Scientific critique of 'ultra-processed foods' classifications

IN BRIEF

The level of processing our food and drink undergoes does not determine the nutritional content of the final product.

Classifying and legislating food on the basis of the level of processing is not a scientifically-sound approach to food policy and would lead to negative outcomes for our food systems.

FoodDrinkEurope has undertaken a review of over 30 independent academic and scientific papers that critique 'ultra-processed foods' classifications and highlighted the main arguments in this paper.

FoodDrinkEurope has not financed, commissioned, or participated in any of this research. Full references and citations are available throughout.

Summary

Below we present a collection of counterarguments to the use of either NOVA or SIGA classifications of food processing as a basis of food policy or food regulation. Each argument is derived from independent, peer-reviewed academic and scientific research.

- Classifications are ideologically biased
- Biased results in epidemiological studies based on nutrient content
- Lack of differentiation between health outcomes and food parameters
- Lack of robustness on the definitions
- Mix of formulation and processing concepts
- No measurable data
- High risk of misclassification
- Ultra-processed products with different nutritional qualities
- Assumption than culinary preparations are necessarily healthier
- Dismissal of established knowledge

- [Better science-based classifications already exist](#)

- [Difficult application when measured](#)

- [Epidemiological studies limited by reversed causality](#)

- [Lack of understanding of reformulation](#)

- [Concept of "hyperpalatable" products in ultra-processed foods](#)

- [Concept of the disruption of food matrices and health in ultra-processed foods](#)

- [Assumption of unhealthy food ingredients](#)

- [Misunderstanding of food additives](#)

- [Misunderstanding of food process contaminants and contaminants](#)

- [NOVA recommendations and food security](#)

- [NOVA recommendations and health](#)

- [Lack of consumer perception data which leads to poor understanding of food processing](#)

- [Important criteria required for dietary guidance are ignored](#)

- [NOVA Classification could hamper relevant innovations in sustainable solutions](#)

- [Risk of policy makers developing policies not based on scientific consensus](#)

Scientific argument of the statements

Classifications are ideologically biased

The NOVA and SIGA promoters seem to have ideological grounds wrapped in a scientific context. Therefore, some of their arguments seem to be clearly biased. The food industry acknowledges that there are industrial foods of which can be further optimised, and it is the duty of the food industry to continue their efforts to improve them where possible. But the industry also offers food that facilitates everyday life and that contributes to pleasure and health, as soon as the consumer knows how to integrate them into a varied and balanced diet (Braesco V. et al., 2019). There is no doubt that the "quality" of food matters, but it is the right mix of processed and unprocessed foods composing a healthy diet what must be considered (Sollid, K., 2019). From the perspective of food science and technology, processing and nutritional value do not have a linear relationship and these concepts need to be dissociated (Sadler, C. R. et al., 2021).

Biased results in epidemiological studies based on nutrient content

The associations related to the numerous epidemiological research publications are already biased by the classification itself. The classified ultra-processed products tend to be energy dense and high in saturated fats, added sugar, and sodium. By default, the unprocessed or minimally processed foods category does not include foods to which salt, sugar, oils or fats are added, and contains the major sources of fibres and micronutrients. It is not clear if the association between ultra-processed foods and disease is related to processing itself or the energy/nutrient content of the selected foods under the classification also taking into account consumers' dietary habits and lifestyle. Also, the residual confounding is high (Eicher-Miller et al., 2012, 2015, Poti, J. M., et al., 2017, Gibney M.J. et al., 2017, Vergeer L. et al. 2019, Marino M., et al., 2021, AESAN, 2020, Lorenzoni G., et al., 2021,).

Lack of differentiation between health outcomes and food parameters (additives, ingredients, type of production process)

How the schemes have been defined appears to have been done in part to demonstrate rather than to test a priori hypothesize. The use of the term 'ultra-processed' within which fall the majority of packaged foods, as a part of segmenting foods for epidemiological research, may demonstrate associations with health effects linked to the known societal challenge of healthy balanced diets, but other causation cannot be inferred. However, the term 'ultra-processed' in itself carries inference as to causality and this is exacerbated by descriptions of how it is defined (Sadler, C. R. et al., 2021, Duan MJ. et al., 2022).

