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Item Type	Article
Authors	Adams, J.;Hofman, K.;Moubarac, J.C.;Thow, A.M.
Citation	Adams J, Hofman K, Moubarac JC, Thow AM. Public health response to ultra-processed food and drinks. BMJ. 2020 Jun 26;369:m2391. doi: 10.1136/bmj.m2391.
DOI	<a href="https://doi.org/10.1136/bmj.m2391">https://doi.org/10.1136/bmj.m2391</a>
Publisher	BMJ Publishing Group
Journal	BMJ
Rights	Attribution 3.0 United States
Download date	2026-03-06 23:36:42
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Link to Item	<a href="https://www.bmj.com/content/369/bmj.m2391">https://www.bmj.com/content/369/bmj.m2391</a>

# Public health response to ultra-processed food and drinks

Growing evidence confirms a link between consumption of ultra-processed food and drinks and non-communicable diseases. **Jean Adams and colleagues** explore the implications for public health action

People have used food processing to make food safe, palatable, and longer lasting since prehistoric times.<sup>1</sup> Common modern food processing to achieve similar safety, palatability, and preservation goals includes pasteurisation of milk to reduce harmful microbes, milling of wheat to remove indigestible components, and canning fruit to increase its shelf life. However, in the past 100 years industrial techniques have been increasingly used to produce novel ultra-processed food and drink products.

Ultra-processed foods (a term which we use to include ultra-processed drinks in this article) tend to be highly palatable, convenient, shelf stable, and affordable, and are often marketed in ways that appeal to children.<sup>2,3</sup> These characteristics may explain why, in high income and, increasingly, in middle-income countries, ultra-processed foods consistently account for more than 50% of dietary energy.<sup>4,6</sup> However, evidence is growing that consumption of ultra-processed foods

is associated with increased risk of non-communicable disease, presenting a public health challenge.

Several definitions and classifications of food processing exist, but in this article we use the Nova system (table 1). Despite some debate,<sup>8,9</sup> Nova is emerging as the most conceptually coherent, operationally useful, and widely used in dietary public health research and policy.<sup>10</sup>

## Global changes in eating patterns

Consumption of ultra-processed foods varies globally. In 2016, 271 kg of ultra-processed foods were sold per capita in the North America and Australasia region compared with only 52 kg per capita in Africa.<sup>11</sup> However, whereas sales were falling or stagnant in the regions with the highest consumption (Western Europe and North America and Australasia) sales of ultra-processed foods increased in all other regions in 2002–16—by a minimum of around 20% in the Latin and Caribbean region to a maximum of around 90% in South and South East Asia.<sup>11</sup> Studies in high income countries have reported an inverse association between consumption of ultra-processed foods and markers of socioeconomic position,<sup>12–14</sup> but the reverse has been reported elsewhere.<sup>15</sup> This probably reflects international differences in the affordability of ultra-processed foods.<sup>5</sup>

Many companies producing ultra-processed foods have a global presence,<sup>16</sup> and as market saturation occurs in higher income countries, there is evidence of “problem shifting” to lower income countries, which have become a growth market. For example, it has been estimated that Coca-Cola, which makes at least three quarters of its global sales from ultra-processed drinks,<sup>17</sup> invested more than \$1bn (£0.8bn; €0.9bn) a year in each of China, Brazil, Mexico, and Africa in the early 2010s.<sup>18</sup>

## Non-communicable disease risk

Evidence is growing that greater consumption of ultra-processed foods is associated

with increased risk of obesity and non-communicable diseases. For example, a longitudinal analysis of country level data from 2002 to 2016 found a positive association between sales of ultra-processed foods and mean body mass index (BMI) in men, and between ultra-processed drinks sales and mean BMI in both men and women.<sup>11</sup> This is consistent with the findings of a recent randomised controlled trial of unrestricted ultra-processed versus unprocessed diets (matched for total energy, macronutrients, sugar, salt, and fibre) where participants randomised to the ultra-processed diet consumed an average of 508 kcal more a day than those on the unprocessed diet and gained a mean of 0.9 kg over two weeks.<sup>19</sup> Despite attempts to match on energy density, ultra-processed diets had a higher energy density indicating this may be an important mechanism of their effects on health.

