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Subject: Food as Medicine

Topic: High cholesterol

Attachment: Handout for clinics and health presentations

<i>What is cholesterol?</i>

Cholesterol is natural and found in all human and animal tissue. It is also present in the blood and an important constituent of all cell membranes. In the nervous system, it forms part of the myelin sheath, surrounding and protecting the nerves. In the endocrine system, it is a precursor to steroid hormones, bile salts and is used in Vit D synthesis.

Endogenous production accounts for more than 80% of cholesterol present in the body. Dietary intake increased above 20-30% can affect liver function, where output is decreased. The excess cholesterol, forced into the bloodstream, provides the building blocks for heart disease.

This fat-like substance cannot be dissolved in the blood and is transported throughout the body by a carrier lipoprotein. Packages of very low-density lipoprotein (VLDL) transport cholesterol from the liver and unload it in other parts of the body becoming low-density lipoprotein (LDL) which deposits in the walls of arteries as plaque (known as arteriosclerosis). High-density lipoprotein (HDL) is protective, acting like a broom; it clears the LDL out of the bloodstream and back to the liver for recirculation or excretion.

Triglyceride is another form of fat stored in adipose tissue and frequently found in obese and diabetic people. Those with high triglycerides often have high total cholesterol.

(Schlenker, 1999)

Risk factors

For high cholesterol depends on increased age, gender and heritage as well as:

- ✓ Overweight & obesity – carrying extra weight generally increases LDL-C
- ✓ Poor diet – effects of poor nutrient intake and high fats exacerbate LDL-C
- ✓ Smoking
- ✓ Stress
- ✓ Insulin resistance & diabetes

Individual lifestyles can greatly improve ones chances to be healthier or adversely, to increase risk. Lifestyle management can greatly affect the causes of high cholesterol and induce lowering of 'bad' LDL-C and improvement of 'good' HDL-C.

Types of fat

SATURATED FAT - These increase blood cholesterol levels. Reduce intake of foods such as *full fat dairy, butter, coconut oil, palm oil, deep fried take away food, commercially baked products & confectionary*

POLYUNSATURATED FAT - Helps lower cholesterol if your diet is low in saturated fat. *Fish, certain nuts & seeds, sunflower, safflower & soybean oils.*

MONOUNSATURATED FAT - Helps lower cholesterol if your intake of saturated fat is low. *Olive oil, certain nuts & seeds, avocado.*

Lipid levels

In biomedicine, Statin drugs are most commonly prescribed to lower lipid levels. These block cholesterol by inhibiting HMG-CoA REDUCTASE in the mevalonate pathway. COQ10 is required for many functions in the body and a decrease of COQ10 increases the risk factor for cardio vascular disease (CVD). **(Langsjoen, 2005)** Cholesterol is essential for life and pharmaceuticals affect beneficial HDL levels as well, resulting in negative side effects.

Atherosclerosis (damage to vascular endothelium) is caused by elevated homocysteine and oxidized cholesterol which forms in the body when anti-oxidants are low

Health benefits are greater with increased levels of HDL-C, than with decreased levels of LDL-C. **(Athyros, 2007)** High LDL-C levels have been implicated in gallstones **(Zak, 2007)**, impotence **(Roumeguere 2003)**, retinal artery occlusion **(Stokajovic, 2007)** It is one of the principal reasons for cardiovascular disease (CVD) which is the leading cause of death and disability in Australia. More than 51% of the population with risk factors for CVD has high serum cholesterol. **(Heart Foundation, 2004)**. According to the Framingham Heart Study a low level of HDL-C increases predisposition to coronary artery disease and considering all the functions cholesterol has in the body it also carries other risk factors.

