



SIX MINUTE WALK TEST AS A VALUABLE ASSESSMENT TOOL FOR EXERCISE CAPACITY IN HEALTHY KIBBUTZ ELDERLY

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Abstract: *Objective:* To study six minute walk test sensitivity in monitoring exercise effects on healthy kibbutz elderly. *Design and participants:* Interventional trial conducted at two north eastern Israeli kibbutz communities involving 11 healthy men and 13 healthy women aged 61 and older. *Methods:* Exercise protocol included 30 min of moderate daily walks for 12 weeks. Six minute walk test was performed according to American Thoracic Society guidelines at baseline and after 12 weeks. *Results:* Six minute walk distance improved by 10.3% ($p < 0.001$). Participants BMI decreased significantly in men and in a greater extent in women (-0.5 and -1.2 Kg/m², respectively, $p < 0.05$). Waist circumference also decreased less in men than women (3.4 and 6.3 cm, $p < 0.01$, respectively). Integration of baseline and end data showed significant correlations between six minute walk test results and height (positive, $r=0.34$, $p < 0.05$), BMI, waist and hips circumferences (negative, $r = -0.43$, $r = -0.43$ $r = -0.29$, respectively, $p < 0.05$). *Conclusion:* Six minute walk test was able to demonstrate the efficacy of 12 weeks of exercise in elderly healthy kibbutz citizens. Exercise was sufficient to induce a promising decrease in body weight and circumferences.

Key words: Six minute walk test, elderly, healthy, exercise capacity, six minute walk test distance, exercise test.

Introduction

The "kibbutz" is a collective community that was founded on principles of economic, social, and ideological partnership. Kibbutzim were built on the principle that members contribute according to their capacity and receive goods and services based on their needs. The collective was responsible for the individual members, while the individuals viewed themselves as an integral part of this collective (1).

The aging populations of the Israeli "kibbutz" communities are known for a high level of health, wellbeing and longevity. Life expectancy of the kibbutz is in three to four years more than that of the general Jewish population in Israel. The kibbutz citizens health institutions take under their responsibility the elders' health (2). As part of an interventional study, we have approached two north eastern kibbutz communities, with high exposure to healthy life style encouraged by the

community health teams (family physician and nurses). The responsible family physicians had special concern for healthy life style and chronic diseases prevention.

Six minute walk test (6MWT) was originally established in 1982 in order to test exercise capacity in patients with chronic respiratory disability [3]. Few years later, the usage of the test broadened to patients with congestive heart failure due to its low risk and simplicity (4). The test can be used as predictive of maximal oxygen consumption. It has high correlations with actual peak vo₂ as measured with maximal cardiopulmonary exercise testing, but its much easier to perform and can be used in patients not suitable for maximal exercise (5).

Nowadays, in addition to respiratory and cardiovascular diseases, there are increased applications of 6MWT in estimation of change in daily functioning. Few of those include severely obese after bariatric surgery, overweight children and adolescents following weight reduction program and heat-sensitive multiple sclerosis patients after cooling treatment (6-8).

The significance of the 6MWT is demonstrated in studies which correlate test performance with mortality rates in various patients. The associations include higher mortality rate with lower test performance in patients suffering from idiopathic pulmonary fibrosis, chronic obstructive pulmonary disease (COPD), primary pulmonary hypertension and liver transplant candidates (5, 9-11). Moreover, 6MWT was also positively correlated

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with quality of life in elders (12).

Therefore, we have undertaken this test to examine the kibbutz elderly population, monitoring the extent of improvement in physical fitness and indirectly the amelioration in life quality following intervention which included daily 30 min of moderate walks.