Several prospective cohort studies have also reported associations between ultra-processed foods consumption and non-communicable disease outcomes.<sup>20</sup> The largely consistent signal from these different study designs using different definitions of both exposure and outcome strengthens the claim that that greater consumption of ultra-processed foods is associated with increased risk of non-communicable disease.

One harmful aspect of ultra-processed foods may be their nutritional profile. These products tend to be higher in energy density, free sugars, sodium, and saturated fats than less processed alternatives.<sup>22</sup> Furthermore, positive associations have been reported between the percentage of total dietary energy from ultra-processed foods and higher intake of free sugars, saturated fats, and sodium; inverse associations are reported with consumption of fibre and fruit and vegetables.<sup>23</sup> It has also been proposed that ultra-processing is itself harmful to health.

## Factors encouraging overconsumption

Ultra-processed foods and drinks are less satiating than less processed alternatives,

## KEY MESSAGES

- Ultra-processed food and drinks are products that are formulated from ingredients resulting from industrial processes
- Growing evidence associates greater consumption of ultra-processed foods with increased risk of non-communicable diseases
- Public health efforts should focus on wider determinants of consumption rather than selected nutrients or individual behaviours
- Structural interventions are required to increase access to convenient, palatable, and affordable minimally processed foods and dishes
- Reducing consumption will require simultaneous changes to supply and demand at local, national, and transnational levels

**Table 1 | Nova classification of foods based on the extent and purpose of processing<sup>7</sup>**

Group	Name	Definition	Example products
1	Unprocessed or minimally processed foods	Edible parts of plants or animals and fungi, algae, and water; or these foods altered by processes such as removing inedible or unwanted parts, drying, crushing, grinding, fractioning, filtering, roasting, boiling, pasteurisation, refrigeration, freezing, placing in containers, vacuum packaging, or non-alcoholic fermentation	Fresh, squeezed, chilled, frozen, or dried fruits and vegetables, including pulses; grains, grits, flakes, or flour; meat, poultry, fish, and seafood; couscous and polenta; tree and ground nuts and other oil seeds without added salt or sugar; spices and herbs; plain yoghurt; tea and coffee
2	Processed culinary ingredients	Substances obtained directly from group 1 foods or from nature by processes such as pressing, refining, grinding, milling, and spray drying	Salt; sugar and molasses; honey and syrup; vegetable oils; butter and lard; starches extracted from corn and other plants
3	Processed foods	Relatively simple products made by adding group 2 substances to group 1 foods. Processes include various preservation or cooking methods and, in the case of breads and cheese, non-alcoholic fermentation	Canned or bottled vegetables and fruits; salted or sugared nuts and seeds; salted, cured, or smoked meats; canned fish; fruits in syrup; cheeses and unpackaged freshly made breads
4	Ultra-processed food and drink products	Formulations of ingredients, mostly of exclusive industrial use, that result from a series of industrial processes, many requiring sophisticated equipment and technology. These include the fractioning of whole foods into substances, chemical modifications of these substances, assembly of unmodified and modified food substances using industrial techniques such as extrusion, moulding and pre-frying, frequent application of additives whose function is to make the final product palatable or hyper-palatable (cosmetic additives), and sophisticated packaging, usually with synthetic materials	Carbonated drinks; ice cream, chocolate, confectionery; mass produced packaged breads and buns; margarines and spreads; biscuits, pastries, cakes, and cake mixes; breakfast cereals, cereal and energy bars; energy drinks; milk drinks, fruit yoghurts, and fruit drinks; meat and chicken extracts and instant sauces; infant formula milks and other baby products; health and slimming products such as meal substitutes; many ready to heat products, including pies, pasta dishes, and pizza; poultry and fish nuggets, sausages, burgers, and hot dogs; and instant soups, noodles, and desserts

which can lead to overconsumption.<sup>19</sup> However, wider factors may also encourage consumption. Ultra-processed foods offer convenience for many consumers. Shelf stable products reduce the need for refrigeration or frequent grocery shopping.<sup>24</sup> Sealed packages can increase perceptions of safety.<sup>25</sup> Those that are ready-to-eat reduce the time and fuel costs of cooking and the need for adequate kitchen facilities.

