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AEROBIC EXERCISE AS A MEANS OF REDUCING LOW BACK
PAIN: A SYSTEMATIC REVIEW

by

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A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Athletic Training
in the College of Health and Public Affairs
and in The Burnett Honors College
at the University of Central Florida
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ABSTRACT

Background: Low back pain (LBP) is considered the leading cause of inactivity and lost employment time. It can be extremely difficult to treat as most conventional therapies have poor success rates. People with LBP need to be made more aware of the diverse and economical treatments available in order to save on expenses and diminish stress. Patients and healthcare professionals have many choices when deciding on the best plan of care; however, it is often difficult to determine which option is best.

Objectives: The purpose of this systematic review was to determine if aerobic exercises play a role in reducing pain in the low back.

Methods: A computerized electronic search was performed using CINAHL, Medline, and Cochrane Central Register of Controlled Trials with key words including low back pain or lumbar pain combined with aerobic and exercise. Inclusion criteria consisted of studies that were randomized controlled trials or controlled clinical trials, peer reviewed, published in the English language, identified low back pain as the primary concern, and identified aerobic exercises as one of the treatment options.

Results: The initial search of the database revealed a total of 40 studies. Hand searching of the references had also revealed an additional 7. Of those 47 studies, 13 were selected as potentially

meeting the inclusion criteria. Ultimately, 10 studies were retained for the final results of the systematic review.

Conclusion: The evaluations provided evidence to suggest that aerobic exercise has positive effects on subjects with LBP. Aerobic exercise encourages strength, flexibility, and muscular endurance. This outcome has also shown to promote levels of activity, leaving the subject feeling better both physically and mentally.

Keywords: Low back pain, Aerobic exercises

DEDICATIONS

For my parents and grandparents, thank you for all your love and inspiration, and always being there for me every step of the way.

For my mentors, Dr. Kristen Schellhase, Jennifer Plant, and Dr. William Hanney, thank you for your guidance and hours put into helping me achieve my goal.

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CHAPTER ONE: INTRODUCTION

Low back pain (LBP) is extremely common in the general population. It has been known to affect about 80% of the total population at some point in their lives.^{1,3} It is considered the most common cause of activity limitations.⁴ LBP is the second leading symptom reported during physician visits and is the leading cause of inactivity and lost employment time.^{1,2} It is responsible for about 12.5% of all sick days.⁴ Approximately 149 million absentees each year are due to injuries of the low back; two-thirds of these days are caused by occupational injuries. Around 20 to 50 billion dollars are spent each year in the United States on expenses related to LBP due to the expenditure of repeated visits and long-term work absence.²

Individuals with acute LBP typically recover within a 12 week span. However, the development of chronic low back pain (CLBP) is not uncommon. There is about a 30% prevalence rate for those with CLBP.⁴ This disorder is generally defined as having recurrent pain past the span of 3 months.³ Recovery following 12 weeks is slow and uncertain.⁴ CLBP is a common cause of long-term limitation that typically leads to physical and psychological problems, disability, and deterioration of quality of life.^{1,5}

LBP or CLBP can be extremely difficult to treat as most conventional therapies have poor success rates.³ Patients and healthcare professionals have many choices when deciding on the best plan of care; however, it is often difficult to determine which option is best. People with LBP need to be made more aware of the diverse and economical treatments available in order to save on expenses and diminish stress.⁵ Some options may be unaffordable for certain patients

and some may not be as effective. It is important to look at the patient as an individual; what may work for one person may not work for another.⁶

While rest is a logical choice for someone in pain, this may not be the best advice for someone with back pain because it can become progressively worse when levels of function are limited. Long-lasting bed rest and/or inactivity may limit pain but will do nothing to change a condition or prevent further injuries.⁶ Extended bed rest can cause many detrimental conditions, such as loss in hydrostatic pressure in the vasculature below the heart, lack of axial compression on the spine and long bones of the lower extremity, decreased muscular force, and decreased total energy utilization. Typically, impairments are seen in cardiovascular, hematologic, musculoskeletal, metabolic, thermoregulatory, immune, neuroendocrine, and psychological functions.⁷ Other complications may include bed sores, osteoporosis, reduced exercise capacity, or loss of muscle mass and bone density.⁸ Extended bed rest can also cause an increased state of depression due to feeling helpless and stuck from being inactive all day.⁹

