

Effects of Pilates on Low Back Pain: A systematic review



Elizabeth Ballard
Tina Carey
Gillian Clayton
Angela Lenz
Erika Mayall
Michael Wall





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

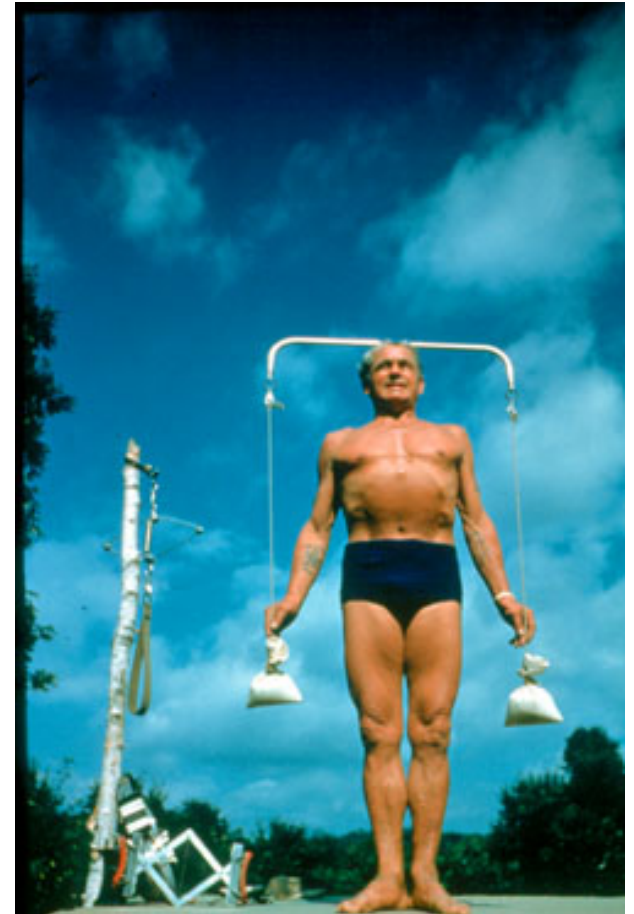


Low Back Pain

- 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)

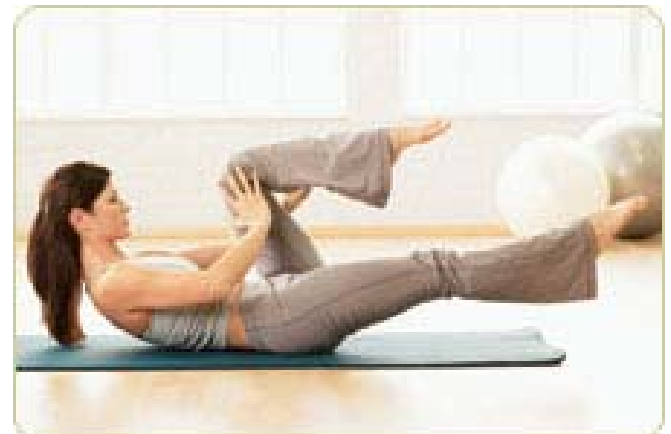
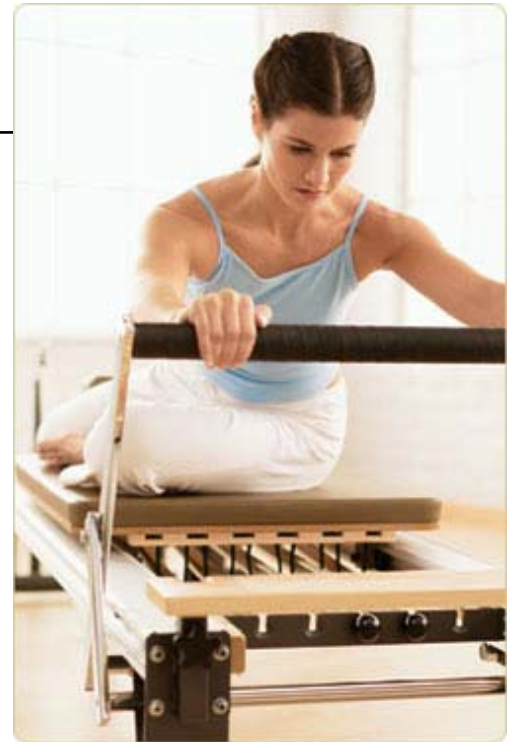
Joseph H. Pilates

