

# COCONUT

## Its role in health



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## Introduction

**T**he waving coconut palm is a symbol of the Pacific Islands.

The coconut palm and the lives of the islanders are intertwined in the Pacific. The coconut palm is considered the “tree of life” and the coconut is spoken of with great reverence because of its cultural significance, economic importance and many uses. The coconut palm is truly a remarkable plant because it provides wood, materials for shelter and handicrafts, refreshing drinks, food, animal feed and cash from copra. It has been said that there are 121 uses of the coconut palm. These uses did not include ecological functions such as shade, protection from wind, sand and salt spray, erosion and flood control, coastal reclamation, animal and plant habitat, and soil improvement. Coconut thrives in the alkaline coral sands of the atolls and the fertile volcanic soils of larger islands.

Despite the decline in the economic importance of copra, coconut remains an important part of the diet of Pacific Islanders. The green coconut — also called drinking coconut — is an important drink, useful for long sea voyages and for daily refreshment. Baked green nut was traditionally a special food for women who had just given birth. Green nuts are fermented and eaten with grilled or baked fish. In the mature form, coconut cream forms the core around which meals are planned and prepared. Nearly all foods are prepared and/or cooked in thick coconut cream. For example, a meal for a family of five can use up to six coconuts. It is used in many popular traditional dishes such as *poke*, *palusami* and *laplap*. Coconut cream is used to moisten baked dishes during cooking and to add extra flavour to the staples such as root crops and to





fresh fish. Grated mature nut is fermented and eaten with most seafood. Even today, despite dramatic changes in the diets of many Pacific Islanders, coconut products are still eaten almost daily and are always eaten at family and community feasts.

coconut products and their possible negative effects on health. There is still a great deal of confusion and misinformation about the role of coconut products in health. To help Pacific Islanders better understand the relationship between the consumption of coconut products and heart disease, SPC's Lifestyle Health Section and Agriculture Programme have collaborated with the University of the South Pacific (USP) and one of the well-known nutritionists in the region to produce this publication on the health and nutritional aspects of coconut. However, this publication is not intended to be the definitive guide because there remain areas of controversy. Research is ongoing and will continue to inform this debate.

With changing lifestyles and growing concerns about obesity and heart disease, many Pacific Islanders are becoming more aware of their lifestyle and how it may affect their health. Over recent decades, a clearer understanding of the role of nutrition in obesity and heart disease has developed. This has, in turn, triggered concerns about

This publication includes nutritional information on coconut products. As the main concerns around coconut and health are linked to its fat content and its potential role in heart disease, there is a focus on these issues. Other health implications of coconut will also be presented. A glossary of technical terms used in this publication is included.



Green coconut

# Coconut products

**F**or the purposes of this publication, it is important to clarify the terms used for different coconut products.

**Green/immature coconut** — also called *drinking coconut*. This is the young nut, which contains large amounts of a clear liquid (called *coconut juice* or *water*) that is used as a refreshing drink. Some green coconuts contain small amounts of a jelly-like white flesh on the inner surface of the nut (called *immature flesh*) that is often scooped out and eaten after the juice has been drunk.

**Mature coconut** — the older coconut, which is no longer green. The coconut, once cracked, will reveal a small amount of a clear liquid (the remains of the coconut juice) and a thick layer of a firm white flesh (*mature flesh, meat or copra*). This flesh can be eaten as a snack. It is commonly grated and then squeezed to extract a white, cloudy liquid (*coconut cream*), which is used in cooking. The addition of water to the grated coconut prior to squeezing, or to the coconut cream before use, will produce *coconut milk*, which is also used for cooking. The amount of water used to make the coconut milk



Young and mature nuts

will obviously vary widely and affect its final nutrient content.

**Coconut toddy** — made by binding and cutting a newly formed coconut bud. This also stops the growth of coconuts. It can be used fresh as a sweet drink, or boiled down to make syrup. If allowed to ferment, it can be used to make an alcoholic drink, vinegar or a yeast for making bread.

**Sprouted coconut** — when a coconut begins to germinate, small, firm, white flesh can be found inside the nut (often called *germinating coconut* or *endosperm*). This can be eaten raw in salads or as a snack.

**Heart of the palm** — this is taken from the tree itself, and can be cooked and used as a vegetable or salad. Unfortunately, removing the heart of the palm will generally kill the tree and so is not often used.

**Fermented coconut** — either the coconut meat or the coconut juice can be fermented; both are then commonly used for flavouring sauces for seafood.



Coconut toddy

# Nutritional content of coconut products

The nutrients in coconut change significantly as it matures. It is useful, therefore, to review the composition of some of the different coconut products before moving on to the possible effects of coconut on health.

Data for some nutrients for these various stages are given in Table 1.

As can be seen, the most significant nutrient in fresh coconut water is sugar and in mature coconut it is fat. Minerals are present only in small amounts with the exception of iron. (A person's daily requirement of iron is about 9–28 mg.) However, absorption of the type of iron found in coconut (non-haem) is low compared with absorption from animal sources. Potassium content is relatively low compared with requirements. (A person's daily requirement is about 2–4 g or 2000–4000 mg.) The vitamin content of



