

Policy Statement

Dietary fat consumption in the management of type 2 diabetes

Summary

A cornerstone of dietary advice for cardiovascular health has been to reduce the intake of total fat to less than 35% of total energy intake, and to reduce saturated fat (SFA) intake to under 11% of total energy intake. However, recent research evidence, as well as media coverage, on the type and amount of dietary fat in obesity and the development and management of type 2 diabetes and cardiovascular disease (CVD) has left some healthcare professionals and the general population uncertain about the optimal dietary intake of fat. Clarification is needed on dietary fat intake in the general population, and also specifically whether the dietary advice for fat intake in people with type 2 diabetes should be any different to the advice for the general population. Public health advice continues to be based on reducing all fat, partial substitution of saturated with unsaturated fat and basing meals on carbohydrate foods, vegetables and fruits as demonstrated by the Eatwell plate. This statement does not address public health advice and is solely concerned with the food and nutrition treatment of those with diabetes.

Recent debates about the role of high saturated fat diets in the management of type 2 diabetes have led to concerns about the efficacy of current guidelines as well as the potential risk of high saturated fat diets.

Diabetes UK and the Diabetes Specialist Group of the British Dietetic Association have appraised the recent evidence from 2000-2015 relating to dietary fat, obesity, glycaemic control, CVD risks and type 2 diabetes.

Conclusions

The main conclusions for the role of saturated fat in the management of type 2 diabetes are:

- There is no convincing evidence for a link between total fat intake as overall percentage of calories and weight gain, type 2 diabetes or CVD. Lowering total fat intake does not directly or consistently improve glycaemic control, weight loss or CVD risk in people with type 2 diabetes.
- Evidence suggests that replacing saturated fat (SFA) with unsaturated fat (polyunsaturated (PUFA) and monounsaturated (MUFA) reduces the risk of CVD in general populations and in high-risk populations including people with type 2 diabetes.

- When saturated fat intake is replaced by carbohydrates (wholegrain and unrefined only), there is evidence for cardiovascular benefit. Substitution with refined carbohydrates appears to increase cardiovascular risk. Therefore, it is important to consider recommendations both from the perspective of what should be reduced and the likely effect of the substituting nutrients.
- There is no evidence suggesting that an increase in saturated fatty acid intake is beneficial in reducing risk of CVD.
- Evidence suggests that Mediterranean-type (MUFA-rich) diets are effective for improving glycaemic control and CVD risk in people with type 2 diabetes.

Recommendations

- Dietary advice for people with diabetes should comply with NICE and Diabetes UK recommendations and should be evidence-based and tailored to the individual.
- Food and nutrition treatment of diabetes is complex and requires the expertise of dietitians to help individuals make food and lifestyle choices to maximise their health.
- Replacement of SFA with unsaturated fats (PUFA or MUFA) should be recommended as part of a healthy overall diet, acknowledging that it is more important to focus on eating beneficial healthy fats.
- More research is needed before suggesting any major changes to the current healthy eating guidance. Thus, despite some prevailing confusion, in the absence of evidence for either the superiority or the long-term effects of adopting high SFA diets, they should not be recommended for people with type 2 diabetes.
- Low carbohydrate diets, which are not high in SFA, and other diets that are evidence-based options for the management of type 2 diabetes can continue to be recommended for weight loss under appropriate dietetic or medical supervision on an individual basis.
- There is increasing evidence that it is important to consider the food sources of the nutrients rather than a sole focus on nutrients (like saturated fat), particularly looking at the foods that people purchase and consume. Dietary advice should focus on the overall health benefits or potential risk associated with foods that are high or low in different types of fat, as part of a whole diet approach.
- The information relating to fat should be considered within the context of a diet that promotes health; that is higher in vegetables, fruits, wholegrains, dairy, seafood, legumes, and nuts; moderate in alcohol (among adults); lower in red and processed meat; and low in sugar-sweetened foods, particularly sugar-sweetened beverages, and refined grains.

