

# Let's Get Physical: The Effectiveness of Physical Activity on Executive Functioning in Children with ADHD

Lisa Blabolil, Cortney Doll, Alyssa Martinez, Isabella Tang, Anthony Koutsoftas & K.F. Nagle  
Seton Hall University

## Background

- Worldwide, 129 million children have been diagnosed with Attention-Deficit-Hyperactivity Disorder (ADHD).
- An important outcome for this population is improved subsequent measures of executive functioning (Thomas et al., 2015).
- Researchers have found evidence to support the framework that physical activity improves executive functioning skills in school-aged children diagnosed with ADHD (Ziereis & Jansen, 2015).
- School-aged children with ADHD have significant deficits in their executive functioning skills, specifically attention, task shifting, inhibition, working memory and planning (Ziereis & Jansen, 2015).
- The purpose of this project is to present a systematic review about the effectiveness of physical activity-related treatment on specific measures of executive functioning (i.e., inhibition, attention, working memory, task shifting), in school-aged children with ADHD.

### Research question:

- Do physical activities improve subsequent measures of executive function in school-age children with ADHD from pre-test to post-test?

## Literature Search

- The following databases/search techniques were used to retrieve articles: CINAHL, Science Direct, ProQuest, PubMed, SAGE Journal, and PsychINFO.

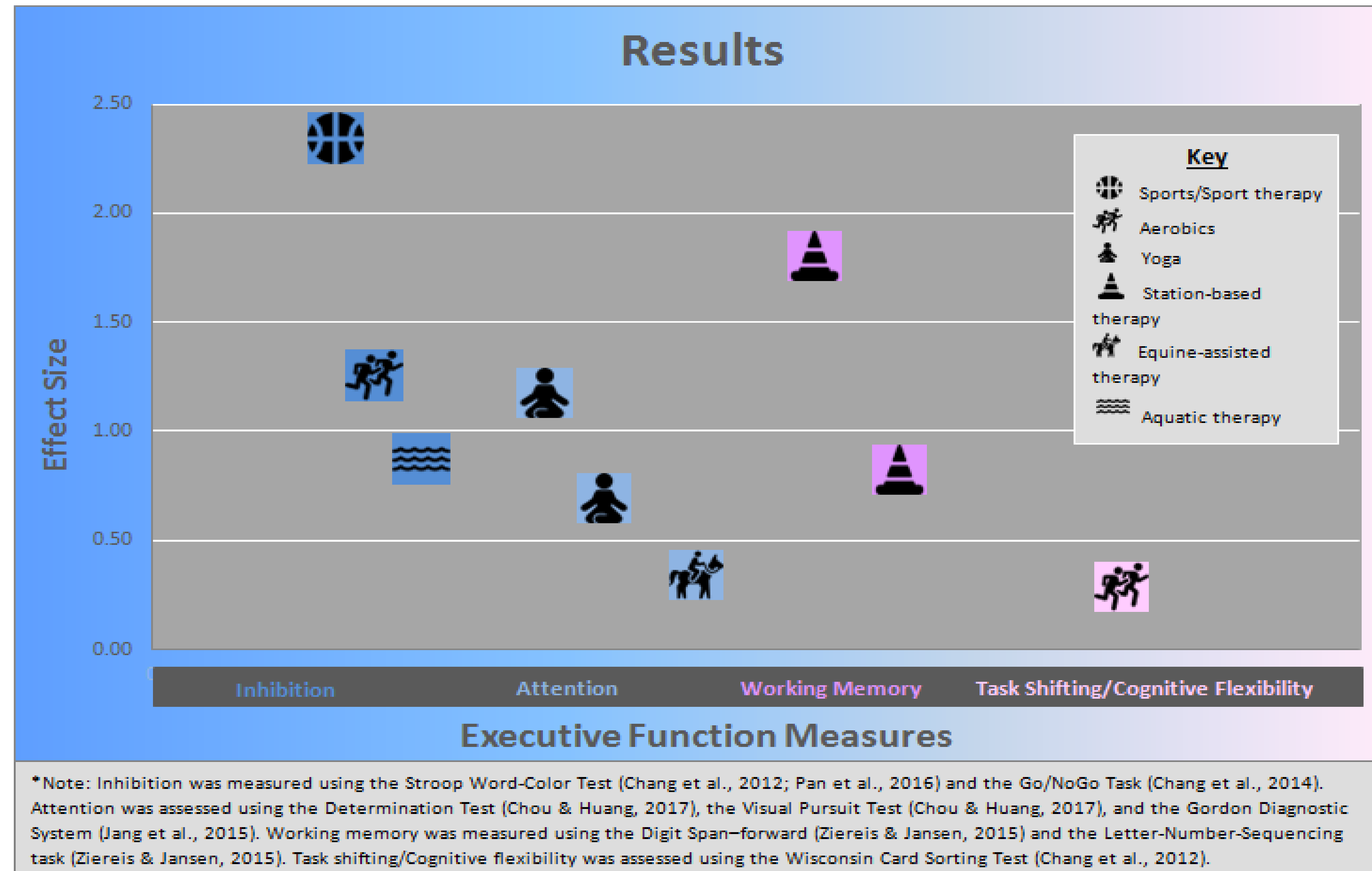
### The search terms/key words used were:

- Athletic Training AND ADHD
- Exercise Therapy AND ADHD executive function
- Physical Therapy AND ADHD executive function
- Physiotherapy AND ADHD executive function
- Exercise Intervention AND ADHD executive function
- Impact of physical activity on executive functioning

