

## Commentary

# Ultra-processed foods: what they are and how to identify them

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### Abstract

The present commentary contains a clear and simple guide designed to identify ultra-processed foods. It responds to the growing interest in ultra-processed foods among policy makers, academic researchers, health professionals, journalists and consumers concerned to devise policies, investigate dietary patterns, advise people, prepare media coverage, and when buying food and checking labels in shops or at home. Ultra-processed foods are defined within the NOVA classification system, which groups foods according to the extent and purpose of industrial processing. Processes enabling the manufacture of ultra-processed foods include the fractioning of whole foods into substances, chemical modifications of these substances, assembly of unmodified and modified food substances, frequent use of cosmetic additives and sophisticated packaging. Processes and ingredients used to manufacture ultra-processed foods are designed to create highly profitable (low-cost ingredients, long shelf-life, emphatic branding), convenient (ready-to-consume), hyper-palatable products liable to displace all other NOVA food groups, notably unprocessed or minimally processed foods. A practical way to identify an ultra-processed product is to check to see if its list of ingredients contains at least one item characteristic of the NOVA ultra-processed food group, which is to say, either food substances never or rarely used in kitchens (such as high-fructose corn syrup, hydrogenated or interesterified oils, and hydrolysed proteins), or classes of additives designed to make the final product palatable or more appealing (such as flavours, flavour enhancers, colours, emulsifiers, emulsifying salts, sweeteners, thickeners, and anti-foaming, bulking, carbonating, foaming, gelling and glazing agents).

**Keywords**  
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Ultra-processed foods already make up more than half of the total dietary energy consumed in high-income countries such as the USA<sup>(1)</sup>, Canada<sup>(2)</sup> and the UK<sup>(3)</sup> and between one-fifth and one-third of total dietary energy in middle-income countries such as Brazil<sup>(4)</sup>, Mexico<sup>(5)</sup> and Chile<sup>(6)</sup>. The average growth in sales of these products amounts to about 1% per year in high-income countries and up to 10% per year in middle-income countries<sup>(7)</sup>.

Population-based studies conducted in several countries, most of them using national dietary intake surveys,

have shown that ultra-processed foods are typically high-energy-dense products, high in sugar, unhealthy fats and salt, and low in dietary fibre, protein, vitamins and minerals<sup>(2–4,6,8–13)</sup>. Experimental studies indicate that ultra-processed foods induce high glycaemic responses and have low satiety potential<sup>(14)</sup>, and create a gut environment that selects microbes that promote diverse forms of inflammatory disease<sup>(15)</sup>. Cross-sectional and longitudinal studies have shown that increases in the dietary share of ultra-processed foods result in deterioration of the

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nutritional quality of the overall diet<sup>(2–4,6–13,16–19)</sup> and increased obesity<sup>(20–23)</sup>, hypertension<sup>(24)</sup>, coronary and cerebrovascular diseases<sup>(25)</sup>, dyslipidaemia<sup>(26)</sup>, metabolic syndrome<sup>(27)</sup>, gastrointestinal disorders<sup>(28)</sup>, and total and breast cancer<sup>(29)</sup>. Avoidance of ultra-processed foods is the ‘golden rule’ of national dietary guidelines issued recently in Latin American countries<sup>(30,31)</sup>.

While much has been published on ultra-processed foods in peer-reviewed journals<sup>(1–24,26–30)</sup>, reports from UN agencies<sup>(32–35)</sup> and in broadcast and written media<sup>(36–39)</sup>, a simple method to identify these products has not yet been made explicit. The present commentary addresses this gap by defining ultra-processed foods within the context of the NOVA food classification system<sup>(40)</sup> and showing how they can be confidently identified.

### Defining ultra-processed foods

Almost all foods are processed to some extent, if only by preservation, and it is therefore unhelpful to criticise foods as being ‘processed’. A number of food classifications have been devised that pay special attention to types of processing. A systematic review has shown that, of these, NOVA is the most specific, coherent, clear, comprehensive and workable<sup>(41)</sup>.

NOVA classifies all foods and food products into four groups according to the extent and purpose of the industrial processing they undergo. It considers all physical, biological and chemical methods used during the food manufacturing process, including the use of additives<sup>(40)</sup>.

A summary of the types and purposes of the industrial processes that define each of the four NOVA groups, shown below, makes it easy to understand the unique features of ultra-processed foods and to appreciate the health concerns associated with their consumption. Full definitions and lists of examples of each of the four NOVA groups are provided in the online supplementary material, Supplemental Table 1.

### Non-ultra-processed food groups

Minimally processed foods, that together with unprocessed foods make up NOVA group 1, are unprocessed foods altered by industrial processes such as removal of inedible or unwanted parts, drying, crushing, grinding, fractioning, roasting, boiling, pasteurization, refrigeration, freezing, placing in containers, vacuum packaging or non-alcoholic fermentation. None of these processes add salt, sugar, oils or fats, or other food substances to the original food. Their main aim is to extend the life of grains (cereals), legumes (pulses), vegetables, fruits, nuts, milk, meat and other foods, enabling their storage for longer use, and often to make their preparation easier or more diverse.

