Background

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The concept of ultra-processed food (UPF) has become the subject of significant debate and controversy, given trends towards increased consumption globally (especially in high-income and upper middle-income countries) and concerns that these trends may be associated with negative nutritional and health outcomes (Zhang and Giovannucci, 2023). Furthermore, there has been significant and growing media attention around UPFs, propelled by high-profile publications with provocative titles, such as ‘Ultra-Processed People: Why do We All eat Stuff That Isn’t Food and Why Can’t we Stop?’ (van Tulleken, 2023).

Evidence of the association between UPF consumption and negative health outcomes is accumulating (see for example Lane *et al*., 2024), with some suggestions that the evidence is sufficient to support the use of the UPF concept to assess the healthiness of foods within the context of the diet as a whole, and to inform the development of new dietary guidelines (see for example Elizabeth *et al* ., 2020). Indeed, there is evidence that many national dietary guidelines refer to the degree to which foods have been processed, if not to UPFs specifically (Koios *et al*., 2022). At the same time, however, there are concerns that many studies do not adequately control for potential confounding factors, such as other

influences on nutritional and health status (Zhang and Giovannucci, 2023). Furthermore, consumer consumption patterns with respect to UPFs have changed over time, including when and where they are eaten, whilst the concept of UPF includes a diversity of foods that vary in their nutritional composition.

The concept of UPF was first proposed as part of a classification of foods according to the level of processing in 2009 (Monteiro, 2009). Since that time, several schemes have evolved that categorise foods according to the level and form of processing (Gibney and Forder, 2022; Sadler et al. 2021; de Araujo et al. 2022; Jones, 2019; Gibney, 2019). Perhaps the most widely referenced scheme, however, is the NOVA classification developed by the Centre for Epidemiological Studies in Health and Nutrition at the University of São Paulo. The NOVA schema (Figure 1) defines a UPF as (Monteiro *et al*., 2018; 2019):

“Formulations of ingredients, mostly of exclusive industrial use, that results from a series of industrial processes”.

As an example of an alternative definition, according to Poti *et al* (2015) a UPF is:

“Multi-ingredient industrially formulated mixtures processed to the extent that they are no longer recognizable as their original animal or plant source.”

It is noteworthy that these definitions of UPF are both complex and rather ‘fuzzy’, in that they include rather imprecise terms such as ‘mostly’, ‘multi’ and ‘series’. It might be expected, therefore, that consumers might struggle with the concept of UPFs and, even more, be unable to reliably differentiate between foods that do or do not fall into the category of UPFs.

Figure 1. NOVA classification of foods

Group	Definition	Examples
Unprocessed (unPF) and Minimally Processed Foods (MPF)	Products e.g. salt, sugar, oils, fats, or other substances are not added to the original food.	Edible parts of plants (seeds, fruits, leaves, stems, roots) or animals (muscle, offal, eggs, milk), and fungi, algae, and water, after separation from nature.

Processed culinary ingredients	Products derived from group 1 or else from nature by processes such as pressing, refining, grinding, milling, and drying.	Processed culinary ingredients include oils, butter, lard, sugar, and salt.
Processed Foods (PF)	Products manufactured by industry, which adds salt, sugar, or another substance to unprocessed food (unPF) to make them stable and more palatable.	Bottled vegetables or legumes (pulses) preserved in brine and vinegar, fruits in syrup, meat products and canned fish, smoked fish, freshly baked bread, and simple cheeses to which salt is added.
Ultra-processed Foods (UPF)	Products involving formulations of ingredients, most of exclusive industrial use, typically created by a series of industrial techniques and processes.	Carbonated soft drinks; sweet, fatty or salty packaged snacks; candies (confectionery); packaged bread and buns, cookies (biscuits), pastries, cakes and cake mixes; margarine and other spreads; sweetened breakfast cereals, fruit yogurt and ‘energy’ drinks; pre-prepared meat, cheese, 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; baby formula.

Source: Petrus *et al*. (2021)

Numerous studies have examined the level, trends and patterns in consumption of UPFs globally (Marino *et al*., 2021; Dicken *et al*., 2023), most often as a percentage of dietary energy intake. Whilst over half of these studies focus on Brazil and the United States, it is possible to establish a comparative picture of

consumption of UPFs across countries, with the United States and the UK consistently having the greatest consumption (exceeding 50% of total energy intake) amongst studied countries, and Italy the lowest (at around 10% of total energy intake) (Marino *et al*., 2021).

Whilst there are appreciable differences in patterns of consumption within countries, it is possible to discern common factors associated with greater consumption of UPFs internationally. Thus, consumption as a percent of energy intake is consistently related to younger age, living in a single person household (and thus being unmarried or living in a single separated or divorced household) and living in an urban area (Marino *et al*., 2021; Dicken *et al*., 2023; Vignola *et al*., 2021). The influence of gender, level of education, income and/or socio-economic status, however, is inconsistent across countries. Other factors found to be associated with higher consumption of UPFs include having obesity (Marino *et al*., 2021), self-reporting of medium or high time scarcity (Djupegot *et al*., 2017), and exhibiting stronger appetite drives when UPFs are observed by consumers (David *et al*., 2017).

Several studies have examined consumption of UPFs in the UK (see for example, Lam and Adams, 2017; Adams and White, 2015; Madruga *et al*., 2022; Rauber et al., 2020; 2021a; 2021b; Onita et al., 2021; Sauza *et al*., 2022; Chavez-Ugalde *et al*., 2024). Across these studies, intake of UPFs amongst adults varies from 53.1% to 67.8% of total energy intake (Marino *et al*., 2021), with an average of 54% (Dicken *et al*., 2023). Recent studies suggest significant consumption of UPFs by younger segments of the UK population. In the study by Chavez-Ugalde, *et al*. (2024), on average UPFs account for 65.9% of energy intake amongst individuals aged 11 to 18 years. In a longitudinal study, the contribution of UPFs to energy intake averaged 46.9% in children aged 21 months, and 59.4% when aged 7 years (Conway *et al*., 2024).

Studies of the UK suggest that consumption has been somewhat stable over the period 2008 to 2016 (Dicken *et al*., 2023). It is noteworthy, however, that Chavez-Ugalde *et al.* (2024) present evidence that consumption by individuals aged 11 to 18 years declined over the period 2008/09 to 2018/19. Across the population, higher consumption of UPF is associated with younger age, male gender, white ethnicity, and lower socio-economic status (Dicken *et al*., 2023).

Whilst there is compelling evidence of widespread and significant consumption of UPFs in the UK, studies in the UK and elsewhere suggest that consumers frequently underestimate their consumption of these foods. For example, in a recent survey across 17 European countries (EiT Food Consumer Observatory,

2024)[1], only 12% of UK survey respondents reported daily consumption of UPF, with 10% reporting consumption five to six times per week, and 21% reporting consumption three to four times per week.[2] In total, 57% of UK respondents claimed that they consumed UPFs less than once or twice per week. In a 2023 survey of UK adults, 62% of respondents claimed that their diet consisted of little or no UPFs (IGD, 2023)[3]. Only 7% of respondents reported that about a half of their diet consisted of UPFs.

[1] Note, the survey results from EiT research referenced here are industry-funded and not academic research.

[2] Note, however, that many consumers struggle accurately to distinguish between UPF and non-UPF (see below), such that self-reporting of UPF consumption is likely to be inaccurate.

[3] Note, the survey results from IGD research referenced here are industry-funded and not academic research.