Lipid target levels

	Standard suggested targets	Targets for patients with increased risk ***	Levels which increase risk for diseases
LDL-C	< 2.5 mmol/L	< 2.0 mmol/L	> 4.0 mmol/L
TTL Cholesterol	< 4.0 mmol/L	< 4.0 mmol/L	> 6.0 mmol/L
HDL-C	> 1.0 mmol/L	> 2.5 mmol/L	< 1.0 mmol/L
Triglycerides	< 1.5 mmol/L	< 1.2 mmol/L	> 1.5 mmol/L
	(Heart, 2001)	(Heart, 2005)	(Heart, 2005)

*** The target levels may be higher in lower-risk patients. Any lowering of plasma total cholesterol and LDL-C levels and any raising of the HDL-C level is beneficial. Targets for patients with increased risk varies according to risk category e.g. Diabetes, heart disease, genetics. Increased Lp(a), increased the risk for heart attack. **(Heart, 2005)**

Foods to avoid

Saturated fats & fried foods; animal meat & organ meat, coconut, palm **(de Roos, 2001)**

Liver, pork, lobster, prawns, sweetbreads

Hydrogenated fats; lard, butter, margarine **(Lichtenstein, 1999)**

Chocolate - polyphenolic substances derived from cocoa powder may contribute to an elevation in HDL cholesterol, however, the additives and sugar to chocolate bars & confectionary make this a food to avoid **(Baba, 2007)**

Alcohol & smoking – lowers HDL-C levels **(Garrison, 1978)**

Coffee

Dairy & ice cream, non-dairy creamers, carbonated drinks,

Refined & junk foods; hot dogs, fries, hamburgers, potato chips, white pasta, pies

<i>Helpful nutrients</i>

This table of nutrients indicates their therapeutic uses with regard to cholesterol, and names their food sources. **(FOM2, sem1/07) (NU2, sem1/07) (Holford, P 2006) (Osiecki, H 2004)**

Vitamin	Therapeutic uses	Source
B Group Vitamins (B1, B2, B3, B5, B6, B9, B12)	Function in glycolysis, Krebs cycle, assist in sugar and carbohydrate metabolism & regulation, co-enzyme, congestive heart failure, detoxification, stress, lowering blood homocysteine	Oats, oat bran, wholegrain, Brewer's yeast, legumes, nuts, seeds, leafy greens, salmon, eggs.
Niacin (Nicotinic acid)	Has a vitamin like role as well as being a hypolipidemic drug. It substantially decreases VLDL and LDL concentrations. It profoundly increases the concentration of HDL-C and reduces the lipoprotein (a) concentration. (Zak, 2006)	
Pantothenic acid	Fatty acid metabolism	

Pyridoxine	Lipid metabolism, D6D activity	
Vitamin C	Antioxidant, recycles Vit E, function in liver repair, carnitine synthesis, diabetic complications, eye health, stress	Guava, kiwi, capsicum, broccoli, berries, cherries, oranges.
Copper	Maintains integrity of cardiovascular system, cholesterolemia.	Almonds, beans, legumes, pecan nuts, sunflower seeds, soybeans, oats.
Iodine	Myelination, atherosclerosis, hypothyroidism, obesity, nnormal function of the thyroid gland, thyroid hormones affect oxygen consumption and the metabolic rate, and may stimulate the release of fatty acids from adipose tissue. Thyroxine may inhibit cholesterol biosynthesis. (Kusic, 1997)	Cod fish, kelp, lima beans, chicken, tuna, sunflower seeds.
Vanadium	Iodine metabolism, thyroid function, diabetes, lipid and cholesterol metabolism, appetite reduction	Linseed, soy beans, spinach, mushrooms, fish.
Vit E	Lipid soluble antioxidant, atherosclerosis, cirrhosis of gall bladder, lowers cholesterol, helps regulate fat and protein metabolism, endocrine glands,	Almonds, corn, sunflower seeds, wheat germ, corn.
Calcium	Promotes heart & nerve health, blood clotting, nourishes the heart, arteries, veins and capillaries.	Tahini, leafy greens, almonds, natural bran, carob
Zinc	enzyme and vitamin co-factor, digestion, nutrient metabolism, hypertension, stress, high fibre diet	Beans, herrings, eggs, sunflower & pumpkin seeds, chickpeas.

