

Reduction of Saturated fat in Bakery Products

A Report to the Biscuits, Cakes and Pastries Stakeholder Group, Food Standards Agency

1. The Food Standards Agency has set a target of reducing saturated fat intake among the UK population (from age 5 upwards) from a current¹ average intake of 13.4% to below 11% of food energy by 2010.
2. Within the scope of the Biscuits, Cakes and Pastries Stakeholder Group the following areas or components can be separately considered in terms of ways in which the saturated fat levels can be reduced.
 - Biscuits - dough, creams, coatings
 - Cake - batter, creams, coatings
 - Pastry - puff, shortcrust
3. In the 2002 National Diet and Nutrition Survey the contribution of this sector to daily total fat intake and daily saturated fat intake was 3% and 4%, respectively, for biscuits and 4% and 4% respectively for buns, cakes and pastries (although this did not include the use of pastry in savoury products such as meat pies and pasties, sausage rolls etc.) This report will consider each of the three main product groups in turn and, where appropriate, will look at both the historic and current situations before making recommendations about what levels of reduction in saturated fat could be possible in the future.

Biscuits

Doughs

4. Four types of biscuit have been considered as being representative of the wide range of different products that are produced - Cream Crackers, Digestive, Rich Tea (semi-sweet biscuit) and a short sweet biscuit (Shortcake type). Compositional information was gathered on a historic basis (a) from the 1998 edition of McCance and Widdowson's 'The Composition of Foods' and (b) from the FSA Processed Foods Database published in 2006 but collected between December 2004 and February 2005. It should be noted that the information given in McCance & Widdowson was collected during 1992 and is a composite analysis of a number of products within a particular category. This means that it is not possible to make a direct comparison between these data and those from 2006 and 2008 which are on specific branded products. Nevertheless, it gives an indication of the way the industry has moved between 1992 and 2004/2005. It also enables the effect of removal of partially hydrogenated fats from biscuit doughs to be evaluated. Current data was collected in October

¹ Based on information published in the 2002 National Diet and Nutrition Survey

2008 on examples of these types of biscuits from the Tesco section of www.mysupermarket.co.uk where information on total fat and saturated fat content of these products is available. The products were chosen simply as examples of the four different types of biscuit and not to imply that they had any particular attributes, either positive or negative.

5. Following the announcement on 27 October 2008 by United Biscuits that they were reducing the levels of saturated fat in Digestive, Hob Nobs and Rich Tea by 50%, further information was gathered from the nutritional declaration on the reduced saturated fat versions of Digestive and Rich Tea.
6. The total fat content, saturated fat content and the saturated fat as a percentage of total fat of these four biscuit types is shown in Table 1.

Table 1 Biscuit doughs

Biscuit type		1998 ^a	2006 ^b	2008 ^c	2008 ^d
Cream Crackers	Total fat	13.3	12.7	13.5 ¹	13.5 ¹
	Saturated fat	5.42	6.5	6.2 ¹	6.2 ¹
	Saturates as % of total fat	40.8	51.2	45.9 ¹	45.9 ¹
	Trans as % of total fat	9.3			
Digestive	Total fat	20.3	21.5	21.5 ²	21.3 ²
	Saturated fat	9.0	10.1	10.0 ²	4.8 ²
	Saturates as % of total fat	44.3	47.0	46.5 ²	22.5 ²
	Trans as % of total fat	4.7			
Semi-sweet biscuit (e.g. Rich Tea)	Total fat	13.3	15.5	15.5 ³	15.5 ³
	Saturated fat	6.25	7.3	7.3 ³	3.5 ³
	Saturates as % of total fat	47.0	47.1	47.1 ³	22.6 ³
	Trans as % of total fat	4.4			
Short sweet biscuit (e.g. Shortcake)	Total fat	21.8	n/a	24.8 ⁴	24.8 ⁴
	Saturated fat	11.05	n/a	11.6 ⁴	11.6 ⁴
	Saturates as % of total fat	50.7	n/a	46.8 ⁴	46.8 ⁴
	Trans as % of total fat	4.1			

