Increased hippocampal volume in exercising mice: comparison of control conditions with in vivo voxel based morphometry (#442)

G. Becker[1], L. - F. Lespine[2], M. A. A. Bahri[1], A. Luxen[1], E. Tirelli[2], A. Plenevaux[1]

[1] University of Liege, GIGA - Cyclotron Research Center, LIEGE, Belgium

[2] University of Liege, Psychology Faculty, LIEGE, Belgium

Introduction

Both human and animal studies have shown that physical exercise (primarily aerobic exercise) may have facilitating effects on brain plasticity and cognition (1). In rodents, improvements of various forms of learning and memory induced by wheel-running have been associated with numerous neuroplastic changes such as increased hippocampal neurogenesis (2). A few studies, using magnetic resonance imaging (MRI), consistently reported hippocampal volumetric increase relative to non-exercising mice (3, 4, 5, 6). However, the control group is commonly limited either to a locked wheel or no wheel.

Methods

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. MRI (Agilent 9.4T) acquisition consisted in 3D T2 volume sequence (voxel size: 0.21 mm isotropic) using a dedicated surface coil receiver. We used Dartel software for the preprocessing of the data, and the Voxel Based Morphometry was done with SPM mouse toolbox (F test, threshold $p < .001$ uncor). A small volume correction was applied to limit the analysis to the hippocampus.

Results/Discussion

VBM analysis shows significant clusters with increased grey matter volume in the hippocampus (cluster sizes 1531 and 3460, $p_{uncor} < .001$) when we compare the wheel vs locked wheel groups. Regarding the wheel vs no wheel comparison, significant clusters were observed in the hippocampus (cluster sizes 955 and 238, $p_{uncor} < .001$). Interestingly, no differences were found when we compare the two control groups (locked wheel vs no wheel).

Conclusions

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 or no wheel are equivalent.

References

1. Hötting and Röder, 2013
2. Vivar et al. 2012
3. Bindermann et al. 2012
4. Pereira et al. 2007
5. Fuss et al. 2014
6. Cahill et al. 2015

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