Background

Metabolic syndrome (MetS) is defined as possessing ≥3 interrelated metabolic risk factors that are associated with increased diabetes and cardiovascular disease risk [1,2]. Clinicians commonly rely on body mass index (BMI) as a measure of overweight to indicate increased risk of MetS. BMI is limited due to the presence of MetS in normal weight adults and no MetS in many overweight adults. Body shape provides an indirect measure of body fatness that may improve the identification of MetS in adults.

Objective: To examine the ability for body shape as measured by 3-dimensional optical imaging (3DO) to improve the prediction of MetS in a sample of adults.

Methods

Adults (>18y) were recruited as part of the Shape Up! Adults study. MetS was diagnosed using the National Cholesterol Education Program (NCEP) guidelines for diagnosis [3]:

- Waist circumference ≥102 cm for males and ≥88 cm for females
- Blood pressure ≥130 mm Hg systolic or ≥85 mm Hg diastolic
- Blood triglycerides ≥150 mg/dL
- Fasting glucose ≥100 mg/dL
- HDL-C <40 mg/dL for males and <50 mg/dL for females

Cutoff Males Females
Waist circumference ≥102 cm ≥88 cm
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Fasting glucose ≥100 mg/dL
HDL-C <40 mg/dL <50 mg/dL

Table 1: NCEP criteria for MetS diagnosis

Body shape was assessed through 3DO scans using a Styku S100 (Styku, Los Angeles, CA) scanner. MetS was coded as a binary outcome (MetS – vs. MetS +) and predicted using logistic regression in SAS version 9.4 (SAS Institute, Cary, NC).

We compared the ability to predict MetS using BMI, demographic-adjusted BMI, 3DO, and BMI + demographics + 3DO models (Model 4) using receiver operating characteristic curves.

Table 2: Participant demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>46.2 (16.5)</td>
<td>18.0</td>
<td>89.0</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>167.7 (10.0)</td>
<td>144.1</td>
<td>202.1</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>77.8 (22.2)</td>
<td>35.4</td>
<td>173.5</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27.5 (7.0)</td>
<td>14.2</td>
<td>52.6</td>
</tr>
</tbody>
</table>

Table 2: Participant demographics

The 3DO variables included in model 4 were, in order of importance: waist to hip ratio, percent bone mass, waist circumference, and calf volume.

Model 4 predicted 78 of 87 (89.7%) MetS+ subjects and 349 of 414 (84.3%) MetS- cases.

Model 4 correctly identified all 7 participants with normal weight MetS+ and correctly predicted MetS- in 201 of 222 (90.5%) overweight subjects.

Conclusion

Body shape measures by 3DO improves the prediction of MetS and is an easily accessible, cost-effective tool for long-term clinical use in disease prevention and detection.

References


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