**Table 1. Nutrient content of a variety of coconut foods (per 100 gram edible portion)**

	<b>Water (immature)</b>	<b>Flesh (immature)</b>	<b>Water (mature)</b>	<b>Flesh (mature)</b>	<b>Cream</b>	<b>Fresh toddy</b>	<b>Sprouted</b>
<b>Energy (kcal)</b>	16	77	22	389	326	43	75
<b>Moisture (g)</b>	97.0	84	92	50	54	86	84
<b>Protein (g)</b>	NA	1.4	0.3	3.5	4.4	0.3	1.3
<b>Fat (g)</b>	NA	3.6	0.2	39	32.3	0.4	3.6
<b>Sugars (g)</b>	4.1	10	5	4	5	10	9
<b>Dietary Fibre (g)</b>	0	0.7	0	7.5	1.7	Trace	1.8
<b>Potassium (mg)</b>	NA	257	310	360	280	109	NA
<b>Iron (mg)</b>	NA	1	1.1	1.1	1.8	Trace	0.7
<b>Vitamin C (mg)</b>	NA	6	2	2	1	28.7	6

NA = not analysed

**Table 2. Content of nutrients in an average-sized coconut**

	<b>Water (immature)</b>	<b>Flesh (immature)</b>	<b>Water (mature)</b>	<b>Flesh (mature)</b>
<b>Average-sized coconut weight (g)</b>	400	100	300	500
<b>Energy (kcal)</b>	64	77	66	1945
<b>Moisture (g)</b>	388	84	276	250
<b>Protein (g)</b>	NA	1.4	0.9	17.5
<b>Fat (g)</b>	NA	3.6	0.6	195
<b>Sugars (g)</b>	16.4	10	15	20
<b>Dietary fibre (g)</b>	0	0.7	0	37.5
<b>Potassium (mg)</b>	NA	257	930	1800
<b>Iron (mg)</b>	NA	1	3.3	5.5
<b>Vitamin C (mg)</b>	NA	6	6	10

NA = not analysed

coconut foods is generally low compared with other foods. A fruit such as guava, for example, will have 100 times the vitamin C of the flesh of a ripe coconut. Fresh or fermented toddy can be a useful source of vitamin C if a number of coconuts or large quantity are drunk each day. (A person's daily requirement is about 30 mg.)

The data given in Table 1 are for a standard edible portion of 100 g. The total nutrients contained in a given coconut depend, of course, on the size of the coconut. Some average values have been determined and are given in Table 2.

Thus, an average drinking coconut can provide around 16 g of sugars and 64 kcal/272 kJoules. Around half of these sugars are fructose (the type of sugar commonly found in fruit), the remainder are glucose and sucrose. Fructose does not increase blood sugar/glucose levels in diabetics as much as sucrose and glucose. It is also slightly less likely to cause dental decay (than sucrose or glucose). The flesh of an average mature coconut contains 17.5 g protein, 195 g fat, 20 g sugars, 37.5 g dietary fibre, and would provide more than 1900 kcals (more than 8000 kJoules) energy.





## Links between fats and health



### *Fats – essential nutrients*

Fats often have a bad image and are considered to be unhealthy and unnecessary. This is far from the truth. Fats are essential to health. Fats provide vital energy, which we need to grow and stay healthy. Children, especially, need sufficient fat in their diets for them to get enough energy to grow well. The building blocks of fats — fatty acids — are important parts of all cell walls. Fats are the carriers of certain fat-soluble vitamins; without some fat in the diet, these vitamins cannot be absorbed.

**T**he concerns about high intakes of coconut and negative effects on health are related to the high fat content of mature coconut (as mature flesh, cream and milk). In this section we will look first at some background information on fats — their types and role in health — and then move on to look more specifically at possible links between coconut fats and health.

### *Fats and the risk of diseases*

The problems with eating fat (and foods containing fat) arise when people eat too much. Like so many things in life, moderation is important — excess causes the problem. Fat intake has been linked to many different diseases including heart disease. The probable links between fats and heart disease are highlighted in the following section.

## Differences between fats and oils

Some definitions:

- ⊙ **lipids** — includes all fats and oils;
- ⊙ **fats** — lipids that are usually solid at room temperature (about 20°C), and generally contain more saturated fats;
- ⊙ **oils** — lipids that are usually liquid at room temperature and they generally contain less saturated fats and more unsaturated fats.

The terms fats and oils are used interchangeably in this publication.

We find fat not just in obvious foods such as oil and margarine, but also hidden in foods such as meat, milk, fish, coconut and many processed foods.

# Heart disease

**T**here is strong evidence of links between heart disease and fat intake and, therefore, it is important to explore the role of fats in heart disease and links with coconut. There are many risk factors involved in heart disease and it is important not to place sole emphasis on just one or two.

Heart disease affects the heart and the heart's blood vessels. Heart disease occurs when the heart muscle does not get enough blood. This happens mostly when a clot of blood blocks a narrowed blood vessel. Blood vessels become narrowed

when there is a fatty build-up on the inside surface of the vessel. This condition is called atherosclerosis.

Research is continuing to identify more possible protective and harmful risk factors. The more risk factors that you have, the higher your risk of developing heart disease. Reducing the number of risk factors a person has will lower his or her risk of developing heart disease.

Risk factors include genetic risk, inactivity, overweight, smoking, diabetes mellitus, high alcohol intake, hypertension and high blood lipids.

## Some risk factors for heart disease

### **Dietary fibre**

Eating a diet rich in fibre has been shown to reduce the risk of heart disease. High-fibre foods are of more benefit than foods with fibre-supplements (e.g. bran cereals).

### **Alcohol**

Evidence suggests that drinking one to two alcohol units per day can reduce the risk of heart disease (see Glossary for definition of a unit). It is unclear how this works, although all types of alcoholic drinks seem to be effective. Drinking larger amounts increases the risk.

