

Nutrient profiles: Applicability of currently proposed model for uses in relation to promotion of food to children aged 5-10 and adults

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1.0 Summary

The nutrient profile model – Model SSCg3d - recommended in the Food Standards Agency’s recent report (Rayner, Scarborough and Stockley, 2004), was developed for children aged 11-16. However the report notes that the model ‘should be applicable to children of any age between 5 and 16 and also to adults.’ This paper provides further evidence to support this contention.

In assessing the applicability of Model SSCg3d to other age groups we considered how the model was developed and what issues would have been approached differently if another age range had been considered.

There are basically four choices involved in developing nutrient profiles. Of these four choices (choice of nutrients, choice of base, choice of model type and choice of numbers), only the choice of numbers for the model is likely to be affected by the age range. The thresholds for nutrients might have been set higher or lower depending on the Guideline Daily Amounts (GDAs) for the age range.

The numbers chosen for the thresholds in the recommended model were specified proportions of GDAs calculated for 11-16 year olds. The proportions were kept constant across groups of related nutrients so that each of the nutrients within groups contributed equally towards the definition. With this restriction, a range of proportions was tested in order to find the most accurate model.

This paper reports two further analyses that have been carried out to assess whether the proportions selected for the recommended model categorise foods in a way which is applicable to the promotion of foods to children aged 5-10 and adults. The results show that the categorisation of foods by the recommended model is generally suitable for all age ranges.

Therefore it is proposed that the recommended model, Model SSCg3d, is appropriate for use in relation to all people over the age of 5 with the one proviso that if it is to be used for a purpose only relating to the promotion of foods to children age 5-10 then it should be slightly modified with respect to the thresholds for sodium.

2.0 Introduction

The Food Standards Agency (FSA) report, *‘Nutrient profiles: Options for definitions for use in relation to food promotion and children’s diets’* (Rayner, Scarborough and Stockley, 2004) details the development and testing of nutrient profile models with associated definitions for ‘foods high in fat, salt or sugar’ and ‘healthier food choices’. The models were developed for purposes related to the promotion of foods to children aged 11-16, but the report also suggests that the model that was finally recommended would be applicable to children of any age between 5 and 16 and also to adults (Section 2.2.1). This paper further explores this contention.

2.1 Developing nutrient profiles

In Section 2 of the FSA report a systematic approach to developing nutrient profiles is advocated. It is proposed that developing nutrient profile models should involve four stages:

- Choice of nutrients and other food components
- Choice of base (e.g. per 100g, per 100kJ, per serving)
- Choice of model type
- Choice of numbers

In Section 2 it is also suggested that when developing nutrient profiles there needs to be clarity about the age group for which they are required. Accordingly models with their associated definitions were developed for purposes related to the promotion of children of one specific age group i.e. children aged 11-16.

2.2 Choice of nutrients and other food components

In developing nutrient profiles for purposes in relation to children aged 11-16 the Expert Group for the project agreed that the choice of nutrients and other food components should reflect current government priorities with regard to public health nutrition and be based on estimated average requirements and recommended average intakes for nutrients rather than take account of nutrient deficiencies within sub-groups of the age-group in question.

It was therefore agreed that the model should take account of population dietary goals for fat ¹ saturated fat, non-milk extrinsic sugars, sodium, fruit and vegetables and n-3 fatty acids but also the food-based dietary guidelines depicted by the Balance of Good Health. To ensure that a reasonable proportion of foods from the ‘milk and dairy foods’ and ‘meat, fish and alternatives’ groups of the Balance of Good Health were defined as ‘healthier food choices’, calcium and iron were included in the model.

Estimated average requirements and recommended average intakes relative to energy intakes for all age-groups of 5 years and over are, with some exceptions considered below, approximately the same. This in turn means that food-based dietary guidelines, as for example depicted by the Balance of Good Health, are equally applicable to children aged 5 or over, adolescents and to adults.

Accordingly there is no reason why the choice of nutrients and other food components for nutrient profiles for purposes in relation to the promotion of foods to children aged 5-10 or to adults should be different from those chosen for purposes in relation to children aged 11-16. In contrast dietary guidelines for infants aged 0-4 are very different to older children (Section 1.4.1.1 of the FSA report) and therefore the choice of nutrients and other food components for nutrient profiles for purposes in relation to this age range would be quite different.