NOVA group 2 is of processed culinary ingredients. These are substances obtained directly from group 1 foods or from nature, like oils and fats, sugar and salt. They are created by industrial processes such as pressing, centrifuging, refining, extracting or mining, and their use is in the preparation, seasoning and cooking of group 1 foods.

NOVA group 3 is of processed foods. These are industrial products made by adding salt, sugar or other substance found in group 2 to group 1 foods, using preservation methods such as canning and bottling, and, in the case of breads and cheeses, using non-alcoholic fermentation. Food processing here aims to increase the durability of group 1 foods and make them more enjoyable by modifying or enhancing their sensory qualities.

Traditional and long-established dietary patterns all over the world, including those known to promote long and healthy lives such as those in Mediterranean countries<sup>(42)</sup>, Japan<sup>(43)</sup> and Korea<sup>(44)</sup>, have been and are based on dishes and meals made from a variety of unprocessed or minimally processed plant foods, prepared, seasoned and cooked with processed culinary ingredients and complemented with processed foods.

### The ultra-processed food group

Ultra-processed foods are formulations of ingredients, mostly of exclusive industrial use, that result from a series of industrial processes (hence ‘ultra-processed’).

Processes enabling the manufacture of ultra-processed foods involve several steps and different industries. It starts with the fractioning of whole foods into substances that include sugars, oils and fats, proteins, starches and fibre. These substances are often obtained from a few high-yield plant foods (corn, wheat, soya, cane or beet) and from puréeing or grinding animal carcasses, usually from intensive livestock farming. Some of these substances are then submitted to hydrolysis, or hydrogenation, or other chemical modifications. Subsequent processes involve the assembly of unmodified and modified food substances with little if any whole food using industrial techniques such as extrusion, moulding and pre-frying. Colours, flavours, emulsifiers and other additives are frequently added to make the final product palatable or hyper-palatable. Processes end with sophisticated packaging usually with synthetic materials.

Sugar, oils and fats, and salt, used to make processed foods, are often ingredients of ultra-processed foods, generally in combination. Additives that prolong product duration, protect original properties and prevent proliferation of micro-organisms may be used in both processed and ultra-processed foods, as well as in processed culinary ingredients, and, infrequently, in minimally processed foods.

Ingredients that are characteristic of ultra-processed foods can be divided into food substances of no or rare culinary use and classes of additives whose function is to make the final product palatable or often hyper-palatable (‘cosmetic additives’). Food substances of no or rare

culinary use, and used only in the manufacture of ultra-processed foods, include varieties of sugars (fructose, high-fructose corn syrup, 'fruit juice concentrates', invert sugar, maltodextrin, dextrose, lactose), modified oils (hydrogenated or interesterified oils) and protein sources (hydrolysed proteins, soya protein isolate, gluten, casein, whey protein and 'mechanically separated meat'). Cosmetic additives, also used only in the manufacture of ultra-processed foods, are flavours, flavour enhancers, colours, emulsifiers, emulsifying salts, sweeteners, thickeners, and anti-foaming, bulking, carbonating, foaming, gelling and glazing agents. These classes of additives disguise undesirable sensory properties created by ingredients, processes or packaging used in the manufacture of ultra-processed foods, or else give the final product sensory properties especially attractive to see, taste, smell and/or touch.

Ultra-processed foods include carbonated soft drinks; sweet or savoury packaged snacks; chocolate, candies (confectionery); ice cream; mass-produced packaged breads and buns; margarines and other spreads; cookies (biscuits), pastries, cakes and cake mixes; breakfast 'cereals'; pre-prepared pies and pasta and pizza dishes; poultry and fish 'nuggets' and 'sticks', sausages, burgers, hot dogs and other reconstituted meat products; powdered and packaged 'instant' soups, noodles and desserts; and many other products (see online supplementary material, Supplemental Table 1).

Processes and ingredients used for the manufacture of ultra-processed foods are designed to create highly profitable products (low-cost ingredients, long shelf-life, branded products) which are liable to displace all other NOVA food groups. Their convenience (imperishable, ready-to-consume), hyper-palatability, branding and ownership by transnational corporations, and aggressive marketing give ultra-processed foods enormous market advantages over all other NOVA food groups. Marketing strategies used worldwide include vivid packaging, health claims, special deals with retailers to secure prime shelf space, establishment of franchised catering outlets, and campaigns using social, electronic, broadcast and print media, including to children and in schools, often with vast budgets. All this explains why ultra-processed foods have been successful in displacing unprocessed or minimally processed foods and freshly prepared dishes and meals – or 'real food' – in most parts of the world<sup>(7,45–47)</sup>.

