

YORK *mind-body* HEALTH

Information Sheet

www.yorknutritionaltherapy.co.uk 01904 435 267 © Glyn Blackett

Fats and Oils

What Is Fat?

Fats and oils, collectively known as lipids, are one of three major food groups or macronutrients (the others being proteins and carbohydrates). They have various functions in the body, the most obvious of which is as a store of energy. Lipids can be burnt directly by cells to release energy. In fact fat is the most energy dense of the macronutrients, providing 9 calories per gram compared to 4 calories per gram for protein and carbohydrates.

Although fat gets a bad press and is seen as unhealthy (probably because of its association with overweight and obesity) We need to be aware that there are different kinds of fat. Lipids are categorised as either saturated or unsaturated, and some of the latter are essential to health - we cannot survive without them. (Omega 3 and 6 oils are types of unsaturated lipid.) This is why very low fat diets have questionable health value.

It is perhaps worth noting that the body can quite easily convert sugars into fat, while the reverse process is not possible. That's partly why many people find it easy to lay down fat stores but much harder to get rid of them.

Chemistry of Fats

This section is somewhat technical but since it's not necessary to understand the chemistry of fats in order to make good dietary choices about fat, you may wish to skip to the next section.

Lipids share a similar chemical structure. The basic constituent molecule is known as fatty acid - it consists of a chain of carbon atoms (numbering between 2 and 22) with a 'carboxylic acid' group (chemical formula COOH) at one end of the chain. The carbon atoms in the chain are bonded to hydrogen atoms. In the most common form of fat, three

fatty acids are linked together, forming a triglyceride.

As mentioned, lipids are classified as either saturated or unsaturated. In this context 'saturated' means that the carbon atoms' bonds are taken up by hydrogen atoms to the maximum extent. By contrast, in unsaturated fats possess one or more 'double bonds' between carbon atoms. Typically unsaturated lipids are oils, i.e. they are liquid at room temperature (fats being solid).

There are various sub-types of unsaturated lipids, with minor structural differences distinguishing them (for example, polyunsaturated lipids, having more than one double bond, and monounsaturated lipids, having a single double bond). Subclasses of unsaturated lipids have names like omega 3 and omega 6, where the number denotes the position of the carbon atom where the (first) double bond is.

Saturated Fats

Saturated fat in the diet comes mainly from animal sources - meat (especially red meats) and dairy products. Eggs also contain some saturated fat. Saturated fat has no other function other than as a source of energy.

The fat stored in our bodies is saturated fat. It serves as our long term energy store. It provides very good heat insulation (animals living in cold environments tend to have a lot of it) and it also acts as padding to protect us from injury. A healthy body composition would be at least 10% - more in females.

Unsaturated Fats

By contrast unsaturated fats have many more functions in the body besides energy production. For example they are used to form phospholipid

molecules which are the basic constituent of cell membranes.

Omega 3 Oils

Omega 3 oils have numerous beneficial effects. For example they reduce cardiovascular risk factors such as blood cholesterol and triglycerides, atherosclerosis, and they reduce blood pressure. They are generally anti-inflammatory.

The basic omega 3 oil is alpha-linolenic acid (ALA), an essential fat. Two further omega 3's (EPA and DHA) are made from ALA, and are more directly useful to the body. Whilst the body can make some of these, the ir production is somewhat limited so it is much better to get them from the diet. The best sources are fish, especially oily fish such as salmon.

Omega 6 Oils

Omega 6 oils also have beneficial qualities. Like omega 3's they reduce cardiovascular risk factors and lower blood pressure. They help the skin, hair and joints.

The main omega 6 oils are linoleic acid (LA), gamma-linolenic acid (GLA) and arichidonic acid (AA). Whilst LA and GLA are anti-inflammatory, AA can promote inflammation if present in excessive levels. AA is itself an essential nutrient, but needs to be balanced by other unsaturated fats. The critical factor seems to be the ratio of omega 3's to omega 6's in the diet - the higher the better. The problem is that the typical western diet has it the wrong way round, with omega 6's predominating over omega 3's (though both are often deficient in absolute terms).

Seeds and nuts are generally very good sources of both omega 3's and omega 6's, but many are weighted towards omega 6's. However, in themselves nuts and seeds can be regarded as very healthful foods. Animal fats often tend to include AA.

Olive Oil

Olive oil contains the omega 9 fat oleic acid, which is also a beneficial fat, though not to the same degree as the omega 3's.

Pathological Fats

Many processed foods contain chemically altered forms of fat, which do not occur in the natural world. There is evidence that at least some of these new fats are harmful. An example of the chemical alteration of lipids is hydrogenation. This process converts liquid oils into forms that are solid at room temperature - hydrogenation is used to make margarine for example. Most commercial cooking oils have been processed in some way.