^aMcCance and Widdowson 'Composition of Foods' (based on composite data collected in 1992)

^bFSA Processed Foods Database

^cNutritional labelling (October 2008)

^dNutritional labelling (November 2008)

¹Jacobs Cream Crackers

²McVities Digestive

³McVities Rich Tea

⁴Tesco Shortcake

7. Although there were some small changes in both total and saturated fat contents moving from the 1990s to 2006 and 2008 these were fairly minor and may be as much to do with the data from McCance and Widdowson being generic and based on composite averages, whereas the 2006 and 2008 data referred to specific products. The interesting trend to consider is the saturated fat as a percentage of the total fat as this is a good indicator of the type of dough fat being used. In the cases of cream crackers and digestive biscuits, the percentage of saturated fat in the total fat phase increased from 1998 to 2006. In that period many biscuit products were reformulated by replacing partially hydrogenated dough fats with non-hydrogenated alternatives. The differences between the 1998 and 2006 data equate approximately to the level of trans fatty acids that were typical in these products in 1998. Semi-sweet biscuits such as Rich Tea, on the other hand did not show such an increase. Nevertheless, it is likely that the average level of saturated fat in biscuits was higher in 2006 than in 1998 because of this change in dough fats.
8. By 2008, saturated fat levels in some products had begun to decrease. Cream crackers had a saturated fat level midway between that in 1998 and that of 2006 indicating that some progress had been made towards ameliorating the effect of replacing partially hydrogenated dough fats. Digestives and Rich Tea biscuits did not show much of a change between 2006 and 2008 but were below the level of saturates+trans in 1998. Shortcake biscuits, though, did have a lower saturate level than that of 1998, although this was a comparison between a single brand in 2008 and a generic average in 1998.
9. The main oil used as a non-hydrogenated biscuit dough fat has been palm oil with possibly minor additions of other oils. Average saturated fatty acid levels in biscuits in October 2008 were 46-47% compared with levels of typically 50% in palm oil, indicating the inclusion of a small percentage of more unsaturated oils in the dough fat.
10. Industry soundings suggest that current developments in biscuit dough fats should allow a 10% reduction in saturates to be made from these levels in biscuit doughs, thus bringing the saturates level down from 46-47% to about 41-42%. It was considered that such a reduction ought to be possible to achieve with a timescale of about 18 months. Greater (and, probably, longer-term reductions) will need to address various questions (see below).
11. The announcement made at the end of October 2008 by United Biscuits that they were making saturates reductions in three of their biscuit varieties has clearly moved the goalposts considerably, although it is unlikely that such large reductions will be possible in all types of biscuit.
12. The extent to which reductions beyond the 10% suggested above can be achieved depends upon a number of factors.

13. *Capabilities of the biscuit manufacturer*

The use of more unsaturated - and, therefore, softer - dough fats needs some investment, particularly in terms of dough fat and dough handling. Soft dough fats will need to be plasticized differently or will need to be dosed into doughs differently. The weight of doughs in a feed hopper can squeeze softer oils out of the dough and so changes may need to be made to the ways in which dough is handled. While these changes may be within the scope of the larger biscuit manufacturers they may prove more difficult for smaller producers. Levels of reduction of more than 10% may be possible for some manufacturers but will probably need investment in further infrastructure.

14. *The type of biscuit*

The changes announced recently by United Biscuits have all been in 'plain' biscuits. As soon as, for example, chocolate is used in conjunction with these biscuits then the problems of oil migration from the dough to the biscuit become more pronounced. Such migration will cause increased softening and possibly fat bloom formation compared with the current dough fats.

