

Nutrient profiles: Further refinement and testing of Model SSCg3d

Final report

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Contents

Summary	3
Membership of Expert Group	8
General introduction to this report.....	9
Section 1. Initial examination and evaluation of areas for refinement	10
Section 2. Assessment of combinations of potential modifications	20
Section 3. Consequences of measuring fibre by Englyst or AOAC methods.....	36
Section 4. Deciding the threshold for a ‘less healthy’ food and a ‘less healthy’ drink	42
Section 5. Comparing Models WXY and SSCg3d against an improved panel of indicator foods.....	44
Appendices.....	61

Summary

This report describes the second stage of a Food Standards Agency project to develop a nutrient profiling model to support Ofcom's work on tightening the rules on broadcast advertising of foods that are high in fat, saturated fat, salt or sugar to children (in this report called 'less healthy' foods). This supports commitments in both the White Paper: Choosing Health¹, and the Agency's Action Plan on Food Promotions and Children's Diets.

A team of researchers (the authors of this report) and an expert stakeholder group (for the members of this Expert Group see page 8) assisted the Agency in the development of the model.

From November 2004 until March 2005 the Agency undertook a number of consultative activities to subject its initial nutrient profiling model (Model SSCg3d) to external scrutiny and assessment.

Model SSCg3d - the development of which has been described previously² - scored foods according to their level of: energy density, saturated fat, non-milk extrinsic sugars (NMES), sodium, calcium, iron, n-3 polyunsaturated fatty acids, and fruit and vegetables.

On 25 November 2004, the Agency launched a public consultation on this initial model, seeking stakeholder's views on its scientific basis and the way in which it had been developed; its effectiveness in categorising foods, and further development and testing.

Over 80 responses were received from a wide range of stakeholders including food manufacturers, public health bodies, local authorities and consumer organisations. A full summary of responses is available on the Agency's website.³

On 25 February 2005 the Agency held a scientific workshop to assess the scientific basis of the model. The workshop, which was attended by around 30 nutrition academics from the UK as well as policy makers from overseas, supported the use of the model for regulatory purposes, and in particular for the intended use in relation to broadcast advertising. The applicability of the model to different age groups was discussed at the Scientific Workshop. A note of the outcome of the scientific workshop is available on the Agency's website.⁴

The Agency also sought the views of the Scientific Advisory Committee on Nutrition (SACN) on the model. SACN members submitted responses to the formal consultation

¹ This work complements that being taken forward as part of the Scottish Action Plan *Eating for Health, Meeting the Challenge*, the Welsh strategy *"Food and Wellbeing"* and the proposed *Food and Nutrition Strategy for Northern Ireland*.

² Rayner M, Scarborough P, Stockley L. Nutrient profiles: options for definitions for use in relation to the promotion of foods to children. London: FSA, 2004
<http://www.food.gov.uk/multimedia/pdfs/nutrientprofilingfullreport.pdf>

³ <http://www.food.gov.uk/healthiereating/nutres/nutprof/>

⁴ <http://www.food.gov.uk/news/newsarchive/2004/nov/signconsult>

exercise, and discussed the model at their February meeting⁵. The Committee was supportive of the model and the way in which it had been developed, and members of its committee have been involved in subsequent work to refine the model.

The responses to the consultation activities indicated that there was general support for the way in which Model SSCg3d classified a wide range of foods. However, a number of suggestions to refine and further improve the model were received. In total 21 possible refinements were considered by the Expert Group and of these it recommended that the following five warranted further investigation:

1. An alternative approach to take account of carbohydrate quality;
2. A refinement to take account of the nutrient density of foods, by introducing a water content criterion;
3. An alternative approach to recognising the importance to the diet of foods from the 'Meat, fish and alternatives' and 'Milk and dairy products' groups of the Balance of Good Health;
4. A refinement to enable the further differentiation of products within the fats and oils category;
5. A refinement to the weighting of scores for fruit and vegetable content.

These refinements – 12 different modifications - were initially tested one by one to identify whether they were likely to improve the efficacy of the model, for the purposes of classifying foods. The modifications that showed promise were then tested in combination.

In the light of testing combinations of modifications the Expert Group now recommend a new model. This improved model was considered by the Expert Group to have several scientific, technical and practical advantages over the initial model and to be easier to apply as a tool to improve the regulation of broadcast advertising of less healthy foods to children. It involves the following criteria:

- energy;
- saturated fat;
- total sugars (instead of NMES);
- sodium;
- fibre;
- protein (instead of iron, calcium and n-3 fatty acids) and;
- fruit and vegetables

The current model is judged to be more effective in distinguishing between, and identifying, healthier cereal based products than the previous version; and also addresses concerns raised

⁵ Minutes of the meeting are available from www.sacn.gov.uk

in the consultation about its application to fortified foods. Full details of the current model (Model WXY) are given below.

The substantive differences between Model WXY and Model SSCg3d are:

- The addition of a criterion for NSP fibre – thereby addressing concerns that some cereal based products (in particular some breakfast cereals and breads) had not been appropriately classified by the initial model;
- The replacement of the NMES criterion with a total sugars criterion addressing the practical difficulties of analysing NMES;
- The replacement of criteria for calcium, iron and n-3 fatty acids with a single protein criterion – simplifying the application of the model and addressing concerns relating to the fortification of foods.
- Capping the maximum scores for protein, fibre and fruit and vegetables at five points – thereby more appropriately balancing the scores allocated for these nutrients against those allocated for energy, saturated fat, sugar and sodium.
- Removing the drinks multiplier and setting a separate overall threshold for the classification of drinks – simplifying the application of the model.

In view of the practical issues associated with measuring fibre content, the effect of two different ways of measuring fibre (Englyst and AOAC method) on the performance of the model was also investigated. Due to the limited data available for AOAC fibre, this testing focussed on a smaller range of categories (although it included breakfast cereals and other key contributors to fibre intake). The Expert Group recognised that retailers and manufacturers are increasingly using the AOAC method for fibre analysis but agreed that the Englyst method should be the primary method for use in conjunction with the model, because of the need to link levels to expert advice on intakes⁶.

Model SSCg3d, which was developed for children aged 11-16, has been found to be equally applicable, subject to further consideration of the threshold for salt, to all people over the age of five years⁷ and it is likely that Model WXY will also be. The Scientific Workshop⁸ recognised that currently salt intakes for children aged 5-10 are higher than recommended intakes, and that therefore there was no immediate benefit in raising the sodium threshold in

⁶ Department of Health. Dietary Reference Values for Food, Energy and Nutrients in the United Kingdom. (Report on Health and Social Subjects, No. 41). London: HMSO, 1991.

⁷ <http://www.food.gov.uk/multimedia/pdfs/nutprofmodelforadults.pdf>

⁸ <http://www.food.gov.uk/healthiereating/nutres/nutprof/workshop250205>

the Nutrient Profiling model until such time as intakes of salt had been reduced to levels closer to the targets set by SACN.

For the purposes of tightening the rules on broadcast advertising of foods to children the Expert Group agreed to define ‘less healthy’ foods as those foods scoring 4 points or more; and those drinks scoring 1 point or more and that it should be these ‘less healthy’ foods to which further advertising restrictions might apply.

Nutrient Profiling Model (WXY)

Model WXY is a “simple scoring” system, where points are allocated on the basis of the nutritional content in 100g of the food or drink. The overall score for the food or drink is calculated in three steps as follows:

Step one: Work out total ‘A’ points

A maximum of ten points can be awarded for each nutrient.

Total ‘A’ points = (points for energy) + (points for saturated fat) + (points for sugars) + (points for sodium)

The following table indicates the points scored, depending on the content of each nutrient in 100g of the food:

Points	0	1	2	3	4	5	6	7	8	9	10
Energy (kJ)	≤335	>335	>670	>1005	>1340	>1675	>2010	>2345	>2680	>3015	>3350
Sat Fat (g)	≤1	>1	>2	>3	>4	>5	>6	>7	>8	>9	>10
Total sugars (g)	≤4.5	>4.5	>9	>13.5	>18	>22.5	>27	>31	>36	>40	>45
Sodium (mg)	≤90	>90	>180	>270	>360	>450	>540	>630	>720	>810	>900

Step two: Work out total ‘C’ points

A maximum of five points can be awarded for each nutrient / food component.

Total ‘C’ points = (points for protein) + (points for NSP fibre) + (points for fruit and veg content)

The following table indicates the points scored, depending on the content of each nutrient / food component in 100g of the food:

Points	0	1	2	3	4	5
Protein (g)	≤1.6	>1.6	>3.2	>4.8	>6.4	>8.0
NSP fibre (g)	≤0.7	>0.7	>1.4	>2.1	>2.8	>3.5
Fruit and Veg (%)	≤40	>40	>60	-	-	>80

Step three: Work out overall score

Overall score = (total 'A' points) - (total 'C' points)

- A food is classified as “high in saturated fat, salt or sugar” where it scores **4 points or more.**
- A drink is classified as “high in saturated fat, salt or sugar” where it scores **1 point or more.**

Membership of Expert Group

Sheela Reddy	Department of Health
Susan Jebb	Medical Research Council Human Nutrition Research Centre, Cambridge
Luci Daniels	Independent Dietician
Judith Buttriss	British Nutrition Foundation
Karen Tonks	British Retail Consortium
Sue Davies	Which?
Joanna Scott	Kraft Foods
John Cummings	SACN
Annie Anderson	SACN
<i>Observer</i>	
Ian Blair	Ofcom
<i>Food Standards Agency Officials</i>	
Rosemary Hignett	Head of Nutrition Division,
Claire Boville	Claims and Promotion Branch, Nutrition Division
Mark Browne	Claims and Promotion Branch, Nutrition Division
Victoria Targett	Nutrition Strategy Branch, Nutrition Division
Cheryl White	Food Standards Agency Scotland
Robin Clifford	Statistical Advice Branch, Analytical Services Division

General introduction to this report

This report is divided into five sections.

Section 1 describes the development and testing of 12 different modifications to Model SSCg3d one by one. After considering the effects of these modifications the Expert Group decided that five of these modifications should be taken forward for testing in combination

Section 2 describes the testing of four of these five modifications in combination and shows how the results of this testing led to the Expert Group recommending that a new model i.e. **Model WXY** was an improvement upon Model SSCg3d.

Section 3 examines whether and how Model WXY would be modified if fibre was measured using the AOAC method rather than the Englyst method.

Section 4 shows how the Expert Group decided that, for the purposes of tightening the rules on broadcast advertising of foods to children, 'less healthy' foods should be defined as those foods scoring 4 points or more, using Model WXY; and those drinks scoring 1 point or more.

Section 5 summarises work to develop new indicator panels of 'healthier', 'intermediate' and 'less healthy' foods with which to test nutrient profile models. This involved canvassing the views of practising nutrition and dietetic professionals on the relative ranking of a range of foods in terms of 'healthiness' via an on-line questionnaire. The results of this work show that there is good agreement between the views of nutrition and dietetic professionals and the way model WXY categories foods.

Section 1: Initial examination and evaluation of areas of refinement

1.1 Summary

This section describes the development and testing of 12 different modifications to Model SSCg3d one by one. After considering the effects of these modifications the Expert Group decided that the following modifications would be taken forward for testing in combination:

- **Modification 1.3: Non milk extrinsic sugars criterion replaced with total sugars and fibre (NSP) criteria**
- **Modification 1.3a: Non milk extrinsic sugars criterion replaced with total sugars and fibre (AOAC) criteria**
- **Modification 3.2: Iron, calcium and n-3 fatty acids criteria replaced with protein criterion**
- **Modification 5.2: All ‘C’ nutrient scores capped at a lower level**
- **Modification 6.1: Scores for drinks measured per 300g rather than per 200g**

1.2 Background

The consultation upon the development and testing of Model SSCg3d generated a number of suggestions as to possible improvements to the model. In total 21 possible areas for refinement were considered by the Expert Group and of these it recommended that five warranted further investigation.

The Expert Group also suggested 12 possible modifications to the model that might help to refine the model in these five areas. The five areas for refinement and the 12 possible modifications are shown in Table 1.1.

Table 1.1 Areas for refinement and possible modifications to, Model SSCg3d

Area for refinement	Possible modifications
1. An alternative approach to take account of carbohydrate quality.	1.1 Fibre (NSP) criterion added; 1.2 NMES criterion replaced with total sugars criterion; 1.3 NMES criterion replaced with total sugars and fibre (NSP) criteria.
2. A refinement to take account of the nutrient density of foods, by introducing a water content criterion.	2.1 Water content multiplier added; 2.2 Energy density criterion replaced with water content multiplier.
3. An alternative approach to recognising the importance to the diet of foods from the ‘Meat, fish and alternatives’ and ‘Milk and dairy products’ groups of the Balance of Good Health.	3.1 Iron and calcium criteria replaced with protein criterion; 3.2 Iron, calcium and n-3 fatty acids criteria replaced with protein criterion.
4. A refinement to enable the further differentiation of products within the fats and oils category.	4.1 Energy density scores capped at lower level; 4.2 Energy density and saturated fat criteria replaced with a fat quality criterion.
5. A refinement to the weighting of scores for fruit and vegetable content.	5.1 Fruit and vegetables scores capped at lower level; 5.2 All ‘C’ nutrient scores capped at lower level; 5.3 Ceiling removed for ‘A’ nutrients. ⁹

The addition of a criterion for NSP fibre was designed to address concerns that some cereal based products (in particular some breakfast cereals and breads) had not been appropriately classified by the initial model.

The replacement of the NMES criterion with a total sugars criterion was designed to address the practical difficulties of analysing NMES.

The introduction of a water content multiplier was designed to take some account of the water content of foods in a similar, but more sophisticated fashion, to the ‘drinks multiplier’ used in Model SSCg3d i.e. scores for drinks are measured per 200g instead of per 100g.

⁹ ‘C’ nutrients are nutrients for which foods score negative points with the scoring systems described here and ‘A’ nutrients are nutrients for which foods score positive points.

The replacement of criteria for calcium, iron and n-3 fatty acids with a single protein criterion was designed to simplify the application of the model and address concerns relating to the fortification of foods.

To address a concern that the model tends to categorise foods in the fats and oils category as 'less healthy' various modifications were explored which sought to further differentiate such products.

A refinement to the weighting of scores for fruit and vegetable content was considered necessary since it was theoretically possible for a food to have a very high content of, for example, salt and yet still be classified using model SSCg3d as a 'healthier' food. Capping the maximum scores for protein, fibre and fruit and vegetables at five points was considered as a way of more appropriately balancing the scores allocated for these substances, against those allocated for energy, saturated fat, sugar and sodium.

Each of the suggested modifications was tested in turn in order to assess its impact on the way that foods were categorised by Model SSCg3d.

1.3 Methods

The modified McCance and Widdowson (M&W) database that has previously been used for testing nutrient profile models (Rayner et al, 2004), and the testing procedures previously used, were updated as discussed below.

Relevant nutritional and recipe data from M&W's The Composition of Foods (Roe et al, 2003), as well as nutritional and recipe data from manufacturers, was provided by the Medical Research Council Human Nutrition Research Centre in Cambridge and was used instead of the estimates of the fruit and vegetable content of foods in the original modified M&W database.