- 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)



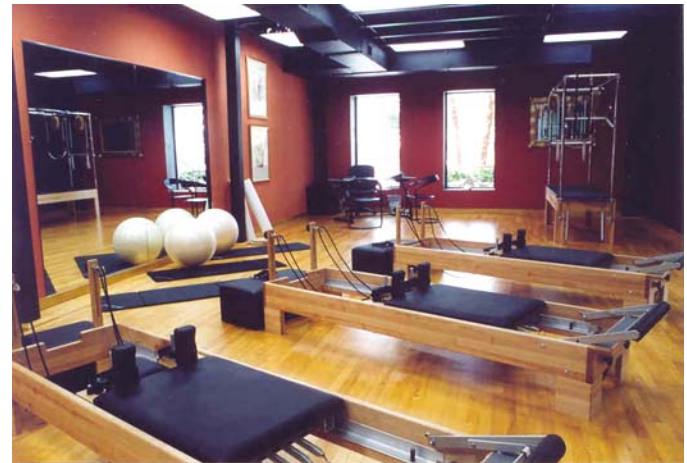
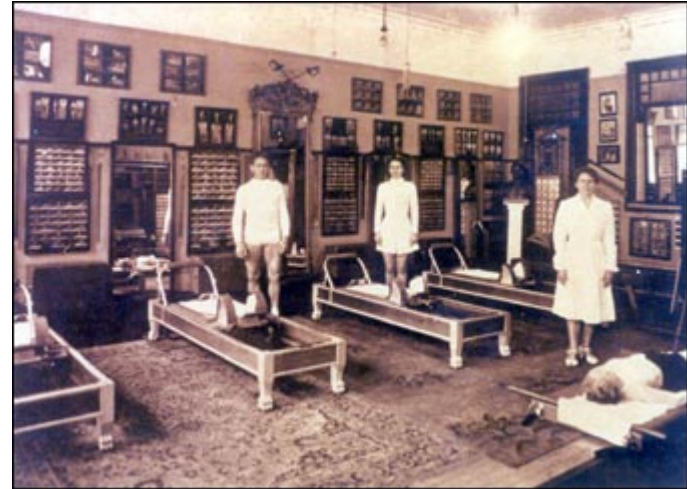
Goals of Pilates Exercise

- 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

pilates physio style
the core solution

PILATES ART
THERAPY & PILATES CENTRE



physiotherapy and pilates

totalphysio

PHYSIOTHERAPY + PILATES

looking after the body and mind...



Freedom
PHYSIO & PILATES

BODY WORKS
PHYSIOTHERAPY & PILATES



clinical pilates
physiotherapy

physiotherapy & clinical pilates



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)



