

Review Article

Exercise-based interventions for ankylosing spondylitis

Naif Salem Alaffari^{1*}, Faisal Ali Alqahtani², Saeed Ahmed Alhudiry³,
Nada Marwa Alharthi⁴, Ghaidaa Malik Melibari⁵, Fatima Ismail Alessa⁶,
Abdulrahman Anis Khan¹, Yousif Bader Alanzi⁷

¹Department of Orthopaedic, King Fahad General Hospital, Jeddah, Saudi Arabia

²Department of Rehabilitation & Physiotherapy, Tathleeth General Hospital, Abha, Saudi Arabia

³Department of Rehabilitation & Physiotherapy, Abha Private Hospital, Abha, Saudi Arabia

⁴Department of Rehabilitation & Physiotherapy, Nahdi Medical Company, Taif, Saudi Arabia

⁵Department of Rehabilitation & Physiotherapy, Comprehensive Rehabilitation Center, Mecca, Saudi Arabia

⁶College of Applied Medical Sciences, University of Hail, Hail, Saudi Arabia

⁷Department of Internal Medicine, Al Jahra Hospital, Al Jahra, Kuwait

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*Correspondence:

Dr. Naif Salem Alaffari,

E-mail: ayman@onnmed.com,

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ABSTRACT

Ankylosing spondylitis (AS) is a chronic inflammatory condition primarily affecting the axial skeleton, leading to pain, stiffness, and reduced spinal mobility. Exercise-based interventions have emerged as an essential non-pharmacological approach to managing AS, complementing pharmacological treatments. Aerobic exercises, such as swimming and cycling, contribute to cardiovascular fitness while alleviating inflammation and fatigue. Strength training addresses muscle imbalances, enhances postural stability, and prevents further functional deterioration. These benefits are amplified when aerobic and strength exercises are combined, providing comprehensive improvements in mobility, physical function, and overall health. Flexibility exercises, including stretching routines and yoga, play a critical role in maintaining spinal mobility and mitigating the effects of spinal fusion. These interventions target the axial skeleton and surrounding musculature, improving range of motion and reducing stiffness. Innovative modalities such as aquatic therapy further enhance flexibility by minimizing joint stress while promoting effective movement. Tailored exercise programs designed to meet the specific needs of AS patients optimize outcomes by addressing individual limitations and disease severity. These programs integrate various exercise modalities, ensuring sustained physical and psychological benefits. Supervised sessions, group activities, and emerging technologies like teleconsultations enhance adherence and accessibility. Furthermore, the integration of relaxation techniques and mindfulness within exercise regimens provides additional mental health advantages. The holistic benefits of exercise extend beyond physical improvements, addressing psychological challenges such as depression and anxiety often associated with chronic diseases. By maintaining mobility, alleviating pain, and enhancing quality of life, exercise-based interventions underscore the importance of an interdisciplinary approach in managing AS. Ongoing research continues to refine these strategies, highlighting their potential in reducing disease burden and improving long-term outcomes for individuals with AS.

Keywords: Ankylosing spondylitis, Exercise therapy, Spinal mobility, Tailored interventions, Quality of life

INTRODUCTION

Ankylosing spondylitis (AS) is a chronic inflammatory disorder that primarily affects the axial skeleton, leading

to pain, stiffness, and progressive fusion of the spine. This condition predominantly manifests in young adults, often in their second or third decade of life, with a higher prevalence among males.¹ AS is classified under the

spectrum of spondylarthritis and is associated with genetic predispositions, particularly the presence of the HLA-B27 antigen, which has been identified in up to 90% of affected individuals in some populations.² The progressive nature of the disease can result in significant impairment in mobility and reduced quality of life, emphasizing the need for effective management strategies.

