PREVENTIVE CARDIOLOGY

Oil, Ghee, Cheese, Butter, Cholesterol and Atherosclerosis...
What Should We Know?
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ABSTRACT
Atherosclerosis is a major cardiovascular burden in the society. Serum cholesterol as a mediator of the disease is increased by eating saturated fats and decreased by eating polyunsaturated fats. Food habit should include lot of fruits and fresh vegetables. Statins not only improve lipid profile but also have several pleiotropic actions which are responsible for overall benefit. Hence, therapeutic lifestyle changes and judicious use of anti-lipid therapy, especially statins for primary prevention in high risk population and secondary prevention for patients with established atherosclerotic cardio-cerebro-vascular diseases, diabetes, hypertension and dyslipidemia may prevent or reduce the burden of this disease.

Keywords: Atherosclerosis, lifestyle changes, statins

INTRODUCTION
Cardiovascular diseases have become an epidemic and leading cause of death worldwide (Figure-1). More and more people of younger generation are affected by this “Life style disease”. Prevention is the only way to limit this epidemic. Let us try to understand very basics which are more pertaining to Indians.

![Figure 1: Worldwide cause of mortality] (image)
What is Fat and Oil?
Lipids that are solid at room temperature are called fats while those that are liquid are called oils.

**Oils and fats have:** Saturated fatty acids (SAFA), Mono Unsaturated (MUFA), Poly Unsaturated (PUFA) and Essential fatty acids (EFA).

All oils and fats are 100% fat, but the components that make up the fat structure of a particular oil are important in determining whether or not the oil or fat is considered healthy. All oils are high in calories (about 120 calories per tablespoon) so they should be consumed in moderation only.

If Fat is Bad...Why Do We Need It?
- Fat is a major source of energy for the body
- Required to build and maintain cell membranes
- Aids in the formation of bile

- Aids in metabolism of fat soluble vitamins
- Major precursor for the synthesis of vitamin D and various steroid hormones
- Maintains neurotransmission and brain function, builds brain and nerve tissue, and nourishes the immune system.
- Cholesterol is found in animal fats
- Plants have only trace amounts of cholesterol

**Polyunsaturated fats**
- Protective against cardiac arrhythmias
- Protective against insulin resistance
- Decreases cholesterol level, but also decreases HDL
- The main sources of polyunsaturated fats are seeds, nuts, grains, and vegetables

**Monounsaturated fats**
- Protective against cardiovascular disease
- Decreases LDL cholesterol, increases HDL cholesterol
- Good sources of monounsaturated fat are mustard oil, macadamia nut oil, olive oil, canola oil, peanut oil, and most nuts

**Saturated Fat**
- Increases LDL, increases cholesterol
- Animal fats, ghee, butter, cream, and whole milk, cakes, pastries, biscuits and food containing coconut or palm oil are the primary sources of saturated fat
Cholesterol

- Cholesterol is a sterol (a combination steroid and alcohol), a lipid found in the cell membrane of all body tissues
- Of total daily need, ~75% (1 gm) is synthesized in liver and other tissues; ~ 25% (250-300 mg) is needed from diet

What are Ghee (hydrogenated fats) and trans fats?

- Hydrogenation is one of the processes that can be used to turn liquid oil into solid fat. During the process of hydrogenation, trans fats may be formed
- Trans fat is made when hydrogen is added to vegetable oil - a process called hydrogenation
- Trans-fats are Neither required nor beneficial for health
- Trans fats may be monounsaturated or polyunsaturated
- Increases the risk of Coronary Artery Disease

Trans-fatty acids in

- French fries: 4.2% - 6.1%
- Puri and tikkis: 7.6%
- Paratha: 7.8%
- Bhatura: 9.5%

What is Junk food?

- Any food that has poor nutritional value is considered unhealthy and may be called a junk food
- A food that is high in fat, sodium, and/or sugar is known as a junk food
- Junk foods are empty calories. An empty calorie lacks in micro-nutrients such as vitamins, minerals, or amino acids and fiber but has high energy (calories)

Omega-3 and omega-6 fatty acids

- Both omega-3 and omega-6 fatty acids are essential, i.e. they are NOT synthesized in body
- Important in the prevention and treatment of heart disease, hypertension, arthritis, and cancer
- Important for normal growth and development in children
- The ideal ratio of omega-6 : omega-3 being from 3 to 5:1
- Milk and cheese from grass-fed cows may also be good sources of omega-3.