It is acknowledged that, within the adult population, there are some stages of life where an increased intake of a specific nutrient is recommended (e.g. calcium during lactation) or where there are recommendations with regard to specific foods (e.g. certain types of oily fish during pregnancy). Such issues were not considered when developing the models tested in the FSA report (since they were not particularly relevant to the age-group in question) however it is difficult to see how they could be addressed by a general model for defining ‘foods high in fat, salt or sugar’ and ‘healthier food choice’. It is proposed that provided the recommended model does not contradict specific public health advice related to particular life-stages, it can sit alongside it.

¹ Note that for the final model it was decided that energy density should be used and not the fat content.

2.3 Choice of base and choice of model type

As with the choice of nutrients or other food components there seems to be no reason why the choice of base or choice of model type should be different when developing nutrient profiles for children aged 5-10, children aged 11-16 or adults. This is because the choice of base only affects the way nutrient levels in foods are measured when setting thresholds for definitions, and choice of model type only affects the way foods are categorised by definitions, and there seems no reason why the age-group for which the nutrient profiles are required should affect these choices.

2.4 Choice of numbers

However the choice of numbers could be different for different age groups. Suppose for example a particular age group had an average requirement for one of the selected nutrients that was substantially above that of other age groups. Then it would be expected that definitions of 'healthier food choice' for people of that age group would reflect that fact. Accordingly we have carried out two further analyses to examine whether estimated average requirements and recommended average intakes for 5-10 year olds and of adults are sufficiently different to those of 11-16 year olds as to make a difference to the choice of numbers for definitions of 'foods high in fat, salt or sugar' and 'healthier food choice' for these age ranges.

Before reporting on these analyses, the stages involved in choosing the numbers for the recommended model should be recalled. The systematic approach to developing nutrient profiles proposed in Section 2 of the FSA report identified three possibilities for the choice of numbers for nutrient profiles. The numbers could be pragmatically chosen (i.e. the numbers could be chosen so that the model is as accurate as possible); they could be taken from respected sources (i.e. the numbers could be selected on the basis of their use elsewhere); or they could be linked to public health recommendations.

The Expert Group agreed that it would be most appropriate to use numbers linked to estimated average requirements and recommended average intakes for nutrients. To achieve this, estimated average requirements and recommended average intakes were converted to Guideline Daily Amounts (GDAs).

The Expert Group also recommended that the nutrients chosen for the model should be split into three groups ('A', 'B' and 'C' nutrients) according to their relation to dietary advice, and within these groups the same proportion of GDAs for different thresholds within a model should be used. So, for example, for the recommended model - a scoring system - the first scoring band was set at 3.8% of the GDA for 'A' nutrients (energy, saturated fat, non-milk extrinsic sugar and sodium) and 15% of the GDA for 'C' nutrients (calcium and iron).

Although thresholds were linked in this manner, the choice of which proportions of the GDA to use was made pragmatically. Initially, models were developed that used proportions that seemed appropriate because of previous FSA advice on what counts as 'a lot' or 'a little', or on the basis of the distribution of nutrient levels in foods. These initial models were then tested for accuracy. The accuracy tests assessed how closely the categorisation of foods by a model resembles a theoretical 'ideal' categorisation, and are described in detail in Sections 3

