

Reducing children's exposure to marketing of foods and drinks that are high in fat, salt or sugar: what would be the best nutrient profile model?

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1 Summary

This report summarises recent developments in relation to the marketing of unhealthy foods to children, which form the background to a commitment that the European Heart Network (EHN) submitted to the European Platform for action on diet, physical activity and health in 2012. It also describes that commitment and progress made towards achieving its objective.

The objective of the commitment was to carry out an investigation with a view to assessing the potential for cross-sector agreement on nutritional criteria for foods and drinks marketed and advertised to children that can be applied across Europe.

The methods for the investigation involve:

- reviewing existing nutritional criteria that companies use for marketing of food to children
- reviewing current and proposed government standards for nutritional criteria for marketing of food to children
- consulting with stakeholders from consumer/public health interest organisations, economic operators as well as representatives from national and international governmental organisations (WHO and the European Commission).

The outputs of the investigation are:

- a report on the reviews
- a stakeholder meeting
- a report of the conclusions of the stakeholder meeting.

EHN asked the British Heart Foundation Health Promotion Research Group (BHF HPRG) at the University of Oxford to:

- compare existing nutrient profile models that companies use, or will use, for their pledges on the marketing of foods to children
- compare current and proposed government nutrient profile models for restrictions on the marketing of foods to children.

The report describes the studies that the BHF HPRG have carried out to compare nutrient profile models currently used or proposed for use in restricting the marketing of foods to children in Europe. These studies have two parts:

- a review of previous studies comparing nutrient profile models
- statistical comparisons of the strictness of, and agreement between, models using a database of foods advertised to children on television in the UK prior to the introduction of advertising restrictions there.

The studies suggest that, compared with the previous nutrient profile models used by companies in connection with their voluntary restrictions on the marketing of foods to children, the recently published EU Pledge Nutrition Criteria are an improvement. It is intended that the new criteria will be used by signatories to the EU Pledge from 2014.

The new Pledge criteria classify foods in a way that seems reasonably consistent with dietary recommendations. This is not to say that the new Pledge criteria could not be improved. Nor does it mean that they are optimal or that they should form the basis for a nutrient profile model that is agreed for all marketing restrictions throughout Europe.

Six models have been investigated that might form the basis of a common European definition of an unhealthy food for the purpose of marketing restrictions, i.e.:

- The FSA/Ofcom model used for statutory restrictions in the UK and Ireland;
- The model proposed by the Norwegian Government for a new regulation on the advertising of foods to children;
- The model within the ‘Code of responsible food marketing communication to children’ of the Danish Forum of Responsible Food Marketing Communication;
- Two models developed for labelling purposes:
 - the model used for the Swedish Keyhole labelling scheme;
 - the model developed by the Choices International Foundation;
- The new EU Pledge Nutrition Criteria.

The investigations described show that two of these models - the Swedish Keyhole model and the Choices International Foundation model - are very strict and would allow very few foods to be advertised to children. This is because they were designed to define what is a ‘healthy’ food rather than an ‘unhealthy’ food.

The Norwegian and Danish models appear to classify some foods in anomalous ways compared with other models – particularly in the meat and dairy categories.

The FSA/Ofcom model and the EU Pledge Nutrition Criteria classify foods in a very similar fashion even though they are constructed differently. The FSA/Ofcom model uses a scoring system and is a two category model. The EU Pledge Nutrition Criteria involves thresholds for food components and nutrients within 20 categories. Neither model is particularly strict but each classifies foods in ways which are reasonably consistent with dietary recommendations. Both models could be improved. In particular it may be thought desirable that they should be stricter.

2 Introduction and background to the European Heart Network's commitment

The European Heart Network (EHN) has long recognised that, in order to reduce premature death and disability from cardiovascular diseases, it is necessary to take a life-cycle approach. Therefore, EHN and its members target children and their environments with diverse interventions. Several of these have been in the form of commitments to the European Platform for action on diet, physical activity and health, and have, in the past, been presented to the members of the Platform. EHN also actively participated in the Platform's Working Group on lifestyles for which EHN prepared a paper on physical activity.

2.1 The European Heart Network's commitment

In March 2012, EHN submitted a commitment to the Platform to investigate the potential for cross-sector agreement on the nutritional criteria (nutrient profile) for foods and drinks marketed to children and that can be applied across Europe.

This commitment is closely related to other work carried out by the EHN in cooperation with its members and national and international experts, on the promotion of healthy diets for adults and children – in particular the recent publication and dissemination of a report entitled *Diet, Physical Activity and Cardiovascular Disease Prevention*¹. That report was the third edition of a report with a similar title published by EHN with the aims of: a) reviewing the scientific evidence for the relation between diet, physical activity and cardiovascular disease and b) making policy recommendations to European institutions and national governments that would facilitate the adoption of healthier diets and increased levels of physical activity.

EHN has also, over the past twenty years, carried out or supported a range of other initiatives directly related to its commitment to investigate the potential for a nutrient profile (NP) model that could be used for restrictions on food marketing to children across Europe.

From 2004 to 2006, EHN was the main partner and co-ordinator of a project on *Children, obesity and associated avoidable chronic diseases*². The project benefitted from financial support from the European Union's health action programme. A major aim of this project

¹ <http://www.ehnheart.org/publications/publications/publication/521-diet-physical-activity-and-cardiovascular-disease-prevention.html>

² <http://www.ehnheart.org/projects/children-a-obesity.html>

was to map the extent and nature of commercial food marketing to children. Another major aim was to review the regulations and voluntary codes of practice governing such marketing including the NP models used for those regulations or codes of practice.

A paper on Phase 1 of the *Children, obesity and associated avoidable chronic diseases project*³ reported that most of the food marketed to children was regarded, by those concerned with public health, as 'unhealthy'⁴. The report, published in spring 2005, included the following recommendations:

- The Television Without Frontiers Directive should be amended to prohibit TV advertising of 'unhealthy' food to children.
- Additional measures should be introduced to protect children from all other forms of 'unhealthy' food marketing, including through schools and the Internet (where it is increasing), and through any other broadcast and non-broadcast media (even though these are currently minor outlets, compared to TV).

The report noted that there was no common definition of 'unhealthy food', referred to work on nutrient profiling on-going in France and the UK and recommended that:

- A common EU definition of an 'unhealthy' food needs to be agreed.

In the event the revised Television without Frontiers Directive – now called the Audiovisual Media Services Directive - adopted in 2010⁵ – did not prohibit television advertising of 'unhealthy' food to children. It did stipulate, however, that Member States and the Commission shall encourage media service providers to develop codes of conduct regarding inappropriate audiovisual commercial communication of unhealthy foods (there defined as 'foods and beverages containing nutrients and substances with a nutritional or physiological effect, in particular those such as fat, trans-fatty acids, salt/sodium and sugars, excessive intakes of which in the overall diet are not recommended.').

In May 2012, a Commission report on the application of the Audiovisual Media Services Directive was submitted to the European Parliament, the Council and the European Economic Committee in May 2012⁶. The report assessed, amongst other things, the issue of television advertising accompanying or included in children's programmes, and in particular whether the Directive has afforded the required level of protection.

The European Commission monitored advertising practices in eight Member States during the reference period. According to the report, the rule that the proportion of advertising and teleshopping spots on television may not exceed 12 minutes per hour was breached regularly. It also reported that five Member States prohibit advertising in children's

³ <http://www.ehnheart.org/projects/children-a-obesity/publication/54.html>

⁴ In this report we defined the term 'unhealthy' to designate foods and drinks which are high in fat, saturated fat, trans fats, free sugars or salt and low in fibre, essential fatty acids, minerals, vitamins, etc. Other terms are and could be used for such foods such as 'high in fat, sugar or salt' (HFSS foods) or 'energy dense, nutrient poor' (EDNP foods).

⁵ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:095:0001:0024:EN:PDF>

⁶ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0203:FIN:EN:PDF>

programmes, that four Member States impose a partial ban or other restriction on advertising in children's programmes, either during specific time slots or for specific products and that seven Member States prohibit the showing of sponsorship logos in children's programmes.

The report states that *"in view of the above, it seems appropriate to update in 2013 the Commission's interpretative communication on certain aspects of the provision on televised advertising in the Television without Frontiers Directive. The experience gained around the EU Platform on Nutrition and the Alcohol Health Forum as well as the work carried out on behavioural advertising will be taken into account in this update."*

The report also states that *"for the advertising and marketing of food to children, self-regulatory practices have been promoted at EU level through the EU Platform on Action for Diet, Physical Activity and Health [...] In the context of these platforms, the Commission will support the development of a definition of stricter age and audience thresholds for advertising and marketing and more consistent nutritional benchmarks across companies. In the more specific area of audiovisual commercial communications in children's programmes for sweets, fatty or salty foods and drinks, Member States must encourage audiovisual media service providers to develop codes of conduct regarding inappropriate audiovisual commercial communications in children's programmes."*

This report therefore goes some way towards EHN's position, outlined in its 2005 report *Children, obesity and associated avoidable chronic diseases*,⁷ that there should be a 'common EU definition of an unhealthy food' for the purpose of regulating the marketing of foods to children. Other policy reports have also called for more consistency and rigour in the nutritional criteria used for restrictions on the marketing of foods to children in particular that of the StanMark project⁸.