15. *The complexity of the technology that is acceptable*

Palm oil contains a wide range of triglycerides, some of which are more functional in doughs than others. The softer oleine fraction gives a softer eating texture to the biscuit but, on its own, will result in a very greasy biscuit and one that is prone to oil migration. The hard palm stearine fraction gives a biscuit with too hard a texture but when used in combination with the oleine fraction it helps to stabilise the structure reducing the greasiness and reducing the potential for oil migration. The mid-fraction seems to add very little in terms of functionality and could be removed from the mix by a two-stage fractionation process resulting in a reduction in saturates. Palm oil contains about 50% saturates. A blend of palm oleine and palm stearine at levels approximately found in palm oil would have a saturates content of about 45%. Although it is not true to say that the mid-fraction does absolutely nothing for a biscuit removing it should, nevertheless, allow for some reduction in total fat to also take place. However, the technology to produce these fractions is more complex and more expensive than current dough fats.

16. *The acceptability of E-numbers*

Reduced-fat biscuits are generally speaking lower in saturates (as well as lower in total fat) than their full-fat counterparts. Fat - and, therefore, saturates - reductions can be achieved by a combination of emulsifiers. How acceptable would that be to the consumer and the retailers?

17. Shortbread biscuits (as opposed to shortcakes) have a much higher total fat content and, depending on the fat used, also a much higher saturates content. The industry Code of Practice on shortbread biscuits stipulates a minimum of 24% fat. This does not have to be butter unless the product is also labelled as pure butter shortbread. Typical total fat and saturated fatty acid contents of selected examples of shortbread biscuits are shown in Table 2.

Table 2 Shortbread Biscuits - Typical saturates levels

Brand	% total fat	% SAFA	% SAFA in fat
Dean's All-Butter Shortbread Rounds*	25.4	15.6	61.4
Dean's Shortbread Fingers**	24.8	12.8	51.6
Tesco Finest Scottish Shortbread Biscuits*	23.9	14.0	58.6
Tesco Shortbread Fingers*	29.3	18.9	64.5

*All butter

**Butter + margarine

18. Clearly, if butter is used then the saturates level is that of butter and therefore subject to the natural variations found in milk fat. If a margarine is used, or a blend of butter and margarine (still allowing the label 'contains butter'), then the saturates level can be lower depending on the fat in the margarine.

Biscuit creams

19. As with doughs, biscuit creams were, historically, based on partially hydrogenated vegetable oils. Some of these were hydrogenated non-lauric² oils with saturates levels of about 20-25% but with trans fatty acid contents of over 50%. Moving to non-hydrogenated alternatives will have increased the saturates level considerably because of the need to maintain structure and hardness in the cream. However, a large proportion of creams were, historically, based on hydrogenated palm kernel oils (HPKO) because these types of fats have a quick crystallisation which allows the manufacturer to have a fast throughput. They do, though, contain between 85% and 95% saturates.
20. The newer varieties of non-hydrogenated biscuit cream fats have saturates levels of between 70% and 80% so, compared with the HPKO-type of cream fat we are already seeing reductions in saturates of some 15-20%. It is considered by the industry that any further reductions would have serious implications for (a) the structural characteristics of the cream and (b) the speed of crystallisation of the cream.

Coatings

21. Biscuit coatings fall into two types. The main type is chocolate as defined by the EU Chocolate Directive (2003). The other type of coating is based on compound coating fats. As far as chocolate is concerned there is very little scope within the EU Directive to reduce saturates.

² Oils and fats for use in bakery and confectionery products are conventionally divided into two types. Lauric oils are those oils that are rich in lauric acid (a medium-chain saturated fatty acid) and are mainly derived from palm kernel oil or coconut oil. Non-lauric oils are rich in longer chain fatty acids, both saturated and unsaturated). Typical non-lauric oils used in bakery and confectionery are palm oil, rapeseed oil, sunflower oil, cocoa butter etc.

