Prevalence of Metabolic Syndrome and Individual Criteria in College Students

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HN&F 614 Seminar #1
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Outline

- Background
- Objective(s)
- Experimental Design
- Methods
- Results
- Strengths/Limitations
- Conclusion
- Class Evaluation
- Class Discussion
**What is Metabolic Syndrome (MetS)?**

Subjects meeting 3 or more of the following criteria:

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Defining Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Waist Circumference</strong></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>&gt; 102 cm (&gt; 40 in)</td>
</tr>
<tr>
<td>Females</td>
<td>&gt; 88 cm (&gt; 35 in)</td>
</tr>
<tr>
<td><strong>Triglycerides</strong></td>
<td>≥ 150 mg/dL</td>
</tr>
<tr>
<td><strong>High-density lipoprotein (HDL) cholesterol</strong></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>&lt; 40 mg/dL</td>
</tr>
<tr>
<td>Females</td>
<td>&lt; 50 mg/dL</td>
</tr>
<tr>
<td><strong>Blood Pressure</strong></td>
<td>≥ 130/85 mmHg</td>
</tr>
<tr>
<td><strong>Fasting blood sugar</strong></td>
<td>≥ 100 mg/dL</td>
</tr>
</tbody>
</table>

Previous research has shown the fastest increase in rates of obesity among 18 to 29 year olds \(^5\)

As many as 35% of college students are classified as either overweight or obese \(^3\)

Overweight or obese college students are more likely to meet 3 or more MetS criteria \(^1, 2, 3\)

Body mass index (BMI) and weight gain have consistently been shown to predict the development of MetS \(^4\)

3. Huang et al. *Diabetes Care*. 2004
MetS is a precursor for coronary heart disease and diabetes \(^{(1, 3, 4, 5, 6)}\)

CHD is the leading cause of death for all adults in the United States and is the second leading cause of death in young adults ages 18 to 29 \(^{(CDC, 2008)}\)

An individual’s risk for cardiovascular disease subsequently doubles and the risk for developing type II diabetes becomes 5x higher \(^{(2)}\)

New England Region: URI
1° **Objective:** Determine the point prevalence of MetS in a sample of first-year college students.

2° **Objective:** Determine which criteria were most prevalent among this population and to examine gender and body mass index (BMI) differences in regards to number of criteria and overall MetS prevalence.
Experimental Design

Inclusion Criteria:
- First year student
- 18 – 24 years

Exclusion Criteria:
- Pregnant/lactating
- Reported one of the following conditions:
  - Liver disease
  - Bleeding disorder
  - Diabetes
  - Cancer
  - CHD
Experimental Design

Cross-sectional: allows researchers to obtain the current health status of the target population at one point in time

Subjects
- Total (n) = 189
- 128 females (67.7%)
- 61 males (32.3%)
- Gender distribution (2:1)

All subjects read and signed an informed consent that was approved by URI’s Institutional Review Board.
Methods:

- **Anthropometrics**
  - Height
  - Weight
  - Waist Circumference

- **Biochemical Measures**
  - Total cholesterol (TC)
  - High-density lipoprotein cholesterol (HDL-C)
  - Triacylglycerols (TAGs)
  - Glucose (GLU)

- **Blood Pressure**
Anthropometric Protocols:

- All measurements performed by trained study staff
- Measurements conducted 2x
  
  **NOTE:** Average of the two readings within specified standard recorded

- Standard procedures:
  1. Following 12 hour fast
  2. Wearing light clothing w/o shoes
  3. Empty bladder
Anthropometrics

Height
- Measured to the nearest 0.1 cm
  Model: *Seca 220 Stadiometer*

Weight
- Measured to the nearest 0.1 kg
  Model: *Seca 769 scale*

BMI
- Calculated using the following formula:
  \[
  \text{BMI} = \frac{\text{weight in kilograms}}{\text{height in meters}^2} \text{ (kg/m}^2\text{)}
  \]

