Harvard School of Public Health

The Nutrition Source

*Fats and Cholesterol: Out with the Bad, In with the*

*Good*

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Introduction

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"Eat a low-fat, low-cholesterol diet" has been the mantra for healthful eating for decades. Touted

as a way to lose weight and prevent or control heart disease and other chronic conditions, millions of people have followed (or, more likely, have *tried* to follow) this advice. Seeing a tremendous marketing opportunity, food companies re-engineered thousands of foods to be lower in fat or fat free. The low-fat approach to eating may have made a difference for the occasional individual,

but as a nation it hasn't helped us control weight or become healthier. In the 1960s, fats and oils supplied Americans with about 45 percent of their calories; Q) about 13 percent ofus were obese and under 1 percent had type 2 diabetes, a serious weight-related condition. (2. 3) Today, Americans take in less fat, getting about 33 percent of calories from fats and oils; Q) yet 34 percent of use obese and 8 percent have diabetes, most with type 2 diabetes.)

Why hasn't cutting fat from the diet paid off as expected? Detailed research-much of it done at Harvard-shows that the *total* amount of fat in the diet isn't really linked with weight or disease. (9.:9) What really matters is the *type qffat* in the diet. Bad fats, meaning trans and saturated fats, increase the risk for certain diseases. Good fats, meaning monounsaturated and polyunsaturated fats, do just the opposite. They are good for the heart and most other parts of the body.

What about cholesterol in food? For most people, the mix of fats in the diet influences cholesterol in the bloodstream far more than cholesterol in food does.

From Food to the Bloodstream

Almost all foods contain some fat. Even quintessential fat-free foods like carrots and lettuce contain small amounts of this nutrient. That's a testament to how important fats are for life. Fat provides a terrific source of energy as well as a great depot for storing it. It is an important part of cell membranes, helping govern what gets into cells and what comes out. The body uses cholesterol as the starting point to make estrogen, testosterone, vitamin D, and other vital compounds. Fats are also biologically active molecules that can influence how muscles respond

to insulin's "open up for sugar" si!,TTial; different types of fats can also frre up or cool down inflammation.

Fat and cholesterol can't dissolve in water or blood. The body gets around this basic chemistry problem by packaging fat and cholesterol into tiny, protein-covered particles called lipoproteins. Although lipoproteins can carry quite a bit of fat, they mix easily with blood and flow with it. Some of these particles are big and fluffy, others small and dense. The most important ones are low-density lipoproteins, high-density lipoproteins, and triglycerides.

Q. \Vhat can I do to lower my total cholesterol and LDL?

A. Several strategies can help you lower the amounts of total and harmful LDL cholesterol in your bloodstream, and thus your risk of heart disease. (Read more)

• Low-density lipoproteins (LDL) cany cholesterol from the liver to the rest of the body. Cells latch onto these particles and extract fat and cholesterol from them. When there is too much LDL cholesterol in the blood, these particles can form deposits in the walls of the coronary arteries and other arteries throughout the body. Such deposits, called plaque, can narrow arteries and limit blood flow. When plaque breaks apart, it can cause a heart attack or stroke. Because of this, LDL cholesterol is often referred to as bad, or harmful, cholesterol.

• High-density lipoproteins (HDL) scavenge cholesterol from the bloodstream, from LDL, and

from artery walls and feny it back to the liver for disposal. Think ofHDL as the garbage trucks of the bloodstream. HDL cholesterol is often referred to as good, or protective, cholesterol.

• Triglycerides make up most of the fat that you eat and that travels through the bloodstream.

As the body's main vehicle for transporting fats to cells, triglycerides are important for good health. But as is the case for so many things, an excess oftriglycerides can be unhealthy.

In general, the lower your LDL and the higher your HDL, the better your chances of preventing heart disease and other chronic conditions. Guidelines from the National Cholesterol Education Program suggest specific targets.

