

Title:

The Brainfit study: efficacy of working memory training and physical exercise in improving cognitive performance in pediatric cancer survivors

Authors:

Benzing V^{1,2,3}, Spitzhüttl J^{2,3,4}, Siegwart V^{2,3}, Schmid J¹, Grotzer M⁵, Roebbers C⁴, Steinlin M³, Leibundgut K², Everts R^{2,3}, Schmidt M¹.

¹Institute of Sport Science, University of Bern, Bern, Switzerland

²Division of Pediatric Hematology and Oncology, University Children's Hospital Bern, Inselspital, Bern University Hospital, University of Bern, Bern, Switzerland

³Division of Neuropaediatrics, Development and Rehabilitation, University Children's Hospital Bern, Inselspital, Bern University Hospital, University of Bern, Bern, Switzerland.

⁴Institute of Psychology, University of Bern, Bern, Switzerland

⁵Division of Pediatric Oncology, University Children's Hospital Zurich, Zurich, Switzerland

Abstract:

Introduction: Due to improved diagnosis and treatment, survival rates for pediatric cancer have increased by over 80%. Nonetheless, pediatric cancer survivors bear a high risk for late effects in cognitive domains such as executive functions (Krull et al., 2019), for example. In order to remediate potential late effects, interventions are needed. Therefore, the aim of this study was to compare the effects of a working memory training, physical training and a wait-list control group on cognitive functions in pediatric cancer survivors.

Methods: In a randomized clinical trial (Benzing et al., 2018), 69 pediatric cancer survivors between 7-16 years ($M = 11.35$; $SD = 3.53$) were randomly assigned either to a working memory training, an exergame intervention group, or a wait-list control group. Participants in the experimental conditions were instructed to train for 8-weeks (3 x 45 min per week). The primary outcome was the core executive functions (inhibition, switching, visual working memory), and the secondary outcomes included nonverbal intelligence, planning, verbal working memory, verbal memory, selective attention, processing speed and motor abilities. Measurements were taken for each outcome before, immediately after intervention termination and at three-months follow-up.

Results: Linear mixed models showed that children in the working memory training group improved over time in visual working memory compared to the exergaming and the control group. No additional intervention effects on secondary outcomes were detected.

Discussion/Conclusion: This study shows that working memory training improves visual working memory in pediatric cancer survivors. This beneficial effect was detected in an area where deficits occur frequently in pediatric cancer survivors. Although this finding is in line with previous empirical evidence, it shows that near transfer effects are to be expected from the training. Given this finding, interventions tailored on the individual cognitive profile are needed to best support development after cancer and its treatment.

References:

Benzing, V., Eggenberger, N., Spitzhüttl, J., Siegwart, V., Pastore-Wapp, M., Kiefer, C., ... Leibundgut, K. (2018). The Brainfit study: efficacy of cognitive training and exergaming in pediatric cancer survivors – a randomized controlled trial. *BMC Cancer*, 18(1), 18. <https://doi.org/10.1186/s12885-017-3933-x>

Krull, K. R., Hardy, K. K., Kahalley, L. S., Schuitema, I., & Kesler, S. R. (2018). Neurocognitive outcomes and interventions in long-term survivors of childhood cancer. *Journal of Clinical Oncology*, 36(21), 2181–2189. <https://doi.org/10.1200/JCO.2017.76.4696>