Since 2005 there have been other developments in relation to the marketing of unhealthy foods to children (see below), and therefore in 2012 EHN considered it would be timely to carry out the current investigation with a view to assessing the potential for cross-sector agreement on nutritional criteria for foods and drinks marketed and advertised to children that can be applied across Europe.

It was proposed that the methods for the investigation should involve:

- reviewing existing nutritional criteria that companies use for marketing of food to children

⁷ <http://www.ehnheart.org/projects/children-a-obesity.html>

⁸ Lobstein T, Parn T, Aikenhead A. (2011) A junk-free childhood: Responsible standards for marketing foods and beverages to children. London: International Association for the Study of Obesity, http://www.iaso.org/site_media/uploads/IASO_food_marketing_report_30_June_2011.pdf
Persson M, Soroko R, Musicus A, Lobstein T (2012) A junk-free childhood 2012: The 2012 report of the StanMark project on standards for marketing food and beverages to children in Europ. London: International Association for the Study of Obesity
http://www.iaso.org/site_media/uploads/IASO_food_marketing_report_30_June_2011.pdf

- reviewing current and proposed government standards for nutritional criteria for marketing of food to children
- consulting with stakeholders from consumer/public health interest organisations, economic operators as well as representatives from national and international governmental organisations (WHO and the Commission).

It was proposed that the output of the investigation should be:

- a report on the reviews
- a stakeholder meeting
- a report of the conclusions of the stakeholder meeting.

2.2 Further background to the commitment: major developments since 2005 related to the marketing of unhealthy foods to children.

Since 2005 there has been a series of major developments relating to the advertising of unhealthy foods to children. In particular the evidence has been accumulating that food advertising has both direct and indirect impacts on the health of children and this has led to a number of policy initiatives aimed at restricting the amount and the impact of advertising of unhealthy foods to children. Here we cover those related to the activities of the European Platform for action on diet, physical activity and health, the World Health Organisation (WHO), national governments in Europe and the European Pledge but there have been a range of other relevant initiatives including EU funded projects such as the Polmark and Stanmark Projects (the latter co-ordinated by the International Association for the Study of Obesity).

2.2.1 The European Platform for action on diet, physical activity and health

The European Platform for action on diet, physical activity and health (the Platform) was launched in March 2005 by 15 founding members including the European Commission, the European Parliament, the EU Presidency, the WHO as well as stakeholders from industry, consumer protection and public health⁹.

The Platform was created as one of several measures to respond to the increase in overweight and obesity, especially among children and young people. It is one of the elements in the European Union's strategy on *Nutrition, Overweight and Obesity related health issues* alongside legislative initiatives.

The Platform's purpose, as set out in its founding paper, is to provide a common forum for all interested actors at European level where:

- (a) they can explain their plans to contribute concretely to the pursuit of healthy nutrition, physical activity and the fight against obesity, and where those plans can be discussed; and

⁹ http://ec.europa.eu/health/nutrition_physical_activity/platform/index_en.htm

- (b) outcomes and experiences from actors' performances can be reported and reviewed, so that over time better evidence is assembled of what works and best practice more clearly defined.

The fields for action identified in the founding paper were:

- Consumer information, including labelling
- Education
- Physical activity promotion
- Marketing and advertising
- Composition of foods, availability of healthy food options, portion sizes

These fields were complemented by a sixth in 2011: Information exchange and advocacy.

The Platform has 32 members. In order to be a member of the Platform, organisations must have commitments in one or more of the six fields of action.

Of relevance to the current investigation of the six fields for Platform action is marketing and advertising.

2.2.2 World Health Organization

In September 2006, the WHO *European Charter on Counteracting Obesity* called for regulations to reduce substantially the extent and impact of commercial promotion of unhealthy foods and drinks, particularly to children, and proposed the development of international approaches, such as a code on marketing to children in this area.

In 2008 the WHO Regional Office for Europe (WHO EURO) facilitated the establishment of the European Marketing Network¹⁰. The network is led by Norway and its members include 17 countries in the WHO European Region i.e. Belgium, Bulgaria, Cyprus, Denmark, Finland, France, Greece, Ireland, Israel, Montenegro, the Netherlands, Norway, Portugal, Serbia, Slovenia, Sweden and the United Kingdom. Representatives of the WHO, the European Commission, the United Nations Standing Committee on Nutrition, the Food and Agriculture Organisation, the International Obesity Task Force and Consumers International participate as Network observers.

The Network aims to work together to find ways to reduce the marketing pressure on children of unhealthy foods. Seven meetings of the Network have taken place to date: January 2008 in Norway, September 2008 in Serbia, February 2009 in Slovenia, June 2009 in UK, 2010 in Portugal, 2011 in Brussels and the latest in Copenhagen in March 2012.

In 2010, the WHO centrally developed a set of recommendations on the marketing of foods and non-alcoholic beverages to children¹¹. The purpose of the recommendations is to

¹⁰ <http://www.euro.who.int/en/what-we-do/health-topics/disease-prevention/nutrition/policy/member-states-action-networks/reducing-marketing-pressure-on-children>

¹¹ <http://www.who.int/dietphysicalactivity/marketing-food-to-children/en/index.html>

promote responsible marketing in order to reduce the impact on children of unhealthy foods defined as foods 'high in saturated fats, trans-fatty acids, free sugars or salt'. The reason for having Recommendations at a global level is that food marketing to children is a worldwide phenomenon and tends to be pluralistic and integrated, using multiple messages in multiple settings. Countries view marketing of foods to children as an international issue and also see the need to ensure that the private sector markets its products responsibly. At the same time countries also point out that cross-border marketing and marketing in schools and pre-school establishments are a concern.

In May 2010 WHO adopted a global framework for implementing the set of Recommendations on the marketing of foods to children at the 63rd World Health Assembly (WHA63.14)¹². This framework will assist countries in implementing the Recommendations by providing guidance in the areas of policy development, policy implementation, and monitoring, evaluation and research.

Following the initiative on the part of the WHO centrally, WHO EURO presented, in 2012, an action plan for implementation of its Strategy for the Prevention and Control of Non-communicable Diseases 2012–2016. This action plan identifies promoting healthy consumption via fiscal and marketing policies as one of the five priority interventions where large health gains can be achieved. It also states that marketing of processed foods, with their "hidden" sugars, salt or excessive saturated fats, especially to children, and their increased availability are contributing to the alarming increase in the prevalence of overweight and obesity among children and adults reported in Europe, particularly for those with a lower socioeconomic status¹³.

Finally, WHO centrally have begun an initiative on nutrient profiling that has involved the production of a document entitled *Guiding Principles and Framework Manual for the development or adaptation of nutrient profile models, First Edition*, and a catalogue of nutrient profile models¹⁴. It is hoped that the manual and the catalogue will both be published shortly. The WHO centrally has also run six workshops in different countries to field-test the manual and build capacity for nutrient profiling. Two of these workshops have been in Europe, i.e. in Oslo, Norway in December 2011 and in Ljubljana, Slovenia in April 2012.

2.2.3 National governments in Europe

There have been various national government initiatives around the world to restrict the marketing of unhealthy foods to children. These have recently been reviewed for the EU funded Polmark Project¹⁵.

¹² <http://www.who.int/mediacentre/events/2010/wha63/en/index.html>

¹³ http://www.euro.who.int/_data/assets/pdf_file/0019/170155/e96638.pdf

¹⁴ <http://www.who.int/nutrition/topics/profiling/en/>

¹⁵ Hawkes C, Lobstein T (2011). Regulating the commercial promotion of food to children: a survey of actions worldwide. *International Journal of Pediatric Obesity*, 6, 2, 83-94.

In Europe the UK, Ireland and France are currently the only countries which have statutory restrictions on the television advertising of foods to children which limit either the extent or the impact of advertisements for unhealthy foods as opposed to all foods in general.

The UK restrictions on the extent of the advertising for unhealthy foods began to be introduced in 2008 by the broadcast regulator (Ofcom) and involved an NP model developed by the UK Food Standards Agency (FSA) which defines an unhealthy food for the purpose of those restrictions. In this report, this model is called the FSA/Ofcom model¹⁶. The Irish restrictions on both the extent and impact were finalised in 2012 and use the FSA/Ofcom model but with some small modifications – in particular an exemption which allows any cheese to be advertised¹⁷.

France, since 2007, has had a statutory requirement for health messages in advertisements for unhealthy foods (i.e. restricts the impact of those advertisements) but the foods to which the restrictions apply are not defined by a NP model. On the other hand the French Government – through its food standards agency (Agence Française de Sécurité Sanitaire des Aliments) – has been one of the few European governments which have taken an active interest in nutrient profiling and have developed an NP model called SAIN_LIM for regulating health and nutrition claims in food labelling¹⁸.

In June 2012, the Government of Norway issued draft proposals for a new regulation limiting the marketing of unhealthy foods and beverages to children under the age of 18, across a wide range of media. The draft regulation includes a proposed NP model for defining an unhealthy food¹⁹.

2.2.4 Other national initiatives

In Denmark, In 2007, the Forum of Responsible Food Marketing Communication – a voluntary collaboration between the food manufacturing, food retail, media and advertising industries – issued a ‘Code of responsible food marketing communication to children’ which came into force in 2008²⁰. This Code also has its own NP model for definition of an unhealthy food which should not be marketed to children. The Danish Government recognises that the Code is helpful but does not go as far as endorsing it.

