Effects of Pilates on Low Back Pain: A systematic review

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Outline

- Introduction
- Methods
- Results
- Discussion
- Limitations
- Conclusion
- Future Research
- Clinical Message
Definition

- **Low Back Pain**
  - Pain in the area between the inferior-most aspect of the scapula and gluteal folds, with or without radiation to the lower extremities

(Van Tulder, 2004)
Low Back Pain

- **Contributors**
  - sedentary lifestyle
  - poor posture
  - age
  - excessive body weight
  - strength of abdominal and back muscles
  - history of smoking
  - anxiety
  - depression
  - occupational factors
  - psychosocial factors
  - trauma
  - pathological
Low Back Pain

- **Prevalence**
  - 4 out of 5 North Americans experience LBP at least once in their lifetime (Luo et al, 2004)

- **Recurrence of LBP** (Woolf and Pfleger, 2003)
  - 20-44% within one year
  - 85% during lifetime

- **Cost**
  - Total cost $8.1 billion annually in Canada
  - total direct health care costs represent 1% of the Gross National Product of Canada (Woolf and Pfleger, 2003)
Joseph H. Pilates

- Inventor of Pilates Method (WW1)
- Introduced to dancers and actors
What is Pilates?

- Approximately 500 exercises that are performed on mats or specialized apparatus
- Available through videos, books, and gym classes
Definitions

- **Core**
  - The inner unit is comprised of the muscles of the pelvic floor, transversus abdominis (TA), multifidus, the diaphragm and the posterior fibers of psoas.
  - The outer unit is comprised of several slings or systems of muscles (global stabilizers and mobilizers)
  
  (Gibbons and Comerford, 2001)

- ‘**Powerhouse’**
  - The connection between the upper torso and the pelvis. In a motor control model, this includes the relationship between the TA, internal and external abdominal obliques, diaphragm, and pelvic floor muscles

  (Anderson, 2005)
Goals of Pilates Exercise

- To stabilize the ‘powerhouse’ by strengthening the abdominal, lower spine and pelvic floor muscles
- To train the active and neural local spinal musculature, incorporating breathing patterns, while inhibiting the global musculature
- http://youtube.com/watch?v=3OPExXyuLc0
Pilates Industry

- In 2003, Pilates exercise was the fastest growing fitness activity in North America
- Stott Pilates increased their sales by 1147% between 1997 and 2002
- In 2000, the Pilates trademark ended which may have resulted in the boom in the industry
Pilates and Physiotherapy

- Pilates exercise training has now become common practice for many physiotherapists in the treatment of many conditions including LBP.
Research

- Joseph H. Pilates did little research to support the effectiveness of his programs in rehabilitation.
- The usage of Pilates exercise in physiotherapy rehabilitation continues to increase.
- **Is there research to support Pilates exercise use in physiotherapy?**
Review Question

To determine if Pilates exercise has an effect on pain and/or function in individuals with LBP compared with no treatment or other treatments.
Methods
Paper Identification

- Conducted between July 2006 and June 2007
- Selected databases
- Grey literature search
  - Google
  - Google Scholar
  - Pilates Exercise Magazines
- Experts in the field
- Hand search from identified studies
Databases

- MEDLINE (1966-present)
- EMBASE (1980-present)
- CINAHL (1982-present)
- SPORTDiscus (1830-present)
- ProQuest (1980-present)
- PEDro
- Academic Search Premier
- Cochrane Central Register of Controlled Trials
- Cochrane Database of Systematic Reviews
Search Strategy

- Title screen
- Abstract screen
- Full text screen
  - Screening tools were developed
  - Two independent reviewers screened at each level
  - Inconsistency was resolved through discussion
Key Terms

- **Population**
  - low back pain, back pain, back ache

- **Intervention**
  - pilates, pilates-based, pilates exercise, lumbo-pelvic, core (strength, strengthening, stability, stabilization), trunk (stabilization, stability, strength), lumbar (strength, stabilization), muscle (strength, strengthening, function), spine stabilization, lumbar spine muscle recruitment, stabilization exercises, stability, and kinesiotherapy.
Inclusion Criteria

- Low back pain as defined earlier
- Any duration (acute, subacute, chronic, recurrent)
- Any type
- No discrimination based on funding
- Adults over 18 years of age
- Pilates method intervention
- Outcome measures of pain and/or function
Exclusion Criteria

- Non-English
- Pregnancy related pain
Outcomes

- Pain
  - An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage  
    (International Association for the Study of Pain)
  - Measured by any valid and reliable pain scale
Outcomes

○ Function
  ● A complex interaction between the health condition of the individual and the contextual factors of the environment as well as personal factors (Stucki, Cieza, & Melvin, 2007).
  ● Measured by any subjective or objective scale validated for the LBP population
Quality Assessment

- RCTs were assessed using the modified van Tulder scale
- Case study was assessed using the Case Study Methodological Quality Assessment Tool
- Levels of evidence assigned using guidelines developed by Phillips (2001)
Data Extraction & Analysis