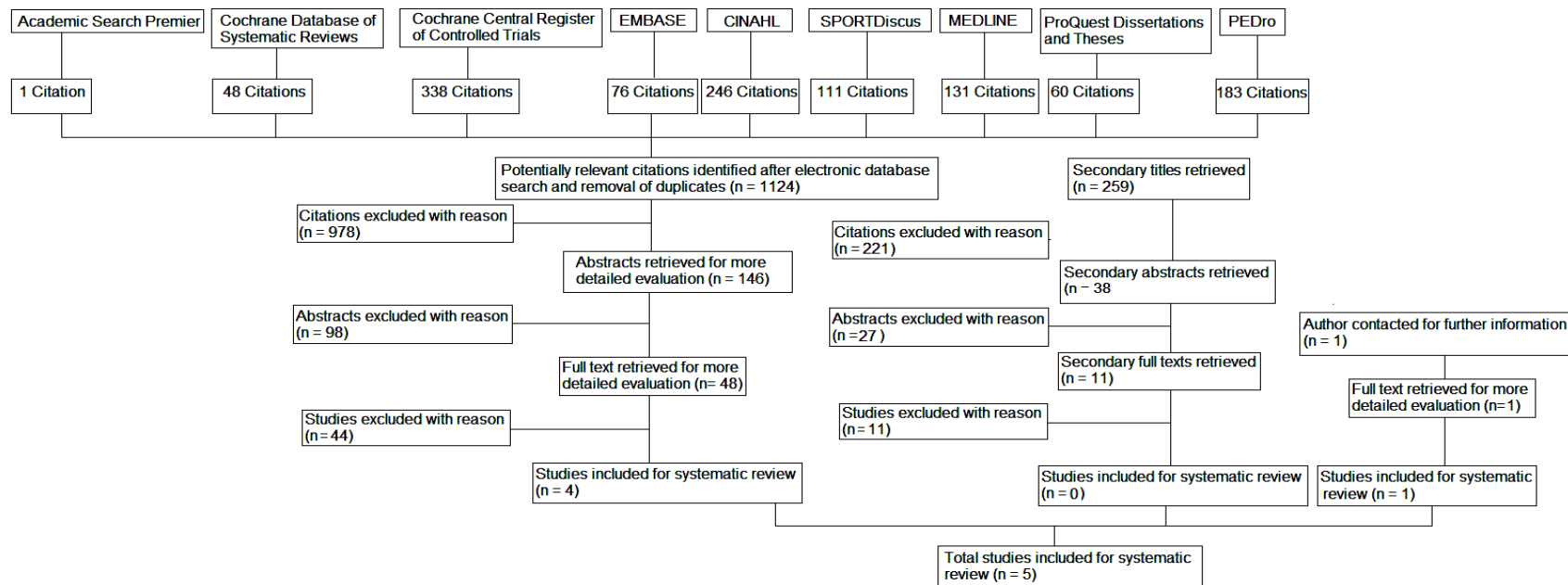
Data Extraction & Analysis

- 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





Study Design and Quality

Author, year	Study Design	Quality Assessment	Level of Evidence
Anderson, 2005	RCT	5/10	Level 2b
Gagnon, 2005	RCT	5/10	Level 2b
Hawson, 2002	Case series	5/7	Level 4
Quinn, 2005	RCT	3/10	Level 2b
Rydeard et al, 2006	RCT	8/10	Level 1b

Population

Author, year	Sample Size (male:female)	Mean Age (yrs)	Duration of LBP
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)	36 (range19-48)	>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

Author, year	Description	Frequency	Duration (session, total)
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

Author, year	Compliance	Drop out rate
Anderson, 2005	N/A	32%
Gagnon, 2005	n=1 non compliant	43%
Hawson, 2002	N/A	44.4%
Quinn, 2005	Attendance 87.5%	31.3%
Rydeard et al, 2006	100%	0%

Outcomes

Author, year	Pain Intervention	Pain Control	Function Intervention	Function Control
Anderson, 2005	MBI Pain ↓ 35.1% (0.54) SF-36 Pain ↑ 7.9% (0.32)	MBI Pain ↓ 8.7% (0.26) SF-36 Pain ↓ 2.0% (0.04)	ODQ ↓ 18.1% (0.35) MBI-D ↓ 32.4% (0.39)	ODQ ↓ 2.9% (0.64) MBI-D ↓ 26.1% (0.42)
Gagnon, 2005	VAS ↓ 51.2% (1.07)	VAS ↓ 60.2% (0.60)	RODI ↓ 55.8% (1.09)	RODI ↓ 46.6% (1.79)
Hawson, 2002	VAS ↓ 39.2% (N/A)	N/A	ODQ ↓ 38.9% (N/A)	N/A
Quinn, 2005	N/A	N/A	ODQ ↓ 57.9% (2.15)	ODQ ↓ 18.2% (0.65)
Rydeard et al, 2006	NRS-101 ↓ 20.4% (1.83)	NRS-101 ↑ 11.5% (4.67)	RMQ/RMDQ-HK ↓ 35% (1.57)	RMQ/RMDQ-HK ↓ 23.8% (3.43)

Summary

Author, year	Summary Statement
Anderson, 2005	Not statistically significant, but PE subjects showed greater improvement on all pain outcomes (MBI Pain & SF-36) and disability outcomes (MBI Disability & ODQ)
Gagnon, 2005	PE group improved in measures of pain and function equal to traditional physiotherapy (VAS & RODI)
Hawson, 2002	4/5 subjects reported a decrease in pain intensity (VAS)
Quinn, 2005	Significant change in pre-post ODQ scores within PE group. No statistical significance in ODQ between PE and control groups.
Rydeard et al, 2006	PE significantly reduces LBP intensity and functional disability levels in comparison to usual care. (NRS-101, RMQ/RMDQ-HK)



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:

- Marie Westby
- Dr. Elizabeth Dean
- Dr. Susan Harris
- Dr. Angela Busch
- Charlotte Beck

Questions?