One particular type of partially hydrogenated fat is trans fats, or trans fatty acids. The name 'trans' derives from the shape of the molecule - it has the same chemical structure as the natural molecule (which is called 'cis') but a different 3D shape. Research suggests that trans fats are associated with wide ranging negative effects on health. For instance, trans fats have been linked to increased incidence of heart disease, cancer and diabetes (1). Trans fats have been banned in some countries.

Cooking Using Oils

As I've already mentioned, most commercial cooking oils have been processed in some way. When we cook with oils using high temperature cooking methods such as frying, we risk altering them chemically ourselves. This is particularly true of unsaturated oils, whose chemical structure means that they are more easily degraded. (In fact, cooking aside, we need to be careful with many unsaturated oils because they easily go rancid, loosing their healthy qualities and become toxic in the process.)

Saturated fats are much more stable and a better choice for frying. Of the unsaturated fats, olive oil is relatively stable.

Fats and Digestion

The fat in our food must first be emulsified, meaning that it is broken into tiny globules. This happens through the action of bile, secreted from the gall bladder into the small intestine. Next an enzyme called lipase (secreted by the pancreas) breaks down the lipid molecules into components such as free fatty acids. These are then absorbed into the cells lining the gut, where they are reconstituted back into lipids (triglycerides) which eventually end up being transported to the liver in the blood.

Note that some vitamins (e.g. A, D and E) are fat soluble but not water soluble and are absorbed into the body alongside lipids. So their proper absorption depends upon healthy fat digestion.

Fats and Health

Being overweight is a major risk factor for many of the common diseases of our age, including diabetes and cardiovascular disease. The media continually exhorts us to eat a low fat diet. Does this mean that fat consumption is unhealthy? Does eating fat make us fat? Actually the picture is more complex than you might think.

In the 1970's research showed that the level of fat consumption correlated with the level of cardiovascular disease and other illnesses, both when comparing different societies and when we look at our own society over time. Scientists concluded fat consumption was indeed a health risk. But since the 70's fat consumption has actually fallen while the incidence of diseases like diabetes has continued to rise. Moreover some societies with very high fat consumption have traditionally been relatively free of cardiovascular disease, e.g. the Inuit or Eskimo people.

Many scientists now think that sugar is the main dietary culprit responsible for the rise in heart disease and diabetes. Sugar consumption also correlates with the incidence of both overweight and obesity, and diseases such as diabetes, and has continued to rise in recent decades. Remember that excess sugar in the diet is converted to fat in the body.

The health effects of our fat consumption really depend on what type of fats we are eating. As the above discussion makes clear, unsaturated fats (present in nuts, seeds and fish) play many vital roles and thus are beneficial to consume. Saturated fat has no real physiological role other than as an energy source, but on the other hand is arguably fairly neutral in its health effects (2). By contrast pathological fats such as trans fats are toxic.

Cholesterol

You're probably aware that high cholesterol is in some sense a health risk. What is cholesterol and what has it to do with fats?

Cholesterol itself is not actually a fat, but its metabolism is closely related to that of fat. Cholesterol is essential for health. It plays a role

in cellular membranes and is a precursor for the "steroid" hormones, such as cortisol, oestrogen and testosterone. It is common in the foods we eat (animal sources) but is also made in the body, especially the liver.

Cholesterol is transported in the blood bound up with lipids, in complex molecules called lipoproteins. There are various forms including High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL) and Very Low Density Lipoprotein (VLDL)

Excess cholesterol is a risk factor for cardiovascular disease, but it partly depends on what form it takes. HDL is known to be healthy while LDL and (especially) VLDL are not (at least when present in excess). Ratios (e.g. HDL to total cholesterol) are better predictors of cardiovascular disease than cholesterol levels.

Fat Tissue

In the body, fat is stored in specialised cells called adipocytes, in the form of triglycerides (also known as triacyl glycerol). It was once believed that adipocytes were simply passive storage sites, but more recent discoveries demonstrate that fat tissue is physiologically active. In fact adipocytes can be considered as part of both the endocrine (hormone) system and the immune system, by virtue of the fact that they produce signalling molecules for both.

Adipocytes produce several hormones including leptin, adiponectin, the stress hormone cortisol, even the sex hormones oestrogen and testosterone (3). Leptin is particularly important, it being a major player in appetite regulation. Leptin production is stimulated when the adipocytes fill up, and signals satiety to the brain. (There is evidence that in overweight people this signalling does not work properly.)

Adipocytes also produce cytokines, which are the messenger molecules of the immune system. There are many different cytokines, and collectively they control the balance of inflammation. This is a complex topic, covered in more detail in other articles, but suffice it to say that in general the more body fat you carry, the greater the level of systemic inflammation - not a good thing. This connection to systemic inflammation is the primary reason why being overweight increases risk of several diseases including cardiovascular disease and diabetes.