Participants and methods

Twenty four healthy men and women participated in this study. Average age was 71.1 ± 1.1 years (range 61-80 years). Body mass index (BMI) was 29 ± 0.7 kg/m² (range 23-35.5). 6MWT was performed at baseline and after 12 weeks intervention. All subjects participated in the exercise program. Antioxidants were supplemented to half of the group but had no effect on walking performance at the end of the study (data not shown). 6MWT was performed according to American Thoracic Society guidelines (13). Daily caloric intake was calculated from 24 hours recall personal interview. Results before and after the intervention were compared by a paired t-test. Results comparing men and women were performed by independent t-test. Linear correlations were assessed by Pearson correlations. The data was analyzed by SPSS (program version 15 SPSS Inc. Chicago, IL) for windows. $P < 0.05$ was considered statistically significant. All results presented are mean \pm SE.

Results

Table 1 shows measurements before and after the intervention. 6MWT distance increased in 18/24 participants ($p < 0.001$). Mean BMI decreased in 21/24 participants ($p < 0.001$). Mean Waist circumference decreased in 20/24 participants ($p < 0.0001$). Mean hips circumference decreased in 18/24 participants ($p = 0.001$). Waist to hips circumference decreased in 17/24 participants ($p = 0.028$).

Integration of parameters from the beginning and the end of our study showed linear correlations between 6MWT distance and age (negative, $r = -0.203$, $p = 0.051$), and with height (positive, $r = 0.34$, $p < 0.05$, respectively). Significant inverse linear correlations were found between 6MWT distance and body indices such as BMI,

waist and hips circumferences ($r = -0.43$, $p < 0.01$, $r = -0.43$, $p < 0.01$, $r = -0.29$, $p < 0.05$, respectively). Men's test distance was 71 ± 27 m greater than women's.

Discussion

Similarly to our study, 6MWT distance was inversely associated with age and positively associated with height in a healthy community dwelling elderly (aged 65.5 years) Belgian men and women (14). Additional coincident data is provided from an Australian study which showed that 6MWT performance was 59m greater in healthy men than in women (aged 64.5 years) (15).

In 1998, Enright & Sherrill published reference equations to predict 6MWT distance in healthy adults. Those equations include gender, height, age and weight (16). In light of our study waist and hips circumferences may serve as complementary predictors of 6MWT distance worth of inclusion.

Several interesting results emerged from our study: 12 weeks of regular physical activity in frequency of 6 times per week and duration of 30 min in a healthy elderly kibbutz population resulted in prominent health benefits. It was found that exercise, without change in daily caloric intake, led to reduction of body weight and circumferences. Thus, it appears that exercise in the mentioned frequency to elderly may serve as alternative to diet in weight loss programs. Our findings are coherent with Cochrane 2006 systematic review which concluded that exercise without nutritional intervention is sufficient for weight loss in overweight and obese people (17). In addition, our study's health benefits showed a 10.3% improvement in physical fitness as measured by 6MWT. Such substantial differences imply that 6MWT is sensitive enough to monitor increase in physical fitness in response to exercise program in healthy elderly.

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Table 1
Comparing male and female baseline and 12th week's data. All results represent mean \pm SE

P	Female N=13		P	Male N=11		
	End	Baseline		End	Baseline	
-	70.4 ± 1.5	70.2 ± 1.5	-	72.5 ± 1.7	72.3 ± 1.7	Age (years)
0.001	563.9 ± 22.2	511 ± 25	0.035	638.1 ± 25.7	578.9 ± 33.2	6MWT (m)
0.001	29.3 ± 1	30.5 ± 1	0.01	26.7 ± 0.6	27.2 ± 0.6	BMI (Kg/m ²)
0.003	91.7 ± 2.7	98 ± 2.6	0.005	97.4 ± 2.4	100.8 ± 2.7	Waist circumference (cm)
NS	107.8 ± 2.3	111.6 ± 2.6	NS	101.6 ± 1.3	102.5 ± 1.2	Hips circumference (cm)
NS	0.85 ± 0.08	0.89 ± 0.07	0.018	0.96 ± 0.02	0.98 ± 0.02	Waist to hips ratio