References

- Anderson BD 2005 Randomized clinical trial comparing active versus passive approaches to the treatment of recurrent and chronic low back pain. Dissertation - University of Miami, pp. 1-206
- Arokoski JP, Valta T, Ariksinen O, Kankaanpaa M 2001 Back and abdominal muscle function during stabilization exercises. Archives of Physical Medicine and Rehabilitation 82: 1089-1098
- Baechle TR, Earle RW 2000 Essentials of strength and conditioning, 2nd edn. Champaign, Human Kinetics.
- Beurskens, A J, de Vet HC, Koke AJ 1996 Responsiveness of functional status in low back pain: a comparison of different instalments. Pain 65: 71-76
- Boditree Pilates and Healing. Accessed online August 1st, 2006 at <http://www.boditreePilates.com/addl.html>.
- Bogduk N, 2004 Management of chronic low back pain. The Medical Journal of Australia 180: 79-83
- Carlsson AM 1983 Assessment of chronic pain. Aspects of the reliability and validity of the visual analogue scale. Pain 16: 87-101
- Collins SL, Moore RA, McQuay HJ. 1997 The visual analogue pain intensity scale: what is moderate pain in millimeters? Pain 72: 95-97
- Coyte PC, Asche CV, Croxford R, Chan B 1998 The Economic cost of musculoskeletal disorders in Canada. Arthritis Care and Research 11: 315-325
- Dean E, Arscott S, Desaulles P, Hughes K, Kotzo S, Preto R (2006) The effects of manual therapy on dorsiflexion range of motion following lateral ankle sprains: A systematic review. Unpublished.
- Environics Research Group Limited 2003 Survey of Canadian adults: Back pain. Toronto, Environics Research Group Limited.
- Fairbank JC, Couper J, Davies JB, O'Brien JP 1980 The Oswestry low back pain disability questionnaire. Physiotherapy 66: 271-27
- Furlan A, Brosseau L, Imamura M, Irvin E 2002 Massage for low-back pain: A systematic review within the framework of the Cochrane Collaboration Back Review Group. Spine 27: 1896-1910
- Gagnon LH 2005 Efficacy of Pilates exercises as therapeutic intervention in treating patients with low back pain. Dissertation - The University of Tennessee, pp. 1-107
- Gibbons S, Comerford M 2001 Strength versus stability Part I: Concept and terms, Part II Limitations and benefits. Orthopaedic Division Review. CPA March/April
- Hawson S 2002 Efficacy of Pilates-based exercises on the treatment of chronic low back pain. Dissertation - California State University, pp. 1-41
- 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.
- Kisner C, Colby LA 2002 Therapeutic exercise foundations and techniques, 4th edn. Philadelphia, FA Davis Company.
- Leclair R, Blier F, Fortin L, Proulx R 1997 A crosssectional study comparing the Oswestry and Roland-Morris Functional Disability scales in two populations of patients with low back pain of different levels of severity. Spine 22: 68-71
- Lee D 2004 The pelvic girdle: An approach to the examination and treatment of the lumbopelvic-hip region, 3rd edn. London, Churchill Livingstone.
- Liddle SD, Baxter GD, Gracey JH 2004 Exercise and chronic back pain: what works? Pain 107: 176-190
- Luo X, Pietrobon R, X Sun S, Liu GG, Hey L 2004 Estimates and patterns of direct health care expenditures among individuals with back pain in the United States. Spine 29: 79-86
- Martin CW, Noertjojo K, Dunn CT. Low Back Pain. 2002. Accessed online July 31st, 2006 at http://www.worksafebc.com/health_care_providers/Assets/PDF/poster-presentations/low_back_pain1987-2001.pdf
- McDonald JC, Lundgren KL 1998 The progressive dynamic lumbar stabilization program for the treatment of musculoskeletal dysfunctions that contribute to mechanical low back pain. Journal of Sports Chiropractic and Rehabilitation 12: 55-64
- Merrithew M 2003 Comprehensive Matwork. Toronto, Merrithew Corp.
- Pilates Association of Canada. (2006). Frequently asked questions. Accessed on line August 2nd 2006, at: <http://www.canadianPilatesassociation.ca/index.php?s=faq#1>

