

Effects of high-intensity interval training versus moderate-intensity continuous training on blood pressure in prehypertensive and hypertensive individuals: a systematic review and meta-analysis of randomized trials

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The following literature search report has been conducted using the STARLITE method.¹

See also PROSPERO registration:

Effects of high-intensity interval training versus moderate-intensity continuous training on blood pressure in prehypertensive and hypertensive individuals: a systematic review and meta-analysis of randomized trials. PROSPERO 2016:CRD42016041885 Available from http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42016041885

SAMPLING STRATEGY

- The systematic review hypothesis of concern is categorized as a interventional question with randomized trials the study design of interest
- The primary investigator (EC) provided prior to the search investigation an established list of citations known to the investigator that met the inclusion criteria in the study proposal (*see List of References to Determine Search Validity*)
- Database selection was based on question type, and study designs of interest, consequently sampling expanded beyond clinical literature to include Sport Discus (Ebscohost), and PEDro
- Conference proceedings were not desired by the primary investigator (JS) thus no gray literature and hand searching was conducted
- Date limit of 1996 to present was applied
- Possible strategies were investigated using several Cochrane and other systematic reviews that included exercise
- Analysis of the results utilizing the validity set determined that the strategy include various combinations of the following concepts: hypertension, prehypertension, blood pressure, exercise, high-intensity – see also *Terms Used*

List of References to Determine Search Validity

1. Ramos JS, Dalleck LC, Ramos MV, Borrani F, Roberts L, Gomersall S, et al. 12 min/week of high-intensity interval training reduces aortic reservoir pressure in individuals with metabolic syndrome: a randomized trial. *J Hypertens.* 2016;34(10):1977-87.
2. Fu TC, Wang CH, Lin PS, Hsu CC, Cherng WJ, Huang SC, et al. Aerobic interval training improves oxygen uptake efficiency by enhancing cerebral and muscular hemodynamics in patients with heart failure. *Int J Cardiol.*

¹ Booth, A. 2006. "Brimful of STARLITE": towards standards for reporting literature searches. *J Med Lib Assoc*, October; 94(4): 421-429. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1629442/pdf/i1536-5050-094-04-0421.pdf>

2013;167(1):41-50.

3. Mitranun W, Deerochanawong C, Tanaka H, Suksom D. Continuous vs interval training on glycemic control and macro- and microvascular reactivity in type 2 diabetic patients. *Scand J Med Sci Sports*. 2014;24(2):e69-76.
4. Rognmo O, Hetland E, Helgerud J, Hoff J, Slordahl SA. High intensity aerobic interval exercise is superior to moderate intensity exercise for increasing aerobic capacity in patients with coronary artery disease. *Eur J Cardiovasc Prev Rehabil*. 2004;11(3):216-22.
5. Hollekim-Strand SM, Bjorgaas MR, Albrektsen G, Tjonna AE, Wisloff U, Ingul CB. High-intensity interval exercise effectively improves cardiac function in patients with type 2 diabetes mellitus and diastolic dysfunction: a randomized controlled trial. *J Am Coll Cardiol*. 2014;64(16):1758-60.
6. Gui Y. Intermittent exercises reduce the hypertension syndromes and improve the quality of life. *J Sports Med Phys Fitness*. 2016;56(1-2):133-40.

TYPES OF STUDIES

- Cochrane Collaboration RCT filter was applied
- Primary, randomized controlled trial research was only considered: see also *Inclusion and Exclusions*

APPROACHES: Not applicable

RANGE OF YEARS

- Date limit of 1996 to present applied; date ranges in databases include Medline (OVID – 1946 – present, in-process and other non-indexed citations), Embase (OVID – 1974 – present)
- Update:
 - April 24, 2017 – CENTRAL not included

LIMITS

- English, Date

INCLUSION AND EXCLUSIONS

Inclusion:

- Studies that describe persons with diagnostically determined prehypertension or high-normal blood pressure, or hypertension and/or using anti-hypertension medication
- Studies published in adults 18 or older
- Studies that include participants with associated risk factors for hypertension, including diabetes, high cholesterol, obesity or overweight, prediabetes as well as known cardiometabolic diseases
- Studies describing physical activity interventions conducted using high-intensity training methodology at intervals of 4 minutes or less
- Studies describing physical activity interventions conducted using moderate-intensity training methodology
- Studies describing exercise training interventions for a minimum of 4 weeks in duration

Exclusion:

- Studies published in persons less than or equal to 18 years old
- Involve animals
- Studies that describe baseline blood pressure values not reported and/or criteria where it is diagnostically unclear the status of hypertension

- Studies describing exercise training protocols using “all-out” supramaximal training methods
- Studies that do not establish or report the type or level of exercise training intensity
- Studies describing exercise training interventions that are less than 4 weeks in duration
- Studies that include high-intensity interval training or moderate-intensity interval training with other interventions (e.g. resistance training, nutrition)

ELECTRONIC SOURCES: Medline (OVID); Embase (OVID); Sport Discus (EBSCO); PEDro; CENTRAL

TERMS USED/STRATEGIES:

Medline

1. hypertension/
2. (antihypertens\$ OR hypertens\$ OR prehypertens\$ OR anti-hypertens\$ OR pre-hypertens\$).tw. [AS added anti-hypertens, pre-hypertens]
3. exp blood pressure/
4. ((blood or arterial or systolic or diastolic) adj2 pressure?).kw,tw. [AS interpretation of Cochrane strategy]
5. (bp or dbp or sbp).tw.
6. prehypertension/
7. or/1-6
8. exercise/
9. exercise therapy/
10. physical exertion/
11. (high-intensity adj3 (interval? OR exercis\$ OR intermittent OR train\$)).kw,tw.
12. HIIT.kw.
13. (exercise training).kw.
14. aerobic adj (interval? OR capacity).tw,kw.
15. (high adj5 (interval? OR exercis\$ OR intermittent OR train\$ OR intensity OR exert\$)).tw,kw.
16. (interval? adj3 (train\$ OR exercise\$)).tw,kw.
17. or/8-16

18. (controlled clinical trial or randomized controlled trial).pt.
19. clinical trials as topic.sh.
20. (randomi#ed OR randomly OR RCT?1 or placebo\$ OR compar\$).tw.
21. ((singl\$ OR doubl\$ OR trebl\$ OR tripl\$) adj (mask\$ OR blind\$ OR dumm\$)).tw.
22. trial.ti.
23. or/18-22 [RCT filter]
24. exp Animals/ not (exp Animals/ and Humans/) [Human filter]
25. (comment or editorial or interview or news).pt.
26. (letter not (letter and randomized controlled trial)).pt.
27. 25 or 26 [Opinion filter]
28. 7 and 17 [concept combination]
29. 28 and 23 [concept + RCT]
30. 29 not 27 [removing Opinion]
31. 30 not 24 [removing Animal]
32. limit 31 to English language and yr=1996-2016

Embase

1. hypertension/
2. (antihypertens\$ OR hypertens\$ OR prehypertens\$ OR anti-hypertens\$ OR pre-hypertens\$).tw.
3. exp blood pressure/
4. ((blood or arterial or systolic or diastolic) adj2 pressure?).kw,tw.
5. (bp or dbp or sbp).tw.
6. prehypertension/
7. or/1-6

8. exercise/
9. exercise therapy/
10. physical exertion/
11. (high-intensity adj3 (interval? OR exercis\$ OR intermittent OR train\$)).kw,tw.
12. HIIT.kw.
13. (exercise training).kw.
14. aerobic adj (interval? OR capacity).tw,kw.
15. (high adj5 (interval? OR exercis\$ OR intermittent OR train\$ OR intensity OR exert\$)).tw,kw.
16. (interval? adj3 (train\$ OR exercise\$)).tw,kw.
17. or/8-16
18. random\$.ab,ti.
19. (clinical adj1 trial\$.de,ab,ti.
20. exp health care quality/
21. or/18-20 [Wong sensitive RCT filter: <http://work.cochrane.org/embase>]
22. exp Animals/ not (exp Animals/ and Humans/) [Human filter]
23. (letter or editorial).pt. [Opinion filter]
24. 7 and 17 [concept combination]
25. 24 and 21 [concept + RCT]
26. 25 not 23 [removing Opinion]
27. 26 not 22 [removing Animal]
28. limit 27 to English language and yr=1996-2016