Three tests that had previously been used in the development of Model SSCg3d were used to assess the effect of the modifications to Model SSCg3d. Details of these tests have been previously provided (Rayner et al, 2004). The three tests were as follows:

- Test A. An assessment of the proportions of 1030 foods from the M&W database classified as 'healthier', 'intermediate' or 'less healthy'.
- Test B. An 'accuracy' test based on the proportion of foods that are correctly assigned as 'healthier' or 'less healthy' using two subsets of foods from the M&W database.

- Test C. An assessment of how the model categorises 120 ‘indicator’ foods from the M&W database selected as representative of the range of nutrient profiles for foods of each group of the Balance of Good Health as well as of composite foods.

In addition a new test was developed:

Test D. An assessment of how the model categories four subsets of foods each consisting of between 8 and 15 foods selected as representative of the range of nutrient profiles for foods in four categories. These categories were those that the consultation identified as most problematic for Model SSCg3d (i.e. high fibre foods, high protein foods, breakfast cereals, and spreads, fats and oils). Table 1.2 gives the precise details of the modifications tested.

Table 1.2. Modifications to Model SSCg3d tested at this stage

Mod-ification	Brief description	Full details
1.1	Fibre (NSP) criterion added. Fibre score bands set at 3.75% of the GDA, similar to ‘A’ nutrients.	Same score bands as ModelSSCg3d, but with additional NSP criterion: 0-0.7 = 0, 0.8-1.4 = 1, 1.5-2.1 = 2 etc. Max score = 10. Healthier if score is 2 or less, less healthy if score is 9 or more.
1.2	NMES criterion replaced with total sugars criterion. Total sugar score bands set at the same percentage of the GDA as for other ‘A’ nutrients.	Same score bands as Model SSCg3d, except the NMES criteria replaced with the total sugar criteria: 0-4.5g = 0; 4.6-9.0g = 1; 9.1-13.5g = 2. Max score = 10. Healthier if score is 3 or less, less healthy if score is 9 or more.
1.3	NMES criterion replaced with total sugars and fibre (NSP) criteria. Total sugar score bands set at the same percentage of the GDA as for other ‘A’ nutrients Fibre score bands set at 3.75% of the GDA, similar to ‘A’ nutrients	Same score bands as Model SSCg3d, except the NMES criteria replaced with total sugars criteria: 0-4.5g = 0; 4.6-9.0g = 1; 9.1-13.5g = 2. Max score = 10; and with NSP criteria 0-0.7 = 0, 0.8-1.4 = 1, 1.5-2.1 = 2 etc. Max score = 10. Healthier if score is 2 or less, less healthy if score is 9 or more.
2.1	Water content multiplier added. The score for each food is calculated using the same score bands as SSCg3d. These scores are then multiplied by a water content score (the higher the water content, the higher the multiplier)	Same score bands as Model SSCg3 (Model SSCg3d without drinks criterion). Additionally, score multiplied by number between 1 and 5, depending upon water content of food. Water content = 0%, multiplier = 1; Water = 25%, multiplier = 2; Water = 50%, multiplier = 3; Water = 75%, multiplier = 4; Water = 100%, multiplier = 5. Healthier if score is 7 or less, less healthy if score is 18 or more.

2.2	Energy density criterion replaced with water content multiplier. Water multipliers used as in Model 2.1	Same score bands as Model SSCg3 (Model SSCg3d without drinks criterion) with energy density criteria removed. Additionally, score multiplied by number between 1 and 5, depending upon water content of food. Water content = 0%, multiplier = 1; Water = 25%, multiplier = 2; Water = 50%, multiplier = 3; Water = 75%, multiplier = 4; Water = 100%, multiplier = 5. Healthier if score is 7 or less, less healthy if score is 18 or more.
3.1	Iron and calcium criteria replaced with protein criterion. Protein score bands set at 3.75% of the GDA, similar to 'A' nutrients.	Same score bands as Model SSCg3d, except the Ca and Fe criteria replaced with protein criteria: 0-1.6g = 0; 1.7-3.2g = 1; 3.3-4.8g = 2 etc. Max score = 10. Healthier if score is 0 or less, less healthy if score is 9 or more.
3.2	Iron, calcium and n-3 fatty acids criteria replaced with protein criterion. Protein score band set at 3.75% of the GDA, similar to 'A' nutrients.	Same score bands as Model SSCg3d, except the Ca, Fe and n-3 fatty acids criteria replaced with protein criteria: 0-1.6g = 0; 1.7-3.2g = 1; 3.3-4.8g = 2 etc. Max score = 10. Healthier if score is 0 or less, less healthy if score is 9 or more.
4.1	Energy density scores capped at lower level. This is to remove the 'discrimination' against fats and oils - virtually the only foods to score highly for energy density.	Same score bands as Model SSCg3d, but energy density score bands capped at 5. Healthier if score is 2 or less, less healthy if score is 9 or more.
4.2	Energy density and saturated fat criteria replaced with a fat quality criterion.	Same score bands as Model SSCg3d, but energy and saturated fat scores replaced with scores where the saturated fat scores are multiplied by the ratio of saturated fat to total fat and rounded up to the nearest whole number. Healthier if score is 0 or less, less healthy if score is 6 or more.
5.1	Fruit and vegetables scores capped at lower level	Same score bands as Model SSCg3d, but fruit and vegetable scores as follows: 0-60% = 0; 61-80% = 2; 81-100% = 5. Healthier if score is 2 or less, less healthy if score is 9 or more.
5.2	All 'C' nutrient scores capped at lower level.	Same score bands as Model SSCg3d, but 'C' nutrient scores capped at 5. Healthier if score is 2 or less, less healthy if score is 9 or more.
5.3	Ceiling removed for 'A' nutrients.	Same score bands as Model SSCg3d, but the ceiling for all 'A' nutrients is removed. Healthier

		if score is 2 or less, less healthy if score is 9 or more.
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1.4 Results

Complete results tables for Tests A, B and C, and tables for Test D are given in Appendices 1 and 2 respectively.

Table 1.3 provides a summary of the effects of each modification.

Table 1.3a. Modifications compared to Model SSCg3d, Tests A, B and C

Model	Test A Dist.	Test B Accuracy score	Test C Indicators	
1.1	H ↑ I ↑ U ↓	+ 1.7	BCP FV MFA C	Sugar Coated Puffed Oat Cereal, currant buns: U to I Crispbread, wholemeal bread, oven chips, wholemeal rolls: I to H Currants: I to H Walnuts: U to I Fruit pie, lasagne: U to I
1.2	H ↑ I ↓ U ↓	- 2.7	FV FS	Currants: I to H Cola: U to I
1.3	H ↑ I ↑ U ↓	- 2.4	BCP MD FV MFA FS C	Sugar Coated Puffed Oat Cereal, currant buns, malt loaf: U to I Oven chips, wholemeal bread, crispbread: I to H Semi-skimmed milk: H to I Currants: I to H Walnuts: U to I Cola: U to I Lasagne: U to I
2.1	H ↑ I ↓ U ↑	- 0.9	BCP MD FV MFA C	Sugar Coated Puffed Oat Cereal, Flaked Corn Cereal, cream crackers: U to I Wholemeal rolls, potato croquettes: I to U Whole milk: I to H Cottage cheese, fromage frais, greek yoghurt: I to U Currants: I to H Walnuts: U to I Fried egg, chicken leg: I to U Fruit crumble, Shepherd's pie, chilli con carne: I to U
2.2	H ↓ I ↓ U ↑	- 1.1	BCP	Sugar Coated Puffed Oat Cereal, Flaked Corn Cereal, Honey and Nut Coated Flaked Corn Cereal: U to I Fried rice: H to I

			MD FV MFA FS C	Potato croquettes: I to U Low fat yoghurt, low fat fruit yoghurt: H to I Cottage cheese, fromage frais, greek yoghurt: I to U Currants: I to H Walnuts: U to I Chicken leg: I to U Olive oil: U to I Salted peanuts: U to I Shepherd's pie: I to U
3.1	H ↑ I ↑ U ↓	- 4.7	BCP MD MFA C	Fried rice, Wheat Biscuit Cereal: H to I Cottage cheese: I to H Fruit yoghurt: H to I Roast lamb, roast beef, lean mince, fried steak, chicken leg, boiled and fried egg: I to H Chicken nuggets, ham, walnuts: U to I Lasagne: U to I
3.2	H ↑ I ↑ U ↓	- 5.5		Same changes as Model 3.1
4.1	H ↑ I - U ↓	+ 0.4		No changes
4.2	H ↓ I ↑ U ↓	+ 2.3	BCP MFA FS C	Fried rice: H to I Sugar Coated Puffed Oat Cereal, French fries: U to I Walnuts: U to H Roast lamb, roast beef: I to H Olive oil: U to I Lasagne: U to I
5.1	H ↓ I ↑ U ↑	- 2.6	FV	Orange juice: H to I
5.2	H ↓ I ↑ U ↑	- 1.9	BCP FV	Wheat Biscuit Cereal: H to I Orange juice: H to I Baked beans: H to I
5.3	H ↓ I ↑ U ↑	- 3.9	FV	Orange juice: H to I Currants: I to U

H = Healthier, I = Intermediate, U = Less healthy, ↑ = proportion greater than with Model SSCg3d, ↓ = proportion less than with Model SSCg3d,
BCP = Bread, cereals and potatoes; MD = Milk and dairy products; FV = Fruit and vegetables; MFA = Meat, fish and alternatives; FS = Foods high in fat, foods high in sugar; C = composite foods.

Table 1.3b: Modifications, compared to Model SSCg3d, Test D

Model	Test D Mini-lists	
1.1	BC HF	Bran Cereal: U to H Sugar Coated Puffed Oat Cereal: U to I Crispbread, wholemeal bread, white bread (added fibre): I to H Wholemeal crackers, wholemeal scones, Wheat Sticks - Yeast Extract Coated: U to I
1.2	BC HP HF	Cocoa Coated Puffed Rice Cereal, Bran Cereal: U to I Roast lamb: I to H Crispbread: I to H
1.3	BC HF	Bran Cereal: U to H Sugar Coated Puffed Oat Cereal, Cocoa Coated Puffed Rice Cereal: U to I Crispbread, wholemeal bread, white bread (added fibre): I to H Wholemeal scones, wholemeal crackers, Wheat Sticks - Yeast Extract Coated: U to I
2.1	BC HP HF	Cocoa Coated Puffed Rice Cereal, Sugar Coated Puffed Oat Cereal, Sugar Coated Flaked Corn Cereal, Flaked Corn Cereal, Bran Cereal: U to I Porridge, made with water: I to U Fried fishfingers: I to U Crispbread: I to H Wholemeal crackers: U to I
2.2	BC FSO HP HF	Sugar Coated Puffed Oat Cereal, Cocoa Coated Puffed Rice Cereal, Sugar Coated Flaked Corn Cereal, Flaked Corn Cereal, Bran Cereal, Honey and Nut Coated Flaked Corn Cereal: U to I Porridge, made with water: I to U Olive oil: U to I Fried fishfingers: I to U Crispbread: I to H Wholemeal crackers, Wheat Sticks - Yeast Extract Coated: U to I
3.1	BC HP HF	Wheat Biscuit Cereal: H to I Wheat Flakes Cereal: I to U Roast lamb, boiled egg, fried fishfingers: I to H Wholemeal crackers: U to I
3.2	BC HP HF	Wheat Biscuit Cereal: H to I Wheat Flakes Cereal: I to U Roast lamb, boiled egg: I to H Wholemeal crackers: U to I
4.1		No changes
4.2	BC FSO HP	Sugar Coated Puffed Oat Cereal, Cocoa Coated Puffed Rice Cereal: U to I Porridge, made with water: I to U Olive oil: U to I

		Roast lamb: I to H
5.1		No changes
5.2	BC HP HF	Wheat Biscuit Cereal: H to I Wheat Flakes Cereal: I to U Fried fishfingers: I to U Baked beans: H to I
5.3		No change to SSCg3d

H = Healthier, I = Intermediate, U = Less healthy

BC = Breakfast cereals, FSO = Fats, spreads and oils, HP = High protein, HF = High fibre

1.5 Conclusion

In general the modifications had only a small effect on the way Model SSCg3d categorises foods. The accuracy scores generated by Test B ranged from approximately 83 to 90 for all of the modifications (the accuracy score for Model SSCg3d is 88.2), and few Test C (Balance of Good Health) indicator foods were re-categorised as a result of the modifications.

The modifications also led to few re-categorisations of Test D indicators – chosen to be particularly sensitive to changes in the model - except in the case of breakfast cereals and high fibre foods when fibre or water criteria were introduced.

The three modifications that had the most effect were Modification 1.3 (**NMES replaced with total sugars and fibre (NSP) criteria**), Modification 2.1 (**Water content multiplier added**) and 2.2 (**Energy density replaced with water content multiplier**).

Modification 1.3 is essentially two modifications and therefore might be expected to have a greater effect than either Modification 1.1 (Fibre (NSP) criterion added) or Modification 1.2 (NMES criterion replaced with totals sugars criterion) alone.

The addition of the water content multiplier in Modifications 2.1 and 2.2 was considered to be more than a model refinement, i.e., equivalent to changing the base of the criteria which significantly effects the way the model would classify foods (Rayner et al, 2004).

Based on the results of this work the Expert Group identified the following five modifications to be taken forward for testing in combination:

1. **Modification 1.3 (NMES replaced with total sugars and fibre (NSP) criteria).** It had a greater effect on the classification of Test C and D indicators than Modification 1.1 (Fibre (NSP) criterion added) or Modification 1.2 (NMES criterion replaced with total sugars criterion). With this modification wholemeal bread moved from intermediate to healthier, and walnuts from less healthy to intermediate

The modification did not appear to have a significant effect on the classification of ‘Foods high in fat, foods high in sugar’ or ‘Fruit and vegetables’, but it did have a

significant effect on the classification of some breakfast cereals e.g. Sugar Coated Puffed Oat Cereal and Cocoa Coated Puffed Rice Cereal moved from less healthy to intermediate. In addition it resulted in cola being re-categorised as intermediate rather than less healthy.

2. **Modification 1.3a (NMES replaced with total sugars and fibre (AOAC) criteria).** Provided data to determine the effect of the fibre method of analysis on classification.
3. **Modification 3.2 (Iron, calcium and n-3 fatty acids criteria replaced with protein criterion).** Modification 3.1 (Iron and calcium criteria replaced with protein criterion) increased the proportion of 'Meat, fish and alternatives' and 'Milk and dairy products' classified as healthier or intermediate foods without increasing the proportion of 'Foods high in fat, foods high in sugar' which are classified as healthier or intermediate foods. The additional removal of the n-3 fatty acid for Modification 3.2 did not lead to any more reclassifications (including those of oily fish).
4. **Modification 5.2 (All 'C' nutrient scores capped at lower level).** This modification had a beneficial effect on the classification of foods with a very high content of A nutrients such as sodium or sugar but also a high content of C nutrients such as fruit and vegetable, as illustrated by the reclassification of baked beans (sodium content 530mg per 100g) from healthier to intermediate. Neither modifications: 5.1 (Fruit and vegetables capped at a lower level) nor 5.3 (Ceiling removed for 'A' nutrients) affected the classification of baked beans.
5. **A new drinks multiplier Modification 6.1 (Scores for drinks measured per 300g rather than per 200g)** was suggested since the modifications designed to take account of the nutrient density of foods, by introducing a water content multiplier (Modification 2.1) or by replacing the energy density criterion with a water content multiplier (Modification 2.2) were found to be unhelpful.