Lack of robustness on the definitions

NOVA and SIGA classification are too broad on the definitions (Weaver C.M. et al., 2014, Gibney M.J. et al., 2017, Braesco V. et al., 2019, Vergeer L. et al. 2019,

Thielecke F. et all., 2020, de Araujo T.P. et al., 2022). There is a lack of a universally accepted definition of ultra-processed foods and there have been several schemes, which has limited the prospective epidemiologic evidence on the selection of items for the studies (Poti, J. M., et al., 2017, Gibney M.J., 2019, Derbyshire E., 2019). There's no legal definition for this term, and its description does not meet the criteria established for the terms "processing" and "processed foods" by Regulation (EC) No 852/2004 on the hygiene of foodstuffs (FoodDrinkEurope comment).

Mix of formulation and processing concepts

These classification schemes are erroneously applied, as they are based on formulation and ingredients and do not properly describe the impact of food processing on health. Moreover, the association between food processing and chronic diseases might lead to a wrong consumer perception about the food safety risks associated to processing (Botelho R. et al., 2016, Lorenzoni G., et al., 2021).

No measurable data

There is a lack of measurable cut-offs to make the classification, therefore the arbitrary component is high (Weaver C.M. et al., 2014, Gibney M.J. et al., 2017).

High risk of misclassification

There is a high risk of misclassification of products along the categories proposed within NOVA and SIGA (Poti, J. M., et al., 2017) since the processing information is not usually available on the package of the product. Also, NOVA classification is applied to databases with no distinction of industrialized products. One of the main sources of variation among study protocols is the tools used for estimating UPF intake. Most of the data on UPF consumption have been derived from FFQs and 24 h dietary recall, which are not specifically validated for estimating UPF; thus, such data should be considered with caution (Marino M., et al., 2021, Capozzi F. et al., 2021).

Ultra-processed products with different nutritional qualities

Within the ultra-processed foods categories we can find products such as whole-grain, packaged bread or unsweetened breakfast cereals. This suggests that processing itself may not be a causal determinant of the nutritional quality of foods (Poti, J. M., et al., 2017). Statistically significant differences in all nutrients, including whole grain, dietary fibre and food components of interest was observed when UPF were excluded from the diet, risking high nutrient deficiencies (Thielecke F. et all., 2020, Estell M. et al., 2022).

Assumption that culinary preparations are necessarily healthier

There are products such as pizza, mixed dishes, cookies or other baked goods which could be culinary preparations or regarded as ultra-processed. It is not known whether the ultra-processed version necessarily has lower nutritional quality than its home-

cooked counterpart. In fact, in some cases, the home recipe could be worse than its ultra-processed alternative (Poti, J. M., et al., 2017, Braesco V. et al., 2019, Estell M. et al., 2022, Petrus, R. R., et al., 2021, Capozzi F. et al., 2021).

Dismissal of established knowledge

The NOVA and SIGA classifications dismisses decades of nutrition research showing the relationship between nutrients and health, which overrules the overall scientific approach accepted worldwide. They regard as conventional and overdue all the actual existing classifications and do not build upon the accepted knowledge. It takes food industry multinationals as the promoters of non-innovative approaches and contributors of unhealthy habits, proving some biased motivations (FoodDrinkEurope notes on Davies, V. F. et al., 2017).

Better science-based classifications already exist

It is unclear whether the NOVA or SIGA classifications improve upon existing classifications based on dietary quality indexes or nutrient profiling scores for researching the relationship between diet and health (Poti, J. M., et al., 2017, Vergeer L. et al. 2019). There are already better classification systems such as FoodEx2 (EFSA) or EPIC (European Prospective Investigation into Cancer and Nutrition) which encompass a better correlation between processing and health (Gibney M.J. et al., 2017).

Difficult application when measured

Authors of the SIGA classification tried to make the NOVA classification more robust by introducing measurable parameters to obtain a Technological Index (TI) for healthiness of products. Their results were initially neutral when considering groups B and C in reference to distinguish numerically between the health effect of processed products and ultra-processed. Further numerical arrangements allowed them to make a final separation, thus arguing that their results backed up the NOVA classification. The initial result is easier to understand, as the meaningful differentiation was found only between nutritional density between un-processed foods and processed foods (FoodDrinkEurope comment on Fardet, A., et al., 2018).

