## Title
Title
1. Identify the report as a systematic review, meta-analysis, or both.

## Abstract
Structured summary
2. Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.

## Introduction
Rationale
3. Describe the rationale for the review in the context of what is already known.

Objectives
4. Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).

## Methods
Protocol and registration
5. Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.

Eligibility criteria
6. Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.

Information sources
7. Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.

Search
8. Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. Online Resource 2

Study selection
9. State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).

Data collection process
10. Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.

Data items
11. List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.

Risk of bias in individual studies
12. Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.

Summary measures
13. State the principal summary measures (e.g., risk ratio, difference in means).

Synthesis of results
14. Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I²) for each meta-analysis.
| Section/topic                          | #  | Checklist item                                                                                                                                                                                                 |
|---------------------------------------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Risk of bias across studies           | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).                                                                   |
| Additional analyses                   | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done pre-specified.                                                                                       |
| **RESULTS**                           |    |                                                                                                                                                                                                             |
| Study selection                       | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.                                                      |
| Study characteristics                 | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.                                                                |
| Risk of bias within studies           | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).                                                                                                     |
| Results of individual studies         | 20 | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. |
| Synthesis of results                  | 21 | Present results of each meta-analysis done, including confidence intervals and measures of consistency.                                                                                                       |
| Risk of bias across studies           | 22 | Present results of any assessment of risk of bias across studies (see Item 15).                                                                                                                               |
| Additional analysis                   | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression) [see Item 16].                                                                                          |
| **DISCUSSION**                        |    |                                                                                                                                                                                                             |
| Summary of evidence                   | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their implications for key groups (e.g., healthcare providers, users, and policy makers).                     |
| Limitations                           | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review level (e.g., incomplete retrieval of identified research, reporting bias).                                                  |
| Conclusions                           | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research.                                                                                       |
| **FUNDING**                           |    |                                                                                                                                                                                                             |
| Funding                               | 27 | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders.                                                                                              |

*From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097*

For more information, visit: [www.prisma-statement.org](http://www.prisma-statement.org).

*Online Resource 2. Exemplary Search Strategy for PubMed Search*
Supplement 3: Sensitivity Analyses

### A. Separate Analysis for Inattentive and Hyperactive Symptoms

#### Inattentive

| Study          | Control | $g$     | 95% CI          | Hedges' $g$ and 95% CI |
|----------------|---------|---------|-----------------|------------------------|
| Bahram, 2014   | Passive | -4.00   | [-5.31; -2.70]  |                        |
| Benzing, 2019  | Passive | -0.02   | [-0.58; 0.53]   |                        |
| Choi, 2015     | Passive | 0.69    | [-1.44; 0.05]   |                        |
| Davis, 2017    | Passive | 0.00    | [-1.39; 1.39]   |                        |
| Felmet, 1998   | Passive | -0.43   | [-1.19; 0.25]   |                        |
| Garcia, 2016   | Passive | 0.24    | [-0.86; 1.33]   |                        |
| Gelade, 2016   | Active* | 0.31    | [-0.08; 0.71]   |                        |
| Kang, 2011     | Passive | -1.84   | [-2.74; -0.93]  |                        |
| Oh, 2015       | Active  | 0.24    | [-0.46; 0.93]   |                        |
| Pan, 2016      | Passive |         |                 |                        |
| Soori, 2020    | Passive |         |                 |                        |

**Overall Effect**

-0.60  [-1.26; 0.06]

**Heterogeneity**

$\tau^2 = 0.82; \chi^2 = 56.4;$
## Publication Bias

**Egger's intercept = -4.22 (p = 0.070)**

**Note.** G = Hedges' $g$; CI: Confidence Interval; p: $p$-Score; MVPA: moderate to vigorous physical activity.

### Heterogeneity

$\tau^2 = 0.07$; $\chi^2 = 12.58$; 
$df = 8 (p = 0.127); I^2 = 36.4\%$

### Publication Bias

Egger's intercept = -1.91 (p = 0.145)

### Hyperactive

| Study         | Group   | Effect Size (g) | 95% CI         |
|---------------|---------|-----------------|----------------|
| Bahram, 2014  | Passive | -0.77           | [-1.52; -0.03] |
| Benzing, 2019 | Passive | -0.28           | [-0.83; 0.28]  |
| Choi, 2015    | Passive | -0.81           | [-1.56; -0.05] |
| Davis, 2017   | Passive | -0.38           | [-1.79; 1.03]  |
| Felmet, 1998  | Passive | -0.22           | [-0.90; 0.45]  |
| Garcia, 2016  | Passive | 0.25            | [-0.85; 1.35]  |
| Gelade, 2016  | Active* | 0.28            | [-0.11; 0.69]  |
| Kang, 2011    | Passive | -0.63           | [-1.40; 0.14]  |
| Oh, 2015      | Active  | -0.06           | [-0.75; 0.64]  |
| Pan, 2016     | Passive |                |                |
| Soori, 2020   | Passive |                |                |