	containing phytates, insulin synergy, hypercholesterolemia	
Chromium picolinate	Potentiates action of insulin in protein, carbohydrate and lipid metabolism (Pattar, 2006), reduces total serum cholesterol, elevates HDL, stress, hypertension, heart disease, sugar cravings	Apples, brewer's yeast, eggs, nuts, asparagus
Selenium	Antioxidant, elevated LDL-C, thyroid hormone, recycling Vit C & Vit E, maintains cell membrane, liver impairment.	Alfalfa, brazil nuts, yeast, mackerel, salmon, brown rice.
Silicon	Atherosclerosis, hypertension, decreases infiltration of cholesterol into arterial walls	Oats and wholegrains
Carnitine	Transports fat to the mitochondria for ATP, increases the rate at which the liver oxidizes fats for energy production. Ability to lower cholesterol is dose dependant.	Avocado, lean beef, fish
CoQ10	Lipid antioxidant, lowers blood pressure, lowers LDL peroxidation, important for healthy heart, increased demand if statin drugs in use	Almonds, broccoli, hazelnuts, mackerel, salmon, sardines, sesame seeds, soy beans
Essential Fatty Acids	Atherosclerosis (specially DHA/EPA), lower blood triglycerides and LDL (specially GLA), excess saturated fat intake & fat malabsorption, cell membrane structure, stress, endocrine function, visual clouding	Cod fish, linseed oil, salmon, tuna, wheat germ oil, sunflower oil.

Foods to enjoy

1)Healthy fats

Fish – EFA, source of linoleic and linolenic acid. Most Australian fish have high levels of the **omega-3** fatty acids and low levels of cholesterol (**CSIRO, 2007**) **Good** source of **Iodine**.

Borage seed oil, blackcurrant seed oil – EFA, gamma linolenic acid in high concentrations in borage seed oil

Flax seeds – source of fibre, albumin, fatty oil, cellulose, hemicelluloses, lignins and **linolenic acid**. Decreases total and LDL-C-C (**Prasad, 1997**)

Nuts – help reduce cholesterol and keep blood vessels elastic **Almonds-** in addition to lowering serum cholesterol levels, almonds may also reduce the glycemic impact of carbohydrate foods with which they are consumed. (**Josse, 2007**) **Walnuts – EFA**, decreases the level of triglyceride and increases the level of HDL (**Zibaenezhad MJ, 2005**) **EFA, omega 3 and omega 6**, increase LDL resistance to oxidation (**Ros, 2006**)

Avocado - effective for reducing total serum cholesterol, LDL cholesterol, apolipoprotein B, and increasing HDL cholesterol, due to **unsaturated fatty acids** and other compounds (oleic acid, tocopherols, vitamin E, sterols, and volatile oils).

2)Fibre

Apples, bananas, pears – Fiber; Cellulose, pectin, lignin, waxes, gums, and mucilages are some of the many types of dietary fiber. Soluble fiber can sequester bile salts, thereby significantly affecting lipid absorption, reducing cholesterol (**Chen, 2006**) Dietary oligosaccharides, are fermented by intestinal bacteria and are beneficial for intestinal health. They are also present in intestinal mucins that may inhibit cholesterol absorption. Psyllium creates a gel, absorbs and cleans (**Anderson, 2000**) Apples also contain phytonutrients that slow the oxidation of LDL-C (**Boyer, 2005**) Pectin found in fruit & veg lowers cholesterol and helps regulate body fat (**Gardiner, 2000**)

Whole grains – grains with a slightly bitter taste like quinoa, rye, amaranth and oats all contain fiber, which helps reduce fat in the blood and cleanses the arteries.

Unprocessed, they are an excellent source of niacin and pure VIT E in their oils.

