Cardiovascular Fat in Women at Midlife: Effects of Race, Overall Adiposity, and Central Adiposity

The SWAN Cardiovascular Fat Study

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Presented by
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March 3, 2016
Financial Disclosures: None
Introduction
Cardiovascular Fat (CF)

- Fat around heart & vasculature
- Important depots
- CF associated with CVD
- Racial/ethnic differences
- ↑ Adiposity = ↑ CF

Fitzgibbons TP, Czech MP. *J Am Heart Assoc.* 2014;3(2):e000582
Racial Differences in CF

• Racial paradox in Blacks:
  - ↑ BMI
  - ↓ Visceral fat (VAT), CF, liver fat
  - ↑ CVD

• Recent ERA-JUMP Study*:
  - Black men ↓ CF, independent of BMI
  - VAT explained racial differences in CF
  - ↑ BMI = ↑ CF in White vs Black men

Important Population: Midlife Women

- Postmenopausal vs Premenopausal women
  - ↑ Risk of CVD
  - ↑ VAT
  - ↑ CF
- Racial differences?
Objectives

• Determine whether race, overall adiposity, and central adiposity are associated with the quantity of cardiovascular fat (CF) in midlife women

• Evaluate whether associations between adiposity measures and CF vary by race in midlife women
Methods
Baseline eligibility criteria:
- Aged 42-52 years
- An intact uterus and at least 1 ovary
- At least 1 menstrual period within the past 3 months
- No hormone therapy use within the past 3 months
Heart Fat Depots
(Volumes by EBCT scan)

Paracardial Adipose Tissue (PAT)

Epicardial Adipose Tissue (EAT)

Total Heart Adipose Tissue (TAT) = PAT + EAT

Tamarappoo et al. *JACC Card Imag.* 2010;3(11):1104-1112

*Measured at Los Angeles Biomedical Research Institute (LA BioMed)*
Aortic Fat Depots
(Volumes by EBCT scan)

Aortic Perivascular Adipose Tissue (PVAT)

Measured at University of Pittsburgh Ultrasound Research Lab
## Menopausal Status

<table>
<thead>
<tr>
<th>Status</th>
<th>Last 3 months</th>
<th>Last 12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premenopausal</td>
<td>Menses</td>
<td>No change in regularity</td>
</tr>
<tr>
<td>Early Peri-menopausal</td>
<td>Menses</td>
<td>Some change in regularity</td>
</tr>
<tr>
<td>Late Peri-menopausal</td>
<td>No menses</td>
<td>Some menstrual bleeding</td>
</tr>
<tr>
<td>Natural Postmenopausal</td>
<td>No menses</td>
<td>No menses</td>
</tr>
<tr>
<td>Hormone Users</td>
<td>Hormone therapy use</td>
<td></td>
</tr>
</tbody>
</table>
Statistical Analyses

• Multivariable linear regression for analyses

• Covariates
  ▪ Age; study site; menopausal status
  ▪ Hypertension
    ▪ \( SBP \geq 140 \text{ mm Hg or DBP} \geq 90 \text{ mm Hg or taking BP medication} \)
  ▪ Diabetes
    ▪ \( \text{Fasting plasma glucose} \geq 126 \text{ mg/dL or taking diabetes medication} \)
  ▪ Alcohol consumption
    • \( \leq 1 \text{ drink/month} \)
    • \( >1 \text{ drink/month to 1 drink/week} \)
    • \( \geq 2 \text{ drinks/week} \)
Results
### Table 1: Characteristics of Population by Race

<table>
<thead>
<tr>
<th>Variables</th>
<th>White (n=324) (62%)</th>
<th>Black (n=200) (38%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>50.9 ± 2.9</td>
<td>51.0 ± 2.8</td>
<td>0.605</td>
</tr>
<tr>
<td>Menopausal Status, n (%)</td>
<td></td>
<td></td>
<td>0.048</td>
</tr>
<tr>
<td>Pre-/early peri-</td>
<td>183 (56.5)</td>
<td>107 (53.5)</td>
<td></td>
</tr>
<tr>
<td>Late peri-/post</td>
<td>103 (31.8)</td>
<td>80 (40.0)</td>
<td></td>
</tr>
<tr>
<td>Hormone Users</td>
<td>38 (11.7)</td>
<td>13 (6.5)</td>
<td></td>
</tr>
<tr>
<td>Alcohol Use</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>≤ 1/month</td>
<td>87 (26.9)</td>
<td>111 (55.5)</td>
<td></td>
</tr>
<tr>
<td>&gt; 1/month to 1/week</td>
<td>134 (41.4)</td>
<td>57 (28.5)</td>
<td></td>
</tr>
<tr>
<td>≥ 2/week</td>
<td>103 (31.8)</td>
<td>32 (16.0)</td>
<td></td>
</tr>
<tr>
<td>Diabetes, n (%)</td>
<td>14 (4.3)</td>
<td>12 (6.0)</td>
<td>0.390</td>
</tr>
<tr>
<td>Hypertension, n (%)</td>
<td>53 (16.4)</td>
<td>80 (40.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>28.1 ± 5.7</td>
<td>31.0 ± 6.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>VAT, cm²</td>
<td>107.6 (69.0, 165.6)</td>
<td>114.0 (79.2, 158.0)</td>
<td>0.956</td>
</tr>
</tbody>
</table>
Figure 1: Unadjusted CF Volumes by Race

