Dyslipidemia in Thai population, National Health Examination Survey IV, 2009

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- Chulalongkorn University
- Konkaen University
- Mahidol University
- Songkla University
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- Health System Research Institute
- Health Policy and Planning, Ministry Of Public Health, Thailand
Acknowledgement

NHSO

THAIHEALTH

MAHIDOL UNIVERSITY

http://www.nheso.or.th

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Background

• Cardiovascular diseases are among the leading causes of death in Thai population.
• Low HDL-C and high LDL-C are associated with increased risk of CVD outcomes.
• The prevalence of lipid abnormality other than total cholesterol is not clear in Thai population.
• Previous study show that screening and treatment rates were low.
• Monitoring and evaluate the situation of dyslipidemia in the population is importance.
CARDIOVASCULAR DISEASE

Twelve-year changes in vascular risk factors and their associations with mortality in a cohort of 3499 Thais: the Electricity Generating Authority of Thailand Study

Piyamitr Sritara, Sayan Cheepudomwit, Neil Chapman, Mark Woodward, Chomsri Kositchaiwat, Supoch Tunlayadechanont, Tanyachai Sura, Bunlue Hengprasith, Vichai Tanphaichitr, Somchart Lochava, Bruce Neal, Sunachai Tanomsup and Tada Yinintsoi

Table 3  Hazard ratios (95% CI) for the association of risk factors with vascular death among 3318 Thais followed for an average of 12 years

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Unadjusted</th>
<th>Adjusted(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (10 years)</td>
<td>3.7 (2.1, 6.5)</td>
<td>2.7 (1.5, 4.8)</td>
</tr>
<tr>
<td>Sex (male/female)</td>
<td>6.7 (1.6, 27.7)</td>
<td>2.6 (0.6, 11.1)</td>
</tr>
<tr>
<td>Body mass index (5 kg/m(^2))</td>
<td>1.6 (1.1, 2.4)</td>
<td>1.0 (0.6, 1.1)</td>
</tr>
<tr>
<td>Systolic blood pressure (10 mmHg)(^b)</td>
<td>1.7 (1.3, 2.2)</td>
<td>1.3 (1.0, 1.8)</td>
</tr>
<tr>
<td>Diastolic blood pressure (5 mmHg)(^b)</td>
<td>1.7 (1.4, 2.2)</td>
<td>1.5 (1.1, 1.9)</td>
</tr>
<tr>
<td>Total cholesterol (1.0 mmol/l)(^b)</td>
<td>1.1 (0.8, 1.7)</td>
<td>1.0 (0.7, 1.6)</td>
</tr>
<tr>
<td>HDL(^c) cholesterol (0.2 mmol/l)</td>
<td>0.6 (0.5, 0.8)</td>
<td>0.7 (0.6, 0.9)</td>
</tr>
<tr>
<td>Diabetes(^d) (yes/no)</td>
<td>5.3 (2.7, 10.2)</td>
<td>3.3 (1.6, 6.6)</td>
</tr>
<tr>
<td>Current smokers (yes/no)</td>
<td>2.8 (1.5, 5.2)</td>
<td>2.2 (1.1, 4.1)</td>
</tr>
</tbody>
</table>

\(^a\) Adjusted for every other variable in the Table (except that diastolic and systolic blood pressure were not adjusted for each other).
Outline

• Epidemiology of dyslipidemia in Thailand.
  – High total cholesterol, high LDL-C,
  – Low HDL-C, High triglyceride
  – By age, sex, urban/rural
  – Among CVD high risk group.
Thai NHES IV, 2009

- Multi-stage random sampling of 30,000 individuals age 1+ yr, non-institutionalized of registered population
- 5 provinces / regions + Bangkok = 21 provinces
- Population aged ≥20 ≈ 19,000 persons
- Blood samples (Fasting),
  - Lipid: TC, HDL-C, TG
  - Calculated LDL-C if TG < 400 and direct measure of LDL-C if TG ≥ 400 mg/dL

