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Independent report

SACN statement on processed foods and health - summary report

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Introduction

The Scientific Advisory Committee on Nutrition (SACN) considered ultra-processed foods (UPF) at its [horizon scanning meeting on 17 June 2022 \(PDF, 173KB\)](https://app.box.com/s/ivrivaemf7fgeo9a17xdmv167c4uvteu/file/968977322326) (<https://app.box.com/s/ivrivaemf7fgeo9a17xdmv167c4uvteu/file/968977322326>).

Members noted that it would be timely to consider this issue since there was increasing discussion and debate regarding the implications of food processing on health.

In autumn 2022, the Office for Health Improvement and Disparities at the Department of Health and Social Care asked that SACN expedite this work.

Terms of reference

In November 2022, SACN agreed the terms of reference for this review. The terms of reference were:

- a) issue a position statement on food processing and health – to include:
 - evaluation of existing classifications of processed foods, including UPF and the NOVA classification
 - evaluation of the suitability and methods to apply food processing definitions as a dietary exposure
 - consideration of the availability and quality of evidence associating different forms or levels of food processing with health outcomes
- b) scope any future work on this issue

SACN has not considered wider issues in relation to processing as part of this statement.

Background

There is growing discussion and research literature on food processing and health.

Food processing has a number of roles including aiming to:

- ensure foods that would otherwise be inedible without processing are edible (for example, cooking)
- ensure foods that could otherwise be unsafe to eat are safe (for example, pasteurisation)
- increase the shelf life, preservation and retention of nutrients for some foods (for example, freezing)

- modify the nutrient composition or bioavailability (for example, reformulation for saturated fat, sugar, salt or micronutrient fortification)
- increase palatability (such as through taste and texture)
- increase convenience

While there is no universally agreed definition of processed foods, a number of classification systems have been developed globally, which attempt to group foods by their level of processing, including:

- a system developed by the [International Agency for Research on Cancer](https://pubmed.ncbi.nlm.nih.gov/19888275/) (<https://pubmed.ncbi.nlm.nih.gov/19888275/>)
- the [NOVA system](https://www.worldnutritionjournal.org/index.php/wn/article/view/5) (<https://www.worldnutritionjournal.org/index.php/wn/article/view/5>) including the UPF category developed in Brazil and a [variation of the NOVA system](https://pubmed.ncbi.nlm.nih.gov/26231112/) (<https://pubmed.ncbi.nlm.nih.gov/26231112/>)
- a system developed by the [International Food Information Council](https://www.sciencedirect.com/science/article/pii/S0022316622026402?via%3Dihub) (<https://www.sciencedirect.com/science/article/pii/S0022316622026402?via%3Dihub>)
- a system developed by the [International Food Policy Research Institute in Guatemala](https://pubmed.ncbi.nlm.nih.gov/20029821/) (<https://pubmed.ncbi.nlm.nih.gov/20029821/>)
- a system developed by the [Mexican National Institute of Public Health](https://pubmed.ncbi.nlm.nih.gov/26626606/) (<https://pubmed.ncbi.nlm.nih.gov/26626606/>)
- [the Siga Index](https://siga.care/indice-siga/) (<https://siga.care/indice-siga/>)
- a system developed by researchers at the [University of North Carolina in 2015](https://pubmed.ncbi.nlm.nih.gov/25948666/) (<https://pubmed.ncbi.nlm.nih.gov/25948666/>)

The purpose of processed food classifications is to categorise foods according to their level of processing. While one classification system has attempted to account for nutritional content and recommended dietary guidelines, other classification systems, including NOVA, do not consider the nutrient content of foods.

Published commentaries have proposed a range of hypotheses and mechanisms for observed associations between (ultra-) processed foods and adverse health outcomes. This includes:

- higher palatability
- higher energy density
- promotion of a faster eating rate – for example, due to softer texture or other changes in the food structure or matrix
- differences in the nutrient content – such as higher saturated fat, salt and free sugars content alongside lower fibre content
- effects of high temperature in the production of processed foods
- effects of specific additives, including low or no calorie sweeteners
- contaminants from packaging

- higher consumption due to widespread marketing and lower cost of processed foods
- combined effects of the above

Methods

In order to address the terms of reference and in keeping with the [SACN framework \(PDF, 389KB\)](https://app.box.com/s/2iz8xeu8hoqeyx7jjce22fxnlp9ba65) (<https://app.box.com/s/2iz8xeu8hoqeyx7jjce22fxnlp9ba65>), a scoping review was carried out consisting of 3 components:

- a review of existing classification systems on food processing
- a review of available evidence that uses UK National Diet and Nutrition Survey (NDNS) data to apply the NOVA food processing classification system
- a review of available evidence on the associations between processed food consumption and health outcomes