The Expert Group considered that Modifications 4.1 and 4.2 - designed to enable the further differentiation of products within the fats and oils category - did not lead to enough desirable reclassifications to be warranted.

1.6 References

Rayner M, Scarborough P, Stockley L. Nutrient profiles. Options for definitions for use in relation to food promotion and children's diets. London: FSA, 2004.

Roe M, Finglas P, Church S. McCance and Widdowson's The Composition of Foods. Sixth Summary Edition. London: Royal Society of Chemistry, 2003.

Section 2: Assessment of combinations of potential modifications

2.1 Summary

This section describes the testing of four of the five different modifications to Model SSCg3d that the Expert Group decided should be taken forward for testing in combination i.e. :

- **Modification 1.3: Non milk extrinsic sugars criterion replaced with total sugars and fibre (NSP) criteria (Henceforward called Modification W)**
- **Modification 3.2: Iron, calcium and n-3 fatty acids criteria replaced with protein criterion (Modification X)**
- **Modification 5.2: All ‘C’ nutrient scores capped at a lower level (Modification Y)**
- **Modification 6.1: Scores for drinks measured per 300g rather than per 200g (Modification (3))¹⁰**

The results of the testing led to the Expert Group recommending that a combination of three of these modifications to Model SSCg3d, i.e. Modifications W, X and Y, were the most successful.

Model WXY categorises foods in a very similar fashion to Model SSCg3d yet:

- The addition of a criterion for NSP fibre means that some cereal based products (in particular some breakfast cereals and breads) that had not been appropriately classified by the initial model were classified as healthier or intermediate foods;
- The replacement of the NMES criterion with a total sugars criterion addresses the practical difficulties of analysing NMES;
- The replacement of criteria for calcium, iron and n-3 fatty acids with a single protein criterion simplifies the application of the model and addresses concerns relating to the fortification of foods.
- Capping the maximum scores for protein, fibre and fruit and vegetables at five points more appropriately balances the scores allocated for these nutrients against those allocated for energy, saturated fat, sugar and sodium.

2.2 Background

As described in the previous section, the Expert Group identified five promising modifications to Model SSCg3d from testing different modifications one by one. In this section four of these modifications were tested in different combinations. The full details of these four modifications are shown in Table 2.1. The remaining modification - Modification 1.3a: Non milk extrinsic sugars criterion replaced with total sugars and fibre (AOAC) criteria – could not be tested using the same methods as the other modifications and

¹⁰ In the original report of this phase of the project we called this modification Z. For the sake of clarity and to indicate the level of the drinks multiplier we are now calling it (3)

the testing of this modification is described in Section 3 because there is very little AOAC fibre data available for the foods in the M&W database used for tests A, B, C and D .

Table 2.1. The modifications selected by the Expert Group for further examination

Code (Section 1 code)	Brief description	Full details
W (1.3)	Non milk extrinsic sugars criterion replaced with total sugars and fibre (NSP) criteria	Same score bands as Model SSCg3d, except the NMES criteria replaced with total sugars criteria: 0-4.5g = 0; 4.6-9.0g = 1; 9.1-13.5g = 2. Max score = 10; and with NSP criteria 0-0.7 = 0, 0.8-1.4 = 1, 1.5-2.1 = 2 etc. Max score = 10.
X (3.2)	Iron, calcium and n-3 fatty acids criteria replaced with protein criterion	Same score bands as Model SSCg3d, except the Ca, Fe and n-3 fatty acids criteria replaced with protein criteria: 0-1.6g = 0; 1.7-3.2g = 1; 3.3-4.8g = 2 etc. Max score = 10.
Y (5.2)	All 'C' nutrients capped at a lower level	Same score bands as Model SSCg3d, but 'C' nutrient scores capped at 5.
(3) (6.1)	Scores for drinks measured per 300g rather than per 200g	Same score bands as Model SSCg3d are used, but nutrient density for drinks is measured per 300g rather than per 200g

This section reports the testing of combinations of these modifications henceforth called Modifications W, X, Y and (3)

2.3 Methods

Modifications W, X, Y and (3) were combined systematically so that all possible combinations were tested, as shown in Table 2.2 and detailed in Table 2.3.

Table 2.2. Possible combinations of Modifications W, X, Y and (3)

No. of modifications	No. of combinations	Models to be tested
0	1	SSCg3d
1	4	W, X, Y, (3)
2	6	WX, WY, W(3), XY, X(3), Y(3)
3	4	WXY, WX(3), WY(3), XY(3)
4	1	WXY(3)

Table 2.3. Full details of the 16 models

Mod- ification	Brief description	Full description
None	Basic Model SSCg3d	As described previously
W	NMES replaced with total sugars and fibre (NSP).	Total sugars: $\leq 4.5\text{g} = 0$; $\leq 9\text{g} = 1$; $\leq 13.5\text{g} = 2$ etc. (Max 10)* Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. (Max 10)* For drinks, nutrient density measured per 200g H = 2 or less; I = 3 to 8; U = 9 or more
X	Iron, calcium and n-3 fatty acids replaced with protein.	Protein: $\leq 1.6\text{g} = 0$; $\leq 3.2\text{g} = 1$; $\leq 4.8\text{g} = 2$ etc. (Max 10)* For drinks, nutrient density measured per 200g H = 0 or less; I = 1 to 8; U = 9 or more
Y	All 'C' nutrients capped at 5 points.	Iron, calcium, n-3 fatty acids and F&V content: Max score is 5. For drinks, nutrient density measured per 200g H = 2 or less; I = 3 to 8; U = 9 or more
(3)	Scores for drinks measured per 300g	For drinks, nutrient density measured per 300g. H = 2 or less; I = 3 to 8; U = 9 or more
WX	NMES replaced with total sugars and fibre (NSP), iron, calcium and n-3 fatty acids replaced with protein.	Total sugars: $\leq 4.5\text{g} = 0$; $\leq 9\text{g} = 1$; $\leq 13.5\text{g} = 2$ etc. (Max 10) Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. (Max 10) Protein: $\leq 1.6\text{g} = 0$; $\leq 3.2\text{g} = 1$; $\leq 4.8\text{g} = 2$ etc. (Max 10) For drinks, nutrient density measured per 200g H = 0 or less; I = 1 to 8; U = 9 or more
WY	NMES replaced with total sugars and fibre (NSP), all 'C' nutrients capped at 5 points.	Total sugars: $\leq 4.5\text{g} = 0$; $\leq 9\text{g} = 1$; $\leq 13.5\text{g} = 2$ etc. (Max 10) Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. Iron, calcium, n-3 fatty acids, fibre (NSP) and F&V content: Max score is 5. For drinks, nutrient density measured per 200g H = 2 or less; I = 3 to 8; U = 9 or more
W(3)	NMES replaced with total sugars and fibre (NSP), scores for drinks measured per 300g	Total sugars: $\leq 4.5\text{g} = 0$; $\leq 9\text{g} = 1$; $\leq 13.5\text{g} = 2$ etc. (Max 10) Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. (Max 10) For drinks, nutrient density measured per 300g. H = 2 or less; I = 3 to 8; U = 9 or more
XY	Iron, calcium and n-3 fatty acids replaced with protein, all 'C'	Protein: $\leq 1.6\text{g} = 0$; $\leq 3.2\text{g} = 1$; $\leq 4.8\text{g} = 2$ etc. Protein and F&V content: Max score is 5. For drinks, nutrient density measured per 200g H = 0 or less; I = 1 to 8; U = 9 or more

	nutrients capped at 5 points.	
X(3)	Iron, calcium and n-3 fatty acids replaced with protein, scores for drinks measured per 300g	Protein: $\leq 1.6\text{g} = 0$; $\leq 3.2\text{g} = 1$; $\leq 4.8\text{g} = 2$ etc. (Max 10) For drinks, nutrient density measured per 300g. H = 0 or less; I = 1 to 8; U = 9 or more
Y(3)	All 'C' nutrients capped at 5 points, scores for drinks measured per 300g	Iron, calcium, n-3 fatty acids and F&V content: Max score is 5. For drinks, nutrient density measured per 300g. H = 2 or less; I = 3 to 8; U = 9 or more
WXY	NMES replaced with total sugars and fibre (NSP), iron, calcium and n-3 fatty acids replaced with protein, all 'C' nutrients capped at 5 points.	Total sugars: $\leq 4.5\text{g} = 0$; $\leq 9\text{g} = 1$; $\leq 13.5\text{g} = 2$ etc. (Max 10) Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. Protein: $\leq 1.6\text{g} = 0$; $\leq 3.2\text{g} = 1$; $\leq 4.8\text{g} = 2$ etc. F&V, protein and fibre (NSP): Max score is 5. For drinks, nutrient density measured per 200g. H = 0 or less; I = 1 to 8; U = 9 or more
WX(3)	NMES replaced with total sugars and fibre (NSP), iron, calcium and n-3 fatty acids replaced with protein, scores for drinks measured per 300g	Total sugars: $\leq 4.5\text{g} = 0$; $\leq 9\text{g} = 1$; $\leq 13.5\text{g} = 2$ etc. (Max 10) Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. (Max 10) Protein: $\leq 1.6\text{g} = 0$; $\leq 3.2\text{g} = 1$; $\leq 4.8\text{g} = 2$ etc. (Max 10) For drinks, nutrient density measured per 300g. H = 0 or less; I = 1 to 8; U = 9 or more
WY(3)	NMES replaced with total sugars and fibre (NSP), all 'C' nutrients capped at 5 points, scores for drinks measured per 300g	Total sugars: $\leq 4.5\text{g} = 0$; $\leq 9\text{g} = 1$; $\leq 13.5\text{g} = 2$ etc. (Max 10) Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. Iron, calcium, n-3 fatty acids, fibre and F&V content: Max score is 5. For drinks, nutrient density measured per 300g. H = 0 or less; I = 1 to 8; U = 9 or more
XY(3)	Iron, calcium and n-3 fatty acids replaced with protein, all 'C' nutrients capped at 5 points, scores for drinks measured per 300g	Protein: $\leq 1.6\text{g} = 0$; $\leq 3.2\text{g} = 1$; $\leq 4.8\text{g} = 2$ etc. Protein and F&V content: Max score is 5. For drinks, nutrient density measured per 300g. H = 0 or less; I = 1 to 8; U = 9 or more

WXY(3)	NMES replaced with total sugars and fibre (NSP), iron, calcium and n-3 fatty acids replaced with protein, all 'C' nutrients capped at 5 points, scores for drinks measured per 300g	<p>Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. Protein: $\leq 1.6\text{g} = 0$; $\leq 3.2\text{g} = 1$; $\leq 4.8\text{g} = 2$ etc. Total sugars: $\leq 4.5\text{g} = 0$; $\leq 9\text{g} = 1$; $\leq 13.5\text{g} = 2$ etc. (Max 10) Protein, fibre (NSP) and F&V content: Max score is 5. For drinks, nutrient density measured per 300g.</p> <p>H = 0 or less; I = 1 to 8; U = 9 or more</p>
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* Score bands all 3.75% of the GDA as for energy, saturated fat and sodium

Wherever possible, the score boundaries for these modified models were set at the same level as Model SSCg3d (H = 2 or less; I = 3 to 8; U = 9 or more), so it was clear how the modifications affected individual foods. Where setting the score boundaries in this way was not helpful, the score boundaries were chosen so that approximately one third of the foods from the database were categorised as 'healthier', one third as 'intermediate' and one third as 'less healthy', with the added proviso that a score of 0 must indicate a healthier food because water scores 0 with all models.

Modifications were tested in the same way as in the previous section.

2.3 Initial results of testing combinations of modifications

Complete results tables for this round of testing are given in Appendices 3 and 4 respectively. Table 2.4 provides a summary of the effects of testing the 16 models shown in Table 2.3.

Table 2.4a Modifications compared to Model SSCg3d, Tests A, B and C

Mod-ification	Test A Dist.	Test B Accuracy score	Test C Indicators	
W (Fibre + total sugars)	H ↑ I ↑ U ↓	- 2.4	BCP MD FV MFA FS C	Oven chips, wholemeal bread, wholemeal rolls, crispbread: I to H Sugar Coated Puffed Oat Cereal, currant buns, malt loaf: U to I Semi-skimmed milk: H to I Currants: I to H Walnuts: U to I Cola: U to I Lasagne, fruit pie: U to I
X	H ↑	- 5.5	BCP	Fried rice, Wheat Biscuit Cereal: H to I

(Protein)	I ↑ U ↓		MD MFA C	Cottage cheese: I to H Low fat fruit yoghurt: H to I Roast lamb, roast beef, lean mince, fried steak, roast chicken, boiled egg, fried egg: I to H Chicken nuggets, ham, walnuts: U to I Lasagne: U to I
Y (Capping Cs)	H ↓ I ↑ U ↑	- 1.9	BCP C	Wheat Biscuit Cereal: H to I Baked beans: H to I
(3) (Drinks per 300)	H ↓ I ↓ U ↑	+ 0.6		No changes to model SSCg3d
WX	H ↑ I ↑ U ↓	- 6.3	BCP MD FV MFA FS C	Crispbread, Wheat Biscuit Cereal, wholemeal bread, wholemeal rolls, oven chips: I to H Malt loaf, currant buns, French fries, Sugar Coated Puffed Oat Cereal, cream crackers: U to I Fried rice: H to I Cottage cheese: I to H Semi-skimmed milk: H to I Currants: I to H Roast beef, lean mince, roast lamb, fried steak, roast chicken, boiled egg, fried egg: I to H Walnuts: U to H Chicken nuggets, ham: U to I Cola: U to I Chilli con carne: I to H Lasagne, salted peanuts, fruit pie: U to I
WY	H ↑ I ↑ U ↓	- 3.5	BCP MD MFA FS C	Crispbread, wholemeal bread, oven chips, wholemeal rolls: I to H Sugar Coated Puffed Oat Cereal, currant buns, malt loaf: U to I Semi-skimmed milk: H to I Walnuts: U to I Cola: U to I Lasagne: U to I
W(3)	H ↑ I ↓ U ↓	- 1.6	BCP MD FV MFA FS C	Crispbread, wholemeal bread, oven chips, wholemeal rolls: I to H Sugar Coated Puffed Oat Cereal, currant buns, malt loaf: U to I Semi-skimmed milk: H to I Whole milk: I to U Currants: I to H Walnuts: U to I Cola: U to I Fruit pie, lasagne: U to I
XY	H ↓	- 7.7	BCP	Fried rice, Wheat Biscuit Cereal: H to I