Epidemiological studies limited by reversed causality

The epidemiological studies researching the relationship between ultra-processed food and disease are limited by the potential of reverse causality. i.e. This relationship does not indicate the validity of the classification (Poti, J. M., et al., 2017, Sadler, C. R. et al., 2021).

Lack of understanding of reformulation

Authors of NOVA classification do not accept the reformulation of products as a solution (Scrinis, G., & Monteiro, C. A., 2017) although they accept that the "clean

label" trends are positive for the health of consumers. They do not account that food processing and reformulation are also widely applied to reduce energy density, as evidenced in semi-skimmed milk, low-fat, spreads, pre-portioned calorie-controlled meals, or zero-energy beverages. Food industry has also reduced the content of other nutrients to limit (Gibney M.J. et al., 2017). Rather than eliminating UPFs, "we should acknowledge their utility and consider that their reformulation, rather than elimination, might have a more meaningful impact on improving the nutritional quality and health on a population level (Derbyshire E., 2019, Tobias D.K. et al., 2021, BDA., 2021).

Concept of "hyperpalatable" products in ultra-processed foods

Authors of NOVA classification also regard ultra-processed foods as intentionally hyperpalatable and addictive. There are not many studies to date that compares the satiating efficiency of the same food material whether it is a minimally processed or ultra-processed, this assertion has no scientific grounds so the term hyperpalatable could be considered the same as palatable (Gibney M.J. et al., 2017). Some studies show no empirical evidence from clinical trials for a disproportionate contribution of specific tastes of ultraprocessed foods in promoting excessive daily energy intakes (Teo, P. S. et al., 2022, Gibney M.J. et al. 2022).

Concept of the disruption of food matrices and health in ultra-processed foods

The latest research links the disruption of the food matrix produced by processing to overconsumption and higher calory intakes (Fardet et al., 2022). To link specific matrix effects and taste–nutrient relationships to food processing, there is a need to explore sensory and metabolic responses to foods that have equivalent nutrients but differ in their degree of food processing (Gibney M.J. et al., 2022, Teo P.S. et al., 2022).

Assumption of unhealthy food ingredients

The authors of the NOVA classification define the health qualities of ultra-processed foods on the basis of second-degree processed foods, such as modified starches, sugar syrups, emulsifiers or gums. Those are produced from food raw materials and tested by EFSA and other worldwide entities that ensure the safety and healthiness of these materials (Braesco V. et al., 2019, Petrus, R. R., et al., 2021, Blumfield M. et al., 2021).

Misunderstanding of food additives

The authors of the NOVA classification also define food additives as ingredients that cause poor health. Food additives have undergone extensive toxicological assessments by EFSA and other entities worldwide, which ensures the safety and healthiness of those (Gibney M.J. et al., 2022). Additives are needed for different technological and functional reasons and the food industry uses them when it is necessary. Additives themselves are not much different than perceived food based ingredients (e.g. salt), they provide the same functionality, and sometimes, even an improved functionality towards health (e.g. additives that provide the technical

characteristic of salt but with a lesser impact on health). The NOVA classification promoters create distrust of the consumers towards the food industry and food safety governmental agencies, jeopardising food security and nutrition security worldwide (Braesco V. et al., 2019).

Misunderstanding of food process contaminants and contaminants

Studies referring NOVA classification also mention processed contaminants such as acrylamide or polycyclic hydrocarbons as a negative effect of ultra-processed foods. These contaminants are produced at any level of processing, not making a distinction between home-made or industrial goods. As a matter of fact, industrial processes have higher control over those chemicals (Van Boekel, M., et al, 2010, Braesco V. et al., 2019). The same case with contaminants such as pesticide residues, antibiotics, heavy metals, mycotoxins, or packaging migrants. Those are not inherent to the ultra-processed foods group and the NOVA classification does not provide information on its presence in any of the categories of the classification (Braesco V. et al., 2019).