Food marketing also influences food preferences, purchasing, and consumption— particularly in children,<sup>26</sup> and ultra-processed foods are often marketed in ways that appeal specifically to children.<sup>23</sup> Since ultra-processed foods tend to have longer shelf lives than less processed foods there is less risk of waste for manufacturers and retailers. This allows them to afford very small profit margins on individual sales, but they must sell substantial volume to generate appropriate revenue—hence the need for marketing. Furthermore, increasing global market concentration, where a small number of brands dominate the global market, means that marketing may be the only way that manufacturers of ultra-processed foods can differentiate their products.<sup>16 27</sup>

Although further work is needed to clarify these potential mechanisms of harm to health from ultra-processed foods, public health action could still be justified in the meantime.

**Over-reliance on nutrient reformulation**

One common approach to addressing the concentration of less healthful characteristics in ultra-processed foods is what has been termed nutrients-to-limit reformulation.<sup>28</sup> This focuses on incentivising the reduction of specific nutrients such as

unhealthy fats, free sugars, or sodium in targeted products. For example, the sliding scale design of South Africa’s health promotion levy, which taxes drinks based on their sugar concentration, has resulted in reduced sugar concentration of drinks.<sup>29</sup> Other successful strategies include voluntary salt reformulation targets in the UK,<sup>30</sup> mandatory calorie labelling in restaurant chains in the US,<sup>31</sup> and marketing bans for foods not meeting formulation targets in Chile.<sup>32</sup>

Many of these reformulation strategies may also be doing double duty by limiting some of the wider factors driving consumption of ultra-processed foods. For example, Chile’s marketing restrictions on foods not meeting formulation targets both reduced children’s exposure to marketing of these products<sup>33</sup> and prompted reformulation.<sup>32</sup>

Despite some success, nutrients-to-limit reformulation is only likely to produce public health benefits in places with minimal growth in the ultra-processed foods market, such as Europe and the US.<sup>28</sup> Elsewhere, any marginal improvements achieved by reformulation may be outweighed by rapid increases in total consumption of ultra-processed foods. Furthermore, such reformulation can lead to perverse effects with, for example, a focus on reducing unhealthy fats leading to an increase in free sugars.<sup>34</sup> Similarly, the current focus on reducing free sugars may lead to increases in low calorie sweeteners. If ultra-processing is in itself harmful to health then modifying nutrient content will do nothing to address this problem.

Nutrients-to-limit reformulation reflects a widespread focus of dietary public health policy on nutrients, rather than foods and

food practices. However, if ultra-processing drives overconsumption partly through wider, non-biological, mechanisms, intervening in these mechanisms could lead to greater global improvements in health than a focus on the biological harms of individual nutrients. Rather than determining how we can make incremental changes in the nature of ultra-processed foods, global public health nutrition policy should focus further on policies that promote widespread access to convenient, palatable, and affordable minimally processed foods and dishes.

**Whole food reformulation**

An alternative to nutrient specific reformulation is whole food reformulation—or development of less processed alternatives. Many ultra-processed foods already have less processed alternatives (eg, canned fruit instead of processed fruit “leathers”; rolled whole oats instead of ultra-processed breakfast cereals), indicating that this is potentially viable. Given the importance of the food industry to the global economy, agricultural and economic incentives that support development of different products while maintaining profits will be important, not least because employment is an important influence on diet and health.

A key concern around whole food reformulation is affordability.<sup>28</sup> Currently, less processed alternatives are often more expensive than ultra-processed foods<sup>35</sup>. One potential approach to maintaining affordability is through greater use of fiscal levers. The cost of ultra-processed food and drinks, and their ingredients, can be increased by increasing taxes and decreasing subsidies on these products.

Similarly, the cost of less processed alternatives, and their ingredients, can be decreased by increasing subsidies and decreasing taxes. Many countries, for example, have introduced consumer facing taxes on sugar sweetened beverages. A recent systematic review found that these are associated with significant reductions in consumption of taxed drinks and non-significant increases in untaxed drinks.<sup>36</sup> Altering current tax and subsidy structures for food producers and manufacturers could further support whole food reformulation. For example, subsidies on corn production in the US have been implicated in the widespread use of cheap high-fructose corn syrup in ultra-processed foods.<sup>37</sup>

### Moving from home prepared to hand prepared

Reducing consumption of ultra-processed foods is now part of national dietary guidance in Brazil and Canada.<sup>38,39</sup> A core stated strategy to achieve this in both cases is greater reliance on home preparation of food. However, a greater focus on “hand prepared” food, irrespective of whether it’s prepared at home, may be more realistic.