### **Antioxidants and heart-disease risk**

Eating a diet rich in antioxidants also reduces risk. Naturally occurring antioxidants found in fruits and vegetables seem to be more protective than supplements. This would suggest that fruits and vegetables contain substances other than the identified antioxidants that can reduce the risk of heart disease.

### **Overweight and obesity**

Being overweight increases the risk of heart disease by affecting a number of risks, one of which is blood fat levels. The more overweight people are, the more body fat they have and greater the risk of heart disease.

### **Physical activity**

Regular physical activity reduces the risk of heart disease.

### **Smoking**

Smoking greatly increases the risk of heart disease through a number of different mechanisms including increased blood pressure.

### **Diabetes**

Diabetics are two to four times more likely to have heart disease than non-diabetics. Improving blood sugar control can reduce this risk.

### **Hypertension**

High blood pressure increases the risk of heart disease. Controlling blood pressure levels can reduce the risk.

### Blood lipids

One of the most widely known types of blood lipid is cholesterol. Cholesterol is an essential substance used to maintain the structure of all body cells. Our bodies produce cholesterol from fats that we eat. It seems that this cholesterol can be involved in the build-up of fatty deposits in the blood vessels when levels in the body (and thus in the blood) are too high.

Some people produce too much cholesterol and this causes an increase in levels of cholesterol in the blood. These individuals can often slow down the rate at which their body makes this cholesterol by altering their diet and lifestyle.

Within the blood, cholesterol travels in a number of forms — LDL (low-density lipoproteins); HDL (high-density lipoproteins); and VLDL (very-low-density lipoproteins).

- ⊙ High levels of LDL and VLDL (“bad” cholesterol) are associated with an increased risk of heart disease.
- ⊙ High levels of HDL (“good” cholesterol), however, have been shown to reduce risk as they are protective.
- ⊙ Another type of fat found in the blood, triglyceride (TG), is also associated with an increased risk.

Generally, advice aimed at reducing the risk of heart disease focuses on altering the levels of these fats in the blood, in particular reducing the LDL:HDL ratio.

### Blood fats and risk of coronary heart disease

	Blood levels	Risk of CHD
TC	↑	↑
LDL	↑	↑
VLDL	↑	↑
TG	↑	↑
HDL	↑	↓
Ratio LDL:HDL	↑	↑



### Total fat intake and risk

The link between the total amount of fat in our diets and the risks of developing heart disease has been known for many years. Eating less fat can reduce the levels of the “bad” cholesterol. Eating less fat and more starchy carbohydrates can, however, also lower levels of the “good” cholesterol. Reducing the amount of fat to moderate levels only (rather than lower levels), while also changing the types of fat (from saturated to unsaturated) has three advantages: it does not lower the “good” cholesterol; it still lowers the “bad” cholesterol; and it also lowers TG levels. There is a large variation in individual response to changes in fat intake (on blood lipid levels), so some people may see more of an improvement in their blood lipid levels than others.

### Types of fat and relation with blood lipids

As blood lipid levels affect the risk of developing heart disease, we need to look at what parts of the diet can alter these blood lipid levels (and so affect risk of heart disease).



## TYPES OF FAT

Fats are made of building blocks called fatty acids. There are two basic types of fatty acid: *saturated* and *unsaturated*. Nearly all food — including margarine, butter and oils — contain a mixture of fatty acids. One type is often present in higher amounts, and so that food is said to be “high” in saturated or unsaturated fat.

**Saturated fatty acids:** These are the main fatty acids in animal-based foods such as meat, milk, cheese and eggs. There are some other foods, which are also very rich in saturated fats such as coconut and palm oil. Generally, the more saturated fatty acids that are present, the more likely the fat is to be solid at room temperature — for example, butter.

**Unsaturated fatty acids:** There are two types — polyunsaturated (PUFAs) and monounsaturated (MUFAs). They predominate in foods of fish and vegetable origin — for example, fish, corn oil, olive oil, avocados, nuts and seeds. Olives, nuts and fish are particularly high in the monounsaturated fats.

The food industry, in an attempt to produce a butter-like spread using oils (that are usually liquids), developed something called “hydrogenated oils”. These are unsaturated fats that have been chemically altered to be solid at room temperature. As a result of this process, substances called *trans-fatty acids* were produced and are present in many foods that contain hydrogenated fats. Manufacturers use these fats in products such as margarine, baked goods, biscuits, cakes and ice creams.

### Saturated fatty acids

Lauric, myristic and palmitic acids contribute 60–70% of saturated fat in Western-style diets (they are also the three main fatty acids in coconut). Coconut oil contains the following fatty acids: caprylic (5–9%), capric (6–10%), lauric (44–52%), myristic (13–19%), palmitic (8–11%), and stearic (1–3%). It also contains 6–8% unsaturated acids fatty acids.

### The main saturated fatty acids

Saturated fatty acids	Number of carbons
Acetic	2
Butyric	4
Caproic	6
Caprylic	8
Capric	10
Lauric	12
Myristic	14
Palmitic	16
Stearic	18

Fatty acids contain a central chain of carbon atoms.

Researchers agree that individual saturated fatty acids have different effects on blood cholesterol.

- ☉ Capric and caprylic acids have no effect on blood cholesterol.
- ☉ Myristic acid has the greatest effect on blood cholesterol as it increases “good” and “bad” cholesterol. Myristic acid accounts for about 10% of the fatty acids in milk, and 19% of the fat in coconut.
- ☉ Stearic acid (found in meat) probably does not affect blood cholesterol.
- ☉ Palmitic and lauric acids probably have a small effect on blood cholesterol.