References

1. Levav I, Shemesh A, Grinshpoon A, Aisenberg E, Shershevsky Y, Kohn R (2004) Mental health-related knowledge, attitudes and practices in two kibbutzim. *Soc Psychiatry Psychiatr Epidemiol.* 39(9):758-764.
2. Estes RJ, Leviatan U, Salm C (2007) Socioeconomic Inequality and Inequalities in Health Among Kibbutz Elderly. In: Michalos AC, Diener E, Glatzer W, Moum T, Vogel J, Veenhoven R (eds) *Advancing Quality of Life in a Turbulent World*: Springer, Netherlands, pp 169-190.
3. Butland RJ, Pang J, Gross ER, Woodcock AA, Geddes DM (1982) Two-, six-, and 12-minute walking tests in respiratory disease. *Br Med J (Clin Res Ed).* 284(6329):1607-1608.
4. Lipkin DP, Scriven AJ, Crake T, Poole-Wilson PA (1986) Six minute walking test for assessing exercise capacity in chronic heart failure. *Br Med J (Clin Res Ed).* 292(6521):653-5.
5. Miyamoto S, Nagaya N, Satoh T, Kyotani S, Sakamaki F, Fujita M, et al. (2000) Clinical correlates and prognostic significance of six-minute walk test in patients with primary pulmonary hypertension. Comparison with cardiopulmonary exercise testing. *Am J Respir Crit Care Med.* 161:487-492.
6. de Souza SA, Faintuch J, Fabris SM, Nampo FK, Luz C, Fabio TL, et al. (2009) Six-minute walk test: functional capacity of severely obese before and after bariatric surgery. *Surg Obes Relat Dis.* 5(5):540-543.
7. Geiger R, Willeit J, Rummel M, Hogler W, Stubing K, Strasak A, et al. (2011) Six-minute walk distance in overweight children and adolescents: effects of a weight-reducing program. *J Pediatr.* 158(3):447-451.
8. Reynolds LF, Short CA, Westwood DA, Cheung SS (2011) Head pre-cooling improves symptoms of heat-sensitive multiple sclerosis patients. *Can J Neurol Sci.* 38(1):106-111.
9. Lederer DJ, Arcasoy SM, Wilt JS, D'Ovidio F, Sonett JR, Kawut SM (2006) Six-minute-walk distance predicts waiting list survival in idiopathic pulmonary fibrosis. *Am J Respir Crit Care Med.* 174(6):659-664.
10. Celli BR, Cote CG, Marin JM, Casanova C, Montes de Oca M, Mendez RA, et al. (2004) The body-mass index, airflow obstruction, dyspnea, and exercise capacity index in chronic obstructive pulmonary disease. *N Engl J Med.* 350(10):1005-1012.
11. Carey EJ, Steidley DE, Aqel BA, Byrne TJ, Mekeel KL, Rakela J, et al. (2010) Six-minute walk distance predicts mortality in liver transplant candidates. *Liver Transpl.* 16(12):1373-1378.
12. Wanderley F, Silva G, Marques E, Oliveira J, Mota J, Carvalho J. (2011) Associations between objectively assessed physical activity levels and fitness and self-reported health-related quality of life in community-dwelling older adults. *Qual Life Res.* Epub ahead of print.
13. (2002) ATS statement: guidelines for the six-minute walk test. *Am J Respir Crit Care Med.* 166(1):111-7.
14. Bautmans I, Lambert M, Mets T (2004) The six-minute walk test in community dwelling elderly: influence of health status. *BMC Geriatr.* 4(1):6.
15. Camarri B, Eastwood PR, Cecins NM, Thompson PJ, Jenkins S (2006) Six minute walk distance in healthy subjects aged 55-75 years. *Respir Med.* 100(4):658-665.
16. Enright PL, Sherrill DL (1998) Reference equations for the six-minute walk in healthy adults. *Am J Respir Crit Care Med.* 158:1384-1387.
17. Shaw K, Gennat H, O'Rourke P, Del Mar C (2006) Exercise for overweight or obesity. *Cochrane Database Syst Rev.* (4):CD003817.

