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Cholesterol Levels: Regaining Control

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Cholesterol Levels: Regaining Control

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Introduction

High blood cholesterol, that is, above about 5.5 millimoles per litre, is known to be one of the prime risk factors for cardiovascular disease (heart attacks, stroke, atherosclerosis and other circulatory disorders). Other risk factors include obesity, high blood pressure, stress, diabetes, family tendencies, age and smoking. In Australia, cardiovascular disease affects nearly three million people nationwide and kills 50 000 each year.¹

There is some debate over a 2001–2002 Budget decision to control access to taxpayer-subsidised cholesterol-lowering drugs. The Federal Government is expressing concern through the Budget over the increasing cost of this class of drugs, known as statins. There are significant consequences of high cholesterol in the Australian population apart from health; between 1998–99 and 1999–2000 the cost of the statins subsidy rose by more than \$110 million and increased in volume by nearly two million prescriptions. This class of drugs now tops the Pharmaceutical Benefit Scheme (PBS) in cost, amounting to over half a billion dollars in 2000 and rising by about 25 per cent each year. As with many other drugs, statins are often prescribed for the life of a patient, thus controlling rather than curing high blood cholesterol. A key concern of the Government is whether statins are being prescribed appropriately on all occasions. Through changes to the wording of PBS guidelines, enhanced by procedures to ensure that doctors adhere to the guidelines, plus education of doctors and consumers, the Government expects to save \$103.9 million on statins over four years.

The debate over levels of blood cholesterol appropriate for drug prescriptions will no doubt continue. Recently, recommendations were made in the US which called for a higher, not lower use of cholesterol-lowering drugs. Seemingly, the Australian Government is moving away from such recommendations in its Budget move. However, rather than discuss in detail the cholesterol level at which drugs are appropriate, this short paper's main emphasis is on *prevention* of cholesterol buildup, including better dietary advice to the class of patient previously offered statins more or less automatically. Whereas the government appears to be relying on encouraging and educating general practitioners to counsel patients on lifestyle matters, there is much more that governments can do through preventive measures to reduce the great social and actual costs of heart disease promoted, at least in part, by high cholesterol.

Dietary advice in relation to reducing blood cholesterol has changed considerably over the years. In 1984 the (US) National Institutes of Health advocated reducing total fat in the diet. In 1988 the US Surgeon-General issued a major report on nutrition and health in

which fat was declared to be the single most unwholesome component of the American diet. It took eleven years of dispute to cancel a further project by the Surgeon-General on the dangers of dietary fat. The subject had become far too complex for simple conclusions. In any case, it was known that several comparatively healthy food cultures included high fat intake. It is the *type of fat*, more than the quantity of fat in the diet which is important. We are all familiar with more specific advice to avoid *saturated* fats. But, to complicate matters, some components of saturated fats raise cholesterol much more than others. And not surprisingly, cholesterol itself in the diet influences cholesterol levels in the blood.

Why is there such a large Australian call on cholesterol-lowering drugs? How can accumulated knowledge about cholesterol and the diet be simplified for communication to the public? Which group or groups should do the communicating? And, once educated, is the public then able to choose those foods with the least risk?

While the Australian population ages, and thus increases the overall risk of heart-related disease, a special concern is the increasing level of cholesterol in young Australians. Indeed, for the entire population there is a danger of moving backwards from the cholesterol-avoiding strategies of the past. This may be due to food manufacturers' advertising, changing habits in food purchasing, forgetfulness, ignorance or sheer indulgence!

The following discussion briefly covers the issue of both preventing and lowering cholesterol buildup in the Australian population. Matters covered include the role of health communicators and the practicality of suitable labels on all foods.

Contribution of dietary fats and oils to cholesterol

Dietary fats (solids and semisolids) and oils (liquids) are *triglycerides*, being composed of three *fatty acid* molecules strung onto a three-carbon backbone (see diagram).

