EFFECTS OF AEROBIC EXERCISE INTENSITY ON AMBULATORY BLOOD PRESSURE: A LOOK AT UNMEDICATED MIDDLE AGE HYPERTENSIVE MALES AND FEMALES

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RSPT 578
What is Hypertension?

Raised blood pressure (BP) greater than 140/90 mmHg

(WHO, 2010)
Most common reason for Canadians to visit a physician or take medication
(Public Health Agency of Canada, 2009)

Cost the Canadian health care system 2.3 billion (physician, medication and laboratory costs) in 2003
(Public Health Agency of Canada, 2009)
‘The Silent Killer’

- #1 Risk factor for stroke
  (Heart & Stroke Foundation of BC & Yukon, 2010)

- Major risk factor for:
  - coronary heart disease (CHD)
  - heart failure
  - peripheral arterial disease
  - renal insufficiency
  (Heart & Stroke Foundation of BC & Yukon, 2010)
‘The Silent Killer’

- Every 20 mmHg above 115 mmHg systolic BP (SBP) & 10 mmHg above 75 mmHg diastolic BP (DBP)
  - Risk of mortality and morbidity ↑ 2x (Kokkinos et al, 2009)
5 mmHg decrease in DBP
- 21% ↑ risk of CHD
- 34% ↑ risk of stroke over 5 years
  (Kokkinos et al, 2009)

2 mmHg decrease in SBP
- 4% ↓ CHD mortality
- 6% ↓ Stroke mortality
  (Whelton, 1994)
Office BP Measurement (OBP)

- **Current clinical standard** (Chavanu et al., 2008)
  - Measurement of BP at a single point in time
  - Usually in clinical setting
  - Quick and convenient
  - Traditional

- BP fluctuates
- White Coat Syndrome
Ambulatory Blood Pressure Monitoring (AMBP)

- **Gold standard** (Chavanu et al., 2008)
  - Portable, self-inflating sphygmomanometer worn continuously
  - Readings at regular intervals over a 24-48 hour period (i.e., every 15 min, every hour)
  - Provides a continuous record of blood pressure during the patient’s daily activities

- Expensive
- Can be disruptive to daily life
AMBP deemed more accurate reflection of patient’s ‘true’ blood pressure levels

- **Dippers vs Non-Dippers** (Nami et al., 2000)
- **OBP dx vs AMBP dx** (Chavanu et al., 2008)

- AMBP measurements usually lower
  (Cooper et al., 2000; Suissa et al., 1998; Grimm et al., 1996)

- AMBP shows less change
  (Arroll et al., 1992; Hagberg & Brown, 1995)
1. **Lifestyle modifications** ‘indispensable’ part of the management of high BP
   - Diet
   - *Exercise*
   - Stress management

2. **Medication**
   - Used concurrently, or not at all

(National Heart, Lung, and Blood Institute, 2003)
Exercise Prescription

- **ACSM (2006)**
  - Aerobic exercise performed for 20-60 mins, at 50-85% HRR, 3-5 days/wk

- **Clinically** (National Heart, Lung, and Blood Institute, 2003)
  - Moderate intensity aerobic exercise performed for at least 30 mins, most days of the wk

*NB. Both are specific to hypertensive patients*
Still Unclear...

- Parameters are vague

- What is the most effective exercise prescription to reduce high blood pressure? (FITT)

- What variables within FITT are most important for the management of BP?
(I) Intensity

- Discrepancies regarding the optimal intensity

  - Low and moderate intensity yield similar results to those with higher intensity

  - Higher intensities yield greater decreases than moderate
    (Cooper, Moore, McKenna & Riddoch 2000)
MDs & PTs should prescribe exercise that is both acceptable to patient AND lead to clinically meaningful reductions in BP
  - How Much by When?

- Refinement of Clinical Practice Guidelines (ie. ACSM)

- Adjusting definition of AMBP hypertension
Our Aim

Systematically review the literature to determine the optimal intensity of an aerobic exercise program to yield the greatest reductions in AMBP
Methodology
PICOS

- **P** – mean age <65 yrs, OBP hypertension dx, no serious co-morbidities, not on antihypertensive meds
- **I** – aerobic exercise program ≥ 4weeks
- **C** – exercise intensities
- **O** – mean daytime AMBP (SBP, DBP)
- **S** – systematic review of RCTs
Search Strategy

- Medline OvidSP
- EMBASE OvidSP
- CINAHL
- SportDISCUS
- PEDro
- Cochrane Systematic Review
- Grey Literature
1. hypertens*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
2. High blood pressure or hypertension/
3. 24 hour blood pressure monitor* or Blood Pressure Monitoring, Ambulatory/
4. ambulatory blood pressure monitor*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
5. exp Exercise/
6. exp Sports/
7. exp Exercise Therapy/
8. Motor Activity/
9. (walk* or exercise* or physical activit* or sport*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]

...
15. limit 14 to (("all adult (19 plus years)" or "adult (19 to 44 years)" or "young adult and adult (19-24 and 19-44)" or "middle age (45 to 64 years)" or "middle aged (45 plus years)" or "all aged (65 and over)" or "aged (80 and over)")) and english and english and humans)
Quality Assessment

