The Association between Physical Activity and Metabolic Syndrome in Older Women

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Abstract
Metabolic syndrome (MetS), a cluster of health conditions, has been associated with developing subsequent diabetes and/or heart disease. Both moderate/vigorous physical activity (MVPA) and sedentary behavior (SB) have been shown to be associated with MetS risk in adults, but little is known about PA/SB and MetS in older women. Therefore, we investigated the link between MVPA and SB with MetS indicators in older (50 yrs. ± 9.5 yrs) and younger women (49 yrs, ± 1.21 yrs), utilizing 2005-06 National Health and Nutrition Examination Survey (NHANES) data. Separate univariate analyses were conducted using weighted questionnaire and laboratory data to assess associations between MVPA and SB with MetS indicators. In older women, MVPA was significantly associated with waist circumference (β = -0.276, p < 0.001), fasting glucose (β = -0.370, p < 0.001), triglycerides (β = -0.575, p < 0.001), and systolic (β = -0.246, p < 0.001) and diastolic blood pressure (β = 0.119, p < 0.001). Similarly, for younger women, significant associations were observed between MVPA and waist circumference (β = -0.276, p < 0.001), triglycerides (β = -0.808, p < 0.001), and systolic (β = -0.084, p < 0.001) and diastolic blood pressure (β = 0.094, p < 0.001). In older women, stronger associations in magnitude were evident between MVPA and MetS indicators compared to those found between SB and MetS (waist circumference: β = -0.276 vs. 0.02; glucose: β = -0.370 vs. 0.003) suggesting that MVPA may have a stronger influence on MetS in this population. Our findings suggest that MVPA may play an important role in improving MetS indicators in older women, potentially curbing later onset diabetes and heart disease.

Background

- Metabolic syndrome (MetS) is a cluster of 3 or more of the following cardiometabolic risk factors:
  - waist circumference >88 cm for women
  - triglycerides >150 mg/dL
  - systolic blood pressure >130 mmHg or
  - diastolic blood pressure >85 mmHg
  - fasting glucose >100 mg/dL
  - HDL cholesterol < 50 mg/dL
- MetS is associated with an increased risk of type 2 diabetes, cardiovascular disease, and stroke.2
- Older adults have a higher prevalence of MetS due to higher rates of physical inactivity, mobility impairments, and obesity.1
- Sedentary behavior (SB), defined as any waking behavior involving sitting or reclining such as watching TV or using the computer, is also associated with MetS in older adults.3
- Understanding how relationships between PA, SB, and MetS differ between younger and older women will allow us to better tailor interventions to improve cardiometabolic health in older women.

Methods

Study design:
- Cross-sectional design using data derived from the 2005-2006 from the National Health and Nutrition Examination Survey (NHANES).

Measures:
- Independent variables: moderate-vigorous activity (MVPA) and sedentary time (ST) measured via accelerometer (type of accelerometer) for 7 consecutive days.
- Dependent variables: waist circumference (WC), fasting glucose (GLU), triglyceride (TRG), systolic (SBP) and diastolic blood pressure (DBP).
  - GLU and TRG measured using blood sampling
  - SBP and DBP measured via automated blood pressure monitor

Data analyses:
- Women were stratified into two groups: ≤ 49 years (N=1,721) ≥ 50 years (N=1,021)
- Separate univariate models were run for each MetS indicator to determine associations with MVPA and sedentary time.
- Statistical significance was set at p<.05

Results

Regression Analysis: Moderate to Vigorous PA

**Table 1: Descriptive Statistics**

<table>
<thead>
<tr>
<th><strong>Age (yrs)</strong></th>
<th><strong>MetS Indicator</strong></th>
<th><strong>WC (cm)</strong></th>
<th><strong>GLU (mg/dL)</strong></th>
<th><strong>TRG (mg/dL)</strong></th>
<th><strong>SBP (mmHg)</strong></th>
<th><strong>DBP (mmHg)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean ± SD</strong></td>
<td>WC (cm)</td>
<td>92.0 ± 16.4</td>
<td>95.2 ± 24.4</td>
<td>116.7 ± 82.1</td>
<td>133.5 ± 13.2</td>
<td>68.4 ± 11.0</td>
</tr>
<tr>
<td><strong>Mean ± SD</strong></td>
<td>GLU (mg/dL)</td>
<td>96.9 ± 15.8</td>
<td>111.6 ± 38.2</td>
<td>147.4 ± 121.5</td>
<td>133.6 ± 23.4</td>
<td>69.4 ± 16.0</td>
</tr>
<tr>
<td><strong>Mean ± SD</strong></td>
<td>TRG (mg/dL)</td>
<td>0.276 ± 0.278</td>
<td>0.370 ± 0.155</td>
<td>0.575 ± 0.092</td>
<td>0.246 ± 0.153</td>
<td>0.119 ± 0.119</td>
</tr>
</tbody>
</table>

**Table 2: Regression Analysis**

<table>
<thead>
<tr>
<th>MetS Indicator</th>
<th>&lt;49 yrs</th>
<th>≥ 50 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC (cm)</td>
<td>-0.278</td>
<td>-0.248</td>
</tr>
<tr>
<td>GLU (mg/dL)</td>
<td>-0.089</td>
<td>-0.092</td>
</tr>
<tr>
<td>TRG (mg/dL)</td>
<td>-0.080</td>
<td>-0.078</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>-0.084</td>
<td>-0.147</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>-0.094</td>
<td>-0.182</td>
</tr>
</tbody>
</table>

**Table 3: Summary**

- In older women, MVPA was significantly associated with waist circumference, fasting glucose, triglyceride, systolic and diastolic blood pressure.
- Strong associations were also found between MVPA and younger women as well: waist circumference, triglyceride, systolic and diastolic blood pressure.
- In older and younger women, the association with each MetS indicator to ST showed very weak correlations.

Conclusion

- Although MVPA is moderately correlated with MetS indicators in both older and younger women, the correlation is stronger in the older group. This may reflect an age-related decline in PA participation and increased engagements in more sedentary activities.
- It is important for older women to stay physically active since MVPA may reduce the likelihood of developing insulin resistance and/or delay the onset of diabetes and heart disease.
- Compared to ST, MVPA may have a stronger influence on indicators of MetS, in both younger and older women.

References

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