Evidence shows that greater consumption of home prepared food is associated with improved dietary intake,<sup>40</sup> but less is known about how to increase food preparation at home.<sup>41</sup> Most interventions assume a knowledge or skills deficit and focus on cooking demonstrations and classes. However, there are many other reasons why people do not prepare more food at home, including lack of time, poor access to affordable ingredients and adequate kitchen facilities, high costs of cooking fuel, and preferences for ultra-processed foods.<sup>25,40</sup> Furthermore, home food preparation remains highly

gendered<sup>40</sup> and any attempts to increase it may fall disproportionately on women.

An alternative to greater reliance on home food preparation is greater availability of affordable and nutritious hand prepared food—that is, food prepared by hand from less processed ingredients but not necessarily in the home. Affordable and nutritious are important—not all hand prepared food is nutritious<sup>42</sup> or made from less processed ingredients and hand prepared food needs to be similarly priced to ultra-processed foods.

### Strategies to increase consumption of hand prepared food

Potential strategies to increase availability of affordable, nutritious hand or home prepared food can be considered at the household, community, retail, and national level (table 2). Although many of these strategies focus on increasing the supply of handmade food, they are also likely to help increase the perceived value of this food, thus driving demand.

At the household level, meal kits providing premeasured ingredients and illustrated recipe cards may support home food preparation by reducing the time, energy, and motivation needed to cook and do the associated planning and shopping. The potential of recipe boxes as a dietary public health intervention is largely untested. Boxes in Australia provide contents that could be further improved to maximise healthfulness but are prohibitively expensive for many (AU\$11.65; £6.40, €7.20; \$8 per serving).<sup>43</sup>

“Quick and easy” recipes are often seen as a solution to the reported lack of time for home food preparation. But it may be more effective to increase the amount

of predictably available time through maximum working hour mandates, stable employment contracts, and regular working schedules. Better access to affordable ingredients (through tax and subsidy strategies), adequate kitchen facilities (through building codes), and affordable cooking fuel could overcome other known barriers to home food preparation.

Within communities, various meal sharing strategies have been proposed to reduce the individual effort required to access hand prepared food. These include taking turns to prepare meals for large groups in central facilities, and meal sharing services where “spare” portions are offered to neighbours.<sup>44</sup>

Retailers could also offer more nutritious and affordable food. Food vendors are a common source of affordable and convenient handmade food in low and middle income countries, but the food is often of poor nutritional quality. Recent efforts to improve the nutritional quality of street food show some promise.<sup>45</sup> Supermarkets are an important source of ingredients, but they also sell ultra-processed foods, and in some places this is their predominant offer.<sup>25</sup> Supermarkets could be encouraged to move away from ultra-processed foods—for example, by mandatory requirements to report sales of ultra-processed foods as a proportion of all sales.<sup>46</sup>

At the national level, food procurement policies could be used to shape the food served in public sector establishments such as schools, hospitals, and government offices.<sup>47</sup> These could be focused on favouring hand prepared food over ultra-processed food, although enforcing this may be challenging in some places.

**Table 2 | Potential strategies to increase consumption of hand prepared food**

Mechanism of action	Potential strategy
Household	
Decrease time burden of preparing food at home	Affordable, nutritious meal kits
Increase household supply of predictable time	Maximum working hour mandates
	Regular working schedules
	Stable employment contracts
Increase affordability of less processed foods and ingredients	Consumer facing taxes and subsidies
	Producer and manufacturer facing taxes and subsidies
Increase access to adequate cooking facilities	Building codes incorporating adequate kitchen facilities
Increase affordability of cooking fuel	Fuel price controls
Communities	
Increase availability of affordable, nutritious hand-prepared food	Community kitchens and meals
	Phone based apps to share spare meal portions
Retailers	
Increase availability of affordable, nutritious hand prepared food	Support use of less processed ingredients by street food vendors
	Mandate reporting of ultra-processed foods sales as a proportion of all sales
National	
Increase availability of affordable, nutritious hand prepared food	Food procurement policies

### Synergistic actions

We have described a range of strategies for rebalancing the availability, affordability, and consumption of ultra-processed foods and less processed alternatives. These recognise both the biological and wider mechanisms of harm of ultra-processed foods and often address both simultaneously. Few of them are novel, indicating that ultra-processed foods do not pose a particularly unique challenge to public health. However, the lens of ultra-processed foods offers an opportunity for reconceptualising the policy problem of poor nutrition in a way that strengthens the imperative to deploy structural strategies, rather than simply continuing with reformulation, education, or motivational strategies. It may also help researchers and policy makers redefine outcomes of interest. Many structural interventions with the potential to improve dietary public health are likely to affect intake of many different foods and nutrients.<sup>48</sup> Evaluating the impact of these interventions on ultra-processed food intake is one way to capture these broad effects.