22. The only fats permitted in chocolate by the EU Directive are cocoa butter (which typically contains about 65% saturates), milk fat (which also typically contains about 65% saturates) and a well-defined vegetable fat (which also typically contains about 65% saturates). There may be limited scope within the variety of cocoa butter used but changing this may well have other effects on the product (such as changing flavour profiles). The main scope is within the vegetable fat part but, as this is limited to only 5% of the chocolate, wholesale reductions in saturated fat is not possible even if manufacturers were given free rein to use any vegetable fat. As, in reality, they are restricted to six basic oils and their fractions the greatest reduction in the vegetable fat part of the chocolate would be from about 65% saturates to 40-45% saturates. Doing this would also soften the chocolate making other changes necessary to maintain hardness. Even after making all of these changes it is unlikely that reductions in saturates will be more than 2-3% (although it is theoretically possible to achieve slightly greater reductions depending on the total fat content of the coating and the balance of fats used and providing the manufacturer is willing to make significant changes to both milk fat levels and type of vegetable fat).
23. If we move to compound coatings then there is potentially more scope, depending on what the starting point is. Compound coating fats fall into three types - (i) supercoatings based on cocoa butter equivalents (CBE) and containing about 65% saturates, (ii) non-lauric (see footnote 2) cocoa butter replacers also containing about 65% saturates, and (iii) lauric (see footnote 2) cocoa butter substitutes containing about 90% saturates. If a manufacturer is using a lauric compound coating then there is scope for reductions in saturates in the coating of 25-30% by switching to one of the other types. Either option would also allow the manufacturer to make other improvements (in flavour profile for instance). The change would, however, have other implications. For example, if the change from a lauric compound coating to a non-lauric compound coating were made then it is likely that the coating would be slower to crystallise and would have a different melting profile. If the change from a lauric compound to a CBE-type of supercoating were made then it could mean that the manufacturer would have to install additional tempering equipment.

Cakes

Cake batters

24. Cake batters are usually based on either cake margarines with saturates levels that typically range from about 30% to 45%, or on shortenings with saturated fatty acid contents ranging from about 25% in pumpable shortenings to 40% in block shortenings. It should be remembered, in making these comparisons, that cake margarines are water-in-oil emulsions and contain only 80% fat, whereas shortenings are 100% fat.
25. Although changing to pumpable shortenings would help to reduce saturates levels, not all cake manufacturers are able to or have the volume to use pumpable shortenings and so will always use block shortenings. It is

considered that current developments in cake margarines should allow a 10% reduction in saturates in cake batters to be made bringing the saturates level down from a maximum of about 45% to a maximum of about 40-41%.

Cake creams

26. Most cake creams are produced from cake margarines as these are already available in the bakery. This means that any changes that can be made in cake margarines for use in cake batters will also benefit cake creams, i.e. reductions of about 10% ought to be possible.
27. Buttercream is a special case, however. Buttercream must contain at least 22.5% butter and no other fat. This is a requirement laid down in EC Regulation 445/2007. This makes it more difficult to change than if it were an industry code of practice. It also means that the saturates level that can be achieved is totally dependent upon the level of butter used in the cream. If it is currently above 22.5% then a reduction is, in theory, possible, although this will also result in textural differences in the buttercream - a lower-fat buttercream will be more crumbly and less creamy.

Cake coatings

28. Essentially the same options are available for cake coatings as for biscuit coatings and so the same comments will apply as were made above for biscuit coatings.

Pastry

29. Two types of pastry - puff pastry and short(crust) pastry have been considered. As with biscuits we can compare data on total and saturated fat from McCance and Widdowson in 1998³ with labelling of currently available puff and shortcrust pastry (Table 3).
30. The trends between 1998 and 2008 are interesting (always remembering that the 1998 data is generic and non brand-specific, whereas the 2008 data is on one particular retail brand). As far as shortcrust pastry is concerned the total fat content is higher in the 2008 product compared with what was typical in 1998, but the saturated fat content in the product has decreased, indicating a significant decrease in the saturated fat content of the shortening used. The reverse is true of puff pastry. The total fat content is lower in the 2008 product compared with what was typical in 1998 but the saturated fat content is higher, indicating a higher level of saturated fat in the shortening being currently used compared to what was typical ten years ago.