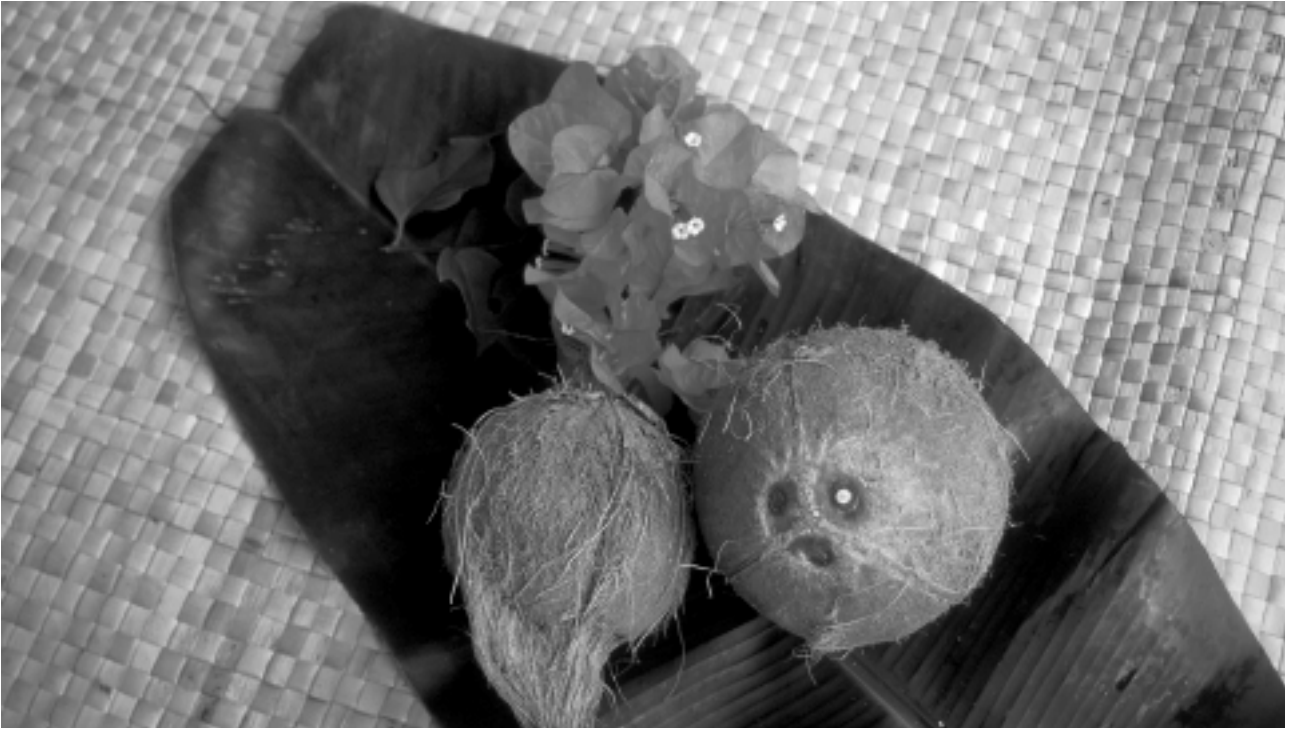
Overall, as most foods contain a mixture of fatty acids, assessing the effect of the different saturated fatty acids is difficult. However, limiting foods high in saturated fatty acids is generally considered to reduce the risk of heart disease.

### Monounsaturated fatty acids

When saturated fatty acids are replaced in the diet with monounsaturated fatty acids, the levels of “bad” cholesterol are reduced, but there is no decrease in the “good” cholesterol. There is also no increase in TG, hence overall risk of heart disease would be reduced.

Evidence suggests that in a diet where some or





most of the fat has been replaced by monounsaturated fatty acids, heart-disease risk is reduced.

### ***Polyunsaturated fatty acids***

There are two main types of PUFAs — omega-6 and omega-3. (These numbers refer to whether the first unsaturated bond in a fatty acid molecule is at the third or the sixth carbon from the end.)

Omega-6 fatty acids are found in high levels in canola and sunflower oils, and have been shown to reduce the levels of “bad” cholesterol and possibly of “good” cholesterol too (i.e. generally a reduction in the risk of heart disease).

Omega-3 fatty acids are found mostly in fish and soya. The vegetable omega-3 fatty acids reduce the levels of “bad” cholesterol. The fish omega-3 fatty acids increase the levels of “good” cholesterol and reduce the level of TG. They also reduce the risk of heart attacks by reducing inflammation and other associated problems. The many benefits of the fish oils in lowering risk has resulted in recommendations to regularly eat fish. Unfortunately, these types of fats are found at fairly low levels in Pacific fish; they are found in higher levels in non-tropical fish such as salmon and mackerel. Replacing saturated fatty acids with omega-3 PUFAs would reduce the risk of heart disease.

### ***Trans-fatty acids***

Trans-fatty acids are another category of fats that have been shown to have a strong influence on the risk of heart disease. Trans-fatty acids are particularly high risk as they increase the “bad” cholesterol but lower the “good” cholesterol.

### ***Cholesterol in foods***

While it would seem likely that eating any foods that contain cholesterol would cause an increase in blood cholesterol levels, the link is not quite so clear-cut. Generally, eating cholesterol-rich foods has very little effect on blood cholesterol levels; it is the intake of saturated fats that is more important. Some people are more sensitive to cholesterol in their foods than others, and so may need to limit these foods in their diet. Only a small number of foods contain cholesterol (e.g. eggs, shellfish, liver).