### Overall Effect

-0.25 [-0.54; 0.05]

## Note

$G = \text{Hedges' } g$; CI: Confidence Interval; $p$: $p$-Score; MVPA: moderate to vigorous physical activity.
### PRISMA 2009 Checklist

#### B. Further Subgroup Analyses

| Subgroup       | n   | g   | 95% CI          | p    | Tau² | Chi² | df | p   | I² (%) |
|----------------|-----|-----|-----------------|------|------|------|----|-----|--------|
| **Assessor**   |     |     |                 |      |      |      |    |     |        |
| blinded        | 3   | -0.93 | [-1.45; -0.41] | 0.000 | 0.6  | 1.96 | 2  | 0.375 | 0.0    |
| non-blinded    | 8   | -0.16 | [-0.44; 0.12]  | 0.259 | 0.06 | 10.77| 7  | 0.149 | 35.0   |
| **Trainer**    |     |     |                 |      |      |      |    |     |        |
| professional   | 6   | -0.46 | [-0.89; -0.03] | 0.037 | 0.13 | 9.21 | 5  | 0.101 | 45.7   |
| parent/investigator | 5   | -0.18 | [-0.60; 0.23]  | 0.386 | 0.11 | 8.36 | 4  | 0.079 | 52.2   |
| **Delivery**   |     |     |                 |      |      |      |    |     |        |
| group-based    | 9   | -0.42 | [-0.72; -0.12] | 0.007 | 0.06 | 11.52| 8  | 0.174 | 30.5   |
| individual     | 2   | -0.04 | [-0.81; 0.73]  | 0.914 | 0.23 | 3.71 | 1  | 0.054 | 73.0   |

*Note: n = number of studies; g = Hedges's g; CI = confidence interval, p = p-Score, df = degrees of freedom

* significantly different to comparison group: confidence intervals do not overlap
C. Meta Regression including Age, Sex and Medication Status

|        | beta  | SE   | 95% CI          | z    | p   | n   | QM | df | R²  |
|--------|-------|------|-----------------|------|-----|-----|----|----|-----|
| Age    | Intercept | 1.02 | 0.45 | [0.15; 1.90] | 2.28 | 0.022 |     |     |     |
|        | age     | -0.13 | 0.05 | [-0.23; -0.05] | -2.96 | 0.003 |     |     |     |
|        | Model Fit | 0.003 |     |     |     |     | 11 | 8.77 | 1   | 88.67% |

|        | Intercept | -0.39 | 0.44 | [-1.30; 0.52] | -0.84 | 0.403 |     |     |     |
|        | gender (% male) | 0.00 | 0.01 | [-0.01; 0.01] | 0.13 | 0.895 | 0.895 | 11 | 0.017 | 0.00% |
|        | Model Fit |     |     |     |     |     |     |     |     |

| Medication | Intercept | -0.10 | 0.21 | [-0.52; 0.32] | 0.47 | 0.639 |     |     |     |
|            | % medicated | -0.01 | 0.00 | [-0.01; 0.00] | -1.69 | 0.09 |     |     |     |
|            | Model Fit | 0.09 |     |     |     |     | 9 | 2.85 | 38.80% |

Key to abbreviations. SE: standard error; z: z-score; p: p-score; n = number of included effect sizes; df: degrees of freedom

Plots of univariate meta-regressions:

Univariate meta-regression analysis: removed data-point with high leverage (Choi et al., 2015)

|        | beta  | SE   | 95% CI          | z    | p   | n   | QM | df | R²  |
|--------|-------|------|-----------------|------|-----|-----|----|----|-----|
| Age    | Intercept | 0.74 | 0.63 | [-0.50; 1.99] | 1.17 | 0.243 |     |     |     |
|        | age     | -0.10 | 0.07 | [-0.24; 0.03] | -1.51 | 0.130 |     |     |     |
|        | Model Fit | 0.130 |     |     |     |     | 10 | 2.29 | 1.00 | 55.07% |

Key to abbreviations. SE: standard error; z: z-score; p: p-score; n = number of included effect sizes; df: degrees of freedom

