

# Six-Minute Walk Test in Patients with Rheumatoid Arthritis

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## Abstract

**Background:** The 6-minute walk test (6TC) was initially used as an instrument for assessing physical and cardiorespiratory capacity, but is currently being used to monitor treatments, and compare physical interventions and prognostic evaluation. Although already recognized as a research method in several specialties, 6TC has not been used in rheumatology. Patients with rheumatoid arthritis (RA) may have impaired functional capacity as well as increased cardiovascular mortality. An adequate functional evaluation of these patients is necessary and the 6TC may be useful in this sense. **Objective:** The aim of this study was to perform the 6-minute walk test in RA patients and to compare the performance with a control group. **Method:** A cross-sectional study was carried out in which the sample consisted of 85 women, 46 patients with rheumatoid arthritis and 39 healthy controls. A descriptive analysis of the data was performed. One-Way ANOVA methodology was used to compare the patient and control groups followed by the graphic analysis. **Results:** The distance walked on the 6TC by RA patients was on average 522.2 meters. In the distance control group found in the 6TC was on average 628.8 meters, the difference being statistically significant. **Conclusion:** In this study the distance covered in 6TC by women with RA was lower than that of healthy women of the same age.

## Keywords

6-Minute Walk Test, Rheumatoid Arthritis, Functional Capacity, Physical Capacity, Cardiorespiratory Capacity, Person Performed

## 1. Introduction

The walk test was originally developed by Cooper as a measure of the level of physical activity of US military soldiers. In the initial model the evaluated person performed the largest race course in 12 minutes [1]. Subsequently, McGavin *et al.* [2] modified the test using the 12-minute walk instead of running to examine patients with chronic bronchitis. Because it is often exhaustive for sick individuals, a new adaptation of the test to shorter distances was created by creating the 6-minute walk test (6TC). Today, 6TC remains the most commonly used standard for patient assessment and is considered to be a good reproducer of daily activity efforts [3] [4]. Although it was initially used as an instrument for the evaluation of physical and cardiopulmonary capacity, it has been used to monitor several treatments, to compare physical interventions and even to evaluate prognosis [5].

Pulmonology was the first specialty to benefit from the 6-minute walk test information [2]. In patients with respiratory diseases, important data can be obtained for lung capacity measurement. Several studies have compared the information from 6TC with other complementary tests such as spirometry and even laboratory blood gas measurements [6] [7] [8].

In cardiology the benefits of the walk test as a complementary exam are also well documented in the literature. In the SOLVD (Substance of Left Ventricular Dysfunction) study, an important multicenter study in the area, in addition to measurements of the physical and cardiorespiratory capacity provided by the test, the researchers suggested that the parameters of the test can be indicators of mortality and therefore have prognostic value in patients with insufficiency [9]. Another study by Rubim *et al.* [10] in Brazil also demonstrated that walking test parameters can be indicators of mortality in patients with heart disease. A cohort of 179 patients with the New York Heart Association (NYHA) Functional Classification classes III and IV performed the test followed by echocardiogram and was followed up for 18 months. The authors concluded that the 6TC's worst measures, especially those that covered a distance of less than 500 meters, had a statistically significant relationship with mortality. In addition, there was a good correlation of the 6TC information with echocardiogram data, as already reported in other studies [11] [12].

Although already recognized as an evaluation instrument in several specialties, the 6TC has not been used in rheumatology. In the literature we found few studies in which the test was used to compare interventions, mainly physical exercise, in patients with osteoarthritis and fibromyalgia. To date, we have no information about the usefulness of 6TC in rheumatoid arthritis, which is the object of our study.

The functional capacity of patients diagnosed with RA can be compromised in several aspects, since the manifestations of the disease can decrease joint mobility and range of motion, weaken skeletal muscles and reduce cardiovascular capacity [13]. This may cause a greater level of physical inactivity, and eventually

compromise activities of daily living, such as bathing, preparing meals, dressing, feeding, as well as walking a certain distance or climbing stairs. On the other hand, restrictions in terms of activity and physical exercise for patients with RA should be increasingly discouraged, as they are mainly related to worsening of joint symptoms, a fact that can contribute to both the inactivity and decline of aerobic capacity, and for increased risk of cardiovascular disease and death. In this sense, in addition to understanding and appropriate management of comorbidities in RA patients, it is fundamental to consider the increase in physical conditioning necessary to attenuate the higher mortality observed in this group [14]. Thus, 6TC can be a practical and extremely useful method for assessing overall, cardiovascular and risk factors of RA patients. In addition to the utilities already reported on the method, it is worth noting that it is an easy-to-perform test, which does not require specific instruments or instruments and therefore of very low cost. Another advantage is that several healthcare professionals can be trained to perform it and obtain valuable data for clinical practice. These characteristics can make the walk test a good tool for use in underdeveloped/ developing countries, especially in centers with difficulties in obtaining complementary exams and more complex tests.

