**SUPPLEMENTAL DIGITAL CONTENT**

**Table S1.** Selected studies supporting the association of executive function and social cognition in healthy individuals and peers with a psychiatric or neurological disorder.

|  |  |  |  |
| --- | --- | --- | --- |
| **Author, year** | **Sample** | **Measures** | **Outcomes** |
| Gyurak et al. 2012 (1) | N = 21 healthy older adultsN = 48 older adults with a neurological disorder | Affective filmForward/ Backward Digit Span Stroop taskTrail Making taskVerbal fluency | Cognitive flexibility ↔ Emotion regulation (both groups) |
| Lantrip et al. 2016 (2) | N = 70 healthy adolescents | Emotion Regulation Questionnaire for YouthBehavior Rating Inventory of Executive Function-Self-Report | Executive function ↔ Emotion regulation |
| Bradford et al. 2015 (3) | N = 62 healthy young and middle-aged adults | False-belief taskStroop task | Inhibitory control ↔ Theory of mind |
| Wang et al. 2016 (4) | N = 255 healthy children | Backward Digit Span Trail Making taskArrows TaskSmiling Faces task Triangles TaskSilent Film taskStrange Stories task | Executive function ↔ Theory of mind |
| Groves et al. 2021 (5) | N = 102 children with ADHDN = 28 healthy children | Emotion Regulation Checklist Letter Updating TaskRapport Visuospatial ReorderingCounting SpanStop Signal taskGo/NoGo taskShifting tasks | Working memory ↔ Emotion regulation (both groups) |
| David et al. 2014 (6) | N = 110 adults with depressionN = 96 healthy adults | Emotion Hexagon TestWisconsin Card Sorting Test | Cognitive flexibility ↔ Emotion recognition (both groups) |

*Notes:* Positive associations between outcomes are indicated by ↔

**Table S2.** Selected experimental studies showing acute and long-term benefits of exercise on executive function.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Author, year** | **Sample** | **Exposure** | **Measures** | **Outcomes** |
| **Acute effects** |
| Brush et al. 2016 (7) | N = 28 healthy adults | I1: 20 min RES, LII2: 20 min RES, MII3: 20 min RES, HIC: passive | Stroop taskSimon taskPlus-Minus taskN-Back task | Pre vs post:(-) Reaction time in I3 vs I1, I2 and C (Stroop task) (0) Accuracy in I3 vs I1, I2 and C (Stroop task) |
| Drollette et al. 2012 (8) | N = 36 healthy children | I: 20 min END, MIC: passive | N-Back taskFlanker task | Post:(+) Accuracy in I vs C (Flanker task)(0) Reaction time in I vs C (Flanker task) |
| Kamijo et al. 2009 (9) | N = 12 healthy young adultsN = 12 healthy older adults | I1: 20 min END, LII2: 20 min END, MIC: passive | Flanker task | Post:(-) Reaction time in I1 vs C (both groups)(-) Reaction time in I2 vs I1 and C (both groups)(0) Accuracy in I1 and I2 vs C (both groups) |
| Ludyga et al. 2017(10)  | N = 18 healthy adolescentsN = 16 adolescents with ADHD  | I1: 20 min END, MII2: 20 min COR, MIC: active | Flanker task | Pre vs post:(-) Reaction time in I1 and I2 vs C (both groups)(0) Accuracy in I1 and I2 vs C (both groups) |
| **Long-term effects** |
| Hillman et al. 2014 (11) | N = 221 healthy children | I: MIX 5 x 120 min/w, MIC: Active | Modified Flanker TaskColor-shape Switch Task | Pre vs post:(+) Accuracy in I vs C (both tasks)(0) Reaction time in I vs C (both tasks) |
| Koutsandréou et al. 2016 (12)  | N = 71 healthy children  | I1: END 3 x 45 min/w, MII2: COR 3 x 45 min/w, MIC: Active | Letter Digit Span | Pre vs post:(+) Accuracy in I1 vs C(+) Accuracy in I2 vs I2 and C |
| Ludyga et al. 2018 (13)  | N = 35 healthy adolescents | I: MIX 5 x 20 min/w, MIC: passive | Stroop Color-Word | Pre vs post:(-) Reaction time in I vs C(0) Accuracy in I1 vs C |
| Best et al. 2015 (14)  | N = 155 older adults  | I1: RES 1 x 60 min/w, HII2: RES 2 x 60 min/w, HIC: Active | Stroop Color-WordTrail Making TestBackward Digit SpanDigit Symbol Substitution Test | Pre vs post:(+) Executive function (latent construct) in I1 (0) Executive function (latent construct) in I2 and C |
| Stern et al. 2019 (15) | N = 132 healthy adults | I: END 4 x 45 min/w, VIC: Active | Set Switching Grotton Maze Learning | Pre vs post:(+) Executive function (latent construct) in I1 vs C |

*Notes:* For outcomes the direction of effects are indicated by (-) = Decrease or inverse association, (0) = No change, and (+) = Increase; C = Control group or condition; COR = coordinative exercise; END = endurance exercise; HI = high intensity; I = Intervention group or condition; LI = low intensity; MI = moderate intensity; MIX = mixed exercise; RES = resistance exercise; UI = unspecific intensity; VI = vigorous intensity

**References**

1. Gyurak A, Goodkind MS, Kramer JH, Miller BL, Levenson RW. Executive functions and the down-regulation and up-regulation of emotion. Cogn Emot. 2012;26(1):103–18. doi:10.1080/02699931.2011.557291 Cited in: PubMed; PMID 21432634.

