SATURATED FAT AND HEALTH

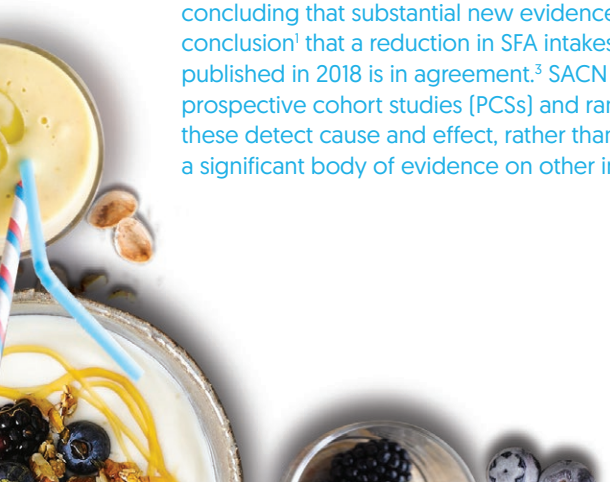
Findings and implications of SACN's 2019 report

Summary of key findings from SACN

- SACN reconfirms the importance of reducing saturated fatty acid (SFA) intakes to no more than 10% of total dietary energy; for adults and children aged 5 years and over.
- SFA should be substituted with unsaturated fatty acids (UFA): polyunsaturated (PUFA) and monounsaturated fatty acids (MUFA).
  - There is less evidence for MUFA, but current government advice is that PUFA intake should not exceed 10% energy intake.
- Reducing intake of SFA *per se* or substituting with PUFA, MUFA or a mixture of the two (in randomised controlled trials) reduces total and low-density lipoprotein (LDL) cholesterol.
- Substituting SFA with UFA had no adverse effect on high-density lipoprotein (HDL) cholesterol whereas simply reducing SFA or substituting with carbohydrate reduces HDL cholesterol.
- Replacing SFA with PUFA or MUFA improves indicators of glycaemic control.
- Reducing SFA is unlikely to increase health risks for the general population.
- Reducing intake of SFA *per se* or substituting with PUFA also reduces risk of cardiovascular (and coronary heart disease) events.
- Owing to data limitations, no conclusions can be drawn about the benefits on cardiovascular events of substituting SFA with MUFA or with carbohydrate.
- Average UK intakes of SFA in adults aged 19-64 have fallen from 16% total dietary energy intake in the mid-1980s (36.6g per day) to 11.9% (25.1g), and since remained fairly static. The average in children aged 4-18 years is 20.9-24.2g SFA per day (12.4-13% total energy).
- The recommended intake of SFA is currently exceeded by 74.5% of UK adults aged 19-64 years and 83.3% of adults aged 65 years and over.
- Three food groups each provide 21-24% of SFA intake (in adults): meat and meat products; milk and milk products (about half from cheese); pizza, biscuits, cakes, pastries, puddings. Fat spreads provide about 9% (adults).
- SACN recommends that government considers strategies to reduce population average intake of SFA to no more than 10% of total dietary energy; approximately 20g for women and 30g for men daily, ensuring strategies are consistent with wider dietary recommendations.

Introduction

The effect of SFA has been hotly debated in the media over recent years and the Scientific Advisory Committee on Nutrition (SACN) was asked to review the evidence for the relationship between SFA and health and make recommendations. This topic was last reviewed for government in 1994.[1] In August 2019, SACN[2] published its report concluding that substantial new evidence published since 1994 supports and strengthens the original COMA conclusion[1] that a reduction in SFA intakes would be beneficial. A draft World Health Organization (WHO) report published in 2018 is in agreement.[3] SACN considered systematic reviews, meta-analyses and pooled analyses of prospective cohort studies (PCSs) and randomised controlled trials (RCTs), with precedence given to RCTs because these detect cause and effect, rather than only associations. As well as further research on blood lipids, SACN found a significant body of evidence on other intermediate factors, risk markers and health outcomes.