A molecule of fat or oil (triglyceride)	
CH ₂ O.....	Fatty acid
I	
CHO.....	Fatty acid
I	
CH ₂ O.....	Fatty acid

Fatty acids are important to this discussion in that they influence blood cholesterol levels. Each fatty acid molecule consists of a long chain of carbon atoms combined with hydrogen atoms. Fatty acid names are derived from (i) the length of the chain, and (ii) the number of 'double bonds' in the chain. Saturated fatty acids have no such bonds. In tissues,

there is a predominance of even-numbered chains in fatty acids. Some common fatty acids are shown below.

Saturated fatty acids

Lauric acid	(12 carbon chain, no double bonds)
Myristic acid	(14 carbon chain, no double bonds)
Palmitic acid	(16 carbon chain, no double bonds)
Stearic acid	(18 carbon chain, no double bonds)

Mono-unsaturated fatty acids

Palmitoleic acid	(16 carbon chain, one double bond)
Oleic acid	(18 carbon chain, one double bond)

Poly-unsaturated fatty acids

Linoleic acid	(18 carbon chain, two double bonds)
Linolenic acid	(18 carbon chain, three double bonds)

Through experimentation, it has been found that different fatty acids in the diet have different effects on blood cholesterol. Myristic acid is especially notable since it promotes cholesterol formation the most. Next in line is lauric acid and third is palmitic acid. The latter is disputed as a cholesterol promoter, not least because it occurs in palm oil, an internationally traded edible oil. Australia's neighbours Malaysia and Indonesia are major producers of palm oil. Some studies, supported by producers, suggest that palmitic acid does not promote cholesterol formation in low-cholesterol diets. A majority of scientific opinion would argue that palmitic acid is indeed a significant cholesterol promoter because there is much more of it in most fats and oils than lauric and myristic acids. Stearic acid, although fully saturated, is believed to have no effect on cholesterol levels. The mono-unsaturated acids oleic and palmitoleic are either neutral or have a slight cholesterol reducing effect. Lastly, the polyunsaturated fatty acids have a cholesterol-lowering effect.

An individual fat or oil will have characteristic proportions of various fatty acids within its basic structure. Note that the three fatty acids in the triglyceride molecule backbone (the fat molecule) are likely to be different. Thus, in one type of fat or oil, it is possible to have a cholesterol-promoting fatty acid and a cholesterol-damping fatty acid present in comparable amounts. For example, the action of cholesterol-neutral stearic acid present in meat fat and chocolate is likely to be counteracted to some extent by other saturated fatty acids (such as palmitic acid) which are present.

Simply on the basis of relative fatty acid content, fats and oils should be able to be ranked in order of cholesterol formation. The following list is a first approximation along these lines, limited to six common fats and oils in the Australian diet.

Fatty Acid	Coconut oil	Milk fat	Beef fat	Palm oil	Olive oil	Canola oil
Lauric acid%	47.5	3.4	0.2	0.1	0	0
Myristic acid%	18.1	11.3	4.7	1.0	0	0
Palmitic acid%	8.8	28.2	27.1	44.3	11.1	4.3
Stearic acid%	2.6	13.2	20.4	4.6	3.0	2.3
Palmitoleic%	0	1.8	2.7	0.1	0.7	0
Oleic acid%	6.2	23.6	39.1	38.7	74.8	62.0
Linoleic acid%	1.6	2.0	2.1	10.5	9.0	20.9
Linolenic acid%	0	0.7	0.8	0.3	0.6	7.9
	<i>Higher cholesterol forming</i>			<i>Lesser cholesterol forming</i>		

Sources: ^{2,3}

In this lineup, emphasis has been placed upon myristic acid content; a very early study⁴ suggested that myristic acid controls more than two-thirds of the diet's effect on blood cholesterol. An 'Atherogenic Index' devised in the US to measure health effects of milk fat is a formula heavily weighted towards myristic acid:

$$\text{Atherogenic Index numerator} = \text{lauric} + (4 \times \text{myristic}) + \text{palmitic} [\text{proportions}]^5$$

One would expect, therefore, that a diet heavily laced with coconut oil would lead to high cholesterol—at least under Western dietary conditions—while a diet concentrated on canola oil should lower cholesterol.