³ The same comment applies regarding the nature of the data in McCance and Widdowson as was highlighted in the section about biscuits. The data was collected in 1992 and is a composite of a number of samples. It is therefore not directly comparable to the 2008 data on specific branded products

Table 3 Total and saturated fat contents of puff and shortcrust pastry

Pastry type		1998 ^a	2008 ^b
Frozen shortcrust pastry	Total fat	24.5	30.9 ¹
	Saturates	11.65	10.7 ¹
	Saturates as % of total fat	47.6	34.6 ¹
Frozen puff pastry	Total fat	28.5	26.8 ²
	Saturates	11.4	13.8 ²
	Saturates as % of total fat	40.0	51.5 ²

^aMcCance and Widdowson's 'The Composition of Foods'

^bCurrent product labelling

¹Saxby's Jusrol Ready Rolled Shortcrust Pastry

²Saxby's Jusrol Puff Pastry Block

31. Having set the scene, as it were, we now move on to look in greater detail at these two types of pastry and to consider what potentially could be achieved in terms of reducing saturates.

Puff pastry

32. There are three basic types of puff pastry (ignoring all the variations that there are on folding and laminating the pastry) and these are dependent on the ratio of flour to fat. The three types are (a) full paste in which the amount of fat used is equal to the amount of flour, (b) three-quarter paste in which the amount of fat used is three-quarters of the amount of flour and, (c) half-paste in which the amount of fat is half the level of flour used. Generally two types of fat are used - a shortening (or sometimes a cake margarine) and a pastry fat (or margarine). The worst case scenario (as far as saturated fat is concerned) is to use a combination of a shortening (with about 47% saturated fat) and a puff pastry fat (with about 48% saturated fat). The three recipes always contain about 10% of the shortening with the remaining fat being the puff pastry fat. Typical recipes and saturated fat levels in the three pastry types are shown in Table 4.
33. The commercially available retail product (Table 3) is closest in total fat and saturated fat content to the half-paste system (Table 4).
34. The question arises, then, as to what scope there is for reductions in saturates in this kind of system. It is possible to reduce the levels of shortening or cake margarine used but this would then give a harder, flintier texture to the product. Using a cake margarine instead of a shortening would give a reduction in saturates compared with those calculated in Table 4 - but some manufacturers may already be doing this. If the puff pastry (laminating) fat were reduced then some differences in flakiness and lightness of the pastry might be observed. However, it is felt that there is some scope within these formulations to reduce the total fat content by about 10% by reducing the

quantity of laminating fat used. This may be a more successful route than reducing the saturates content of the fats themselves.

Table 4 Puff pastry recipes

	Full paste	$\frac{3}{4}$ paste	$\frac{1}{2}$ paste
Strong flour	100	100	100
Salt	1.5	1.5	1.5
Shortening	10	10	10
Water	45	45	45
Puff pastry fat	90	65	40
% total fat	40.6%	33.9%	25.4%
<u>SAFA levels</u>			
Puff pastry fat (48% SAFA)	17.52	14.08	9.76
Shortening (47% SAFA)	1.90	2.11	2.37
Total	19.42%	16.19%	12.13%
Saturates as % of total fat	47.8%	47.8%	47.8%

Short pastry

35. Short pastry falls into two main types, essentially dependent on the type of product it will be encasing, i.e. sweet and savoury. Sweet short pastry often contains a proportion of sugar, whereas savoury short pastry is mainly flour, fat and water. The fats used in short pastry can be either shortenings (100% fat) containing saturates levels ranging from 32% to 47%, or cake margarines (80% fat) containing about 30.5% saturated fat. Table 5 shows some typical short pastry recipes.