The review of existing classification systems on food processing was based upon papers identified by SACN and the secretariat as part of, and subsequent to, the [SACN horizon scanning process](https://app.box.com/s/ivrivaemf7fgeo9a17xdmv167c4uvteu/folder/163937234122) (<https://app.box.com/s/ivrivaemf7fgeo9a17xdmv167c4uvteu/folder/163937234122>). Papers were reviewed and an informal PubMed search was carried out to identify any other key papers. Reference lists of papers were searched to identify available classification systems on food processing. Classification systems identified were assessed based on whether the following 4 core themes had been considered in the development of the system:

- extent of change (from the natural state)
- nature of change (for example, change to food's natural properties, or addition of ingredients or food additives)
- place of change (for example, at home, artisanal or industry)
- purpose of change (for example, essential, cosmetic, convenience or palatability)

A set of initial screening criteria agreed by SACN were applied to the classification systems identified to understand which systems were practical and applicable for use in the UK, and thus would be useful to review further. The criteria were whether:

1. the system could be applied to a UK population
2. there is a clear 'usable definition' of the system (as provided by the studies)
3. the system has been used in peer-reviewed publications by more than one research group
4. there is data available on inter-assessor reliability when applying the system (irrespective of the degree of inter-assessor reliability reported)
5. the classification system has been used to evaluate associations between consumption and health outcomes

During the review of available evidence that uses UK NDNS data to apply the NOVA food processing classification system, database searches were conducted and assessed by one reviewer to identify papers that considered the application of NOVA to NDNS data.

During the review of available evidence on the associations between processed food consumption and health outcomes, database searches were conducted and assessed by 2 reviewers to identify systematic reviews (SRs) with or without meta-analyses examining the relationship between 2 or more levels of food processing and health outcomes. SRs that met the specific inclusion criteria of the review were included and key data was extracted and tabulated.

Results

Review of existing food processing classification systems

Eight classification systems were identified and considered against the 5 initial screening criteria.

NOVA was the only system identified that met all 5 screening criteria. NOVA was found to be potentially applicable to the UK population (criterion 1) and had been used to evaluate health outcomes associated with consumption (criterion 5). It has been used in peer-reviewed publications by more than one research group (criterion 3).

Assessment beyond the initial screen identified that the literature is currently dominated by NOVA, raising the risk that any limitations or biases present within the NOVA classification system may be replicated throughout the research literature. While NOVA also met criterion 2 on a clear, usable definition and criterion 4 on the availability of data on inter-assessor agreement, assessment beyond the initial screen identified less certainty on the clarity, reliability and feasibility of the system.

Review of available evidence that uses the UK NDNS to apply the NOVA food processing classification system

In order to evaluate the suitability of using food processing as a dietary exposure, this rapid scoping review assessed the available evidence that applied the NOVA food processing classification system to UK NDNS data.

A range of assumptions have to be made in order to apply NOVA to the NDNS – for example, the NDNS does not distinguish between manufactured and homemade for all food groups. Some key characteristics required by NOVA are not available within the NDNS – for example, whether foods are ‘mass-produced’ or ‘artisanal’ – and no

information is collected on low or no calorie sweeteners or other additives, packaging or preservation methods.

Twelve studies were identified that considered the application of NOVA to the NDNS. Nine of the 12 included authors who were members of the research group that developed NOVA. All 9 used the same methodology for applying NOVA to NDNS data.

Estimates of population UPF intake in the UK ranged from 51% to 68% of total dietary energy, varying within this range by age and socioeconomic status. The validity and reproducibility of these estimates is unclear given difficulties in disaggregating some food codes within the NDNS.

In order to undertake further assessment of (ultra-) processed food intakes using NDNS, consideration would need to be given to:

- the impact of assumptions about coding (ultra-) processed food categories in the nutrient database on error, bias and interpretation of findings if no further adjustments to NDNS methodology were made
- the potential for adjustments to NDNS methodology to better capture population exposure to (ultra-) processed foods, and the potential impact of these on resource needs, participant burden and response rates

Results of the review of the available evidence on associations between processed food consumption and health outcomes

Data for 10 SRs was extracted and tabulated. These SRs considered associations between UPF intake and:

- overweight and obesity (2 SRs)
- chronic non-communicable diseases, including type 2 diabetes, hypertension, cardiovascular disease (CVD), cerebrovascular disease and gastrointestinal tract disease (6 SRs)
- depression (2 SRs)
- mortality risk, including all-cause mortality, CVD-cause mortality, heart-cause mortality and cancer-cause mortality (4 SRs)
- maternal and child health outcomes, including gestational weight gain, gestational diabetes, hypertension during pregnancy, pre-eclampsia, low-birth weight, large-for-gestational age, preterm birth and child adiposity (2 SRs)

Most SRs reported that increased consumption of processed food (specifically UPF) was associated with an increased risk of the adverse health outcomes considered.