2.2.5 The EU Pledge

In 2007, the World Federation of Advertisers made a commitment to the European Platform for action on diet, physical activity and health to reduce the advertising of unhealthy foods

¹⁶ <http://www.dph.ox.ac.uk/bhfhprg/publicationsandreports/acad-publications/bhfhprgpublished/nutrientprofilingmode>

¹⁷ <http://www.bai.ie/wordpress/wp-content/uploads/Childrens-Commercial-Communications-Code.pdf>

¹⁸ Agence Française de Sécurité Sanitaire des Aliments (2008) Setting of nutrient profiles for accessing nutrition and health claims: proposals and arguments, Paris.AFSSA. : <http://www.afssa.fr/Documents/NUT-Ra-ProfilsEN.pdf>

¹⁹ <http://www.regjeringen.no/nb/dep/hod/dok/hoeringer/hoeringsdok/2012-2/horing---forslag-til-ny-regulering-av-ma/horingsnotat.html?id=684711>

²⁰ <http://kodeksforfoedevarereklamer.di.dk/Om%20Kodeks/Pages/Om%20Kodeks.aspx>

to children²¹. The EU Pledge was a voluntary commitment, originally signed by 11 major food and beverage producing companies in Europe, but member companies remained free to apply more stringent rules individually.

Signatories to the Pledge commit not to advertise any of their products to children under 12 years, 'except for products which fulfil specific nutrition criteria based on accepted scientific evidence and/or applicable national and international dietary guidelines.' For the purpose of this initiative, 'advertising to children under 12 years' means advertising to media audiences with a minimum of 50% of children under 12 years. It was also agreed that there would be no communication related to products in primary schools except where specifically requested by, or agreed with, the school administration for educational purposes.

Each of the signatories to the Pledge used their own nutritional criteria for deciding which foods should and should not be advertised to children.

In 2012, the EU Pledge member companies enhanced their commitment by lowering the audience threshold to 35% of children under 12 years. This tougher threshold will have the effect of covering more media channels that have a significant child audience. The new commitment will apply to marketing communications for food and beverage on company-owned websites, in addition to third-party internet advertising. By December 2012, 19 companies had signed up to the EU Pledge²².

At the end of 2012, the EU Pledge members published common nutrition criteria (a nutrient profile model) for products that can and cannot be advertised to children under the age of 12. The nutrition criteria will apply to those companies that previously had individual NP models as of the end of 2014. The seven companies included in the Pledge that do not currently advertise to children will continue not to advertise any of their products to children.

²¹ <http://www.eu-pledge.eu/>

²² See <http://www.eu-pledge.eu/content/members-pledges> (20 companies if you included the European Snacks Association)

3. Reviewing current and proposed nutrient profile models

In the light of these developments EHN considered it timely to review the NP models used (or proposed) for legislative and voluntary restrictions on the marketing and advertising of foods to children. EHN asked the British Heart Foundation Health Promotion Research Group (BHF HPRG) at the University of Oxford to:

- Compare existing NP models that companies use, or will use, for their pledges on the marketing of foods to children
- Compare current and proposed government NP models for restrictions on the marketing of foods to children

3.1 Other studies which compare nutrient profile models

Preparatory to the BHF HPRG's comparisons between food company and government nutrient profile (NP) models currently used, or proposed for use, in restricting the marketing of unhealthy foods to children, the group has carried out a review of published studies which compare NP models.

3.1.1 Introduction

'Nutrient profiling' can be defined as 'the science of classifying or ranking foods according to their nutritional composition for reasons related to preventing disease and promoting health'²³. Restrictions on the marketing of foods to children need NP models when it is necessary to differentiate 'unhealthy foods' from other foods for the purpose of those restrictions.

Nutrient profiling is a growing field and there are now hundreds of different NP models that are in use for a range of different applications including marketing restrictions²⁴. The models vary considerably in the way they are constructed and in the ways in which they classify or rank foods. Unfortunately there is, as yet, no gold standard against which the classifications or scores generated by NP models can be assessed.

The most rigorous method of validating a NP model is by assessing how well the NP model classifies the foods that, when consumed, lead to an increased/reduced risk of disease or other adverse/beneficial health outcomes. However there have been few attempts to carry out this type of predictive validity testing. The only published example of such an analysis is a study by Chiue and her colleagues who showed that the consumption of foods that have a higher score for the Overall Nutrition Quality Index (ONQI) NP model is associated with a lower risk of chronic disease and all-cause mortality in 62,284 healthy women from the

²³ World Health Organisation, Guiding Principles and Framework Manual for the development or adaptation of nutrient profile models (First Edition). Geneva: WHO, in press

²⁴ Rayner, M., Scarborough, P. Kaur A (2012) Nutrient profiling and the regulation of marketing to children. Possibilities and pitfalls. *Appetite* (<http://dx.doi.org/10.1016/j.appet.2012.06.021>)

Nurses' Health Study and 42,382 healthy men from Health Professionals Follow-Up Study (followed between 1986 to 2006 in the US)²⁵.

In theory ONQI scores could be used as a 'gold standard' against which other NP model scores or classifications could be compared. However the ONQI model is a proprietary model and cannot be used without payment and/or signing a confidentiality agreement.

Although there is, to all intents and purposes, no gold standard for assessing NP models it is possible to compare them with one another on various grounds and in particular to demonstrate statistically how they compare with respect to two characteristics:

- Strictness i.e. the percentage of foods classified as unhealthy/not unhealthy or healthy/not healthy by a model both overall and within food categories
- Agreement i.e. the extent to which two models classify the same foods as unhealthy/not unhealthy or healthy/not healthy both overall and within food categories.

A number of studies have been carried out that compare the strictness of, and agreement between, NP models and so the BHF HPRG have carried out a review of those studies with the aims of establishing the precise methods that have been used, of assessing the strengths and limitations of those studies, and of providing recommendations for comparing NP models.

3.1.2 Methods

The following databases were searched for publications: PubMed, Medline, Embase, Cinahl, and Scopus.

The search terms used were nutrient profiling/nutrition profiling/nutrient profile/nutrition profile, nutrient criteria/nutrition criteria, health claim/nutrition claim, and food label*. Several keywords were added to the searches to reduce the number of resulting publications while ensuring relevant publications were still found. Such terms included 'food', 'fat'/'fats', 'calories', 'compare', 'comparison', 'similar*' and 'different*'. The titles and abstracts of publications were screened, and those that appeared relevant were read to determine whether they met the inclusion criteria. The inclusion and exclusion criteria are listed in Table 1.

Table 1: Inclusion and exclusion criteria for review of articles comparing NP models

<i>Included if paper:</i>	<i>Excluded if paper</i>
Aims to compare NP models OR a has a subsection that compares NP models	Makes no mention of the similarities/differences between NP models
Investigates more than one NP model	Examines just one NP model (e.g. to seek to validate the model)

²⁵ Chiuve, S E, Sampson, L, Willett, WC (2011) The association between a nutritional quality index and risk of chronic disease. American Journal of Preventive Medicine, 40, 505–513.

Involves testing NP models against a minimum of five foods	Does not involve testing NP models
Makes a quantitative comparisons between strictness and/or percentage agreement	Does not make quantitative comparisons
Written in English	Not in English
Published in/after January 2000	Published before January 2000

3.1.3 Results

A total of 474 articles were identified by the searches, of which 36 were considered relevant based on screening the title and abstract. Once duplicates had been removed, 17 articles remained. Of these, six articles were identified that met the predetermined inclusion criteria. An additional article (Hebden et al 2010) which was known to the researchers also met the inclusion criteria and was therefore included in the review. Details of the seven articles are listed in Table 2. Only two of the articles (Hebden et al 2010 and Roberto et al 2011) focused on NP models used for marketing restrictions.

Of the seven articles identified, six set out with the purpose of either validating or aiding in the development of NP models. The sixth compared the categorisations of NP models to price and energy density.

There was overlap in the models assessed by different articles. The FSA/Ofcom model featured in five articles, 'Smart Choices' and 'SAIN_LIM' in three articles each, and the US Food and Drug Administration model and the Choices International model in two articles each.

The articles varied in the selection of food products used to compare models. Eyles et al (2010), Azais-Braesco et al (2006), and Drenowski et al (2009) used databases that were likely to represent the typical diet of the population in question. Eyles et al drew foods from a list of regularly purchased supermarket products; Azais-Braesco et al chose foods in various food groups with the final list being proposed as representative of foods regularly consumed in European countries; Drenowski et al used food composition data used in conjunction with a food frequency questionnaire. The two Trichterborn et al (2011a and 2011b) papers focused on specific food groups, one on dairy products and the other on fine bakery wares. Finally, two articles examined products marketed by food companies as healthy (or at least not unhealthy). Roberto et al (2011) used a list of products that were labelled as healthy by the US 'Smart Choices' model to determine whether these products would also be categorised as healthy by another NP model (FSA/Ofcom), Hebden et al (2010) used a sample of products that were being advertised to children by signatories of the Australian Food and Grocery Council's Responsible Marketing to Children Initiative.

Despite differences in the actual food products used by the articles, the authors of all articles had been careful to select a database of foods that would be relevant to the aims of their research.

Articles compared between two and six different NP models against databases of between 52 and 550 foods. Percentage agreement was the most commonly used method of

establishing the similarities between models. Although all the papers used 52 or more individual foods, a limitation observed by many authors was that the number of products in particular food categories was small therefore the observed results may not be representative of the situation for the category as a whole. Roberto et al (2011) noted that this was a problem in four out of the eight food categories they examined, each of which had three or less products. However, in this case the small sample size in some categories is likely to be partly due to the database of foods containing only foods that were deemed 'healthy' by a commercial NP model. The seemingly large differences between models observed in Hebden et al's paper also appear to be a result of the small number of products in particular food categories.