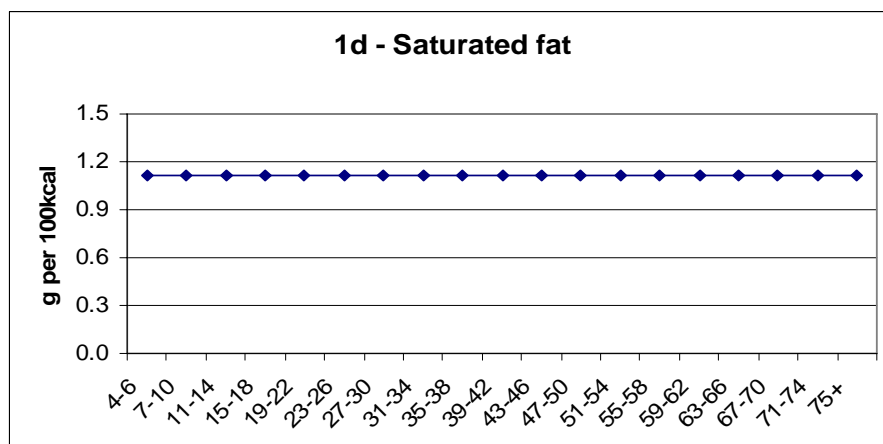
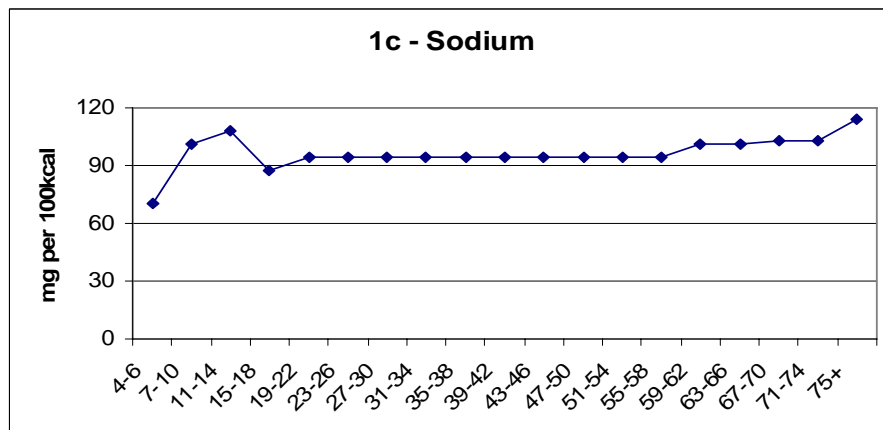
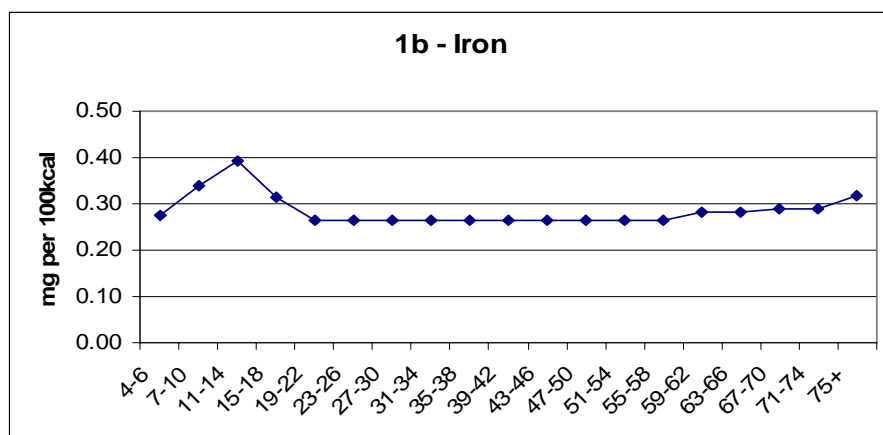
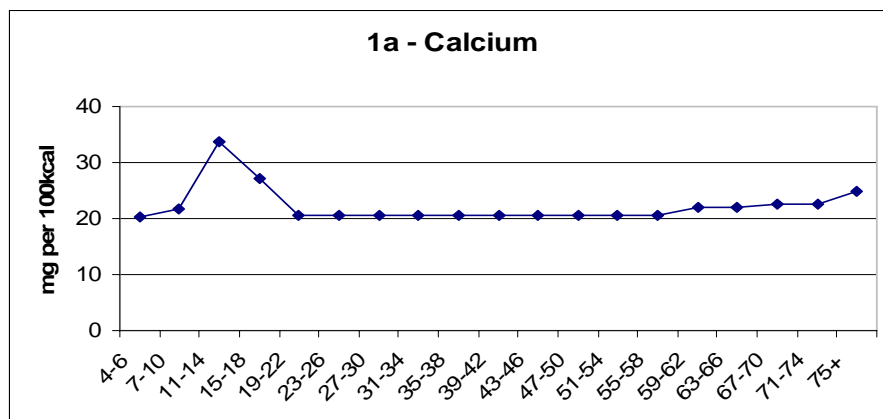
and 4 of the FSA report. The initial models were improved by adjusting the proportions of GDAs used as thresholds, in order to increase their accuracy.