The nature of the processes and ingredients used in their manufacture, and their displacement of unprocessed or minimally processed foods and freshly prepared dishes and meals, make ultra-processed foods intrinsically unhealthy. The disorders and diseases associated with diets largely made up from ultra-processed foods, and the mechanisms linking these diets to specific diseases, are described elsewhere<sup>(40)</sup>. The displacement of 'real food' by ultra-processed foods is also a cause of social, cultural,

economic, political and environmental disruption and crises. These are also described elsewhere<sup>(40)</sup>.

### Identifying ultra-processed foods

The food manufacturing industry is not obliged to state on food labels the processes used in its products and even less the purposes of these processes. In some cases, this can make confident identification of ultra-processed foods difficult for consumers, health professionals, policy makers and even for researchers.

There is of course no need to examine every food to know whether or not it belongs to the ultra-processed food group. As stated above, and to take a few examples, fresh vegetables, fruits, and starchy roots and tubers are obviously not ultra-processed; nor are pasteurized milk and chilled meat. Plant oils, sugar and salt, typically used in culinary preparations in combination with unprocessed or minimally processed foods, are also not ultra-processed.

It is however not always immediately clear when some specific food products are ultra-processed or not. Examples include breads and breakfast cereals. Here the solution is to examine the ingredients labels that by law must be included on pre-packaged food and drink products.

Industrial breads made only from wheat flour, water, salt and yeast are processed foods, while those whose lists of ingredients also include emulsifiers or colours are ultra-processed. Plain steel-cut oats, plain corn flakes and shredded wheat are minimally processed foods, while the same foods are processed when they also contain sugar, and ultra-processed if they also contain flavours or colours.

Generally, the practical way to identify if a product is ultra-processed is to check to see if its list of ingredients contains at least one item characteristic of the ultra-processed food group, which is to say, either food substances never or rarely used in kitchens, or classes of additives whose function is to make the final product palatable or more appealing ('cosmetic additives').

Food substances not used in kitchens appear in the beginning or in the middle of the lists of ingredients of ultra-processed foods. These include hydrolysed proteins, soya protein isolate, gluten, casein, whey protein, 'mechanically separated meat', fructose, high-fructose corn syrup, 'fruit juice concentrate', invert sugar, maltodextrin, dextrose, lactose, soluble or insoluble fibre, hydrogenated or interesterified oil; and also other sources of protein, carbohydrate or fat which are neither foods from NOVA group 1 or group 3, nor culinary ingredients from NOVA group 2. The presence in the list of ingredients of one or more of these food substances identifies a product as ultra-processed.

Cosmetic additives are at the end of lists of ingredients of ultra-processed foods, together with other additives. As

said above, cosmetic additives include flavours, flavour enhancers, colours, emulsifiers, emulsifying salts, sweeteners, thickeners, and anti-foaming, bulking, carbonating, foaming, gelling and glazing agents. The presence in the list of ingredients of one or more additives that belong to these classes of additives also identifies a product as ultra-processed.

Although information in ingredients labels is not fully standardized in all countries, some of the most frequently used cosmetic additives such as flavours, flavour enhancers, colours and emulsifiers are usually easy to identify in ingredients lists. They are often expressed as a class, such as flavourings or natural flavours or artificial flavours; or their names are followed by their class, such as 'mono-sodium glutamate (flavour enhancer)', or 'caramel colour', or 'soya lecithin as emulsifier'. Other cosmetic additives may be known to consumers, such as certain types of sweeteners like aspartame, cyclamate or compounds derived from stevia. In any case, the UN *Codex Alimentarius* provides a regularly updated list of additives with their functional classes<sup>(48)</sup> as well as an online search facility where both names and classes of additives can be browsed<sup>(49)</sup>.

## Conclusion

Most foods as purchased and consumed are processed to some extent. For this reason, accounts that are critical of 'processed food' are not useful. Diets restricted to unprocessed food would be less diverse and less secure. Foods benefit, and are made more available, when processed by various harmless methods of preservation; and some processes enhance food quality, non-alcoholic fermentation being an example. Traditional and established cuisines all over the world are based on dishes and meals prepared from unprocessed and minimally processed food together with processed culinary ingredients and processed foods. The issue is not processing. It is ultra-processed foods, the fourth group in the NOVA system of food classification.

Ultra-processed foods are not 'real food'. As stated, they are formulations of food substances often modified by chemical processes and then assembled into ready-to-consume hyper-palatable food and drink products using flavours, colours, emulsifiers and a myriad of other cosmetic additives. Most are made and promoted by transnational and other giant corporations. Their ultra-processing makes them highly profitable, intensely appealing and intrinsically unhealthy.

The present commentary shows how to identify ultra-processed foods, and is designed for policy makers, researchers, health professionals, journalists and consumers. Computer software and cell phone apps that scan and interpret food package barcodes should make this identification even easier. A cell phone app created by the

non-profit organization Open Food Facts, based in France, already enables consumers to identify among more than 145 000 packaged products the more than 75 000 that are ultra-processed<sup>(50)</sup>.

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## Supplementary material

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