Five of the seven articles included additional comparisons of the ways models classified foods beyond statistical tests of the similarity of the classifications. Four of these examined differences in the nutrient composition of products deemed 'healthy' and 'unhealthy'. One article (Azais-Braesco et al. 2006) compared the classifications produced by NP models to rankings of foods made by nutritionists as well as comparing NP models to one another.

Comparisons of NP models are limited by the availability of appropriate nutritional information for an appropriate range of products. For example, food composition databases generated for the purpose of comparing NP models, e.g. from food labelling information, may lack information about nutrients which NP models need to generate scores or classifications. However solutions can be found to such problems as this. For example Trichterborn et al (2011a and 2011b) used food composition tables to generate nutrient values where values for nutrients were not available from the packaging.

Comparisons between NP models also depend on whether any food categorisation required by the models can be done accurately. Six of the seven articles commented on this problem.

3.1.4 Conclusion

Assessing the similarities and differences between NP model scores and classifications and making judgements about the validity of models, on the basis of such comparisons, is made difficult by the lack of a gold standard to compare with the scores and classifications generated by models. However, this review shows that a number of attempts have been made to draw conclusions about NP models by comparing models' scores and classifications and that this can help to distinguish between models.

Conclusions about the validity of NP models and how models compare to one another have also been made in studies that do not meet the inclusion criteria. These have generally used more qualitative and subjective methods than the studies included in this review. For example the StanMark Project report published by the International Association for the Study of Obesity entitled '*A Junk-Free Childhood 2012*' looked at, amongst other things, the categorisations of selected products by a range of commercial models and several government-approved systems. It identified a number of products that are allowed to be advertised by their respective manufacturer's model but that would not be allowed under

the government-approved systems²⁶. These reports are valuable, in other respects, in that they, for example, highlight a number of problems in relation to the self-regulation of advertising of foods to children, but they tell us little about the different NP models examined.

On the basis of our review, four recommendations can be made with respect to methods for comparing NP models.

Firstly, it is important to consider the food composition database which is to be used for the comparisons. Large databases which ensure an adequate number of products in all the relevant food categories are preferable. The foods in the database should be selected in a known manner (preferably random) from a circumscribed population of food.

Secondly, it would seem desirable that the database should reflect the application for which the models are used or proposed for use. For example if the NP models are for restrictions on the advertising of foods to children it would seem more reasonable to assess models against advertised foods than say foods which are not.

Thirdly, it is important to apply the NP models to the database as accurately and transparently as possible as differences in the application of models to foods in food composition databases can lead to different classifications. In cases where the full application of NP models is not possible, or where there is ambiguity in terms used by models, the methods used by researchers to overcome these problems should be described and the possible magnitude and direction of bias should be commented upon.

Fourthly, additional comparisons of NP model scores or classifications to some external reference point are desirable.

²⁶Persson M, Soroko R, Musicus A, Lobstein T (2012) A junk-free childhood 2012: The 2012 report of the StanMark project on standards for marketing food and beverages to children in Europe. London: International Association for the Study of Obesity.
http://www.iaso.org/site_media/uploads/IASO_food_marketing_report_30_June_2011.pdf

Table 2. Studies comparing NP models

Article Number	Reference	Included Models	Purpose/Objective	No. of Foods	Food Type(s)	Statistical Tests Comparing Models	Results	Additional Comparisons	Strengths	Limitations
1	H. Eyles, D. Gorton & C. Ni Mhurchu (2010) <i>Classification of 'healthier' and 'less healthy' supermarket foods by two Australasian nutrient profiling models. NZMJ</i> 123(1322)	Heart Foundation Tick (modified) FSANZ (modified)	To determine whether a modified version of the Heart Foundation Tick appropriately classifies supermarket foods to endorse its use for identifying healthier products eligible for promotion in a supermarket intervention trial (validation)	550	Regularly purchased supermarket products in New Zealand	Percentage agreement Consistency (kappa) Average nutrient values	72% overall; 52-84% for individual categories 0.46 (moderate) overall; 0.07-0.67 for individual categories	Comparison of mean nutrient values for products classified as 'healthier' and 'less healthy'	Compares two of the best known and most widely used NP models in Australia/New Zealand Focus on top-selling products means that comparison is relevant to the food purchases of New Zealanders	Modifications likely to result in less stringent models and as such the level of agreement may be higher or lower than that which would be observed normally Use of selective database which meant some food categories contained fewer products than others within particular food groups Exclusion of drained and reconstituted foods
2	J. Trichterborn, G. Harzer & C. Kunz (2011) <i>Nutrient profiling and food label claims: evaluation of dairy products in three major European countries. EJCN</i> 65	Swedish Keyhole Choices Programme Smart Choices Programme FSA/OFCOM SAIN/LIM (only LIM used) FDA	To provide guidance on the model characteristics required to appropriately categorise products into those suitable for carrying claims versus those whose overall nutritional composition does not support such product communication (development)	242	Dairy products with any sort of product communication giving the impression of 'healthier' Products identified in supermarkets in France, Germany and the UK between January 2007 and December 2009	Percentage agreement Overall Cheese Other Dairy	52% to 87% 30% to 97% 47% to 93%	Differences in average critical nutrient contents in products with claims today and after theoretical application of the models	Not listed	Not listed
3	V. Azaïs-Braesco, C. Goffi and E. Labouze (2006) <i>Nutrient profiling comparison and critical analysis</i>	Calorie For Nutrient Index Nutritious Food Index Ratio of Recommended to Restricted Foods FSA (old version)	To assess the performance of nutrient profiling models (validation/development)	125	Various food groups, and likely to represent most of the foods regularly consumed in European countries	Spearman Correlation Coefficient on ranks on quintiles	0.637 to 0.791 0.587 to 0.757	Comparison with rankings of 12 nutrition experts	Not listed	Not listed

	<i>of existing systems. Public Health Nutrition 9(5)</i>									
4	A. Drenowski, M. Maillott & N. Darmon (2009) <i>Testing nutrient profiling models in relation to energy density and energy cost. EJCN 63</i>	Nutrient adequacy scores family of models (n=2) Nutrient density score family of models (n=3) Nutrient-rich food family of models (n=7) LIM WXYfm	To test the performance of selected nutrient profile models in relation to the foods' energy density(kcal/g) and energy cost (\$ per 1000kcal) (other)	378	Component foods of the food frequency questionnaire (USA)	Pearson's Correlation Coefficient	-0.59 to 0.99	Comparison of models with energy density, percent energy from fat, total saturated fats (g), added sugars(g), cost per 100g and cost per 1000kcal	Not listed	Not listed
5	J. Trichterborn, G. Harzer & C. Kunz (2011) <i>Fine bakery wares with label claims in Europe and their categorisation by nutrient profiling models. EJCN 65</i>	Choices Programme Smart Choices Programme FSA/OFCOM SAIN/LIM (only LIM used) FDA	To assess a range of commercially available fine bakery wares with nutrition or health related on-pack communication against the criteria of selected nutrient profiling models (development)	238	Commercially available fine bakery wares with on-pack communication that links the products to nutrition and health in any possible way. Products identified in supermarkets in France, Germany, Spain, Sweden and the UK between January 2007 and December 2009	Percentage agreement Overall Sweet products Savoury products	68% to 96% 79% to 98% 37% to 92%	Differences in average critical nutrient contents in products with claims today and after theoretical application of the models	Not listed	Not listed
6	C. A. Roberto, M. A. Bragg, K. A. Livingston, J. L. Harris, J. M. Thompson, M. J. Seamans & K. Brownell (2011) <i>Choosing front-of-package food labelling nutritional criteria: how smart were 'Smart</i>	Smart Choices FSA/OFCOM (referred to as the Nutrient Profiling Model (NPM) throughout the paper)	To test the extent to which products labelled as 'Smart Choices' could be classified as healthy choices on the basis of the NPM (validation)	100	Selection of products labelled as 'Smart Choices' All were packaged foods Several types of food excluded due to no 'Smart Choices' products in the group (e.g. cheese) or due to concerns with applying the FSA/OFCOM model	Percentage agreement Overall Condiments Fats, oils and spreads Cereals Snacks and sweets Desserts Soups Beverages Bread, grains, pasta and flour	36.00 0.00 8.7 15.63 31.58 100 100 100 100	n/a	Not listed	Not all 'Smart Choices' products analysed and some categories had few possible products for analysis Only two possible FOP nutrition criteria compared

	<i>Choices'?</i> Public Health Nutrition 15(2)				(e.g. tomato based sauces) due to fruit/vegetable content not being listed					
7	L. Hebden, L. King, B. Kelly, K. Chapman, C. Innes-Hughes & N. Gunatillaka (2010) <i>Regulating the types of foods and beverages marketed to Australian children: How useful are food industry commitments?</i> Nutrition & Dietetics 67	Various industry models (FSANZ)	To examine commitments made by signatory companies of the Australian Food and Grocery Council's Responsible Marketing to Children Initiative regarding the types of foods considered appropriate for marketing to children (validation)	52	Unique food and beverage products manufactured by signatory companies	Percentage difference in strictness	57% more energy-dense nutrient poor foods assessed as appropriate compared to FSANZ. Differences also listed by food category.	Differences in the nutrient thresholds discussed	Not listed	Not listed

3.2 Comparisons between NP models used, or which potentially could be used, for regulating the marketing of foods to children in Europe.