It turns out that the level of inflammation depends in part on where in the body the fat is stored. Abdominal fat is particularly inflammatory (and therefore particularly unhealthy).

Metabolic Types

You may have wondered why some people seem to do very well on diets which recommend high levels of fat, such as the Atkins diet, even though this is the opposite of mainstream opinion, which is to keep fat intake to a minimum. I think at least part of the reason is to do with *biochemical individuality*. This idea, that there are wide variations in our biochemical functioning due to genetic differences, was first proposed in 1956 by biochemist Roger Williams, and has since been substantiated by genetics research. The consequence is that individuals have quite widely varying nutritional requirements.

Human beings can derive energy at the cellular level from carbohydrates, fats and proteins. (The cellular “burning” of these three to release energy is known as metabolism.) Carbohydrates (and in particular the sugar glucose) are the main form - all cells are able to burn glucose. Biochemical individuality means that we utilise these three nutrients with variable efficiency. Just as some cars run on diesel and others on petrol, so some people will function better on a particular mix of these food components. This idea has developed into the concept of metabolic types. Determining your metabolic type enables you to predict what kind of diet will optimise your physiological and metabolic functioning. Though there are different variants of the theory, the core idea is that some people will do relatively better with relatively more fat and protein in their diet, while others will prefer a more predominantly carbohydrate based diet (4). This topic is covered in more detail in other articles of this collection.

Dietary Recommendations

Conventional recommendations suggest fat consumption should not exceed around 25-30% of calories, and saturated fat should not exceed about 5-10% (5). Recommendations do vary - Patrick Holford for instance recommends 20% of calories from fat (6). The right amount is to some extent an individual thing - i.e. it depends

on your metabolic type. William Wolcott, an authority on metabolic typing, suggests a range from 15% to 30% (7).

Virtually all health-aware writers agree that trans fats should be avoided completely.

Healthy sources of fats include nuts and seeds, and oily fish. (However the care must be taken with the latter as it tends to contain mercury and other toxins. Smaller fish are generally less contaminated.) I recommend most people supplement their intake of omega 3 oils.

Research documents many health benefits. Krill oil is a particularly useful supplement - it will contain less toxic contamination, generally derives from sustainable sources, and seems to be a particularly potent form (8).

When purchasing plant based oils, cold-pressed or extra-virgin is best, and take care that they don't go rancid (store in a cool, dark place).

Frying as a cooking method is best kept to a minimum, but saturated fat (e.g. lard) is best as it is more stable and won't turn toxic. Olive oil is OK but you should probably avoid frying in seed oils due to their instability at high temperatures.

Eggs contain relatively high levels of cholesterol but for most people they don't seem to raise blood levels of cholesterol so can be regarded as a very healthy food choice.

Summary

Though fat seems to have a bad reputation, we must remember there are different types of fats - good (unsaturated fats), relatively neutral (saturated fat) and bad (trans fats). The unsaturated fats are essential for health, most notably the omega 3 and omega 6 fats. Most people are (i) deficient in both omega 6's and omega 3's, and (ii) consume relatively more omega 6's than 3's than is ideal for health. Good sources of healthy fats include nuts, seeds and fish (though it is not advisable to eat excessive amounts of fish due to the risk of contamination with toxins such as mercury). Supplementation of especially omega 3 oils and perhaps some omega 6 oils is probably a good idea for most people.

Fat's bad reputation seems to stem from firstly the fact that it is more calorie dense than either carbohydrate or protein (and therefore may contribute to weight gain), and secondly the statisti-

cal correlation of fat consumption with cardiovascular disease and other health concerns. However, if your diet is healthy in other ways then I believe it is safe to consume fats (including saturated fats but excluding manufactured fats such as trans fats) in reasonably modest amounts.

Footnotes

- 1 . References are given in for example, ‘The True You Diet’ by Dr John Briffa.
- 2 . Though some studies do reveal a correlation between saturated fat intake and levels of cardiovascular disease, the relationship is arguably not causal. John Briffa (‘The True You Diet’) discusses the evidence.
- 3 . See ‘Ultrametabolism’ by Mark Hyman, M.D. (p133) for a fuller discussion.
- 4 . Books exploring the concept of metabolic typing include ‘The Nutrition Solution’ by Harold Krystal, ‘The Metabolic Typing Diet’ by William Wolcott, and ‘The True You Diet’ by John Briffa.
- 5 . Source: ‘Nutrition in Clinical Practice’ by David L Katz.
- 6 . Patrick Holford, ‘New Optimum Nutrition Bible’ p45.
- 7 . See ‘The Metabolic Typing Diet’ by William Wolcott.
- 8 . For more information go to www.mercola.com and search for ‘krill oil’.