Diet and Cholesterol: How Fat and Cholesterol in Food

Affect Blood Levels

The types of fat in the diet determine to a large extent the amount of total and LDL cholesterol in the bloodstream. Cholesterol in food matters, too, but not nearly as much.

What Type of Fat ls It' ? This table shows the percentage of saturated, monounsaturated, polyunsaturated, and trans fat in common oils and cooking fats.

The Best Diet is the One Youtll Follow: The POUNDS LOST trial found that people can lose weight on any diet- whether it is high in fat or low in fat- as long as they stick to a lower-calorie eating plan.

Good Fats: Unsaturated Fats

Unsaturated fats are called good fats because they can in1prove blood cholesterol levels, ease inflammation, stabilize heart rhythms, and play a number of other beneficial roles. Unsaturated fats are predominantly found in foods from plants, such as vegetable oils, nuts, and seeds. They are liquids at room temperature.

There are two types of unsaturated fats:

• Monounsaturated fats are found in high concentrations in canola, peanut, and olive oils; avocados; nuts such as ahnonds, hazelnuts, and pecans; and seeds such as pumpkin and sesame seeds. .

• Polyunsaturated fats are found in high concentrations in sunflower, corn, soybean, and flaxseed oils, and also in foods such as walnuts, flax seeds, and fish. OJnega-3 fats, which are fast becoming the darling of the supplement industry, are an important type of polyunsaturated fat. The body can't make these, so they must come from food. An excellent way to get omega-

3 fats is by eating fish two or three times a week. Good plant sources of omega-3 fats include

chia seeds (sold as Salvia), flax seeds, walnuts, and oils such as flaxseed, canola, and soybean.

Dutch researchers conducted an analysis of 60 trials that examined the effects of carbohydrates and various fats on blood lipid levels. In trials in which polyunsaturated and monounsaturated fats were eaten in place of carbohydrates, these good fats decreased levels of harmful LDL and increased protective HDL. (10) More recently, a randomized triallrnown as the Optimal Macronutrient Intake Trial for Heart Health (OmniHeart) showed that replacing a carbohydrate­ rich diet with one rich in unsaturated fat, predominantly monounsaturated fats, lowers blood pressure, improves lipid levels, and reduces the estimated cardiovascular risk. (!1)

Most oeoole don't 1!et enough of these healthful unsaturated fats each day. No

For years, margarine was promoted as a heart-healthy alternative to butter. Since margarine was made from unsaturated vegetable oils, most people assumed it would be better for long-term health than butter, which was known to contain a lot of cholesterol and saturated fat. That

assumption turned out to be wrong. Research showed that some forms of margarine­ specifically the hard stick margarines-were *worse* for the heart than butter. This was because they contained large amounts of trans fats from partially hydrogenated oils.

1ublished regarding their intake. Prudent targets ies from monounsaturated fats and 8 to 10 yunsaturated fats. Since no one eats by percentage of thumb is to choose unsaturated fats over

:d, so we don't need to eat any of it. That's why e we don't need to eat any of it, and it has

the United States and other developed countries, poultry with skin, and whole-milk dairy products

: are also high in saturated fats, including coconut

TI1.e Nurses' Health Study found that women aturated fats boost total cholesterol by elevating who ate 4 teaspoons of stick margarine a day .Iso raises the protective HDL. Unsaturated fat is had a 50 percent greater risk of heart disease rol and raises the good.

than women who ate n1.argarine only rarely.

(21. ) 1take of saturated fats as low as possible.

vegetable oils that are mainly unsaturated fats, so

So should you choose butter over margarine? Whenever possible, skip both and use a liquid vegetable oiL At the table, try dipping bread in olive oil instead of slathering it with butter or margarine. When

sauteing, try using olive, canola, or another

!rcent of total calories or lower is a good target. saturated fat in our diets, so keeping these low is

liquid vegetable oil, with a little bit of butter Lonly called trans fats, are made by heating liquid

for flavor. If you need something spreadable, of hydrogen gas, a process called hydrogenation.

choose a soft margarine that is not only trans able oils makes them more stable and less likely

free but low in saturated fat. A number of soft margarines are made from a blend of healthful oils, and some have the added benefit of containing cholesterol-lowering plant sterols. Keep in mind that you need to eat two servings ofthese sterol-containing margarines a day to put a small dent in your LDL leveL

Read more about how to spot trans fat on food labels.

il into a solid, which makes transportation easier.

