

Scientific Critique of NOVA

The NOVA classification system assesses foods and drinks based on the extent of processing. Some foods are classified as ultra-processed due to the type and number of processing methods and the use of certain ingredients.

However, to date, there is no scientific evidence that the level of processing foods and drinks undergo determines the nutritional content or value of the final product. Classifying and legislating food based on the level of processing is not a scientifically sound approach to food policy and would lead to negative outcomes for our food systems.

The Australian Food and Grocery Council (AFGC) has reviewed* a scientific critique of FoodDrinkEurope (FDE)**, added new references, and modified the content to the Australian context. The review comprises more than 30 independent academic scientific papers that critique NOVA and highlight the main arguments.

Below is a collection of counterarguments, based on five key areas, to the use of NOVA classification of food processing as a basis of food policy or food regulation. Each argument is derived from independent, peer-reviewed academic scientific research.

Key areas

1. **NOVA Classification – definitions**
2. **Science - study design, health outcomes, hyper-palatability, addiction**
3. **Preventive health – reformulation, policy, sustainability**
4. **Misconceptions – additives, contaminants**
5. **Future work – research**

1. NOVA Classification – definitions

Classifications are ideologically biased

The food industry acknowledges that some processed foods can be further improved nutritionally, and the food industry continues its efforts to improve them where possible. Foods produced by the industry facilitate everyday life and contribute to food safety, health and pleasure¹.

The 'quality' of food matters. When composing a healthy diet, it is the quality and quantity of both processed and unprocessed foods which is critical². Processing and the nutritional value of a food do not have a linear relationship and these concepts need to be dissociated³.

Classifying foods according to their assumed 'purpose', including their design to be, for example, 'highly profitable', 'intensely appealing' or 'convenient' is subjective, and has been suggested to reflect an ideological bias against modern food production systems^{4 5}.

There is no evidence that foods that are unprofitable, unpalatable, expensive or inconvenient are linked to better health outcomes⁴.

No universally accepted classification scheme or definitions

Several classification schemes have been proposed and used to classify foods by various degrees to which they are processed^{3 6}.

There is a lack of a universally accepted definition of high or ultra-processed foods (UPFs), highlighting the different perspectives on which food properties are considered to affect the degree of food processing. The schemes are inconsistent in their associations with nutrients which form the basis of most nutrition guidelines⁶.

The different schemes are inconsistent in their associations with health outcomes⁴, which suggests the basic concept of high or ultra-processing of foods is unlikely to be the major explanatory factor responsible⁵.

Any definitions and schemes should be based on scientific evidence concerning any impact of food processing on health and thus better aligned on health outcomes.

Lack of validated dietary intake methods and risk of divergent classification

The classification schemes post-date most methods of estimating dietary intake (usually with food-frequency questionnaires and 24-h dietary recall), which have not been specifically validated for estimating processed food intake and are often applied on a post-hoc basis i.e. without adequate information to classify products. In addition, existing food composition databases do not contain complete information on ingredients or processing of foods³. Thus, such data should be considered with caution^{7 8}.

Due to the subjective nature of the classification schemes and caution regarding the validity of dietary assessment of processed intake, there is a high risk of discrepancies in classifying foods by researchers and consumers^{1 9}.

Few studies report adequate detail on the method used to classify foods or the level of agreement between coders⁴. Thus, consistency in classification is low on food assessed by nutrition experts¹⁰ and consumers¹¹.

Classifications are too broad and not based on scientific evidence

The classifications are diverse, based on the extent and nature of change in a food from its original form, including changing inherent properties of foods, the addition of ingredients, as well as considering the place of processing, and the purpose of processing. Furthermore, the classifications assume that most food processing is deleterious for health and are hypothesis-driven rather than derived from strong scientific evidence i.e. studies using NOVA to support claims made by the NOVA classification itself may represent a circular argument ³.

Without scientific evidence for adverse effects of specific ingredients or processing methods, the ultra-processed category may be too broad - covering a high proportion of energy sources (up to 60% in some developed countries) and approximately 10-12 different food groups with a wide and diverse nutrient composition^{4 12}.