- Data were extracted from the selected studies using the Data Extraction Form
- Two independent reviewers extracted relevant data
- In situations where results were inconsistent, the two reviewers referred to the study to come to a consensus
- Best evidence synthesis was performed
Results
Search Strategy Flow Diagram

- 1 Citation
- 48 Citations
- 338 Citations
- 76 Citations
- 246 Citations
- 111 Citations
- 131 Citations
- 60 Citations
- 183 Citations

Potentially relevant citations identified after electronic database search and removal of duplicates (n = 1124)

- Citations excluded with reason (n = 976)
- Abstracts retrieved for more detailed evaluation (n = 146)
- Studies excluded with reason (n = 44)

Secondary titles retrieved (n = 259)

- Citations excluded with reason (n = 221)
- Abstracts excluded with reason (n = 38)
- Studies excluded with reason (n = 11)

Secondary abstracts retrieved (n = 27)

- Full text retrieved for more detailed evaluation (n = 48)
- Studies included for systematic review (n = 4)

Author contacted for further information (n = 1)

Secondary full texts retrieved (n = 11)

- Full text retrieved for more detailed evaluation (n = 1)
- Studies included for systematic review (n = 0)

Total studies included for systematic review (n = 5)
## Study Design and Quality

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Study Design</th>
<th>Quality Assessment</th>
<th>Level of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson, 2005</td>
<td>RCT</td>
<td>5/10</td>
<td>Level 2b</td>
</tr>
<tr>
<td>Gagnon, 2005</td>
<td>RCT</td>
<td>5/10</td>
<td>Level 2b</td>
</tr>
<tr>
<td>Hawson, 2002</td>
<td>Case series</td>
<td>5/7</td>
<td>Level 4</td>
</tr>
<tr>
<td>Quinn, 2005</td>
<td>RCT</td>
<td>3/10</td>
<td>Level 2b</td>
</tr>
<tr>
<td>Rydeard et al, 2006</td>
<td>RCT</td>
<td>8/10</td>
<td>Level 1b</td>
</tr>
</tbody>
</table>
## Population

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Sample Size (male:female)</th>
<th>Mean Age (yrs)</th>
<th>Duration of LBP</th>
</tr>
</thead>
</table>
| Anderson, 2005 | n= 10 I n= 11 C (11:10) | I= 42.4  
C= 44 | >3 months |
| Gagnon, 2005  | n= 6 I (1:5) n= 6 C (1:3) | I= 36  
C= 30.33 | >3 months |
| Hawson, 2002 | n= 5 (2:3)  
(range 19-48) | 36 | >3 months |
| Quinn, 2005  | n= 15 I n= 7 C | I= 46.3  
C= 34.7 | >6 months |
| Rydeard et al, 2006 | n= 21 I(8:13) n= 18 C(1:2) | I= 34  
C= 37 | >6 weeks |
## Intervention

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Description</th>
<th>Frequency</th>
<th>Duration (session, total)</th>
</tr>
</thead>
</table>
| Anderson, 2005 | I=Pilates, Pilates instructor, Allegro Reformer  
C=Massage, Massage Therapist, gluteal folds to head | 2x/week | 50 minutes  
6 weeks |
| Gagnon, 2005 | I=Pilates, Stott Pilates instructor, mat Pilates  
C=Traditional physio, AT/Ex Phys/PT, mat exercises | ~1.5x/week | 30-45 min  
7.3 weeks |
| Hawson, 2002 | I=Traditional physio & Pilates, Pilates instructor, reformer/wall unit/combo chair | 6 treatments | Range 2.5 – 5 weeks |
| Quinn, 2005 | I=Pilates, certified instructor, mat exercises  
C=no exercise, normal daily activities | 2x/week | 45-60 min  
12 weeks |
| Rydeard et al, 2006 | I=Pilates, clinic & home, PT, mat/reformer/video  
C=No exercise, treatment from health care professionals as needed | 3x/week – clinic  
6x/week – home | 1 hour – clinic  
15 min – hour  
4 weeks |
## Intervention

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Compliance</th>
<th>Drop out rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson, 2005</td>
<td>N/A</td>
<td>32%</td>
</tr>
<tr>
<td>Gagnon, 2005</td>
<td>n=1 non compliant</td>
<td>43%</td>
</tr>
<tr>
<td>Hawson, 2002</td>
<td>N/A</td>
<td>44.4%</td>
</tr>
<tr>
<td>Quinn, 2005</td>
<td>Attendance 87.5%</td>
<td>31.3%</td>
</tr>
<tr>
<td>Rydeard et al, 2006</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>
## Outcomes

