Background: Estradiol has previously been attributed for mediating gender differences in physiological responses to tissue damage. Since the immune-endocrine and immune systems coordinate the body’s response to such stress, we hypothesized that estradiol β receptors (ERβ) on B-lymphocytes may coordinate such communications and explain the protective responses previously reported in women.

Purpose: The purpose of this investigation was to examine estradiol expression on circulating B-lymphocytes in response to acute level of heavy resistance exercise in men and women.

Methods: Using a within-subject design, men and women (n=7, age 22±5 yrs) performed a heavy resistance exercise equal protocol (6 sets of 5 reps at 90% of 1-RM) in a counterbalanced order. Blood samples were collected before, during and after the exercise and control trials. ERβ expression on circulating lymphocytes was evaluated with flow cytometry and secretory cytokines were assayed by ELISA.

Results: Serum estradiol did not significantly differ between men (CON=60.5±23.2 pg•ml-1) and women (CON=86.5 ± 60.5 pg•ml-1) or women (6 HR POST-EX = 73.9±35.8 pg•ml-1) vs men (6 HR POST-EX = 120 pg•ml-1). Estradiol β Receptor Expression on Human B Lymphocytes showed large inter-individual variations before exercise (relative fluorescence = 22.3 ± 28.9) and trends for differences at 6 hours post-exercise (relative fluorescence = 32.1 ± 54.0). However, no significant gender differences in changes in response to the exercise protocol were observed.

Conclusion: Estradiol β receptors on B-lymphocytes unlikely explain gender differences in physiological responses to tissue damage elicited by acute heavy resistance exercise. It is possible that interactions may occur beyond the recovery period measured in the present study or it may be that ER on muscle tissue, rather than B-lymphocytes, dictate the protective effects of estradiol previously reported in women.

INTRODUCTION

Previous research has shown reduced tissue disruption and inflammatory responses in women compared to men following acute strenuous exercise.

• Gender differences have been attributed to the ‘protective’ effects of estradiol as an antioxidant and membrane stabilizer.

• The mechanisms of estradiol’s protective effects are not known, but may involve reduced inflammatory responses through its interaction with immune cells.

• B-lymphocytes contain estradiol β receptors and estradiol is known to influence critical events in B lymphocytes.

• It is unknown how estradiol β receptor presence on immune cells respond to acute stress resistance exercise.

• Such information will contribute to our understanding of the potential gender differences in communication between the endocrine and immune systems in tissue damage and repair models, and other immune challenges and diseases.

METHODS

Participants

Resistance trained men (n=8) and women (n=7) completed two trials (exercise and control) in a balanced, randomized order. Blood samples were collected before, during and after the exercise and control trials.

Exercise protocol was 6 sets of 5 repetitions at 90% of 1-RM with 3 min of rest between sets.

Blood samples were collected immediately after the test (post), and at 1, 6, and 24-hrs into recovery.

Table 1. Participant Characteristics

<table>
<thead>
<tr>
<th>Measure</th>
<th>Men (n=8)</th>
<th>Women (n=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>21 ± 3</td>
<td>22 ± 4</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.75 ± 0.08</td>
<td>1.69 ± 0.09</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>86.2 ± 10.0</td>
<td>75.3 ± 13.3</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>23.8 ± 2.6</td>
<td>20.6 ± 2.2</td>
</tr>
<tr>
<td>1-RM squat (kg)</td>
<td>120 ± 20</td>
<td>172 ± 25</td>
</tr>
<tr>
<td>1-RM bench press (kg)</td>
<td>87.8 ± 15.9</td>
<td>74.3 ± 22.6</td>
</tr>
<tr>
<td>Blood pressure (mmHg)</td>
<td>120/70</td>
<td>110/60</td>
</tr>
</tbody>
</table>

Results

Estradiol β Receptor Expression on Human B lymphocytes showed large inter-individual variations before exercise (relative fluorescence = 22.3 ± 28.9) and trends for differences at 6 hours post-exercise (relative fluorescence = 32.1 ± 54.0). Estradiol β receptors on B-lymphocytes showed large inter-individual variations before exercise (relative fluorescence = 22.3 ± 28.9) and trends for differences at 6 hours post-exercise (relative fluorescence = 32.1 ± 54.0). However, no significant gender differences in changes in response to the exercise protocol were observed.

Evaluation of Estradiol β Receptor Expression on Human B lymphocytes

Estradiol β receptors on circulating lymphocytes were evaluated with flow cytometry.

• B-lymphocytes were labeled with a CD19 antibody conjugated to APC

• Circulating 17 β-estradiol concentrations were assayed via enzyme-linked immunosorbent assay (ELISA) at pre-, +6HR, and +24HR

• Estradiol β Receptor Expression on Human B Lymphocytes showed large inter-individual variations before exercise (relative fluorescence = 22.3 ± 28.9) and trends for differences at 6 hours post-exercise (relative fluorescence = 32.1 ± 54.0).

Stressful Exercise

• Serum estradiol did not significantly differ between men (CON=60.5±23.2 pg•ml-1) and women (CON=86.5 ± 60.5 pg•ml-1).

• Serum estradiol did not significantly change during recovery to the exercise stress in men (6 HR POST-EX = 49.7±13.6 pg•ml-1) vs women (6 HR POST-EX = 73.9±35.8 pg•ml-1).

• Estradiol β receptors on B-lymphocytes revealed large inter-individual variations before exercise (relative fluorescence = 22.3 ± 28.9) and trends for differences at 6 hours post-exercise (relative fluorescence = 32.1 ± 54.0).

SUMMARY & CONCLUSIONS

• Muscle damaging exercise protocols trigger an inflammatory response where chemo-attractive factors are released to recruit leucocytes to both “clean up” the damaged tissue and to activate satellite cells to repair the tissue.

• Despite the hypothesized protective influence of estradiol in tissue disruption, this study did not show any clear patterns or gender differences in estradiol β receptor expression on B-lymphocytes in response to heavy resistance exercise.

• Present findings reveal that estradiol β receptors on B-lymphocytes unlikely explain gender differences in physiological responses to tissue damage elicited by acute heavy resistance exercise.

• It is possible that interactions may occur beyond the recovery period measured in the present study or it may be that ER on muscle tissue, rather than B-lymphocytes, dictate the protective effects of estradiol previously reported in women.

• It is also possible that the protective effects of estradiol on muscle damage are mediated predominantly by estradiol –α receptors, rather than the β receptors measured in the present study.

• Although α and β receptors differ among tissue types with the β after being the dominant receptor in muscle, recent results from animal models reveal that the α receptor is important following exercise-induced muscle damage.

• Despite the null findings, results have implications for understanding mechanisms underlying recovery, tissue damage and repair models, and other immune challenges and diseases.

REFERENCES


