

# Low Back Pain – an Umbrella Overview of Exercise Therapy in the General Population and Special Demands in Athletes

*Rückenbeschwerden und Übungstherapie – eine Übersicht zur Evidenz in der Allgemeinbevölkerung und Besonderheiten für Athleten*

## Summary

- › **This paper intends** to give an umbrella overview of both low back pain (LBP) management in the general population focusing on exercise therapy and specific recommendations for LBP in athletes. We have included systematic reviews and international guidelines starting from the year 2000. Among all the varying concepts, advice to stay active was most evidently beneficial for chronic LBP patients in general.
- › **There was strong evidence** that unspecific exercise therapy was not more effective than cognitive-behavioral concepts, and also that specific back exercises should not be advised for chronic unspecific LBP.
- › **Individually** tailored and supervised exercise programs were more effective, but in general there were no differences in the efficacy of differing types of specific exercise concepts; and even classification within the pool of heterogeneous LBP syndromes and a consecutively specified exercise management did not lead to conclusive LBP management solutions.
- › **It may be proposed** that future research should focus more on the problem of chronic pain in general than on unspecific back pain.
- › **For athletes**, the literature mirrors an understanding of LBP, which is specific according to sports-specific demands on the back rather than on LBP which is chronic and of unknown origin. Evidence-based guideline recommendations for the management of LBP and exercises in athletes are still lacking, or merely suggested. So far, athletes suffering from chronic unspecific LBP are treated like the general population.

## KEY WORDS:

Low Back Pain, Exercise Therapy, General Population, Athletes, Umbrella Review

## Introduction

Due to the high prevalence in the western world and the great impact on life-quality of individuals suffering from chronic unspecific low back pain (cLBP) (11), low back pain (LBP) is still an emerging topic in scientific as well as in popular discussions. Non-scientific publications might mirror an over-estimated importance of therapy concepts consisting

## Zusammenfassung

- › **Vor dem Hintergrund** der Vielfalt von Behandlungsansätzen beim unspezifischen Rückenschmerz (LBP: low back pain) war es das Ziel dieser Arbeit, einen Überblick zur klinischen Evidenz von Trainingstherapiekonzepten bei LBP Patienten in der Allgemeinbevölkerung zu geben und auf Besonderheiten bei Athleten hinzuweisen. Hierzu wurden systematische Übersichtsarbeiten und internationale Behandlungsrichtlinien aus den Jahren 2000 bis 2015 herangezogen.
- › **Kurze und einfache edukative Hinweise**, den Alltag aktiv zu gestalten (advice) wurden in der Literatur mit starker Evidenz als günstig für chronische Rückenschmerzen eingestuft. Mit starker Evidenz wurde konstatiert, dass eine allgemeine Trainingstherapie (exercise) bei LBP nicht vorteilhafter war als kognitiv-behaviorale Maßnahmen; spezifische Rückenübungen sollten bei chronischen Rückenschmerzen nicht empfohlen werden. Individualisierte und betreute Trainingsprogramme wurden zwar als günstiger beschrieben, abgesicherte Unterschiede in der klinischen Effizienz zwischen unterschiedlichen Übungen, bzw. Übungskonzepten wurden jedoch nicht festgestellt. Selbst eine Klassifikation heterogener LBP Populationen und eine differenzierte Behandlung von Teilgruppen ergab keine klare Evidenz für Vorteile im Behandlungsmanagement von LBP Patienten.
- › **Vielleicht** sollte sich die zukünftige Forschung eher auf das Problem des chronischen Schmerzes konzentrieren, als auf die Beschwerdeproblematik des schmerzenden unteren Rückens.
- › **Im Falle** von Rückenbeschwerden bei Athleten spiegelte die Literatur ein Verständnis von LBP wider, das sich eher mit (sportart-) spezifischen und beanspruchungsabhängigen strukturellen Überlastungsbeschwerden befasst als mit chronischen Beschwerden unklarer Genese. Verallgemeinerbare Behandlungsempfehlungen für Athleten fehlen. Trotz anderer Voraussetzungen werden Athleten bislang behandelt wie die Allgemeinbevölkerung. Hier gibt es weiteren Forschungsbedarf.

