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Original Article PT&R

The effects of pre-obesity on quality of life, disease activity, and functional status in patients with ankylosing spondylitis

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ABSTRACT

OBJECTIVE: This study was an investigation of effects of pre-obesity on clinical characteristics and quality of life in patients with ankylosing spondylitis (AS).

METHODS: Total of 28 AS patients and 30 age- and sex-matched healthy controls were included in the study. Patients and controls with any systemic inflammatory disease and/or cognitive and mental problems were excluded. Disease activity and functional capacity were measured using the Bath Ankylosing Spondylitis Disease Activity Index and Bath Ankylosing Spondylitis Functional Index. For quality of life assessment, 36-Item Short Form Health Survey was used in both groups, and AS group also responded to Ankylosing Spondylitis Quality of Life questionnaire.

RESULTS: There was no significant difference in sociodemographic characteristics between AS patients and healthy controls ($p>0.05$). Mean quality of life scores were significantly lower in the pre-obese AS patients compared with controls ($p<0.05$). Functional capacity was positively and significantly associated with body mass index (BMI) ($p=0.024$) and disease activity was significantly associated with female gender ($p=0.011$).

CONCLUSION: Increased BMI in patients with AS is factor that affects quality of life, disease activity, and functional capacity. Multidisciplinary rehabilitation programs will support improved quality of life for pre-obese patients with AS.

Keywords: Ankylosing spondylitis; body mass index; pre-obesity; quality of life.

Ankylosing spondylitis (AS) is important autoimmune disease that is the prototype of spondyloarthritis group of diseases, and particularly affects the musculoskeletal system [1]. Anatomical changes resulting in vertebral ankylosis lead to typical kyphotic deformity in patients with AS [2]. Kyphotic deformity causes reduced angle of vision and difficulty performing daily life activities, such as looking across the street while walking, communicating, driving a car, walking downhill, and main-

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taining personal hygiene [3, 4].

Numerous features of the course of AS, including pain, limitation of movement, functional loss, and deterioration of well-being, have negative effect on the patient's quality of life [5]. As in many chronic diseases, there may also be social and economic consequences for patients with AS. Environmental factors are also of great importance to quality of life. Social support, family support, suitable work conditions, and minimizing fatigue are important for these patients. It is also known that there is connection between psychological condition and the course and clinical findings of AS. Deteriorating psychiatric condition causes AS to clinically progress more rapidly [6]. Among patients with AS, risk of permanent work disability is 3 times greater than those of similar age and gender in general population [7].

Role of adipose tissue in AS has not been widely investigated; however, some indirect results suggest that there is connection between excess adipose tissue and inflammation in AS [8]. Weakening of skeletal muscles and decreased muscular function and physical inactivity lead to change in body composition. Due to reduction in quantity of lean (non-fatty) tissue in AS, total fatty tissue is more prominent [9].

Fat deposit centers in the body cause center of gravity to shift toward the front in comparison with healthy-weighted individuals, which then adds mechanical strain and stress to structures behind the center of gravity [10]. Body mass index (BMI) is the most commonly used method of evaluating obesity. An individual's weight in kilograms is divided by the square of height in meters [weight (kg) / height (m^2)]. BMI correlation with quantity of body fat measured directly with densitometer is quite good [11].

In the literature, there are indirect prospective studies regarding relationship between BMI and AS; however, relationship to quality of life, disease activity, and functional condition has not been evaluated. For this reason, the main objective of this study was to assess quality of life, functional level, and disease activity of pre-obese patients with AS and compare results with healthy individuals.

MATERIALS AND METHODS

Our case-control study sample consisted of 28 patients diagnosed with AS by specialist physicians according to the modified New York Criteria for AS (Group 1) and 30 healthy individuals (Group 2). Number of participants was determined as result of power analysis performed by department of biostatistics. Study was conducted in the Physical Therapy and Rehabilitation Unit of Turgut Ozal Medical Center, Inonu University, after receiving approval (number 2013/121) from the Human Ethics Committee of Inonu University. The patients and healthy controls were informed about the study and all study participants provided written informed consent. Criteria for participation for both groups were age in range of 25 to 55 years, BMI in range of 25 to 30 (pre-obese), and having no cognitive or mental problems.

