Lifestyle modifications to control metabolic syndrome

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The Metabolic Syndrome: A Constellation of CHD Risk Factors

• Abdominal obesity*
• Atherogenic dyslipidemia
• Elevated blood pressure
• Insulin resistance ± glucose intolerance
• Prothrombotic state: increased fibrinogen, and PAI-1
• Proinflammatory state: increased CRP

Reusch JEB. Am J Cardiol. 2002;90(suppl):19G-26G.
### ATP III: The Metabolic Syndrome*

*Diagnosis is established when ≥3 of these risk factors are present

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Defining Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal obesity† (Waist circumference‡)</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>&gt;102 cm (&gt;40 in)</td>
</tr>
<tr>
<td>Women</td>
<td>&gt;88 cm (&gt;35 in)</td>
</tr>
<tr>
<td>TG</td>
<td>≥150 mg/dL</td>
</tr>
<tr>
<td>HDL-C</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>&lt;40 mg/dL</td>
</tr>
<tr>
<td>Women</td>
<td>&lt;50 mg/dL</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>≥130/≥85 mm Hg</td>
</tr>
<tr>
<td>Fasting glucose</td>
<td>≥110 (≥100)**mg/dL</td>
</tr>
</tbody>
</table>
The Metabolic Syndrome: Historical Perspective

1988: Syndrome X

Insulin Resistance

Glucose Intolerance

Hyperinsulinemia

↑TG

↓HDL-C

Hypertension

CORONARY HEART DISEASE

The Metabolic Syndrome: Current Perspective

Adapted from Reaven G. Drugs. 1999;58 (suppl):19-20

Body Size
↑ BMI
↑ Central Adiposity

Insulin Resistance

Hyperinsulinemia

Glucose Metabolism
• ± Glucose intolerance

Uric Acid Metabolism
• ↑ Uric acid
• ↓ Urinary uric acid clearance

Dyslipidemia
• ↑ TG
• ↑ PP lipemia
• ↓ HDL-C
• ↓ PHLA
• Small, dense LDL

Hemodynamic
• ↑ SNS activity
• ↑ Na retention
• Hypertension

Novel Risk Factors
• ↑ CRP
• ↑ PAI-1
• ↑ Fibrinogen

CORONARY HEART DISEASE
Pathogenesis of the Metabolic Syndrome

Central obesity → Insulin Resistance

Type 2 Diabetes
Dyslipidemia
Hypertension
High visceral fat increases cardiovascular risk

Pouliot MC et al. Diabetes (1992) 41:826-834
High visceral fat increases diabetes risk

Glucose

- Nonobese
- Obese low VAT
- Obese high VAT

1 significantly different from Nonobese
2 significantly different from Obese with low visceral AT levels

Insulin

Pouliot MC et al.
Diabetes (1992) 41:826-834
The Metabolic Syndrome

- Incidence is rapidly increasing in the US and other countries; related to increasing obesity
- The metabolic syndrome enhances the risk for CHD at any given LDL-cholesterol level
- Has been compared to cigarette smoking as an equal partner to premature CHD

Prevalence of The Metabolic Syndrome Among US Adults

Prevalence (%)

Age (years)

0
5
10
15
20
25
30
35
40
45

20–29
30–39
40–49
50–59
60–69
≥70

Men
Women

Metabolic Syndrome in Iranian adults

Prevalence of the metabolic syndrome in developing countries

- India: 21%
- Oman: 19%
- Turkey: 24%
- Brazil: 8%
- Kuwait: 56%
- Prevalence (%)
شیوع سندرم متابولیک در نوجوانان تهران

شیوع کلی سندرم متابولیک: 11.1 با فاصله اطمینان 95%: 9.0 تا 11.1

Unadjusted Kaplan-Meier Curve

Coronary Heart Disease Mortality

Cardiovascular Disease Mortality

All Cause Mortality

Prevalence of Individual Metabolic Abnormalities

- Abdominal Obesity
- Hypertriglyceridemia
- Low HDL
- High BP
- Increased Glucose

Which components are the most common?