## SCHLÜSSELWÖRTER:

Rückenschmerzen, Trainingstherapie, Allgemeinbevölkerung, Athleten, Übersichtsarbeit

of strengthening, stretching and coordination tasks, while – on a closer scientific inspection – its evidence may be contradictory or doubtful.

For athletes suffering from LBP, special recommendations should be reasonable, but low back pain in athletes seems to be a research area still lacking evidence. International treatment guidelines >

## REVIEW

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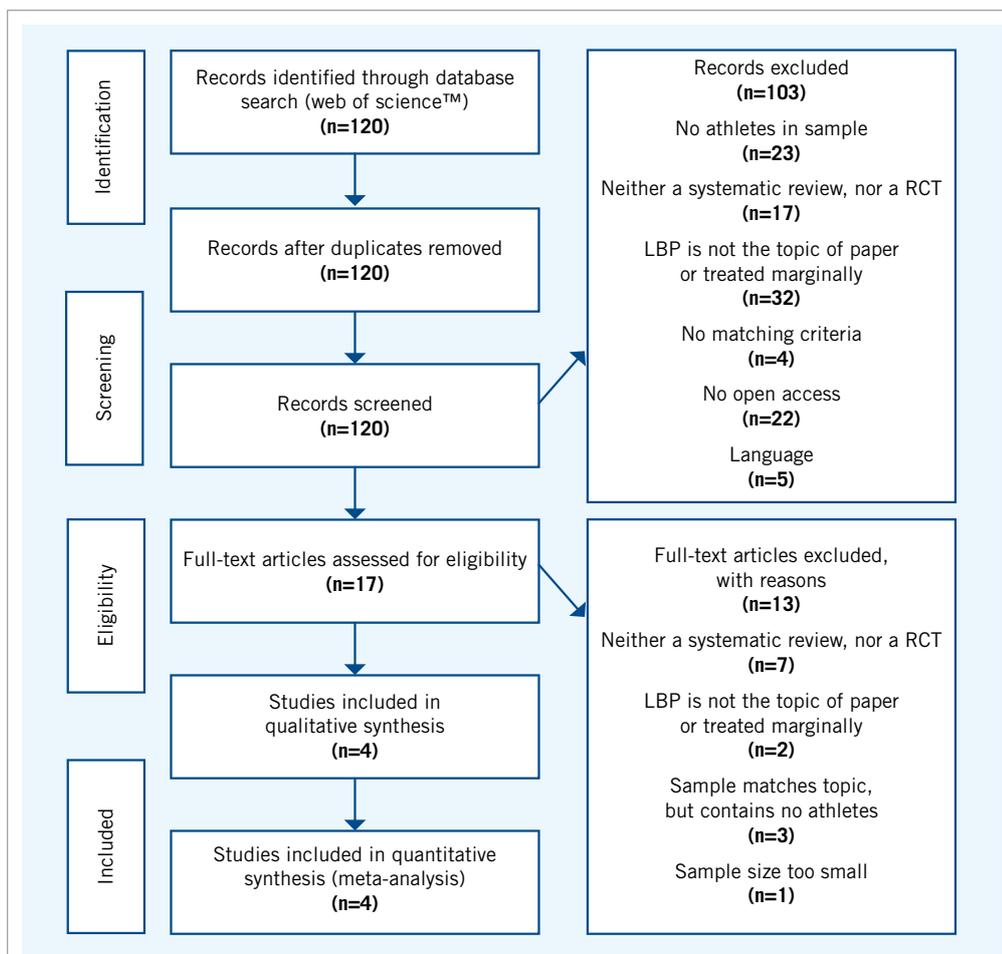


Figure 1

Flow chart for the systematic review of reviews dealing with „LBP and exercise therapy in athletes“.

for the special needs of athletes and competitive sports are not available, yet. This implicates that athletes suffering from LBP are considered to be treated like anybody else (15).

Does this mean athletes should maintain their exercise and competition schedules? What kind of activity should be reduced, modified, substituted or left away? Having in mind that athletic training and exercise or exercise therapy, should not be confused, there might be some contradictory items of interest: Athletic training can be helpful in the prevention of back injuries and complaints, but when LBP is established, sporting participation may contribute to increase severity of pain (16). Competitive sports may even be a risk factor for LBP, with an increase in pain noted in those sports that carry with them significant low back demands (2). Due to potentially accumulating risks of aggravation – particularly in case of years of intense athletic training, LBP episodes in youth should also be well-considered (3, 13, 41).