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Fatty acids

Most dietary fat is comprised of triacylglycerols (triglycerides) in which three fatty acids are attached to a glycerol backbone.

These fatty acids can be:

- Saturated (SFA): no carbon to carbon double bonds.
- Monounsaturated (MUFA): one double bond.
- Polyunsaturated (PUFA): two or more double bonds.

See table 1 for recommended intakes.

All fat-containing foods have a mix of the three types of fatty acids, but the proportions vary, with solid fats containing a higher proportion of SFA (see figure 2).

PUFA: Depending where along the carbon chain the double bonds exist, PUFA are classed as n-6 (omega 6) or n-3 (omega 3). An n-9 subclass also exists.

Trans fatty acids: Most of the unsaturated fatty acids found in nature are in the ***cis*** configuration but they can also exist in the ***trans*** form. UK and Irish intakes are very low at 0.5[4]-0.56%[5] total energy as a result of changes in vegetable spread processing techniques.

SACN's findings

Evidence, from RCTs in particular, has accumulated and strengthened to support the need to reduce SFA to no more than 10% of total dietary energy, SACN's conclusions were influenced by:

- Limited length of follow-up for assessing disease (or death) as an outcome.
- The quality of methods, in some studies, used to measure dietary intakes.
- Lack of:
  - Information on statistical power in some studies.
  - Standardisation of some measurements.
  - Information on the type of carbohydrate or PUFA substituted for SFAs.
- Potential confounding by:
  - The impact of individual SFAs.
  - Trans fat intakes, especially in older data.
  - Changes in body weight in studies that did not use iso-caloric diets.
  - The complexity of dietary and other changes made during interventions.
  - Statin use in studies published since 1990.

Saturated fat and health: the evidence

A) Blood lipids and glycaemic control: benefit from SFA reduction and substitution with PUFA or MUFA

There was good agreement from RCTs that reducing SFA intake lowered total and LDL cholesterol, regardless of the intervention (reduction in *SFA per* se and substitution with PUFA, MUFA or carbohydrates). Substituting with PUFA and/or MUFA had no adverse effect on HDL cholesterol whereas simply reducing SFA or substituting with carbohydrate reduced HDL cholesterol. SACN found evidence from RCTs of an increase in serum triacylglycerol when SFA was replaced by carbohydrate, but no change when SFA was reduced *per se* or replaced by PUFA or MUFA.

SACN found evidence that substitution of SFA by PUFA and to a lesser extent MUFA improves markers of glycaemic control. There was evidence of no benefit for substitution with carbohydrates.

Not all saturated fatty acids raise cholesterol

SACN did not evaluate the effects of individual SFA. However, it is widely considered that some may have little impact on serum cholesterol levels.[3,6]

- Lauric (C12), myristic (C14) and palmitic (C16) acids adversely affect LDL cholesterol. *See figure 1 for food sources.*
- Stearic acid (C18) is considered neutral.
- Shorter chain length SFA (up to C10). The effect is unclear. It has been suggested that they are not detrimental and may explain the lower than predicted effect of dairy products on blood cholesterol.[7]

B) Cardiovascular and coronary heart disease events: benefit from SFA reduction and substitution with PUFA

SACN identified consistent evidence from RCTs that reducing SFA intake or substituting with PUFA reduced cardiovascular disease (CVD) and coronary heart disease (CHD) events. For example, a robust Cochrane systematic review and meta-analysis of 11 RCTs showed a 7-17% reduction in CVD events with lower intake of SFA compared with usual intake.[8] It also reported a 27% lower risk of CVD events following substitution of SFA with PUFA. There was insufficient evidence on the effect of substituting with MUFA and no effect on CVD/CHD events when SFA was substituted by protein or carbohydrate, although the evidence was limited and did not provide information on carbohydrate type, e.g. whole grains vs refined carbohydrates.

