

# Evaluation of the effectiveness of home based or hospital based calisthenic exercises in patients with ankylosing spondylitis

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## Abstract.

**OBJECTIVE:** The aim of this study is to evaluate the effects of calisthenic exercises on functionality, mobility, disease activity, quality of life, and psychological status in patients with Ankylosing spondylitis (AS).

**METHODS:** Prospective analysis of forty patients diagnosed with AS were randomized into two exercise groups. AS patients having diagnosis based on 1984-modified New York criteria were involved. Patients were given 8 weeks calisthenic exercise program. Outcome measures including the Bath AS Functional Index (BASFI), Bath AS Disease Activity Index (BASDAI), Bath AS Metrology Index (BASMI), AS Quality of Life Questionnaire (ASQoL), Bath AS Patient Global Score (BAS-G) Hospital Anxiety Depression Score (HADS), erythrocyte sedimentation rate (ESR) and the serum C-reactive protein (CRP) levels were assessed at the baseline and at 8 weeks.

**RESULTS:** Thirty-seven participants completed the exercise programme. After the 8-week exercise programme, the home-based exercise group showed significant improvement in ESR levels and hospital-based exercise group showed significant improvements in terms of the BASMI and HADS-A scores.

**CONCLUSION:** Calisthenic exercises can be easily performed both at home and in hospital setting. In patients with AS, calisthenic exercises performed at the hospital may improve the mobility, and psychological status (anxiety).

Keywords: Ankylosing spondylitis, calisthenic exercise, mobility, anxiety

## 1. Introduction

Ankylosing spondylitis (AS) is a chronic systemic inflammatory disease that affects mainly the axial skeleton and causes significant pain and disability [1]. AS may lead to structural impairment and loss of important dynamic functions, resulting in problems

with daily activities. Extra-articular manifestations can often occur, restrictive respiratory dysfunction being commonly reported in a significant proportion of patients [1,2]. Inflammatory back pain is characterized by improvement of symptoms with exercise and no improvement or worsening with rest. The treatment guidelines therefore recommend exercise as an important part of the disease management [3]. The optimal management requires a grouping of nonpharmacologic and pharmacologic treatment modalities aiming to maximize long-term health-related quality of life throughout control of inflammation and preven-

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tion of structural damage progression. Furthermore, ASAS/EULAR approvals highlight the role of education, physical exercise, physical therapy and rehabilitation tailor-made to separate patient in reducing the general burden of the disease [3,4]. AS includes inflammation and pain in many joints and spine, which cause physical results such as reduced physical activity, reduced spinal mobility, painfulness, fatigue, sleep disorders, and psychological concerns such as depression [5]. Some studies have reported positive effects of exercise on symptom severity, spinal mobility, muscle strength, functional capacity, cardiovascular capacity, and psychological status [6].

It is known that exercise treatment is as crucial as drug usage in management of AS. There are a wide variety of exercise programs such as individual or group exercises conducted under supervision, home-based programs could be effective in patients with AS. Previous studies revealed that the efficiency of the home-based exercises in terms of cost and time have been declared [7]. However, to our best knowledge, calisthenic exercises has not been studied in patients with AS in the relevant literature.

Primary aim of this study is to evaluate the effectiveness of calisthenic exercises in terms of functionality, mobility, disease activity, quality of life, and psychological state in patients with AS. The secondary aim is the comparison of the exercise therapy and disciplines performed at home and in the hospital setting.

## 2. Methods

This randomized, prospective, controlled study was conducted in Physical medicine and Rehabilitation department of Bezm-i Alem Vakıf University, faculty of Medicine. The patients, fulfilling the 1984 modified New York criteria for AS, were enrolled in the study and assigned to two groups. In addition to their demographic characteristics (age, gender, weight, height, body mass index [BMI]), the patients were also questioned for occupation, main symptoms, time of diagnosis, and drug usage (NSAID, disease-modifying antirheumatic drugs including biologics). The patients were between the ages of 20 and 65 included in this study, if they had not been practicing regular exercise during the previous 6 months, were able to understand the content of questionnaires and experimental schedules, had no coexistent systemic disease, have not been given anti-TNF treatment, and if they were classified in the Functional classes I–III for New York Heart Association Functional Classification.