Cheese

- Nutritively, cheese is essentially concentrated milk
- Cheese can be made from whole, 2% low fat, 1% low fat or fat-free milk
- Paneer is the most common Indian form of Cheese
- Mozzarella melts like any other cheese whereas paneer does not melt
- Cottage cheese is low in fat and carbohydrates while high in protein
- A 4 oz (113 g) serving has approximately 120 calories, 5 g fat (3 g saturated), 3 g carbohydrates, and 14 g protein
- It also contains approximately 500 mg sodium, and 20 mg cholesterol

Tea and Coffee: Which is preferable?

- Coffee: 1-2 cups / day is safe without health benefits and risks
- Large quantities of unfiltered coffee may raise cholesterol and homocysteine level
- Tea: Rich in flavanoids, reduces LDL cholesterol and CV risk
- Adding full fat milk to tea abolishes benefits and adding sugar makes it worse

Alcohol: Double Edged Sharp Sword

- J shape relation between alcohol intake and adverse health outcomes: CAD, DM, HT, CHF, CVA, SD, dementia, mortality
- Health benefit is similar for all products with equivalent ethanol content
- Small dose (M:1-2 units, F:<2 units) daily intake is better than occasional intake
- Mechanism: Lipid profile, BP, IR, platelet aggregation

Recommended intakes of fat in the diet (Table - 1)

- Less than 10 percent of calories from saturated fat
- An average of 30 percent of calories or less from total fat
- Less than 300 mg a day of dietary cholesterol
- Other recommendations include
  - 10 percent or less of total calories from polyunsaturated fat intake
  - 10 to 15 percent of total calories from monounsaturated fat
  - Balance omega-3 and omega-6 fatty acid intake with a ratio of 1 part omega-3 to 4 parts omega-6 fatty acids
Table 1: Food recommendations

<table>
<thead>
<tr>
<th>Eat Less of</th>
<th>Eat Moderate Amounts of</th>
<th>Eat More of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold cuts, sausage, regular hot dogs, fried meats, organ meats (e.g. liver), eggs</td>
<td>Steak, ham, roasts, chicken or turkey hot dogs</td>
<td>Fish, other seafood, skinless poultry</td>
</tr>
<tr>
<td>Whole milk, canned milk, cream, sour cream, ice cream, butter, hard cheese, cream cheese</td>
<td>Lowfat milk, frozen yogurt, low-fat cheese, ice milk, margarine</td>
<td>Skim milk, lowfat yogurt, cheese with less then 5% fat</td>
</tr>
<tr>
<td>Cakes, cookies, pies, candy, chips</td>
<td>Peanut butter, unsalted peanuts, almonds, walnuts, pecans</td>
<td>Fresh fruits, fresh veggies, unbuttered popcorn</td>
</tr>
<tr>
<td>Regular salad dressings, gravies, sauces, and spreads</td>
<td>Lowfat dressings</td>
<td>Fresh onions, garlic powder, herbs and spices</td>
</tr>
</tbody>
</table>

Table 2: Fat composition of various oils and fats

<table>
<thead>
<tr>
<th>Type of Oil or Fat</th>
<th>Saturated %</th>
<th>Monounsaturated %</th>
<th>Polyunsaturated %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mustard Oil</td>
<td>1</td>
<td>76</td>
<td>23</td>
</tr>
<tr>
<td>Almond Oil</td>
<td>8</td>
<td>73</td>
<td>19</td>
</tr>
<tr>
<td>Safflower Oil</td>
<td>10</td>
<td>13</td>
<td>77</td>
</tr>
<tr>
<td>Sunflower Oil</td>
<td>11</td>
<td>20</td>
<td>69</td>
</tr>
<tr>
<td>Corn Oil</td>
<td>13</td>
<td>25</td>
<td>62</td>
</tr>
<tr>
<td>Olive Oil</td>
<td>14</td>
<td>77</td>
<td>9</td>
</tr>
<tr>
<td>Sesame Oil</td>
<td>14</td>
<td>40</td>
<td>46</td>
</tr>
<tr>
<td>Walnut Oil</td>
<td>14</td>
<td>19</td>
<td>67</td>
</tr>
<tr>
<td>Soybean Oil</td>
<td>15</td>
<td>24</td>
<td>61</td>
</tr>
<tr>
<td>Peanut Oil</td>
<td>18</td>
<td>49</td>
<td>33</td>
</tr>
<tr>
<td>Margarine (Soft)</td>
<td>20</td>
<td>47</td>
<td>33</td>
</tr>
<tr>
<td>Cottonseed Oil</td>
<td>24</td>
<td>26</td>
<td>50</td>
</tr>
<tr>
<td>Lard</td>
<td>41</td>
<td>47</td>
<td>12</td>
</tr>
<tr>
<td>Ghee</td>
<td>65</td>
<td>32</td>
<td>3</td>
</tr>
<tr>
<td>Butter</td>
<td>66</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>Margarine (Hard)</td>
<td>80</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Coconut Oil</td>
<td>92</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>
CORONARY ARTERY DISEASE AMONG INDIANS

