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Effect of Varying Exercise Intensities on GDNF Expression and Neuromuscular Junction Morphology

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**ABSTRACT**

GDNF has been shown to:
- be the most potent trophic factor to rescue motoneurons
- play a significant role in postnatal remodeling and maintenance of mature neuromuscular junction (NMJ) structures
- cause hyperinnervation and multiple end plate formation at mature NMJ structures
- be expressed at higher levels in slow-twitch muscle following low-intensity exercise

**INTRODUCTION**

GDNF has been shown to:
- be the most potent trophic factor to rescue motoneurons
- play a significant role in postnatal remodeling and maintenance of mature neuromuscular junction (NMJ) structures
- cause hyperinnervation and multiple end plate formation at mature NMJ structures
- be expressed at higher levels in slow-twitch muscle following low-intensity exercise

**RESULTS**

<table>
<thead>
<tr>
<th>Training Alters Muscle Fiber CSA in Recruited Muscles</th>
<th>Training Alters GDNF Protein Content in Recruited Muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soleus</strong></td>
<td><strong>Soleus</strong></td>
</tr>
<tr>
<td>Control</td>
<td>Control</td>
</tr>
<tr>
<td>3831 ± 180</td>
<td>2.5 ± 2.2</td>
</tr>
<tr>
<td>Run</td>
<td>Run</td>
</tr>
<tr>
<td>2109 ± 65*</td>
<td>7.6 ± 6.4*</td>
</tr>
<tr>
<td>Swim</td>
<td>Swim</td>
</tr>
<tr>
<td>3243 ± 101**</td>
<td>8.6 ± 4.5*</td>
</tr>
</tbody>
</table>

*Significant difference between the exercise group and control group; #Significant difference from Run Group; Values are means ± S.E.M.; Protein content (pg GDNF/tissue weight)

**METHODOLOGY**

**Subjects**
- 6 month-old Sprague Dawley rats
- Randomly assigned to control, swim-training and run-training groups

**Swim Training (n=6)**
- 2 fold 3 day/week for 2 weeks
- Filled to 100cm at 35°C
- 10 minutes

**Run Training (n=5)**
- 10 minute intervals

**Visualization of GDNF & NMJ**
- **Soleus (SOL; slow twitch)**
- **Extensor Digtiorum Longus (EDL; fast twitch)**

**Visualization of Skeletal Muscle Fibers**
- **Average Cross Sectional Area (CSA)**
- **Transverse sections cut on cryostat (20µm)**
- **Antibodies raised against MHC (I, IIa, IIx, IIb)**
- **CSA measured for 125-150 random EDL and SOL fibers (3 animals/group) using confocal microscopy**

**Quantification of GDNF protein content**
- **ELISA**

**Statistics**
- A one-way ANOVA and PostHoc tests used for statistical significance among different groups (P<0.05).
- Linear regression analysis used to evaluate association between variables (P<0.01).

**CONCLUSIONS**

- Swim- and run-training can alter GDNF protein content at the NMJ
- Higher intensity exercise can increase GDNF protein content in fast twitch muscle fibers
- GDNF may play a role in altering the morphology at the NMJ