It is unlikely that any single intervention will achieve substantial change. Instead simultaneous action in multiple areas may lead to potentiation of effects. For example, changes to supply and demand cannot be considered independently. Supply side changes in what food is made financially (through fiscal interventions), cognitively (through changes in food marketing), and physically (through changes in what food is displayed in supermarkets) available to consumers will only be economically viable if demand side change leads to consumers placing greater value on hand prepared food. Similarly, the economic influences of changing demand will be felt by food producers only if there are some early supply changes so that consumers have something different to demand.

The global presence of many ultra-processed foods companies further emphasises the need for coordinated action not just within, but also between, countries. There is a real risk that effective action to reduce ultra-processed foods sales in high income countries leads to efforts to build compensatory growth in poorer nations. The comprehensive action we have proposed can be powerfully supported by global policy actors such as the World Health Organization. Recommendations that support, for example, whole food approaches to reformulation, consideration of community food facilities in urban design, and protection of policy space

for strong nutrition policy interventions such as taxes and labelling in trade and investment agreements would create an enabling environment for such action.

Increasing awareness of the health harms of ultra-processed foods provides the opportunity for a shift in global dietary public health policy away from a strict focus on individual nutrients and dietary behaviours, towards the wider social, economic, commercial, and political drivers of the overproduction and overconsumption of some types of food over others. This approach should also ensure that the most vulnerable and food insecure also benefit. Coordinated action at local, national, and transnational levels will be required to seize these opportunities and equitably improve dietary public health.

**Contributors and sources:** JA leads publicly and charitably funded research on population level influences on, and interventions with the potential to improve, dietary public health. KH leads a public health research to policy unit focused on “best buys” and priority setting to improve health outcomes. J-CM is trained in anthropology, public health, and nutrition. He contributed to the development of the Nova system and has applied it to monitor consumption of ultra-processed food in Canada and globally and assess its impact on diet quality and human health. He also works on the commercial determinants of health and public policies for healthy and sustainable food systems. AMT leads a programme of research on nutrition policy; she has published widely on policy analyses and the political economy of increasing consideration of nutrition in food system policy making. The article is based on the authors’ collective professional experience and review of material in the public domain. JA led the drafting of the article and all authors contributed to developing the arguments, researching the literature, providing comments and edits on earlier drafts, and approved the final version. JA is guarantor.

**Competing interests:** We have read and understood BMJ policy on declaration of interests and have the following interests to declare: JA is funded by the Centre for Diet and Activity Research (CEDAR). CEDAR is a UK Clinical Research Collaboration Public Health Research Centre of Excellence, with funding from the British Heart Foundation, Cancer Research UK, Economic and Social Research Council, Medical Research Council (MRC), National Institute of Health Research (NIHR) and Wellcome Trust. JA has been a member of panels advising governmental and charitable organisations. KH has been a member of several ministerial task teams and national health committees and is a fellow of the Academy of Science of South Africa (ASSAf). J-CM helped develop the Nova system and has worked as a consultant for the Food and Agriculture Organization of the United Nations and PAHO. He is a member of the WHO Nutrition Policy sub-Group of the Nutrition Guidance Advisory Group, which is tasked with developing formal policy guidance on nutrition for all member states.

**Provenance and peer review:** Commissioned; externally peer reviewed.

This article is one of a series commissioned by *The BMJ*. Open access fees for the series were funded by Swiss Re, which had no input into the commissioning or peer review of the articles. *The BMJ* thanks the

series advisers, Nita Forouhi, Dariush Mozaffarian, and Anna Lartey for valuable advice and guiding selection of topics in the series.

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Cite this as: *BMJ* 2020;369:m2391  
<http://dx.doi.org/10.1136/bmj.m2391>