C) Cardiovascular and coronary heart disease mortality: inconclusive

SACN reported no effect on CVD/CHD mortality of SFA reduction *per se* or substitution with PUFA, suggesting that the duration of follow up may have been too short to detect effects.[9]

D) SFA intake and other health outcomes: no effect or evidence was inconclusive

- No relationship between lower SFA intakes and risk of stroke.
- No or insufficient evidence from RCTs that reducing or substituting SFA affects type 2 diabetes risk.
- No association between SFA and cancers.
- Substitution of SFA with PUFA had no effect on anthropometric measurements. There was no evidence for other forms of substitution.
- There was no evidence for an effect of SFA on cognitive function.
- Potential benefits of replacing SFA on markers of insulin sensitivity, vascular function and post prandial lipid metabolism are areas of active research.[8]

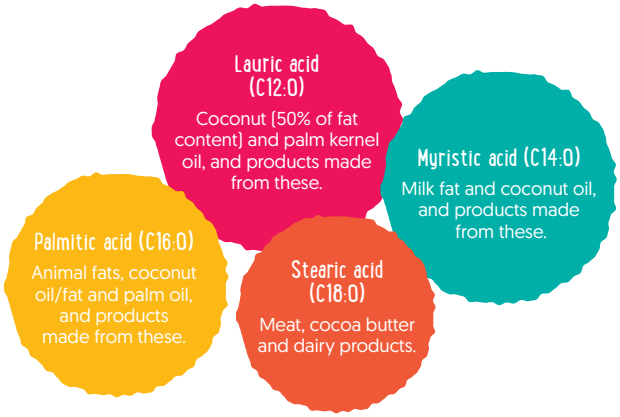
In a paper[10] not included in the SACN review, (as SACN only considered systematic reviews and meta-analyses) data from two large PCSs were combined to model the effect of different fat and carbohydrate substitutions on CHD risk. When saturates were replaced iso-calorically, risk of CHD fell to the greatest extent when PUFA was the replacer, followed by MUFA and carbohydrate from whole grains.

CHD risk increased when trans fatty acids replaced SFA and, to a lesser extent, when the SFA were replaced by refined starches/sugars. The impact on CHD risk when energy from refined starches/sugars is substituted by whole grains or different types of fatty acid was also considered. Again, the biggest reduction in CHD risk was seen when PUFA was the replacer, followed by carbohydrate from whole grains and then MUFA.[10]

In summary

SACN's report confirms that reducing SFA *per se* will lower serum total and LDL cholesterol. SACN also re-affirms that the type of substitution made when SFA is reduced may affect CVD/CHD risk, with the strongest beneficial effect seen when PUFA replaces SFA.

Figure 1: Major sources of individual saturated fatty acids[20]



SACN's findings in context

Table 1: Dietary recommendations and intakes for the UK and Ireland

	UK Dietary Reference Values for UK Adults vs Intakes[2,4]	Irish Recommended Dietary Allowances[22,28] vs Intakes[5]
Total Fat	No more than 35% DE	20-35% TE (≥14 years)
	Average adult intakes within 35% DE	Average adult intakes within 35% TE
Saturates	Reduce to no more than 10% DE	Reduce to no more than 10% TE
	75% adults exceed the recommended intakes Average intakes for 19-64-year olds - 11.9% TE (12.5% DE)	Average intakes for 18-64-year olds - 13.3% TE; ≥65-year olds – 14.3% TE
Cis MUFA	No recommendations set but, if the other guidance is followed, the level would be about 12% DE	No recommendations set
	Average intakes 12.0% (19-64 years) and 11.7% (≥65 years) TE	Average intakes 12.5% (18-64 years) and 12.2% (≥65 years) TE
Cis PUFA	Cis n-3 PUFA ***Long chain n-3 (DHA / EPA):*** Increase average intake from 0.2 g/day to 0.45 g/day ***Alpha linolenic acid (ALA):*** At least 0.2% TE	Cis n-3 PUFA: 0.5% DE
	Average total cis n-3 PUFA intakes: 1% TE/2g (18-64 years) and 1.1% TE/2g (≥65 years)	Average intakes reported as TE (mainly from ALA): 0.71% (18-64 years); 0.81% (≥65 years) TE ***Long chain n-3 (DHA / EPA):*** Average intakes 0.27g / 0.1% TE (18-64 years) and 0.44g / 0.2% TE (≥65 years) daily ***Alpha linolenic acid (ALA):*** Average intakes 1.5g / 0.6% TE (18-64 years) & 1.2g / 0.6% TE (≥65 years)
	Cis n-6 PUFA: No further increase in intakes and proportion of population consuming in excess of 10% of TE – should not increase ***Linoleic acid (C18:2):*** At least 1% of TE	Cis n-6 PUFA: 2% of DE ***Linoleic acid (C18:2):*** No recommendations set
	Average total cis n-6 PUFA intakes 4.8%/10g (19-64 years) and 4.6%/8.7g (≥65 years) TE	Intake data not available
Trans Fat	No more than 2% DE	No specific recommendation set
	Average intakes for 19-64 years and ≥65 years: 0.5% TE/1g	Average adult intakes 0.51% TE (18-64 years) & 0.56% TE (≥65 years)