A check of a trial registry during the drafting of this paper indicated that a number of registered trials were underway on the topic of processed foods and health.

Limitations

Several limitations were noted with respect to SACN's scoping review process, largely due to the limited time frame and resources available for this work.

Limitations were identified regarding processed food classification systems. Some systems draw on subjective concepts such as 'natural', 'wholesome', 'raw', 'artisanal' and 'mass produced'. These concepts may be understood and applied differently between users. Systems differ in their classification of components such as refined vs wholegrains and additives.

Classification systems identified generally did not consider the nutritional content of products or known associations between specific processed foods and health (such as processed meat and cancer).

Specific limitations of the NOVA classification system were that the categories are very broad and capture a wide range of foods. They group together foods with differing nutritional attributes. There were also different estimates of the degree of inter-assessor agreement.

A number of limitations were identified in applying NOVA to UK dietary survey data. The NDNS currently does not capture all of the detail required by NOVA. Researchers may under or over-estimate UPF consumption as a result of oversimplified interpretation of the NDNS food groupings. Data identified on the application of NOVA to the NDNS was of insufficient detail to enable comparison.

In relation to assessing the evidence on processed foods and health outcomes, there are important limitations:

- the majority of included studies used the NOVA classification system for processed foods
- the available evidence is almost exclusively observational in nature
- there was inconsistent adjustment for covariables as well as inconsistency between SRs regarding which are the key covariables. Hence, although adverse health associations were consistently reported, it is unclear whether these associations are due to or independent of the 'unhealthy' nutrient contents that are typical of many UPFs (for example high energy density, salt, saturated fat or free sugars)
- limited available information on the impact on population subgroups and the lack of studies to date undertaken among socially and ethnically diverse groups. This impacts both on the potential generalisability of study findings to the UK population and limits our understanding on potential differential effects of UPF consumption on health

- dietary data within observational studies was mostly based on dietary collection methods unlikely to have been designed or validated for assessing level of food processing
- the method of reporting UPF intakes (for example, grams of UPF per day or percentage of energy from UPF per day) and the cut-offs for the quantiles used varies across studies

Conclusions

The SRs identified have consistently reported that increased consumption of (ultra-) processed foods was associated with increased risks of adverse health outcomes. However, there are uncertainties around the quality of evidence available. Studies are almost exclusively observational and confounding factors or key variables such as energy intake, body mass index, smoking and socioeconomic status may not be adequately accounted for.

NOVA was the only processed food classification that met SACN's initial screening criteria as being potentially suitable for use in the UK. Assessment of the NOVA approach identified some concerns around practical application in the UK. In particular, the classification of some foods is discordant with nutritional and other food-based classifications.

Consumption of (ultra-) processed foods may be an indicator of other unhealthy dietary patterns and lifestyle behaviours. Diets high in (ultra-) processed foods are often energy dense, high in saturated fat, salt or free sugars, high in processed meat, and/or low in fruit and vegetables and fibre.

It is unclear to what extent observed associations between (ultra-) processed foods and adverse health outcomes are explained by established nutritional relationships between nutritional factors and health outcomes on which SACN has undertaken robust risk assessments.

The observed associations between higher consumption of (ultra-) processed foods and adverse health outcomes are concerning – however, the limitations in the NOVA classification system, the potential for confounding, and the possibility that the observed adverse associations with (ultra-) processed foods are covered by existing UK dietary recommendations mean that the evidence to date needs to be treated with caution.

Research recommendations

A number of limitations in the available evidence on processed foods and health were identified. Further research is required in particular in the following areas:

- further assessment and development of an (ultra-) processed foods classification system that can reliably be applied to estimate consumption of processed foods in the UK
- further evidence exploring relationships between (ultra-) processed foods and health outcomes, based on a classification system that can reliably be applied in the UK (see 'Conclusions' above). This includes:
 - good-quality randomised controlled trials that may help to identify potential mechanisms and establish whether they are independent of energy density or other dietary factors that have been considered in previous SACN risk assessments
 - good-quality prospective cohort studies that can address concerns relating to confounding and reverse causality for observed associations between (ultra-) processed foods and health outcomes
 - good-quality studies that consider the benefits of consuming products with minimal processing in comparison with existing UK dietary recommendations and/or other dietary patterns for which there is evidence of beneficial health outcomes
 - assessing any role of food additives or other processing methods in observed associations between (ultra-) processed foods and health
- further assessment and refinement of NDNS methodology to better estimate and monitor processed food consumption, while minimising impact on participant burden

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