## 2. Material and Methods

A total of 85 women were evaluated, being 46 patients from the Brasília Cohort of rheumatoid arthritis and 39 healthy controls. Brasília Cohort [15]-[21] is an incident cohort of patients diagnosed with RA, followed at the Rheumatology outpatient clinic of the University Hospital of Brasília (HUB), University of Brasília (UnB). RA is defined for inclusion in this cohort as the occurrence of compatible joint symptoms (pain and inflammatory pattern joint edema with or without morning stiffness or other manifestations suggestive of inflammatory joint disease, evaluated by a single observer) lasting more than 6 [22]. All patients selected retrospectively met the EULAR/ACR 2010 criteria [23]. From the time of diagnosis, patients are treated with followed-up prospectively, receiving the standard treatment regimen used in the service, including traditional disease-modifying drugs (DMARDs) or biological response modifiers (biological therapy) as needed. Currently, there are patients who have been followed up for up to 11 years, from the initial diagnosis. The patients were evaluated at the Laboratory of Aptitude and Rheumatology (LAR) of UnB.

The study was carried out in a transversal way, from March to August 2013, with direct interview and review of medical records. The care protocol began with the collection of descriptive clinical data, including the determination of the values of DAS 28 [6], HAQ [7] Visual Analogue Scale (EVA) [8] for pain and fatigue, diagnosis time and presence of comorbidities (hypertension, diabetes mellitus, fibromyalgia, dyslipidemia, hypothyroidism, depression and others). Data on body composition (body mass, height and body mass index—BMI) were collected and the 6TC was performed.

The 6TC was executed in a HUB corridor with a distance of 40 meters. The materials used were a hand-held timer for the 6-minute marking, a measuring tape for distance measurement and cones for delimiting the start and end points of the course. Each participant was instructed to walk down the aisle and outline the cones at the highest speed during the 6 minutes of the test.

The descriptive analysis of the data was shown by mean, median and standard deviation, in addition to the absolute and relative frequencies and distribution of the total sample in tertiles. One-Way ANOVA methodology was used to compare the groups of patients and controls regarding weight, height, BMI and distance walked in the walking test followed by the graphic analysis. All the hypothesis tests developed in this study considered a significance of 5%, that is, the null hypothesis was rejected when p-value was less than or equal to 0.05.

The project was submitted to the Human Research Ethics Committee (CEP) of the Faculty of Medicine of UnB (FM-UnB) on June 15, 2007, analyzed and approved on August 22, 2007 (Registration of the project: CEP-FM 028/2007), and all participants signed a free and informed consent form.

### 3. Results

The final sample consisted of 85 female participants, 46 patients with rheumatoid arthritis and 39 healthy controls.

Exclusion criteria were defined as difficulties or impediment to perform the 6TC, such as severe osteoarticular disorders in the lower limbs, blood pressure above 140/100 mmHg or cardiac dysfunction. The group of patients had a mean age of 49 years, and 6.5 years of diagnosis of the disease. The control group had a mean age of 37.43 years. The descriptive analysis of the sample can be visualized in **Table 1**.

Regarding body composition, it was noted that the majority of the patients, approximately 65%, were overweight, according to the classification of the World Health Organization [24]. The amount and distribution of body fat appear to be concentrated in the central region of the body, according to the analysis of the percentage of body fat and BMI, which showed, respectively, that the majority of the sample has high body fat and high or high risk high risk of developing heart disease.

The evaluation of the specific control parameters of the disease, its signs, symptoms and associated comorbidities presented important data. When the DAS 28 scores were analyzed, the sample was most often classified as low disease activity or remission. In addition, a similar satisfactory behavior was also shown in the HAQ values, which indicated that 84% of this sample had no, little or moderate difficulty performing basic life tasks. The levels of pain and fatigue appear to be well controlled and, finally, fibromyalgia and arterial hypertension were the most frequent comorbidities in this sample.

The distance walked on the 6TC by patients with RA ranged from 347 to 675 m, with an overall mean of  $522.4 \pm 76.8$  m. The distribution of the data was classified as lower limit ( $\leq 507$  m), intermediate zone ( $< 507$  m  $\geq 565$  m) and upper