2. Lantrip C, Isquith PK, Koven NS, Welsh K, Roth RM. Executive Function and Emotion Regulation Strategy Use in Adolescents. Appl Neuropsychol Child. 2016;5(1):50–5. doi:10.1080/21622965.2014.960567 Cited in: PubMed; PMID 25650638.

3. Bradford EEF, Jentzsch I, Gomez J-C. From self to social cognition: Theory of Mind mechanisms and their relation to Executive Functioning. Cognition. 2015;13821–34. doi:10.1016/j.cognition.2015.02.001 Cited in: PubMed; PMID 25704580.

4. Wang Z, Devine RT, Wong KK, Hughes C. Theory of mind and executive function during middle childhood across cultures. J Exp Child Psychol. 2016;1496–22. doi:10.1016/j.jecp.2015.09.028 Cited in: PubMed; PMID 26592766.

5. Groves NB, Wells EL, Soto EF, Marsh CL, Jaisle EM, Harvey TK, Kofler MJ. Executive Functioning and Emotion Regulation in Children with and without ADHD. Res Child Adolesc Psychopathol. 2021. doi:10.1007/s10802-021-00883-0 Cited in: PubMed; PMID 34762251.

6. David DP, Soeiro-de-Souza MG, Moreno RA, Bio DS. Facial emotion recognition and its correlation with executive functions in bipolar I patients and healthy controls. J Affect Disord. 2014;152-154288–94. doi:10.1016/j.jad.2013.09.027 Cited in: PubMed; PMID 24211178.

7. Brush CJ, Olson RL, Ehmann PJ, Osovsky S, Alderman BL. Dose-Response and Time Course Effects of Acute Resistance Exercise on Executive Function. J Sport Exerc Psychol. 2016;38(4):396–408. doi:10.1123/jsep.2016-0027 Cited in: PubMed; PMID 27385719.

8. Drollette ES, Shishido T, Pontifex MB, Hillman CH. Maintenance of cognitive control during and after walking in preadolescent children. Med Sci Sports Exerc. 2012;44(10):2017–24. doi:10.1249/MSS.0b013e318258bcd5 Cited in: PubMed; PMID 22525770.

9. Kamijo K, Hayashi Y, Sakai T, Yahiro T, Tanaka K, Nishihira Y. Acute effects of aerobic exercise on cognitive function in older adults. J Gerontol B Psychol Sci Soc Sci. 2009;64(3):356–63. doi:10.1093/geronb/gbp030 Cited in: PubMed; PMID 19363089.

10. Ludyga S, Brand S, Gerber M, Weber P, Brotzmann M, Habibifar F, Pühse U. An event-related potential investigation of the acute effects of aerobic and coordinative exercise on inhibitory control in children with ADHD. Dev Cogn Neurosci. 2017;2821–8. doi:10.1016/j.dcn.2017.10.007 Cited in: PubMed; PMID 29100212.

11. Hillman CH, Pontifex MB, Castelli DM, Khan NA, Raine LB, Scudder MR, Drollette ES, Moore RD, Wu C-T, Kamijo K. Effects of the FITKids randomized controlled trial on executive control and brain function. Pediatrics. 2014;134(4):e1063-71. doi:10.1542/peds.2013-3219 Cited in: PubMed; PMID 25266425.

12. Koutsandréou F, Wegner M, Niemann C, Budde H. Effects of Motor versus Cardiovascular Exercise Training on Children's Working Memory. Med Sci Sports Exerc. 2016;48(6):1144–52. doi:10.1249/MSS.0000000000000869 Cited in: PubMed; PMID 26765631.

13. Ludyga S, Gerber M, Herrmann C, Brand S, Pühse U. Chronic effects of exercise implemented during school-break time on neurophysiological indices of inhibitory control in adolescents. Trends in Neuroscience and Education. 2018;101–7. doi:10.1016/j.tine.2017.11.001

14. Best JR, Chiu BK, Liang Hsu C, Nagamatsu LS, Liu-Ambrose T. Long-Term Effects of Resistance Exercise Training on Cognition and Brain Volume in Older Women: Results from a Randomized Controlled Trial. J Int Neuropsychol Soc. 2015;21(10):745–56. doi:10.1017/S1355617715000673 Cited in: PubMed; PMID 26581787.

15. Stern Y, MacKay-Brandt A, Lee S, McKinley P, McIntyre K, Razlighi Q, Agarunov E, Bartels M, Sloan RP. Effect of aerobic exercise on cognition in younger adults: A randomized clinical trial. Neurology. 2019;92(9):e905-e916. doi:10.1212/WNL.0000000000007003 Cited in: PubMed; PMID 30700591.