### Additional search criteria included:

- Published between 2000-2017
- Standardized assessments that measure executive functioning
- Pre-test and post-test measures
- Included school-aged participants (ages 5-13)
- Patients with medical diagnosis of ADHD

## Results



## Inclusion/Exclusion Criteria

### Articles were excluded based on the following criteria:

- Only used checklists/questionnaires to measure executive function
- If participants exhibited:
  - Comorbid conditions
  - Personal history of brain injury or neurological disorders
  - Currently taking sedatives/other mood altering medication, other than stimulants prescribed for ADHD
  - Motor or perceptual impairments that would prevent participation in physical exercise program
  - Learning disorders or intellectual disabilities
  - ADHD-like symptoms, but no formal/medical diagnosis

## Dosage

- The treatment approaches varied between 1 and 30 sessions.
- The sessions ranged from 20 to 45 minutes.
- The length of the treatment interventions ranged from 1 to 12 weeks.

## References

- Chang, Y.-K., Hung, C., Huang, C., Hatfield, B. D., & Hung, T. (2014). Effects of an aquatic exercise program on inhibitory control in children with ADHD: A preliminary study. *Archives of Clinical Neuropsychology*, 29(3), 217-223. doi:10.1093/arclin/acu003
- Chang, Y.-K., Liu, S., Yu, H.-H., & Lee, Y.-H. (2012). Effect of aerobic exercise on executive function in children with attention deficit hyperactivity disorder. *Archives of Clinical Neuropsychology*, 27, 225-237. doi:10.1093/arclin/acr094
- Chou, C., & Huang, C. (2017). Effects of an 8-week yoga program on sustained attention and discrimination function in children with attention deficit hyperactivity disorder. *The Journal of Alternative and Complementary Medicine*, 21(9), 546-553. doi:10.1089/acm.2015.0067
- Jang, B., Song, J., Kim, J., Kim, S., Lee, J., Shin, H., Joong, Y. (2015). Equine-assisted activities and therapy for treating children with attention-deficit/hyperactivity disorder. *The Journal of Alternative and Complementary Medicine*, 21(9), 546-553. doi:10.1089/acm.2015.0067
- Kang, K.D., Choi, J.W., Kang, S.G., & Han, D.H. (2013). Sports therapy for attention, cognition and sociality. *International Journal of Sports Medicine*, 32(12), 959-969. doi:10.1055/s-0031-1288375
- Pan, C., Chu, C., Tsai, C., Lo, S., Cheng, Y., & Liu, Y. (2016). A racket-sport intervention improves behavioral and cognitive performance in children with attention-deficit/hyperactivity disorder. *Research in Developmental Disabilities*, 57, 1-10. doi:10.1016/j.ridd.2016.06.009
- Taylor, A. F., & Kuo, F. E. (2009). Children with attention deficits concentrate better after walk in the park. *Journal of Attention Disorders*, 12(5), 402-409. doi:10.1177/1087054708323000
- Thomas, R., Sanders, S., Doust, J., Bellini, E., Glasziou, P. (2015). Prevalence of attention-deficit/hyperactivity disorder: a systematic review and meta-analysis. *Pediatrics*, 135(4), 994-1001. doi:10.1542/peds.2014-3482
- US Census Bureau, (2017). Population Division: World Midyear Population by Age and Sex for 2013. Retrieved from: <https://www.census.gov/population/international/data/worldpop/tablepopulation.php>
- Verret, C., Guay, M., Berthiaume, C., Gardiner, P., & Bellevue, L. (2012). A physical activity program improves behavior and cognitive functions in children with ADHD: An exploratory study. *Journal of Attention Disorders*, 16(1), 71-80. doi:10.1177/1087054710379735
- Ziereis, S., & Jansen, P. (2015). Effects of physical activity on executive function and motor performance in children with ADHD. *Research in Developmental Disabilities*, 36, 185-191. doi:10.1016/j.ridd.2014.12.005

## Results

- Studies were categorized based on the following subsequent measures of executive function: attention, inhibition, task shifting, and working memory.
  - Nine control trials adhered to inclusion criteria.
- Evidence from studies supported the framework that physical activity improves executive functioning skills in school-aged children diagnosed with ADHD.

### Effect Sizes (Cohen's d):

- Studies demonstrated an average effect size of 1.09.
- Thus, results indicate that outcome measures of executive functioning improved significantly from pre-test to post-test.
- Attention resulted in small to large effect sizes, inhibition and working memory both yielded large effect sizes, and task shifting demonstrated a small effect size.

### Limitations:

- Due to the limited number of standardized assessments that measure planning skills, research for this part of executive function in children with ADHD is needed.
- The studies reviewed did not all control for use of medication.
- Post-test measures were taken anywhere from minutes to one week after completion of treatment.

## Clinical Recommendations

### Findings suggest:

- Physical activity of various kinds can improve the executive functioning of children with ADHD.
- Physical activity appears to be a beneficial treatment approach to improve executive functioning in children with ADHD.

### Clinical Recommendations:

- SLPs should consider implementing physical activity before treatment to enhance attention and other executive functioning skills in children with ADHD.

### Future Directions:

- Include long-term, systematic treatments, with larger sample sizes in the treatment settings.
- Request follow-up observations to determine the long-term effects of the treatment.
- Include only participants not using ADHD medication.