For Group 1, diagnosis of AS based on modified New York Criteria was criterion for inclusion in the study. Individuals who had undergone surgery related to AS and those with additional systemic disease, visual, or cognitive problems were excluded. Demographic data of participants were recorded. Measurement of height was performed with sensitivity of 0.1 cm using standard steel stadiometer while participants were barefoot. Measurement of weight was performed using Tanita BC-418 Segmental Body Composition Analyzer (Tanita Corp., Tokyo, Japan). World Health Organization BMI classification, Bath AS Disease Activity Index (BASDAI), and Bath AS Functional Index (BASFI) were employed to assess individuals according to study criteria. Both groups completed 36-Item Short Form Health Survey (SF-36) and patients with AS also responded to AS Quality of Life Questionnaire (ASQoL). Developed to evaluate disease activity, BASDAI is questionnaire consisting of 6 questions associated with 5 major symptoms of AS (fatigue, spinal pain, joint pain/swelling, localized sensitivity/susceptibility areas, and morning stiffness) [12–15]. If BASDAI result is ≥4, it is then evaluated as high disease activity [16]. ASQoL questionnaire asks patients to answer 18 questions with "yes" or "no," and number of affirmative responses is used to

Table 1. Demographic characteristics of patients with ankylosing spondylitis and healthy controls

Socio-demographic features	Group 1 Patient population (n=28)			Group 2 Control group (n=30)			p
	n	%	Mean±SD	n	%	Mean±SD	
Age (years)			40.64±11.4			43.8±9.4	0.251
Gender							
Female	8	28.6		12	40		
Male	20	71.4		18	60		0.523
Body mass index			27±3.4			27.2±3.2	0.279
Educational status							
Primary school	8	28.6		8	26.7		
High school	10	37.5		11	36.7		0.987
University	10	37.5		11	36.7		
Occupational status							
Housewife/student/unemployed	7	25		9	30		
Artisan/laborer	7	25		7	23.3		0.913
Civil servant	14	50		14	36.7		

SD: Standard deviation.

calculate score between 0 and 18; lower scores suggest better quality of life [17].

The quality of life scale most frequently used in the field of medicine, SF-36 form, consists of 36 items that evaluate health in terms of physical and mental aspects in 8 scaled sections [18].

Statistical analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 22.0. software (IBM Corp., Armonk, NY, USA). In group comparisons, Mann-Whitney U-test and Kruskal-Wallis test were used. Following Kruskal-Wallis test, Conover method was used for paired comparison. In group comparisons of categorical data, chi-square test with Yates correction and Fisher's exact test were used. Significance level was determined to be $p<0.05$.

RESULTS

Demographic characteristics of Group 1 and Group 2 are provided in Table 1.

Table 2. BASDAI, BASFI, and ASQoL scores of the patients with ankylosing spondylitis

Tests	Mean±SD	Value range
BASDAI	4.78±2.1	1.6–6.7
BASFI	4.87±2.8	0–6.2
ASQoL	10.5±5.095	0–18

ASQoL: Ankylosing Spondylitis Quality of Life questionnaire; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; BASFI: Bath Ankylosing Spondylitis Functional Index; SD: Standard deviation.

BASFI, BASDAI, and ASQoL score data can be seen in Table 2. Mean BASFI value of group with BMI of 25 to 27 was 2.9±1.1, whereas mean BASFI of the group with BMI of 27.1 to 29.9 was 6.45±2.3 ($p=0.024$) (Table 3). ASQoL results revealed only 39.3% of patients had score of 9 or less (Figure 1). When the patients with AS were evaluated in terms of gender, a statistically significant difference was seen in women's BASDAI values

TABLE 3. Comparison of BASFI, BASDAI, and ASQoL scores of the patients with AS according to BMI group

Tests	BMI 25–27 (n=14) Mean±SD	BMI 27.1–29.9 (n=14) Mean±SD	p
BASFI	2.9±1.1	6.45±2.3	0.024
BASDAI	3.75±1.7	5.65±1.9	0.265
ASQoL	8.5±2.5	13.5±6.1	0.114

AS: Ankylosing spondylitis; ASQoL: Ankylosing Spondylitis Quality of Life questionnaire; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; BASFI: Bath Ankylosing Spondylitis Functional Index; BMI: Body mass index; SD: Standard deviation.

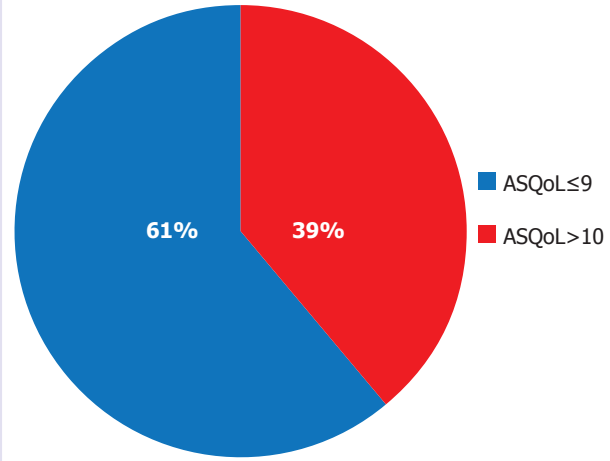

FIGURE 1. ASQoL scores in patients with AS.