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### Characteristics of participants aged ≥20, NHES4, 2009

<table>
<thead>
<tr>
<th>Variable</th>
<th>Men (n=9021)</th>
<th>Women (n=10,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>45.3 (0.1)</td>
<td>46.4 (0.04)</td>
</tr>
<tr>
<td>Total Cholesterol, (mg/dL)</td>
<td>203.1 (1.2)</td>
<td>209.8 (1.0)</td>
</tr>
<tr>
<td>Triglyceride (mg/dL)</td>
<td>171.9 (2.9)</td>
<td>140.8 (2.6)</td>
</tr>
<tr>
<td>HDL (mg/dL)</td>
<td>45.2 (0.3)</td>
<td>48.7 (0.4)</td>
</tr>
<tr>
<td>LDL (mg/dL)</td>
<td>124.3 (1.2)</td>
<td>133.2 (1.1)</td>
</tr>
<tr>
<td>Non-HDL-C (mg/dL)</td>
<td>157.9 (1.0)</td>
<td>161.1 (0.9)</td>
</tr>
<tr>
<td>TC/HDL-C</td>
<td>4.7 (0.02)</td>
<td>4.5 (0.03)</td>
</tr>
<tr>
<td>LDL/HDL-C</td>
<td>2.9 (0.02)</td>
<td>2.9 (0.02)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.4 (0.1)</td>
<td>24.6 (0.1)</td>
</tr>
<tr>
<td>WC (cm)</td>
<td>80.6 (0.3)</td>
<td>79.5 (0.3)</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>124.6 (0.5)</td>
<td>121.0 (0.3)</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>77.4 (0.3)</td>
<td>74.3 (0.2)</td>
</tr>
<tr>
<td>Smoking (%)</td>
<td>40.2 (1.1)</td>
<td>2.2 (0.2)</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>6.4 (0.4)</td>
<td>8.1 (0.3)</td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>23.0 (1.0)</td>
<td>22.6 (0.5)</td>
</tr>
</tbody>
</table>
Mean Total cholesterol among population aged >20-59 yr

Prevalence of TC>=240 mg/dL in Thai population aged >=20-59 in 1991-2009
Mean total cholesterol by age

NHES IV, 2009

Mean (mg/dL)

Women: 209.8
Men: 203.1

Women
Men
Mean HDL-C by age

NHES IV, 2009

Women: 48.7 (mg/dL)
Men: 45.2

Mean HDL-C in Thai population
aged>=20 by age, NHES4, 2009

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Women: 133.2 mg/dL
Men: 124.3 mg/dL
**Mean non HDL-C by age**

Women: 161.1 mg/dL
Men: 157.9 mg/dL

**Mean Non HDL-C in Thai population aged>=20 by age, NHES4, 2009**
### Mean TC/HDL ratio by age

Mean (mg/dL)
- **Women:** 4.5
- **Men:** 4.7

### TC/HDL ratio in Thai population aged ≥20 by age, NHES IV, 2009

#### Men urban
- **Men rural**
- **Women urban**
- **Women rural**
Mean triglyceride by age

NHES IV, 2009

Mean (mg/dL)
Women: 140.8
Men: 171.9

Mean Triglyceride in Thai population aged>=20 by age, NHES4, 2009

NHES IV, 2009

Mean (mg/dL)
Women: 140.8
Men: 171.9

NHES IV, 2009
## LDL-C Goals and Cut-points: ATP-III

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>LDL-C Goal</th>
<th>Consider Drug Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHD or CHD risk equivalent</td>
<td>&lt;100 mg/dL</td>
<td>≥130 mg/dL*</td>
</tr>
<tr>
<td>≥2 Risk Factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-yr risk 10–20%</td>
<td>&lt;130 mg/dL</td>
<td>≥130 mg/dL</td>
</tr>
<tr>
<td>10-yr risk &lt;10%</td>
<td>&lt;130 mg/dL</td>
<td>≥160 mg/dL</td>
</tr>
<tr>
<td>&lt;2 Risk Factors</td>
<td>&lt;160 mg/dL</td>
<td>≥190 mg/dL</td>
</tr>
</tbody>
</table>