Cholesterol present in foods is a contributor to blood cholesterol. However, in recent years the National Heart Foundation and others have advised that saturated fats in the diet play a greater role. Nonetheless, a relatively recent development in 'functional' foods has seen plant sterols added to margarines; their function is to inhibit the absorption of dietary cholesterol from the gastro-intestinal tract. Last year it was reported⁶ by one maker (Unilever) that levels of blood cholesterol could be reduced by 10–15 per cent with sterol-enriched spreads. CSIRO is reported to be examining the possibility of adding plant sterols to other foods. This approach cannot *by itself* sufficiently reduce high blood cholesterol or prevent the same. Plant sterols are not able to prevent uptake of saturated fats. Also, there are fears that the sterols may inhibit absorption of some vitamins.

Trans fats are the result of polyunsaturated fatty acids being 'hardened' or made more saturated in nature through hydrogenation. The process is used to make solid margarine out of vegetable oils or for stable frying oils. Unfortunately, *trans* fats enhance cholesterol formation and therefore are less benign than the polyunsaturated oils used as the starting point.

Why is high cholesterol so common?

Like other affluent societies, the Australian population may be said to be suffering from overnutrition. Apart from a noticeable trend towards obesity and its hazards (Australia is said to be on its way to becoming the fattest nation in the world),⁷ increasing total food intake and decreasing physical activity will most likely stimulate cholesterol levels in the population. Work pressures resulting from longer hours, job insecurity and so on are encouraging workers' consumption of high-calorie 'treats' between meals. The humble biscuit for morning and afternoon break has been replaced by the monster lamington, huge 'Danish pastry' or outsize 'muffin' (cupcake), that is, if the Parliamentary staff cafeteria is any guide.

Manufacturers and restaurant owners know that saturated fats are often tasty and have special textural and other useful manufacturing characteristics not shared by healthier vegetable oils. In 1998, 35 per cent of meals in Australia were bought rather than being cooked by consumers.⁸ Much of this expenditure is in restaurants and fast food outlets where there are endless opportunities for 'treats', and where there is no health labelling. What are the fats in McDonalds 'fries' and 'shakes'? Very few people know or care. Regular restaurant patronage has become almost a marker for high cholesterol. Butter-soaked garlic bread followed by cream soup followed by rich steak sauces and fried potato wedges plus the cream-filled cake or ice cream for sweets adds up to a large serve of cholesterol precursors. Popular Indian and Thai restaurants (and other varieties) offer ghee—which is clarified butter—and coconut oil laden food. Of course, the cholesterol precursors can be avoided, but one might reasonably suspect that most patrons are not doing so.

When they are not eating out, Australians are bringing home more and more packaged and pre-prepared food, that is, if supermarket space for such foods is an indication. People are eating unhealthy, hidden fats even though they would not consider buying lard for frying or cophera for cooking. While nutrition labels are being improved under the new Food Code, there is no existing requirement for informing customers of cholesterol content, and certainly no indication of, say, the percentage of myristic acid in contained fats. Familiar labels such as 'lite', or 'vegetable oil—contains no cholesterol', etc. have been misleading because they do not give enough specific information to the consumer.

A declining awareness of cholesterol seems to be underlined by newspaper articles telling us we can eat whatever we like. 'Chocolate is good for you' is the commercially-inspired message for Australians around Eastertime. Cholesterol-monitoring kiosks in shopping malls seem to have disappeared. People are simply not concerned about their cholesterol to the same extent. It is probably seen by many as yesterday's fad.

One bright spot is the increasing popularity of olive oil, which may create a significant Australian olive oil industry. Epidemiological studies of the classic Mediterranean diet indicate that liberal use of olive oil has a healthy outcome.

What should the cholesterol message be?