Best practice advices are lacking, so far.

## Background

The role of exercise therapy for LBP and its evidence may be ambiguous, and therapy options may depend on the preferred scientific background, too.

In the late 1970ies, Gordon Waddell identified ‘nonorganic physical signs in low-back pain’. Factor analyses revealed components of psychological, behavioral and social origin (38). Consecutively, LBP treatment approaches covering psychological and especially cognitive-behavioral issues like fear-avoidance beliefs were established (39). Representing a change of para-

digm, Waddell formulated ‘A new clinical model for the treatment of low-back pain’, and emphasized the necessity to “... distinguish pain from disability, the symptoms and signs of distress and illness behavior from those of physical disease ...” (36). An important recommendation was the change of LBP management away from rest due to pain and towards a more active restoration of function pointing out the advice to stay active (36), whereas it is important not to confuse active restoration or physical activity with exercise treatment approaches (37).

On the other hand, following numerous biomechanical studies Manohar M. Panjabi postulated an ‘instability hypothesis’, meaning that clinical instability of the spine is an important cause of LBP due to a disturbed stabilizing system (26). Exercise therapy was supposed to be beneficial for the restoration of the needed spinal stability by increasing stiffness. It was most probably the decrease of the neutral zone, the high flexible vertebral position where inter-ver-

tebral motion is merely limited by passive structures or active neuromuscular control, which was considered to be responsible for pain reduction (27).

Among these positions – the more biomechanical and the more biopsychosocial understanding of LBP causes – various approaches for the management of LBP were established in the time course of clinical research.

## Purpose

This paper tries to give an umbrella overview covering the evidence of exercise therapy in the general population. Recommendations for exercise therapy in athletes are reviewed systematically as a secondary topic.

## Methods

For this umbrella overview, the Cochrane Collaboration back group reviews of the year 2000 served as start-up publications (34, 35). Based on their LBP therapy categories, literature research included review articles published since the year 2000, addressing definite key issues covering LBP and its management (‘systematic review’, ‘low back pain’, ‘exercise therapy’ and linked CrossRefs; databases: Pubmed and Web-of-Science). We also included LBP treatment guidelines (Germany/Europe/USA), and partly comparative publications.

For the secondary topic, we used limiting key words: ‘athletes’, ‘low back pain’, ‘exercise therapy’, and ‘review’ for a systematic review. On closer inspection we excluded articles focus-

Table 1

Exercise therapies for acute and chronic LBP, and specific or classified treatment approaches. LBP = low back pain, cLBP = chronic low back pain, REV = review, NSAID = Non-Steroid Anti-Inflammatory Drugs, SSE = Segmental Stabilization Exercise.