*RF: smoking, DM, HT, HDL-C<40, fam Hx, age>=45 in men, >=55 women

Estimate CVD risk

Cardiovascular risk prediction tools for populations in Asia

Asia Pacific Cohort Studies Collaboration

\[
p(8)_{\text{men}} = 1 - S(8)_{\text{men}} \exp \left\{ 0.068 (\text{age}_i - \overline{\text{age}}) + 0.012 (\text{SBP}_i - \overline{\text{SBP}}) + 0.15 (\text{TC}_i - \overline{\text{TC}}) + 0.37 (\text{smoke}_i - \overline{\text{smoke}}) \right\}
\]

and for women is

\[
p(8)_{\text{women}} = 1 - S(8)_{\text{women}} \exp \left\{ 0.078 (\text{age}_i - \overline{\text{age}}) + 0.017 (\text{SBP}_i - \overline{\text{SBP}}) + 0.14 (\text{TC}_i - \overline{\text{TC}}) + 0.55 (\text{smoke}_i - \overline{\text{smoke}}) \right\}
\]

- Estimate CVD risk for assigning LDL-C goal for each persons
  based on ATP III
- Asian Equation and survival prob. from EGAT study

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Age-adjusted prevalence of high LDL-C by LDL goal category

- <2 RF
  - Men: 18.8%
  - Women: 20.6%
- >=2 RF
  - Men: 34.6%
  - Women: 33.6%
- CHD risk equivalent
  - Men: 70.3%
  - Women: 76.2%

Risk category

Prevalence of dyslipidemia in Thai population, NHES4, 2009

- TC>240
  - Men: 18.8%
  - Women: 21.8%
- High LDL-C
  - Men: 31.1%
  - Women: 31.8%
- Low HDL-C
  - Men: 35.6%
  - Women: 48.7%
- TG>150
  - Men: 44.3%
  - Women: 32.9%
- Non HDL<130
  - Men: 29.4%
  - Women: 29.0%
- 130-159
  - Men: 23.8%
  - Women: 24.8%
- 160-189
  - Men: 20.5%
  - Women: 22.3%

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Prevalence of high LDL-C in people with and without CVD risk factors

- DM (70.0%)
- HT (42.4%)
- CHD (83.6%)
- Stroke (75.3%)
- Any of 4 CVD: DM, HT, CHD, Stroke (48.5%)
- Any of 5 CVD: + BMI>=25 (47.9%)

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Age-adjusted prevalence (%) of dyslipidemia in Thai population aged ≥ 20, NHES IV 2009

- Low HDL-C: 18.3%
- High LDL-C: 18.5%
- High TG: 3.0%
- No dyslipidemia: 29.2%

High LDL-C calculated based on ATPIII and estimated CVD risk, Asian equation

HDL<40 mg/dL in men / 50 in women
TG>=200 mg/dL

Based on risk stratification
Age-adjusted prevalence (%) of dyslipidemia in Thai population aged ≥ 20, NHES IV 2009

High LDL-C calculated based on number of CVD risk factors (ATPIII) Not using estimated CVD risk

High LDL-C goal at LDL-C >=160 mg/dL
Low HDL-C: HDL-C <40/50 ; High TG: TG=200 mg/dL

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Figure 1  Prevalence of standard lipid abnormalities among U.S. adults from NHANES 2003–2006.
Age-adjusted prevalence of dyslipidemia by urban/rural

Men

Women

Urban
Rural
### Mean and prevalence of CVD risk factors by type of lipid abnormality