### ***Other links between fatty acids and risk for heart disease***

In some studies, diets high in polyunsaturated fats have been found to increase the risk of oxidation (see Glossary). The lowest levels of oxidation were found with diets high in saturated or monounsaturated fatty acids.

# Links between fats and other diseases

## Diabetes

No evidence has been found of direct links between fat intake and the risk of developing diabetes. High-fat and unbalanced diets, in conjunction with unhealthy lifestyles and obesity, have been shown to increase risk. Some limited evidence suggests that high intakes of saturated fats may increase the risks, but this issue is still not clear at this time.

## Hypertension

No association has been found between intake of fats and risk of developing high blood pressure.

## Obesity

The fat content of the diet itself does not cause obesity. However, as fat is a more concentrated source of energy than other nutrients, it is likely that high fat diets are energy-rich, and so can encourage unwanted weight gain. Obesity is a risk factor for heart disease, gout, diabetes, hypertension and stroke. All fatty acids contain the same amount of energy/calories; therefore, if weight loss is an objective, there is no difference between saturated or unsaturated fats.

## Cancer

High fat diets have been linked to increased risks of developing prostate cancer and less convincingly with breast and colon cancer.

## Overall recommendations are:

- ⊙ reductions in fat intake where intake is higher than recommended;
- ⊙ reductions in saturated and trans-fatty acids;
- ⊙ some increase in monounsaturated and polyunsaturated (especially fish-based) fatty acids (as partial replacement for saturated and trans-fatty acids).



In terms of foods, this might involve eating less fatty meats, full-fat dairy foods, processed foods and margarines high in trans-fatty acids and more fish. Replacing some of the saturated cooking fats (e.g. lard, shortening, butter) with monounsaturated or polyunsaturated oils (e.g. nut and olive oils) is also recommended.

Saturated fatty acids may be found in a number of foods in the typical diet including coconut, meats, butter and cooking fats. An overall reduction in these foods would therefore be recommended. Intake of one food — for example, coconut — does not necessarily need to be changed, if the other food sources were reduced significantly.

## Coconut and heart disease — evidence

**I**n this section, we look at whether there is any evidence to suggest that coconut affects the risk of developing heart disease. Some of this evidence is based on the types of fats that it contains and some evidence is based on diets high in coconut/coconut oil.

The first type of study examines the amount of coconut eaten and the incidence of heart disease in a population (Table 3). The second type of study compares the effects of using different kinds of oils on blood lipid levels (Table 4). The third type compares the effect of eating diets rich in certain fatty acids with levels of blood cholesterol (Table 5).



These studies shown in table 3 would strongly suggest that within a traditional lifestyle — which includes many protective factors such as high physical activity levels, high fish intake, high vegetable and root crop intake, minimal use of tobacco and alcohol and low intake of salt — coconut intake is associated with no additional risk of heart disease.

**Table 3: Examples of some studies of coconut-rich diets and heart disease risk**

	Place of study	Findings
1981	<b>Pacific</b> Cooks and Tokelau islands	Tokelauans ate the most coconut and had higher blood cholesterol levels, but there were no differences in heart disease rates. Both populations showed low levels of heart disease.
1999	American Samoa and Samoa	American Samoans ate more imported foods, but overall less fat and less saturated fat, partly due to eating less coconut (coconut provided 37% of fat in Samoa, but only 15% in American Samoa). Rates of heart disease are higher in American Samoa. (Many dietary changes and lifestyle changes have also occurred, so risks cannot be directly linked to type or source of fats.)
2000	Review of previous studies in Pacific Islands	Generally, people in rural areas have lower levels of blood cholesterol than people in urban communities, although people in rural areas often consume more saturated fats (from coconut).
1997	<b>Elsewhere</b> Kerala, India	Individuals with heart disease and individuals without heart disease had similar diets and similar intakes of coconut.
2001	West Sumatra, Indonesia	Traditional diet high in coconut, also high in fish oils, vegetables and fruits. Levels of heart disease low.

**Fatty acids in coconut and effect on blood lipids**

The types of fatty acid in coconut products were detailed, and their relative risks were highlighted on page 9. The types of saturated fatty acids found in coconut (mainly lauric, myristic and palmitic) suggest that diets high in coconut would increase the risk of heart disease.

Individual study results can be conflicting due to the fact that people's responses to diet varies. For example, while eating a lot of coconut might increase the levels of "bad" cholesterol in one person, the effect in another person might be minimal.

**Table 4: Examples of some studies looking at the effects of different oils on blood lipids**

	<b>Study type</b>	<b>Results</b>	<b>Meaning</b>
<b>1985</b>	Diets rich in beef fat, coconut oil and safflower oil.	The beef fat diet did not increase blood cholesterol, but the coconut-rich diet did.	Coconut oil increases risk of heart disease.
<b>1991</b>	Compared diets rich in coconut oil and corn oil.	Corn oil reduced the LDL:HDL ratio. The coconut oil raised total cholesterol, but had no effect on LDL:HDL ratio.	Coconut oil increased risk of heart disease.
<b>1994</b>	Compared diets rich in palm oil, coconut oil, canola oil and corn oil.	Coconut increased LDL and TG levels, but also increased HDL levels. The other oils reduced LDL levels and very slightly reduced HDL levels.	Coconut increased risk of heart disease, but not as much as was expected because the "good" cholesterol level also increased.