- PEDro (11)
  - Methodological quality of intervention studies
- Van Tulder (2)
  - Compliance and dropout
- Additional (1)
  - Construct Validity

- Performed independently by 2 reviewers
- Used standardized form
- In case of discrepancy, a third reviewer \(\rightarrow\) tie-breaker

* 3 criteria from PEDro removed \(\frac{3}{11}\)
Data Abstraction

- Performed independently by 2 reviewers
- Used standardized form
- In case of discrepancy, a third reviewer served as tie-breaker
Results
Study Selection

MEDLINE
- OvidSP=157
- Excluded Articles = 153

Embase
- OvidSP=367
- Excluded Articles = 364

PEDro
- Excluded Articles = 31

after reviewing abstracts = 4

after abstracts/duplicates = 3

after abstracts/duplicates = 1
Study Selection

- after abstracts/duplicates = 0
- Sport-Discus = 6
- Excluded Articles = 6
- after abstracts/duplicates = 1
- CINAHL = 27
- Excluded Articles = 26
- after abstracts/duplicates = 0
- Cochrane SRs = 0
- Excluded Articles = 0
- after reviewing abstracts = 10
- Total = 589
- Excluded Articles = 579
<table>
<thead>
<tr>
<th>Reviewed</th>
<th>Reviewed Articles</th>
<th>Excluded Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Evaluated</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>6 Pre-post</td>
<td>2 RCTs</td>
<td></td>
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<tr>
<td></td>
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<td>Excluded Articles = 6</td>
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</table>

Included in SR = 2
Study 1


What is the magnitude of blood pressure response to a program of moderate intensity exercise? Randomized controlled trial of sedentary adults with unmedicated hypertension.

*British Journal of General Practice, 50, 958-962.*
Study 2


Exercise and Weight Loss Reduce Blood Pressure in Men and Women with Mild Hypertension: Effects on Cardiovascular, Metabolic, and Hemodynamic Functioning.

<table>
<thead>
<tr>
<th>Study</th>
<th>Exercise Type</th>
<th>Duration of session</th>
<th>Intensity</th>
<th>Frequency</th>
<th>Program Length</th>
<th>N (treatment/control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper (2000)</td>
<td>Walking (Unsup)</td>
<td>30 mins</td>
<td>‘Moderate’</td>
<td>5x/wk</td>
<td>6 wks</td>
<td>47/39</td>
</tr>
<tr>
<td>Blumenthal (2000)</td>
<td>Cycling Ergo/ Walking/ Jogging (Sup)</td>
<td>35 minutes + 10 mins of warm up &amp; cool down</td>
<td>70-85% of HRR</td>
<td>3-4x/wk</td>
<td>24 wks</td>
<td>54/24</td>
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<tr>
<td>Study</td>
<td>Group</td>
<td>Baseline mean SBP</td>
<td>Follow-up mean SBP</td>
<td>P value</td>
<td>Baseline mean DBP</td>
<td>Follow-up mean DBP</td>
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</tr>
<tr>
<td>Cooper (2000)</td>
<td>I</td>
<td>139.8 (+/-12.7)</td>
<td>137.0 (+/-9.3)</td>
<td>0.059</td>
<td>89.5 (+/-9.6)</td>
<td>87.7 (+/-9.4)</td>
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<tr>
<td></td>
<td>C</td>
<td>135.7 (+/-9.3)</td>
<td>136.3 (+/-8.6)</td>
<td>0.059</td>
<td>87.6 (+/-8.5)</td>
<td>88.5 (+/-7.6)</td>
</tr>
<tr>
<td>Blumenthal (2000)</td>
<td>I (ex only)</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td></td>
<td>C</td>
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</table>

* No values reported
Blumenthal Results

- AMBP significantly different between all groups (WM – EX – CON) (p < 0.001)

- SBP & DBP significantly lower in Intervention groups (WM & EX Only) vs Controls
  - SBP, p = 0.02
  - DBP, p = 0.002
Data Synthesis

- Unable to do meta-analyses
- Unable to do forest plots

**WHY?**
- Only 1 study (Cooper) with reported data that included means and SDs
- Statistician resource not available
Discussion
Summary of Findings

- Very few high quality studies in the literature that assess the effect of various intensities of aerobic exercise programs on AMBP

- Cooper – no statistically significant change

- Blumenthal – statistically significant change, we just don’t know how much

At this time we are unable to conclude which intensity of an aerobic exercise program is most effective at reducing ambulatory blood pressure
Limitations of Literature

- Lack of studies using AMBP
- Poor methodological quality
  - Pre-post
  - No control group
  - Unsupervised
  - No stringent monitoring of exercise intensity
Limitations of Studies in Review

- Methodological issues
  - Unsupervised exercise
  - No stringent exercise intensity monitoring

- No reporting of means & SDs

- Heterogeneity - Apples vs Oranges
Recommendations

- Redo previous research on the effect of regular aerobic exercise on reducing blood pressure
  - Use AMBP monitoring
  - Systematically manipulate FITT variables

- High methodological quality RCTs
  - Supervised exercise (attend class)
  - Stringent monitoring of intensity levels (HR monitor)
  - Include all outcome data
Thank You
References