AUTHORS	YEAR	TYPE OF PUBLICATION	CONCLUSIONS
<b>Exercise therapy for acute and sub-acute low back pain</b>			
van Tulder et al. (34)	2000	REV	Strong evidence: exercise therapy was no more effective than inactive or other active treatments for acute LBP patients.
Pengel et al. (28)	2002	REV	No evidence for exercise therapy or any other therapy form in sub-acute LBP.
Keller et al. (18)	2007	REV	No effects for exercise therapy compared to non-treatment controls for acute LBP patients, but modest effect sizes for manipulation and NSAID medication for acute LBP patients.
Chou et al. (7)	2007	Guideline USA	Advice to remain active for LBP in general and spinal manipulation for acute LBP, and first-line medication: NSAID. Sub-acute LBP should be treated like cLBP.
<b>Exercise therapy for chronic low back pain</b>			
van Tulder et al. (34)	2000	REV	Exercise therapy was more effective in cLBP patients than usual care by general practitioners. Conflicting evidence that strengthening exercises are more effective than inactive treatment for cLBP. Specific back exercises have no clinical effect.
Liddle et al. (21)	2004	REV	Exercise – strengthening and partly stretching – had positive and in follow-up maintaining effects in cLBP patients; co-interventions must not be overlooked.
Hayden et al. (12)	2005	REV	Individually designed exercise therapy including strengthening and stretching with supervision improves pain and function in cLBP patients; adherence strategies should be encouraged.
Airaksinen et al. (1)	2006	Guideline EUR	In cases of low impairment and disability: Supervised exercise therapy – beside other treatments – can be recommended for cLBP. Short term use of NSAID and weak opioids can be recommended.
Keller et al. (18)	2007	REV	Exercise therapy – comparable to acupuncture, behavioural therapy, and NSAID – had modest effect sizes for cLBP patients compared to non-treatment controls.
Chou et al. (7)	2007	Guideline USA	First-line medication: NSAID. For cLBP exercise therapy and others like interdisciplinary rehabilitation, acupuncture, massage, spinal manipulation, and cognitive-behavioural therapy can be recommended.
van Middelkoop et al. (32)	2011	REV	Exercise therapy improved pain intensity and disability, and long-term function compared to usual care. The level of evidence was low.
<b>Segmental Stabilisation Exercise (SSE) therapy for chronic low back pain</b>			
van Tulder et al. (34)	2000	REV	It is still unclear if any type of exercise is better than another. Specific back exercises have no clinical effect.
Ferreira et al. (9)	2006	REV	Limited evidence for beneficial efficacy of SSE, but in general positive effects for LBP.
Rackwitz et al. (29)	2006	REV	Limited evidence for beneficial efficacy of SSE, but in general positive effects for LBP.
Kriese et al. (20)	2010	REV	Limited evidence for beneficial efficacy of SSE, but in general positive effects for LBP.
Yue et al. (42)	2014	REV	No clinical relevant advantages for Sling Exercise Therapy compared to other exercises or physical agents combined with drug therapy.
Smith et al. (29)	2014	REV	Strong evidence that stabilisation exercises are not more effective than any other form of active exercise in the long term.
<b>Specific exercises and tailored therapy concepts after sub-group classification</b>			
van Tulder et al. (34)	2000	REV	Conflicting evidence about what type of exercise, extension or flexion, is more effective for cLBP. Strong evidence that strengthening exercises are not more effective than other exercises for cLBP.
Clare et al. (8)	2004	REV	For low back pain patients McKenzie therapy does result in a greater decrease in pain and disability in the short term than other standard therapies. Matched (exercise) treatment leads to better functional outcome than unmatched treatments.
Hayden et al. (12)	2005	REV	Beneficial effect sizes for individually designed programs, including stretching or strengthening with supervision.
van Middelkoop et al. (33)	2010	REV	No evidence that one particular type of exercise therapy is clearly more effective than others.

ing on very specific aspects, e.g. ‘pregnancy’, ‘spondylolisthesis’, ‘gymnastics’, or ‘female rowing’ (Fig. 1).

## Results

We found relevant papers for almost all fields of interest, except for the topic ‘LBP in athletes’:

- Exercise therapy and rehabilitation interventions for acute/sub-acute LBP patients (18, 28, 34) (Tab. 1).
- Exercise therapy and rehabilitation interventions for chronic LBP patients (9, 12, 18, 20, 21, 29, 32, 33, 34) (Tab. 1).
- Specifically directed exercises after classification of LBP patients (17, 40) (Tab. 1).
- Educational and behavioral treatment for chronic LBP patients (14, 22, 35) (Tab. 2).

For ‘LBP in athletes’, the literature mirrored a differing understanding: LBP in athletes was considered to deal with prevention and rehabilitation of specific structural injury and overuse according to sports specific back demands. Exercise therapy approaches were reviewed merely and with uncertain evidence only (4, 19, 31) (Tab. 3).

## Exercise Therapy for Acute and Sub-Acute Low Back Pain

Acute and sub-acute LBP – 6 to 12 weeks duration – must be distinguished from chronic LBP. For acute LBP, there was strong evidence that exercise therapy was no more effective than inactive or other active treatments (34). Pengel et al. (28) resumed that there was no evidence for exercise therapy benefits or any other therapy form in sub-acute LBP except advice; back specific exercises should not be advised. Keller et al. (18) found minimal effect sizes for exercise therapy, and modest effect sizes for non-steroidal anti-inflammatory drugs and manipulation. Chou et al. (7) recommended that sub-acute LBP should be treated like chronic LBP.