TE = Total energy (including alcohol)

DE = Dietary energy (excluding alcohol)

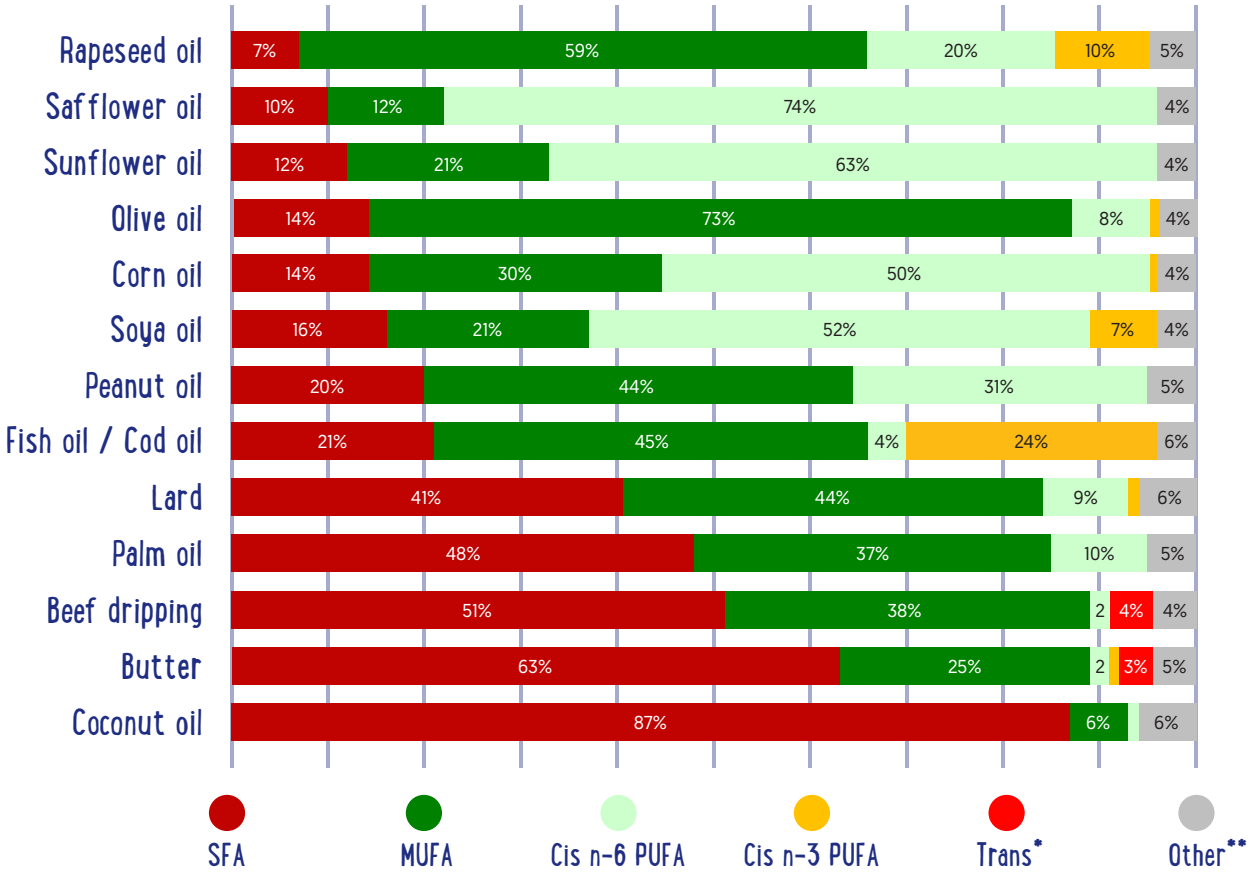
Recommendation figures

Intake figures

UK and Irish rates of CHD have improved considerably in recent decades but it remains a major cause of ill health and death,[11,12] although progress has been blunted more recently by the increased incidence of type 2 diabetes and obesity.[13,14] CHD is responsible for over 4,100 Irish[12] and 66,000 UK[11] deaths per year. Elevated serum cholesterol level is one of the major modifiable risk factors for CHD alongside smoking, elevated blood pressure, high BMI, central obesity and type 2 diabetes.[15,16] The recommended serum total and LDL cholesterol levels are shown in table 2.[14,17,18]

Using data from the latest NDNS (years 7 & 8), SACN reports that the majority of adults aged 19-64 years are within the normal range for total and LDL cholesterol with just 27.1 % of men and 34.6% of women with total cholesterol levels above 5mmol/L. The majority of men over the age of 65 years are also within the normal cholesterol range, but cholesterol levels remain elevated in women over 65 years at an average of 5.32mmol/L total cholesterol and 3.2mmol/L LDL cholesterol. In Ireland, up to 60% of adults are estimated to have elevated serum cholesterol levels.[19]

Figure 2: Saturated fatty acid profile of common fats expressed as % of total fat[20]



*Naturally present in ruminant fats
**Other refers to non-triglyceride components of total fat such as mono- and di-acylglycerols, phospholipids, phytosterols, cholesterol etc.

Table 2: Recommended levels of serum lipids for healthy and high-risk adults

