Impact of Menopausal Status and BMI on Metabolic Flexibility

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INTRODUCTION

Menopause and the associated changes in hormones (i.e., estrogen and progesterone) are known to negatively impact body composition and metabolism, ultimately producing a metabolically compromised phenotype. Physical activity and exercise may mitigate these changes; however, little is known about substrate utilization and metabolic flexibility in menopausal women. Identifying changes in metabolic flexibility may highlight a critical window for preventative interventions.

PURPOSE:
The purpose of this study was to compare fat and carbohydrate oxidation at rest and during exercise (metabolic flexibility) in pre-menopausal (PRE), peri-menopausal (PERI), and post-menopausal (POST) women of varying adiposity levels.

FORMULAS

\[
\text{RER}(\text{a.u.}) = \frac{\dot{V}O_2(L + \min^{-1})}{\dot{V}CO_2(L + \min^{-1})}
\]

Intensity | % HRR
--- | ---
Low | ≤ 30%
Moderate | 31-50%
High | > 50%

Reduced metabolic flexibility in PERI compared to PRE may identify peri-menopause as a critical window for preventative intervention.

METHODS

72 healthy women (24 PRE, 24 PERI, 24 POST) (Mean±SD: Age: 48.28±7.21 yrs, BMI 26.01±5.21 kg/m²; Range: 18.81-41.00 kg/m²) underwent metabolic assessments at rest and during exercise.

RESULTS

At all intensities (rest, low, moderate, and high), post-menopausal women oxidized the most carbohydrates (and least amount of fat) as indicated by a higher RER. Metabolic flexibility displayed in pre-menopausal women is diminished in both peri- and post-menopausal women.

CONCLUSION

Transitioning to menopause appears to reduce metabolic flexibility during exercise, impacting POST women to a greater extent than PERI; metabolic inflexibility through menopause may be exacerbated by obesity.

<table>
<thead>
<tr>
<th>Variable</th>
<th>PRE (n=24)</th>
<th>PERI (n=24)</th>
<th>POST (n=24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>39.79 ± 3.27*</td>
<td>49.96 ± 3.37*</td>
<td>55.08 ± 3.49*</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.25 ± 5.06</td>
<td>26.48 ± 5.44</td>
<td>26.42 ± 5.24</td>
</tr>
<tr>
<td>Salivary Estradiol (pg/mL)</td>
<td>0.85 ± 0.47</td>
<td>1.02 ± 0.42</td>
<td>0.79 ± 0.29</td>
</tr>
<tr>
<td>Resting RER (a.u.)</td>
<td>0.76 ± 0.04</td>
<td>0.73 ± 0.06†</td>
<td>0.76 ± 0.06</td>
</tr>
<tr>
<td>Low Intensity RER (a.u.)</td>
<td>0.81 ± 0.10</td>
<td>0.76 ± 0.04*</td>
<td>0.82 ± 0.07</td>
</tr>
<tr>
<td>Moderate Intensity RER (a.u.)</td>
<td>0.81 ± 0.08</td>
<td>0.83 ± 0.08</td>
<td>0.87 ± 0.11</td>
</tr>
<tr>
<td>High Intensity RER (a.u.)</td>
<td>0.92 ± 0.09</td>
<td>0.92 ± 0.08</td>
<td>0.94 ± 0.09</td>
</tr>
</tbody>
</table>

One-way ANOVAs with Bonferroni post-hoc comparisons were conducted by intensity (Rest, Low, Moderate, High) for the total sample and stratified by BMI: Normal: 18.5-24.9 kg/m²; Overweight/Obese: ≥25.0 kg/m².