GRIP STRENGTH AS A MARKER FOR DIABETES RISK?

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Internal Medicine
• Diabetes risk factors:\(^1\):
  – Age
  – Obesity
    • Fat distribution
    • Birth weight
  – Ethnicity
  – Lack of exercise
  – Family history
  – Smoking
DM & OBESITY

- Lifetime risk of developing diabetes: 33%
- Lifetime risk of obesity: >50%³
2007 Age-Adjusted Estimates of the Percentage of Adults with Diagnosed Diabetes and Obesity

Diabetes

Obesity (BMI ≥ 30)
DM & MUSCLE

- Associated with excessive loss of skeletal muscle\(^5\)
- Associated with poorer muscle strength and quality\(^6\)
- And grip is associated with overall fitness in diabetes (type 1, at least)\(^7\)
THE QUESTION

• Is hand-grip strength associated with incident diabetes?
METHODS

• Cohort from the Japanese-American Community Diabetes Study
• Longitudinal design
• 394 nondiabetic Japanese-Americans (100% Japanese ancestry)
• **Outcome:** Association between HGS and type 2 diabetes risk, adjusted for age, sex, family history of DM, and BMI
METHODS

- HGS: Measured at baseline with Harpenden R dynamometer x3 on the dominant hand
- Normal range: $50.8 \text{ kg} \pm 9.1^8$
- Mean HGS in our dataset: $50.4 \text{ kg} \pm 0.7$
METHODS

• Diabetes defined by OGTT
  – 75g CHO load
  – Fasting glucose $\geq 126$ mg/dl and/or 2-hr glucose $\geq 200$ mg/dl

• Not A1c? Data collection started before A1c was standardized

• BMI: kg/m$^2$
METHODS

• Follow-up: Presence of diabetes at 10 years

• 80% follow-up rate\textsuperscript{9}
ANALYSIS

- Logistic regression model
- Covariates were age, family history of diabetes, BMI, and sex
- Interactions between HGS and model covariates were assessed using first-order interaction terms
OUR COHORT

• 394 Japanese-American subjects
• Mean age 51.9 years, range 34-75
• More commonly male, 53%
• Mean BMI 24.1 kg/m², range 16.6 to 36.9
• Mean HGS 50.4 kg, range 21.5 to 86.5
OUR COHORT

<table>
<thead>
<tr>
<th></th>
<th>Diabetes</th>
<th>No diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>57.4 ± 0.6</td>
<td>50.6 ± 1.3</td>
</tr>
<tr>
<td><strong>Sex ( % male)</strong></td>
<td>60% ± 6</td>
<td>52% ± 3</td>
</tr>
<tr>
<td><strong>Family history (% yes)</strong></td>
<td>58% ± 6</td>
<td>31% ± 3</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td>25.2 ± 0.4</td>
<td>23.8 ± 0.2</td>
</tr>
</tbody>
</table>
RESULTS

• Incidence of diabetes: 18.5%
• Age and family history were associated with increased risk
• Sex was not
• No association between grip strength and DM
RESULTS

• Association between HGS and diabetes risk
  – Negative (coefficient -0.208)
  – Statistically significant (p=0.008)

• High BMI erases benefit of grip strength
Probability of 10-year incident type 2 diabetes by baseline hand-grip strength (continuous measurement). Probabilities are shown for persons with BMI set to the 25th percentile (solid line), median (long-dashed line), or 75th percentile (short-dashed line) and average age, sex and family history for this cohort.
# RESULTS

## Adjusted ORs for diabetes risk for a 10-kg increase in HGS by BMI percentile

<table>
<thead>
<tr>
<th>BMI percentile</th>
<th>Odds ratio</th>
<th>95% CI</th>
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<tbody>
<tr>
<td>25th</td>
<td>0.68</td>
<td>0.43-1.09</td>
</tr>
<tr>
<td>50th</td>
<td>0.79</td>
<td>0.52-1.20</td>
</tr>
<tr>
<td>75th</td>
<td>0.98</td>
<td>0.67-1.43</td>
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What is “interaction”? 

• a.k.a. “effect modification”
• Strength of association between two factors varies by a third factor
• Here, the relationship between HGS and risk of diabetes varies according to BMI
• Classic example: Lung ca, asbestos, and tobacco
  – RR in asbestos alone = 5
  – RR in tobacco alone = 10
  – RR in asbestos + tobacco = 50
• ≠ confounding
About confounding

• An unmeasured factor is responsible for association between exposure and outcome

• A simple example:
  – People who carry matches have higher risk of lung cancer but …
  – People who carry matches are more likely to be smokers

• Key distinction: Confounding is bias. If you don’t take it into account, you will report a biased result
LIMITATIONS

• HGS measured only at baseline
• 100% Japanese-American cohort limits generalizability
• Observational design
• Only single glucose measurement—not enough for clinical diagnosis, but adequate for epidemiology according to WHO and ADA
• Of less use in heavier people—those more likely to get DM
CONCLUSIONS

• Among leaner individuals, greater HGS was associated with lower risk of type 2 diabetes, suggesting it may be a useful marker of risk in this population.
THE SIGNIFICANCE

• Novel way to help predict diabetes risk
• HGS could provide similar information about diabetes risk as more expensive and time consuming measurements of body composition


4. Boyko EB, Diabetes and Obesity Trends, PowerPoint presentation


