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DIETARY FATTY ACIDS: AN OVERVIEW

Fat is a macronutrient which our body needs in significant amounts to provide energy and also to aid the transport and absorption of fat-soluble vitamins (vitamin A, D, E and K).¹ While some fats are essential to human health, others are associated with increasing the risk of chronic diseases when consumed in high amounts. This article will aim to examine the current evidence base related to dietary fatty acids and summarise the main current public health messages.

Maeve writes a blog called *Dietetically Speaking.com* which promotes evidence-based nutrition and dispels fad diets and misleading nutrition claims.

For full article references please email info@networkhealthgroup.co.uk

Fat is generally composed of a glycerol molecule with three fatty acids attached to this. Depending on the amount of hydrogen atoms and the type of bonds present between molecules, these fatty acids are usually classified as saturated, monounsaturated or polyunsaturated. Trans fatty acids occur when the carbon chains in polyunsaturated fats are arranged on opposite sides of a double bond rather than on the same side (which is known as a cis arrangement and is found more commonly in nature than the trans-arrangement).²

TRANS FATS

A high intake of trans fats has been linked with a higher incidence of coronary heart disease due to raising LDL cholesterol and lowering HDL cholesterol.^{3,4} There is a small amount of naturally occurring trans fats found in some meat and dairy products such as: milk, cream, cheese, lamb, mutton and beef.⁵ However, the majority of trans fat is artificially produced when vegetable oils are hardened at an industrial level, turning it into a solid or semi-solid state (i.e. partially hydrogenated vegetable oil or fat) to use in processed foods for frying and baking, or to improve the shelf-life of the products, such as cakes, biscuits, pies, fried foods, margarines and takeaways.^{2,5} There is currently insufficient evidence to differentiate

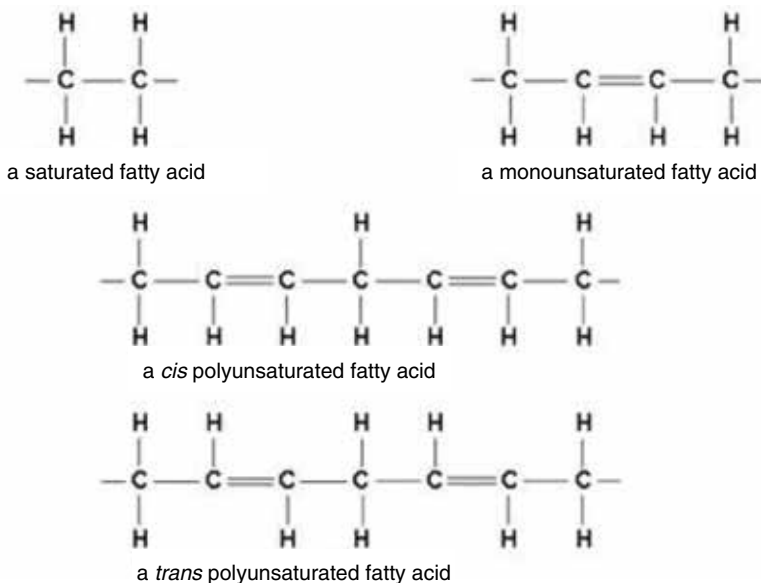
between the health risks of naturally occurring trans fats and those which have been artificially produced.⁶

The best way to check if a product contains trans fat is to look at the ingredients list for 'partially hydrogenated fats or oils'; as fully hydrogenated fat does not contain trans fat. Many manufacturers have now altered their production methods in order to reduce the amount of trans fats in their products to very low levels,⁵ and the most recent National Diet and Nutrition Survey (NDNS) found that average UK trans fats intakes were 0.5% of food energy, which is lower than previous years and remains below the recommended target of <2%.⁷

SATURATED FATS

This type of fat is associated with raising LDL cholesterol levels and increasing our risk of heart disease.¹ NICE reports that a 50% reduction in saturated fat intake could potentially prevent 30,000 deaths from cardiovascular disease per year, and could also prevent a similar number of new cases from developing annually.⁸ Sources of saturated fat include: lard, butter, coconut oil, the visible fat on meat, full fat dairy, pies, pastries, cakes, biscuits and takeaways.¹ It is recommended that saturated fatty acid intake should be <11% of total dietary energy; the most UK NDNS data shows that saturated fat intake for adults exceeds this at 12.7%.⁷