3.2.1. Introduction

The comparisons between NP models in this investigation were carried out in two stages:

- Stage 1 involved comparing the new EU Pledge Nutrition Criteria (EUPNC) with the models companies are currently using for their pledges.
- Stage 2 involved comparing a number of NP models that European governments currently use to regulate the advertising of foods to children together with models that might be used (the new EUPNC were included in these comparisons).

Models can be compared in the way they have been constructed, e.g. the number and nature of exemptions to the model, the number and nature of the food categories for which the model has different nutrient criteria, the number and nature of the nutrients considered, and the reference quantity for the model (whether nutrient criteria are set per 100g, 100kJ, per serving, etc).

However, differences in the ways models are constructed are not necessarily important determinants of the differences in the way models classify or rank foods. For example the UK FSA/Ofcom model is constructed in a very different way to the model that the US Federal Trade Commission (and other US agencies) had proposed to regulate the marketing of foods to children in the US and yet they classify foods in a very similar way²⁷.

Therefore in this section of the report we have sought to demonstrate statistically how models compare with respect to:

- Strictness i.e. the percentage of foods classified as unhealthy by the models and therefore not suitable for advertising to children (both overall and within food categories)
- Agreement i.e. the extent to which two models classify the same foods as unhealthy.

3.2.2 Methods

3.2.2.1 The food composition database used

For the comparisons between NP models a food composition database, constructed using data from the University of Liverpool, was used. This database has been developed specifically for the purpose of making comparisons between NP models used for restrictions on marketing of foods to children. It is a database of 336 foods that were advertised to children in the UK prior to the full introduction of marketing restrictions in 2009. The foods can be weighted by the number of advertisements for that food during 2008.

²⁷ Rayner, M, Scarborough P, Kaur A (2012). Nutrient profiling and the regulation of marketing to children. Possibilities and pitfalls. *Appetite* . <http://dx.doi.org/10.1016/j.appet.2012.06.021>

The food composition database was based on a dataset of food advertisements initially developed by the University of Liverpool from surveying advertisements broadcast in the UK in 2008. The advertisements were broadcast on the 14 commercial television channels most popular with children aged 4-16 years²⁸. These channels included those predominately broadcasting general family (e.g. ITV, Sky One), sports (e.g. Sky Sports One), dedicated child (e.g. Nickelodeon, Boomerang) and music related programming (e.g. MTV, Smash Hits).

The advertisements were taken from recordings of one week day's and one weekend day's television every month (from 6am until 10pm) during the study period (January – December 2008). The dataset consisted of the name of the food, brand or company advertised and the number of advertisements for that food/brand/company recorded in the total sample. It ended up consisting of 455 different advertisements broadcast on a total of 18 888 occasions.

Advertisements were then removed from the dataset if they were for:

- an alcoholic drink, tea or coffee;
- a retailer that provides a broad range of products (e.g. a supermarket);
- a food or drink for babies or toddlers;
- a weight-loss or weight-gain shake;
- chewing gum.

The remaining advertisements were categorised as follows, advertisements for:

- single food items;
- single brands that include a range of products (e.g. Golden Wonder Pot Noodles, which are available in 12 flavours in the UK);
- meals that incorporate more than one food or drink (e.g. McDonald's Big Mac meal).

Food composition data were sourced and computed for these three categories of advertisement as follows:

For single food items, company websites were reviewed and all available nutrient composition data and recommended serving size information were taken. Where information that is usually available from nutrition information panels was not available from the company website, food packaging was sourced and nutrient composition data were extracted. These data were supplemented with nutrient composition data for a similar food from a UK food composition table of generic foods²⁹ (e.g. nutrition data for Kerry Cheestrings was supplemented with data on the generic food 'Cheese, processed slices or block').

²⁸ Boyland EJ, Harrold JA, Kirkham TC, Halford JC. (2011) The extent of food advertising to children on UK television in 2008. *Int J Pediatr Obes.* 6(5-6):455-61.

²⁹ Food Standards Agency (2002) McCance and Widdowson's the composition of foods, sixth summary edition. Cambridge: Royal Society of Cambridge.

For brands, a single product from the range was selected at random to represent the brand, and nutrition data were sourced as for single food or drink items.

For meals, nutrition data for each component of the meal were sourced as for single food or drink items. Using serving size data, the nutrition data were then combined to create weighted average nutrition data for the meal.

Throughout, where serving size data were not available from company websites, these were supplemented by information from a UK serving size guide³⁰.

An internal validity exercise was conducted to assess the similarity between supplementary data from the generic food composition table and data extracted directly from websites/packaging, using situations where both sets of data were available. Correlation (assessed with the Pearson correlation coefficient) between the two sets of data ranged from $r = 0.62$ for sodium per 100g to $r = 0.92$ for energy per 100g, indicating that agreement between the two data sources was strong.

3.2.2.2 The nutrient profile models

Eleven NP models were included in the comparisons for Stage 1. These models included the eleven models that are currently used by signatories to the EU Pledge, i.e. the models used by UniChips, Kraft, Kellogg's, Intersnack, Burger King, General Mills, Danone and Royal FrieslandCampina (both use a model call the Food Profiler), McDonald's (a slightly modified version of the FSA/Ofcom model), Unilever, PepsiCo and Nestle. It should be noted that seven of the 19 Pledge signatories do not use an NP model. The Stage 1 comparisons also included the new EU Pledge Nutrition Criteria (EUPNC).

Six NP models were included in the comparisons for Stage 2. These NP models include all the models that are currently used, or proposed for use, by national governments in Europe for restrictions on the marketing of food to children. These models were the FSA/Ofcom model developed by the UK Food Standards Agency for the UK Government's restrictions on the television advertising of foods (this model is also used by the Irish government for its restrictions); the NP model proposed by the Norwegian Government for its proposed regulation; the model in the Danish Forum of Responsible Food Marketing Communication's '*Code of Responsible Food Marketing Communication to Children*'. Two other models that some have suggested would be appropriate for marketing restrictions were also included: the Swedish Keyhole model (now called the Nordic Keyhole model) originally developed by the Swedish National Food Administration to underpin a scheme for labelling healthy foods, and the model developed for food labelling purposes by the Choices International Foundation. The Stage 2 comparisons also included the new EUPNC.

For references (weblinks) to all models see Table 3.1.

³⁰ Food Standards Agency (2002) Food portion sizes, third edition. London: TSO.

Table 3.1 Links to models compared

Model name	Web Link (accessed 7th January 2013)
UniChips	http://www.esa.org.uk/advpledge_criteria_unichips.pdf
Kraft	http://www.kraftfoodscompany.com/SiteCollectionDocuments/pdf/nutrition-criteria.pdf
Kellogg's	http://eu-pledge.eu/sites/eu-pledge.eu/files/pledges/EU_Pledge_Kellogg_Commitment.pdf
Intersnack	http://www.intersnack.com/index.php?id=486&L=1%29
Burger King	http://eu-pledge.eu/sites/eu-pledge.eu/files/pledges/EU_Pledge_Burger_King_Commitment.pdf
General Mills	http://www.cerealpartners.com/cpw/pdf/CPW_EU_Pledge_Commitments_112008.pdf
Food Profiler (used by Royal FrieslandCampina and Danone)	http://thefoodprofiler.com/pdfs/thefoodprofiler_detailed_method.pdf http://www.eu-pledge.eu/sites/eu-pledge.eu/files/pledges/EU_Pledge_Royal_FrieslandCampina_Commitment.pdf http://eu-pledge.eu/sites/eu-pledge.eu/files/pledges/EU_Pledge_Danone_Commitment.pdf
McDonald's	http://eu-pledge.eu/sites/eu-pledge.eu/files/pledges/EU_Pledge_McDonalds_Europe_Commitment.pdf http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_123492.pdf
PepsiCo	http://eu-pledge.eu/sites/eu-pledge.eu/files/pledges/EU_Pledge_PepsiCo_Commitment.pdf
Unilever (Nutrition Enhancement Programme)	http://www.unilever.com/aboutus/Nutritionandhealth/Makingourfoodhealthier/NEPbenchmarksApril2012.aspx
Nestle	http://www.nestle.com/asset-library/Documents/Creating%20Shared%20Value/Nutrition/Nestle-Research-Nutritional-Profiling-System-Dec2010.pdf *
EUPNC	http://eu-pledge.eu/sites/eu-pledge.eu/files/releases/EU_Pledge_Nutrition_White_Paper_Nov_2012.pdf
FSA/OFCOM	http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_123492.pdf
Swedish Keyhole	http://www.slv.se/upload/nfa/documents/food_regulations/Nyckelh%C3%A5l_dec_2009_6%20eng.pdf
Norwegian	http://www.regjeringen.no/nb/dep/hod/dok/hoeringer/hoeringsdok/2012-2/horing---forslag-til-ny-regulering-av-ma/horingsnotat.html?id=684711 (Norwegian. English translation provided to Mike Rayner by Tim Lobstein)
Danish	http://kodeksforfoedevarereklamer.di.dk/SiteCollectionDocuments/Foreningssites/kodeksforfoedevarereklamer.di.dk/Downloadboks/guideline_English%20Jan%202008.pdf
Choices International	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3208753/pdf/ejcn2011101a.pdf

* This link was provided to the authors by the company. There is no link to this model on the EU Pledge website at the time of writing.