This approach would have been no different if the nutrient profile models were to be used for a wider age range. Foods high in any of the 'A' nutrients would be considered high for 5-10 year olds, 11-16 year olds and adults alike, since by the age of 5 children should be consuming a similar diet to adults (albeit with a lower energy intake). Foods categorised as 'foods high in fat, salt or sugar' would therefore be similar for all over the age of 5. Similarly, fruits, vegetables, oily fish and a proportion of foods from the 'Meat, fish and alternative' and 'Milk and dairy foods' group are recommended for all people over the age of 5, so their categorisation as 'healthier food choices' would be appropriate for all age ranges.

It is conceivable, however, that the recommended model might over-emphasise the importance of calcium and iron in the diet, if applied to adults or 5-10 year olds. This is because the GDAs for calcium and iron are – when assessed relative to energy needs - disproportionately high for 11-16 year olds, reflecting the body's additional needs for these nutrients during puberty (see Figure 1a and 1b). It is possible that some foods should be categorised as 'foods high in fat, salt or sugar' for adults or 5-10 year olds rather than intermediate foods or intermediate foods rather than 'healthier food choices' because adults and 5-10 year olds have a lesser need for iron or calcium relative to their energy needs.

This argument also applies to sodium since the maximum daily sodium intakes recommended by the Scientific Advisory Committee for Nutrition for 11-16 olds are higher relative to energy needs than those for other age groups (see Figure 1c).

Figure 1. Calcium, iron, sodium and saturated fat (for comparison) recommendations per 100 kcal of intake for males of all age ranges above 4 years.



3.0 Two further analyses

In order to assess how the choice of GDAs for 11-16 year olds affects the categorisation of foods by the recommended model, GDAs for 5-10 year olds and adults were calculated and these are shown in Tables 1 and 2. The GDAs were calculated in the same way as the GDAs for 11-16 year olds used in the FSA report were calculated (provided for reference in Table 3).

Table 1. Population dietary goals and Guideline Daily Amounts for adults

Nutrient	Source of population dietary goal	Population dietary goal	GDA
Energy	1 (a)	2245 kcal	2245 kcal
Saturated fat	1 (b)	11% food energy	27 g
NME sugar	1 (c)	11% food energy	66 g
Sodium	2 (d)	2.35 g/day	2.35 g
Fruit and vegetables	3 (e)	400 g/day	400 g
Calcium	1 (f)	525 mg/day	525 mg
Iron [†]	1 (g)	9 mg/day	9 mg
Long chain n-3 polyunsaturated fatty acids	4 (h)	0.45 g/day	0.45 g

Table 2. Population dietary goals and Guideline Daily Amounts for children aged 5-10

Nutrient	Source of population dietary goal	Population dietary goal	GDA
Energy	1 (i)	1765 kcal	1765 kcal
Saturated fat	1 (j)	11% food energy	22 g
NME sugar	1 (k)	11% food energy	52 g
Sodium	2 (l)	1.7 g/day	1.7 g
Fruit and vegetables	3 (m)	315 g/day	315 g
Calcium	1 (n)	395 mg/day	395 mg
Iron [†]	1 (o)	5.9 mg/day	5.9 mg
Long chain n-3 polyunsaturated fatty acids	4 (p)	0.35 g/day	0.35 g

Table 3. Population dietary goals and Guideline Daily Amounts for children aged 11-16

Nutrient	Source of population dietary goal	Population dietary goal	GDA
Energy	1 (q)	2130 kcal	2130 kcal
Saturated fat	1 (r)	11% food energy	26 g
NME sugar	1 (s)	11% food energy	63 g
Sodium	2 (t)	2.35 g/day	2.35 g
Fruit and vegetables	3 (u)	380 g/day	380 g
Calcium	1 (v)	690 mg/day	690 mg
Iron [†]	1 (w)	10 mg/day	10 mg
Long chain n-3 polyunsaturated fatty acids	4 (x)	0.4 g/day	0.4 g

† For the purpose of this model an average value for recommended iron intakes has been used. This may not be applicable in other situations.