## Exercise Therapy for Chronic Low Back Pain

For cLBP van Tulder et al. (34) stated that exercise therapy was more effective in cLBP patients than usual care by general practitioners. They reported conflicting evidence that strengthening was more effective than inactive treatment for cLBP, and furthermore that specific back exercises had no clinical effect. Liddle et al. (21) resumed that exercise – strengthening and

Table 2

Back schools, brief education, and advice to stay active, behavioural, and multidisciplinary treatment concepts for chronic LBP. LBP = low back pain, cLBP = chronic low back pain, REV = review.

AUTHORS	YEAR	TYPE OF PUBLICATION	CONCLUSIONS
Heymans et al. (14)	2005	REV	Back Schools: moderate evidence suggesting advantages, in an occupational setting, to reduce pain and improve function and return-to-work status, in the short- and intermediate-term better, compared with exercises, manipulation, myofascial therapy, advice, placebo, or waiting list controls, for patients with chronic and recurrent LBP.
Airaksinen et al. (1)	2006	Guideline EUR	Strong evidence for the effectiveness of cognitive-behavioural and multidisciplinary (bio-psycho-social) treatment: recommended for cLBP. Cognitive-behavioural intervention encouraging activity/exercise seem to be the most promising approach. Conflicting evidence for the effectiveness of back schools and moderate evidence for different kind of advice and brief education for cLBP.
Liddle et al. (22)	2007	REV	Strong evidence for beneficial clinical outcome effects for the advice to stay active, particularly if combined with back-school or exercises depending on the patients' condition (acute LBP, cLBP).
Chou et al. (7)	2007	Guideline USA	Cognitive-behavioural therapy like others – acupuncture, interdisciplinary rehabilitation, exercise therapy, massage, and spinal manipulation – can be recommended for cLBP. Sub-acute LBP should be treated like cLBP.
van Middelkoop et al. (32)	2011	REV	Behavioural treatment and multidisciplinary treatment improved pain intensity at short-term follow-up. The level of evidence was low.

partly stretching – had positive and maintaining effects in cLBP patients; confounders like the degree of exercise supervision or exercise combination effects, and participants' compliance must not be overlooked. Hayden et al. (12) added that individually designed exercise therapy including strengthening and stretching with supervision improved pain and function in cLBP patients; adherence strategies should be encouraged.

Keller et al. (18) reported modest effect sizes for exercise therapy in cLBP patients compared to non-treatment controls, and van Middelkoop et al. (32) found that exercise therapy improved pain intensity and disability, and long-term function compared to usual care, but the level of evidence was low.

For Segmental Stabilization Exercise (SSE) therapy and its special deep trunk muscle coordination pattern concept, we found several specifically conducted investigations. Some reviews found limited evidence for beneficial efficacy of SSE, but positive effects for LBP in general (9, 20, 29). A recent review found no clinically relevant advantages of Sling Exercise Therapy – one particular exercise mode for SSE – compared to other exercises or physical agents combined with drug therapy (42). Smith et al. (30) concluded that there is no long term advantage for stabilization exercises compared to any other active exercise therapy. Due to the large number of available studies of high methodological quality at long term follow-up, further research is unlikely to considerably alter this conclusion.

German, European and US American guidelines incorporated that exercise therapy can be recommended for cLBP patients (1, 6, 7).

**Specific Exercises or Tailored Programs for LBP Patients**

Although there was conflicting evidence about what type of exercise was more effective for cLBP, and although there was strong evidence that strengthening exercises were no more effective than other exercises (34), Hayden et al. (12) found beneficial effect sizes for individually designed programs, including stretching or strengthening with supervision: impairment related matched exercise treatment led to better functional outcome than unmatched treatment. Especially McKenzie therapy did result in a greater decrease in pain and disability in the short term than other standard therapies (8), while the latest best-practice review revealed again no evidence that one particular type of exercise was clearly more effective than the other (33).