Patients with back pain may have to modify their activity or be confined to bed rest for a few days, but that should not be the treatment. It is important for the patient to return to normal activity as soon as possible; however, many are afraid that constant movement and activity may be harmful. LBP is a major reason as to why people under 45 years old limit physical activity. Evidence based research (EBR) has shown that advice to continue ordinary activity and to become physically active is likely to provide faster results and few recurring problems.¹⁰ Inactivity itself can cause pain and aggravations of the back.¹¹ LBP and CLBP are self-limiting conditions that are not always disabling. The patient needs to be aware of how important it is for them to remain physically active to the best of their abilities, considering their current level of

fitness and medical conditions.^{6,9} Without a physically fit body, the area can become susceptible to more injury and time needed during the healing process may increase.⁶ Exercise is also responsible for increasing bone stress, postponing degeneration, reducing calcium loss, and maintaining normal motor system functions.¹¹

Physical exercise as a treatment for back pain was developed around the 1820s by Jacques-Mathieu Delpech, who developed one of the earliest known back schools. As new research became available, many different programs were established to expand on Delpech's ideas. He had reported that it is important to not focus solely on the lumbar spine.⁶ One way to incorporate a whole-body workout is through active treatment methods. This program set by Delpech includes physical exercises that the patient can enjoy doing while also decreasing pain and disability, and increasing spinal mobility and muscular endurance.⁵

Certain injuries may require surgery and/or intensive rehabilitation because of biomechanical deficiencies, crippling dysfunctions, alignment difficulties, and compromised structures that may need to be corrected.⁵ However, surgical intervention and continual rehabilitation sessions are not always beneficial and may result in large health care expenditures.¹ The high cost of such treatment options can increase stress levels which may also play a role in chronic conditions.⁵

An aerobic exercise program is a form of low intensity physical activity that maintains a 60% maximal heart rate for at least 30 minutes.³ It improves cardio-pulmonary function and decreases resting pulse rate while increasing good cholesterol in the bloodstream.¹ Non-impact aerobic exercises involve motions that increase the amount of blood flowing through the contracting muscles; increase flexibility in the lower back; and release endorphins, the body's

natural pain killers, into the bloodstream. Unlike a surgical procedure, a regular and specific aerobic exercise program may improve the functions of the tissues in the spinal column instead of just removing the underlying pathology.⁹

While aerobic exercises are more commonly known for improving cardiovascular endurance, benefits to muscular endurance and flexibility are seen as well. Two common forms of aerobic exercises are cycling and walking on a treadmill. Performing these exercises can minimize loading of the spine and increase strength of the surrounding musculature, while improving muscular endurance and preventing fatigue. Research has found that by preventing muscles from fatiguing, improper body mechanics may also be avoided. This effect of aerobic exercise can also have a psychological effect on pain by improving mood and causing an overall feeling of well-being.⁹

Prevention and rehabilitation of LBP and CLBP should not solely focus on strength, flexibility, and body mechanics. Muscular endurance of the surrounding musculature is also important to consider.⁹ Trunk muscles are activated when sitting, standing, lifting, walking, or rolling over. Therefore, they are needed to sustain low levels of activity for an extended duration. Pain and inactivity alter muscles so that they fatigue in such normal situations. Lack of muscular endurance plays an important role in this; an adequate amount is needed for maintaining typical activities and reducing fatigue.⁶ Muscle endurance is more important than pure muscle strength in many activities.¹² Stressing the muscles of the back and abdomen through common aerobic exercises such as walking, jogging, swimming, and bicycling plays a role in increasing both strength and endurance. A physically fit body can protect an area, increase the healing process, and prevent reoccurrence better than an unfit body can.⁶

Healthcare providers who practice EBR use the most valid and reliable research to help determine a solution to a clinical problem. By using the research others have already done, providers can save time and money by using what is already known. Throughout the course of this systematic review of literature, quality research on treatments for LBP was reviewed.