All the recruited subjects signed informed consent forms before participating in the study and the approval of the local Ethics Committee was obtained. All the subjects gave their consent to the random assignment to the groups. Using computer-generated random numbers, the subjects were randomized into two groups to participate in either the hospital-based (group 1), or home-based exercise programs (group 2). Twenty patients were enrolled in the hospital-based exercise group, while 20 further patients were enrolled in the home-based exercise group. Two patients in the hospital group 1 failed to complete the work in house groups. Both groups were applied exercise programs 5 days a week for 8-weeks. The 5-day exercise program consisted of calisthenic exercises for 3 days and relaxation exercises for 2 days. Calisthenic exercises were focused on the large muscles and were applied rhythmically and in combination with breathing exercises. Calisthenic exercises are consecutive and repetitive exercises aimed at training large muscle groups through aerobic and step routines that also include regional training sequences and end with a 5 minute rest (Fig. 1) [8,9]. Calisthenic exercises were performed 3 days a week, in 1-hourly sessions including 15 min of warm-up, 20 min intensive training 10 min cooling and 15 min of relaxation. The relaxation exercises were given in 20-minute sessions twice a week. The patients were advised to rest in the remaining two days of the week. In the hospital-based group, all the exercises were conducted by a physiatrist at the hospital, the home-based group were asked to perform the exercises at home and their exercise schedule was followed up through telephone every day. The erythrocyte sedimentation rate (ESR) was measured through the Westergren method (mm/h) and the serum C-reactive protein (CRP) level was determined with the help of nephelometry (mg/dl).

The functional status was evaluated with the Bath AS Functional Index (BASFI) [10]. The disease activity was evaluated using the Bath AS Disease Activity Index (BASDAI) [11]. The reliability and validity of the Turkish version of BASDAI and BASFI have already been demonstrated [12,13]. The scores of the spinal and hip measurements were determined through the Bath AS Metrology Index (BASMI) [14]. The disease-related quality of life was measured with the ankylosing spondylitis quality of life questionnaire (ASQoL) [15]. This questionnaire consists of 18 items with dichotomous responses (yes/no). The reliability and validity of the Turkish version of this questionnaire have been verified by Duruöz et al. The hospital

