Ethnic Differences: Are they important?

Gary R. Hunter
Expectation of life in years (based on 2006 CDC statistics)
Health Risk

- AA increased risk of developing diabetes
- AA increased risk of developing cardiovascular disease
- AA increased risk of developing several different cancers
- AA increased risk of developing glaucoma
Fat Distribution

- Major ethnic differences in fat distribution
IAAT or visceral fat
Fat distribution

Hunter et al Obesity 2010
Effect of arm and waist circumference on mortality in older men

Adjusted for age, soc class, PA, smoke, alcohol

Wannamethee et al AJCN 07
Fat free mass changes with age

Hunter J Bod Comp Res 2005
Sarcopenia

Mid-Thigh CSA

Male Age 25

Male Age 63

Petrella et al.
Visceral fat across different ages for 203 men and 220 women

Visceral Fat: Unadjusted, bars: standard error

Adapted from Hunter et al Int J Body Comp Res 05
Ethnic/racial body composition differences

- Although AA have higher BMI and % fat,

At any similar % fat:
- AA are more muscular
- AA distribute less fat in the viscera and more fat on the legs
It is probable that cut-points for healthy BMI and even %fat should be race specific

- With weight loss AA have:
  - Less increase in insulin sensitivity & Less increase in muscle function
  - Less improvement in inflammation
  - Less improvement in Si
Difficult to Determine how much lower body fat but

- Based on differences in visceral fat accumulation the cut-point for adverse percent fat in premenopausal AA women would be almost 2% lower than EA women or about 33% fat for young AA instead of 35% for EA women
Insulin sensitivity and fat distribution

Hunter et al Obesity 2010
### Review of Primary Fiber Types

<table>
<thead>
<tr>
<th>Variable</th>
<th>Type I</th>
<th>Type IIa</th>
<th>Type IIx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twitch time</td>
<td>Slow</td>
<td>Fast</td>
<td>Fast</td>
</tr>
<tr>
<td>Motor unit threshold</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Glycolytic capacity</td>
<td>Low</td>
<td>High-Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Oxidative capacity</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Resistance to fatigue</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Specific Tension</td>
<td></td>
<td>20% higher</td>
<td>20% higher</td>
</tr>
<tr>
<td>Shortening velocity</td>
<td>Low</td>
<td>Intermediate</td>
<td>Highest</td>
</tr>
<tr>
<td>Myosin heavy chain</td>
<td>MHCI</td>
<td>MHCIIa</td>
<td>MHCIIx</td>
</tr>
</tbody>
</table>
Health ramifications of type 2 fiber type

- May be a disadvantage in insulin signaling and glucose disposal
- Is related to long term weight gain
Muscle fiber type may be different between AAs and EAs (type 1 %)

Sedentary (Kohn 07) vs. Middle distance runners (Tanner 02)
Energy Expenditure Differences

Hunter et al Am J Clin Nutr 2000
Ease of moving may affect participation in AEE

Adapted from Hunter et al Int J Obes 2004
Despite lower oxygen cost of walking AA women have less ease in walking.
Reduced TEE in AA Women

↓ REE

↓ Trunk Lean Tissue
   (Organ Mass)

↓ AEE

↑ Exercise Economy

↓ VO2 Max

↓ Hemoglobin

↑ Limb Lean Tissue

↓ MuscleMax Ox Phos

Longer Achilles Tendon
Metabolic differences may be cellular

- Sea-Horse isolated mitochondrial metabolism reduced in endothelial cells of AA – may contribute to increased BP
- Increased oxygen concentration in vitreous of AA suggests reduced metabolism of retina and cornea in AA – may contribute to up to 4-fold increase in risk of glaucoma
Muscle mitochondrial function (ADP recovery rate following maximal exercise)

Normal weight

Hunter et al 2003
Reactive Oxygen/Nitrogen Species

- Formed as natural byproduct of cellular metabolism and have important roles in cellular signaling.
- Reactive oxygen/nitrogen species are highly reactive due to the presence of at least one or more unpaired valence shell electrons.
Why Study ROS?

- Oxidative stress is linked to many diseases
  - atherosclerosis
  - hypertension
  - diabetes
  - immune dysfunction
  - cancer
  - Parkinson's disease and Alzheimer's disease
  - ageing
Oxidative/Nitrosative Stress

Results from an imbalance between excessive ROS/RNS formation and/or limitations in the antioxidant defense mechanisms.
Si negatively related to 3-nitrotyrosine but not nitric oxide

- AA have elevated 3-nitrotyrosine and myeloperoxidase and do not decrease 3-nitrotyrosine or myeloperoxidase with wt loss
- EA have lower 3-nitrotyrosine and myeloperoxidase and decrease 3-nitrotyrosine and myeloperoxidase with wt loss

Fenster et al Free Rad Bio & Med 04
Dietary differences between AA & EA
Vitamin D

Vitamin D Intake (IU/d) vs. Serum 25-Hydroxy D (ng/ml)

- Alvarez et al Nut & Met 2010
- Alvarez et al AJCN 2010
25-hydroxvitamin D and insulin sensitivity

- Serum 25-hydroxyvitamin D is related to insulin sensitivity even after adjusting for visceral fat, age, ethnicity, and parathyroid hormone.

Alvarez et al Am J Clin Nutr 2010
Vitamin D & Insulin Sensitivity

Insulin Sensitivity (adjusted for 25-hydroxy vitamin D)

Alvarez et al AJCN 2010
% Difference in serum antioxidant levels and serum DNA oxidative damage between AA & EA (% less than EA)

Watters JL et al. Canc Epid Biomarkers Prev 07
AA seem to have an advantage in sports that require running and jumping.
Muscle fiber type may influence performance differences in AAs and EAs

- AA have lower type I and higher type II muscle fiber
Performance ramifications of type 2 fiber type

- May give advantage in rapid power development
- May be a disadvantage or in some cases an advantage in long duration endurance activities
Running VO2 with residuals for flexibility and length of the Achilles tendon (R = 0.69)
Leg press stretch shortening potentiation Achilles Tendon Length \( (r = 0.51) \)
Economy of Walking (ml/kg/min)

McCarthy JSCR 2006
Leg and Tendon Length
Muscle Metabolic Economy

Net VO2 grade walk

Muscle Metabolic Economy

AA

EA