	I ↑ U ↓		MD MFA C	Low fat fruit yoghurt: H to I Roast beef, roast lamb, boiled egg, lean mince: I to H Chicken nuggets, ham, walnuts: U to I Canned tuna: H to I Lasagne: U to I Canned sardines: H to I
X(3)	H ↑ I ↑ U ↓	- 6.2	BCP MD FV MFA C	Fried rice, Wheat Biscuit Cereal: H to I Cottage cheese: I to H Low fat fruit yoghurt: H to I Orange juice: H to I Roast beef, roast lamb, lean mince, fried steak, roast chicken, boiled egg, fried egg: I to H Chicken nuggets, ham, walnuts: U to I Lasagne, fruit pie: U to I
Y(3)	H ↓ I ↑ U ↑	- 2.4	BCP FV C	Wheat Biscuit Cereal: H to I Orange juice: H to I Baked beans: H to I
WXY	H ↑ I ↑ U ↓	- 9.1	BCP MD MFA FS C	Crispbread, wholemeal bread, wholemeal rolls, oven chips: I to H Currant buns, malt loaf, Sugar Coated Puffed Oat Cereal, French fries, cream crackers: U to I Fried rice: H to I Semi-skimmed milk: H to I Roast beef, roast lamb, boiled egg, lean mince: I to H Walnuts, chicken nuggets, ham: U to I Canned tuna: H to I Cola: U to I Chilli con carne: I to H Lasagne, fruit pie: U to I Canned sardines: H to I
WX(3)	H ↑ I ↑ U ↓	- 5.8	BCP MD FV MFA FS C	Crispbread, wholemeal bread, wholemeal rolls, oven chips: I to H Malt loaf, currant buns, French fries, Sugar Coated Puffed Oat Cereal, cream crackers: U to I Fried rice: H to I Cottage cheese: I to H Semi-skimmed milk: H to I Currants: I to H Roast beef, lean mince, roast lamb, fried steak, roast chicken, boiled egg, fried egg: I to H Walnuts: U to H Chicken nuggets, ham: U to I Cola: U to I Chilli con carne: I to H

				Lasagne, salted peanuts, fruit pie: U to I
WY(3)	H ↓ I ↑ U ↓	- 2.8	BCP MD MFA FS C	Crispbread, wholemeal bread, oven chips, wholemeal rolls: I to H Sugar Coated Puffed Oat Cereal, currant buns, malt loaf: U to I Semi-skimmed milk: H to I Whole milk: I to U Walnuts: U to I Cola: U to I Fruit pie, lasagne: U to I
XY(3)	H ↓ I ↑ U ↓	- 5.8	BCP MD FV MFA C	Fried rice: H to I Low fat fruit yoghurt: H to I Orange juice: H to I Roast beef, boiled egg, lean mince, roast lamb: I to H Chicken nuggets, ham, walnuts: U to I Canned sardines: H to I Lasagne: U to I
WXY(3)	H ↑ I ↑ U ↓	- 8.8	BCP MD FV MFA FS C	Crispbread, wholemeal bread, wholemeal rolls, oven chips: I to H Currant buns, malt loaf, Sugar Coated Puffed Oat Cereal, French fries, cream crackers: U to I Fried rice: H to I Semi-skimmed milk: H to I Orange juice: H to I Roast beef, boiled egg, roast lamb, lean mince: I to H Walnuts, chicken nuggets, ham: U to I Cola: U to I Chilli con carne: I to H Lasagne, fruit pie: U to I Canned sardines: H to I

H = Healthier, I = Intermediate, U = Less healthy, ↑ = proportion greater than with Model SSCg3d, ↓ = proportion less than with Model SSCg3d,
BCP = Bread, cereals and potatoes; MD = Milk and dairy products; FV = Fruit and vegetables; MFA = Meat, fish and alternatives; FS = Foods high in fat, foods high in sugar; C = composite foods

Table 2.4b. Modifications compared to Model SSCg3d, Test D

Model	Test D Mini-lists	
W	BC	Bran Cereal: U to H Sugar Coated Puffed Oat Cereal, Cocoa Coated Puffed Rice Cereal: U

	HF	to I Crispbread, wholemeal bread, white bread (added fibre): I to H Wholemeal scones, wholemeal crackers, Wheat Sticks - Yeast Extract Coated: U to I
X	BC HP HF	Wheat Biscuit Cereal: H to I Wheat Flakes Cereal: I to U Roast lamb, boiled egg: I to H Wholemeal crackers: U to I
Y	BC HP HF	Wheat Biscuit Cereal: H to I Wheat Flakes Cereal: I to U Fried fishfingers: I to U Baked beans: H to I
(3)		No difference to model SSCg3d
WX	BC HP HF	Bran Cereal: U to H Sugar Coated Puffed Oat Cereal: U to I Roast lamb, boiled egg: I to H Roasted peanuts: U to I Crispbread, wholemeal bread, white bread (added fibre): I to H Wheat Sticks - Yeast Extract Coated, wholemeal crackers, wholemeal scones: U to I
WY	BC HF	Bran Cereal, Sugar Coated Puffed Oat Cereal, Cocoa Coated Puffed Rice Cereal: U to I Crispbread, wholemeal bread, white bread (added fibre): I to H Wholemeal crackers, wholemeal scones: U to I
W(3)	BC HF	Bran Cereal: U to H Sugar Coated Puffed Oat Cereal, Cocoa Coated Puffed Rice Cereal: U to I Crispbread, wholemeal bread, white bread (added fibre): I to H Wholemeal crackers, wholemeal scones, Wheat Sticks - Yeast Extract Coated: U to I
XY	BC HP	Wheat Biscuit Cereal: H to I Wheat Flakes Cereal: I to U Roast lamb, boiled egg: I to H Canned tuna: H to I
X(3)	BC HP HF	Wheat Biscuit Cereal: H to I Wheat Flakes Cereal: I to U Roast lamb, boiled egg: I to H Wholemeal crackers: U to I
Y(3)	BC	Wheat Biscuit Cereal: H to I Wheat Flakes Cereal: I to U
WXY	BC HP HF	Bran Cereal, Sugar Coated Puffed Oat Cereal: U to I Roast lamb, boiled egg: I to H Canned tuna: H to I Crispbread, wholemeal bread, white bread (added fibre): I to H Wholemeal scones, wholemeal crackers, Wheat Sticks - Yeast Extract Coated: U to I

WX(3)	BC HP HF	Bran Cereal: U to H Sugar Coated Puffed Oat Cereal: U to I Roast lamb, boiled egg: I to H Crispbread, wholemeal bread, white bread (added fibre): I to H Wholemeal scones, wholemeal crackers, Wheat Sticks - Yeast Extract Coated: U to I
WY(3)	BC HF	Bran Cereal, Sugar Coated Puffed Oat Cereal, Cocoa Coated Puffed Rice Cereal: U to I Crispbread, wholemeal bread, white bread (added fibre): I to H Wholemeal crackers, wholemeal scones: U to I
XY(3)	BC HP	Wheat Biscuit Cereal: H to I Wheat Flakes Cereal: I to U Roast lamb, boiled egg: I to H Canned tuna: H to I
WXY(3)	BC HP HF	Bran Cereal, Sugar Coated Puffed Oat Cereal: U to I Roast lamb, boiled egg: I to H Canned tuna: H to I Crispbread, wholemeal bread, white bread (added fibre): I to H Wholemeal crackers, wholemeal scones, Wheat Sticks - Yeast Extract Coated: U to I

H = Healthier, I = Intermediate, U = Less healthy

BC = Breakfast cereals, FSO = Fats, spreads and oils, HP = High protein, HF = High fibre

As observed in the previous section the individual modifications to Model SSCg3d (W, X, Y and (3)) have both positive and negative effects, summarised in Table 2.5.

Table 2.5 Pros and cons of modifications individually and in combination.

Model	Pros	Cons
W (Fibre + total sugars)	<ul style="list-style-type: none"> • Doubles the number of BCP foods categorised as healthier • Walnuts move from less healthy to intermediate 	<ul style="list-style-type: none"> • Sugar Coated Puffed Oat Cereal, Bran Cereal and Cocoa Coated Puffed Rice Cereal move from less healthy to intermediate • Wheat Sticks - Yeast Extract Coated move from less healthy to intermediate • The number of healthier MD foods is reduced e.g. semi-skimmed milk moves from healthier to intermediate • Cola moves from less healthy to intermediate
X	<ul style="list-style-type: none"> • Doubles the number of MFA 	<ul style="list-style-type: none"> • High sodium MFA foods can

(Protein)	foods categorised as healthier	move from less healthier to intermediate, intermediate to healthier e.g. Chicken nuggets move from less healthy to intermediate
Y (Capping Cs)	<ul style="list-style-type: none"> • Some, presumably fortified, breakfast cereals move from healthier to intermediate, intermediate to less healthy • Baked beans move from healthier to intermediate • Fruit and veg ‘loophole’ is closed i.e. theoretical possibility that 100g of tinned veg might contain 6g of salt and still be categorised as healthier 	
(3) (Drinks per 300g)	<ul style="list-style-type: none"> • Very little effect on its own. 	
WXY(3)	<ul style="list-style-type: none"> • Big increase in both BCP and MFA categorised as healthier 	<ul style="list-style-type: none"> • French fries and chicken nuggets move from less healthy to intermediate despite high sodium content • Decrease in number of MD foods categorised as healthier • Cola moves from less healthy to intermediate

BCP = Bread, cereals and potatoes; MD = Milk and dairy products, MFA = Meat, fish and alternatives;

2.4 Conclusion from initial testing of combinations of modifications

As might have been expected, combining modifications generally had more effect on the way Model SSCg3d categorises foods than the individual modifications in isolation. In the case of Modifications W, X and (3), all had different effects on different foods so changes produced with two or more modifications in combination tended to be the sum of the changes resulting from the individual modifications. In contrast Modification Y tended to counteract the effects of Modifications W, X and (3) but it also had some other effects.

Modifications W (fibre (NSP) + total sugars instead of NMES) and X (protein instead of calcium, iron and n-3 fatty acids) had the most effect. W more than doubled the number of foods from the ‘Bread, cereal and potatoes’ group that were categorised as healthier, and X did the same for ‘Meat, fish and alternatives’. Wholemeal bread and rolls moved from

intermediate to healthier and walnuts moved from less healthy to intermediate with W. Roast lamb and roast beef moved from intermediate to healthier with X.

There were also some potentially adverse consequences of Modifications W and X. With W Sugar Coated Puffed Oat Cereal, Cocoa Coated Puffed Rice Cereal and cola, which are high in sugar, moved from less healthy to intermediate and with X chicken nuggets, which are high in salt, moved from less healthy to intermediate.

Combining Modifications W and X (Model WX) leaves the 'Bread, cereal and potatoes', 'Meat, fish and alternatives' and 'Fruit and vegetables' groups well represented in the healthier category. However, both the individual and combined modifications had little effect on the 'Milk and dairy products' group (slightly fewer products are classified as healthier with Model WX than with Model SSCg3d and, for example, semi-skimmed milk was re-categorised from healthier to intermediate).

The use of Modification Y (capping of 'C' nutrients at 5 points) reduced the effect produced by Modifications W and X. For example with Model WXY the number of foods from the 'Bread, cereals and potatoes' and 'Meat, fish and alternatives' groups categorised as healthier was reduced to 44% and 38% respectively, compared with 50% and 59% with Model WX. In the process fried egg and grilled fish fingers moved back from the healthier to the intermediate category.

The use of Modification (3) (scores for drinks measured per 300g rather than per 200g) made little difference by itself or in combination. Modification (3) made no difference to the way Models SSCg3d, W, X or Y categorise food e.g. the changes in categorisations between Model SSCg3d and Model X(3) are the same as between Model SSCg3d and Model X.

In summary the Expert Group considered that Model WXY should be considered further because:

- The use of total sugars rather than NMES has little effect on the categorisation of foods.
- Incorporating fibre into the model means that more foods from the 'Bread, cereals and potatoes' group – such as wholemeal bread – are categorised as healthier.
- Whilst incorporating protein into the model to replace iron, calcium and n-3 fatty acids has quite a large effect on the categorisation of foods, these effects are largely beneficial.
- The use of a cap on 'C' nutrients limits the number of 'Bread, cereals and potatoes', 'Meat, fish and alternatives' and 'Milk and dairy products' that can be categorised as healthier while having little effect on the 'Fruit and vegetable' group.

However, the Expert Group considered that Model WXY had not adequately addressed all issues. In particular:

- The categorisation of Cola and other such drinks containing a large amount of sugar.
- The categorisation of some high protein foods such as chicken nuggets which may also have high levels of salt or saturated fat.

Model WXY gives cola a score of 5 as opposed to Model SSCg3d, which gives it a score of 10. This is because the score bands for total sugars are wider than the score bands for NMES because the GDA for total sugars is higher (here calculated in the same way as the other GDAs) at 119g than it is for NMES at 63g.¹¹

Model WXY gives chicken nuggets, which are high salt, a score of 6, as opposed to Model SSCg3d which gives them a score of 11. This is entirely due to the introduction of protein, for which chicken nuggets score 10 points for model WX, and 5 points for Model WXY.

These issues led to the development and testing of three modifications to Model WXY shown in Table 2.6.

¹¹ Note that the IGD's proposed GDAs for all nutrients are lower than those used here. The GDA for total sugars used here was calculated in the same way as the other GDAs used to develop these models and using a population dietary goal developed in a way previously proposed (Rayner et al, 2004 (2)). Using the IGD's proposed GDAs would make no difference to any of the models tested here.

Table 2.6. Full details of the three modifications to Model WXY

Modification	Brief descriptions	Full description
WXY(4)	As Model WXY, scores for drinks measured per 400g rather than per 200g	Total sugars: $\leq 4.5\text{g} = 0$; $\leq 9\text{g} = 1$; $\leq 13.5\text{g} = 2$ etc (Max 10). Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. Protein: $\leq 1.6\text{g} = 0$; $\leq 3.2\text{g} = 1$; $\leq 4.8\text{g} = 2$ etc. F&V content, protein and fibre (NSP): Max score is 5. For drinks, nutrient density measured per 400g H = 0 or less; I = 1 to 8; U = 9 or more
WXYa	As Model WXY, but total sugars criterion not linked to GDA in the same way as other nutrients (Total sugar score bands set at 2.1% of the GDA).	Total sugars: $\leq 2.6\text{g} = 0$; $\leq 5.2\text{g} = 1$; $\leq 7.8\text{g} = 2$ etc (Max 10). Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. (2.1% of the GDA). Protein: $\leq 1.6\text{g} = 0$; $\leq 3.2\text{g} = 1$; $\leq 4.8\text{g} = 2$ etc. F&V content, protein and fibre (NSP): Max score is 5. For drinks, nutrient density measured per 200g H = 0 or less; I = 1 to 8; U = 9 or more
WXYb	As Model WXY, but protein criterion not linked to GDA in the same way as other nutrients. (Protein score bands set at 14.8% of the GDA).	Totals sugars: $\leq 4.5\text{g} = 0$; $\leq 9\text{g} = 1$; $\leq 13.5\text{g} = 2$ etc(Max 10) Fibre (NSP): $\leq 0.7\text{g} = 0$; $\leq 1.4\text{g} = 1$; $\leq 2.1\text{g} = 2$ etc. Protein: $\leq 6.4\text{g} = 0$; $\leq 12.8\text{g} = 1$; $\leq 19.2\text{g} = 2$ etc. (14.6% of the GDA) F&V content, protein and fibre (NSP): Max score is 5. For drinks, nutrient density measured per 200g H = 0 or less; I = 1 to 8; U = 9 or more

Modifications WXY(4) and WXYa were designed to ensure that drinks containing a large amount of sugar were classified appropriately by::

- Adjusting the drinks criterion, so that nutrient density is measured per 400g, rather than per 200g (Model WXY(4))
- Uncoupling the total sugars criterion from the other criteria (Model WXYa).