If it is accepted that there should be an updated message for the general public in a preventive sense, what should that message be? The list below could be a basis for a mass marketing exercise (similar to the AIDS or anti-smoking campaigns):

- cholesterol-lowering drugs are expensive and can be avoided in many cases. Life-long dependence on drugs is not desirable and there may be side effects for individuals.
- have your cholesterol level tested *before* drugs are necessary. Monitor regularly.
- be aware, even curious about the types of fat and oil you are consuming.
- reduce intake of foods containing coconut oil and milk fat. This includes full-fat cheese, butter, cream and ice-cream. Eat low-fat milk products and other vegetable oil-based substitutes (exceptions for infants and some adults). Trim meat fat.
- ask for butter-free and coconut oil-free food in restaurants. Inquire as to the type of frying oil used (in a commercial kitchen, stable mono-unsaturated Monola or Sunola is best, though still quite rare).
- watch intake of high-calorie 'treats' at work. Many treats are loaded with unhealthy fats.
- eat more fruit and vegetables (*recognises the value of a whole-of-diet approach*).
- stop smoking, exercise more, etc. (but cholesterol does not quickly 'burn off' with exercise because it is not a primary energy source for the body).
- there is some evidence that dietary fibre reduces blood cholesterol (but not by much!).

As with anti-smoking advertisements, the above advice needs to be accompanied by warnings of the personal consequences of heart and circulatory disease.

Note: the biochemistry of fat absorption, storage, burn up, conversion to cellular structures, cholesterol synthesis and so on is controlled by dozens of enzymes (protein catalysts) and hormones. Because of personal differences in the genes controlling these enzymes and hormones, there will be individual differences in metabolising dietary fat. This could explain stories about persons with extravagant eating habits living to healthy old age. For some patients, an improved diet may not result in sufficiently lowered blood cholesterol. Ideally, health advice should be shaped to individual needs, but general advice based on the above dot points could be very effective nationally if presented properly.

Who should deliver the cholesterol message?

The 2001–2002 Budget Measures paper declares that:

The Government has decided to clarify and improve the wording of the current Pharmaceutical Benefits Scheme instructions to prescribers for the use of cholesterol lowering medicines. This will help ensure that these medicines will be used by those most likely to benefit from them.

The instructions presently advise that:

all patients should receive dietary therapy, typically for six weeks, before resorting to drug treatment. For obese patients, a longer dietary period should be considered. In addition to dietary advice, specific advice should be provided about lifestyle changes to modify risk factors such as smoking, obesity, excessive alcohol intake and physical inactivity.

There may be difficulties in achieving the Government's desired objectives. For example, busy doctors rarely have the time to present adequate dietary advice to patients. General practitioners may not have the necessary detailed knowledge in any case. Vague messages about avoiding saturated fats can no longer be considered sufficient. Thirdly, doctors are widely perceived as prescribers of medicines rather than preventive health advisors. It is infinitely preferable to deliver health messages *before* an enforced and perhaps belated visit to the doctor. Fourthly, many patients would not regard their GPs as suitable role models for fitness and lifestyle. They are frequently overworked and overstressed! Lastly, doctors should be referring patients more frequently to dietitians; it follows that a reassessment of Medicare support for such services is necessary.

If advice from doctors is insufficient, as suggested by the arguments above, then who else can deliver a truthful message on diets and lifestyle? There is of course the National Heart Foundation, a private organisation. But there is no government body with a strong independent public health voice on nutrition issues. And this at a time when 'industry is widely perceived to be gaining more control over food standards...and has developed close links with many professional organisations'.⁹ One suspects that most players in the food arena have either a direct commercial interest in what people eat, or else are beholden to industry for funding. A good example of increasing industry influence is within the CSIRO Division of Health Sciences and Nutrition. The Division has been forced to turn increasingly to industry in recent years for funding support. In one sense, this makes CSIRO less isolated from industry and prevents its research from becoming commercially irrelevant. However, unless the Federal Government spends more on nutrition research there is likely to be tension between consumer interests and food industry interests within the Division. Even universities appear less able to speak out independently, as they too are becoming more reliant on external funding. Although the National Health and Medical Research Council is expected to issue a new draft of national dietary guidelines in July, the NH&MRC has no formal advisory group on nutrition.