3.2.2.3 Statistical analyses performed

The overall strictness of the NP models i.e. the proportion of ‘foods’ that would be allowed to be advertised and also the proportion of foods weighted by the number of advertisements broadcast that would be allowed by each NP model were calculated, with accompanying 95% confidence intervals assuming a binomial distribution (not shown in this report).

The overall agreement between models in their classifications of foods was assessed using Cohen’s kappa statistic, with agreement assessed as follows: 0.21-0.40 ‘fair’; 0.41-0.60 ‘moderate’; 0.61-0.80 ‘good’³¹. Note that these verbal descriptions of the level of agreement shown by kappa statistics are quite arbitrary and what would be a ‘fair level of agreement to one person might be considered ‘poor’ by another. It is better to use the statistics themselves to see where NP models are in most agreement.

Strictness within food categories was also calculated. For these analyses all foods (weighted by the number of advertisements broadcast) were split into seven categories based on the UK Food Guide – the Eatwell Plate³²:

- Fruit and vegetables
- Bread, cereals and potatoes
- Meat, fish and alternatives
- Milk and dairy
- Fatty and sugary foods (further subdivided into snacks, not snacks, and drinks)
- Composite foods (foods composed of items from more than one nutritional group, such as pizza)
- Miscellaneous

Agreement within categories was not calculated for this report.

3.2.3 Results

3.2.3.1 Characteristics of the database used

Table 3.2 shows the number of foods in the dataset by UK Food Guide food category, and the number and percentage of advertisements for foods in each category. It shows that the advertised diet is quite different from the ideal diet recommended by the UK Food Guide (Figure 3.2) a result confirmed by many other studies.

³¹ Altman DG (1991) Practical Statistics for Medical Research. Chapman and Hall: London.

³² NHS Choices. The Eatwell Plate. <http://www.nhs.uk/Livewell/Goodfood/Pages/eatwell-plate.aspx>

Table 3.2 Categorisations of foods and advertisements within the database

Food Category	Number of Foods	Number of Advertisements	% of Advertisements
Fruit and Vegetables	10	234	1.99
Bread, Cereals and Potatoes	51	2821	23.98
Meat, Fish and Alternatives	15	257	2.18
Milk and Dairy	41	2381	20.24
Fatty and Sugary Foods	125	3204	27.24
Snacks	(92)	(2106)	(17.90)
Not snacks	(14)	(491)	(4.17)
Drinks	(19)	(607)	(5.16)
Composite Foods	80	2346	19.94
Miscellaneous	14	520	4.42
Total	336	11763	100

Figure 3.2a The Eatwell Plate

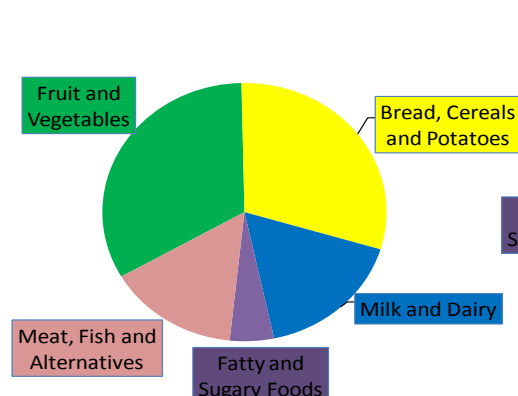
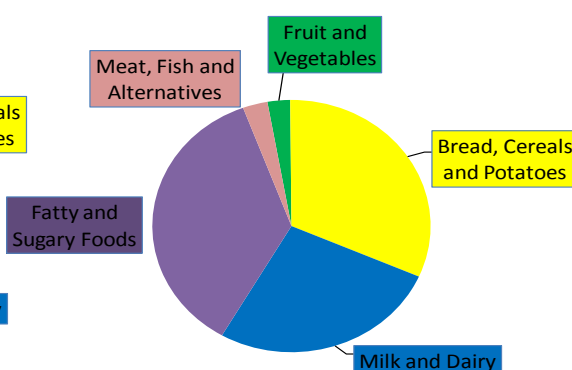


Figure 3.2b The advertised diet



3.2.3.2 Comparison of EU Pledge signatories' models and the new EU Pledge nutrition criteria

The NP models vary considerably in how they have been constructed. The nutrients involved, the reference quantity and the number of categories for each model are given in Table 3.3. The most commonly included nutrient was sodium/salt which was used for all models. Cholesterol and protein were the least commonly used nutrients out of those listed; each was included in only three models. Table 3.3 also shows that the models also varied considerably in the reference quantity and the number of categories used.

Table 3.3 Nutrients, categories and bases (reference quantities) used by each of the Pledge signatories' NP models.

Model	Kcal/ kJ	Added Sugar	Total Sugar	Fat	Saturated Fat	Trans fat	Cholesterol	Sodium/ Salt	Protein	Fibre	Vitamins/Minerals	Total Nutrients*	Categories	Base
UniChips	y		y		y	Y	y	y				6	1	Combination
Kraft	y	y	y	y	y	Y	y	y	y	y	y	11	16	/serving
Kellogg's	y		y		y	Y		y				5	1	/serving
Intersnack		y		y	y	Y		y				5	1	/30g (serving)
Burger King	y	y		y	y	Y		y				6	2	/meal
General Mills	y		y		y			y			y	5	1	/serving
Food Profiler		y	y	y				y		y	y	6	1	Combination
McDonald's	y		y		y			y	y	y		6	2	/100g
PepsiCo		y		y	y	Y	y	y			y	7	6	Combination
Unilever	y	y			y			y				4	21	Combination
Nestle	y	y		y	y	Y		y	y	y	y	9	27	Combination
EUPNC	y		y	y	y			y	y	y	y	8	20	Combination
Totals	9	7	7	7	11	7	3	12	4	5	6			

* Models may also use non-nutrient components e.g. the McDonald's model has 'fruit, vegetables and nuts' as one of its components.

The models also varied in the number of foods that they would allow to be advertised.

Table 3.4 shows the number and percentage of foods that would be allowed by each model. Note that the design of the Kraft model and the Burger King model did not allow all foods to be classified.

Table 3.4: Numbers of foods and advertisements classified as suitable for advertising to children according to Pledge signatories' models					
Model	N	Foods approved	% approved***	Foods approved, weighted by advertisements	% approved, weighted by advertisements
UniChips	336	7	2.08	188	1.60
Kraft	261	41	15.71	1170	13.31
Kellogg's	336	51	15.18	2870	24.40
Intersnack	336	68	20.24	2441	20.75
Burger King (adjusted*)	92 92	3 3	3.26 3.26	67 67	1.99 1.99
General Mills (adjusted**)	336 336	3 3	0.89 0.89	157 157	1.33 1.33
Food Profiler	336	171	50.89	7936	67.47
McDonald's	336	124	36.90	5389	45.81
PepsiCo	336	48	14.29	1691	14.38
Unilever	336	93	27.68	3720	31.62
Nestle	336	20	5.95	1196	10.17
EU Pledge Nutrition Criteria (EUPNC)	336	86	25.60	3758	31.95
*Adjusted to account for children's serving sizes					
** Adjusted to account for children's RDAs (taken from Dietary Reference Values for Food, Energy and Nutrients for the UK, Department of Health 1991). Values used are for children aged 7-10years.					
***Where not all foods assessed, this is the percentage of assessed foods that were approved					

The strictest models were the Burger King and General Mills models, which only allowed three of the foods in the database to be advertised. The Burger King model is designed to classify meals comprising of an entrée, side dish and drink but was applied to any food in the database that could be considered as a 'meal'. The fact that foods classified generally failed the Burger King model is a reflection of the fact that the majority of such foods did not contain a drink as the model seemed to assume.

The least strict model was the Food Profiler model (used by Danone and Royal Friesland Campina) which would allow 51% of foods to be advertised (67% of advertisements).

Many of the models appear very strict; UniChips, Kraft, Kellogg's, Burger King, PepsiCo, Nestle and General Mills all approve less than 20% of both individual foods and advertisements. McDonald's, the Food Profiler, Unilever and the EU Pledge Nutrition Criteria are less strict in the overall percentage of foods they would allow to be advertised. The small proportions of foods that are allowed by some of the models can be explained by a number of factors. Firstly, over a third of products in the database are 'Fatty or Sugary Foods' (n=125), and therefore likely to be unhealthy foods by any definition. Secondly, features of the models themselves help to account for their strictness. In many cases, many more foods would be allowed to be advertised if the threshold for one of the nutrients used

in the model was removed or changed. For example, if the sodium criterion was removed from the Intersnack and Kellogg's models, 71 and 54 foods would be approved by the two models, respectively.

Another feature of models that appears to have an effect on the overall level of strictness of some is the total number of nutrients used. The Kraft model's use of a total of 11 nutrients makes it difficult for products that may otherwise be considered to be healthy to be approved on the basis of not meeting the criteria for a single nutrient.

It should be noted that a number of the models may not have been designed to be applied to as broad a range of foods as represented in the database and this may partly account for the high level of strictness of, and anomalous categorisations produced by, some of the models.

The agreement between models was assessed on a pairwise basis (i.e. each model was compared to each other model in turn). The results are shown in Table 3.5. Although the percentage agreement between many of the models appears high, this is often an artefact of the high level of strictness of those models. A better measure of the agreement between models is the kappa statistic which examines the agreement between models accounting for the level of agreement that would be expected by chance. When we examine the kappa scores, agreement between the models is generally poor.