Lipid measure	Healthy adults[17]	Adults at high risk of CVD[14]
Total cholesterol	<5mmol/L	Individuals with existing cardiovascular disease, diabetes, chronic kidney disease, familial hypercholesterolaemia, markedly elevated single risk factors (BP≥180/110mmHg, LDL-C>4.9mmol/L and/or total cholesterol >8mmol/L) are classified as high risk. For such patients, an individualised assessment is required. Generalised target lipid levels are not applicable.
Non-HDL cholesterol	<4mmol/L	
LDL cholesterol	<3mmol/L	
HDL cholesterol	No specific levels set, but recommendations: >1mmol/L for men and >1.2mmol/L for women.	
Total cholesterol to HDL ratio	<6 lower risk. A level above 6 is associated with high risk, therefore the lower the figure the lower the risk.	
Fasting triglycerides	<1.7mmo/L	
Non-fasting triglycerides	<2.3mmol/L	

Saturated fat intakes remain above the recommended ≤10% of total energy

Since 1986/7, mean intake of SFA in the UK has fallen from around 16%[2] of energy but still exceeds the recommendations in all age, sex and income groups.[4] SACN found no consistent pattern in intake by household income.

Average daily SFA intake in UK adults 19-64 years is 25.1g (11.9% total energy, 12.5% food energy), with the vast majority (75%) exceeding recommendations (table 3).

In adults over 65 years, the average is 13.3% total energy (13.8% food energy).

In children it is 13% (total and food energy) for 4-10 year olds and 12.4% (total and food energy) for 11-18 year olds.