Only a single randomised controlled trial has been undertaken to date¹³ indicating unrestricted consumption of a diet high in ultra-processed foods may cause greater energy intake and weight gain, compared to a diet low in ultra-processed foods.

Further studies are warranted to repeat the findings while addressing the study limitations and informing on specific properties of processed foods that may result in adverse health outcomes ⁴.

Processed foods or UPF consumption patterns are not all adversely associated with health

An increasing number of observational studies show inconsistent associations (some positive, others negative) between intake of sub-categories of ultra-processed foods or specific dietary patterns of ultra-processed foods consumption and health outcomes. This suggests that the overall concept of ultra-processed foods is flawed^{14 15 16 17 18}.

Based on scientific evidence and consensus, some processed foods and those described as ultra-processed are recommended in dietary guidelines around the world^{5 19}. Removal of processed foods or advising against consumption of ultra-processed foods which are associated with a reduced risk of a health outcomes could have an unintended consequence and pose a health risk⁴. Foods that are adversely associated with health outcomes are addressed by nutrient or food-based dietary guidelines^{20 21}.

Nutrient-dense products such as whole grain foods and dairy products – both of which may be fortified – can be found within the ultra-processed foods category. Mandatory fortification of specific foods has improved nutrient intakes in populations and yet all foods with added nutrients are considered ultra-processed foods^{4, 19}.

Avoidance of ultra-processed foods could decrease intakes of whole grains, dietary fibre and certain micronutrients such as thiamine, folate, calcium and iodine^{19, 32, 36}. A recent study showed that a carefully chosen dietary pattern when predominantly based on ultra-processed foods could achieve a high diet quality score (and above the population average diet quality score) and contain adequate amounts of most macro- and micronutrients³⁷.

2. Science - study design, health outcomes, hyper-palatability, addiction

Epidemiology studies limited by reverse causality

Results of observational studies are subject to residual and unmeasured confounding.

Authors have reported clear differences in a wide range of demographic, socioeconomic and behavioural characteristics between high and low ultra-processed foods consumers²². For example, in one study higher ultra-processed foods consumers were younger, with higher body mass index, lower socio-economic status, undertaking less physical activity, and with total intakes of energy, sodium, carbohydrate and total fat increasing with increasing ultra-processed foods consumption²³. These factors, in addition to factors not measured or reported in such studies, impact the results of observational studies.

A review of systematic reviews investigating associations between ultra-processed foods consumption and health outcomes reported a high risk of bias and flawed reporting quality which required significant improvement to inform health policies more reliably²⁴.

Biased results in epidemiological studies based on nutrient energy, diet quality and patterns

The classification of foods and drinks termed ultra-processed are often energy-dense and high in saturated fats, added sugars and sodium. It is therefore not surprising that this category is linked to adverse health outcomes and thus associations are likely biased⁴.

Results of observational studies that have attempted to control for nutrient intake or diet quality are inconsistent regarding the health risks of ultra-processed foods^{4,6}. Further research is needed to understand if or to what extent any associations between ultra-processed foods and body weight or health outcomes are confounded by the energy and/or nutrient content of these classified foods, or indeed dietary patterns or other confounding factors^{4,6}.

Information on diet is usually only measured at baseline in cohort studies with long-term follow-ups, whereas dietary intake, including formulation of foods and drinks, may have changed over time, limiting the interpretation of results²².

Given the small size of associations, the risk of confounding, and the impossibility of correcting for all confounders, there is a need to move away from observational evidence that cannot establish causality to higher-quality controlled feeding studies to establish whether the relationship between ultra-processed foods consumption and health is independent of diet quality^{5,12}.

Any addition of elements of processing to nutrient-based classification schemes should be based on strong scientific evidence.

Lack of evidence for food 'processing' mechanisms, independent of diet quality and health outcomes

There is currently no single mechanism that can explain associations between consuming foods deemed ultra-processed foods and the diverse range of health outcomes reported in the literature, which presents a research challenge⁴.