NOVA recommendations and food security

The NOVA and SIGA classification authors recommend that the intake of ultra-processed foods should be avoided and that the intake of processed foods should be minimized, however, there is no scientific evidence on how this model might affect food security and maintain the sustainability of the actual food system (Gibney M.J. et al., 2017, Tobias D.K. et al., 2021). In addition, avoidance of foods deemed as ultra-processed foods could decrease intakes of dietary fibre and micro-nutrients like folate, calcium (Jones J.M. 2019, Thielecke F. et all., 2020). It has been shown that a narrow range of food choices may lead to dietary inadequacies, a particular concern in elderly people (Bernstein, M. A. et al. 2002). Therefore, limiting the variety of food choices ignores major trends in society and their implications.

NOVA recommendations and health

According to NOVA, certain ingredients such as lard, coconut oil and rapeseed oil are all classified as culinary ingredients and no distinction is made on the healthiness of the product based on e.g. saturated fat content. This approach does not help consumer to choose a healthier product because is not addressing the nutritional value of the nutrients themselves. Consumers need to be correctly informed that healthiness has no direct or absolute correlation either with the number of ingredients, intensity, or number of processes or with the fact that the food has been processed in households or a large industrial plant (Petrus, R. R., et al., 2021, BDA., 2021)

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

Consumers understanding, and implementation of NOVA is poorly known. There have been very few studies on consumers' conceptualization of the term Ultra-processed food. Existing studies found mixed results with some of the participants perceiving processed food culinary ingredients and even some minimally processed foods as

ultra-processed foods (Ares, G et al., 2016, Sadler, C. R. et al., 2021). 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; (c) rejection of any messages (Sadler, C.R. et al., 2022)

Important criteria required for dietary guidance are ignored

NOVA classification fails to demonstrate the criteria required for dietary guidance: understandability, affordability, workability and practicality. Consumers' confusion about definitions and food categorisations, inadequate cooking and meal planning skills and scarcity of resources (time, money), may impede adoption and success of NOVA (Jones, J. M. 2019, Tobias D.K. et al. 2021, Estell M. et al., 2022, Petrus, R. R., et al., 2021).

NOVA classification could hamper relevant innovations in sustainable solutions

In addition to the conflicts with nutrition advice, guidelines based on food processing could be misinterpreted as meaning that processing in itself is bad. Such consumer rejection could hamper sustainable innovations that address a more (environmentally and social) sustainable food system (Sadler, C. R. et al., 2021). The impact of UPFs on greenhouse gas emission is not greater than that of less processed alternatives. Moreover, 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 biodiversity (Capozzi F. et al., 2021).

Risk of policy makers developing policies not based on scientific consensus

Some dietary guidelines, at first in Brazil and now in other countries such as India, and regions such as Flanders in Belgium, refer to food processing and advise avoiding/limiting ultra-processed food. Hence the concept of "processed food," and its classification, is increasingly in the spotlight stimulating debate among professionals within different scientific disciplines in the published literature. In a recent critical review of classification systems, we found a lack of consensus on what features determine the level of food processing (Sadler, C.R. et al., 2022).

References:

AESAN (2020). Report of the Scientific Committee of the Spanish Agency for Food Safety and Nutrition (AESAN) on the Impact of Consumption of Ultra-processed Foods on the Health of Consumers. Ministerio de Consumo (Spain), AESAN 2020/3. Translation available: https://zenodo.org/record/3935602#.Yk_wIijP3yR

Ares, G., Vidal, L., Allegue, G., Giménez, A., Bandeira, E., Moratorio, X., et al. (2016). Consumers' conceptualization of ultra-processed foods. Appetite, 105, 611–617.

Bernstein, M. A., Tucker, K. L., Ryan, N. D., O'Neill, E. F., Clements, K. M., Nelson, M. E., et al. (2002). Higher dietary variety is associated with better nutritional status in frail elderly people. Journal of the American Dietetic Association, 102(8), 1096–1104.

Blumfield, M., Starck, C., Keighley, T., Petocz, P., Roesler, A., Abbott, K., Cassettari, T., Marshall, S., Fayet-Moore, F. (2021). Diet and Economic Modelling to Improve the Quality and Affordability of the Australian Diet for Low and Medium Socioeconomic Households. Int. J. Environ. Res. Public Health, 18, 5771.