**Table 5: Examples of some studies looking at the effects of different saturated fatty acids on blood lipid levels**

	<b>Study type</b>	<b>Results</b>	<b>Meaning</b>
<b>1992</b>	Compared synthetic lauric oil with palm oil.	Lauric did not raise blood cholesterol as much as palmitic.	The main saturated fatty acid in coconut is less likely to cause heart disease than one of the saturated fatty acids found at lower levels.
<b>1994</b>	Compared synthetic myristic with palmitic.	Myristic affected blood cholesterol the same as palmitic.	The second and third most common saturated fatty acids in coconut are equally as effective in increasing risk of heart disease.
<b>1999</b>	Compared synthetic myristic with palmitic.	Myristic affected blood cholesterol less than palmitic.	The second most common saturated fatty acids in coconut is less effective in increasing risk heart disease than the third most common saturated fatty acid (i.e. conflicts with above study).





**Table 6: Summary of relevant review papers (which reviewed previously published studies)**

	<b>Results</b>	<b>Meaning</b>
<b>1994</b>	<p>Replacing carbohydrate with lauric, myristic or palmitic raised LDL and HDL levels, but stearic had no effect.</p> <p>Palm-kernel oil and coconut oil were judged to have the worst effect on blood cholesterol.</p> <p>Myristic is the worst of the saturated fatty acids.</p>	<p>The types of saturated fatty acid most common in coconut strongly increase the risk of heart disease.</p>
<b>1999</b>	<p>Lauric, myristic and palmitic raised blood cholesterol, but stearic does not.</p>	<p>The types of saturated fatty acid most common in coconut strongly increase the risk of heart disease.</p>
<b>1999</b>	<p>The ratio of polyunsaturated to saturated fatty acids is strongly and inversely associated with heart-disease risk.</p> <p>A high intake of some of the types of saturated fatty acids was associated with a small increased heart-disease risk, although some had no effect.</p>	<p>Diets that contain more saturated fats increase the risk of heart disease.</p> <p>The types of saturated fatty acid that make up most of the fat in coconut increase the risk of heart disease.</p>

Overall, it seems that the main types of saturated fatty acid found in coconut do increase the risk of heart disease although the individual effects of different saturated fatty acids is debateable. The saturated fatty acids may cause some increase in levels of “good” cholesterol; however, overall the risk of heart disease still seems to be increased.

As can be seen from some of the information presented here, evidence remains controversial and more research is needed to clarify more precisely the role of coconut in heart disease.

A traditional lifestyle and diet that includes coconut does not seem to present a risk for heart disease. However, all aspects of the traditional lifestyle may need to be present in order to prevent or reduce the risk of developing heart disease.

The effects of different fatty acids on blood cholesterol levels seems to be partly influenced by individual susceptibility, and probably also by other components of the diet such as fibre and lifestyle.

Dietary fats are not the sole or probably even the most important determinant of blood lipid levels.

Most of the research to date has been unable to separate the effects of one saturated fatty acid from another. The potentially differing effects of natural and synthetic oils (which are slightly different chemically) in research is also of concern. The results of these studies are confusing, although overall they reinforce the evidence related to specific fatty acids.

Overall, there is strong evidence to show that the main types of saturated fatty acid found in coconut (and in most foods rich in saturates) are effective at raising blood cholesterol levels and so increase the risk of developing heart disease. The individual effects of different fatty acids needs further research.

Based on the above, we can say that high saturated fatty acid intake from a variety of foods is likely to increase the risk of heart disease in most people. To reduce the risk of heart disease, peo-

ple are advised by their medical practitioners to reduce their saturated fatty acid intake. Coconut intake as part of a traditional lifestyle appears to produce less risk than a Western lifestyle that includes high levels of saturated fatty acids (whether from coconut or other sources).

Responses of individuals to specific saturated fats are complex, and some individuals will benefit more than others from reducing saturated fat in the diet. This “individual susceptibility” is linked to genetics and also other lifestyle factors.

## Coconut and health — Other possible links

### *Coconut as a source of nutrition*

The coconut tree is often known as the “tree of life” not just for its role in food provision but also for its many other functions. In most Pacific Island traditional communities, coconut provided the main source of valuable fat in what would otherwise have been a very low fat diet (fat is an essential nutrient). In one village in Fiji it was reported that most families used one to three coconuts, three to four times per week.

The coconut was traditionally an essential source of fat in the early diets of young children. Complementary foods, which should be introduced from six months of age, need to include some fat to ensure that babies get enough energy in their diets. Even in preschool children, coconut provides a valuable source of energy in diets that are based on high-volume, low-energy foods such as root crops.

Coconut cream can also be a useful source of protein. In a study in Samoa, coconut was the fourth highest source of protein in the diet, contributing about 9% of total intake.

Fresh coconut meat and desiccated coconut also contain an appreciable amount of fibre (coconut cream contains much less). Dietary fibre has an important role to play in gut health, is thought to help control blood fat and sugar levels, and to reduce the risk of bowel cancer. Fibre-rich foods are also more satisfying (filling) than low-fibre foods and can help as part of efforts to control weight.

### *Fresh coconut water and rehydration*

Fresh green coconut water is an ideal drink to replace lost fluids as a result of heavy sweating, diarrhoea or vomiting. The small amounts of sugar and minerals in fresh coconut water help the body to absorb it more quickly than plain water. This is particularly useful when fluid needs to be replaced quickly. Research is currently looking at ways





that fresh coconut juice can be preserved so that it can be sold internationally as a sports-rehydration drink. It can also be used in place of ORS/ORT (see Glossary) packets when these are not available.

In emergencies, coconut water has also been used for short-term intravenous fluid for dehydrated patients.