Figure 1: The composition of fats



Picture source: British Nutrition Foundation 'Fats'

Saturated fat is currently a very hot topic and there are many contrasting opinions about how this nutrient affects our health; we will hopefully gain more clarity into this when the Scientific Advisory Committee on Nutrition (SACN) complete their review of the evidence related to saturated fat and health outcomes for the general population.⁹ A lot of the controversy arose with the release of a large meta-analysis by Chowdhury et al (2014) which did not find a significant association between saturated fat intake and cardiovascular disease.¹⁰ Despite these findings and the numerous 'Butter is Back' headlines, there have been several criticisms of this study including: the omission of relevant studies in the meta-analysis; errors in some of the data presented (with subsequent corrections by the author); a lack of consistency with the methodological approaches used in included trials (for example whether total fat or just saturated fat intake was reduced, and whether fat was substituted for refined carbohydrates). It was also highlighted that data representing monounsaturated fats was taken from meat and dairy rather than nuts, olive oil and plant sources.¹¹

Other large scale meta-analyses which have accounted for some of these limitations,

report that lowering saturated fat intake, but not total fat intake, and replacing saturated fat with unsaturated versions or wholegrain carbohydrates, but not refined carbohydrates, reduces cardiovascular disease risk factors.^{12,13} For example, a recent systematic review by Hooper et al (2015)¹⁴ which included almost 60,000 subjects and trials that lasted at least two years, found that reducing saturated fat intake resulted in a 17% reduction in cardiovascular disease risk, and replacing saturated fat with polyunsaturated fat had a significant protective effect, whereas replacement with carbohydrate or protein was not found to be beneficial to health. They also found that reducing saturated fat intake was associated with improvements in weight and BMI.

MONOUNSATURATED FATS

Monounsaturated fats are traditionally thought to be particularly beneficial for health via raising HDL cholesterol and lowering LDL cholesterol.^{1,15} In line with this, NICE recommends that those at risk of CVD should reduce their saturated fat intake and increase their intake of monounsaturated fats.¹⁶ Sources of monounsaturated fats include: olive oil, rapeseed oil, avocados, almonds, hazelnuts, peanuts.^{1,17}



... there is also mounting evidence that replacing saturated fat with polyunsaturated fat reduces the risk of cardiovascular disease.

There has also been some emerging uncertainty related to the health benefits of monounsaturated fats, as large scale data has reported that there is insufficient evidence to examine the effects of replacing saturated fats with monounsaturated fats.^{14,18} Despite this uncertainty, there is an abundance of research to support the health benefits of wholefoods which are high in monounsaturated fats, such as olive oil and nuts. For example, olive oil has an EFSA approved health claim that 'consumption of olive oil polyphenols contributes to the protection of blood lipids from oxidative damage'¹⁹ and a meta-analysis by Schwingshackl and Hoffmann (2014),²⁰ which included over 840,000 subjects, found that a higher intakes of olive oil was associated with a reduced risk of all-cause mortality, cardiovascular events and stroke (by 11%, 12%, 9% and 17% respectively); but, interestingly, no significant association was found when monounsaturated fat was analysed in isolation. Similarly, a large meta-analysis by Psaltopoulou et al (2011) found that the highest intakes of olive oil were significantly associated with a reduced risk of any type of cancer, and the authors conclude that it remains unclear whether this is related to olive oil's monounsaturated fatty acid content or its polyphenol content.²¹ In relation to nuts, randomised control trials have found

that consuming a handful of nuts (roughly 40g) per day can reduce cholesterol levels by around 4%.²²⁻²³

It is interesting to note that the basis of the public health messages related to the benefits of monounsaturated fats is derived from studies such as the famous 'Seven Countries Study', the PREDIMED study and LYON heart study which found a reduced risk of the metabolic syndrome from following a Mediterranean diet which included wholefoods high in monounsaturated fats, rather than from studying monounsaturated fat in isolation.²⁴⁻²⁹