(Pitchford, 2001)

Oats & oat bran – Beta glucans in oats is a soluble fiber that cannot be digested by human enzymes, but is degraded in the colon into short-chain fatty acids (fuel for mucosa). Increases bile excretion and improves HDL & diminishes LDL **(Reyna-**

Villasmil, 2007)

3) Phytosterols, stanols & other nutrients

Alfalfa – saponins may reduce cholesterol through their ability to neutralize cholesterol before digestion

Chilli peppers - Capsaicin regular consumption of chilli for 4 weeks increases the resistance of serum lipoproteins to oxidation **(Ahuja, 2006)**

Fruits, vegetables, nuts, seeds, legumes, vegetable oils – are rich in **phytosterols & stanols** – Research into these compounds that compete for absorption with cholesterol, thus increasing hepatic uptake of LDL and reducing serum LDL cholesterol, started over 50 years ago. **(Pollack, 1953)** More recently, studies still indicate that they reduce intestinal absorption and decrease total and LDL cholesterol by approximately 10%.

(Calvo, 2006)

Raspberries – raspberry **ketone** is an aromatic compound and similar in structure to capsaicin, which alters lipid metabolism **(Morimoto, 2005)**

Soya beans & tofu & miso - Beta-sitosterol reduces cholesterol absorption & **soy isoflavones** significantly reduced serum total and LDL cholesterol but did not change HDL cholesterol and triacylglycerol **(Taku, 2007)**

Lecithin granules – Contain **choline**, a lipotropic agent that controls fat metabolism and cleans the arteries **(Pitchford, 2002)**

Olive oil - virgin olive oil favorably affects cholesterol & enhances increased resistance to oxidation (**Nagyova A, 2003**)

Garlic – a recent study casts doubt on the effectiveness of garlic to lower LDL cholesterol (**Gardner, 2007**), however, other studies indicate that **organosulfur** compounds in garlic decrease LDL, and LDL oxidation and exerts selective inhibition on platelet aggregation and adhesion, powerful antiatherosclerotic properties. (**Lau, 2001**) Also contains selenium, vitamin C, niacin, riboflavin, zinc and copper.

Green tea - catechins increase the amount of LDL receptors (**Roach, 2000**)

Ginger – gingerol and shogaol, interfere with cholesterol biosynthesis lowering levels and preventing oxidation of LDL (**Fuhrman, 2000**)

Other helpful foods:

Apricots, shiitake/reishi mushrooms, brewer's yeast, carrots (raw), fenugreek (an herb), eggplant, grapefruit, nori, legumes, prunes, whole grains (rice, barley, millet, oats, wheat and rye), onions and olives.

Lifestyle factors

- Quit smoking (**Garrison, 1978**)
- Exercise & maintain weight – regular intense exercise (**Kuller, 2006**) (**Slentz, 2007**)
- Reduce stress
- Know your cholesterol levels
- The action of UV rays on cholesterol in skin synthesises Vit D. This action may reduce overall cholesterol levels in body.

Conclusion

The typical modern diet inclines heavily towards processed foods and does a double disservice. Excessive intake of unhealthy saturated and trans fats, coupled with insufficient intake of essential fatty acids. The bad fats are competing in our systems to be metabolized first.

Time constraints on busy families, encourages take away foods. Just a single meal in harmful fats will cause release of thromboxane, which causes vasoconstriction and more rapid blood clotting.

Whilst a total lifestyle turnaround with drastic change of eating habits and commitment to regular exercise would deliver the fastest sustained results, a gradual approach will also be beneficial.

The results of implementing these techniques will bring more benefits than merely improving 'cholesterol management'. They will bring about comprehensive health benefits and an overall feeling of wellbeing.