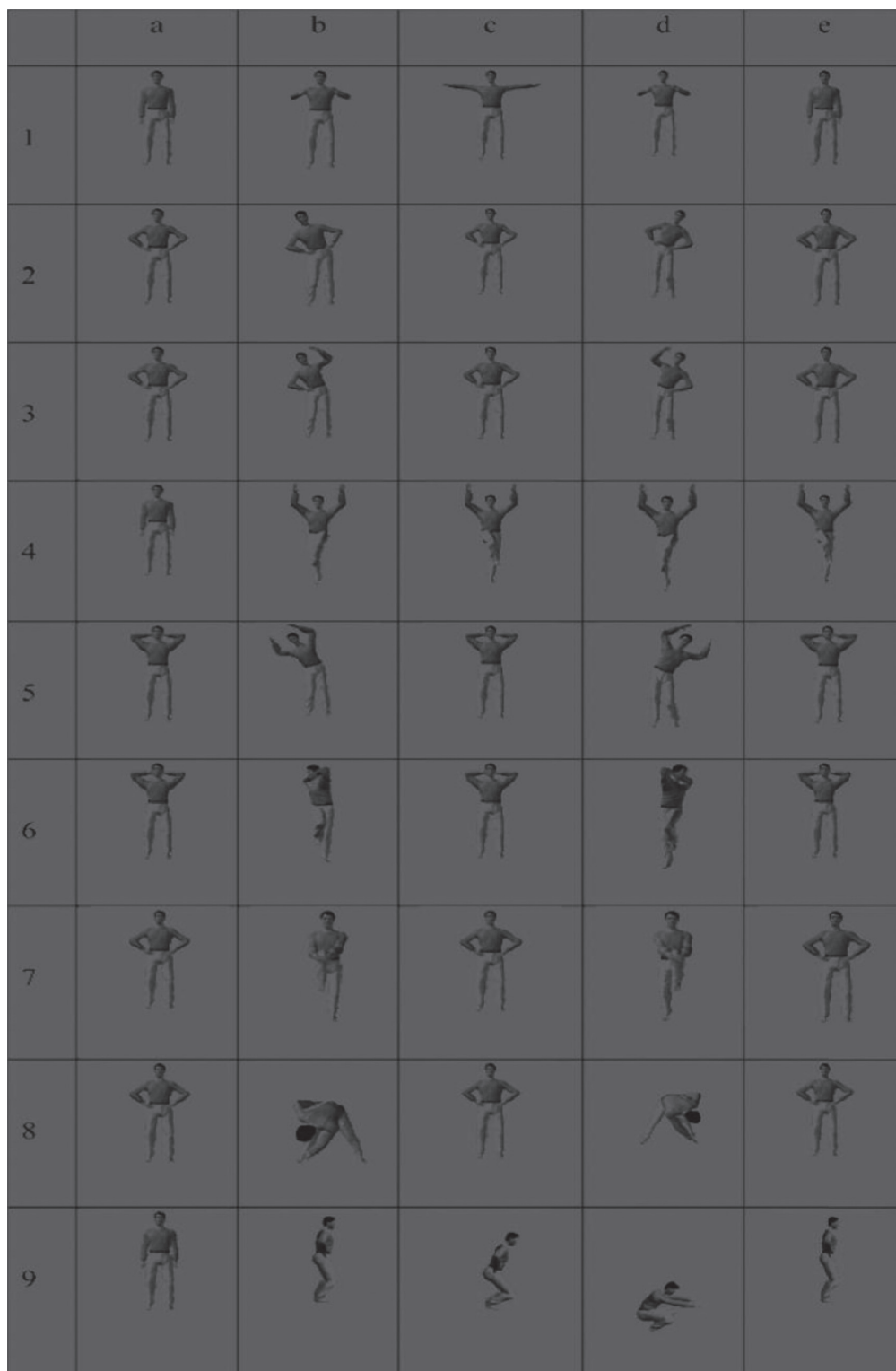


Fig. 1. The calisthenic exercises which were conducted in patients with multiple sclerosis.



Fig. 1. continued.

anxiety and depression scale (HADS) were applied to the patients with AS. This scale has been developed by Zigmond and Snaith [16] and its Turkish version was verified in terms of its validity and reliability by Aydemir et al. [17]. HADS is a Likert-type self evaluation scale that consists of 14 items; seven to investigate the depression symptoms (HADS-D) and the other seven to investigate the anxiety symptoms (HADS-A). In order to assess the overall effect of the disease on patient's well-being in clinical practice, the Bath Ankylosing Spondylitis Patient Global Score (BAS-G) was developed [18].

Assessments were made at the baseline and after 8-weeks of exercise; using BASDAI, BASFI, BASMI, ASQoL, HADS, and BAS-G. The patients were not allowed to change the dosage of their regular medication or begin a new medication.

The calculations were performed using the Statistical Package for Social Sciences for Windows software version 16.0 (SPSS Inc., Chicago, IL, USA). The Kolmogorov-Smirnov test was used to confirm that data within the ranges of normal distribution in both groups. A non-parametric test was employed for the variables outside the normal distribution. The comparison of the data between the groups was carried out

Table 1  
Clinical and demographic characteristics of the patients with AS  
(mean  $\pm$  SD or n, %)

	Home based (n = 19)	Hospital based (n = 18)	p
Age	33.52 $\pm$ 7.72	35.83 $\pm$ 8.08	> 0.05
Male patients (n, %)	11 (57%)	9 (50%)	> 0.05
Disease duration	7.10 $\pm$ 2.79	7.22 $\pm$ 2.19	> 0.05
HLA B27(+)	11 (57%)	10 (55%)	> 0.05
Indomethacin	10 (52.6%)	9 (50%)	> 0.05
Indomethacin+SAZ	9 (47.4%)	9 (50%)	> 0.05

through the independent-samples t test. Statistical significance was based on a value of  $p < 0.05$  with a 95% confidence interval.

### 3. Results

Two patients in the hospital-based group and 1 patient in the home-based group discontinued the study due to the failure to adapt to the exercise. No exacerbation has been observed in any of the patients. A total of 37 patients completed the study (18 hospital-based, 19 home-based). The clinical, demographic characteristics and drug usage of the patients and the healthy controls are listed in Table 1. The majority of the AS patients were male (62.3%). The mean age was 34.67  $\pm$  7.90 years. The mean disease duration was 7.16  $\pm$  2.49 years. Among the patients, 48.5% had depressive symptoms (HADS-D > 7) and 55.8% had anxious symptoms (HADS-A > 8) at the baseline (Table 1). After the 8-week exercise programme, the home-based exercise group showed significant improvement in ESR levels. Hospital-based exercise group showed significant improvements in terms of the BASMI and HADS-A scores ( $p < 0.05$ ) (Table 2). No significant improvement was observed in terms of CRP, BASDAI, BASFI, BASG, ASQoL, HADS-D and chest expansion in any of the groups. A significant difference was found in the score of BASMI as compared to the differences between the groups ( $p < 0.05$ ) (Table 3).

