health Organisation.

Pandemic

A pandemic is the widespread occurrence (i.e. global or at multiple continents) of a disease during a particular period. Historically, many pandemics have involved infectious diseases that have been spread by viruses such as cholera and flu. Pandemics, however, can both be caused by communicable and non-communicable diseases.

Reconstituted meat

Reconstituted meat is a paste- or liquid-like meat product that is produced from ground meat. Fat and excess water are separated from the meat using a centrifuge or an emulsifier (a machine used to produce the meat into a fine and homogeneous paste or liquid of a desired thickness). Reconstituted meat is mostly used as a basis for pet food and as a supplement in some meat products for human consumption (e.g. chicken nuggets and some sausages).

Reformulation

Reformulation refers to changes food manufacturers make to the production recipes of processed and ultra-processed food products to improve their nutritional profile. Examples of reformulation include replacing sugar with artificial sweeteners (e.g. aspartame or sucralose) to reduce the food's energy content or reducing the amount of salt or saturated fat in a food product.

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