Background information

Definition of high and low fat diets

There are no generally accepted definitions for high or low fat diets, although UK guidelines for the general population state that <35% of total energy should be derived from fat [1]. Low fat diets are generally considered those that provide <30% energy from fat, and high fat diets those that provide >35% energy from fat. In terms of saturated fat (SFA), major guidelines have recommended reducing SFA consumption to under 10% of total energy [2,3]. In research studies what is described as a low carbohydrate or low fat diet can vary. It can be anything from intake slightly reduced from the participant's normal diet or less than the standard diet, through to extreme reductions of 20% of energy or less.

Different types of fat

Foods contain a mixture of fatty acids and they appear in different ratios. Food provides hundreds of different combinations of fatty acids, and no food is a pure source of any one type of fatty acid—all foods present combinations. But for easy communication to the general population, the conventional public health messages have considered four main types of fat:

- *Mono-unsaturated fats or MUFA* are mostly found in olive oil, rape-seed oil and walnut-oil.
- *Polyunsaturated fats or PUFAs* are found in sunflower oil, corn oil and oily fish (omega-3).
- *Saturated fats* are very broadly equated with 'animal fats' (e.g. in meat and dairy products).
- *Trans-fatty acids* are a sub-group of unsaturated fats which include some (but not all) fats that are artificially manufactured by industrial hydrogenation of vegetable oils.

Unsaturated fats (both MUFA and PUFA) are generally associated with health benefits. There is strong evidence for the adverse effect of industrial trans-fatty acids on blood lipid profile and CVD risk. Naturally occurring trans-fatty acids in dairy and certain animal products are different and are not deemed to be detrimental to health. Average intake of trans-fat in the UK is within current guidelines but the current advice is to eliminate industrial trans-fat from the diet. There is broad agreement about recommendations for trans-fat. As a result, this evidence has not been considered in this review.

Saturated fats are clearly a concern. But not all saturated fats are the same - individual SFAs have different physiological effects [4]. For example, myristic acid (14:0) found in butterfat and palmitic acid (16:0) found in palm oil, have adverse metabolic effects, and increase the risk of CVD. However, stearic acid found in dairy products, beef, dark chocolate and olive oil is not thought to increase cholesterol or influence cardiovascular risk.

The challenge is when food contains differing mixtures of saturated fats and the fact that saturated fat is not eaten in isolation. For any single SFA, physiological effects are complex with the potential for both benefit and harm.

Guidelines for dietary fat intake for primary and secondary prevention of CVD

Nutritional recommendations for fat intake are formulated as a result of the association between dietary fat intake and risk of CVD. The rationale is to reduce the low density lipoprotein (LDL) cholesterol fractions, as there is a linear relationship between serum cholesterol and vascular events [5]. Guidelines for CVD prevention in the general UK population have been published [1]. People with type 2 diabetes are 2-3 times more likely to develop CVD than those without [6]. For people at increased risk, the National Institute for Health and Care Excellence (NICE) and the Joint British Societies' (JBS3) consensus recommendations for the prevention of cardiovascular disease recommends a cardio protective diet, including reductions in both total and saturated fat [7] or reductions in saturated fat [8]. The nutritional guidelines from Diabetes UK state that dietary interventions should reflect those for people with existing CVD, although the exact proportion of energy that should be derived from total fat is less clear in people with type 2 diabetes [9]. What is consistent is that, the NICE guidelines, JBS3 recommendations and Diabetes UK guidelines state that replacing saturated fat with unsaturated fat (both monounsaturated and polyunsaturated fats) should be recommended. Table 1 summarises the intake of dietary fats and the current UK recommendations.

Nutrient (% energy intake)	Current intake in adult UK population [10]	Recommendations for primary prevention [1]	Recommendations for those at high risk of CVD [7]
Total fat	34.7	<35	<30
SFA	12.6	<11	<7
PUFA	6.1	6.5	Replace SFA with PUFA or MUFA
MUFA	12.6	13	
Trans fat	0.6 – 0.7	<2.0	

Table 1. Dietary fat intake in the UK and current UK nutritional recommendations for dietary fat intake and cardiovascular disease.