There are a number of cases where the kappa score is low whilst the percentage agreement is high. For example, the percentage agreement between the UniChips and General Mills models is 97%, but the kappa score is negative. This is because both models allow very few foods to pass (a total of 10 foods between the two models). Even though there are no foods which both models allow to be advertised, the percentage agreement is very high because the models are both very strict. This illustrates the problem of looking at percentage agreement rather than percentage agreement as measured by the kappa statistic.

There are a few cases where there is 'moderate' agreement between the models: McDonald's with Kraft, Food Profiler, PepsiCo, Unilever and the EUPNC; and between PepsiCo and Kellogg's. There are also 19 cases of 'fair' agreement between models as judged by the kappa score. There is negative agreement (i.e. disagreement) between the models in around a quarter of the comparisons.

Table 3.5 Percentage agreement and pairwise kappa values (showing level of agreement adjusted for that expected by chance) calculated for 10 models

	UniChips	Kraft	Kellogg's	Intersnack	Burger King	General Mills	Food Profiler	McDonald's	PepsiCo	Unilever	Nestle	EU PNC
UniChips		0.1267	0.1051	0.0716	-0.0166	-0.0127	0.0168	0.0702	0.0377	0.063	-0.0318	0.0047
Kraft	84.67		0.2840 *	0.3246 *	-0.0430	0.0246	0.1223	0.4344 **	0.3840 *	0.1527	-0.0529	0.2088 *
Kellogg's	85.12	81.23		0.2171 *	0.2080 *	0.0205	0.1769	0.2647 *	0.4196 **	0.1708	-0.0011	0.2696 *
Intersnack	80.06	81.23	77.08		0.2434 *	0.0399	0.3698 *	0.3512 *	0.3994 *	0.2947 *	-0.0763	0.3120 *
Burger King	95.65	82.14	86.96	83.70		-0.0166	0.0484	0.0805	0.1238	-0.0026	-0.0268	0.1576
General Mills	97.02	83.91	84.52	80.06	95.65		0.0172	0.0303	0.0627	0.0248	-0.0158	0.0510
Food Profiler	50.00	60.15	58.33	68.15	45.65	50.00		0.4016 **	0.1360	0.3032 *	-0.0138	0.2860 *
McDonald's	65.18	78.93	69.94	72.62	58.70	63.99	69.94		0.2531 **	0.4001 **	-0.0523	0.4540 **
PepsiCo	84.82	83.52	85.42	82.74	89.13	86.01	56.25	69.64		0.2747 *	-0.0917	0.3055 *
Unilever	73.21	70.88	71.43	74.11	64.13	72.62	64.88	73.51	75.30		-0.0498	0.3226 *
Nestle	91.96	79.31	80.65	74.40	94.57	93.15	48.51	59.52	79.76	68.15		-0.0234
EUPNC	73.51	75.10	75.89	75.60	75.00	75.30	63.99	76.19	77.38	73.51	70.83	

*Fair agreement

**Moderate agreement

The models were also compared for their strictness within food categories and the results are displayed in Figure 3.5.

The food category with the highest percentage of foods approved by most models (but not all) was 'Fruit and Vegetables'. 'Fatty and Sugary Foods' generally had the lowest percentage of foods allowed to be advertised. These results were to be expected given that 'Fruit and Vegetables' and 'Fatty and Sugary Foods' can reasonably be regarded as the healthiest and least healthy food categories respectively.

Examination of the strictness of models within categories calls into question the validity of certain models. For example, the Kellogg's model allows a greater number of products to be advertised in the 'Fatty and Sugary Foods' category than in the 'Meat, Fish and Alternatives', and 'Milk and Dairy' categories which may reasonably be considered to be healthier than the 'Fatty and Sugary Foods' category.

The EUPNC classify foods in a way that seems reasonably consistent with dietary recommendations in that they allow a high percentage of foods within the 'Fruit and Vegetables' and the 'Bread, Cereals and Potatoes' categories and a low percentage of 'Fatty and Sugary Foods' to be advertised.

Overall conclusion for this section

The low levels of agreement between different Pledge models, and the differences in overall strictness and strictness within categories suggest that many of the previous Pledge models were/are not suitable for the regulation of advertising aimed at children.

The previous Pledge models that appear most suitable are the McDonald's model (based on the FSA/Ofcom model), the PepsiCo, the Unilever model and the Food Profiler model. These four models, although not necessarily particularly strict overall, appear to have better differentiation between foods on a category by category basis and allow very few foods classified as 'Fatty and Sugary' to be advertised.

Compared with the previous Pledge models the EUPNC appears to be an improvement but this does not necessarily mean it is the best possible model. The next section compares the EUPNC to other models that are being used or have been proposed for use in regulating the advertising of food to children in Europe. Some of these models, notably the FSA/Ofcom model, the Swedish Keyhole model and the Choices International model have been in use for a number of years, have been used for a number of different applications and have been the subject of considerable validity testing.

3.2.3.3 Comparison between models that European governments currently use or that they might use for marketing restrictions

The six models compared in this section are all used, or potentially could be used in restrictions on the marketing of food to children in European countries and potentially could form the basis of a common European model.

As with the Pledge signatories' models, there are differences in how the six models are constructed. Table 3.6 shows the nutrients that are used. Sodium/salt is used by all the models but otherwise there seem little consistency in the nutrients used. Vitamins and minerals are used far less commonly in these models than in the Pledge signatories' models.

Note, moreover, that in the Danish model the salt criterion is included as a 'further consideration'. The implications of this are discussed later. When comparing the Danish model with the other models the salt criterion has not been included due to the ambiguity of its application.

The models also differed in the number of categories involved and the reference quantity used. It is worth noting that the FSA/Ofcom model is the only model of the six which involves a scoring system to generate scores for foods based on nutrient content levels. The other five models use thresholds nutrient levels and Boolean operators (AND, OR, etc.) to generate classifications.

Table 3.6: Nutrients, categories and bases (reference quantities) used by each of the six models compared in this section														
Model												Total Nutrient*	Categories	Base
	Kcal/ kJ	Added Sugar	Total Sugar	Fat	Saturated Fat	Trans fat	Cholesterol	Sodium/ Salt	Protein	Fibre	Vitamins/Minerals			
EUPNC	y		y	y	y			y	y	y	y	8	8	Combination
FSA/Ofcom	y		y		y			y	y	y		6	2	/100g
Swedish Keyhole		y	y	y				y		y		5	25	Combination
Norwegian	y		y	y	y			y				5	8	/100g
Danish			y	y				**				2	10	/100g
Choices International	y	y			y	y		y		y		6	9	Combination
Totals	4	2	5	4	4	1	0	5	2	3	1			
* Models may also use non-nutrient components e.g the FSA/Ofcom model has ‘fruit, vegetables and nuts’ as one of its components														
**The Danish model only includes a salt criterion as a ‘further consideration’.														

The models again varied in the number and percentage of foods and advertisements that they allowed, but to a lesser extent than the Pledge signatories’ models and also in more predictable ways as shown in Table 3.7.

Table 3.7: Numbers of foods and advertisements classified as suitable for advertising to children according to the models compared in this section.

Model	Number of foods	Percentage of foods	Number of foods, weighted by ad frequency	Percentage of foods, weighted by ad frequency
EUPNC	86	25.60	3758	31.95
FSA/Ofcom	134	39.88	5571	47.36
Swedish Keyhole	16	4.76	642	5.46
Norwegian	151	44.94	4936	41.96
Danish	124	36.90	3828	32.54
Choices International	21	6.25	724	6.15

The strictest model was the Swedish Keyhole model, closely followed by the Choices International model. The fact that these models are strict (particularly in relation to this database where over one third of the foods were 'Fatty and Sugary Foods' as defined by the UK Food Guide) is not surprising given that they were designed to highlight healthy foods rather than foods which are unhealthy. The other four models are similar in their overall strictness with the FSA/Ofcom model being marginally the least strict and the EUPNC being marginally stricter than the others in relation to foods (but not advertisements).

Agreement between models, as assessed by the kappa statistic, is generally poor as illustrated in Table 3.8. However, moderate agreement is observed between the models on four occasions and fair agreement is observed on an additional two occasions.

Table 3.8: Percentage agreement and pairwise kappa values (showing level of agreement adjusted for that expected by chance) calculated for six models

	EUPNC	FSA/OFCOM	Swedish Keyhole	Norwegian Model	Danish model	Choices International
EUPNC		0.4056 **	0.1259	0.2423 *	0.2629 *	0.0961
FSA/OFCOM	73.21		0.1402	0.4349 **	0.5600 **	0.1537
Swedish Keyhole	75.60	64.88		0.1154	0.1575	0.0571
Norwegian model	63.99	72.32	59.82		0.4925 **	0.0465

Danish model	67.86	79.17	67.86	75.30		0.0965
Choices International	74.11	65.18	90.18	56.55	65.18	
*Fair agreement						
**Moderate agreement						

Agreement between models is partially a function of how similar they are in terms of strictness. It is possible to obtain some idea of the extent to which differences between models' classifications are due to different levels of strictness by examining the proportion of foods which are allowed by the less strict model but not by the stricter model. Observations suggest that differences in overall strictness between these models are likely to account for a substantial portion of the overall differences. There is even one case where difference in strictness appears to account for all disagreements: between the FSA/Ofcom model and the Swedish Keyhole model. There are no instances where the stricter Swedish Keyhole model allows a food to be advertised but the FSA/Ofcom model prohibits it on examination of the raw data.