In Ireland, adults' (18-64 years) mean intake has fallen from 13.9% total energy in 2001 to 13.3% in 2011. In older adults, mean SFA intake in 2011 was 14.3%; 35.5% of adults 18-64 years and 30.2% of older adults consumed <10% energy as saturates.[5]

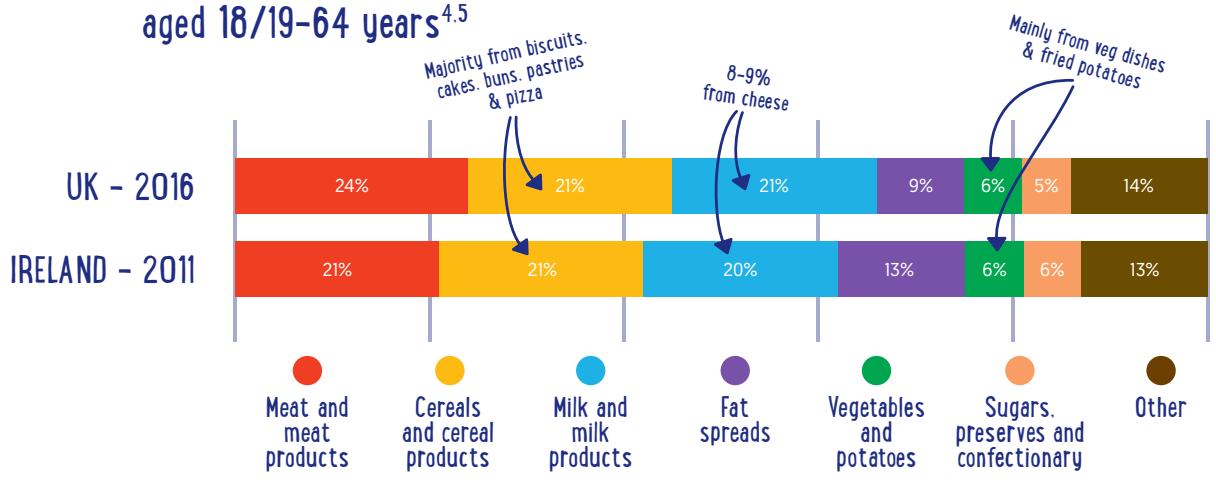
Table 3: Current UK and Irish mean daily intakes of saturated fatty acids in grammes (figures in brackets presented as % total energy intake)

	UK[4]			Ireland[5]		
	All	Male	Female	All	Male	Female
4-10 years	20.9g (13%)	21.5g (12.7%)	20.3g (13.2%)	N/A	N/A	N/A
11-18 years	24.2g (12.4%)	26.7g (12.5%)	21.4g (12.2%)	N/A	N/A	N/A
19-64 years	25.1g (11.9%)	27.5g (11.6%)	22.8g (12.2%)	33.9g (13.3%)	38.7g (13.1%)	28.9g (13.5%)
65 years and over	24.3g (13.3%)	27.3g (12.8%)	21.8g (13.7%)	30.7g (14.3%)	35.6g (14.5%)	26.5g (14.2%)

Key food sources in the British and Irish diet

The main dietary sources of SFA are shown in figure 3 and have changed little over the past 30 years.[4,5] The pattern is similar in all age groups with the exception of children under 10, among whom milk makes a greater contribution.

Figure 3: Key food sources of saturated fatty acid intakes in UK and Irish adults aged 18/19-64 years[4,5]



There has been a notable fall in the contribution of whole milk to UK adult (19-64 years) SFA intakes, falling from 11% to 2%. In Ireland, whole milk still contributes 7%. The overall contribution to SFA intake from milk and milk products is unchanged at around 21% for the UK and 20% for Ireland, mainly driven by cheese consumption. Contribution of fat spreads to SFA intakes has been falling for some time with the switch from butter to PUFA spreads. Other key contributors are meat and meat products at 21% in the UK and 24% in Ireland, and biscuits, cakes, buns and pastries (8.3% and 9% of adult SFA intakes for Ireland and the UK respectively).