**Educational, Behavioral and Multidisciplinary Treatment Concepts for Chronic LBP**

For chronic LBP there was strong evidence to support advice to remain active in addition to exercise and functional activity to promote active self-management (22). There was moderate evidence suggesting advantages for back schools in reducing pain, improving function and return-to-work status, in the short- and intermediate-term better for cLBP patients, compared to exercise, manipulation, myofascial therapy, advice, placebo, or waiting list controls (14). Behavioral and multidisciplinary treatment improved pain intensity at short-term follow-up compared to waiting controls, but the level of evidence was low (32). Recently conducted RCTs showed outcome advantages for multidisciplinary approaches including behavioral goals compared to exercises and usual care (25), especially if cognitive-behavioral techniques were classified and tailored individually (10).

American, German and European guidelines conclude that cognitive-behavioral therapy can be recommended for cLBP patients (1, 6, 7).

**Low Back Pain in Athletes**

The evidence for the efficacy of treatment approaches in LBP athletes could be revealed neither for specific core stability or functional rehabilitation exercises nor for osteopathic manipulation (4, 5, 19, 31).

McGill (24) made some practical proposals for athletic training modifications, but the evidence remains uncertain. Further research is needed.

**Take-Home Notes**

1. Clinicians should conduct a focused history and physical examination to separate nonspecific LBP ('yellow flags') from specific LBP etiologies ('red flags').
2. In cases of low impairment and disability, simple evidence-based therapies (i.e. exercises, brief interventions, and medication) may be sufficient, but the most promising approach for longer duration and more substantial disability seem to be cognitive-behavioral interventions.
3. There is no evidence that one particular type of exercise therapy is clearly more effective than others.
4. No single intervention is likely to be effective in treating the overall problem of cLBP, due to its multidimensional nature.
5. Classification and identification of specific clinical subgroups is still important for future research.

Table 3

Low Back Pain in athletes – rehabilitation approaches. LBP = low back pain, REV = review.

AUTHORS	YEAR	TYPE OF PUBLICATION	CONCLUSIONS
Bono (4)	2004	REV	Specific LBP in athletes: Spondylolysis – pain relief in 80% of all patients after non-operative treatment Sacral stress fractures – return to sports in one to two months when pain has resolved after a brief period of limited weight-bearing followed by progressive mobilization and physical therapy.
Brolinson et al. (5)	2008	REV	No conclusions possible to support the evidence for Osteopathic Manipulative Medicine LBP treatment in athletes due to lacking data on efficacy.
Krabak et al. (19)	2008	REV	Lacking evidence for efficacy of spinal strengthening exercises in the prevention or treatment of LBP after injury in athletes due to a lack of prospective and randomized trials.
Stuber et al. (31)	2014	REV	No strong conclusions for the evidence of core stability exercise for low back pain treatment in athletes due to methodological differences in study designs.

6. Dose-response relations are still insufficiently known for exercise therapy, back school and brief education (advice), cognitive-behavioral therapy and multidisciplinary therapy, as well as for physical therapy approaches and therapy combinations, requiring further research.

7. For LBP in athletes, evidence based recommendations for exercise therapy advices are still lacking; in case of chronic un-specific LBP, athletes are treated like the general population.

## Conclusions

Summing up the evidence of LBP therapy is rather disappointing. Looking at the clinical outcomes after exercise therapy or other approaches in the care of LBP, effectiveness appears to be only of little evidence with small or moderate effect-sizes (32, 34, 35, 40). Even sub-grouping LBP patients using different assessment tools – being aware of a not homogenous pool of LBP syndromes – revealed little evidence (17). Maybe, treatment has been ineffective, because it has been misdirected.

According to the underlying mechanisms, exercise effects not necessarily have to affect clinical outcomes maybe due to

moderating psychological factors rather than physiological pathways (23). Looking at the processes causing LBP, neuroscience pain based, or contextual cognitive behavioral therapy or mindfulness based stress-reduction, or biomechanical but less pathoanatomic focused orientated education could be beneficial (17). Maybe, the problem of cLBP does not lie within the back, but within the brain. Thinking of non-specific LBP as a problem of cortical reorganization and degeneration may increase the understanding of the problem and direct intervention more appropriately (40).

As LBP in athletes is deemed to be rather of specific than unspecific origin, recommendations should differ from those to the general population. Further research investigating overuse and predisposition in several types of sport is needed to make reasonable advice for childhood, adolescence and adulthood. ■

## Conflict of Interest

*The authors have no conflict of interest.*

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