Numerous factors are known to influence energy intake, including but not limited to, eating rate, protein content, energy density, and oro-sensory properties such as texture and palatability^{3 25}.

Further research is needed to uncover which, if any of these factors, are responsible for any effect in addition to any possible role of non-nutritive components, such as additives, on metabolic outcomes⁴.

Effect of processing on palatability and tastes requires further evidence

There is no clear evidence for a heightened hedonic (feeling of pleasure) response when consuming ultra-processed foods⁴, and current research does not support that the palatability of processed foods drives overconsumption¹³.

However, there is some secondary evidence that certain pairings of nutrients termed 'hyperpalatable' (fat and sugar, fat and sodium, carbohydrates and sodium) may be associated with ad libitum (as much as desired) energy intake when they exceed objective thresholds²⁵. Further research is being undertaken which will inform on this concept.

There is also no clear empirical evidence from clinical trials for a disproportionate contribution of specific tastes of ultra-processed foods in promoting excessive daily energy intakes^{6 26}. Although there is some evidence that certain taste combinations may be associated with indices of body weight, this evidence does not include reference to whether the foods would be considered 'processed' or not^{26 27} and 'taste-nutrient' relationships appear to be maintained across all categories of processed foods²⁶.

Other preliminary evidence suggests the degree of processing of the food (as indicated by NOVA classification) in a diet did not appear to alter salt and sweet taste preferences and sensitivity²⁸.

A rigorous appraisal of the evidence relating to food processing impacting food palatability and/or affecting taste-nutrient signals and thereafter food intake is needed⁶.

Effect of processing on texture and matrices requires further evidence

The disruption of food matrices (food's physical structure) from processing in ultra-processed foods on health requires further research. As effects can be both favourable and unfavourable¹.

Recent intervention studies support that hard- versus soft-textured food results in lower food and energy intake, with slower eating rates, independent of processing level, energy density and palatability^{29 30}. In the sole study that reported an ultra-processed foods diet resulted in higher energy intake, the rate of energy intake was higher in the ultra-processed foods versus the unprocessed condition¹³. This may have resulted from differences in texture and/or energy density of foods selected on each diet. Research is underway which will further inform on this concept and whether foods can be processed to decrease the rate of energy intake.

Dismissal of established knowledge

The NOVA classification dismisses decades of nutrition research on the established relationship between nutrients and health — a widely accepted scientific approach. Thus, the classification does not build upon the accepted knowledge^{4 31}.

3. Preventive health – policy, reformulation, sustainability

Important criteria required for dietary guidance are ignored

The design of any food processing classification scheme needs to consider its intended policy use⁶. NOVA fails to demonstrate the criteria required for dietary guidance: understandability, actionable, affordability and safety³². There is an emerging consensus that classifications based on processing, such as NOVA, are not fit for purpose i.e. to inform food policy or provide dietary guidance^{3 6 12}

NOVA classification could hamper relevant innovations in sustainable solutions

Guidelines based on food processing may be misinterpreted as meaning that processing in itself is bad. Such consumer rejection could hamper sustainable innovations that address a more environmentally and socially sustainable food system³.

The impact of ultra-processed foods on greenhouse gas emissions is not greater than that of less processed alternatives. Advancements in food processing technologies can affect this source of dispersion that generates a significant impact on the entire supply chain, and thereby offset the potential threat to sustainability and biodiversity⁸.

Risk of policymakers developing policies not based on scientific consensus

Some countries' dietary guidelines (e.g. Brazil, India, and regions such as Flanders, Belgium) refer to food processing and advise avoiding/ limiting ultra-processed foods consumption. However, other scientific advisory organisations consider the current evidence should be viewed with caution due to uncertainties regarding the quality of the evidence²⁰, and with observed associations considered to be already covered by existing nutrient and food-based recommendations^{20 21}.

Lack of recognition of the benefits of reformulation

Authors of the NOVA classification do not accept the reformulation of products as a solution to improve the nutrition of the food supply³³. Product reformulation policies have reduced levels of 'nutrients to limit', including reducing energy density of products such as lower-fat milk, low-fat spreads, pre-portioned energy-controlled meals, and zero-energy beverage^{4 31}. Some authors advocate that reformulation, rather than elimination, might have a more meaningful impact on improving the nutritional quality and health on a population level^{34 35}.