The clinical presentation of AS is characterized by chronic back pain, which is often inflammatory in nature, improving with exercise but not with rest. Over time, the condition can lead to ankylosis, or fusion of the vertebrae, causing a loss of spinal flexibility and a characteristic stooped posture.³

Peripheral joint involvement and extra-articular manifestations, including uveitis, inflammatory bowel disease, and cardiovascular complications, are also common in individuals with AS. The management of AS requires a multifaceted approach, combining pharmacological treatments with non-pharmacological interventions to address both systemic inflammation and musculoskeletal symptoms.

While pharmacological therapies, including non-steroidal anti-inflammatory drugs and biologics, play a pivotal role in reducing inflammation and halting disease progression, exercise-based interventions have emerged as a cornerstone of symptomatic management in AS. Regular physical activity is not only associated with pain relief but also helps maintain spinal mobility, improve posture, and enhance overall physical fitness.⁴ Structured exercise programs tailored to the needs of individuals with AS can mitigate the impact of the disease on functional capacity, thereby preserving independence and improving long-term outcomes.

Different types of exercises, including aerobic activities, strengthening routines, and flexibility training, have been studied for their potential benefits in managing AS symptoms. Group-based exercise programs, often supervised by physiotherapists, have shown promising results in fostering adherence and improving outcomes. Additionally, aquatic therapy, which minimizes joint stress while allowing for effective resistance training, has gained attention as a viable option for patients with advanced disease.

Despite the clear benefits, adherence to exercise regimens remains a challenge, often influenced by factors such as disease severity, access to resources, and individual motivation. Understanding the physiological benefits of exercise and its role in alleviating the clinical burden of AS offers valuable insights for both patients and healthcare providers. The potential for exercise-based interventions to serve as an adjunct to pharmacological therapies reinforces the importance of non-pharmacological approaches in the holistic management of AS.

LITERATURE REVIEW

Exercise-based interventions are a vital component in managing the symptoms and functional impairments associated with AS. Studies suggest that regular physical activity significantly reduces pain, stiffness, and fatigue while improving spinal mobility and overall physical fitness. Aerobic exercises, such as swimming and cycling, have demonstrated their ability to improve cardiovascular health, which is often compromised in AS patients due to systemic inflammation and reduced physical activity levels.⁵ Strength training further complements aerobic activities by enhancing muscle support for the spine, mitigating postural deformities, and preventing the progression of functional limitations.

Flexibility exercises, particularly stretching and yoga, have shown promise in maintaining or even improving spinal range of motion in patients with AS. Aquatic therapy, an increasingly popular approach, combines the benefits of aerobic and resistance training while minimizing joint stress due to buoyancy. Supervised group-based exercise programs are especially effective, as they improve adherence and motivation through peer support and professional guidance. However, barriers such as disease severity, lack of access to facilities, and patient education often limit widespread implementation.⁶ The integration of tailored exercise regimens into the management plans for AS patients highlights the necessity of interdisciplinary care involving physiotherapists, rheumatologists, and patient educators to optimize outcomes and improve quality of life.

Effectiveness of aerobic and strength training in managing ankylosing spondylitis symptoms

Aerobic and strength training exercises have been identified as essential tools in managing the symptoms of AS. Aerobic exercises such as swimming, cycling, and walking are particularly beneficial due to their ability to reduce inflammation and improve cardiorespiratory fitness. Research has shown that aerobic training can alleviate fatigue and enhance the overall quality of life in AS patients by promoting cardiovascular health and reducing systemic inflammatory markers.⁷ Importantly, activities like swimming are often recommended for individuals with significant spinal or joint involvement, as the buoyancy of water minimizes stress on joints while allowing for effective movement.