- Abdominal obesity
- Low HDL-cholesterol levels
- High serum triglyceride levels

This discrepancy can be explained by:

Different diet
Different polymorphism
Causes of The Metabolic Syndrome

- Overweight/obesity
- Physical inactivity
- Genetics
- Closely associated with insulin resistance
  - Underlying cause of diabetes
  - Reduced HDL-C
  - Elevated triglycerides
  - Hypertension
  - Abdominal obesity

Lifestyle Modification in The Metabolic Syndrome

- Greatest benefit from successful therapeutic lifestyle change (TLC) will occur in persons diagnosed with the metabolic syndrome
- Prioritize resources to implement TLC in these patients first

- HDL-C levels were significantly associated with dietary fat intake in prepubertal lean boys from several countries.

Be=Benin; Fi=Finland; Ge=Germany; Gr=Greece; Hu=Hungary; It=Italy; Ke=Kenya; Ne=Netherlands; Ph=Philippines; Pol=Poland; Por=Portugal; Ta=Tanzania; US=United States.

Low-Fat Diets and HDL-C

- Low-fat diets with equivalent saturated-fat content lower HDL-C levels (mg/dL) without significantly lowering LDL-C.

<table>
<thead>
<tr>
<th>Diet (% energy from fat)</th>
<th>Mean LDL-C</th>
<th>Mean HDL-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safflower oil (n = 11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9%</td>
<td>128</td>
<td>37</td>
</tr>
<tr>
<td>20%</td>
<td>128</td>
<td>41</td>
</tr>
<tr>
<td>30%</td>
<td>124</td>
<td>46</td>
</tr>
<tr>
<td>Olive oil (n = 11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9%</td>
<td>129</td>
<td>43</td>
</tr>
<tr>
<td>20%</td>
<td>136</td>
<td>46</td>
</tr>
<tr>
<td>30%</td>
<td>128</td>
<td>48</td>
</tr>
</tbody>
</table>

Essential Components of TLC

<table>
<thead>
<tr>
<th>Component</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ LDL-raising nutrients</td>
<td></td>
</tr>
<tr>
<td>• Saturated fats</td>
<td>Less than 7% of total calories</td>
</tr>
<tr>
<td>• Dietary cholesterol</td>
<td>Less than 200 mg/day</td>
</tr>
<tr>
<td>✓ Therapeutic options for LDL lowering</td>
<td></td>
</tr>
<tr>
<td>• Plant stanols/sterols</td>
<td>2 g per day</td>
</tr>
<tr>
<td>• Increased viscous (soluble) fiber</td>
<td>10–25 g per day</td>
</tr>
<tr>
<td>✓ Total calories</td>
<td>Adjust caloric intake to maintain desirable body weight/prevent weight gain</td>
</tr>
<tr>
<td>✓ Physical activity</td>
<td>Include enough moderate exercise to expend at least 200 kcal per day</td>
</tr>
</tbody>
</table>

## Macronutrient Recommendations for the TLC Diet

<table>
<thead>
<tr>
<th>Component</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyunsaturated fat</td>
<td>Up to 10% of total calories</td>
</tr>
<tr>
<td>Monounsaturated fat</td>
<td>Up to 20% of total calories</td>
</tr>
<tr>
<td>Total fat*</td>
<td>25%–35% of total calories</td>
</tr>
<tr>
<td>Carbohydrate†</td>
<td>50%–60% of total calories*</td>
</tr>
<tr>
<td>Dietary fiber</td>
<td>20–30 grams per day</td>
</tr>
<tr>
<td>Protein</td>
<td>Approximately 15% of total calories</td>
</tr>
</tbody>
</table>

*NCEP ATP III allows an increase of total fat to 35% of total calories and a reduction in carbohydrate to 50% for persons with the metabolic syndrome. Any increase in fat intake should be in the form of either polyunsaturated or monounsaturated fat.

†Carbohydrate should derive predominantly from foods rich in complex carbohydrates, including grains, especially whole grains, fruits, and vegetables.

Does Treating The Metabolic Syndrome Make a Difference?

Finnish Diabetes Prevention Study

• Design
  – 522 middle-aged overweight/obese patients (mean BMI 31 kg/m²)
  – 172 men and 350 women
  – Mean duration 3.2 years

• Intervention group: individualized counseling
  – Reducing weight, total intake of fat and saturated fat
  – Increasing intake of fiber, physical activity

Benefit of Treating The Metabolic Syndrome: Finnish Diabetes Prevention Study

- After 4 years, risk of diabetes reduced by 58%

Drug Therapy of The Metabolic Syndrome

- Decrease small, dense LDL particles
  - Statins
  - Nicotinic acid (niacin)
  - Fibrates
    (statins may be more effective in reducing total number of LDL particles)
- Decrease triglycerides
  - Fibrates
  - Omega-3 fatty acids
  - Nicotinic acid (niacin)
  - Statins
- Increase HDL-C
  - Nicotinic acid (niacin)
  - Fibrates, especially if hypertriglyceridemia is present

Effects of Lifestyle and Dietary Modification on HDL-C Levels

- Weight loss
- Smoking cessation
- Exercise
Weight and HDL-C

- Inverse correlation between body weight and HDL-C is consistently observed in both men and women.
- For every 3 kg (7 lb) of weight loss, HDL-C levels increase 1 mg/dL.