Sources:

1. Department of Health, *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom. Report on Health and Social Subjects No 41.* London: HMSO, 1991;
2. Scientific Advisory Committee on Nutrition. *Salt and Health.* London: The Stationery Office, 2003.
3. Department of Health. *Nutritional Aspects of Cardiovascular Disease.* London: HMSO, 1994.
4. Scientific Advisory Committee on Nutrition. *Advice on Fish Consumption: Benefits and Risks.* London: The Stationery Office, 2004

Notes:

- (a) Average of 2550 kcal/day (Estimated Average Requirement (EAR) for men aged 19-50) and 1940 kcal/day (EAR for women aged 19-50).
 - (b) GDA calculated using EARs for energy and a conversion factor of 9 kcal for 1 g fat.
 - (c) GDAs calculated using EARs for energy and a conversion factor of 3.75 kcal for 1 g sugar.
 - (d) The Scientific Advisory Committee on Nutrition (SACN) recommends; 6g/day for the adult population.
 - (e) The Committee on Medical Aspects of Food and Nutrition Policy (COMA) recommends a 50% increase in consumption of fruit and vegetables. This has been translated into 5 servings a day or 400g.
 - (f) Average of: 525 mg/day (EAR for men aged 19-50) and 525 mg/day (EAR for women aged 19-50).
 - (g) Average of: 6.7 mg/day (EAR for men aged 19-50) and 11.4 mg/day (EAR for women aged 19-50).
 - (h) SACN recommends that the average 'population' intake should be 0.45 g/day.
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- (i) Weighted average of 1715 kcal/day (EAR for boys aged 4-6), 1970 kcal/day (EAR for boys aged 7-10), 1545 kcal/day (EAR for girls aged 4-6) and 1740 kcal/day (EAR for girls aged 7-10).
 - (j) GDA calculated using EARs for energy and a conversion factor of 9 kcal for 1 g fat.
 - (k) GDAs calculated using EARs for energy and a conversion factor of 3.75 kcal for 1 g sugar.
 - (l) SACN recommends; 3g/day for 4-6 year olds, and 5g/day for 7-10 year olds.
 - (m) COMA recommends a 50% increase in consumption of fruit and vegetables. This has been translated into 5 servings a day or 400g. Here this amount in g has been adjusted to take account of the lower energy needs of children.
 - (n) Weighted average of: 350 mg/day (EAR for children aged 4-6) and 425 mg/day (EAR for children aged 7-10).
 - (o) Weighted average of: 4.7 mg/day (EAR for children aged 4-6) and 6.7 mg/day (EAR for children aged 7-10).
 - (p) SACN recommends that the average 'population' intake should be 0.45 g/day. Here this amount has been adjusted to take account of the lower energy needs of children.
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- (q) Weighted average of 2220 kcal/day (EAR for boys aged 11-14), 1845 kcal/day (EAR for girls aged 11-14), 2755 kcal/day (EAR for boys aged 15-18) and 2110 kcal/day (EAR for girls aged 15-18).
 - (r) GDA calculated using EARs for energy and a conversion factor of 9 kcal for 1 g fat.
 - (s) GDAs calculated using EARs for energy and a conversion factor of 3.75 kcal for 1 g sugar.
 - (t) SACN recommends; 6g/day for children aged 11 and over.
 - (u) COMA recommends a 50% increase in consumption of fruit and vegetables. This has been translated into 5 servings a day or 400g. Here this amount in g has been adjusted to take account of the lower energy needs of children.
 - (v) Weighted average of: 750 mg/day (EAR for boys aged 11-14); 625 mg/day (EAR for girls aged 11-14); 750mg/day (EAR for boys aged 15-18); 625mg/day (EAR for girls aged 15-18).
 - (w) Weighted average of: 8.7 mg/day (EAR for boys aged 11-14); 11.4 mg/day (EAR for girls aged 11-14); 8.7mg/day (EAR for boys aged 15-18); 11.4mg/day (EAR for girls aged 15-18).
 - (x) SACN recommends that the average 'population' intake should be 0.45 g/day. Here this amount has been adjusted to take account of the lower energy needs of children

Next, for illustrative purposes, we calculated the percentage of the GDA for 5-10 year olds, 11-16 year olds and adults (and the average of all ages for comparison) for the first threshold of the recommended model. The results are shown in Table 4

Table 4. Percentage of the GDA used for the first threshold of the recommended model, for 5-10 year olds, 11-16 year olds, adults and average of all ages.