Strength training, on the other hand, plays a pivotal role in addressing the musculoskeletal challenges associated with AS. The disease often leads to muscle weakness and imbalances, which contribute to poor posture and limited functional capacity. Targeted strength training exercises, particularly those focusing on core and spinal muscles, help support the spine and improve postural stability.⁸ By enhancing muscle strength, these exercises also reduce the mechanical strain on inflamed joints, thereby decreasing pain and stiffness. Strengthening the lower

limb muscles, in particular, has been shown to improve mobility and functional independence, especially in patients with advanced disease. Evidence suggests that combining aerobic and strength training yields synergistic benefits for AS management. Patients who engage in comprehensive exercise programs that incorporate both forms of training experience greater improvements in spinal mobility and physical function compared to those who focus on a single exercise modality.⁹ Additionally, combining these approaches appears to mitigate the risk of cardiovascular comorbidities commonly associated with AS, such as atherosclerosis and hypertension. Physiological improvements are accompanied by psychosocial benefits, as regular exercise has been linked to reduced depression and anxiety, both of which are prevalent among individuals living with chronic diseases.

Supervised training programs have demonstrated superior outcomes compared to unsupervised regimens. This can be attributed to the tailored approach provided by professional guidance, which ensures that exercises are performed with proper technique and intensity, reducing the risk of injury or exacerbation of symptoms. Moreover, group-based programs foster a sense of community and encourage adherence, a significant challenge in the long-term management of AS.¹⁰

Despite these advantages, barriers such as accessibility, cost, and lack of awareness limit the adoption of such programs. Addressing these barriers through patient education and policy changes is crucial to maximizing the benefits of exercise interventions. Emerging approaches other than traditional aerobic and strength training such as high-intensity interval training (HIIT) are gaining attention for their potential in managing AS symptoms. While research on HIIT in AS is still in its infancy, preliminary findings indicate that short bursts of high-intensity activity interspersed with periods of rest may offer similar, if not greater, benefits than moderate-intensity continuous exercise. However, these protocols must be carefully adapted to individual patients' needs to ensure safety and efficacy.

Role of stretching and flexibility exercises in improving spinal mobility

Stretching and flexibility exercises have long been considered foundational in the non-pharmacological management of AS, particularly for their role in maintaining and enhancing spinal mobility. The chronic inflammatory process in AS often leads to the progressive fusion of vertebrae, resulting in a significant reduction in range of motion. Stretching exercises target this limitation by alleviating stiffness and promoting flexibility in the axial skeleton and surrounding musculature. Specific techniques, such as static and dynamic stretching, have been shown to significantly benefit AS patients, especially when incorporated into daily routines.¹¹ These exercises aim to elongate shortened muscle fibers, reduce

contractures, and improve circulation, all of which contribute to maintaining functional mobility.

Yoga, a form of stretching that integrates breathing techniques and mindfulness, has gained popularity as a therapeutic intervention for AS. Certain yoga poses, such as the cobra and cat-cow, are specifically designed to mobilize the thoracic and lumbar spine, areas commonly affected by AS. Studies suggest that yoga not only enhances flexibility but also helps in alleviating pain and improving posture through controlled spinal extension and rotation movements.¹²⁻¹⁴ The combination of physical stretching and mental relaxation in yoga has been particularly beneficial in reducing the psychosomatic impact of chronic pain in AS patients. Another critical aspect of flexibility training is its role in mitigating postural deformities.

Over time, patients with AS often develop a stooped posture due to spinal rigidity and thoracic kyphosis. Stretching exercises targeting the chest, shoulders, and hamstrings can counteract this tendency by promoting spinal extension and improving alignment. For instance, passive stretching with the assistance of a physiotherapist can be particularly effective in addressing tight muscles and joint capsules that resist active motion.^{15,16} These interventions are often complemented by posture-correcting devices and techniques to maximize their effectiveness.