#### **Antiviral and antibacterial effects**

Research has shown that the anti-infective properties of breastmilk are partly due to its saturated fatty acids. Coconut oil has been shown to contain these same saturated fatty acids. Once in the human stomach, partial digestion of these fatty acids produces substances that can kill certain bacteria and viruses. In particular, the saturated fatty acids lauric, capric and caprylic, all found in coconut oil, have been identified in studies as having some anti-infective action. Some polyunsaturated fatty acids have been identified as having the same action.

It seems that the saturated fatty acid digestion products destroy the wall of the virus or bacteria, which means that there is little chance of resistant types of bacteria developing (a concern with most antibiotics). These fatty acids also seem to be able to destroy *Giardia lamblia*, a gut parasite responsible for one type of severe diarrhoea.

#### **Coronary heart disease, infection and saturated lipids**

Studies during the past decade have suggested, but not yet proven, that certain bacteria and viruses — for example, the virus cytomegalovirus — may encourage the build-up of fatty deposits on blood vessel walls (part of the process of heart disease). The possible anti-viral effects of saturated fatty acids, such as those found in coconut may be very significant if the role of viruses in heart disease is proven.

#### **Anti-inflammatory effects**

Limited studies suggest that coconut oil may have an anti-inflammatory role, in a similar way to fish oils.

#### **Coconut and antioxidant activity**

Antioxidants are involved in protecting the body from oxidation, a natural process, but one also linked to the development of chronic diseases and the changes associated with ageing. There have been suggestions that some of the protein found in coconut, may have antioxidant properties; however, there is minimal supporting evidence at this time.

## Summary

Coconut has been an important part of the traditional lifestyle of Pacific Islanders for generations and its many products have helped to feed and protect them. As many people in the region have started to adopt a more urban lifestyle, diets and health have undergone significant changes. It is in response to many of these changes that the need for this publication has arisen. Increasing rates of noncommunicable diseases, alongside cases of childhood malnutrition, indicate that many of these changes are adversely affecting the once healthy Pacific Islanders.

Coconut is not just a source of fat. The fresh green coconut water is a useful and safe drink, and has been a valuable rehydration drink for those affected by sickness and diarrhoea. Its properties are now being recognised internationally and it may be marketed in the future as a sports-rehydration drink.

The mature coconut provides not just fat, but significant amounts of fibre, protein and some substances that have antioxidant properties. Coconut can provide valuable contributions towards fibre and protein intake.

The fat content of coconut has led to concerns about the health implications of including coconut cream, coconut meat or coconut oil in the diet. Mature coconut has a high fat content, most of which is saturated fat. Most healthy lifestyle recommendations now include recommendations to reduce the intake of fat and, in particular, saturated fat. Specifically, fat and saturated fat have been linked to heart disease and obesity. This publication sought to clarify these issues and to look more specifically at coconut itself.

Fat is an essential nutrient that is needed for energy and to aid the absorption of certain vitamins. Traditionally, coconut was the main source of fat in the diet, and helped to ensure adequate fat and energy content of diets. This was particularly important for small children (from six months onwards), who have very high energy needs that cannot be met without sufficient fat in the diet. Concerns about the negative health effects of fat are linked to its over-consumption.

High intakes of fat have not been directly linked with the development of high blood pressure or of diabetes; however, evidence does show links to an increased risk of certain types of cancer, heart disease and obesity/overweight. Two of the biggest health problems seen in this region are overweight and heart disease. The high energy density of fat (which is so valuable for young children) results in a diet that is energy-dense. But fat's high energy



density can increase the risk of weight gain, particularly when associated with low physical activity levels. Most people who want to lose weight will be more successful if they reduce their fat intake and increase their levels of physical activity.

The diets of many Pacific Islanders are now high in fat and their lives have become increasingly sedentary. The fat comes not just from the traditional sources such as coconut and fish, but also increasingly from imported foods such as fatty meats, baked goods, margarines, cooking oils and baking fats. The combination of fat from these imported and local foods is resulting in relatively high fat diets.

The risk of developing heart disease is associated with many risk factors and the list is constantly growing as researchers discover other factors. Overweight and obesity are strong risk factors and losing weight can significantly reduce the risk of heart disease. Another risk factor is fat intake and this has led to the concern about possible links between eating coconut and developing heart disease.



The evidence and research used to produce this publication has shown.

- ☉ A diet high in fat increases the risk of heart disease (although this is less important than was once thought).
- ☉ High levels in the blood of “bad” cholesterol and TG along with low levels of “good” cholesterol increase the risk of heart disease.
- ☉ High intakes of many of the saturated fatty acids affect blood fat levels in such a way as to increase risk of heart disease. These include the main saturated fatty acids in coconut.
- ☉ Adding coconut oil to the diet affects blood levels in such a way as to increase the risk of heart disease.
- ☉ Replacing some of the saturated fatty acids in the diet with unsaturated fatty acids will affect the blood fat levels so as to reduce the risk of heart disease.
- ☉ Individuals who eat diets high in saturated fats have a higher risk of heart disease than those who eat diets where the saturated fats have been partially replaced with starchy-carbohydrate and partially replaced with unsaturated fats.
- ☉ Traditional communities (including Pacific Islanders) who included large amounts of mature coconut in their diet did not show high rates of heart disease (although some studies did show higher levels of the blood fats that are associated with increased risk).

The bulk of the evidence indicates that eating a diet that includes coconut fat would increase the risk of heart disease, and yet the studies in traditional communities do not show this. Possible reasons for this have been presented, including individual variation in susceptibility to dietary fat, the influence of other aspects of the traditional lifestyle and the influence of other components of coconut.