Group	Nutrient / food component	Percentage of GDA used for the first threshold			
		5-10 year olds	11-16 year olds	Adults	Average (all ages)
A	Energy	4.5%	3.8%	3.6%	3.7%
	Saturated fat	4.5%	3.8%	3.7%	3.7%
	NME sugar	4.6%	3.8%	3.6%	3.8%
	Sodium	5.3%	3.8%	3.8%	3.9%
B	n-3 fatty acids	14.3%	12.5%	11.1%	11.3%
	Fruit and vegetables	n/a	n/a	n/a	n/a
C	Calcium	27%	15%	20%	20%
	Iron	25%	15%	17%	18%

First analysis: inter-group variation

Table 4 shows that for the 11-16 year old age range, the proportion of the GDA for ‘A’ nutrients is 3.8%, whereas for ‘C’ – calcium and iron - nutrients it is 15%, giving a ratio of 1:4. However, for the 5-10 year old age range and the adult age range, the equivalent ratio is 1:5.5 and 1:5 respectively. The difference in the ratios is due to the increased need for calcium and iron during puberty as shown in Figure 1.

Table 5 shows which foods in the modified McCance and Widdowson database described in Section 3.3.1 of the FSA report (i.e. of 1,030 foods) would be re-categorised by two variants of the recommended model in which the calcium and iron score bands have been reset so that, using the 11-16 year old GDAs, the ratio between the proportions of the GDAs for ‘A’ and ‘C’ nutrients are 1:5.5 (as for children aged 5-10) and 1: 5 (as for adults) whilst keeping the proportions of the GDAs for ‘A’ nutrients constant.

Table 5. Recategorisations of all foods in the modified McCance and Widdowson database as a result of varying the ratios of the amounts (as proportions of GDAs) for ‘C’: ‘A’ nutrients.

Model SSCg3d (Ca/Fe – 19%)		Model SSCg3d (Ca/ Fe – 21%)	
‘Healthier food choice’ to Intermediate	Intermediate to ‘foods high in fat, salt or sugar’	‘Healthier food choice’ to Intermediate	Intermediate to ‘foods high in fat, salt or sugar’
<ul style="list-style-type: none"> ▪ Beef steak, lean ▪ Reduced fat cottage cheese ▪ Kidney ▪ Semi-skimmed milk (UHT) ▪ Tahini paste 	<ul style="list-style-type: none"> ▪ Almonds ▪ Ciabatta ▪ Drinking chocolate (made with whole milk) ▪ Vegetable flan ▪ Thick milkshake ▪ Chocolate mousse ▪ Naan bread ▪ Reduced fat pate ▪ Porridge ▪ Egg mayo sandwich ▪ Scampi in breadcrumbs ▪ Wholemeal bread, toasted 	<ul style="list-style-type: none"> ▪ Beef steak, lean ▪ Reduced fat cottage cheese ▪ Kidney ▪ Semi-skimmed milk (UHT) ▪ Tahini paste ▪ Liver ▪ Weetabix ▪ Low fat fruit yoghurt 	<ul style="list-style-type: none"> ▪ Almonds ▪ Ciabatta ▪ Drinking chocolate (made with whole milk) ▪ Vegetable flan ▪ Thick milkshake ▪ Chocolate mousse ▪ Naan bread ▪ Reduced fat pate ▪ Porridge ▪ Egg mayo sandwich ▪ Scampi in breadcrumbs ▪ Wholemeal bread, toasted ▪ Hamburger buns ▪ English muffins ▪ Savoury pancakes ▪ Rice Krispies ▪ Stewed lamb ▪ White bread, toasted

Balance of Good Health Indicator Foods (See Section 3.3.2 of the FSA report) are marked in bold.

Table 5 shows that both variants of the model lead to a substantial number of recategorisations of foods that are relatively high in calcium and/or iron to less healthy categories. This would not seem to be desirable – particularly for 11-16 year olds.

Second analysis: intra-group variations

In developing nutrient profile models for definitions of ‘foods high in fat, salt or sugar’ and ‘healthier food choices’ the Expert Group agreed that thresholds should be set at the same proportion of the GDA within the three nutrient groups. This was to ensure that nutrient profiles reflected nutrient goals to a comparable extent.

Table 4 does show that for 5-10 year olds and for adults the percentage of GDA used for the first scoring threshold in Model SSCg3d are generally the same for each group of nutrients.

(These percentages are, of course, not the same across the age ranges (for example, n-3 fatty acids uses 14.3% for 5-10 year olds, 12.5% for 11-16 year olds, and 11.1% for adults) but this is to be expected, since GDAs tend to increase as overall intake increases.)