Trans fat: Intake is well below the 2% total energy recommended limit: now 0.5% total energy in the UK[4] and 0.56% in Ireland.[5]

Key food sources of unsaturated fat[20]

n-6 PUFA: Vegetable oils, in particular sunflower, corn and soya bean, and the spreads made from these are typically rich sources, including the essential n-6 PUFA linoleic acid (C18:2). In the UK, the main n-6 PUFA sources are fat spreads, meat and meat products, and products made with the oils such as some cereal products, savoury snacks and fried potatoes.

MUFA: Oleic acid (C18:1) is found in abundance in both olive and rapeseed oils, and consequently is present in cereal, potato and snack products made with these oils. Other major sources of MUFA are meat and meat products, and whole milk and its products.

n-3 PUFA: Rapeseed oil and products made from it (e.g. cereal products, fried potatoes and savoury snacks) provide a relatively high proportion of the essential n-3 PUFA alpha-linolenic acid (C18:3). Other oils containing alpha-linolenic acid include walnut, soya and blended vegetable oils (typically based on rapeseed in the UK).

Other sources of n-3 PUFA include walnuts, meat, eggs and of course oil-rich fish, which is the primary source of the long-chain n-3 fatty acids EPA (C20:5) and DHA (C22:6).

So, what are the implications?

SACN's report provides clear support for the validity of the longstanding recommendation to reduce SFA intake. A report from the WHO published at around the same time reached the same conclusion[3]. SACN's recommendations sit within the context of the UK Eatwell guide[21] and Ireland's Food Pyramid.[22]

Helping consumers achieve the saturated fat recommendations

SFA intakes have been static for some time at a population level, at around 12% of total energy in the UK[4] and 13% in Ireland.[5] So, what needs to change to reduce intakes no more than 10% of total dietary energy?

UK adults consume around 4-5g SFA in excess of daily recommendations (9g in Ireland)

Notwithstanding the recognised under-reporting in dietary surveys, a reduction in SFA intakes could be achieved by various strategies aligned with the Eatwell guide[21] and the food pyramid,[22] e.g. restricting intake of pastries, biscuits, cakes; opting for PUFA- or MUFA-rich oils and spreads, or reduced fat spreads; selecting leaner meat and lower fat dairy products or plant-based protein alternatives. This advice has been around for a long time and has helped drive the reduction in SFA seen to date.

In light of the prevalence of overweight and obesity[23,24] and the need to reduce energy intake, an additional strategy would be to opt for partial replacement of SFA by foods providing PUFA and MUFA, rather than complete substitution.

Simple swaps to reduce SFA and rebalance the fatty acid profile of the diet to favour PUFA and/or MUFA[20,25-27]

Opting for...	...instead of...	Serving size	...reduce SFA intake by...
Rapeseed oil	Coconut oil	1 tsp / 3g	2.4g
Lean 5% fat beef mince	Standard 20% fat beef mince	100g raw	6.4g
Sorbet	Standard dairy ice cream	2 scoops	4.7g
A grilled chicken breast skin removed (115g)	2 grilled pork sausages (80g)	NA	5.7g
Reduced fat canned coconut milk	Standard canned coconut milk	50ml	4.1g
Reduced fat PUFA or MUFA spread on toast	Butter	20g (spread on 2 slices bread)	7.4g
Semi-skimmed milk (or calcium-fortified soya alternative to milk)	Whole milk	125ml on cereal	1.6g (2.6g)
Reduced fat cheddar in your sandwich or in cooking	Standard cheddar	45g serving	3.6g
Rich tea biscuits	Chocolate digestives	2 biscuits	3.6g
Low fat plain yogurt or a soya alternative to yogurt	Sour cream	30g (1 tbsp)	3.2g

Conclusion

The new report from SACN is an important reminder that sugar is not the only area of concern in the diet. Reduction in SFA remains an important consideration which can be achieved through simple dietary adaptations. Furthermore, it's important to note that intakes of fibre and, in some population groups, essential vitamins and minerals, remain significantly below recommendations.[4] This emphasises the importance of adopting a more holistic approach to dietary advice, as depicted in the Eatwell guide[21] and Irish Food Pyramid.[22]

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