Levels of evidence

The highest level of evidence is generated by meta-analyses and systematic reviews of randomised controlled trials (RCT). RCTs are often referred to as the 'gold standard' in research and are designed to evaluate the effect of a particular intervention compared with a control group receiving either a placebo or no intervention (such as continued routine care or advice). Although this study design is applicable for testing the efficacy and safety of new pharmaceutical agents, it has many drawbacks for assessment of dietary factors, especially for long-term outcomes such as CVD. With respect to dietary studies in particular, the challenge of altering a single variable with interventions consisting of foods that are complex mixes of many nutrients (and non-nutrients) can mean that subsequent recommendations should be made with the necessary caveats.

The ideal trial would recruit at birth and compare two or more types of fat intake over a long follow-up period (preferably life-long) while all other constants e.g. weight, smoking, physical activity would be similar between groups. In the real world, these kinds of trials have many challenges including being very expensive, poor adherence, lack of blinding, contamination, and are nearly impossible to conduct. Thus the majority of evidence in nutritional research relies on outcomes from short-term, randomised, controlled trials of intermediate endpoints (like metabolic factors such as glycaemia or lipids), and from observational cohort studies providing epidemiological evidence. There are very few studies conducted specifically in people with type 2 diabetes (especially at a similar stage of their condition) and this has led to conclusions and recommendations that have been extrapolated from studies in general populations.

Randomised controlled trials

As the subject is of intense interest both in the scientific community and the public, there have been a number of trials, systematic reviews and meta-analyses of trials that have investigated the effect of a lower SFA diet on coronary heart disease incidence. A key issue has been to understand whether it is the reduction of SFA *per se* in the diet that might be related to future CHD risk, or whether the replacement nutrient related to a decrease in SFA intake matters.

For instance, eight RCTs that considered replacing SFA with PUFA did not individually find significant effect for CHD events. However a meta-analysis reported that CHD risk was lowered by 10% for each 5%E greater PUFA intake replacing SFA [11]. It is important to note that many of the trials had limitations such as difficulties assessing compliance, lack of double-blinding, and/or inclusion of certain food factors that also confer CVD benefit that are not related to decrease in SFA. In the largest trial, the Women's Health Initiative trial, which enrolled 46,558 women to lower total fat and included lowering of SFA consumption by ~3%E over eight years, there was no significant reduction in either incident of CHD or total CVD [9]. An important issue to note in this trial was that the reduction in total fat or SFA intake was replaced largely with carbohydrates. This highlighted the fact that the replacement nutrient(s) is/are of importance.

A recent review of dietary, circulating and supplement fatty acids with coronary risk concluded that the current evidence does not clearly support cardiovascular guidelines that encourage high consumption of PUFA and low consumption of SFA [12]. This review did not suggest clear benefits of replacement of SFA with n-6 PUFA (RR 0.86 [CI, 0.69 to 1.07]). However, the authors acknowledged that future trials and individual participant level meta-analyses of these trials could identify subgroups that may benefit. This article generated much controversy and discussion that was widely reported in the media and scientific press, and attracted criticism from the research community, including calls for the paper to be withdrawn [13]. The British Heart Foundation, which part-funded this review, cautioned against changes to current dietary guidelines and made two helpful points. Firstly, large scale clinical studies are needed before making a conclusive judgement. Secondly, the totality of the diet and not a single element alone such as fat should be considered, including intakes of salt, sugar, fruit and vegetables as well as stopping smoking and staying active. Another article has questioned the historical dietary guidance on fat reduction for cardio-protection [14], but it approached the topic from a retrospective perspective and was controversial.

In contrast, the recent Cochrane review combining both primary and secondary prevention RCTs concluded that reduction of SFA could reduce the risk of CV events by a modest but significant 17% (RR 0.83; 95% CI 0.72 to 0.96), and that replacement of SFA by PUFA was a useful strategy [15]. Notably, effects were less clear for all-cause or cardiovascular mortality, myocardial infarction (fatal and non-fatal, or non-fatal alone) and for stroke. The review also found in subgroup analyses that reduction in CV events was seen in studies that primarily replaced SFA calories with PUFA but no effects were seen in studies replacing SFA with carbohydrate or protein. Although this review found that there was insufficient evidence to support replacement of SFA by MUFA, a meta-analysis of RCTs conducted in people with type 2 diabetes has reported positive effects of a Mediterranean-type MUFA-rich diet on both glycaemic control and CVD risk [16]. A 2010 review reached similar conclusions to the Cochrane review and recommends replacement of SFA by polyunsaturated fats [17]. The systematic review conducted during the preparation for the NICE report [7] supports reductions in both total and saturated fat for those at high risk of CVD and this includes those with type 2 diabetes.