Another possible candidate for national advisor on dietary matters is the Australia New Zealand Food Authority, ANZFA (or its intended successor, Food Standards Australia New Zealand, FSANZ). Through developing standards the Authority has had plenty of opportunities to build up expertise in matters of diet and health. During its short life, however, the Authority has encountered resistance on key issues from powerful food manufacturers and distributors. Commonwealth/State issues have also complicated its affairs. Depending on the representative makeup of its Board, to be laid down in the final version of the *ANZFA Amendment Bill 2001*, there is still hope that the new FSANZ can be both authoritative and influential. One of its roles could be to send independent messages about diet—through its standards and otherwise—to both the Australian and New Zealand communities.

Cholesterol-promoting foods; can they be avoided?

While the new joint Australia New Zealand Food Standards Code was being developed by ANZFA, there was much discussion over food labelling. Some improvements in nutrition and ingredient labelling will follow as a result. There has been major opposition from the food industry over a requirement to label genetically engineered foods. While the industry has insisted that such foods are safe, adequate labels give the customer the freedom to choose between genetically manipulated food or normal food. Polls have shown overwhelming public support for the labels. Similar choices will be made with labelling of irradiated foods.

In a follow-up to the new Food Code, ANZFA is currently proposing that *additional* items as follows should be mentioned as quantities on a package of food whenever a nutrition claim is made (Proposal P233):

- polyunsaturated fat
- mono-unsaturated fat
- cholesterol
- trans fatty acids
- dietary fibre.

(Note: saturated fats are already required)

One could well argue that these items deserve to go on all packaged foods, not just those which make a nutritional claim. While trans fatty acids are proposed to be listed, there is no corresponding requirement for separately notifying myristic, lauric and palmitic acid content. Listing the level of total saturated fats is less precise, given the major differences in cholesterol promotion by the various saturated fatty acids.

The more effective the label, the more pressure is brought to bear on manufacturers to supply consumers with the foods they want. Meanwhile, the food industry insists that supplying consumer needs is one of its main aims. Both public education and effective food labelling are needed for preventive action on cholesterol.

With about one-third of all consumers' food budgets going to restaurants and fast food outlets,¹⁰ it really is an anomaly that health labelling is not required where food is served. This discrepancy has long been a complaint of the Australian Food and Grocery Council. A relatively simple reform could be to require fast food outlets to display a sign informing customers of the type of frying oil being used. It would quickly become known which fast food chains were using beef tallow, hydrogenated cottonseed oil, palm oil or the more healthy Monola or Sunola oils. For restaurants, the menu is the most obvious place for health information. Just what form this could take is debatable. Up until now, ANZFA seems to have regarded labelling at food service outlets as 'too hard'. But authorities should no longer ignore the accelerating trend away from home cooking and towards restaurant meals.

Summary points

- Given that cholesterol biochemistry is complex, and varies between individuals, the characteristic fatty acid components of fats and oils determine their cholesterol-forming potential.
- *Myristic acid* in saturated fats preferentially leads to cholesterol in the blood. It is present in coconut oil, dairy fat and beef fat (in descending order), but is virtually absent from olive oil and most other vegetable oils. Other saturated fat components promoting cholesterol buildup are *palmitic acid* and *lauric acid*. By contrast, *stearic acid*, although saturated, is believed to have no effect on blood cholesterol.
- The Federal Government intends to improve advice from doctors to patients with high cholesterol, with the aim of reducing cholesterol-lowering drug use. However, a strong anti-cholesterol message should also be sent to the general public in order to prevent an even larger national drug bill in future. Blood cholesterol testing needs to be reinstated as a health priority. Consideration should be given to appointing an independent government body such as Food Standards Australia New Zealand to advise the nation on dietary matters. Meanwhile, the nutrition advisory work of the National Heart Foundation should be more strongly supported.
- In order that consumers can distinguish foods which can lead to high cholesterol, more specific labelling is required on packaged foods. Health labelling is required for restaurants and takeaway outlets.
- In recognition of the importance of diet to good health, Medicare rebates on dieticians' fees should be considered.

Endnotes

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