Waist circumference
- Measured at the top of the iliac crest upon exhalation to the nearest 0.1 cm
  using a Gulick fiberglass, nonstretchable tape measure with a tensometer
### BMI Classifications

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5 kg/m²</td>
</tr>
<tr>
<td>Normal</td>
<td>18.5 – 24.9 kg/m²</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0 – 29.9 kg/m²</td>
</tr>
<tr>
<td>Obesity</td>
<td>≥ 30 kg/m²</td>
</tr>
</tbody>
</table>
Biochemical Measures

- Trained phlebotomist completed two 12-hour fasting venous blood draws on two nonconsecutive morning visits in the same week
- 40 to 50 mL of whole blood was collected
- Samples were centrifuged for 20 minutes
- Preservation cocktail was added to plasma
- Samples were stored in separate 500 – mL aliquots in a -80°C freezer until analysis
- Glucose concentrations were based on 1 day’s blood sample
- Lipids were based on the mean of the 2 days
Blood Pressure

- 5 minute seated resting period
- Trained exercise physiologist measured each subject’s resting BP 2x
- 1 minute interval b/t measurements
- Variance > 2 mmHg
Results

Point Prevalence
- Point prevalence of MetS in the total sample was 3.7%
- More females than males were classified with MetS (4.7% vs. 1.6%)
- Significance could not be tested due to 1 male meeting the MetS classification
- 28% of the sample had at least 1 criterion for MetS and 7.4% had 2 criteria

Gender
- Males had a significantly greater WC and higher SBP and DBP than females
- Females had significantly higher mean concentrations of TAG and HDL-C
- Significantly more males had no MetS criteria compared to females (73.8% vs. 54.7%, p = 0.009)
Results

BMI

- Mean BMI (23.6 ± 3.9 kg/m²) was in the normal range
- 35 subjects were identified as overweight (18.5%)
- 13 subjects were identified as obese (6.9%)
- Obese subjects were more likely to meet 3 or more MetS criteria (38.5%) than under/normal weight (0.0%, p < 0.001) and overweight (5.7%, p = 0.011)
- Prevalence of low HDL-C, elevated WC, and elevated BP was significantly greater in obese participants compared to those with a BMI < 30 kg/m²
Anthropometric, Clinical and Biochemical Descriptives of Subjects

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>All (n = 189)</th>
<th>Female (n = 128)</th>
<th>Male (n = 61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC</td>
<td>Mean 78.9 SD 9.6</td>
<td>Mean 77.0 SD 9.8</td>
<td>Mean 82.8** SD 7.8</td>
</tr>
<tr>
<td>SBP</td>
<td>Mean 107.4 SD 9.7</td>
<td>Mean 105.2 SD 9.0</td>
<td>Mean 112.1** SD 9.5</td>
</tr>
<tr>
<td>DBP</td>
<td>Mean 67.9 SD 7.5</td>
<td>Mean 66.8 SD 6.6</td>
<td>Mean 70.2** SD 8.8</td>
</tr>
<tr>
<td>HDL-C</td>
<td>Mean 58.8 SD 14.4</td>
<td>Mean 61.22 SD 14.7</td>
<td>Mean 53.6** SD 12.5</td>
</tr>
<tr>
<td>TAG</td>
<td>Mean 99.0 SD 52.0</td>
<td>Mean 104.3 SD 54.2</td>
<td>Mean 87.8* SD 45.6</td>
</tr>
<tr>
<td>GLU</td>
<td>Mean 88.0 SD 8.1</td>
<td>Mean 87.5 SD 8.5</td>
<td>Mean 89.1 SD 7.1</td>
</tr>
</tbody>
</table>

* denotes p < .05 , ** denotes p < 0.01

Adapted from Table 1
Results

Number of Metabolic Criteria per BMI category

Underweight/normal weight (n=141), overweight (n = 35), obese (n=13). Different subscripts denote significant group differences (p < 0.05).

