Increased hippocampal volume in exercising mice: comparison of control conditions with in vivo voxel based morphometry

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INTRODUCTION & METHODS

Both human and animal studies have shown that physical exercise (primarily aerobic exercise) may have facilitating effects on brain plasticity and cognition. In rodents, improvements of various forms of learning and memory induced by wheel-running have been associated with numerous neuromorphic changes such as increased hippocampal neurogenesis. A few studies, using magnetic resonance imaging (MRI), consistently reported hippocampal volumetric increase relative to non-exercising mice. However, the control group is commonly limited either to a locked wheel or no wheel. In the present study, we intended to test whether 6 weeks of voluntary wheel-running exercise during adulthood induced a detectable volumetric change in mice brain in comparison to non-exercised control mice housed either with a locked wheel or without such wheel.

54 C57Bl6 males were randomly assigned to one of the three groups and individually housed for 6 weeks before imaging session

RESULTS & DISCUSSION

Behavioral results

Average distance covered by C57Bl6 mice over the 42 days of free wheel-running activity. Values are mean ± S.E.M.

Imaging results

VBM analysis shows significant clusters with increased grey matter volume in the hippocampus when we compare the wheel vs locked wheel groups. Regarding the wheel vs no wheel comparison, significant clusters were observed in the hippocampus.

RESULTS & DISCUSSION

Table: Cluster size, coordinate, P value

<table>
<thead>
<tr>
<th>Cluster size</th>
<th>Coordinate</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel &gt; Locked</td>
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<td>0.009 0.009 0.009</td>
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<tr>
<td>Wheel &gt; No Wheel</td>
<td>0.009 0.009 0.009</td>
<td>0.009 0.009 0.009</td>
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Those results were confirmed by extracting MRI signal values to compare them among the 3 groups.

SUMMARY

In this study, we replicate previous studies depicting an increased hippocampal volume under physical exercise in mice using VBM. Moreover, we certified here that attempting to study the impact of physical exercise on brain volume, control groups with a locked wheel are equivalent.

REFERENCES


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