POLYUNSATURATED FATS

Omega-3 (n-3) and omega-6 (n-6) are referred to as essential fatty acids as they cannot be synthesised in the body in sufficient amounts; therefore, we must rely on dietary sources.²

There are three main dietary forms of omega-3: alpha linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). ALA is a precursor to the active forms of omega-3 (EPA and DHA) which have important roles in building healthy cells, cellular signalling, reducing the risk of blood clots, helping to regulate heart rhythm, reducing inflammation and improving outcomes after a heart attack.^{1,2,15} EPA and DHA can also be derived straight from dietary sources such as:

Table 1: Main sources of saturated, unsaturated and trans saturated fats in the diet

Saturated fat	Trans saturated fats	Polyunsaturated fat	Monounsaturated fat
Butter, lard, ghee, dripping Fatty meats - beef, lamb, corned beef, sausages, beef burgers, streaky bacon Dairy products - full fat milk, cream, full fat yoghurt, cheese Pies, cakes, biscuits, chocolate and pastry products Coconut	Baked products Cakes, biscuits, pastires Convenience foods e.g. takeaways, ready meals	Oils - sunflower, soya, linseed, sesame seed Fish Margarines Soyabeans	Olive oil, rapeseed oil, peanut oil (ground nut) Almonds, walnuts, peanuts, avocados

Table reference: Manual of Dietetic Practice (5th ed.)

pilchards, mackerel, herring, salmon, sardines and fresh tuna. ALA, on the other hand, is found in plant sources such as walnuts, rapeseed oil, flaxseeds, soya, dark green vegetables and wholegrain cereals (but ALA is thought to be poorly converted into EPA and DHA in humans).^{2,15}

For primary prevention of cardiovascular disease it is recommended to consume one portion (roughly 140g) of white fish per week and one portion of oily fish per week, and for secondary prevention it is recommended to consume two to four portions of oily fish per week (total 300g).¹⁵ For those who are unable to tolerate oily fish, omega-3 fatty acid compounds, or fish oil supplement, are no longer recommended for primary or secondary prevention of cardiovascular disease due to a lack of supporting evidence.³⁰

Linoleic acid is the main dietary form of omega-6 fatty acid; once consumed, this is converted to the active form of omega-6 which is arachidonic acid (AA).³¹ The main sources of linoleic acid are vegetable oils such as: corn, safflower, sunflower and soya oils,^{15,31} whereas pre-formed AA is found mainly in eggs, meat and some kinds of fish.³¹

There is contention over the possible inflammatory effect of omega-6 in relation to coronary heart disease, as linoleic acid is used as a substrate for both pro-inflammatory and anti-inflammatory molecules. The American Heart Association (AHA) ‘supports an omega-6 PUFA intake of at least 5% to 10% of energy in the context of other AHA lifestyle and dietary recommendations [and] to reduce omega-6 PUFA intakes from their current

levels would be more likely to increase than to decrease risk for coronary heart disease’.³¹ However, a recent Cochrane review of randomised controlled trials reported that there is insufficient evidence to recommend altering omega-6 levels for cardiovascular disease prevention.³²

Some research suggests that reducing the ratio of omega-6 to omega-3 in our diets could reduce the risk of cardiovascular disease; for example, the western diet is thought to have a ratio of roughly 16:1 (omega-6:omega-3) whereas for secondary prevention of cardiovascular disease a ratio of 4:1 has been associated with a 70% decreased total mortality risk.³³ More large scale data on this subject is needed.

As discussed above, there is also mounting evidence that replacing saturated fat with polyunsaturated fat reduces the risk of cardiovascular disease.¹⁴

CONCLUSION

Current evidence indicates that, to promote health, we should continue to limit our intake of trans fat and reduce our saturated fat intake (but not total fat intake) and replace this with unsaturated fat or wholegrain carbohydrates. There is a strong body of evidence to support the health benefits of the Mediterranean diet, including specific benefits of olive oil and nuts, but there is uncertainty around the direct effect of monounsaturated fat.

Evidence to support the benefits of polyunsaturated fats is increasing, but more research is needed to explore the specific effects of omega-3 and omega-6 fatty acids.