:peated heating without breaking down, making Lating a vegetable oil creates a fat that acts like a genated oils have been a mainstay in restaurants

Most of the trans fats in the American diet come from commercially prepared baked goods, margarines, snack foods, and processed foods, along with French fries and other fried foods prepared in restaurants and fast food franchises.

Trans fats are worse for cholesterol levels than saturated fats because they raise bad LDL and lower good HDL. They also fire inflammation, 01.) an overactivity of the immune system that has been implicated in heart disease, stroke, diabetes, and other chronic conditions. Even small amounts of trans fat in the diet can have harmful health effects. For every extra 2 percent of calories from trans fat daily- about the amount in a medium order of fast-food French fries- the risk of coronary heart disease increases by 23 percent. Eliminating trans fats from the U.S. food supply could prevent between 6 and 19 percent of heart attacks and related deaths, or more than

200,000 each year. (13)

The average American eats about six grams of trans fats a day. Ideally that should be under two grams a day, or zero if possible. A new labeling law that forces food companies to list trans fats

on the label should help curb the consumption of these harmful fats. Not only can consumers now see which products contain trans fats- something that wasn't easily done in the past-but many food makers are now trying to claim the high ground by using trans-free oils and fats in their products.

As trans fat intake dwindles in developed countries, it is on the rise in developing nations. Inexpensive partially hydrogenated soybean oil has become a staple not only for the food industry but for home use. This shift away from traditional cooking oils and toward trans-rich partially hydrogenated oils is contributing to the slowly growing epidemic of cardiovascular disease in developing nations around the world

**Cholesterol in Food**

The discovery half a century ago that high blood cholesterol levels were strongly associated with an increased risk for heart disease triggered numerous warnings to avoid foods that contain cholesterol, especially eggs, liver, shrimp, and lobster. That advice was something of a red herring; for

example eating shrimp and lobster doesn't raise LDL cholesterol. Also, most people make more cholesterol than they absorb from their food. A body of scientific studies shows only a weak relationship between the amount of cholesterol a person consumes and his or her blood cholesterol levels (.1.1) (weak but important for heart disease). In studies of more than 80,000 female nurses, Harvard researchers found that consuming about an egg a day was not associated

with higher risk of heart disease (too few women in the study were eating more than an egg a day to evaluate the effects of higher egg intakes). (15, 16) One note of caution: Among women in this study with diabetes and in another study of men with diabetes, higher egg consumption has been associated with increased risks of heart disease.

Research suggests that moderate egg consumption can be part of a healthy diet. But this research doesn't give the green light to daily three-egg omelets, especially for people who already have heart disease or diabetes. Read more about e is and heart health.

For most people, the amount of cholesterol eaten has only a modest impact on the amount of cholesterol circulating in the blood. (17) For some people, though, blood cholesterol levels rise and fall very strongly in relation to the amount of cholesterol eaten. For these "responders," avoiding cholesterol-rich foods can have a substantial effect on blood cholesterol levels. Unfortunately, at this point there is no way other than by trial and error to identifY responders from non-responders to dietary cholesterol.

Dietary Fats and Heart Disease: Beyond the "30 Percent" Recommendation

For years, the party line from the American Heart Ass?ciation, National Institutes of Health, World Health Organization, and others was to reduce dietary fat. They generally called for limiting fat intake to under 30 percent of daily calories. One problem with a generic lower fat diet is that it prompts most people to stop eating fats that are good for the heart along with those that

are bad for it. In place of fats, many people tum to foods full of easily digested carbohydrates, or to fat-free products that replace healthful fats with sugar and refmed carbohydrates.