Modification WXYb was designed to ensure that products containing high levels of A nutrients were not classified as intermediate or healthier foods solely as a result of their protein score awarded: i.e. by:

- Uncoupling the protein criterion from the other criteria

2.5 Results of testing modifications to Model WXY

Complete results tables for testing the three modifications to Model WXY shown in Table 2.5 are given in Appendices 3 and 4. Table 2.6 provides a summary of the effects of testing the three modifications.

Table 2.6. Three modifications of Model WXY compared to Model WXY Tests A, B and C

Model	Test A Dist.	Test B Accuracy score	Test C Indicators	
WXY(4)	H ↓ I ↓ U ↑	+ 2.4	MD FV FS	Whole milk: I to U Orange juice: H to I Cola: I to U
WXYa	H ↓ I ↑ U ↑	+ 1.2	FV FS C	Orange juice: H to I Cola: I to U Chilli con carne: H to I Fruit pie, fruit crumble: I to U
WXYb	H ↓ I ↑ U ↑	+ 3.9	BCP MD MFA C	Wholemeal bread, wholemeal rolls, boiled rice, oven chips: H to I French fries, Sugar Coated Puffed Oat Cereal, cream crackers: I to U Semi-skimmed milk: H to I Cod, roast lamb, mackerel, lean mince, boiled egg: H to I Chicken nuggets, ham: I to U Chilli con carne: H to I

2.6 Conclusions from testing modifications to Model WXY

Modifications (4), a and b were found to solve some of the problems with Model WXY but create others.

The ‘drinks multiplier’ used in Model SSCg3d and Model WXY i.e. that scores for foods are measured per 100g whereas scores for drinks are measured per 200g, is in line with the criteria for nutrition claims in the draft EU Regulation on nutrition and health claims which are in turn based on Codex Alimentarius criteria for nutrition claims. There was no such justification for Modification WXY(4) – where scores for drinks are measured per 400g rather than per 200g.

Uncoupling the width of score bands from GDAs for Modifications WXYa and b (and doing so for one nutrient and not all) was considered by the Expert group to be a significant and

unwarranted departure from the previous approach to developing nutrient profile models where score band widths bear a standard relationship to GDAs.

Modification WXYa - where the score bands for total sugars no longer bear a standard relationship to the GDA, leads to a few re-categorisations: notably cola from intermediate to less healthy and orange juice from healthier to intermediate.

Modification WXYb, - where the score bands for protein no longer bear a standard relationship to the GDA had many consequences such as the re-categorisation of wholemeal bread, wholemeal rolls, cod, and mackerel from healthier to intermediate, although chicken nuggets were re-categorised from intermediate to less healthy.

For these reasons the Expert Group agreed that these three modifications did not lead to any improvements on the way Model WXY categorises foods. Instead they agreed that no drinks multiplier should be applied to Model WXY¹² favouring separate thresholds for 'less healthy' foods and 'less healthy' drinks instead (see Section 4).

2.7 References

Rayner M, Scarborough P, Stockley L. Nutrient profiles: options for definitions for use in relation to the promotion of foods to children. London: FSA, 2004.

Rayner M, Scarborough P, Williams C. The origin of Guideline Daily Amounts and the Food Standards Agency's guidance on what counts as 'a lot' and 'a little'. Public Health Nutrition, 2004; 7 (4): 549-556

¹² For Sections 1 and 2 of this report Model WXY has a drinks multiplier so that for drinks, nutrient density is measured per 200g. For Sections 3 and 4 all models including Model WXY have no drinks multiplier except Model SSCg3d.

Section 3. Consequences of measuring fibre by Englyst or AOAC methods

3.1 Summary

This section explores whether and how Model WXY¹³ should be modified if fibre was measured using the AOAC method rather than the Englyst method. The AOAC method typically produces a higher fibre level than the Englyst method because it measures fibre in a very different way. Clearly these higher AOAC fibre levels cannot be used directly by a model which uses as its basis a GDA for NSP.

There was not enough food composition data to come to firm conclusions and since expert advice on fibre intakes relates to levels of fibre measured by the Englyst method, the Expert Group strongly advised against the use of the AOAC method for categorising foods using Model WXY. But they agreed that if Englyst data was unavailable the following score band for AOAC fibre would be a reasonable proxy $\leq 0.9\text{g} = 0$; $\leq 1.8\text{g} = 1$; $\leq 2.7\text{g} = 2$, etc.

3.2 Background

The models that involved fibre criteria that were described and tested in the previous sections of this report all assumed that fibre would be measured as non-starch polysaccharide (NSP) by the Englyst method. In particular the width of the score bands for fibre was set at 3.75% of the Guideline Daily Amount (GDA) for NSP in turn derived from the population dietary goal for fibre recommended by the Committee on Medical Aspects of Food and Nutrition Policy (Department of Health, 1991). However, it was recognised that manufacturers are increasingly to measuring and recording the fibre levels in food for the purpose of nutrition labelling using the AOAC method.

The first step in developing models for categorising foods where fibre is measured using the AOAC method was to develop a GDA for AOAC fibre. It was agreed that the GDA for AOAC fibre for adults – for the purpose of developing nutrient profiling models using AOAC fibre levels - should be 24g. This is because the mean ratio of NSP to AOAC fibre in foods is approximately 1:1.33 according to a study funded by the former Ministry of Agriculture, Fisheries and Food (Englyst et al, 1996) and multiplying the population dietary goal of 18g per day of NSP (as specified by the Committee on Medical Aspects of Food and Nutrition Policy (Department of Health, 1991)) by 1.33 gives 24g. This is the method that

¹³ In the original report of this phase of the project we described the results of testing fibre variants of Model WXY(4) (then called Model WXY1). In this final report we describe the results of testing variants to Model WXY (without a drinks multiplier).

the Institute of Grocery Distribution (IGD) has recently adopted in developing a GDA for AOAC fibre.

Although the mean ratio of NSP to AOAC fibre is 1: 1.33 there is a wide variation in this ratio between foods. Table 3.1 shows the NSP and AOAC fibre levels for selected foods, where data is available and the fibre content is relatively high. It shows that the ratio of AOAC fibre to NSP varies between 0.37 for egg noodles and 4.25 for Honey and Nut Coated Flaked Corn Cereal.

Table 3.1. NSP and AOAC fibre levels for selected indicator foods

Food	NSP	AOAC	Ratio AOAC/NSP
Crispbread Rye	11.7	16.5	1.41
White bread	1.9	2.3	1.21
Wholemeal bread	5.0	6.9	1.38
Oven chips	2.0	3.2	1.60
Pear	2.2	3.1	1.41
Prunes	2.4	3.8	1.58
Avocado	3.4	6.7	1.97
Walnuts	3.5	6.7	1.91
Flaked Corn Cereal	0.9	2.5	2.78
Tomato	1.0	1.2	1.20
Frozen peas, boiled	5.1	5.5	1.10
Broccoli	2.3	3.3	1.43
Mushroom	1.1	1.2	1.10
Honey and Nut Coated Flaked Corn Cereal	0.8	3.4	4.25
Wheat Biscuit Cereal	9.7	11.4	1.17
Baked beans	3.7	5.5	1.49
Bran Cereal	24.5	43.0	1.76
Oatmeal	7.1	10.6	1.49
Egg noodles	2.9	1.1	0.37
		Overall mean ratio	1.61

Source: J Cummings, personal communication

The study funded by the former Ministry of Agriculture, Fisheries and Food mentioned above (Englyst et al, 1996) also shows that the mean ratio of AOAC fibre to NSP varies considerably for different food groups (Table 3.2).

Table 3.2. Analysis of major food groups for fibre (% dry matter).

Food Group	NSP	AOAC	Ratio AOAC/NSP
Bread	4.5	5.9	1.31
Other cereals	3.8	4.8	1.26

Meat products	1.1	1.1	1.00
Green vegetables	25.2	30.2	1.20
Potatoes	6.1	7.6	1.25
Other vegetables	10.0	17.7	1.77
Canned vegetables	11.3	16.9	1.50
Fresh fruit	8.7	12.1	1.39
Fruit products	3.1	4.0	1.29
Nuts	6.9	9.2	1.33
		Overall mean ratio	1.33

Source: Englyst et al, 1996.

It would therefore appear, then, that switching from NSP to AOAC fibre criteria simply by multiplying the band thresholds for NSP fibre by 1.33 will have no effect on the categorisation of foods by a nutrient profile model that has a fibre criterion.

3.3 Methods

Due to the lack of AOAC fibre data available for the foods in the M&W database (Roe et al, 2003) it was not possible to test modifications to Model SSCg3d that involve including an AOAC fibre criterion using the standard tests A, B, C and D. It was therefore necessary to construct a new database and a new test for this stage of testing.

The database was constructed from two sources: the M&W database, which has limited data on AOAC fibre, and the Food Standards Agency's rolling programme of nutrient analysis.¹⁴ This currently provides information on; pasta and pasta sauces, breakfast cereals, and 'catch-up' foods – miscellaneous foods selected to improve the coverage of the FSA's nutrient databank and the M&W series of databases.

The resulting database consisted of 82 foods for which both NSP and AOAC levels were available. Of these foods, 34 were breakfast cereals, 10 were cook-in sauces, 18 were dried or fresh pasta products and the remainder were miscellaneous foods such as fish, cakes, biscuits, soup and curry. Since breakfast cereals, pasta and pasta sauces were over-represented in the database the results should be treated with caution.

The fruit and vegetable content and NMES content for these foods were estimated in a similar way as for the original modified M&W database (Rayner et al, 2004). It was assumed that all foods in the database contain no n-3 fatty acids.

¹⁴ Food Standards Agency website - <http://www.food.gov.uk/science/surveillance/fsis2004branch/fsis6504> 14th June, 2005.

The test of different modifications to Model SSCg3d simply involved assessing the proportion of the foods in the database that were categorised as healthier, intermediate and less healthy foods by each model and inspecting how different foods were categorised.

Firstly the foods in the database were tested against Model SSCg3d, in order to establish a benchmark for comparison. Then they were tested against NSP and AOAC fibre variations of Model W (Non milk extrinsic sugars criterion replaced with total sugars and fibre criteria) and Model WXY (NMES replaced with total sugars and fibre, iron, calcium and n-3 fatty acids replaced with protein, all 'C' nutrients capped at 5 points.) For details see page 23.

The score bands for AOAC fibre were calculated by multiplying the NSP score bands by 1.33 as discussed above.

3.4 Results

The results of testing Model SSCg3d and four fibre variations are shown in Table 3.3

Table 3.3. Results of testing fibre variations of models against the fibre database

Model	N*	Distribution of database (%) (H / I / U)**	Consequence of moving from NSP to AOAC modifications	
SSCg3d	64	Total: 16; 42; 44 B'fast cereals: 8; 38; 54 Pasta: 31; 54; 15	n/a	
W (NSP)	64	Total: 50; 27; 23 B'fast cereals: 71; 17; 13 Pasta: 62; 31; 8	<ul style="list-style-type: none"> • Honey and Nut Coated Multigrain Hoops Cereal and Multigrain Hoops Cereal • Healthy eating type fruit and nut cereal • Crunchy/crisp mixed cereal with fruit/nuts including tropical fruit • Canned spaghetti in tomato sauce • Crunchy/honey nut coated Flaked Corn Cereal 	H to I
W (AOAC)	64	Total: 44; 34; 22 B'fast cereals: 58; 33; 8 Pasta: 62; 31; 8		H to I
				H to I
				U to I
WXY (NSP)	64	Total: 36; 41; 23 B'fast cereals: 33; 42; 25 Pasta: 85; 15; 0	<ul style="list-style-type: none"> • Ambient and fresh tomato based sauce with added vegetables • Fresh egg pasta filled with green vegetables/herbs and cheese, cooked • Sushi, salmon nigiri 	H to I H to I I to H

WXY (AOAC)	64	Total: 34; 42; 23 B'fast cereals: 33; 42; 25 Pasta: 77; 23; 0		
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* Size of database for testing (reduced due to lack of info for saturated fat, calcium or iron)

** H = Healthier; I = Intermediate; U = Less healthy

3.5 Conclusions

Table 3.3 suggests that measuring fibre by the Englyst or AOAC method does not make much difference to the categorisation of foods by Models W or WXY provided the appropriate adjustments are made.

Changing the measurement of fibre from Englyst to AOAC affected the fibre score in 44 of the 82 foods in the database for Models W and WXY. However, of these 44 changes, 34 made a difference of only 1 point, 9 made a difference of 2 points, and only one made a difference of 3 points (for the 34 breakfast cereals, 19 changes were made, of which 13 were of only 1 point). These small changes would only affect the overall categorisation of a food if it has been awarded a total score that is very close to a boundary between healthier and intermediate, or intermediate and less healthy. This is only the case for a small proportion of foods.

It should be noted that as the database contains a relatively limited sample of foods that are available for purchase in the UK, these findings may not be reproduced more widely (e.g. the 120 foods used for Test C). However, as Table 3.2 suggests, the mean ratio of AOAC fibre to NSP is reasonably close to 1.33 for most groups of foods, implying that similar tests against databases made up of other foods should provide similar results.

As a result of this, the Expert Group recommended that Model WXY can be adapted for use with AOAC measurements of fibre, by multiplying the score bands for NSP by 1.33 (i.e. AOAC fibre score bands are $\leq 0.9\text{g} = 0$; $\leq 1.8\text{g} = 1$; $\leq 2.7\text{g} = 2$, etc.).

3.7 References

Englyst HN, Quigley ME, Englyst KN, Bravo L, Hudson GJ. Dietary fibre. *J Assoc Publ Analysts* 1996; 32: 1-38.

Department of Health. Dietary Reference Values for Food Energy and Nutrients for the United Kingdom. Report on Health and Social Subjects No 41. HMSO: London, 1991.

Roe M, Finglas P, Church S. McCance and Widdowson's The Composition of Foods. Sixth Summary Edition. London: Royal Society of Chemistry, 2003.

Rayner M, Scarborough P, Stockley L. Nutrient profiles: Options for definitions for use in relation to advertising and children's foods. FSA: London, 2004.

Section 4. Deciding the threshold for a ‘less healthy’ food and a ‘less healthy’ drink.

4.1 Summary

This section shows how the Expert Group decided that, for the purposes of tightening the rules on broadcast advertising of foods to children, ‘less healthy’ foods should be defined as those foods scoring 4 points or more using Model WXY; and those drinks scoring 1 point or more.

4.2 Background

Having decided to recommend Model WXY for the purpose of tightening the rules on broadcast advertising of foods to children the Expert Group decided to revisit the thresholds for defining a ‘less healthy’ food.

Furthermore the Expert Group had previously agreed that Model WXY should not have a drinks multiplier (see Section 2). Since this means that many drinks will have relatively low scores (compared say with a food supplying the same amount of nutrient to a person’s diet), the Expert Group considered that foods and drinks should have separate thresholds for defining ‘less healthy’ foods.

4.3 Methods

In order to make the decision about where the ‘less healthy’ thresholds should lie for foods and drinks, the Expert Group requested information about the points scored under Model WXY for a larger spectrum of indicator foods than previously used for Tests C and D.

The Expert Group felt that data on real foods (as opposed to data gathered from the McCance and Widdowson (Roe et al, 2003) series, which normally gives information about ‘average’ foods from a specified range, such as takeaway French fries) was required in order to be able to accurately predict the effects of setting the ‘less healthy’ threshold in a variety of places.