### 4. Discussion

Exercise programs purpose to correct the static deformities through holding the flexion of the spine in normal range, relaxing the neck, stretching the girdle muscles, as well as the abdominal muscles, superficial and profound back muscles, stabilizing the pelvis muscles in a neutral position, controlling breathing accompanied by controlled movements and reeducating the

diaphragmatic breathing in rheumatic diseases [19]. Exercises effects spinal movement, improves physical capacity and patient global assessment in patients with AS [7]. A new review that examined the efficacy of physiotherapy in AS patients showed that home-based exercises have been recognized as an effective physiotherapy modality for AS patients with respect to pain reduction, spinal mobility, function, and decreased disease activity [20]. In our study ESR level was significantly decreased in home-based exercise group and also mobility [BASMI] scores and anxious symptoms were improved in hospital-based exercise group. Exercise programs may reduce the levels of serum CRP and ESR [21]. A beneficial effect of regular exercises demonstrating a reduction of disease activity and systemic inflammation has also been demonstrated in patients with inflammatory rheumatic diseases. Although, in agreement with previous reports, significant improvement of clinical measures and disease activity was observed, an intensive exercise programme did not change the levels of CRP or ESR in patients with AS in these study [22,23]. In the present study, despite the ESR levels was significantly reduce in hospital-based exercise group, no significant difference has been observed in CRP levels in both groups. The results of previous studies and the present study indicate that the effects of exercise on CRP or ESR levels is still controversial.

BASFI is a preferred method to quantify the functions in patients with AS. Some studies have suggested that exercise programs significantly increases the functional capacity of patients with AS as evaluated with BASFI [4,15]. BASDAI is a comprehensive self-administered method for assessing disease activity in patients with AS. The effects of the exercise on BASDAI are also controversial. Some authors claim that exercises recover BASDAI, whereas some others claim that they are not [4,15]. Previous studies revealed significant differences in almost all mobility measures in terms of the BASMI (except for cervical rotation) and BASFI, in favor of the AS patients. Regular exercise purposes at maintaining and improving movement of the spine and peripheral joints; strengthening the muscles of the trunk, legs, back, and abdomen; and increasing the functional capacity and quality of life in patients with AS [24,25]. Sweeney et al. investigated the effect of a 6-month home-based exercise programme in 4569 AS patients and found no differences in terms of BASDAI, BASMI, and BASG scores [26]. Efficacy parameters comprising pain, lumbar spine mobility (modified Schober test, finger-to-



Table 2  
Pre and post exercise inter- group comparisons of the groups (mean  $\pm$  SD)

	Home based ( <i>n</i> = 19)			Hospital based ( <i>n</i> = 18)		
	Preexercise	Postexercise	P	Preexercise	Postexercise	P
ESR (mm/h)	21.52 $\pm$ 12.98	17.47 $\pm$ 8.59	0.043	30.38 $\pm$ 21.74	26.38 $\pm$ 16.42	> 0.05
CRP (mg/dl)	0.44 $\pm$ 0.54	0.32 $\pm$ 0.30	> 0.05	1.25 $\pm$ 2.80	0.90 $\pm$ 1.69	> 0.05
BASDAI	5.02 $\pm$ 2.43	4.66 $\pm$ 2.02	> 0.05	4.15 $\pm$ 1.79	3.66 $\pm$ 1.84	> 0.05
BASFI	3.64 $\pm$ 2.87	3.78 $\pm$ 2.67	> 0.05	3.16 $\pm$ 2.43	2.63 $\pm$ 2.07	> 0.05
BASMI	2.42 $\pm$ 1.50	2.52 $\pm$ 1.34	> 0.05	2.38 $\pm$ 1.19	1.83 $\pm$ 1.04	0.008
BASG	5.10 $\pm$ 2.11	4.80 $\pm$ 1.67	> 0.05	4.58 $\pm$ 1.88	4.45 $\pm$ 2.14	> 0.05
ASQoL	9.63 $\pm$ 5.41	9.00 $\pm$ 5.06	> 0.05	7.11 $\pm$ 4.33	6.22 $\pm$ 4.59	> 0.05
HADS-A	8.84 $\pm$ 4.08	8.63 $\pm$ 4.23	> 0.05	8.22 $\pm$ 4.90	6.50 $\pm$ 3.45	0.045
HADS-D	9.21 $\pm$ 4.57	9.47 $\pm$ 5.61	> 0.05	7.66 $\pm$ 4.25	6.38 $\pm$ 3.58	> 0.05
Chest expansion (cm)	4.89 $\pm$ 1.24	5.00 $\pm$ 1.00	> 0.05	4.22 $\pm$ 1.89	4.72 $\pm$ 1.99	> 0.05

ESR erythrocyte sedimentation rate, CRP C-reactive protein, BASFI Bath Ankylosing Spondylitis Functional Index, BASDAI Bath Ankylosing Spondylitis Disease Activity Index, BASMI Bath Ankylosing Spondylitis Metrology Index, HADS-A hospital anxiety and depression scale-anxiety, HADS-D hospital anxiety and depression scale-depression, ASQoL ankylosing spondylitis quality of life, BASG Bath Ankylosing Spondylitis Patient Global Score.