The effect on food security requires further evidence

There is no scientific evidence on the way (i.e. mechanism) by which ultra-processed foods might affect food security and maintain the sustainability of the food system^{31 32 35}. It has been shown that a narrow range of food choices may lead to dietary inadequacies. Avoidance of ultra-processed foods could decrease intakes of whole grains, dietary fibre and micro-nutrients such as thiamine, folate, calcium and iodine^{19, 32 36 37}. This has implications for the variety of food choices and in turn food security, a particular concern in elderly people (and other vulnerable groups).

4. Misconceptions – additives, contaminants, and home-cooked foods

Distrust of added ingredients, additives and contaminants in UPFs

Studies referring to the NOVA classification mention contaminants such as acrylamide or polycyclic hydrocarbons as a negative effect of ultra-processed foods. However, these contaminants can be produced at any level of processing, regardless of whether processing is undertaken at home or by industry. Industrial processes will have a higher degree of control over the production of such chemicals^{1 5 38}.

The same is true of contaminants such as pesticide residues, antibiotics, heavy metals, mycotoxins, or packaging migration chemicals. These contaminants are not inherent to ultra-processed foods, and the classification provides no information on their presence in any of the categories of the classification¹. Conversely, there are examples where food processing reduces exposure to naturally occurring toxins, such as in cassava root and legumes⁵.

Additives are used when necessary by the food industry for different technological and functional reasons. Some of the additives used in industrially-produced foods are also found as natural components in foods, such as lecithin in eggs, citric acid in orange juice and carotene in spinach. Therefore, the use of additives should not be perceived as negative⁵. Food additives have undergone extensive toxicological assessments to ensure their safety by the European Food Safety Authority (EFSA) and other similar organisations worldwide¹.

Culinary preparations and traditional foods are assumed to be healthier

It is not known whether the processing of foods or the ‘ultra-processed’ versions of composite foods are of lower nutritional quality or affect health outcomes differentially versus their home-cooked or processed counterpart^{3 39}.

Some research has identified home recipes as less healthy than their ultra-processed counterpart, and not all ‘traditional’ foods, which are favoured in some classifications based on processing, are ‘healthy’³. Classifying foods based on ‘place’ or ‘person’ is misleading and may have negative consequences.

5. Future work – research

Lack of consumer perception data which leads to a poor understanding of food processing

Little is known regarding consumer understanding and implementation of classifications based on processing³². Studies have reported inconsistent results with some participants perceiving processed food culinary ingredients and even some minimally processed foods as ultra-processed^{3 11}.

Confusion may arise from conflicting messaging relating to the processed nature of a product versus its nutritional quality¹. Conflict and disagreement among professionals could sow doubts and amplify consumer confusion about this topic, leading to either (a) amplified or attenuated perception of risk; (b) loss of trust; and (c) rejection of any messages⁴⁰. Classifying foods, including culinary ingredients, together with no distinction based on their nutritional value (e.g. saturated fat content) does not help consumers choose healthier products.

Any classification based on ‘processing’ should be supported by strong scientific evidence with clear mechanisms.

Only a single randomised controlled trial has been undertaken¹³ indicating an unrestricted consumption of a diet high in ultra-processed foods may cause greater energy intake and weight gain, compared to a diet low in ultra-processed foods.

To better inform dietary guidance, research priorities have been proposed^{6 39} to improve the categorisation of ultra-processed foods, assessment of their exposure, and assessment of risk independent of diet quality; identify what, if any, attributes of ultra-processed foods influence ingestive behaviour and/or contribute to clinically meaningful metabolic responses; and understand if any external environmental factors lead people to consume high amounts of ultra-processed foods.

It has also been proposed that research priorities need to be framed against a backdrop of rising food insecurity, including food costs and impact on the environment¹².

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*** <https://www.fooddrinkeurope.eu/resource/scientific-critique-of-ultra-processed-foods-classifications/>*

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