But Table 4 also shows that there are two significant² divergences from the principal that the proportion of the GDA should be the same within a nutrient group. For 5-10 year olds, the sodium threshold is 15% higher than the other 'A' nutrients, and for adults, the threshold for calcium is 18% higher than the threshold for iron.

Table 6 shows which foods would be recategorised by three variants of the recommended model in which the score bands have been reset so that

- a) the sodium threshold (and accompanying score bands) were set at 4.5% of the GDA for children aged 5-10 (i.e. so that the proportion of the GDA for sodium is the same as for the other 'A' nutrients the recommended model)
- b) the calcium threshold was set at 17% of the GDA for adults (i.e. so that the proportion of the GDA for calcium is the same as that it is for iron in the recommended model)
- c) the iron threshold was set at 20% of the GDA for adults (i.e. so that the proportion of the GDA for iron is the same as it is for calcium in the recommended model)

² Greater than 5% of lower proportion difference between higher and lower proportions.

Table 6. Recategorisations of all foods in the modified McCance and Widdowson database as a result of varying the ratios of the amounts (as proportions of GDAs) within groups of nutrients

Model SSCg3d (Na – 4.5% of 5-10 year old GDA)		Model SSVg3d (Ca – 17% of adult GDA)		Model SSCg3d (Fe- 20% of adult GDA)	
‘Healthier food choice’ to intermediate	Intermediate to ‘food high in fat, salt or sugar’	Intermediate to ‘healthier food choice’	‘Food high in fat, salt or sugar to intermediate	‘Healthier food choice’ to intermediate	Intermediate to ‘food high in fat, salt or sugar’
<ul style="list-style-type: none"> • Beef steak • Cottage cheese • Kidney • Canned potatoes • Onion sauce • Vegetable pie • Canned tomato soup 	<ul style="list-style-type: none"> • Brown rolls • Canned chicken soup • Chicken tikka masala • Tomato chutney • Ciabatta • Fruit crumble • Fish fingers • Vegetable flan • Granary bread • Hamburger buns • English muffins • Naan bread • Pancakes • Reduced fat pate • Pork chops • Porridge • Scampi • Shish kebab, meat only • White bread • Wholemeal bread 	<ul style="list-style-type: none"> • Takeaway prawn curry • Onion sauce 	<ul style="list-style-type: none"> • Granary rolls • Lasagne 	<ul style="list-style-type: none"> • Beef steak • Kidney • Tahini paste • Weetabix 	<ul style="list-style-type: none"> • Faggots • Chocolate mousse • Naan bread • Reduced fat pate • Egg mayo sandwich • Scampi • Special K

Balance of Good Health Indicator Foods (See Section 3.3.2 of the FSA report) are marked in bold.

Table 6 shows that altering the calcium or iron thresholds – in line with adults GDAs - makes little difference to the categorisation of foods. However, the resetting of the sodium thresholds – in line with the 5-10 year old GDAs - has more of an effect. In particular many bread products are recategorised from intermediate to ‘foods high in fat salt or sugar’. This may be appropriate for 5-10 year olds.

4.0 Conclusions and recommendations

The recommended model was developed for 11-16 year olds. However, had the model been specifically designed for 5-10 year olds or adults, it would not have been substantially different. Adopting the same approach to the development of the model whilst choosing

numbers based on GDAs for 5-10 year olds or adults makes very little difference to the model and to the way foods are categorised by the model.

Superficially it might appear that using GDAs for calcium and iron for 11-16 years, rather than for 5-10 year old or adults, might lead to too many foods being categorised as 'healthier food choices' for 5-10 year olds or adults but this does not appear to be the case.

However basing the model on the GDAs for 11-16 year olds probably does lead to the thresholds for sodium being too high for 5-10 year olds. If the model were to be modified to overcome this problem it would involve altering the sodium bands from $\leq 90\text{mg} = 0$, $90-180\text{mg} = 1$, $180-270\text{mg} = 2$, etc. to $\leq 75\text{mg} = 0$, $75-150\text{mg} = 1$, $150-225\text{mg} = 2$, etc. However a relatively small number of foods are affected.

Therefore it is proposed that the recommended model, Model SSCg3d, is generally appropriate for use in relation to all people over the age of 5 with the one proviso that if it is to be used for a purpose only relating to the promotion of foods to children age 5-10 then it should be slightly modified with respect to the thresholds for sodium in the way proposed above.

5.0 References

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