Sport Discus

1. SU hypertension

2. TI (antihypertens* OR hypertens* OR prehypertens* OR anti-hypertens* OR pre-hypertens*) OR AB (antihypertens* OR hypertens* OR prehypertens* OR anti-hypertens* OR pre-hypertens*)
3. SU blood pressure
4. TI ((blood OR arterial OR systolic OR diastolic) N2 pressure?) OR AB ((blood OR arterial OR systolic OR diastolic) N2 pressure?)
5. TI (bp OR dbp OR sbp) OR AB (bp OR dbp OR sbp)
6. SU prehypertension
7. S1 OR S2 OR S3 OR S4 OR S5 OR S6
8. SU exercise
9. SU exercise therapy
10. SU physical exertion
11. SU interval training
12. TI (high-intensity N3 (interval? OR exercis* OR intermittent OR train*)) OR AB (high-intensity N3 (interval? OR exercis* OR intermittent OR train*))
13. TI HIIT OR AB HIIT
14. TI "exercise training" OR AB "exercise training"
15. TI (aerobic N1 (interval? OR capacity)) OR AB (aerobic N1 (interval? OR capacity))
16. TI (high N5 (interval? OR exercis* OR intermittent OR train* OR intensity OR exert*)) OR AB (high N5 (interval? OR exercis* OR intermittent OR train* OR intensity OR exert*))
17. TI (interval? N3 (train* OR exercise*)) OR AB (interval? N3 (train* OR exercise*))
18. S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16
19. S7 AND S17 [CONCEPT TOTAL]
20. SU randomized controlled trials
21. TI (randomi#ed OR randomly OR RCT?1 OR placebo* OR compar*) OR AB (randomi#ed OR randomly OR RCT?1 OR placebo* OR compar*)
22. TI ((singl* OR doubl* OR trebl* OR tripl*) N1 (mask* OR blind* OR dumm*)) OR AB ((singl* OR doubl* OR trebl* OR tripl*) N1 (mask* OR blind* OR dumm*))

23. S20 OR S21 OR S22 [RCT filter]

24. S19 AND S23 [concept + RCT]

25. limit 24 to English language and yr=1996-2016

CENTRAL

#1 [mh ^ hypertension]

#2 (antihypertens* OR hypertens* OR prehypertens* OR anti-hypertens* OR pre-hypertens*):ti,ab,kw {{AS added anti-hypertens, pre-hypertens}}

#3 [mh “blood pressure”]

#4. ((blood OR arterial OR systolic OR diastolic) NEAR/2 pressure?):ti,ab,kw {{AS interpretation of Cochrane strategy}}

#5 (bp OR dbp OR sbp):ti,ab,kw

#6 [mh ^ prehypertension] {{AS added this}}

#7 {OR #1-#6}

#8 [mh ^ exercise]

#9 [mh ^ ”exercise therapy”]

#10 [mh ^ ”physical exertion”]

#11 (high-intensity NEAR/3 (interval? OR exercis* OR intermittent OR train*)):ti,ab,kw

#12 HIIT:ti,ab,kw

#13 (“exercise training”):ti,ab,kw

#14 (aerobic NEXT (interval? OR capacity)):ti,ab,kw

#15 (high NEAR/5 (interval? OR exercis* OR intermittent OR train* OR intensity OR exert*)):ti,ab,kw

#16 (interval? NEAR/3 (train* OR exercise*)):ti,ab,kw

#17 {OR #8-#16}

#18 [mh Animals] NOT ([mh Animals] AND [mh Humans]) {{Human filter}}

#19 #7 AND #17 {{concept combination}}

#20 #19 NOT #18 {{removing Animal}}

#21 limit #20 to English language and yr=1996-2016 and RCT

PEDro

#1 hypertension high intensity (when searching match all search terms (AND)) -- Abstract & Title, pub since 1995

#2 hypertension high-intensity (when searching match all search terms (AND)) -- Abstract & Title, pub since 1995

#3 prehypertension high intensity (when searching match all search terms (AND)) -- Abstract & Title, pub since 1995

#4 pre-hypertension high intensity (when searching match all search terms (AND)) -- Abstract & Title, pub since 1995

#5 HIIT (when searching match all search terms (AND)) -- Abstract & Title, pub since 1995

#6 blood pressure high intensity (when searching match all search terms (AND)) -- Abstract & Title, pub since 1995

#7 blood pressure high-intensity (when searching match all search terms (AND)) -- Abstract & Title, pub since 1995

#8 blood pressure exercise training (when searching match all search terms (AND)) -- Abstract & Title, pub since 1995

#9 blood pressure aerobic interval (when searching match all search terms (AND)) -- Abstract & Title, pub since 1995

#10 blood pressure aerobic capacity (when searching match all search terms (AND)) -- Abstract & Title, pub since 1995