7-day Menu planner – Therapeutic foods for the management of lipid levels

	<i>Breakfast</i>	<i>Lunch</i>	<i>Snack</i>	<i>Dinner</i>
<i>Monday</i>	<i>Muesli slice Almond milk & strawberry smoothie</i>	<i>Green & orange vegetable quiche</i>	<i>Crudités (celery, carrots, cucumber) Tahini dip</i>	<i>Red lentil bolognaise Spelt pasta Corn on cob</i>
<i>Tuesday</i>	<i>Herb omelette Pink grapefruit</i>	<i>Sourdough nut burger</i>	<i>Cucumber with avocado filling & sesame seeds</i>	<i>Spiced chick- peas Wild rice Baby spinach salad</i>
<i>Wednesday</i>	<i>Fruit salad, low fat yoghurt & LSA</i>	<i>Zucchini & mushroom slice</i>	<i>Oatmeal cookies</i>	<i>Steamed salmon Garlic broccoli & green beans Herb salad</i>
<i>Thursday</i>	<i>Whole oats topped with banana</i>	<i>Cashew nut spread on oatmeal bread</i>	<i>Apple, walnuts & cinnamon muffins (wholemeal & spelt flour)</i>	<i>Mexican beans Steamed carrots Polenta</i>
<i>Friday</i>	<i>Baked apples with walnuts & strawberries</i>	<i>Seasonal salad with olives, alfalfa sprouts & nuts</i>	<i>Maple, carob, granola bar</i>	<i>Grilled tuna steaks Stir fry tofu, soy bean sprouts & mushrooms</i>
<i>Saturday</i>	<i>Oatmeal waffles with maple syrup & blueberries</i>	<i>Split pea soup prepared with Spanish onion & garlic</i>	<i>Apple ginger crisp with soy hurt</i>	<i>Mixed seasonal veg hot pot Steamed millet & butternut</i>
<i>Sunday</i>	<i>Spinach & buckwheat pancakes & grilled cherry tomatoes</i>	<i>Sardine, watercress & boiled egg on rye bread</i>	<i>Brown rice pudding with dates & cashew nut cream</i>	<i>Grilled fish Capsicum stuffed with shiitake, garlic & quinoa</i>

- Use only the best vegetable oils you can afford. Unrefined and cold pressed in dark glass bottles and store away from heat. Use to prepare salad dressings with fresh herbs, lemon, lime or apple cider vinegar.
- Drizzle flax oil directly onto your plate, over soups, stews & curries, over yoghurt. Flax oil should be refrigerated.
- Sprinkle LSA mix and/or Lecithin over breakfast meals, soups, stews & curries. If possible grind freshly as required. Store fresh seeds & nuts in a sealed container in the refrigerator.
- Keep an ample supply of fresh vegetables & salad ingredients. Raw foods are alkaline forming and full of vitality. Organic is best.
- Prepare extra and freeze portions for snacking and lunches
- Sprouts are very healthful and add extra crunch to sandwiches & salads
- For snacking on the go, enjoy preservative & non-oiled dried fruit, raw & unsalted nuts, fresh fruit in season, home made wholemeal & wholegrain muffins & biscuits
- Diet can significantly lower cholesterol, eat wholegrain, unrefined, unprocessed, fresh, raw foods, preferably organic.
- Be careful of margarine & shortening. May be low cholesterol, but they may contain harmful cis/trans fatty acids that oxidize and form harmful free radicals.
- The best place to store fresh seeds, nuts and whole-grains is in a sealed container in the fridge to prevent them from oxidising and becoming rancid.
- Increase consumption of filtered water – vessels are damaged by the increased pressure of thicker dehydrated blood. LDL coats the damaged areas. Water is cholesterol lowering (Batmanghelidj, 1992) Herbal teas are great too.
- A study by Prof David Jenkins (Uni Toronto) says that cholesterol-lowering foods may be more effective when eaten together

Shopping for healthy products;

Purchase organic foods where possible. Head for the organic section at your local market or **farmer's market**. Large **supermarkets** are increasing their organic product range. **Online**, there are many suppliers offering a home-delivery service. **Health food shops** selling organic fresh and packaged produce are abundant.

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