CHAPTER TWO: METHODS

Data sources and searches

A computerized electronic search was performed using CINAHL, Medline, and Cochrane Central Register of Controlled Trials. Key words used were low back pain or lumbar pain combined with aerobic and exercise. To be included, the articles must have been from 1990 to 2011. Each study must have been a randomized controlled trial or a controlled clinical trial that identified the treatment of acute or chronic low back pain, specific or non-specific, using an aerobic exercise program. The patient population must have been between 18 and 65 years old. Studies were excluded if they analyzed patients who had a history of lumbar surgery. The reference lists of chosen articles were also examined for other publications that matched the criteria, and 2 were selected to be included.

Quality assessment

The Physiotherapy Evidence Database (PEDro) scale was used to score the individual quality of each selected study, providing a process to confidently measure the validity variables of clinical trials by scoring 10 different components of the study. The PEDro scale includes ratings of the following criteria: random allocations, concealed allocations, baseline similarity, subject blinding, therapist blinding, assessor blinding, 85% follow up for at least one key outcome, intention to treat analysis, between-group statistic comparison for at least one key outcome, and variability for at least one key outcome.¹⁴

The methodological quality assessment using the PEDro scale is laid out in Table 1. Exact scoring for most of the articles came directly from the PEDro database, which includes articles that are independently assessed by raters who are either casual staff of the Centre for

Evidence-Based Physiotherapy or volunteer physiotherapists. A typical score for this type of research question is generally around a 6/10. However, it is not uncommon for these types of studies used in this systematic review to have a lower score due to how they were designed. Studies performed for medical purposes are typically impossible to have all blind subjects, blind therapists, and blind assessors because of ethical standards, and the individual qualifications necessary. Also, in some cases, the participants may be allowed a preference as to which group to be placed in.

CHAPTER THREE: RESULTS

Study Selections

The initial search of the electronic database revealed a total of 40 articles from CINAHL, Medline, and Cochrane Central Register of Controlled Trials. Hand searching of the reference lists had also revealed an additional 7. Of those 47, thirteen were selected as potentially meeting the inclusion criteria. Ultimately, 10 articles were retained for the final results.

PEDro Scoring

The studies in this systematic review earned a mean score of 5 with a range of 2-7.¹⁵ Sculco et al.⁹ had the lowest score of 2 because they had a control group with no treatment given, minimal exclusion criteria, did not have a large number of participants, and all participants were recruited from the same location based on neurological appointment logs from the previous 2 years. Also, subjects, researchers, therapists, and aerobic exercise instructors were unable to be blinded to the treatment groups in order to complete the study. This study was not excluded from the final number because it still provided reliable information on aerobic exercise as a superior treatment option.

Table 1 - PEDro Scale

	Eligibility Criteria	Random Allocated	Concealed Allocation	Similar Baseline	Blind Subjects	Blind Therapists	Blind Assessors	Sufficient Follow-Up	Intent To Treat	Btwn-Group Comparisons	Point Estimates & Variability	Score
Moffett et al ¹⁶	YES	YES	YES	YES	NO	NO	NO	YES	YES	YES	YES	7/10
Mannion et al ¹⁹	YES	YES	NO	YES	NO	NO	NO	YES	YES	YES	YES	6/10
Murtezani et al ¹⁸	YES	YES	YES	YES	NO	NO	NO	YES	YES	NO	YES	6/10
Tritilanunt et al ¹	YES	YES	YES	YES	NO	NO	NO	YES	NO	YES	YES	6/10
Dogan et al ⁵	YES	YES	NO	YES	NO	NO	NO	YES	NO	YES	YES	5/10
Wu et al ¹¹	YES	NO	NO	YES	NO	NO	NO	YES	YES	YES	YES	5/10
Turner et al ²⁰	YES	YES	NO	YES	NO	NO	YES	NO	NO	YES	YES	5/10
Chatzitheodorou et al ³	YES	YES	NO	YES	NO	NO	NO	NO	NO	YES	YES	4/10
Kell et al ¹⁷	YES	YES	NO	YES	NO	NO	NO	NO	NO	YES	YES	4/10
Sculco et al ⁹	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	2/10