Accordingly food composition data was collected from a variety of sources, including the M&W database and a FSA data source which includes the nutritional composition of real foods that are available to purchase on the UK market. These foods included both manufactured produce and foods available from retail outlets (such as takeaway hamburgers, pizzas etc.).

4.4 Results

Table 4.1(a) and (b) provide the scores awarded to foods and drinks respectively by Model WXY. For ease of comparison, the foods have been split into 11 categories: bread; cereals; potatoes; milk and dairy (including fat spreads); meat, fish and alternatives; ready meals; foods high in fat, salt and sugar (including crisps and savoury snacks); fast food – burgers, chicken; fast food – pizzas; baked beans and tinned pasta; fruit and vegetable based products; and drinks.

4.5 Conclusion

On balance the Expert Group considered that the most appropriate threshold for a less healthy food was 4 points or more and that the appropriate threshold for a less healthy drink was 1 point or more. In drawing this conclusion, the Expert Group primarily considered those categories that are likely to contain products that are advertised to children: namely, foods high in fat, salt and sugar (including crisps and savoury snacks); breakfast cereals; fast food – burgers and chicken; baked beans and tinned pasta; and drinks. The other categories were also considered for verification purposes i.e. to check whether a threshold would categorise a range of foods inappropriately.

For foods, setting the threshold at 4 resulted in all foods high in fat, salt and sugar (including crisps and savoury snacks) being categorised as ‘less healthy’. Additionally, a large majority of fast foods were also categorised as ‘less healthy’ (the exceptions were mainly salads, although some takeaway burgers and fries were categorised as ‘intermediate’).

For breakfast cereals, setting the threshold at 4 produced a range of products on either side of the threshold. Breakfast cereals with a large amount of added sugar or salt were categorised as ‘less healthy’, whereas high fibre breakfast cereals all scored zero points or less. Most baked beans and tinned pasta scored less than four, but one example of spaghetti rings in tomato sauce shows that the threshold would be effective in restricting the advertising of the less healthy products within this range.

Virtually all fruit and vegetables attain a score of zero or less, and other categories – such as milk and dairy (including fats and spreads) were satisfactorily distributed on either side of the threshold.

Since the scoring system is based on nutritional values measured per 100g of food, foods with a low water content (such as dried fruit) attain higher scores than foods with a high water content (such as ready meals).

4.6 References

Roe M, Finglas P, Church S. McCance and Widdowson’s The Composition of Foods. Sixth Summary Edition. London: Royal Society of Chemistry, 2003.

Section 5. Comparing Models WXY and SSCg3d against an improved panel of indicator foods

5.1 Summary

This section summarises the outcome of comparing the Models WXY and SSCg3d against a new panel of ‘healthier’, ‘intermediate’ and ‘less healthy’ indicator foods derived from a survey of the views of practising nutrition and dietetic professionals. Each respondent was asked to rank 40 foods (selected at random from a master list of 120), as ‘more healthy’ or ‘less healthy’ on a six point scale, where a score of 6 is ‘more healthy’ and a score of 1 is ‘less healthy’. There was a high level of agreement amongst the nutrition professionals as to the appropriate rating for each food. The average rating for each food was then compared with the scores awarded to each food by Models SSCg3d and WXY, these models score foods on a scale of –11 to 26, where the higher the positive number, the ‘less healthy’ the food. There was a strong level of concordance between the scores given by the models and the ratings of the nutrition professionals.

5.2 Background

To improve the testing of nutrient profiling models and to address the concern expressed by some stakeholders that the panels of “indicator foods” against which different models had been tested had not been developed in a systematic way, further work has been undertaken to develop new indicator panels based on the views of practising nutrition and dietetic professionals by using an on-line questionnaire.

5.3 Methods

An on-line questionnaire was sent to members of the Nutrition Society and to dietitians on the British Dietetic Association’s (BDA) paediatric and community registers. Respondents were asked to provide demographic information on their qualifications and experience, to ensure that only respondents with the relevant level of expertise were included in the exercise. Each respondent was asked to rank 40 foods (selected at random from a master list of 120), as ‘more healthy’ or ‘less healthy’ on a six point scale. The respondents were instructed to regard a ‘more healthy’ food as a food that a person who is aiming to eat healthily could eat frequently and/or in large amounts; and a ‘less healthy’ food as a food they should eat infrequently and/or in small amounts. The 120 foods included in the exercise were chosen with reference to NDNS data to ensure the list was representative of actual diets. The list therefore included foods from each major food group, and included a large number of composite foods.

5.4 Results

Responses from over 700 nutrition and dietetic professionals were received and included in the analysis. On the basis of these responses an average rating for each of the 120 foods was determined. Table 5.1 shows the average ratings, and the standard deviations around these ratings, for each of the 120 foods. In general, the standard deviation around the average ratings was low, implying that there was a high level of agreement between the nutrition professionals as to the appropriate rating for each food.

The average ratings for each food were then compared with the scores awarded to each food by Models SSCg3d and WXY. Figures 5.1 and 5.2 show scatter-graphs of the nutrition professionals' ratings plotted against Model SSCg3d and WXY scores, respectively¹⁵. A best fit line has been added to each graph where the nutrition professionals' ratings were weighted by the inverse of the standard deviation for each rating. In this way, foods where there was a high level of agreement amongst nutrition professionals as to its rating, were given greater prominence than foods where there was a low level of agreement.

The weighted R^2 s for the correlation between Model SSCg3d and WXY scores and the nutrition professionals' ratings were 0.71 and 0.67 respectively, indicating that there was a good correlation between the ratings and the scores, demonstrating a strong level of concordance between the scores given by the models and the ratings of nutrition and dietetic professionals.

The weighted R^2 for Model SSCg3d was higher than that for Model WXY. However, it should be noted that since they are based on a sample of only 120 foods, the standard errors for the weighted R^2 s are relatively large. Therefore, it cannot be said that Model SSCg3d achieved a significantly higher weighted R^2 than Model WXY, and the comparison between the two correlations should therefore be treated with caution.

5.5 Conclusion

This survey of the views of nutrition and dietetic professionals shows a high level of concordance between the scores given by Models SSCg3d and WXY and the ratings of the nutrition professionals. However the level of agreement amongst the nutrition professionals was not high enough to be able to say for certain whether the scores awarded by Model WXY were more or less in accordance with their views than Model SSCg3d. The results of the survey therefore support the view of the Expert Group that the technical and practical advantages of Model WXY over Model SSCg3d are not gained at the expense of 'concordance' with the views of nutrition and dietetic professionals.

¹⁵ Note that with Models SSCg3d and WXY a high positive score indicates a 'less healthy' food whereas for nutritional professional ratings a high positive rating indicates a 'healthier' food

Table 5.1. Average nutritionist rating for 120 questionnaire foods, plus scores for Models SSCg3d, and WXY, ranked from healthiest to least healthy (based on average nutritionist rating).

Food name	N	Average nutritionist rating¹⁶	Standard deviation	95% confidence interval	SSCg3d	WXY
Raw green peppers	256	5.91	0.32	(5.87, 5.95)	-10	-7
Apples	246	5.89	0.39	(5.84, 5.93)	-10	-5
Satsumas	224	5.88	0.42	(5.83, 5.94)	-10	-5
Green beans, boiled in unsalted water	240	5.82	0.52	(5.75, 5.88)	-10	-11
Bananas	229	5.81	0.50	(5.74, 5.87)	-9	-1
Iceberg lettuce	247	5.79	0.61	(5.72, 5.87)	-10	-5
Watermelon	235	5.79	0.54	(5.72, 5.86)	-10	-4
Carrots, boiled in unsalted water	237	5.77	0.54	(5.70, 5.84)	-10	-8
Courgette, boiled in unsalted water	213	5.75	0.58	(5.67, 5.82)	-10	-7
Steamed haddock	252	5.74	0.54	(5.68, 5.81)	-2	-4
Grilled rainbow trout	254	5.74	0.49	(5.68, 5.80)	-8	-3
Lemons	224	5.71	0.59	(5.64, 5.79)	-10	-7
Skimmed milk	227	5.63	0.66	(5.54, 5.71)	-1	-2
Wholemeal spaghetti	212	5.58	0.60	(5.50, 5.67)	1	-5
Wholemeal bread	230	5.41	0.75	(5.31, 5.51)	6	-3
Canned tomatoes	224	5.41	0.87	(5.29, 5.52)	-10	-5
Granary bread	237	5.36	0.76	(5.26, 5.46)	7	-1
Semi-skimmed milk	231	5.32	0.80	(5.21, 5.42)	1	0
Baked beans, reduced salt, reduced sugar	241	5.24	0.78	(5.14, 5.33)	-7	-10
Orange juice, unsweetened	226	5.14	0.91	(5.02, 5.26)	-2	-4
Soya milk, unsweetened	227	5.03	1.04	(4.90, 5.17)	0	-1
Stewed rabbit	228	5.03	0.98	(4.90, 5.16)	2	-3
Boiled egg	234	5.01	0.82	(4.91, 5.12)	4	0
Oat bran flakes with raisins	253	5.00	1.04	(4.87, 5.12)	16	4
Apple juice, unsweetened	214	4.95	0.90	(4.83, 5.07)	-1	-3
Vegetable risotto	229	4.92	0.93	(4.80, 5.04)	5	0
Boiled white rice	219	4.90	0.96	(4.77, 5.03)	1	0
Pasta with meat and tomato sauce	251	4.88	0.79	(4.79, 4.98)	3	-1
Celery, boiled in salted	212	4.87	0.89	(4.75, 4.99)	-9	-5

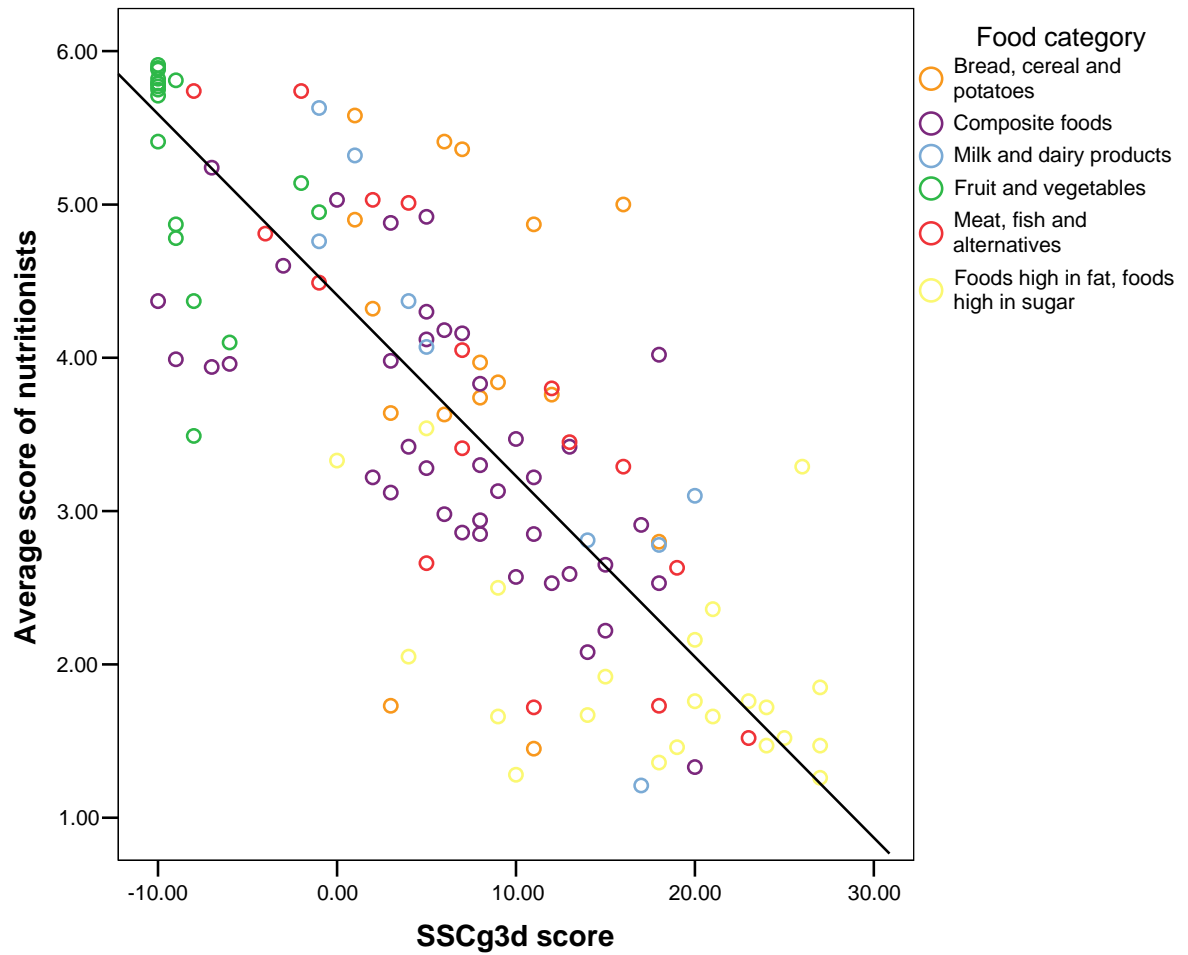
¹⁶ Note that with Models SSCg3d and WXY a high positive score indicates a 'less healthy' food whereas for nutritional professional ratings a high positive rating indicates a 'healthier' food

water						
Bran flakes	214	4.87	0.98	(4.74, 5.00)	11	7
Salmon, canned in brine	236	4.81	0.92	(4.69, 4.92)	-4	1
Red peppers, boiled in salted water	223	4.78	1.02	(4.64, 4.91)	-9	-6
Fruit flavoured diet yoghurt	252	4.76	1.16	(4.62, 4.90)	-1	-1
Baked beans	235	4.60	0.90	(4.49, 4.72)	-3	-6
Boiled winkles	215	4.49	1.17	(4.33, 4.64)	-1	3
Drinking yoghurt	242	4.37	1.11	(4.23, 4.51)	4	2
Ratatouille, ready-meal	234	4.37	1.15	(4.22, 4.52)	-10	-6
Canned peas	240	4.37	1.18	(4.22, 4.52)	-8	-10
Canned new potatoes	244	4.32	1.07	(4.19, 4.45)	2	1
Lancashire hotpot	229	4.30	1.03	(4.16, 4.43)	5	0
Chilli con carne	231	4.18	1.00	(4.05, 4.31)	6	0
Vegetable cannelloni	239	4.16	0.97	(4.04, 4.28)	7	3
Beef bourguignonne	226	4.12	1.03	(3.99, 4.26)	5	1
Canned mushy peas	225	4.10	1.16	(3.95, 4.25)	-6	-6
Whole milk	207	4.07	1.11	(3.92, 4.22)	5	0
Roast beef	233	4.05	1.05	(3.92, 4.19)	7	3
Plain omelette	225	4.02	1.14	(3.87, 4.17)	18	14
Takeaway stir-fry vegetables	233	3.99	1.16	(3.84, 4.14)	-9	-4
Wholemeal fruit crumble	241	3.98	1.01	(3.85, 4.10)	3	1
Toasted English muffins	239	3.97	1.17	(3.82, 4.12)	8	0
Plums, stewed with sugar	261	3.96	1.16	(3.82, 4.10)	-6	-2
Apple, stewed with sugar	257	3.94	1.20	(3.80, 4.09)	-7	-2
Crusty white rolls	250	3.84	1.08	(3.71, 3.98)	9	2
Ham salad sandwich (white bread)	229	3.83	1.11	(3.69, 3.97)	8	2
Ham	215	3.80	1.14	(3.65, 3.96)	12	7
Corn flakes	227	3.76	1.25	(3.60, 3.92)	12	10
Porridge, made with whole milk and added salt	219	3.74	1.13	(3.58, 3.89)	8	7
Potatoes, mashed with butter	238	3.64	1.03	(3.51, 3.77)	3	1
White bread	232	3.63	1.18	(3.48, 3.79)	6	1
Drinking chocolate powder, made up with semi-skimmed milk	229	3.54	0.95	(3.41, 3.66)	5	1
Fried tomatoes	203	3.49	1.18	(3.33, 3.65)	-8	-4
Tomato chutney	255	3.47	1.24	(3.31, 3.62)	10	10
Roast lamb chops	224	3.45	1.17	(3.30, 3.60)	13	9