Taken together, the issue of reduction in saturated fat intake for cardiovascular benefit should consider not only a reduction per se, but also the replacement nutrient. Collective evidence suggests a modest but significant coronary benefit when SFA intake reduction is accompanied by an increase in PUFA intake. WHO [2] cites 6-11% AMDR as the recommended range of intakes with reference to lipid peroxidation, particularly where tocopherol levels are low, although EFSA [3] concludes that there are inconsistencies in setting an upper limit.

It is important to remember that all studies investigating the effects of different types of fat have examined intakes within a fairly narrow range of 20-40% total energy intake, and there is little or no evidence for the effects of higher intakes of either total fat or SFA. Evidence for

higher intakes of fat are limited to intervention studies and case series over shorter periods of times with very limited reporting of hard end points.

Prospective observational cohort studies

Observational prospective cohort studies are those where the investigator does not intervene, but observes and analyses the strength of a relationship between an exposure (in this case, fat intake) and a disease variable in a defined population over time. Well-known examples of this design in the UK include the Whitehall study [18] and the European Prospective Investigation into Cancer and Nutrition (EPIC) [19] study, which is Europe wide but includes two research centres in the UK. The main criticism of these types of studies is that they report associations and do not directly investigate cause and effect.

However, prospective studies can be very informative as they study large numbers of people over long periods of time and capture habitual diets of free-living individuals. Weighing up the strengths and limitations of RCTs and prospective observational studies in a dietary context, the collective evidence generated by these study designs can be helpful, particularly if the findings are similar. Data from general population cohort studies have generally reported similar findings as the RCT evidence reviewed above. For instance, a review published in 2009 suggested that replacement of SFA by PUFA (but not carbohydrate or MUFA) prevented coronary heart disease [20]. A more recent review reported that SFA were not associated with all-cause mortality, CVD, stroke or development of type 2 diabetes [21], although the authors acknowledge that there is a small body of evidence suggesting that SFA may increase the risk of CVD and mortality among people with type 2 diabetes [22,23]. Also recently published evidence from the Nurses' Health Study and Physicians' Health Study concluded that replacing SFA with PUFA or with carbohydrates from wholegrains was associated with lower CHD, but replacing SFA with refined starches and/or added sugars was not associated with CHD risk [24].

High saturated fat diets and glycaemic control

There are no studies investigating the specific effect of high SFA diets on glycaemic control in people with type 2 diabetes. The majority of the evidence is derived from low carbohydrate studies, where the assumption is that lowering carbohydrate increases total fat and SFA intake. Although this is true for the proportion of energy derived from fat, absolute intakes of both total fat and SFA are reduced in the majority of studies as many processed fatty foods like confectionary, cakes, biscuits, savoury snacks, chips, that are high in both carbohydrate and fat, are eliminated from the diet. The effects of low carbohydrate diets are therefore unlikely to be related to either higher total fat or higher SFA intake alone. A recent trial in people with type 2 diabetes that concluded that a low carbohydrate diet achieved greater improvements in lipid profile, blood glucose stability, and reduction in diabetes medication requirement used a diet high in unsaturated fat and low in saturated fat [25]. The conclusion that low carbohydrate diets are more effective in improving glycaemic control may hold true over the short-term [26,27], but not over the long term [28, 29] and although they are recommended as a strategy for weight loss by Diabetes UK, there is no evidence of superiority over other approaches in the long term.

High saturated fat diets and weight loss

As is the case with glycaemic control, the majority of studies quoted as showing evidence of greater weight loss with higher total fat intakes are actually low carbohydrate diets, and these are not necessarily associated with higher total or saturated fat intakes. Greater weight loss over the short term is seen when low carbohydrate diets are compared with

higher carbohydrate intakes, but this is not maintained over the longer term [30]. Low fat diets are commonly advised for weight loss and for general health in people with diabetes, but there is inconsistent evidence of benefit in terms of weight loss [31]. However, two recent studies promoting low fat (<30%) and low SFA (<10%) diets have shown greater weight loss than conventional higher fat diets [32, 33].