Weight Loss Increases HDL-C Level

- 131 overweight sedentary men were randomized to 1-year intervention of exercise, diet, or no instructions.
- Lipids were tracked.

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Weight Change (kg)</th>
<th>LDL-C (mg/dl)</th>
<th>HDL-C (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (n = 42)</td>
<td>+ 0.2</td>
<td>144</td>
<td>40</td>
</tr>
<tr>
<td>Exercise (n = 47)</td>
<td>− 4.0</td>
<td>138</td>
<td>44*</td>
</tr>
<tr>
<td>Diet (n = 42)</td>
<td>− 7.2</td>
<td>137</td>
<td>47*</td>
</tr>
</tbody>
</table>

*P < 0.01 vs control subjects

Smoking Cessation Increases HDL-C Level

- In study by Moffatt, smokers had HDL-C levels 15–20% lower than nonsmokers ($P < 0.05$).\(^1\)
  - PROCAM showed less of an effect of smoking on HDL-C (7% lower than nonsmokers).\(^2\)

- HDL-C levels returned to normal within 30–60 days after smoking cessation.\(^1\)

- In eight women who smoked $>1$ packs per day for 5 years, HDL-C levels increased from 51 to 64 mg/dL after quitting for 60 days.\(^1\)

Effects of Chronic Exercise on HDL-C Level

- Regular exercise increases HDL-C level.
- Kokkinos et al. reported a clear dose-response relationship between aerobic exercise (running) and HDL-C levels in healthy men:

<table>
<thead>
<tr>
<th>HDL-C (mg/dl)</th>
<th>Nonrunner (n = 685)</th>
<th>5 mi/wk (n = 335)</th>
<th>9 mi/wk (n = 512)</th>
<th>12 mi/wk (n = 376)</th>
<th>17 mi/wk (n = 602)</th>
<th>31 mi/wk (n = 396)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>47.3</td>
<td>48.7</td>
<td>50.7*</td>
<td>52.5*†</td>
<td>53.0*†</td>
<td>56.3*‡</td>
</tr>
</tbody>
</table>

*P < 0.001 vs nonrunners; †P < 0.01 vs nonrunners and 5 mi/wk; ‡P < 0.01 vs all other groups

Dietary Influences

- Total fat intake, independent of type
- *Trans*-fatty acids
- Alcohol
- Caloric restriction
Summary
Effects of Lifestyle Modifications on HDL-C Levels

- Weight reduction
  - For every 3 kg (7 lb) of weight loss, HDL-C levels increase 1 mg/dL.

- Smoking cessation
  - HDL-C levels in smokers are 7–20% lower than those in nonsmokers.
  - HDL-C levels return to normal within 30–60 days after smoking cessation.

- Exercise
  - Aerobic exercise (e.g., running) increases HDL-C in dose-dependent manner.
Effects of Dietary Modifications on HDL-C Levels

- Total fat intake
  - Low-fat diets lower HDL-C in all patients.

- Alcohol
  - Alcohol increases HDL-C in a dose-dependent manner.

- Caloric restriction
  - Caloric restriction acutely lowers HDL-C.
Healthy Eating Pyramid

- Use sparingly
  - Red Meat
  - White Broad
  - Pasta, Potato
  - Rice, Sweets

- Multivitamins for most

- Alcohol in moderation unless contraindicated

- Dairy or Calcium Supplement 1-2 times/day
- Fish, Poultry or Eggs 0-2 times/day
- Nuts, Legumes, 1-3 times/day
- Vegetables (in abundance)
- Fruits, 2-3 times/day
- Whole Grain Foods (at most meals)
- Plant oils: Olive, Avocado, Grapeseed & other plant oils

Daily Exercise & Weight Management

www.supplementgold.ir

www.rasayesh.com
Thank you