Custard, made with whole milk	241	3.42	1.14	(3.27, 3.56)	4	3
Wholemeal fruit cake	232	3.42	1.09	(3.28, 3.56)	13	9
Barbequed pork chops	222	3.41	1.19	(3.26, 3.57)	7	3
Diet cola	228	3.33	1.54	(3.13, 3.53)	0	0
Macaroni cheese	210	3.30	1.05	(3.16, 3.44)	8	5
Margarine, polyunsaturated	251	3.29	1.28	(3.13, 3.45)	26	26
Grilled bacon, fat trimmed	258	3.29	1.25	(3.13, 3.44)	16	11
Dried minestrone soup, as served	247	3.28	1.19	(3.14, 3.43)	5	5
Chicken satay	237	3.22	1.05	(3.09, 3.35)	11	3
Tahini paste	220	3.22	1.41	(3.03, 3.40)	2	5
Baked vegetable kiev	228	3.13	1.21	(2.97, 3.28)	9	4
Takeaway prawn curry	235	3.12	1.26	(2.96, 3.28)	3	-2
Feta cheese	233	3.10	1.12	(2.96, 3.25)	20	18
Takeaway seafood pizza	224	2.98	1.22	(2.82, 3.14)	6	-1
Chicken tikka masala	250	2.94	1.17	(2.79, 3.08)	8	1
Pistachio nuts, roasted and salted	236	2.91	1.21	(2.75, 3.06)	17	10
Potato salad	230	2.86	1.13	(2.71, 3.00)	7	6
Sausage casserole	251	2.85	1.07	(2.72, 2.98)	11	5
Egg mayo sandwich (white bread)	230	2.85	0.97	(2.73, 2.98)	8	4
Parmesan cheese	236	2.81	1.16	(2.67, 2.96)	14	18
Crunchy cereal bar	225	2.80	1.06	(2.66, 2.94)	18	5
Full fat goat's milk cheese	244	2.78	1.06	(2.65, 2.91)	18	14
Fried egg	243	2.66	1.03	(2.53, 2.79)	5	1
Doner kebab in pitta bread with salad	244	2.65	1.19	(2.50, 2.80)	15	10
Grilled pork sausages	235	2.63	1.12	(2.49, 2.77)	19	15
Baked chicken pie	240	2.59	1.07	(2.45, 2.72)	13	7
Sage and onion stuffing	207	2.57	0.88	(2.44, 2.69)	10	5
Sweet pickle	214	2.53	1.12	(2.38, 2.68)	18	17
Coronation chicken	228	2.53	1.09	(2.39, 2.67)	12	4
Takeaway milkshake	232	2.50	1.11	(2.36, 2.64)	9	4
Low fat potato crisps	244	2.36	0.95	(2.24, 2.48)	21	13
Barbecue sauce	249	2.22	1.02	(2.10, 2.35)	15	16
Gingernut biscuits	262	2.16	0.91	(2.05, 2.27)	20	16
Chinese style crispy duck	220	2.08	1.00	(1.95, 2.21)	14	11
Lemonade	224	2.05	1.17	(1.90, 2.20)	4	1
Tortilla chips	241	1.92	0.87	(1.81, 2.03)	15	8
Margarine, not polyunsaturated	233	1.85	1.02	(1.72, 1.98)	27	27

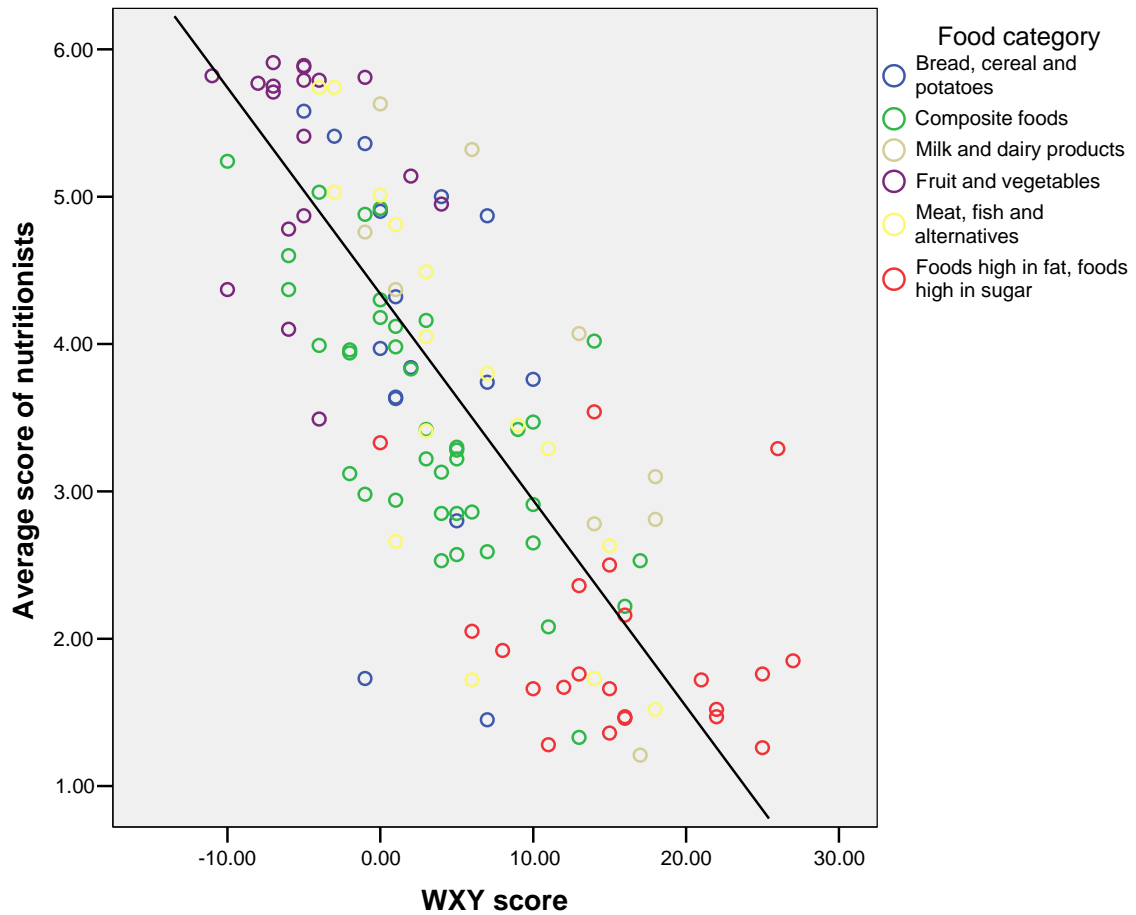
Butter	222	1.76	0.93	(1.63, 1.88)	23	25
Canned sponge pudding	226	1.76	0.77	(1.66, 1.86)	20	13
Saveloy	211	1.73	0.95	(1.60, 1.86)	18	14
Fried chips	222	1.73	0.85	(1.61, 1.84)	3	-1
Milk chocolate	227	1.72	0.83	(1.61, 1.83)	24	21
Takeaway chicken nuggets	236	1.72	0.85	(1.61, 1.82)	11	6
Marshmallows	230	1.67	0.90	(1.55, 1.78)	14	12
Battenburg cake	252	1.66	0.76	(1.57, 1.75)	21	15
Fizzy fruit juice drink	212	1.66	0.88	(1.54, 1.77)	9	2
Fried bacon	220	1.52	0.71	(1.43, 1.62)	23	18
White chocolate	254	1.52	0.74	(1.43, 1.61)	25	22
Potato crisps	212	1.47	0.66	(1.38, 1.56)	24	16
Chocolate biscuits	229	1.47	0.67	(1.38, 1.56)	27	22
Fancy iced cake	226	1.46	0.70	(1.37, 1.55)	19	16
Takeaway French fries	237	1.45	0.69	(1.36, 1.54)	11	7
Chocolate fudge cake	233	1.36	0.61	(1.28, 1.44)	18	15
Profiteroles with sauce	217	1.33	0.58	(1.25, 1.40)	20	13
Cola	227	1.28	0.55	(1.21, 1.35)	10	2
Mixed toffees	226	1.26	0.62	(1.18, 1.34)	27	25
Clotted cream	239	1.21	0.51	(1.15, 1.28)	17	17

Figure 5.1. Average nutritionist rating against Model SSCg3d scores with weighted fit line



Weighted $R^2 = 0.71$ (weight for each food = $1 / \text{standard deviation}$)

Figure 5.2. Average nutritionist rating against Model WXY scores with weighted fit line



Weighted $R^2 = 0.67$ For this graph Model WXY had a drinks multiplier so that for drinks nutrient density is measured per 200g. This allows both food and drink ratings for Model WXY to be displayed on one scale, thereby enabling direct comparison with Model SSCg3d.

Table 4.1(a). WXY scores for individual foods

‘Less healthy’ foods are those scoring 4 points or more. ‘Healthier choice’ are those foods scoring 0 points or less. Foods scoring 1,2 or 3 points are classified as ‘Intermediate’.

SCORE	CATEGORY					
	Bread	Cereals	Potatoes	Milk and Dairy (inc fat spreads)	Meat, Fish and Alternatives	Ready Meals
-10					<ul style="list-style-type: none"> ▪ Lentils, Red, Split, Dried, Boiled in Unsalted Water ▪ Tofu, Soya Bean, Steamed 	
-9						
-8						
-7						
-6						
-5	<ul style="list-style-type: none"> ▪ Crisp-bread, Rye 					
-4		<ul style="list-style-type: none"> ▪ Supermarket Own Brand Instant Hot Oat Cereal 		<ul style="list-style-type: none"> ▪ Fromage Frais, Virtually Fat Free, Natural 	<ul style="list-style-type: none"> ▪ Chicken Breast, Grilled Without Skin, Meat Only 	
-3	<ul style="list-style-type: none"> ▪ Supermarket Own Brand Medium Sliced Brown Bread ▪ Supermarket Value Range Brand Medium Sliced Brown Bread ▪ Supermarket Value Range Brand Brown Bread - Medium Sliced ▪ Supermarket Own Brand Premium Wholemeal Medium Sliced Bread ▪ Wholemeal Bread - Medium Sliced ▪ Wholemeal Bread, Average 	<ul style="list-style-type: none"> • Wheat Biscuit Cereal 				<ul style="list-style-type: none"> ▪ Supermarket Own Brand Spaghetti Bolognese ▪ Roast Beef Dinner
-2	<ul style="list-style-type: none"> ▪ Supermarket Own Brand Medium Sliced Brown Loaf ▪ Wholemeal Bread Rolls 	<ul style="list-style-type: none"> • Muesli, With No Added Sugar • Swiss Style Muesli - No Added Sugar • Supermarket Healthy Eating Range Brand Wheat Biscuit Cereal 	<ul style="list-style-type: none"> • Supermarket Healthy Eating Range Own Brand Oven Chips • Old Potatoes, Roasted in Blended Oil 	<ul style="list-style-type: none"> • Skimmed Milk, Average 		<ul style="list-style-type: none"> ▪ Supermarket Own Brand Chicken Tikka Masala & Rice

-1	<ul style="list-style-type: none"> Supermarket Own Brand Medium Wholemeal Buns Medium Sliced White Bread Danish, Soft Light White Bread For Toasting 	<ul style="list-style-type: none"> Swiss Style Muesli - Original 	<ul style="list-style-type: none"> New Potatoes, Boiled In Unsalted Water 	<ul style="list-style-type: none"> Yoghurt, Low Fat, Plain 	<ul style="list-style-type: none"> Supermarket Own Brand Value Range Fish Fingers Cod, Baked; Beef, Rump Steak, Lean Only, Grilled; Beef, Topside, Roasted Well-done, Lean 	<ul style="list-style-type: none"> Lasagne Specifically for Weight Loss Spaghetti Bolognese Supermarket Own Brand Indian Style - Chicken Jalfrezi & Pilau Rice
0	<ul style="list-style-type: none"> Premium Brown Medium Sliced Bread Wholemeal Deliciously Soft Wholemeal Bread Supreme Medium White Sliced Bread Supermarket Own Brand White Thick Sliced Bread Soft White Bread Rolls 		<ul style="list-style-type: none"> Oven Baked Potato Chips "Home Fried Style" Supermarket Own Brand Crispy Roasting Potatoes Takeaway, Fries Oven Chips, Frozen Baked 	<ul style="list-style-type: none"> Yoghurt, Low Fat, Fruit Semi-Skimmed Milk, Average Whole Milk, Average 	<ul style="list-style-type: none"> Mackerel, Grilled, Lamb, Leg, Lean Only, Roast; Eggs, Chicken, Boiled; Beef, Minced, Extra Lean, Stewed 	<ul style="list-style-type: none"> Lasagne Beef Stew & Dumplings Italian Fish Bake Supermarket Own Brand Cod Portions in Butter Sauce Chicken Curry with Rice Meat Alternative Cottage Pie Supermarket Own Brand Broccoli Mornay Supermarket Own Brand Jacket Potatoes with Cheese Supermarket Own Brand Beef in Black Bean Sauce – Mild Chilli Con Carne
1	<ul style="list-style-type: none"> White Bread, Sliced 	<ul style="list-style-type: none"> Mini Wheat Biscuits Cereal 		<ul style="list-style-type: none"> Cottage cheese, plain; 	<ul style="list-style-type: none"> Supermarket Own Brand Breaded Chicken Nuggets Supermarket Own Brand Value Range Chicken Nuggets Tuna, canned in oil, Drained; Eggs Chicken, Fried in Vegetable Oil; Beef Rump Steak, Lean and Fat, Fried 	<ul style="list-style-type: none"> Supermarket Own Brand Healthy Eating Range Lasagne Specifically for Weight Loss Chicken Curry
2	<ul style="list-style-type: none"> Milk Roll, Soft White Sliced Bread 		<ul style="list-style-type: none"> Supermarket Own Brand Great British Crispy Roast Potatoes Supermarket Own Brand Potato Croquettes 		<ul style="list-style-type: none"> Chicken, Leg Quartered, Roasted, Meat and Skin Sardines, Canned In Tomato Sauce 	<ul style="list-style-type: none"> Specifically for Weight Loss Beef Lasagne Sweet Chilli Chicken With Egg and Pea Rice
3	<ul style="list-style-type: none"> Malt Bread, Fruited Currant buns 			<ul style="list-style-type: none"> Fromage Frais, plain; 	<ul style="list-style-type: none"> Roasted Chicken Bites Fish Fingers, Cod, Grilled 	<ul style="list-style-type: none"> Vegetable Lasagne Supermarket Own Brand Lasagne Supermarket Own Brand Mash Potato Topped Cumberland Pie Ocean Pie