Overall, there are lots of trials claiming that one or other diet is “better”, but a 2014 meta-analysis which included people with type 2 diabetes [34], reported that significant weight loss can result from any low-carbohydrate or low-fat diet and concluded that adherence is key to success. A trial that assigned overweight adults to one of four diets, each targeting different macronutrient composition, found that energy restriction, rather than macronutrient content, dictated weight loss at two years follow-up [35]. In type 2 diabetes, a recent trial comparing low and high carbohydrate diets concluded that both diets can lead to significant weight loss and improvements in diabetes management, and noted that none of the diets were high in saturated fat [25].

The importance of focusing on foods

Despite attempts to determine the ideal macronutrient (protein, fat and carbohydrate) intake for people with type 2 diabetes, evidence to date is inconclusive [36]. One of the best predictors of improved outcomes in people with type 2 diabetes is energy restriction and weight loss, and there are a variety of strategies by which this may be achieved, with no clear indication of the superiority of any one particular strategy. Increasingly, attention is being drawn to the importance of a move away from a focus on macronutrients towards food-based whole diet recommendations. There is strong evidence that diets that are the most compatible with health are those that are higher in vegetables, fruits, wholegrains, dairy, seafood, legumes, and nuts; moderate in alcohol (among adults); lower in red and processed meat; and low in sugar-sweetened foods, particularly low in sugar-sweetened beverages, and refined grains [37].

Future directions

There are new lines of evidence which are paving the way for greater understanding of the role of dietary fats in health. This includes the use of nutritional biomarkers that allow measurement of circulating fatty acid levels on large scale.

For instance, in the recent review that questioned the evidence for the current guidelines on saturated fats [12], the authors systematically reviewed studies with fatty acid biomarkers and concluded that none of the individual SFAs were significantly related with incident of CHD except margaric acid (17:0), and that was inversely associated with CHD incidence. Evidence from the EPIC-study [38] also reported that within the group of circulating SFAs, some are related with increased risk and some with reduced future risk of type 2 diabetes.

This emphasises the fact that SFA is not a single homogenous group and it is importance to recognise the different types of SFA as having different physiological effect. However, this interpretation is complex. In future, evidence from RCTs, prospective studies of fat intake, and studies including fatty acid biomarkers will need to be combined. As dietary assessment is complex and prone to measurement error and reporting bias, biomarkers can help elucidate associations.

What does this mean to people with Type 1 diabetes?

The advice to choose foods that have health benefits and to restrict intake of saturated fat is common to the population in general and all people with diabetes.

In type 1 diabetes, the priority is to maintain glycaemic control, maximise quality of life and minimise complications. Carbohydrates are the main nutritional consideration for glycaemic

control in people with type 1 diabetes. For people using multiple daily injections and pumps, matching insulin dose to the amount of carbohydrate consumed on meal-by-meal-basis is an effective strategy in improving glycaemic control [9]. For those on fixed insulin regimens, consistent quantities of carbohydrates on meal-by-meal basis is also beneficial. Carbohydrate awareness, carb-counting education and insulin dose adjustment should be recommended on an individual basis.

Weight gain can be a concern for people with type 1 diabetes and the ability to adjust insulin based on changes in carbohydrate intake may help with weight management. People with type 1 diabetes are also at an increased risk of cardiovascular disease. Therefore, the general principles of the cardio protective diet would be prudent and sensible as a general recommendation.

This policy statement address type 2 diabetes. Dietary advice for people with type 1 diabetes should be evidence-based and tailored to the individual using the expertise of dietitians to help individuals make food and lifestyle choices to maximise their health.

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Written by members of the Diabetes Specialist Group and Diabetes UK

©2015 The British Dietetic Association
 5th Floor, Charles House, 148/9 Great Charles Street Queensway, Birmingham B3 3HT
 Tel: 0121 200 8080 Fax: 0121 200 8081 email: info@bda.uk.com

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