Adapted from Figure 3
Underweight/normal weight (n = 141), overweight (n = 35), obese (n = 13). Different letters denote significant group differences (p < 0.01).
## Comparison of Results to Other Studies

<table>
<thead>
<tr>
<th>Study Name</th>
<th>Prevalence of MetS (%)</th>
<th>Results Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fernandes et al.</td>
<td>3.7%</td>
<td></td>
</tr>
<tr>
<td>Yen et al.</td>
<td>4.6%</td>
<td>Similar</td>
</tr>
<tr>
<td>Burke et al.</td>
<td>4.9%</td>
<td>Similar</td>
</tr>
<tr>
<td>Huang et al.</td>
<td>0.6%, 1.3%</td>
<td>Higher</td>
</tr>
<tr>
<td>Barbieri et al.</td>
<td>7.7%</td>
<td>Lower</td>
</tr>
<tr>
<td>Cardoso et al.</td>
<td>10.3%</td>
<td>Lower</td>
</tr>
<tr>
<td>Mattsson et al.</td>
<td>13.0%</td>
<td>Lower</td>
</tr>
</tbody>
</table>

- Similar to Yen et al. (North Taiwan) and Burke et al.; possibly due to comparable ethnic compositions & age range
- Higher than Huang et al. (USA)
- Lower than Barbieri et al. (Brazil), Cardoso et al. (Brazil) and Mattsson et al. (Finland)
Comparison of Results to Other Studies

### Prevalence

<table>
<thead>
<tr>
<th>Study Name</th>
<th>Most prevalent MetS Risk Factor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fernandes et al.</td>
<td>HDL-C, TAG</td>
</tr>
<tr>
<td>De Ferranti et al.</td>
<td>Similar</td>
</tr>
<tr>
<td>Huang et al.</td>
<td>Similar</td>
</tr>
<tr>
<td>Yen et al., Burke et al. &amp; Tsai et al.</td>
<td>HDL-C, elevated BP</td>
</tr>
<tr>
<td>Ervin et al.</td>
<td>Elevated WC</td>
</tr>
</tbody>
</table>

### Gender

<table>
<thead>
<tr>
<th>Study Name</th>
<th>Females w/ MetS (%)</th>
<th>Males w/ MetS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fernandes et al.</td>
<td>4.7%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Park et al.</td>
<td>18.6%</td>
<td>16.6%</td>
</tr>
<tr>
<td>Barbieri et al.</td>
<td>n/a</td>
<td>Twice as high</td>
</tr>
<tr>
<td>NHANES 2003-2006</td>
<td>15.6%</td>
<td>20.3%</td>
</tr>
</tbody>
</table>
## Strengths & Limitations

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>All measures were performed by trained staff</td>
<td>Cross-sectional design limits causal inferences</td>
</tr>
<tr>
<td>Each measure was repeated until 2 measures fell within designated range</td>
<td>Sample had few minorities (13.2%) which isn’t reflective of the national population (25.9%)</td>
</tr>
<tr>
<td>If subjects were not fasting, they were rescheduled</td>
<td>Unequal ratio of females to males (2:1)</td>
</tr>
<tr>
<td>Variety of academic majors</td>
<td>Multiple definitions of “young adult”</td>
</tr>
<tr>
<td>Few studies have been conducted in NE region</td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

- Young adults are at risk of developing MetS (3.7%)
- Approximately ⅓ of subjects presented with at least 1 MetS criterion
- A greater percentage of females (4.7%) presented with MetS than males (1.6%)
- Most prevalent MetS risk factors:
  - low HDL concentrations (20.1%)
  - elevated TAG concentrations (17.5%)
- GLU does not seem to be much of a factor in this population
- BMI plays a significant role in the development of certain MetS risk criteria (HDL-C, WC & BP)
- Lifestyle habits, such as diet composition and physical activity level, can impact MetS criteria.
Evaluation : Accept or Reject?
Class Discussion

- Title
- Abstract
- Introduction
- Methods
- Table/Graph(s)
- Results
- Comments
- Strengths/Limitations
- Conclusion