Table 5 Short pastry - standard recipes

Ingredient	Savoury		Sweet		
	Plain flour	56.1	56.1	53.3	53.3
Shortening A*	28.0		26.7		
Shortening B*		28.0		26.7	
Cake margarine					33.4
Sugar			13.3	13.3	13.3
Salt	0.8	0.8			
Water	15.1	15.1	6.7	6.7	
Total fat	28.0	28.0	26.7	26.7	26.7
Saturated fat	13.16	8.96	12.53	8.54	8.13

*Shortening A contains 47% saturates; shortening B contains 32% saturates

36. Although it has a slightly higher total fat content, the commercially available retail sample (Table 3) falls within the scope of these recipes. The data in Table 5 do show that there is already considerable scope for reduction in saturates in those products currently using the shortening type containing 47% saturates. If this is replaced by the shortening containing 32% saturates then a reduction in total saturates of 32% would be possible. If it were replaced by

cake margarine in a sweet short pastry then it would, in theory, be possible to have a total saturates reduction of 35%. Although such reductions would be remarkable they would only apply to cases where a high-saturates shortening were currently being used. Would there be scope for saturates reductions in other cases?

37. One possible route to take would be to reduce the ratio of fat to flour. The shortening is normally used at a level of 50% of the flour weight. Reducing this to 45% will have an effect on both recipes and total fat content resulting in a reduction in saturated fat of 7-8% compared with the standard recipe (see Table 6).

Table 6 Short pastry - lower fat recipes

Ingredient	Savoury		Sweet	
Plain flour	57.7	57.7	54.7	54.7
Shortening A*	26.0		24.6	
Shortening B*		26.0		24.6
Sugar			13.7	13.7
Salt	0.8	0.8		
Water	15.5	15.5	7.0	7.0
Total fat	26.0	26.0	24.6	24.6
Saturated fat	12.22	8.32	11.56	7.87

*Shortening A contains 47% saturates; shortening B contains 32% saturates

38. A second possibility would be to switch from boxed shortenings (typically 32-47% saturates) to a fluid shortening containing about 26% saturates. This would give a potential reduction in saturated fat of between 18% and 45% (depending on the saturated fat level in the boxed shortening currently being used).

Summary

39. Taking all of these data into account what levels of reductions in saturated fats could be achieved within the short term, and on what would such reductions depend?
40. *Biscuits*
- A 10% reduction in saturates from about 46-47% to about 41-42% ought to be achievable in a wide range of products. Higher levels of reduction (up to 50%) may also be achievable in some plain biscuits
 - Saturated fat reduction in biscuit creams is likely to be minimal because many manufacturers have already made a reduction in moving from hydrogenated to non-hydrogenated systems
 - A 2-3% reduction in saturates could be achieved in chocolate. Where a lauric-based chocolate-flavoured coating is currently used then reductions in saturates of 25-30% could be possible.

41. *Cakes*

- A 10% reduction in saturates from 45% to about 41-42% should be achievable in batters and doughs
- Since the same cake margarine is often used in creams as in doughs a similar degree of reduction ought to be achievable here also. If the cream used is buttercream then changes are restricted by legislation and would be dependent upon the amount of butter currently being used.

42. *Puff Pastry*

- A 10% reduction in total fat is possible in puff pastry by reducing the amount of laminating fat

43. *Short pastry*

- In short pastry, reducing the fat:flour ratio from 50:100 to 45:100 could give a reduction in saturates of 7-8%. A change from a high saturates shortening to an already existing lower-saturates shortening could reduce saturates by up to 30%. Switching from boxed to fluid shortenings could reduce saturates by about 18%. It should be noted that it will be unlikely that all of these reductions will be possible within a single pastry product and so they are not additive!

Acknowledgements

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Note

The information and recommendations made in this report are meant as guidelines and suggestions as to the levels of reductions in saturated fats that might be achieved. Nothing in this report is to be construed as either an expressed or implied warranty. It is the responsibility of users to determine and define the applicability of the information or the suitability of any suggested recipes or ingredient changes to their own particular purposes and to carry out appropriate sensory and storage trials to be assured of their commercial application.