Note: Eligibility criteria item does not contribute to total score

Study Characteristics

Aerobic Exercise versus Non-Exercising

Sculco et al⁹ compared a low to moderate aerobic exercise group to a non-exercising control group. The study included 35 middle-aged subjects who participated in a two and a half year study. Half of the subjects were instructed to begin aerobic exercises immediately while the other half were instructed to begin after the 10-week mark. The aerobic exercise program included walking or cycling four times per week with progressing durations. A low to moderate exercise intensity for 10 weeks was an effective treatment for improving psychological status; however, the perception of pain level was insignificant. A follow-up occurred 30 months after the initial treatment and revealed a significant decrease in pain for those who continued the aerobic exercises. Performing the exercises regularly at this intensity over a period of time has been theorized, based on the results of this study, to improve overall mood state, functional status, and work status. It can also provide a reduction in the use of pain medication and in the amount of physical therapy referrals. However, these results were achieved by the 30-month mark, while the initial assessment at the end of the first 10 weeks revealed no difference between the intervention group and the control group. This could be explained by most subjects having a lower pain level prior to the study. This may have made any fluctuations in the pain level harder to detect, or pain tolerance may have been influenced due to the level of activity.

Moffett et al¹⁶ utilized 187 patients that were prevented from doing daily tasks due to severity of pain in the low back. Patients were randomly split into 2 groups after the initial assessment. The exercise group consisted of 8 sessions lasting for 1 hour spread over a 4-week timespan. Those in the control group were advised to continue current treatment under the care

of their individual physician while those in the intervention group were referred to physiotherapy. The exercise program had not influenced pain intensity, though it did affect the ability to cope with the pain. Also, the results demonstrated that the intervention group reported a greater decrease in all measures of back pain and disability, and improvements increased continually through the end of the study one year later. These patients also required fewer healthcare and other resources, saving time and money.

Aerobic Exercise versus Other Exercises

Tritilanunt et al¹ compared the effects of a lumbar flexion exercise program with an aerobic exercise program. Patients who had chronic pain for more than 3 months were randomly assigned to a group by drawing a card that either said aerobic or flexion. There were 36 participants in each group. Along with the lumbar flexion exercises, this group also received regular health education, postural instructions, and behavioral instructions. The aerobic exercise group also received health education sessions, with a modeling demonstration followed by self-practice. The reasoning behind a lumbar flexion exercise program was to relieve nerve root compression by stretching the extensor muscles of the back, strengthening the abdominal muscles, and opening the intervertebral foramen. Results in both programs had demonstrated improvements; however, those in the aerobic exercise program had better pain scores (average of 5.6 to 2.3) than those in the lumbar flexion program (average of 5.4 to 4.0). Those performing aerobic exercise also experienced decreased resting pulse rate and increased serum High Density Lipoprotein-Cholesterol levels.

Kell et al¹⁷ compared an aerobics training program with a resistance training program. The study examined effects on musculoskeletal health, body composition, pain, disability, and

quality of life. Twenty-seven (27) subjects complaining of LBP for 6 months to 8 years were randomly assigned to 1 of 3 groups: resistance training, aerobic training, or the control group. The study consisted of 3 sessions a week for 18 weeks. Those assigned to resistance training were instructed to follow a specific routine that utilized free weights (barbells/dumbbells), machines (leg press/bench press), and body weight (prone superman) working on both the upper and lower body. The resistance used was determined based on the 10 rep max completed at baseline, and were performed using concentric and eccentric muscle activation in a smooth and controlled motion. The aerobic training group included forms of aerobic exercises that the individual subjects were most interested in. The most commonly selected were the elliptical and the treadmill for walking or jogging. Though both training groups demonstrated decreased LBP, those doing resistance training showed a greater improvement and also established increased muscle strength, endurance, flexibility, and power.