(p=0.011) (Table 4). Results indicated that healthy individuals had significantly higher score in all of the quality of life criteria in comparison with the pre-obese patients with AS (Table 5). Although the SF-36 test results revealed better quality of life in the patients whose BMI was in range of 25 to 27 compared with those whose BMI was between 27.1 and 29.9, no statistically significant relationship was observed (Table 6).

DISCUSSION

AS is chronic inflammatory disease with broad clinical spectrum and unknown etiology. It primarily affects young men, and is characterized by apparent inflammation in the spinal joints and neighboring structures, causing progressive bone fusion in the vertebrae [19, 20]. The disease leads to serious impairment in at least one-third of cases. Influences on psychological state, such as pain in the vertebrae and joints, reduced physical activity and spinal mobility, joint stiffness/involvement, fatigue, and depression may worsen physical findings [21]. Our study was designed to evaluate effect of preobesity in patients with AS on quality of life, disease activity, and functional condition/status. Since 33.7% of society (38.2% of males and 29.3% of females) is pre-obese, according to 2014 data of the Turkish Statistical Institute, and as we were of the opinion that obesity and morbid obesity would already have reduced quality of life, we incorporated pre-obese patient population into our study [22]. Based on study results, we came to conclusion that pre-obesity led to increase in disease activity of AS patients, deterioration of functional condition, and significant decline in quality of life compared with healthy individuals.

Studies have reported that age, gender, and duration of disease affect the course of the disease as well as metrological indices [23].

Review of the literature yielded mean age of AS patients in 1 study [24] of 37.0±9.7 years, and another study reported 67% of the patients were male with mean age of 38±13 years [25]. Mean age of the patients with AS in our study proved to be 40.64±11.4 years; 28.6% of our participants were female and 71.4% of them were male. In recent

TABLE 4. Comparison of BASFI, BASDAI, and ASQoL scores of the patients with AS according to gender

Tests	Female	Male	p
BASFI	7.3±2.6	3.6±1.5	0.182
BASDAI	6.35±2.	3.75±1.6	0.011
ASQoL	13.5±6.1	10±5.5	0.469

AS: Ankylosing spondylitis; ASQoL: Ankylosing Spondylitis Quality of Life questionnaire; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; BASFI: Bath Ankylosing Spondylitis Functional Index.

Table 5. Evaluation of SF-36 test results of the AS patients and control group

Sub-groups	AS patients (n=28) Mean±SD	Control group (n=30) Mean±SD	p	Value range
Physical function	35.07±11.5	50.12±7.3	<0.0005	10–100
Difficulty in physical role	34.11±8.6	48.01±8.9	<0.0005	0–100
Pain	36.42±7.8	46.81±6.7	<0.0005	10–100
General health	37.04±8.1	48.76±7.3	<0.0005	20–97
Vitality	43.07±7.04	48.61±4.6	0.02	25–100
Difficulty in social role	37.22±11.5	49.6±7.6	<0.0005	0–100
Difficulty in emotional role	34.37±10.6	47.21±9.3	<0.01	0–100
Psychological health	41.4±9.1	50.4±7.8	<0.0005	0–80

SD: Standard deviation.

Table 6. Comparison of SF-36 test results in the AS group according to BMI categories

	Group	n	Mean±SD	p	Value range
Physical function	BMI 25–27	14	37.25±6.1	0.194	10–100
	BMI 27.1–29.9	14	28.85±4.9		
Difficulty in physical role	BMI 25–27	14	35±6	0.164	0–100
	BMI 27.1–29.9	14	28±4.9		
Pain	BMI 25–27	14	37.5±6.5	0.603	10–100
	BMI 27.1-29.9	14	35.55±6.3		
General health	BMI 25–27	14	37.05±7.1	0.210	20–97
	BMI 27.1–29.9	14	33.6±6.5		
Vitality	BMI 25–27	14	44.35±8.5	0.734	25–100
	BMI 27.1–29.9	14	42.15±8.3		
Difficulty in social role	BMI 25–27	14	35.4±6.9	0.603	0–100
	BMI 27.1–29.9	14	30.8±5.1		
Difficulty in emotional role	BMI 25–27	14	34.55±6.8	0.77	0–100
	BMI 27.1–29.9	14	24.75±4.9		
Psychological health	BMI 25–27	14	41.4±7.5	0.62	0–80
	BMI 27.1–29.9	14	34.5±6.3		

AS: Ankylosing spondylitis; BMI: Body mass index; SD: Standard deviation.

studies, female/male ratio reported has ranged between 1/10 and 1/3 [26]. In the present study, female/male ratio was determined to be 2/5. Patient population in the present study was consistent with the literature in terms of age and gender.