**Table 1.** Descriptive analysis of the sample.

Variable	Mean $\pm$ Standard deviation	Median	n (%)
AGE (years)	49 $\pm$ 14.95	49	
DIAGNOSTIC TIME	6.5 $\pm$ 3.28	7	
DAS 28	3.04 $\pm$ 1.44	2.83	
Remission			26 (48.1)
Low activity			6 (11.1)
Moderate activity			17 (31.5)
High activity			5 (9.3)
HAQ	0.593 $\pm$ 0.63	0.375	
Little or no difficulty			17 (30.4)
Difficulty moderate			30 (53.6)
Much difficulty			6 (10.7)
Impossible to perform			3 (5.3)
BMI (kg/m <sup>2</sup> )	26.60 $\pm$ 5.31	25.59	
Under weight			2 (3.3)
Ideal weight			28 (45.0)
Overweight			19 (31.1)
Obesity Grade 1			10 (16.4)
Obesity Grade 2			1 (1.6)
Obesity Grade 3			1 (1.6)
Fat mass (%)	35.48 $\pm$ 6.83	35.34	
Great			1 (2.8)
Good			3 (8.3)
Above average			2 (5.6)
Average			2 (5.6)
Below average			7 (19.4)
Bad			5 (13.9)
Too bad			16 (44.4)
Pain visual analog scale (mm)			
0 - 34			20 (48.8)
35 - 66			14 (34.1)
67 - 100			7 (17.1)
Visual analogue scale fatigue (mm)			
0 - 34			23 (57.5)
35 - 66			9 (22.5)
67 - 100			8 (20)
Comorbidities			
Fibromyalgia			20 (42.6)
Systemic arterial hypertension			15 (31.9)
Dyslipidemia			10 (21.3)
Hypothyroidism			8 (17.0)
Diabetes			6 (12.8)
Depression			10 (21.3)
Others			10 (21.3)

limit (>565 m). 34.1% of the patients were in the first tertile, 34.1% in the intermediate tertile and 31.8% in the last tertile. 14 patients (35.9%) walked a distance of less than 500 meters. In the distance control group found in the 6TC ranged from 521 to 746 meters. The comparison between the two groups can be seen in **Table 2**.

#### 4. Discussion

This study aimed to verify the functional capacity of female patients of Brasília Cohort of RA through the 6TC, in addition to demonstrating the distribution of performance in tertiles and comparing it with a control group. The values presented in the 6TC tertiles demonstrate that the physical performance of the majority of RA patients was below that of healthy women of similar age, according to the study by Enright and Sherrill [25]. Although there is currently no in the scientific literature a normative of this specific test for the RA public, the result was compatible with that of the elderly from 60 to 65 years [26]. When compared to the control group, the group of patients with rheumatoid arthritis presented inferior performance, being this variable with statistically significant difference.

BMI and fat percentage were high and this behavior is common in patients with RA [27] [28]. In addition, what attracted attention was the fact that they had a higher amount of body fat in the region of the trunk, alerting to the high cardiovascular risk [29] [30] [31].

The risk of morbidity and mortality from cardiovascular diseases in patients with RA is high [32] such that the evaluation of functional and cardiovascular capacity is becoming an increasingly frequent recommendation [33]. In addition, this is justified because of the ease of execution of the 6TC, especially when the care is performed by a multi and interdisciplinary team and due to the practical application regarding the referral of the patient, first, to the cardiologist to verify the cardiological status and, later to the physiotherapist and physical education teachers for rehabilitation and development of cardiovascular fitness.

This indication is especially advisable in cases of poor performance on the 6TC, high frequency of associated diseases, worse status of body composition and worse classifications of DAS 28 and HAQ. However, we can not rule out the fact that, in general, independent of the results found in the 6TC, the diagnosis of RA per se is enough to indicate the practice of physical activity [34] to intervene as an adjuvant in the treatment of RA and its more frequent comorbidities such as hypertension, fibromyalgia, dyslipidemias, obesity, depression, diabetes and others [35] [36] [37] [38] [39].

In addition, the experience of this work brings to light a warning to health professionals, since the similarity in terms of cardiovascular and functional condition of individuals with different levels of control of RA, once again, shows the need for referral and indication of the practice of physical activities for individuals with RA, even though it was diagnosed early in the disease and well controlled over time.

**Table 2.** Mean and standard deviation of weight, height, body mass index and walk by group (RA and control) followed by F, p-value and R<sup>2</sup> of ANOVA.

Variable	Group				ANOVA One Way		
	Control		RA		F	p-value	R <sup>2</sup>
	Mean	Standard deviation	Mean	Standard deviation			
Weight	61.1	8.6	65.9	13.9	3.5	0.0649	0.040
Height	1.60	0.06	1.58	0.05	2.9	0.0911	0.034
BMI	23.8	3.1	26.4	4.7	8.3	0.0050	0.090
Walking	628.8	52.1	525.2	73.7	54.4	<0001	0.393

The reduced CCV and functional in individuals with RA also appears to be characteristic of other rheumatologic and autoimmune diseases such as systemic lupus erythematosus (SLE) [40] [41] and fibromyalgia [42], when compared to individuals of the same genus and age [25] or the elderly [26].

It should be borne in mind that this study presents some limitations in the extrapolation of the conclusions, such as the fact that the study is transversal (not determining cause and effect relationship), limited N, variability of patient age and controls, the time of diagnosis and the treatments used. Further studies in the area should be performed to confirm these results.

## 5. Conclusion

Thus, it was concluded that the distance covered by women with RA is lower than that traveled by healthy women of the same age. Finally, the pioneerism of the proposal stands out, since no references were found from other research groups investigating the results of 6TC tests in individuals with RA. It is important that, in the future, cohort studies are developed that assess the behavior of functional capacity over time in comparison with healthy individuals.

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## Conflicts of Interest

The authors have no competing interests to this article to disclose.

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