**EAT**
- White Women: 38.2 cm³
- Black Women: 35.4 cm³
- p = 0.014

**PAT**
- White Women: 8.9 cm³
- Black Women: 9.5 cm³
- p = 0.615

**TAT**
- White Women: 48.0 cm³
- Black Women: 45.2 cm³
- p = 0.044

**PVAT**
- White Women: 30.6 cm³
- Black Women: 28.6 cm³
- p = 0.088
### Table 2: Percent differences in CF by race

<table>
<thead>
<tr>
<th></th>
<th>EAT %Diff (95% CI)</th>
<th>PAT %Diff (95% CI)</th>
<th>TAT %Diff (95% CI)</th>
<th>PVAT %Diff (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>-17.6*** (-24.5, -10.1)</td>
<td>-19.8** (-30.4, -7.6)</td>
<td>-17.6*** (-24.6, -9.9)</td>
<td>-11.6*** (-17.4, -5.4)</td>
</tr>
<tr>
<td><strong>Model 2: model 1 + BMI</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Black</td>
<td>-21.7*** (-27.1, -16.0)</td>
<td>-26.1*** (-34.2, -16.9)</td>
<td>-22.2*** (-27.4, -16.6)</td>
<td>-15.9*** (-20.2, -11.4)</td>
</tr>
<tr>
<td><strong>Model 3: model 1 + VAT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>-10.1** (-16.0, -3.9)</td>
<td>-8.6 (-18.4, 2.3)</td>
<td>-9.3** (-15.0, -3.3)</td>
<td>-5.4* (-10.1, -0.7)</td>
</tr>
</tbody>
</table>

Model 1: adjusted for age, study site, menopausal status, hypertension, diabetes, and alcohol consumption; *p<0.05; **p<0.01; ***p<0.001
Effect Modification of Race

• Race modified associations between adiposity measures and CF

• Stronger associations between…
  - BMI & PAT in White vs Black women
  - VAT & EAT in Black vs White women
Every 1 standard deviation $\{6.2 \ kg/m^2\}$ increase in BMI corresponded to 70% greater PAT in White women compared to 43% greater PAT in Black women.
Every 1 standard deviation increase in VAT \( \{59.6 \text{ cm}^2\} \) corresponded to 31% greater EAT in Black women compared to 25% greater EAT in White women.
Summary

• Racial differences in CF for midlife women
  ▪ Black women ↓ CF, independent of BMI
  ▪ Results somewhat attenuated after adjusting for VAT

• Race modified associations between adiposity measures & CF
  ▪ ↑ BMI = ↑ PAT in White vs Black women
  ▪ ↑ VAT = ↑ EAT in Black vs White women
Strengths and Limitations

Limitations
• Cross-sectional analyses
• Lack of generalizability to other populations
• BMI surrogate marker of overall adiposity

Strengths
• First study: racial differences in CF among women
• SWAN: well-established study
• High quality measurements for fat depots
Conclusion

• Our findings are consistent with midlife men
  ▪ Racial differences in CF (Black women ↓ CF)
  ▪ Race modified associations between adiposity & CF

• Mounting evidence supports potential role of CF in the pathogenesis of CVD

• Understanding potential determinants of CF may help identify areas for intervention
Future Direction

• Longitudinal changes in adiposity & changes in CF by race

• Racial differences in how changes in CF relate to future CVD events
Funding Acknowledgments

The Study of Women’s Health Across the Nation (SWAN) has grant support from the National Institutes of Health (NIH), DHHS, through the National Institute on Aging (NIA), the National Institute of Nursing Research (NINR) and the NIH Office of Research on Women’s Health (ORWH) (Grants U01NR004061; U01AG012505, U01AG012535, U01AG012531, U01AG012539, U01AG012546, U01AG012553, U01AG012554, U01AG012495). SWAN Heart was supported by the National Heart, Lung, and Blood Institute (NHLBI) (Grants HL065581, HL065591). The content of this presentation is solely the responsibility of the authors and does not necessarily represent the official views of the NIA, NINR, ORWH or the NIH.

The SWAN Cardiovascular Fat Ancillary Study was supported by an award from the American Heart Association (AHA) Great River Affiliation Clinical Research Program 12 CRP11900031.
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Thank you