When AS symptoms are evaluated in terms of gender, in female patients this disease courses more insidiously; it progresses slowly and more moderately, starting in the form of peripheral joint involvement [27]. In our study, as in the literature [27],

BASDAI score of women was significantly higher than that of men (p=0.011). We are of the opinion that disease activity in women was higher due to fact that most of the women who participated in our study were housewives and had been exposed to more physical strains and stresses at home. Separately, we must also consider influences such as hormonal changes in women due to their menstrual cycle, the fact that women are more susceptible to trauma, and that they are often more able to express their complaints as factors in higher scores.

In their study in which 101 patients with AS responded to SF-36 quality of life survey, Ozgul et al. reported that subsections affected most were difficulty in physical role, evaluation of general health, and pain [28]. Turan et al. stated that SF-36 subgroups most affected by AS were physical function, physical role, and emotional role in a study they conducted [29]. Ward et al. [30] evaluated 175 patients diagnosed with AS and found that quality of life of those whose educational level was low was worse in 7 out of 8 fields of SF-36.

In our study, there was significant decrease in quality of life in all subsections of SF-36 in the preobese patients with AS when compared with the healthy controls. We believe this could be explained by the fact that it is outcome of mechanical factor that increases along with obesity.

Yilmaz et al. [31] reported in their study that high BASDAI, BASFI, and BASMI scores had caused all subgroup scores of SF-36 to decline, while causing ASQoL scores to rise significantly. ASQoL is valuable tool in evaluating effect of interventions performed on patients with AS. In our study, unlike several studies in the literature, we used ASQoL index to evaluate quality of life of patients with AS. ASQoL score of pre-obese patients with AS revealed that quality of life was poor for 60.3% of our patients.

When we compared ASQoL scores in 2 subgroups based on BMI and sub-groups of female and male patients, we found no significant difference.

While in the literature there are numerous evidence-based studies conducted for the purpose of minimizing pain, spinal stiffness, fatigue, and restriction in joint movement, which are among the symptoms of AS, as well as to increase functioning, there is very limited number of studies that examine BMI and AS. There are studies [32, 33] regarding the fact that visceral adiposity increase in AS raises cardiovascular risks, and it was reported that during 1- or 2-year period following tumor necrosis factor (TNF) alpha therapy, early abdominal obesity increased visceral adipose tissue in patients with AS [32]. It was also reported that in patients who received TNF alpha therapy there was significant correlation between visceral adipose tissue and body fat and disease activity [34]. In studies in which body composition in AS was evaluated, changes within fat and muscle mass compared with normal controls were identified [35]. Another study reported that epicardial fat thickness was significantly increased in patients with AS compared with healthy controls [36].

Retrospective European study of spondyloarthropathy in 155 individuals who were treated with infliximab (Remicade; Janssen Biotech, Inc., Horsham, PA, USA) evaluated the patients in groups defined as normal, pre-obese, and obese according to BMI, and results of 6-month infliximab treatment revealed significant difference between groups in terms of visual analogue scale responses, though no significant difference was observed in their BASDAI scores [37].

Durcan et al. [38] reported in a study conducted with 46 patients with AS that BASFI score within group with mean BMI of 27.4 (67.5%) proved to be 4.7, whereas BASFI score in group with normal mean BMI was 2.5. BASDAI score in group with mean BMI of 27.4 was 4.8, while in the other group it was found to be 2.9. In another study, significant correlation was found between body fat and BMI and BASMI. In a study conducted in Turkey [39], quantity of central/peripheral fat and quantity of upper/lower-half body fat in patients with AS were found to be significantly high, and anthropometric measurements of the AS patients were reported to be different from those of healthy individuals. In contrast, Rubio et al. reported that BMI and ASDAS score were not related [40].

In our study, we separated the patients into 2

subgroups with mean BMI of 25 to 27 and 27.1 to 29.9, and we found that BASFI results within group with greater BMI were significantly higher (p=0.024). Separately, since BASDAI in our pre-obese AS patients was ≥4 (4.78±2.1), this score suggests severe disease activity.

Even though BMI increase in patients with AS is identified with medical treatments and mobility restriction stemming from pain, more remains to be clarified; however, we can assume that greater BMI will lead to additional physical complaints over time. Our study suggests that while specifying treatment strategies for patients with AS, taking BMI into consideration, trying to bring it to normal level, and implementing specially planned, extensive, and multidisciplinary rehabilitation program for patients will promote improved quality of life for patients with AS.

Conflict of Interest: None declared.

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Authorship contributions: Concept – S.T.; Design – S.T.; Supervision – D.O.; Materials – Z.A.; Data collection &/or processing – S.T.; Analysis and/or interpretation – Z.A.; Literature search – D.O.; Writing – S.T.; Critical review:- D.O.

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