<table>
<thead>
<tr>
<th></th>
<th>HighLDL</th>
<th>LowHDL</th>
<th>LowHDL</th>
<th>HighTG</th>
<th>HighLDL</th>
<th>Isolated LowHDL</th>
<th>HighTG</th>
<th>HighLDL</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BMI (kg/m²)</strong></td>
<td>27.5</td>
<td>25.4</td>
<td>25.8</td>
<td>25.7</td>
<td>23.5</td>
<td>24.4</td>
<td>24.3</td>
<td>22.7</td>
<td></td>
</tr>
<tr>
<td><strong>Waist (Cm)</strong></td>
<td>89.3</td>
<td>84.6</td>
<td>84.5</td>
<td>85.8</td>
<td>78.6</td>
<td>81.9</td>
<td>80.8</td>
<td>76.4</td>
<td></td>
</tr>
<tr>
<td><strong>SBP (mmHg)</strong></td>
<td>128.8</td>
<td>124.6</td>
<td>124.5</td>
<td>133.6</td>
<td>118.6</td>
<td>125.4</td>
<td>125.7</td>
<td>119.5</td>
<td></td>
</tr>
<tr>
<td><strong>DBP (mmHg)</strong></td>
<td>79.7</td>
<td>77.8</td>
<td>76.3</td>
<td>82.9</td>
<td>73.2</td>
<td>77.6</td>
<td>77.9</td>
<td>74.2</td>
<td></td>
</tr>
<tr>
<td><strong>Smoking (%)</strong></td>
<td>28.9</td>
<td>19.8</td>
<td>28.0</td>
<td>25.4</td>
<td>23.3</td>
<td>19.9</td>
<td>20.0</td>
<td>19.1</td>
<td></td>
</tr>
<tr>
<td><strong>Diabetes (%)</strong></td>
<td>24.1</td>
<td>7.6</td>
<td>15.9</td>
<td>20.4</td>
<td>3.8</td>
<td>3.9</td>
<td>11.9</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td><strong>Hypertension (%)</strong></td>
<td>34.6</td>
<td>26.3</td>
<td>26.6</td>
<td>45.1</td>
<td>14.6</td>
<td>25.2</td>
<td>28.9</td>
<td>15.8</td>
<td></td>
</tr>
<tr>
<td><strong>MetS (%)</strong></td>
<td>84.6</td>
<td>66.6</td>
<td>44.8</td>
<td>51.7</td>
<td>25.0</td>
<td>25.2</td>
<td>14.4</td>
<td>4.4</td>
<td></td>
</tr>
</tbody>
</table>
Trends in percentage of energy intake from macronutrients

Source: Thai National Nutritional Survey and NHES IV
Figure 1. Trends in mean TC and individual lipid fractions of respondents 20 to 74 years old for the NHANES II, NHANES III, and NHANES 1999 to 2006. All estimates are weighted to the United States population using oral glucose tolerance test final examined weights. All estimates are age adjusted to the 2000 standard United States population using the direct method (groups 20 to 39, 40 to 59, and 60 to 74 years of age).

Cohen JD. et al.  Am J Cardiol 2010;106:969–975
Summary

• Dyslipidemia is very common in Thai population and it increases with age.
• Trends in prevalence of hypercholesterolemia increase.
• The most common dyslipidemia is low HDL-C in women and high TG in men
• High LDL-C is more common in those living in urban areas.
• Low HDL-C and high TG was more prevalence in rural areas and the northeastern.
• The urban/rural difference is likely to be related to dietary pattern, but need further investigation.
Summary

• Compared to other populations, Thai population have a relatively higher prevalence of low HDL-C and high triglyceride.

• If the international cut-off points for dyslipidemia, eg. HDL/LDL is appropriate for Thais.

• Factors related to low HDL-C and high triglyceride might be due to the lifestyle including diet, alcohol drinking, smoking and physical activity.

• High proportion of population not on LDL-C target, especially those with high risk stratum.
Summary

• Socioeconomic status and education might also play role in the difference.
• More research is needed for looking into the causes.
• Guideline for Mx of dyslipidemia, definition for Thais.
• Intervention program to promote healthy lifestyle and strengthen the screening, treatment and control need to be scaled up.
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