Aerobic Exercise versus Passive Modalities

Chatzitheodorou et al³ compared a 12-week aerobic exercise program to 12 weeks of passive modalities without any form of physical activity. There were 10 participants in each group. Specific passive modalities administered included 10 minutes of continuous short-wave diathermy set moderate to high intensity, 5 minutes of continuous ultrasound, 10 minutes of LASAR therapy, and 8 minutes of moderate to high intensity electrotherapy. The aerobic exercise program consisted of a 15-minute warm-up, followed by running on a horizontal treadmill at 60 to 85% heart rate reserve for 30 to 50 minutes, 3 times a week. Questionnaires were designed to measure functional levels in each participant and were administered before and

after the 12-week programs. The results showed that aerobic exercise reduced pain, disability, and psychological strain in those with CLBP, while passive modalities were ineffective.

Murtezani et al¹⁸ used passive modalities including interferential current, TENS, therapeutic ultrasound, and heat 3 times a week with no form of physical activity. The study lasted 12 weeks and included 101 patients having suffered from LBP for at least 3 months. Patients participating in the exercise group completed a program of aerobic exercises that were individualized according to initial fitness assessments and were increased in intensity over time. Following the 12 weeks, significant improvements in pain intensity, disability, and psychological strain were demonstrated after completing the program of high intensity aerobic exercises.

The study performed by Wu et al¹¹ compared 2 groups. One group consisted of aerobic exercises plus massage treatments while the other consisted of massage treatments plus manipulations. There were 189 patients randomly divided into the 2 groups. The exercises included 30 to 40 minutes of about 10 different activities with intensity increased based on age and body type several days after the initial meeting. Both groups reported diminished pain and disability; however, the exercise group had a lower reoccurrence rate when a follow-up evaluation was completed 6 months and 2 years later. Exercise also played an important role in the restoration of core function. Therefore, this study concluded that early exercise intervention can relieve pain, improve waist functions, prevent the body from decline, and improve daily mobility.

Aerobic Exercise versus Active Physiotherapy versus Muscle Reconditioning

Mannion et al¹⁹ conducted a 12-month study with 148 cases by using active physiotherapy, muscle reconditioning with instrumental training, and low intensity aerobic

exercises respectively for 3 months. The active physiotherapy program focused on improving functional capacity through strengthening and coordination exercises and understanding proper ergonomics. Instrumental training was completed using training machines and devices. The goal was to focus on muscle reconditioning by progressing a constant load to the trunk. The aerobic exercise program consisted of 1 hour classes, including a 10 to 20 minute warm-up, followed by twenty to 30 minutes of specific trunk and leg exercise and a 15 minute cool-down. This study was able to reveal that the effect of exercise improves general function and perception of pain and disability by acting on the central core. All 3 treatments proved to be equally successful in reducing pain intensity, frequency, and disability during daily tasks; however, after the first 6 months those partaking in the physiotherapy program showed a relapse towards pre-study levels. Physiotherapy, along with instrumental training, cost about 4 times more than an aerobic exercise program, leaving aerobic exercise as being both effective and economical.

Aerobic Exercise versus Physical Therapy versus Self Treatment

Dogan et al⁵ compared a treadmill aerobic exercise program combined with a home exercise routine with 2 other groups. One group included a combination of physical therapy and home exercises, while the other group included home exercises only. The home exercises performed were the same for each group, including basic flexion, extension, mobilization, and stretching. There were 60 subjects with 3 months or greater history of LBP tested in this study. It is hypothesized by the researcher that trust in treatment is higher when performed in the presence of a healthcare professional. However, there were no significant differences between the 3 groups in pain severity, disability, and psychiatric status after treatment or at 1 month; the

evaluation carried out at 6 months showed evidence of aerobic exercises and strengthening exercises having more of an improvement than the physical therapy group.

Aerobic Exercise versus Behavioral Therapy

The study performed by Turner et al²⁰ compared 2 groups of subjects. Both groups were required to perform aerobic exercises, including a walking and jogging program, with 1 group also completing behavioral therapy. The behavioral intervention consisted of information about the role of social reinforcers in maintaining pain behaviors. Spouses were present and were instructed to not reinforce “pain behaviors,” but to reinforce “well behaviors” positively while keeping daily records of behaviors and responses. This treatment included group discussions, role playing with feedback, and assignments with social reinforcements. The final results suggested that group treatment including both behavioral therapy and aerobic exercise provides greater overall improvements initially. However, when follow-up was done a year later, all 3 groups produced statistically significant improvements. This suggests that both behavioral therapy and aerobic exercises are beneficial long-term treatments for LBP.