Several ethnic population with high prevalence of conventional risk factors but have much lower prevalence of CAD:

- **The Japanese/Chinese Paradox:** The highest rates of smoking and HT but, CAD rates are 1/5th that of USA and 1/10th that of UK
- **Hispanic Paradox:** High rates of DM and obesity among Spanish but, CAD rates are one of the lowest!
- **African American/Afro-Caribbean Paradox:** High prevalence of obesity, DM, HT but, CAD rates are much lower
- **American Indian Paradox:** The Pima American Indians have the World’s highest rates of DM (80%) and other major RF: but, CAD rates are the lowest among all Americans!
- **Indian Paradox:** Indians have lower rates of conventional RF but, CAD rates are the highest in the world:1-4
  - **Prevalence:** 2-4 times higher compared to rest of the world
  - **Occurs at younger age:** 5-10 years earlier onset of first MI. Among young (< 40 yr), this rate is 5 –10 times higher
  - **More diffuse disease**
- **Double Jeopardy from Nature and Nurture**

"Many Asian Indians are in double jeopardy from nature and nurture … nature being the genetically determined and nurture being the unhealthy lifestyle associated with affluence, urbanization, and mechanization”

**What should we do?**

For optimal CV risk reduction, combined approach of lifestyle intervention along with total control of blood pressure, diabetes and lipids to a therapeutic target should be an ultimate goal. (Figure-2, Table-4)

- **Lifestyle Changes Could Reduce Heart Disease Deaths by 60 %**

\[\text{Lipid modification} \quad \text{Lifestyle intervention} \]
\[\text{Glucose lowering} \quad \text{BP lowering} \]

\[\text{Optimal CV risk reduction} \]

**Figure 2: Approaches to CVD prevention**

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**Best Cooking Oil (Table – 2, 3)**

(Low in saturated fat and high in monounsaturated fat)

- For deep frying foods:
  - The best oils are those with a high smoke point such as canola oil, corn oil, safflower oil, sunflower oil
- For stir-frying and salad dressing:
  - any oil low in saturated fat like canola oil, corn oil, or flax seed oil, olive oil, peanut oil, safflower oil, sunflower oil and walnut oil
- Oils to avoid:
  - coconut oil, palm oil, butter, hard margarine

**Table 3: Dietary factors useful for LDL reduction**

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Quantity</th>
<th>Decrease in LDL %</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAFA intake</td>
<td>&lt; 7 %</td>
<td>10</td>
</tr>
<tr>
<td>Dietary cholesterol intake</td>
<td>&lt; 200 mg</td>
<td>5</td>
</tr>
<tr>
<td>Weight loss</td>
<td>5 kg</td>
<td>5</td>
</tr>
<tr>
<td>Plant sterols/stanols</td>
<td>1-3 g/d</td>
<td>5</td>
</tr>
<tr>
<td>Soy protein</td>
<td>25 g/d</td>
<td>5</td>
</tr>
<tr>
<td>Nuts (almonds)</td>
<td>50 g/d</td>
<td>5</td>
</tr>
<tr>
<td>Viscous fiber intake</td>
<td>5-10 g/d</td>
<td>5</td>
</tr>
<tr>
<td>Total LDL reduction</td>
<td>Full portfolio</td>
<td>40</td>
</tr>
</tbody>
</table>

Why should we worry?

- Atherosclerosis is a major cardiovascular burden?
- Prevalence of CAD among Indians is 4 -10 times higher than rest of world
- By 2011, 60% of all cardiac patients of the world will be Asian Indians
- By 2020, 50% of all cardiac patients of the world will be in India *(WHO, 2001)*
- We are GENETICALLY prone to this “malignant” course
Table-4: Indo-US health summit recommendations: recommended thresholds of Intervention and Treatment goals for Asian Indians:

<table>
<thead>
<tr>
<th></th>
<th>Summit</th>
<th>JNC / NCEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist size male</td>
<td>&lt;35 inches (&lt;90 cm)</td>
<td>&lt;40 inches (&lt;102 cm)</td>
</tr>
<tr>
<td>Waist size female</td>
<td>&lt;31 inches (&lt;80 cm)</td>
<td>&lt;35 inches (&lt;88 cm)</td>
</tr>
<tr>
<td>Overweight</td>
<td>BMI &gt;23</td>
<td>BMI &gt;25</td>
</tr>
<tr>
<td>Obesity</td>
<td>BMI &gt;25</td>
<td>BMI &gt;30</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>&lt;130/80 mmHg</td>
<td>&lt;140/90 mmHg</td>
</tr>
<tr>
<td></td>
<td>&lt;120/70 in diabetes or HF</td>
<td>&lt;130/80 mmHg</td>
</tr>
<tr>
<td>Blood sugar</td>
<td>&lt;100 mg/dL (AIC &lt;6.5%)</td>
<td>&lt;100 mg/dL &lt;7.0%</td>
</tr>
<tr>
<td>Physical activity</td>
<td>45-120 minute/day</td>
<td>30 minutes/day</td>
</tr>
</tbody>
</table>

Lipid Profile Target For Indians:

**Normal:**
- S.Cholesterol <200 mg%
- S.LDL < 100 mg%
- S. TG < 150 mg%
- S.HDL > 45 mg%

**Patients with Heart Disease, DM, HT or Risk Factors:**
- S.Cholesterol <150 mg%
- S.LDL < 70 mg%
- S. TG < 120 mg%
- S.HDL > 50 mg%

New Philosophy is:
- Even specific LDL threshold level is artificial!
- If clinically significant atherosclerosis develops, the LDL-C warrants treatment regardless of Absolute level (Figure 3)
- For Secondary Prevention, 50% reduction in LDL is essential
- For Primary Prevention, 30% reduction in LDL is essential

Potential New Therapeutic Goals for High Risk Patients:
- LDL < 70 mg/dl
- Total Cholesterol/HDL ratio < 3.0
- Global Risk Score < 4
- Hs-CRP < 1.0
- Apo B/A-1 ratio < 0.7

Figure 4: Secondary prevention statin trials

Why Statins are so beneficial?

Statins not only improve lipid profile but have several pleiotropic actions which are responsible for overall benefit. Although the lesion size regression may be minimal, plaque stabilizing effects are responsible for reduction in clinical events. (Figure 4, 5, 6)

Figure 5: Effect of statin therapy

Figure 6: Meta analysis of statin trials
In conclusion, therapeutic lifestyle changes and judicious use of anti-lipid therapy, especially statins for primary prevention in high risk population and secondary prevention for patients with established atherosclerotic cardio-cerebrovascular diseases, diabetes, hypertension and dyslipidemia may prevent or reduce the burden of this deadly disease. (Figure 7)

![Figure 7: Effect of lipid reduction on coronary events](image)

Following two quotes, written relatively long back, summarize this concept:

“If the serum cholesterol can be prevented from rising above 150 mg/dl, plaques are not laid down; if elevated levels are lowered to 150 mg/dl, further plaques do not form and parts of those present may vanish” William Roberts.

As James H. O’Keefe, Jr, Loren Cordain, William H. Harris, Richard M. Moe, and Robert Vogel writes We live in a world very different from that for which we are genetically adapted. Profound changes in our environment began with the introduction of agriculture and animal husbandry 10,000 years ago, too recent on an evolutionary time scale for the human genome to adjust. As a result of this ever-worsening discordance between our ancient genetically determined biology and the nutritional, cultural, and activity patterns in modern populations, many of the so-called diseases of civilization, including atherosclerosis, have emerged. Evidence from hunter-gatherer populations while they were still following their indigenous lifestyles showed no evidence for atherosclerosis, even in individuals living into the seventh and eighth decades of life. These populations had total cholesterol levels of 100 to 150 mg/dl with estimated LDL cholesterol levels of about 50 to 75 mg/dl. The LDL levels of healthy neonates are even today in the 30 to 70 mg/dl range. Healthy, wild, adult primates show LDL levels of approximately 40 to 80 mg/dl. In fact, modern humans are the only adult mammals, excluding some domesticated animals, with a mean LDL level over 80 mg/dl and total cholesterol over 160 mg/dl. Thus, although an LDL level of 50 to 70 mg/dl seems excessively low by modern American standards, it is precisely the normal range for individuals living the lifestyle and eating the diet for which we are genetically adapted. If our genetically determined ideal LDL is indeed 50 to 70 mg/dl, perhaps lowering the currently average but elevated levels closer to the physiologically normal range may improve not just CHD but also many other diseases commonly attributed to the aging process.

REFERENCES