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Pain Intervention</th>
<th>Pain Control</th>
<th>Function Intervention</th>
<th>Function Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anderson, 2005</strong></td>
<td>MBI Pain ↓ 35.1% (0.54)</td>
<td>MBI Pain ↓ 8.7% (0.26)</td>
<td>ODQ ↓ 18.1% (0.35)</td>
<td>ODQ ↓ 2.9% (0.64)</td>
</tr>
<tr>
<td></td>
<td>SF-36 Pain ↑ 7.9% (0.32)</td>
<td>SF-36 Pain ↓ 2.0% (0.04)</td>
<td>MBI-D ↓ 32.4% (0.39)</td>
<td>MBI-D ↓ 26.1% (0.42)</td>
</tr>
<tr>
<td><strong>Gagnon, 2005</strong></td>
<td>VAS ↓ 51.2% (1.07)</td>
<td>VAS ↓ 60.2% (0.60)</td>
<td>RODI ↓ 55.8% (1.09)</td>
<td>RODI ↓ 46.6% (1.79)</td>
</tr>
<tr>
<td><strong>Hawson, 2002</strong></td>
<td>VAS ↓ 39.2% (N/A)</td>
<td>N/A</td>
<td>ODQ ↓ 38.9% (N/A)</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Quinn, 2005</strong></td>
<td>N/A</td>
<td>N/A</td>
<td>ODQ ↓ 57.9% (2.15)</td>
<td>ODQ ↓ 18.2% (0.65)</td>
</tr>
<tr>
<td><strong>Rydeard et al, 2006</strong></td>
<td>NRS-101 ↓ 20.4% (1.83)</td>
<td>NRS-101 ↑ 11.5% (4.67)</td>
<td>RMQ/RMDQ-HK ↓ 35% (1.57)</td>
<td>RMQ/RMDQ-HK ↓ 23.8% (3.43)</td>
</tr>
<tr>
<td>Author, year</td>
<td>Summary Statement</td>
<td></td>
<td></td>
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<td>----------------------</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Anderson, 2005</td>
<td>Not statistically significant, but PE subjects showed greater improvement on all pain outcomes (MBI Pain &amp; SF-36) and disability outcomes (MBI Disability &amp; ODQ)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Gagnon, 2005</td>
<td>PE group improved in measures of pain and function equal to traditional physiotherapy (VAS &amp; RODI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hawson, 2002</td>
<td>4/5 subjects reported a decrease in pain intensity (VAS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quinn, 2005</td>
<td><strong>Significant change in pre-post ODQ scores within PE group.</strong> No statistical significance in ODQ between PE and control groups.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rydeard et al, 2006</td>
<td>PE significantly reduces LBP intensity and functional disability levels in comparison to usual care. (NRS-101, RMQ/RMDQ-HK)</td>
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</tr>
</tbody>
</table>
Discussion
Study Quality

- **Strengths**
  - Groups similar at baseline for prognostic indicators
  - Randomization and timing of outcome assessment adequate
  - 3/4 had treatment allocation concealment

- **Concerns**
  - Lack of blinding
  - Level of adherence
  - Drop out rate
  - Presence of co-interventions
  - Lack of intention-to-treat analysis

- **Peer-reviewed article higher quality**
Population

- Male: female subjects consistent with gender distribution of LBP in population
- Mean age of studies was lower than LBP population reported
- Subjects were no longer in acute stage of healing, but in the repair or remodeling stage
- Sample sizes were small
- All subjects were volunteers with relatively mild LBP
Intervention

- Pilates exercise protocols varied
  - Type, frequency, duration, certification of instructor, progression
- Intensity of intervention
- Presence of co-interventions
- Lack of long-term follow-up
- Adverse effects and safety
Comparisons

- Variability of control groups
  - Massage and lumbar stabilization
  - No active treatment
- Lack of details of control group parameters
Outcomes

- No single outcome measure was used in all studies
- Some overlap of outcome measures used between studies
- Outcome measures validated in the LBP population
- Sensitive enough to show change in less severely effected subjects?
Limitations

- Broad selection criteria
- No limits set for study design
- No limits set for quality assessment score
- Heterogeneity of included studies
- Bias in quality assessment tool modifications
- Limited outcomes investigated
- Effect size calculator
Conclusion

- There is limited evidence to support the efficacy of a Pilates exercise intervention in the management of LBP when compared to no treatment.
- There is no evidence that Pilates exercise is superior to lumbar stabilization exercises or massage therapy in the treatment of LBP.
Future Research

Higher quality studies should incorporate:
- Thorough study design
- Larger sample sizes
- Variation in intervention protocols
- Variation in control groups
- Use of a standardized outcome measure to facilitate comparison
- Long term follow-up
Clinical Message

- Pilates exercise may be an effective therapeutic intervention for the chronic LBP population when provided by a Pilates certified physiotherapist.
Acknowledgements

We would like to say a BIG “Thank You” to:

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- Dr. Elizabeth Dean
- Dr. Susan Harris
- Dr. Angela Busch
- Charlotte Beck
Questions?
References


Hong Kong Hospital Authority. 1999. Examining reliability, validity and responsiveness of Hong Kong version of Roland-Morris Disability Questionnaire (RMDQ-HK) as an outcome measure of patients with low back pain: a multicentre study. Hong Kong, Working Group on Low Back Pain Outcomes Assessment, Coordinating Committee for Physiotherapists.


References