References

- Phillips B, Ball C, Sackett D, Badenoch D, Straus S, Haynes B, Dawes M 2001 Levels of evidence and grades of recommendation. Centre for Evidence-Based Medicine. <http://www.cebm.net/index.aspx?o=1025>. Accessed July 20, 2007.
- Portney LG, Watkins MP 2000 Foundations of clinical research: Applications to practice, 2nd edn. Upper Saddle River, Prentice Hall Health.
- Quinn JV 2005 Influence of Pilates-based mat exercise on chronic lower back pain. Dissertation - Florida Atlantic University, pp. 1-64
- Revill SI, Robinson JO, Rosen M, Hogg MI 1976 The reliability of a linear analogue for evaluating pain. *Anaesthesia* 31: 1191-1198
- Roach K, Calang A, Redmond G, Campos F, Yadao C. 2000 Concurrent validity of the Miami Back Index. *Physical Therapy* 81: A28
- Roach K, Carreras K, Lee, Reed L, Zimmerman G. 2001 Development and reliability of the Miami Back Index. *Journal of Orthopaedic and Sports Physical Therapy* 31: P097
- Rocchi MB, Sisti D, Benedetti P, Valentini M, Bellagamba S, Federici A 2005 Critical comparison of nine different self-administered questionnaires for the evaluation of disability caused by low back pain. *Europa Medicophysica* 41: 275-281.
- Roland M, Fairbank J 2000 The Roland-Morris Disability Questionnaire and the Oswestry Disability Questionnaire. *Spine* 25: 3115-3124.
- Rydeard R, Leger A, Smith D 2006 Pilates-based therapeutic exercise: Effect on subjects with nonspecific chronic low back pain and functional disability: A randomized controlled trial. *Journal of Orthopaedic and Sports Physical Therapy* 36: 472-484
- Slade SC, Keating JL 2006 Trunk-strengthening exercises for chronic low back pain: A systematic review. *Journal of Manipulative and Physiological Therapeutics* 29: 163-173
- Sriwatanakul K, Kelvie W, Lasagna L, Calilim JF, Weis OF, Mehta G 1983 Studies with different types of visual analog scales for measurement of pain. *Clinical Pharmacology and Therapeutics* 34: 234-239
- Statistics Canada, Back Pain. Accessed online July 31st, 2006 at <http://www.statcan.ca/english/research/82-619-MIE/2006003/backpain.htm>
- Stratford P, Gill C, Westaway M, Binkley J 1995 Assessing disability and change on individual patients: a report of a patient specific measure. *Physiotherapy Canada* 47: 258-263
- Stott Pilates. Biography of Joseph H. Pilates. Accessed Aug 2nd 2006 online at: <http://www.stottPilates.com/media/releases/biojoe.html>
- Stott Pilates. Background, Stott Pilates and Merrithew Corporation. Accessed Aug 2nd 2006 online at: <http://www.stottPilates.com/media/releases/background.html>
- Stott Pilates. Fact Sheet: 2004-2005. Accessed Aug 2nd 2006 online at: <http://www.stottPilates.com/media/releases/factsheet2.html>
- Stucki G, Cieza A, Melvin J 2007 The International Classification of Functioning, Disability and Health: a unifying model for the conceptual description of the rehabilitation strategy. *Journal of Rehabilitation Medicine* 39: 279-285
- Taylor SJ, Taylor AE, Foy MA, Fogg AJ 1999 Responsiveness of common outcome measures for patients with low back pain. *Spine* 24: 1805-1812
- Van Tulder M, Furlan A, Bombardier C, Bouter L 2003 Updated method guidelines for systematic reviews in the Cochrane Collaboration Back Review Group. *Spine* 28: 1290-1298
- Von Korff M, Jensen MP, Karoly P 2000 Assessing global pain severity by self-report in clinical and health services research. *Spine* 25: 3140-3151
- Ware JE, Sherbourne CD 1992 The MOS 36-item short-form health survey (SF-36). A conceptual framework and item selection. *Medical Care* 30: 473 - 483.
- Woolf AD, Pfleger B 2003 Burden of major musculoskeletal conditions. *World Health Organization Bulletin* 81: 646-656