There wasn't much evidence to support the notion of low-fat diets in the beginning. (1.8\_) There is even less now. Numerous reports over the years have questioned the wisdom of recommending low.:.fat diets for preventing or retarding heart disease. A big nail in the coffm came from the Women's Health Initiative Dietary Modification Trial, published in the February 8, 2006, *Journal*

*of the American Medical Association.* (\_B.) This eight-year trial, which included almost 49,000 women, found virtually identical rates of heart attack, stroke, and other forms of cardiovascular

disease in women who followed a low-fat diet and in those women who didn't. What's more,

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women on the low-fat diet didn't lose-or gain-any more weight than women who followed

their usual diets. (1)

This randomized trial supports prior rmdings from the Nurses' Health Study (l 9) and the Health Professionals Follow-up Study. (19) In both of these, no link was seen between the overall percentage of calories from fat and any important health outcome, including cancer, heart disease, and weight gain.

What was important in these studies was the *type* of fat in the diet. (20) Ounce for ounce, trans fats are far worse than saturated fats when it comes to heart disease. In the Nurses' Health Study, replacing just 30 calories of carbohydrates (7 grams) every day with 30 calories of trans fats (4 grams) nearly doubled the risk for heart disease. (£1) Saturated fats increased the risk as well, but not nearly as much.

For good fats, there is consistent evidence that higher intake of either monounsaturated or polyunsaturated fat (especially the latter) lowers the risk for heart disease. In the Nurses' Health Study, replacing 80 calories of carbohydrates with 80 calories of either polyunsaturated or monounsaturated fats lowered the risk for heart disease by about 30 to 40 percent. (20)

**Dietary Fats and Cancer**

Heart disease is not the only condition that has been linked with fat intake. Researchers once suspected an association between dietary fat and certain cancers. Here again, in adults, the percentage of calories from total fat consumed appears to have no important relation to risk, and no clear evidence has linked any specific type of fat with cancer incidence.

**Breast Cancer**

By the early 1980s, most nutrition experts believed that dietary fat was a major cause of breast cancer. (22, 23) This thinking was largely based on international comparisons showing higher breast cancer rates in countries with higher per capita fat intake. But such comparisons are very broad in nature. As more detailed studies were performed over the next couple of decades, the apparent link between total fat intake and breast cancer has faded. (24) The Women's Health Initiative Dietary Modification Trial, which was specifically designed to examine the effect of a low-fat diet on the development of breast cancer, showed similar rates of breast cancer in women

eating a low-fat diet and in those eating a "regular" diet. CD One recent study from the National Institutes of Health-AARP Diet and Health Study, (25) found a very weak positive association between fat and postmenopausal breast cancer, but when combined with the many other studies detailed above, the overall evidence does not support a relationship between total fat intake and breast cancer.

Although studies- including those by Harvard researchers- of different types of fat have largely failed to fmd a link with breast cancer, some evidence suggests that animal fat intake may be linked to higher risk of breast cancer. In the Nurse's Health Study II, premenopausal women who ate diets high in animal fat had a 40 to 50 percent higher risk ofbreast cancer, compared to women who ate the least animal fat. (26) Because vegetable fat was not related to risk of breast

cancer, these findings suggest that red meat and high-fat dairy products may contain other factors, such as hormones, that increase risk of breast cancer. Some European studies have reported suggestive fmdings of lower breast cancer risk among women with a high intake of monounsaturated fats (mainly in the form of olive oil). (27, 28)

**Colon Cancer**

As with breast cancer, international comparisons initially suggested an association between total dietary fat intake and colon cancer risk. But later studies contradicted these earlier fmdings and revealed instead an association that was weak at best. As was the case with breast cancer, women in the Women's Health Initiative Dietary Modification Trial who ate a low-fat diet developed colon cancer at the same rate as women who didn't. (Q) Although fat intake doesn't seem to increase colon cancer risk, there is convincing evidence that high consumption of red meat (beef, pork, and lamb) and processed meat (hot dogs, bacon, and deli meats) does increase colon cancer risk. (29) It's best to limit red meat consumption to no more than 18 ounces per week, and to avoid processed meats.