Table 3  
Compare the differences between the groups (mean  $\pm$  SD)

	Home based ( <i>n</i> = 19)	Hospital based ( <i>n</i> = 18)	P
	Preexercise	Preexercise	
ESR (mm/h)	-4.05 $\pm$ 8.07	-4.00 $\pm$ 9.21	> 0.05
CRP (mg/dl)	-0.12 $\pm$ 0.35	-0.35 $\pm$ 1.21	> 0.05
BASDAI	-0.35 $\pm$ 1.08	-0.48 $\pm$ 1.03	> 0.05
BASFI	0.13 $\pm$ 1.50	-0.53 $\pm$ 1.23	> 0.05
BASMI	0.10 $\pm$ 0.56	-0.55 $\pm$ 0.78	0.006
BASG	-0.30 $\pm$ 1.36	-0.12 $\pm$ 1.49	> 0.05
ASQoL	-0.63 $\pm$ 3.51	-0.88 $\pm$ 2.27	> 0.05
HADS-A	-0.21 $\pm$ 2.67	-1.72 $\pm$ 3.37	> 0.05
HADS-D	0.26 $\pm$ 3.88	-1.27 $\pm$ 3.68	> 0.05
Chest expansion (cm)	0.10 $\pm$ 1.04	0.50 $\pm$ 1.42	> 0.05

ESR erythrocyte sedimentation rate, CRP C-reactive protein, BASFI Bath Ankylosing Spondylitis Functional Index, BASDAI Bath Ankylosing Spondylitis Disease Activity Index, BASMI Bath Ankylosing Spondylitis Metrology Index, HADS-A hospital anxiety and depression scale-anxiety, HADS-D hospital anxiety and depression scale-depression, ASQoL ankylosing spondylitis quality of life, BASG Bath Ankylosing Spondylitis Patient Global Score.

floor distance, BASMI), chest expansion, BASDAI and BASFI were evaluated during three visits. A specific McKenzie training should be included in the standard-care of AS aiming to improve pain, posture and function, especially in early axial disease bulmuşlardır [27].

In our research although the BASMI and anxiety scores were improved in hospital-based patients, there was no significant improvement in both groups in terms of the BASDAI, BASG and BASFI scores. In our study, the better mobility status of our patients at the baseline and the relatively small number of study population may explain the conflicting results with the existing literature. Hospital-based group of patients as accompanying teaching staff is made complete in terms of patient groups according to the home-based exercise program and can contribute to the positive development in BASMI and HADS-A score. Are set out in the discussion.

In our study despite the anxious symptoms were improved in hospital-based exercise group, there was no improvements in both groups in terms of QoL and depression scores. Previous studies found that there was a close relationship between the BASDAI, BASFI, BASMI, QoL and the depression/anxiety scores of the AS patients [28,29]. In recent years, the effects of exercise programs on physical health rather than the psychological health have been studied. The achievement in AS patients' QoL, depression and anxiety is significant to determine the success of treatment. Pain and stiffness have been broadly recognized as principal symptoms of AS, whereas fatigue has only newly become featured as a core symptom meaningfully impacting patient's QoL [30]. It has been implied that improved disease activity and functional disability are related with poor mental health in patients with AS. Exercise has been shown to be effective for improving psychological distress and QoL [31–33].

It is noted in the previous studies that most clinicians recommend home-based exercise programmes, as supervised exercises require more time and money [34]. Also in our study hospital-based exercise group has been required more time and cost when compared with the home-based group. In the present study more positive improvements have been provided in supervised hospital-based exercise group. However the number of patients in our study was limited, prospective studies in larger patient groups may shed light on the effects of calisthenic exercises in AS in more detail. In this context supervised exercises seems to be more effective. Positive improvements have been observed in the parameters in Table 2 with an exercise in most of the parameters related to the disease. Significant changes in these parameters can be observed in case of increasing the exercise time. We were determined to be 2 months after the exercise period. This duration may be more meaningful results if removed 6 months. Inactivity that influence the quality of life negatively and leads to depressive mood, is a crucial problem in rheumatologic diseases. Calisthenic exercises are simple and economical exercises which do not require any devices and can be performed both at home and in the hospital setting.

### Conflict of interest

The authors report no conflict of interest.

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