						<ul style="list-style-type: none"> ▪ Supermarket Own Brand Chicken Curry With Rice ▪ Lasagne
4		<ul style="list-style-type: none"> • Wheat Biscuit Cereal • Supermarket Own Brand Bran Flakes 	<ul style="list-style-type: none"> ▪ Takeaway Fries – No Added Salt ▪ Oven Chips ▪ Chunky Croquettes ▪ Potato Croquettes, Fried in Blended Oil 	<ul style="list-style-type: none"> ▪ Supermarket Own Brand 5% Fat Sunflower Low Fat Spread Substitute 	<ul style="list-style-type: none"> ▪ Walnuts 	<ul style="list-style-type: none"> ▪ Cottage / Shepherds Pie, Frozen, Reheated
5		<ul style="list-style-type: none"> • Bran Cereal, Original • Supermarket Own Brand Instant Hot Oats • Supermarket Own Brand Instant Hot Oat Cereal • Supermarket Own Brand Instant Hot Oat Cereal • Multigrain Hoops Cereal 		<ul style="list-style-type: none"> ▪ Greek Yoghurt, Sheep 		
6		<ul style="list-style-type: none"> • Bran Cereal 	<ul style="list-style-type: none"> • Takeaway onion rings 		<ul style="list-style-type: none"> ▪ Chicken Nuggets, Takeaway 	
7		<ul style="list-style-type: none"> • Sugar Coated Puffed Oat Cereal • Oat Cluster Crunchy Cereal • Flakes Corn Cereal 	<ul style="list-style-type: none"> • Chips, French Fries, Retail • Takeaway French Fries • Takeaway Potato Wedges 		<ul style="list-style-type: none"> • Ham 	
8		<ul style="list-style-type: none"> • Wheat Flakes Cereal • Wheat Flakes with Dried Fruit Cereal 	<ul style="list-style-type: none"> ▪ Supermarket Own Brand Potato Waffles 		<ul style="list-style-type: none"> ▪ Supermarket Own Brand Turkey & Chicken Thick Sausages 	
9		<ul style="list-style-type: none"> • Puffed Rice Cereal 			<ul style="list-style-type: none"> ▪ Supermarket Own Brand Aberdeen Angus Thick Beef Sausages 	
10		<ul style="list-style-type: none"> • Flaked Corn Cereal 		<ul style="list-style-type: none"> ▪ Fat Spread, 20-25% Polyunsaturated 		
11		<ul style="list-style-type: none"> • Supermarket Own Brand Triple Chocolate Crunch Cereal • Honey and Nut Coated Flaked Corn Cereal 		<ul style="list-style-type: none"> ▪ Crème Fraiche, Half Fat 		
12		<ul style="list-style-type: none"> ▪ Cocoa Coated Puffed Rice Pops Cereal 			<ul style="list-style-type: none"> ▪ Supermarket Own Brand Value Range Chicken Kiev 	
13		<ul style="list-style-type: none"> ▪ Supermarket Own Brand Sugar Coated Flaked Corn Cereal 				
14		<ul style="list-style-type: none"> ▪ Honey and Nut Coated Flaked Corn Cereal ▪ Sugar Coated Flaked 		<ul style="list-style-type: none"> ▪ Cheddar Type Cheese, Half Fat; ▪ Camembert 		

		Corn Cereal				
15		<ul style="list-style-type: none"> • Cocoa Coated Puffed Rice Cereal 			<ul style="list-style-type: none"> ▪ Thick Pork & Beef Sausages 	
16		<ul style="list-style-type: none"> • Sugar Coated Flaked Corn Cereal • Sugar Coated Puffed Wheat Cereal 			<ul style="list-style-type: none"> ▪ Pork sausages, chilled, fried 	
17						
18				<ul style="list-style-type: none"> ▪ Cheddar Cheese ▪ Light Margarine ▪ Supermarket Own Brand Reduced Fat Sunflower Spread ▪ Supermarket Own Brand Healthy Eating Range Olive Oil Light Spread 	<ul style="list-style-type: none"> ▪ Bacon Rashers, Streaky, Fried 	
19						
20				<ul style="list-style-type: none"> ▪ Olive Oil 		
21						
22				<ul style="list-style-type: none"> ▪ Butter Style Margarine ▪ Margarine 		
23						
24						
25				<ul style="list-style-type: none"> ▪ Butter 		
26				<ul style="list-style-type: none"> ▪ Supermarket Own Brand Value Range Butter, Salted ▪ Margarine, Soft, Polyunsaturated 		

Table 4.1(a cont.). WXY scores for individual foods

SCORE	Foods High in fat, salt or sugar + crisps and savoury snacks	Fast Food – Burgers, Chicken	Fast Food - Pizzas	Baked beans and Tinned Pasta	Fruit and vegetable based products
-10				<ul style="list-style-type: none"> Reduced Sugar & Salt Baked Beans in Tomato Sauce 	
-9				<ul style="list-style-type: none"> Healthy Eating Range Baked Beans in Tomato Sauce 	
-8					
-7			<ul style="list-style-type: none"> Takeaway Coleslaw 	<ul style="list-style-type: none"> Baked Beans Supermarket Own Brand Value Range Baked Beans in tomato sauce 	
-6		<ul style="list-style-type: none"> Takeaway Green Side Salad 		<ul style="list-style-type: none"> Baked Beans, Canned in Tomato Sauce, Re-heated 	<ul style="list-style-type: none"> Peaches, Raw; Celery, Raw; Lettuce, Average, Raw; Tomatoes, Grilled
-5				<ul style="list-style-type: none"> Supermarket Own Brand Value Baked Beans in a Tomato Sauce Baked Beans in a Rich Tomato Sauce 	<ul style="list-style-type: none"> Celery, Boiled in Salted Water Mushrooms, Common, Fried in Corn Oil
-4				<ul style="list-style-type: none"> Supermarket Own Brand Baked Beans in a Rich Tomato Sauce Supermarket Own Brand Baked Beans in Tomato Sauce 	<ul style="list-style-type: none"> Avocado, Average Rhubarb, Stewed With Sugar
-3					<ul style="list-style-type: none"> Pineapple, Canned in Juice
-2		<ul style="list-style-type: none"> Takeaway Roasted Caesar Salad Without Dressing and Croutons 			
-1		<ul style="list-style-type: none"> Takeaway Veggie Burger With Mayonnaise 		<ul style="list-style-type: none"> Spaghetti in a Rich Tomato Sauce 	
0		<ul style="list-style-type: none"> Takeaway Caesar Salad Takeaway Bacon, Lettuce and Tomato Salad Without Dressing 	<ul style="list-style-type: none"> Takeaway Vegetarian Pizza 		
1			<ul style="list-style-type: none"> Takeaway Potato wedges 	<ul style="list-style-type: none"> Supermarket Own Brand, 	

			<ul style="list-style-type: none"> Takeaway Lower Fat Diced Chicken, Red Onion and Green Pepper Pizza 	Children's Range Spaghetti Letters	
2		<ul style="list-style-type: none"> Takeaway Delicatessen Style Sandwiches- Roast Beef and mature cheddar 	<ul style="list-style-type: none"> Takeaway Cheese and Tomato Pizza Takeaway Extra Large Chicken Pizza with extra toppings 		
3		<ul style="list-style-type: none"> Takeaway Fruit Jelly with Fruit Takeaway Double Beef Patty Burger in Sesame Seed Bun 	<ul style="list-style-type: none"> Takeaway Deep Pan Chicken Pizza 	<ul style="list-style-type: none"> Spaghetti Bolognese Supermarket Own Brand Beef Ravioli in Spicy Tomato & Beef Sauce 	<ul style="list-style-type: none"> Strawberries, Canned in Syrup
4		<ul style="list-style-type: none"> Takeaway Flame Grilled Beef Burger in Sesame Seed Bun Takeaway Fish Burger in Bun Takeaway French fries- No Added Salt Takeaway Beef Burger with Cheese in Bun Takeaway Fruit & Yogh0urt pot 	<ul style="list-style-type: none"> Takeaway Vegetarian Pizza Takeaway Thin and Crispy Vegetarian Pizza 		
5	<ul style="list-style-type: none"> Doughnuts, jam 	<ul style="list-style-type: none"> Takeaway Crispy Chicken Sandwich Takeaway Double Beef Patty Burger with Special Sauce in Sesame Seed Bun 	<ul style="list-style-type: none"> Takeaway Lower Fat Pizza - Ham, Pineapple and Diced Red Tomato 		<ul style="list-style-type: none"> ▪ Currants ▪ Fruit crumble
6		<ul style="list-style-type: none"> Takeaway Onion Rings Takeaway Crispy Chicken Strips in Tortilla Wrap Takeaway Grilled Chicken Caesar Salad with Low Fat Light Caesar Salad Dressing and Croutons Takeaway Double Sausage & Egg Breakfast English Muffin 	<ul style="list-style-type: none"> Takeaway Extra Meat Toppings and Cheese Pizza Takeaway Chicken Strips 	<ul style="list-style-type: none"> Supermarket Own Brand Spaghetti Rings in Tomato Sauce 	
7		<ul style="list-style-type: none"> Takeaway Flame Grilled Beef Burger in Sesame Seed Bun with Cheese Takeaway Special Coated 	<ul style="list-style-type: none"> Takeaway Cheese Pizza Takeaway Extra Meat Toppings and Cheese Pizza with Cheese Stuffed 		

		<ul style="list-style-type: none"> French Fries Takeaway Large Milkshake, Chocolate Syrup added Takeaway Battered Chicken Breast Takeaway Potato Wedges Takeaway Battered Chicken Drumstick Takeaway Breakfast Bacon Roll 	Crust		
8		<ul style="list-style-type: none"> Takeaway Double Flame Grilled Hamburger Takeaway Spicy Chicken Wings 	<ul style="list-style-type: none"> Takeaway Chicken, Beef and Pepperoni Pizza Takeaway Thin and Crispy Ham Pizza Takeaway Supreme Pizza 		
9		<ul style="list-style-type: none"> Takeaway Flame Grilled Cheese Burger 	<ul style="list-style-type: none"> Takeaway Pepperoni Pizza 		
10	<ul style="list-style-type: none"> Peanuts, Roasted and Salted Wheat Sticks - Yeast Extract Coated 	<ul style="list-style-type: none"> Takeaway Crispy Coated Chicken Breast Strips 	<ul style="list-style-type: none"> Takeaway Low Carbohydrate Range Pepperoni Pizza Takeaway Garlic Bread with Cheese 		
11	<ul style="list-style-type: none"> Salted Peanuts 	<ul style="list-style-type: none"> Takeaway Spicy Chicken Wings Takeaway Lemon Meringue Pie 			
12	<ul style="list-style-type: none"> Supermarket Own Brand Roasted and Salted Cashew Nuts 	<ul style="list-style-type: none"> Takeaway Battered Chicken Thigh 	<ul style="list-style-type: none"> Takeaway Low Carbohydrate Range Meat Pizza 		
13	<ul style="list-style-type: none"> Potato Crisps, Low Fat 	<ul style="list-style-type: none"> Takeaway Popcorn Style Crispy Coated Chicken Bites 			
14			<ul style="list-style-type: none"> Takeaway New York Style Baked Cheesecake 		
15	<ul style="list-style-type: none"> Sponge Cake Mini Poppadoms, Coriander Chutney Flavour Supermarket Own Brand Dry Roasted Peanuts 				
16	<ul style="list-style-type: none"> Digestive Biscuits, Plain; Dark Chocolate Coated Orange Jelly Layered Sponge Cakes Potato Crisps 				

	<ul style="list-style-type: none"> ▪ Wheat Tubes, Crispy Bacon Flavour Snacks ▪ Chilli Flavour Thick Cut Ridged Potato Crisps 				
17	<ul style="list-style-type: none"> ▪ salt and vinegar crisps 	<ul style="list-style-type: none"> • Takeaway Tomato Ketchup Dip 			
18	<ul style="list-style-type: none"> • Chocolate Coated Wafer Biscuits • Reduced Calorie Mayonnaise • Mini Cheddar Biscuits 	<ul style="list-style-type: none"> • Takeaway Double Chocolate Chip Cake 	<ul style="list-style-type: none"> • Takeaway Indulgence Dessert 		
19	<ul style="list-style-type: none"> ▪ Chocolate Chip Cookies 				
20	<ul style="list-style-type: none"> ▪ Olive Oil 				
21	<ul style="list-style-type: none"> • Pickled Onion Flavour Maize and Corn Snack 				
22	<ul style="list-style-type: none"> • Mayonnaise, Retail 				
23	<ul style="list-style-type: none"> ▪ Chocolate Coated Whipped Nougat Bar ▪ Salted Potato Rings 				
24	<ul style="list-style-type: none"> ▪ Chocolate Coated Whipped Nougat and Caramel Bar ▪ Prawn Cocktail Flavoured Maize Snacks 				
25	<ul style="list-style-type: none"> ▪ Butter ▪ Spicy Flavoured Corn Snacks 		<ul style="list-style-type: none"> • Takeaway Cheese Cake 		
26					

Table 4.1(b). WXY scores for individual drinks

‘Less healthy’ drinks are those scoring 1 points or more. ‘Healthier Choice’ drinks are those scoring 0 points or less.

SCORE	Drinks
-10	
-9	
-8	
-7	
-6	
-5	<ul style="list-style-type: none"> • Fruit Juice Drink, Low Calorie, Ready to Drink
-4	<ul style="list-style-type: none"> • Orange Juice, Unsweetened
-3	<ul style="list-style-type: none"> • Apple Juice, Unsweetened • Fruit Juice Drink, Ready to Drink • Grape juice, unsweetened • Pineapple Juice, Unsweetened • Tomato Juice
-2	<ul style="list-style-type: none"> • Skimmed Milk, Average
-1	<ul style="list-style-type: none"> • Flavoured Milk, Pasteurised, Chocolate • Lassi, Sweetened • Soya Non-dairy Alternative to Milk Sweetened, Calcium Enriched • Soya, Non-dairy Alternative to Milk, Unsweetened
0	<ul style="list-style-type: none"> • Water, distilled • Tea, Black, Infusion, Average • Coffee, Infusion, Average • Cola, Diet • Whole Milk, Average • Semi-skimmed Milk, Average • Flavoured Milk, Pasteurised
1	<ul style="list-style-type: none"> • Lemonade • Drinking chocolate powder, Made up With Semi-Skimmed Milk
2	<ul style="list-style-type: none"> • Cola • Fruit Juice Drink, Carbonated, Ready to Drink • Channel Island Milk, Whole, Pasteurised • Milkshake, Thick, Takeaway • Takeaway 1% Low Fat Chocolate Milk • Takeaway Carbonated Orange Soda
3	<ul style="list-style-type: none"> • Drinking Chocolate Powder, Made Up With Whole Milk

4	<ul style="list-style-type: none"> • Takeaway Large Milkshake – Vanilla Flavour
5	
6	<ul style="list-style-type: none"> • Takeaway Large Milkshake, Strawberry Syrup Added
7	<ul style="list-style-type: none"> • Takeaway Large Milkshake, Chocolate Syrup added
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