Research Summary

Table 2 provides a breakdown of interventions, assessment methods used, follow-up dates, and outcomes measured. One hundred percent (10 out of 10) of the studies analyzed in this systematic review provided evidence that aerobic exercise is an effective treatment option for long-term treatment of acute LBP or CLBP. Confirmation was unclear regarding whether aerobic exercise is the most effective short-term treatment for LBP or CLBP. The evidence provides a strong indication that aerobic exercises that do not restrict movement or avoid pain are cost effective and will reduce pain and disability.¹⁶

Table 2 - Studies

Wu et al ¹¹	Turner et al ²⁰	Chatzitheodorou et al ³	Kell et al ¹⁷	Sculco et al ⁹	Article
<p>Group 1: Aerobic Exercise + Massage</p> <p>Group 2: Massage only</p>	<p>Group 1: Aerobic Exercise + Behavioral Therapy</p> <p>Group 2: Behavioral Therapy only</p> <p>Group 3: Aerobic Exercise only</p>	<p>Group 1: High-Intensity Aerobic Exercise</p> <p>Group 2: Passive Modalities</p>	<p>Group 1: Aerobic Training</p> <p>Group 2: Resistance Training</p> <p>Group 3: Control</p>	<p>Group 1: Aerobic Exercise</p> <p>Group 2: Non-exercise</p>	<p>Intervention</p>
<p>Visual Analogue Scale (VAS)</p> <p>Oswestry Low Back Pain Index (OSW)</p>	<p>McGill Pain Questionnaire (MPQ)</p> <p>Sickness Impact Profile (SIP)</p> <p>Pain Behavior Checklist (PBC)</p> <p>Physical Work Capacity (PWC)</p>	<p>Questionnaires for pain (MPQ) and disability (RMDQ)</p>	<p>Visual Analog Scale (VAS)</p> <p>Oswestry Disability Index (ODI)</p> <p>Health Survey</p>	<p>Questionnaires (POMS short form)</p> <p>Brief Pain Inventory (BPI)</p> <p>Phone Interviews</p>	<p>Primary Measures</p>
<p>Baseline</p> <p>6 months</p> <p>2 years</p>	<p>Baseline</p> <p>6 months</p> <p>12 months</p>	<p>Baseline</p> <p>12 weeks</p>	<p>Baseline</p> <p>8 weeks</p> <p>16 weeks</p>	<p>Baseline</p> <p>10 weeks</p> <p>30 months</p>	<p>Follow-up Assessment</p>
<p>Exercise group had a lower recurrence rate during follow-up evaluations</p>	<p>Greatest improvement with Aerobic Exercise + Behavioral Therapy</p>	<p>Aerobic exercise reduced pain, disability, and psychological strain</p>	<p>Resistance Training more effective for CLBP</p>	<p>No differences in pain after the 10 weeks; Aerobic exercise provided better improvements after 30 month check</p>	<p>Outcome</p>

Moffett et al ¹⁶	Group 1: Low-Impact Aerobic Exercise Group 2: Physiotherapy	Mannion et al ¹⁹	Group 1: High-Intensity Aerobic Exercise Group 2: Passive Modalities	Tritilanunt et al ¹	Dogan et al ⁵
Group 1: Active Physiotherapy Group 2: Muscle Reconditioning on Training Devices Group 3: Low-Impact Aerobic Exercise	Group 1: Aerobic Exercise Group 2: Back Flexion Exercise	Group 1: Active Physiotherapy Group 2: Muscle Reconditioning on Training Devices Group 3: Low-Impact Aerobic Exercise	Group 1: Aerobic Exercise Group 2: Back Flexion Exercise	Group 1: Aerobic Exercise + Home Exercise Group 2: Physical Therapy (MHP, US, TENS) + Home Exercise Group 3: Home Exercise only	Modified Schober Test Visual Analogue Scale (VAS) General Health (GHQ) and Disability (RMDQ) Questionnaires Ergospirometric Exercise Test
Roland Disability Questionnaire Aberdeen Back Pain Scale Pain Diaries	Sociodemographic Information Visual Analogue Scale (VAS) Ronald & Morris Questionnaire	Visual Analogue Scale (VAS) Oswestry Low Back Pain Index (OSW)	Visual Analogue Scale (VAS) T-test Z-test Mann-Whitney U-Test	Baseline Pretreatment Posttreatment 1 month 6 months	Baseline Pretreatment Posttreatment 1 month 6 months
Baseline Pretreatment Posttreatment 6 months 1 year	Baseline 6 months 12 months	Baseline 12 weeks	Baseline 3 months	No significant difference between the 3 groups at 1 month; Aerobic Exercise or Strengthening Exercise had more improvement than PT at 6 months	
Aerobic Exercises were more clinically and cost effective	All 3 were equally efficient in reducing pain, but the Devices & Aerobics groups had a further decline in disability at 6 months	Aerobic Exercise resulted in improvements in pain and disability	Aerobic Exercise had better pain score improvement		