Botelho, R., Araújo, W., & Pineli, L. (2016). Food formulation and not processing level: Conceptual divergences between public health and food science and technology sectors. Critical Reviews in Food Science and Nutrition, 58(4), 639–650.

Braesco V., Corrieu G., Feillet P., Giacchetti I., Pascal G., Risse J., Serpelloni M., This H., Trystram G. (2019). Aliments dits "ultra-transformés et santé: que faut-il en penser? Publication of the Academie d'Agriculture de France.

Capozzi, F.; Magkos, F.; Fava, F.; Milani, G.P.; Agostoni, C.; Astrup, A.; Saguy, I.S. (2021). A Multidisciplinary Perspective of Ultra-Processed Foods and Associated Food Processing Technologies: A View of the Sustainable Road Ahead. Nutrients, 13, 3948.

Davies, V. F., Moubarac, J.-C., Medeiros, K. J., & Jaime, P. C. (2017). Applying a food processing-based classification system to a food guide: a qualitative analysis of the Brazilian experience. Public Health Nutrition, 21(01), 218–229.

de Araújo, T.P., de Moraes, M.M., Afonso, C., Santos, C., Rodrigues, S.S.P. (2022). Food Processing: Comparison of Different Food Classification Systems. Nutrients, 14, 729.

Derbyshire, E. (2019). Are all 'ultra-processed' foods nutritional demons? A commentary and nutritional profiling analysis. Trends in Food Science & Technology. 94, 98 – 104.

Duan, M.J., Vinke, P.C., Navis, G., Corpeleijn, E., Dekker L.H. (2022). Ultra-processed food and incident type 2 diabetes: studying the underlying consumption patterns to unravel the health effects of this heterogeneous food category in the prospective Lifelines cohort. BMC Med 20, 7.

Eicher-Miller, H.A., Fulgoni, V.L. and Keast, D.R. (2012) Contributions of processed foods to dietary intake in the US from 2003-2008: a report of the Food and Nutrition Science Solutions Joint Task Force of the Academy of Nutrition and Dietetics, American Society for Nutrition, Institute of Food Technologists, and International Food Information Council. J Nutri. 142(11), 2065s-2072s.

Eicher-Miller, H. A., Fulgoni, V. L., & Keast, D. R. (2015). Processed Food Contributions to Energy and Nutrient Intake Differ among US Children by Race/Ethnicity. Nutrients, 7(12), 10076–10088.

Estell M.L., Barrett E.M., Kissock K.R., Grafenauer S.J., Jones J.M., Beck E.J. (2022). Fortification of grain foods and NOVA: the potential for altered nutrient intakes while avoiding ultra-processed foods. European Journal of Nutrition 61(2):935-945.

Fardet, A., Lakhssassi, S., & Briffaz, A. (2018). Beyond nutrient-based food indices: a data mining approach to search for a quantitative holistic index reflecting the degree of food processing and including physicochemical properties. Food & Function, 9(1), 561–572.

Fardet, A., Richonnet, C., & Mazur, A. (2019). Association between consumption of fruit or processed fruit and chronic diseases and their risk factors: a systematic review of meta-analyses. Nutrition Reviews.

Fardet A., Christodoulou A., Kelly F., Davidou S. (2019). La classification holistico-réductionniste Siga des aliments en function de leur degré de transformation.

Fardet, A., Rock, E. Chronic diseases are first associated with the degradation and artificialization of food matrices rather than with food composition: calorie quality matters more than calorie quantity. Eur J Nutr (2022).

Gibney, M. J., Forde, C. G., Mullally, D., & Gibney, E. R. (2017). Ultra-processed foods in human health: a critical appraisal. The American Journal of Clinical Nutrition.

Gibney, M. J. (2019). Ultra-processed foods: definitions and policy issues. Current Developments in Nutrition, Volume 3, Issue 2.

Gibney, M.J., Forde, C.G. (2022). Nutrition research challenges for processed food and health. Nat Food 3, 104–109.

Jones, J. M. (2019). Food processing: criteria for dietary guidance and public health? The Proceedings of the Nutrition Society, 78(1), 4–18.