- ☉ The traditional lifestyle includes many protective factors such as high physical activity levels, high fish intake, high vegetable and root crop intake, minimal use of tobacco and alcohol, and low intake of salt.
- ☉ Coconut fats may have a role in destroying viruses, bacteria and protozoa in the gut (and possibly elsewhere in the body). This effect could be important in destroying a virus that may be involved in the development of heart disease.
- ☉ The fats have an effect in reducing unwanted inflammation, part of the process of heart disease development.
- ☉ Coconut contains fibre, including the type of fibre that has been shown to reduce blood lipid levels.
- ☉ Substances found in coconut act as antioxidants and anti-inflammatory agents; both inflammation and oxidation are involved in the development of heart disease.

Therefore, there are a number of constituents of coconut that may serve to reduce the overall risk of heart disease. The presence of these factors may reduce the overall effect of the fats in coconut (in the diet) on the risk of heart disease. However, more research is needed to clarify these issues.

Current evidence suggests that a healthy diet contains moderate amounts of fat, with most of the fats coming from unsaturated (particularly monounsaturated) fatty acids. For most Pacific Islanders, this involves eating less fat overall and substituting some of the fat in the diet with fats that are mainly monounsaturated or polyunsaturated. Most saturated fat should, preferably, be from coconut rather than other foods. A diet that includes plenty of local foods — such as fish, fruit, vegetables and root crops — in preference to imported foods, is recommended. Moderate intakes of coconut would seem to be acceptable, providing that other sources of saturated fats are minimised. These recommendations should form part of an overall healthy lifestyle that includes increased physical activity, weight loss and avoidance of unhealthy habits such as heavy drinking and tobacco use.

Further research is needed to confirm and clarify all these issues.

# Glossary



<b>Term</b>	<b>Meaning</b>
alcohol unit	A standard drink. Equivalent to 285 ml full-strength beer or 375 ml light beer, 100 ml wine, or 30 ml spirits.
antioxidants	Natural or synthetic substances that can prevent oxidation.
CHD	Coronary heart disease — a disease that affects the blood vessels to the heart. A build-up of fatty deposits in the blood vessels prevents blood flow.
cholesterol	A type of fat used to make cell walls. It is produced by the body from fats (particularly saturated fatty acids). When there is too much cholesterol produced, levels in the blood increase, and some is deposited on blood vessel walls as a fatty layer. It is found in some foods such as eggs, liver and shellfish.
fats	Also known as lipids or oils. A type of nutrient that is rich in energy/calories. Essential in the diet, but diets that contain too much fat increase the risk of certain diseases.
fatty acids	Fatty acids are the building blocks of fats. Most fats contain a mixture of different fatty acids.
fibre	Found in foods, fibre is essential in the diet. It helps to keep the gut healthy and may affect blood cholesterol and blood sugar levels. There are two types — soluble and insoluble. The former has the greater effect on blood cholesterol and sugar levels, whereas the latter is more involved in gut health.
HDL	High-density lipoproteins. This type of cholesterol in the blood is known as “good” cholesterol as its main role is to remove cholesterol from the fatty deposits on the blood vessel walls.
hypertension	High blood pressure, which is above certain defined cut-offs.
inflammation	Defensive reaction of the body to “attack” — for example, swelling, an increase in body temperature, itching. The body can react when such defence is not needed — for example, in arthritis and allergic reactions.
lauric acid	Type of saturated fatty acid. Also called C12:0. Makes up almost half of the fatty acid in coconut.
LDL	Low-density lipoproteins. This type of cholesterol is often known as “bad” cholesterol as it deposits cholesterol on blood vessel walls.
lipids	Also known as oils or fats.



MUFAs	Monounsaturated fatty acids — found in fish, nuts and olives.
myristic acid	Type of saturated fatty acid. Also called C14:0. Makes up less than 20% of fatty acid in coconut.
NCDs	Noncommunicable diseases, also known as lifestyle diseases. Includes diabetes, heart disease, obesity/overweight and hypertension.
non-haem	Iron occurs in foods and supplements in two forms, haem and non-haem. The haem type found in animal products is well absorbed by the body. The non-haem form found in plants is poorly absorbed.
ORS/ORT	Oral rehydration salts/treatment. These are used to prevent or treat dehydration. The dry powder is added to clean water to make a drink that needs to be drunk frequently to counter dehydration.
oxidation	A process of attack on cells. It is thought to play a part in changes associated with ageing, cancer and heart disease.
PUFAs	Polyunsaturated fatty acids — found in vegetable oils and fish.
rehydration	Treatment or prevention of dehydration (a serious condition in which the body does not have enough fluid; it can be fatal).
stearic acid	Type of saturated fatty acid. Also known as C18:0. Makes up less than 4% of fatty acid in coconut.
synthetic	Man-made. In this publication, the term refers to specially created oils with specific fatty acid contents. Unfortunately, synthetic fatty acids are not exactly the same as natural ones and may have slightly different effects in the body.
TC	Total cholesterol. The combination of VLDL, HDL and LDL levels gives total cholesterol level in the blood.
TG	Triglycerides — type of fat in the blood. High levels are a risk factor for CHD. High levels are not generally associated with fat or saturated fatty acids intake, but with low activity levels and high sugar and alcohol intake.
TFA	Trans-fatty acid — type of fatty acid that is produced during food processing, for example, in making margarine. Very strongly associated with increased risk of CHD.
unsaturated fats	Types of fatty acid. Consists of two types — MUFAs and PUFAs.
VLDL	Very-low density lipoprotein. Type of fat found in blood. Generally levels are low.