**Prostate Cancer**

Although the exact connection between dietary fat and prostate cancer is far from clear, there is some evidence that diets high in animal fat and saturated fat increase prostate cancer risk. However, some studies have also shown no association, while others have implicated unsaturated fats. Clearly much more research is needed to clear up the exact links between dietary fat and prostate cancer.

**Other Cancers**

Preliminary research has also linked the intake of certain kinds fat with other cancers, though much more research is needed to confirm these results. In the Nurses' Health Study, Harvard researchers found that a high intake of trans fats was associated with risk for non-Hodgkin's lymphoma.

Dietary Fat and Other Chronic Conditions

Although cardiovascular disease and cancer have received the lion's share of researchers' attention, there is a small but growing body of work on the effects of dietary fats on conditions such as osteoporosis, (30) age-related memory loss, (11) macular degeneration, (32) multiple

sclerosis, G?J) infertility, (34) and other chronic conditions. These fmdings, which are still early,

do not provide any evidence to modify recommendations based on the prevention of cardiovascular disease.

Dietary Fat and Obesity

It is a common belief that the more fat you eat, the more weight and body fat you gain. This belief has been bolstered by much of the nutrition advice given to people over the past few decades, which has focused on lowering total fat intake while increasing carbohydrate intake. But the

notion that food fat equals body fat isn't completely true, and the advice has been misguided. For example, while Americans have gradually decreased the proportion of calories they get from fat over the past few decades, rates of obesity have increased steeply. (l)

Over the short term, following a low-fat diet does lead to weight loss. But so does following a high-fat, low-carbohydrate diet. Or a high-protein, low-carbohydrate diet. Actually, almost *any* diet that helps you take in fewer calories works over the short term. In other words, for most people low-fat diets offer no apparent advantages over diets with fat levels close to the national average. This was demonstrated in the Women's Health Initiative Dietary Modification Trial. Women in this trial who were assigned to a low-fat diet did not lose, or gain, more weight than women eating a "usual" diet. (1) More recently, POUNDS LOST (Preventing Overweight Using Novel Dietary Strategies), a two-year head-to-head trial comparing different weight loss strategies found that lower-fat diets (20 percent of calories from fat) were no more effective than higher-fat diets (40 percent of calories from fat) in the long run. (35) (Read more about the POUNDS LOST diet study.)

Although more research is needed, a prudent recommendation for losing weight or maintaining a healthy weight is to be mindful of the amount of food you eat in relation to the amount of calories you burn in a day. A moderate intake of fats, with an emphasis on healthful unsaturated fats, fits

in fine with a weight-loss or weight-maintaining diet.

The Bottom Line: Recommendations for Fat Intake

Avocado is a great source of healthy unsaturated fats. Try this recipe for

 ruacamole from The Culinary Institute of

America.

Although the different types of fat have a varied-and admittedly confusing- effect on health and disease, the basic message is simple: Out with the bad, in with the good. As you limit the amount of trans and saturated fats in your diet, as the American Heart Association, National Cholesterol Education Program, and others recommend, keep in mind th«t there is no good evidence that replacing saturated fat with carbohydrates will protect you against heart disease, while there is solid proof that replacing saturated fat with unsaturated fats will help.

• Try to eliminate trans fats from partially hydrogenated oils. Check food labels for trans fats;

avoid fried fast foods.

• Limit your intake of saturated fats by cutting back on red meat and full-fat dairy foods. Try replacing red meat with beans, nuts, poultry, and fish whenever possible, and switching from whole milk and other full-fat dairy foods to lower fat versions.

• In place of butter, use liquid vegetable oils rich in polyunsaturated and monounsaturated fats in cookingd at the table.

• Eat one or more good sources of omega-3 fats every day-fish, walnuts, canola or soybean oil,

ground flax seeds or flaxseed oil.