Lorenzoni, G., Di Benedetto, R., Silano, M., & Gregori, D. (2021). What Is the Nutritional Composition of Ultra-Processed Food Marketed in Italy? Nutrients, 13(7), 2364.

Marino, M., Puppo, F., Del Bo', C., Vinelli, V., Riso, P., Porrini, M., & Martini, D. (2021). A Systematic Review of Worldwide Consumption of Ultra-Processed Foods: Findings and Criticisms. Nutrients, 13(8), 2778.

Monteiro, C. A., Cannon, G., Moubarac, J.-C., Levy, R. B., Louzada, M. L. C., & Jaime, P. C. (2017). The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing. Public Health Nutrition, 21(01), 5–17.

Monteiro, C. A., Cannon, G., Moubarac, J.-C., Levy, R. B., Louzada, M. L. C., & Jaime, P. C. (2017). Ultra-processing. An odd "appraisal." Public Health Nutrition, 21(03), 497–501.

Monteiro, C. A., Cannon, G., Levy, R. B., Moubarac, J.-C., Louzada, M. L., Rauber, F., Khnadpur, N., Cediel, G., Neri, D., Martinez-Steele, E., Larissa, G., Jaime, P. C. (2019). Ultra-processed foods: what they are and how to identify them. Public Health Nutrition, 1–6.

Petrus, R. R., do Amaral Sobral, P. J., Tadini, C. C., & Gonçalves, C. B. (2021). The NOVA classification system: A critical perspective in food science. Trends in Food Science & Technology, 116, 603–608.

Poti, J. M., Braga, B., & Qin, B. (2017). Ultra-processed Food Intake and Obesity: What Really Matters for Health—Processing or Nutrient Content? Current Obesity Reports, 6(4), 420–431.

Sadler, C. R., Grassby, T., Hart, K., Raats, M., Sokolović, M., & Timotijevic, L. (2021). Processed food classification: Conceptualisation and challenges. Trends in Food Science & Technology, 112, 149–162.

Sadler C.R., Grassby T., Hart K., Raats M.M., Sokolović M., Timotijevic L. (2022). "Even We Are Confused": A Thematic Analysis of Professionals' Perceptions of Processed Foods and Challenges for Communication. Frontiers in Nutrition, 9.

Scrinis, G., & Monteiro, C. A. (2017). Ultra-processed foods and the limits of product reformulation. Public Health Nutrition, 21(01), 247–252

Sollid, K. (2019). Fast Take: Do Ultraprocessed Foods Cause Weight Gain? International Food Information Council Foundation (IFIC), Post May 17, 2019.

Teo P.S., Tso R., van Dam R.M., Forde C.G. (2022). Taste of Modern Diets: The Impact of Food Processing on Nutrient Sensing and Dietary Energy Intake. The Journal of Nutrition Jan 11, 152(1):200-210.

The British Dietetic Association (BDA). (2021). Position statement on processed food. https://www.bda.uk.com/resource/processed-food.html

Thielecke, F., Lecerf, J-M., Nugent, A. P. (2020). Processing in the food chain: do cereals have to be processed to add value to the human diet?. Nutrition Research Reviews, (), 1–43.

Tobias D.K., Kevin D.Hall K.D. (2021). Eliminate or reformulate ultra-processed foods? Biological mechanisms matter. Volume 33, Issue 12, 7 December 2021, Pages 2314-2315.

Van Boekel, M., Fogliano, V., Pellegrini, N., Stanton, C., Scholz, G., Lalljie, S., et al. (2010). A review on the beneficial aspects of food processing. Molecular nutrition & food research, 54(9), 1215–1247.

Vergeer L., Veira P., Bernstein J.T., Weippert M., L'Abbé M.R. (2019). The Calorie and Nutrient Density of More- Versus Less-Processed Packaged Food and Beverage Products in the Canadian Food Supply. Nutrients 11(11):2782.

Weaver, C. M., Dwyer, J., Fulgoni, V. L., King, J. C., Leveille, G. A., MacDonald, R. S., Ordovas J., Schnakenberg, D. (2014). Processed foods: contributions to nutrition. The American Journal of Clinical Nutrition, 99(6), 1525–1542.