CHAPTER FOUR: DISCUSSION

This systematic review provides EBR on the effectiveness of aerobic exercise in reducing pain and disability in those with acute LBP and CLBP. Most of the researchers from these studies had different hypotheses as to why aerobic exercise was found to be a valuable treatment option. Sculco et al⁹ believed in the potential of both positive physical and psychological benefits associated with aerobic exercise. There are multiple other studies that also demonstrated a reduction in depression, anger, anxiety, and total mood disturbance. Similarly, Dogan et al⁵ believed that the differing attitudes a specific person has regarding disability can affect their perception of pain and efforts to seek different treatment options. Researchers also mentioned the increased importance of positive effects in cardiopulmonary fitness level as it affects pain severity, disability status, spinal mobility, and psychological status. Kell et al¹⁷ felt that too many programs focus on core strengthening and neglect a whole-body workout. The researchers in this study aimed to mimic programs used by athletes during a preparatory phase of training. Their goal was to provide significant stress to all large muscle groups to enhance overall health of the musculoskeletal system and increase physical function. Wu et al¹¹ believed in 3 main purposes of exercise treatment for LBP: enhancing tolerance of waist movements, relieving pain, and changing the attitude or belief of pain. They found that the major strategies of exercise for clinical effects are back specific and general exercises. Murtezani et al¹⁸ acknowledged that those with LBP should refrain from specific back exercises and focus on overall physical activities. It is important to focus on functional reconstruction of the back and surrounding structures to relieve pain, spasms, stiffness, and disability.

This systematic review of literature sought to determine the effectiveness of aerobic exercise on relieving pain in the low back. It demonstrated that aerobic exercises are beneficial in relieving low back pain in patients between 18 and 65 years old. Multiple studies showed that staying active and continuing daily activities as normally as possible is more likely to allow less chronic disability than continual resting. The research confirms that individuals affected by LBP and CLBP can focus on non-specific aerobic activities to reduce pain and improve overall health status.

The importance of early exercise intervention on LBP and CLBP is to improve and rebuild core functions and prevent the body from functional declines. Early intervention of aerobic exercise can improve the general condition, increase physiological functions of the cardiovascular system, and reduce disability rate.¹¹ Studies have concluded that improvement in aerobic capacity is clinically and statistically correlated to a decrease in pain and disability.⁵ It can also enhance the strength and stability of the trunk muscles and spine, while relieving muscle spasms and atrophy.¹¹

This study has provided EBR that found using aerobic exercise as a treatment intervention is effective in pain management and reducing limitations for those with LBP or CLBP. The benefits of this type of treatment also include a reduction of cost expenses and an increase in overall mental wellbeing.

CHAPTER FIVE: CONCLUSION

The results of this systematic review provide evidence that aerobic exercise is an effective treatment for acute LBP and CLBP. Healthcare providers and patients need to understand their options in relation to what works and what is cost-efficient to make a confident and well-educated decision regarding their choice of a rehabilitation program. More studies with increased reliability and validity, as rated by the PEDro scale or similar method, are needed to more confidently answer the questions of short-term and long-term effectiveness.⁵ Further studies are also needed to evaluate the specific aerobic exercise durations required to provide improvements.²⁰

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