The percentages of foods within a category that are allowed by each model are displayed in Figure 3.4. All the models allow a low percentage of foods in the 'Fatty and Sugary Foods' category to be advertised and a higher percentage of foods in the 'Fruit and Vegetables' category.

The Danish model is different to the other four models with comparable overall strictness in allowing a smaller percentage of 'Fruit and Vegetables' to be advertised to children. This is largely the result of juices and smoothies not meeting the sugar criterion.

Both the Danish and Norwegian models appear to allow more foods in the 'Meat, Fish and Alternatives' category than other models (although as there are only a few foods in the database in this category (n=15) this conclusion must be tentative). The Norwegian model also allows more products in the 'Milk and Dairy' category to be advertised than any other model and the Danish model also allows more 'Composite Foods' than any other model ('Composite Foods' includes meals that incorporate more than one food or drink for the purpose of this study).

However, the interpretation of the Danish model used for the analyses above, assumed that the salt criterion did not need to be applied as it is only listed as a further consideration. Consultation with the Forum of Responsible Food Marketing Communication in Denmark suggests that the salt criterion is applied when foods are close to crossing the thresholds for fat and/or sugar.

A supplementary analysis shows the proportion of 'Meat, Fish and Alternatives', 'Milk and Dairy', and 'Composite Foods' allowed to be advertised is considerably reduced when the salt criterion is applied but there are less noticeable differences across the other categories. Overall 14% of the foods in the database would be allowed to be advertised if the salt criterion is applied compared with 37% if not.

Overall conclusions to this section

Two of the six models examined in this section - the Swedish Keyhole model and the Choices International model - are very strict and would allow very few foods to be advertised to children. This is because they were designed to define a 'healthy' food rather than an 'unhealthy' food. If policy makers think that only the healthiest of foods should be advertised to children then these would be appropriate NP models to use for advertising restrictions.

The Norwegian and the Danish models are less strict than the Swedish Keyhole model and the Choices International model and appear to classify some foods in anomalous ways compared with other models – particularly in the meat and dairy categories. It should be noted that had the discretionary salt criterion for the Danish model been applied in all cases then the model would be nearly as strict as the Swedish Keyhole model and the Choices International model and would classify meat and dairy products in less anomalous ways.

The FSA/Ofcom model and the EU Pledge Nutrition Criteria classify foods in a very similar fashion even though they are constructed differently.

3.2.1. Overall summary of Section 3

The studies that the BHF HPRG have carried out to compare NP models currently used or proposed for use in restricting the marketing of foods to children in Europe suggest that, compared with the previous NP models used by companies in connection with their voluntary restrictions on the marketing of foods to children, the recently published EU Pledge Nutrition Criteria classify foods in a way that seems reasonably consistent with dietary recommendations

However this does not necessarily mean that the EU Pledge Nutrition criteria are optimal or that they should form the basis for an NP model that is agreed for legislative or voluntary marketing restrictions throughout Europe.

Six models have been investigated that might form the basis of a common European definition of an unhealthy food for the purpose of marketing restrictions, i.e.:

- The FSA/Ofcom model used for statutory restrictions in the UK and Ireland;
- The model proposed by the Norwegian Government for a new regulation on the advertising of foods to children;
- The model within the '*Code of responsible food marketing communication to children*' of the Danish Forum of Responsible Food Marketing Communication;
- Two models developed for labelling purposes:
 - the model used for the Swedish Keyhole labelling scheme;
 - the model developed by the Choices International Foundation;
- The new EU Pledge Nutrition Criteria.

The investigations described show that two of these models - the Swedish Keyhole model and the Choices International Foundation model - are very strict and would allow very few

foods to be advertised to children. This is because they were designed to define what is a 'healthy food' rather than an unhealthy food.

The Norwegian and Danish models are less strict than the Swedish Keyhole model and the Choices International model. They appear to classify some foods in anomalous ways compared with other models – particularly in the meat and dairy categories. In addition, the ambiguity of how and when the salt criterion should be applied in the Danish model is a problem as the number of foods allowed to be advertised changes considerably depending on the criterion's application.

The FSA/Ofcom model and the EU Pledge Nutrition Criteria classify foods in a very similar fashion even though they are constructed differently. Both models are not particularly strict but classify foods in ways which are reasonably consistent with dietary recommendations. Both models could be improved. In particular it may be thought desirable that they should be stricter.

The assessment of which nutrient profile model should be adopted for the purposes of reducing children's exposure to marketing of foods that are high in fat, salt or sugar is limited by the absence of a 'gold standard' against which to compare the classifications produced by nutrient profile models. Detailed discussion of the methods of validating nutrient profiling models is beyond the scope of this report but it should be noted that there has only been one study to date which has compared the classifications produced by a nutrient profile model with long-term health outcomes³³. 'Silver standards' for assessing nutrient profiling models have included rankings of the healthiness of products as assessed by nutritionists, etc.

Until further studies of the validation of nutrient profile models have been conducted, the assessment of which nutrient profile model would be best will unfortunately rely on comparisons of how nutrient profile models perform when applied to a particular database of foods.

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³³ Chiuve, S. E., Sampson, L., & Willett, W. C. (2011). The association between a nutritional quality index and risk of chronic disease. *American Journal of Preventive Medicine*, 40, 505–513.

Figure 1: Percentage of foods in each food category allowed by pledge models

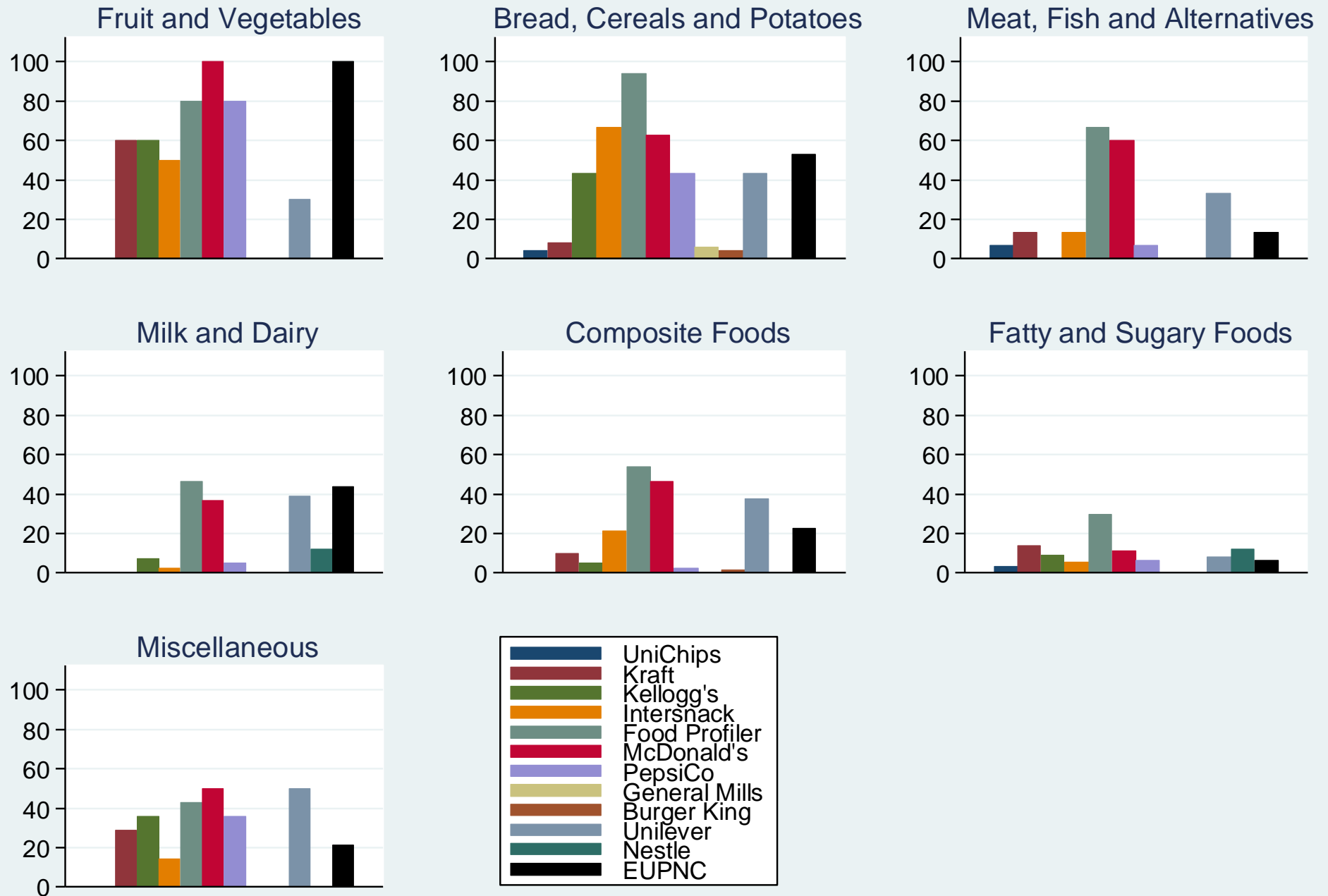


Figure 2: Percentage of foods in each food category allowed by country models