Supplement 4: Studies included in meta-analyses Cerrillo-Urbina et al. (2015); Zang (2019), but excluded in this systematic review and meta-analysis
Exclusion due to non-randomized design:
- Verret, Gardiner, and Beliveau (2010) (+ acute exercise intervention)
- Verret, Guay, Berthiaume, Gardiner, and Beliveau (2012)
- McKune, Pautz, and Lombard (2003)

Exclusion due to implementation of single bouts of MVPA:
- Chang, Liu, Yu, and Lee (2012)
- Fritz and O'Connor (2016) Pontifex, 2013
- Tantillo, Kesick, Hynd, and Dishman (2002)

Exclusion due to lack of outcome measure of ADHD core symptoms:
- Chou and Huang (2017)
- Pan, Chang, Tsai, and Chu (2014)
- Da Silva et al. (2019)
- Memarmoghaddam, Torbati, Sohrabi, Mashhadi, and Kashi (2016)

Exclusion due to lack of fulfilled clinical diagnosis of full ADHD symptom criteria:
- Hoza et al. (2015)

Exclusion due to intervention provided less than twice per week:
- Jensen and Kenny (2004)

Exclusion due to lack of adequate control group:
- Kadri, Slimani, Bragazzi, Tod, and Azaiez (2019)
References

Cerrillo-Urbina, A. J., Garcia-Hermoso, A., Sanchez-Lopez, M., Pardo-Guijarro, M. J., Santos Gomez, J. L., & Martinez-Vizcaino, V. (2015). The effects of physical exercise in children with attention deficit hyperactivity disorder: a systematic review and meta-analysis of randomized control trials. *Child Care Health Dev*, 41(6), 779-788. doi:10.1111/cch.12255

Chang, Y. K., Liu, S. Y., Yu, H. H., & Lee, Y. H. (2012). Effect of acute exercise on executive function in children with attention deficit hyperactivity disorder. *Archives of Clinical Neuropsychology*, 27(2), 225-237. doi:10.1093/arclin/acr094

Chou, C. C., & Huang, C. J. (2017). Effects of an 8-week yoga program on sustained attention and discrimination function in children with attention deficit hyperactivity disorder. *PeerJ*, 5, e2883. doi:10.7717/peerj.2883

Da Silva, L. A., Doyenart, R., Henrique Salvan, P., Rodrigues, W., Felipe Lopes, J., Gomes, K., . . . Silveira, P. C. (2019). Swimming training improves mental health parameters, cognition and motor coordination in children with Attention Deficit Hyperactivity Disorder. *International Journal of Environmental Health Research*. doi:10.1080/09603123.2019.1612041

Fritz, K. M., & O'Connor, P. J. (2016). Acute Exercise Improves Mood and Motivation in Young Men with ADHD Symptoms. *Medicine and Science in Sports and Exercise*, 48(6), 1153-1160. doi:10.1249/MSS.0000000000000864

Hoza, B., Smith, A. L., Shoulberg, E. K., Linnea, K. S., Dorsch, T. E., Blazo, J. A., . . . McCabe, G. P. (2015). A randomized trial examining the effects of aerobic physical activity on attention-deficit/hyperactivity disorder symptoms in young children. *Journal of Abnormal Child Psychology*, 43(4), 655-667. doi:10.1007/s10802-014-9929-y

Jensen, P. S., & Kenny, D. T. (2004). The effects of yoga on the attention and behavior of boys with Attention-Deficit/ Hyperactivity Disorder (ADHD). *J Atten Disord*, 7(4), 205-216. doi:10.1177/108705470400700403

Kadri, A., Slimani, M., Bragazzi, N. L., Tod, D., & Azaiez, F. (2019). Effect of Taekwondo Practice on Cognitive Function in Adolescents with Attention Deficit Hyperactivity Disorder. *International Journal of Environmental Research and Public Health*, 16(2), 204. doi:10.3390/ijerph16020204

Pan, C. Y., Chang, Y. K., Tsai, C. L., & Chu, C. H. (2014). Effects of Exercise Intervention in Youths With Attention-Deficit Hyperactivity Disorder. *Res Q Exercise Sport*, 85, 83-84.

Y., Chang, Y. K., Tsai, C. L., & Chu, C. H. (2014). Effects of Exercise Intervention in Youths With Attention-Deficit Hyperactivity Disorder. *Res Q Exercise Sport*, 85, 83-84.

Verret, C., Gardiner, P., & Beliveau, L. (2010). Fitness level and gross motor performance of children with attention-deficit hyperactivity disorder. *Adapt Phys Activ Q*, 27(4), 337-351. doi:10.1123/apaq.27.4.337

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