Aquatic-based stretching programs, often conducted in warm water pools, have also emerged as a promising modality for AS patients. The buoyancy of water reduces the load on inflamed joints and allows for greater range of motion during stretching exercises. Additionally, the warmth of the water helps relax tense muscles, making it easier to perform flexibility routines. Regular participation in such programs has been associated with significant improvements in spinal mobility and reductions in stiffness, particularly in patients with advanced disease stages.^{17,18}

Patient adherence plays a pivotal role in the success of stretching and flexibility programs. While these exercises are highly effective, their benefits are often limited by inconsistent practice. Education about the importance of routine stretching, along with individualized exercise plans tailored to the severity of the disease, is essential to ensure long-term commitment. Digital solutions, such as mobile apps and online video tutorials, have made it easier for patients to access guided stretching routines, even in remote settings. These innovations are helping bridge gaps in care and make flexibility exercises more accessible to a broader patient population.

Impact of tailored exercise programs on quality of life and functional outcomes

Tailored exercise programs are increasingly recognized as a critical aspect of managing AS, particularly for their

ability to improve quality of life and functional outcomes. These individualized regimens account for the unique needs, disease severity, and physical limitations of each patient, ensuring that the exercises prescribed are both safe and effective. Studies highlight that patients participating in customized exercise plans report significant improvements in pain management, physical function, and psychological well-being.¹⁰ Unlike generic programs, tailored interventions offer the flexibility to adapt exercises as the disease progresses, ensuring sustained benefits over time.

A key advantage of tailored exercise programs is their ability to address specific functional impairments caused by AS. For example, in patients with severe spinal stiffness, exercises focusing on thoracic and lumbar mobility are prioritized, while those with peripheral joint involvement benefit from routines that enhance range of motion in the hips and shoulders. Strength training and low-impact aerobics activities are often integrated into these programs, targeting muscle weakness and cardiorespiratory fitness. Such a multidimensional approach not only improves physical function but also supports the management of comorbidities like cardiovascular disease and osteoporosis, both of which are prevalent in AS patients.¹⁹

The role of physiotherapists in developing and supervising tailored exercise programs cannot be overstated. These professionals design regimens that align with individual patient goals while minimizing the risk of injury or exacerbation of symptoms. For example, a supervised program might include isometric exercises for strengthening core muscles, dynamic stretches for improving spinal flexibility, and gradual aerobic conditioning. Group sessions often serve as a motivational tool, fostering a sense of community and enhancing adherence. Additionally, periodic reassessment of the exercise program allows for modifications based on the patient's progress or emerging challenges, ensuring that the plan remains relevant and effective.^{19,20}

Beyond physical improvements, tailored exercise programs have a profound impact on mental health and overall quality of life. The chronic nature of AS often leads to psychological challenges, including anxiety, depression, and feelings of isolation. Engaging in structured physical activity has been shown to alleviate these issues by reducing disease-related stress and enhancing self-efficacy. Regular participation in exercise programs instills a sense of achievement and control over one's condition, fostering positive mental health outcomes.

Furthermore, tailored regimens that incorporate relaxation techniques or mindfulness, such as yoga-based exercises, provide additional psychological benefits by promoting stress relief and mental clarity.^{6,20} Technology has increasingly played a role in enhancing the accessibility and effectiveness of tailored exercise programs for AS

patients. Virtual platforms and mobile applications now allow patients to access personalized exercise routines remotely, guided by video demonstrations and progress-tracking tools. These digital solutions have been particularly beneficial for individuals living in remote areas or those unable to attend in-person sessions. Real-time feedback and teleconsultations with physiotherapists ensure that the exercises are performed correctly and adjusted as needed, reducing the risk of improper technique or injury. As technology continues to evolve, it offers promising avenues to expand the reach and impact of tailored exercise programs.

CONCLUSION

Exercise-based interventions are indispensable in managing ankylosing spondylitis, addressing both physical and psychological challenges associated with the disease. Aerobic, strength, and flexibility exercises improve spinal mobility, reduce pain, and enhance quality of life when tailored to individual needs. Integrating these programs with professional guidance ensures safety and effectiveness while fostering adherence. As evidence grows, the role of exercise in holistic AS management becomes increasingly clear.

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