

# Functional Exercise Capacity and Quality of Life in Type II Diabetes Mellitus Patients

AMARICAI Elena<sup>1</sup>

<sup>1</sup>Department of Rehabilitation, Physical Medicine and Rheumatology,  
„Victor Babes” University of Medicine and Pharmacy, Timisoara (ROMANIA)  
E-mail: amaricai.elena@umft.ro



DOAJ  
DIRECTORY OF  
OPEN ACCESS  
JOURNALS



Balneo Research Journal

DOI: <http://dx.doi.org/10.12680/balneo.2020.330>

Vol.11, No.2, May 2020

p: 145–148

1.

## Abstract

Assessment of physical capacity is of much interest in people with diabetes mellitus in order to correctly prescribe an exercise program for these patients. Therefore, the aim of this study was to assess the functional exercise capacity and the quality of life in a sample of patients with type II diabetes mellitus.

For this cross-sectional study, 20 consecutive type II diabetic women and 20 age and sex matched healthy controls were recruited. The physical capacity was assessed using the 6-minute walk test (6MWT). There were no significant differences between groups in terms of anthropometric characteristics. Mean age in patients' group was  $62.35 \pm 5.21$  years and in control group  $61.82 \pm 4.89$  years. In the 6MWT, the distance covered by the diabetic patients was  $498.56 \pm 58.3$  meters, significantly shorter than that covered by the control group ( $601.34 \pm 42.5$  meters) ( $p < 0.05$ ). The AQoL-4D scores were significantly lower in patients' group compared to controls ( $0.297 \pm 0.089$  vs  $0.778 \pm 0.091$ ). The functional exercise capacity and the quality of life are reduced in patients with type II diabetes mellitus compared to healthy controls.

**Key words:** functional exercise capacity, type II diabetes, 6MWT,

## Introduction

The prevalence of diabetes mellitus is relatively high in the adult population, being an important cause of death in developed countries (1,2). The diabetes symptoms and complications negatively affect the patients quality of life, the physical function, leading to deconditioning and deterioration of overall health status (physical and emotional) (2,3). The exact causes of reduced physical fitness and exercise capacity are unknown. The associated cardiovascular diseases and dysfunctions, accentuated by the chronic low-level inflammation (with increased inflammatory markers such as interleukin-10, 18, tumor-necrosis factor-alpha, adiponectin), overweight and obesity, poor glycemic control, associated with high levels of physical inactivity are some of the factors responsible for the low exercise tolerance and capacity in patients with diabetes mellitus (1,4–9). The decreased lower limb muscular strength and impaired mobility also play an important role in the lower functional capacity, which influences the health-related quality of life in diabetes mellitus patients (10).

The impact of diabetes on the health-related quality of life has been studied and patients with type 2 diabetes mellitus has been shown to have a lower quality of life (11,12). Assessment of physical capacity is of much interest in people with diabetes

mellitus in order to correctly prescribe an exercise program for these patients and to improve the quality of life. Therefore, the aim of this study was to assess the functional exercise capacity and the quality of life in a sample of patients with type 2 diabetes mellitus.

## Material and method

For this cross-sectional study, 20 consecutive type II diabetic women and 20 age and sex matched healthy controls were recruited. The inclusion criteria were aged 50 to 70 years, diagnosis of type II diabetes for at least two years, under a pharmacological regimen stabilized for at least five months, living independently. Patients presenting diabetes peripheral neuropathy or severe musculoskeletal disorders were not included.

The physical capacity was assessed using the 6-minute walk test (6MWT). The test was performed on a 30-meter straight corridor with no obstacle, according to the American Thoracic Society protocol (13). The patients walked on a self-selected speed. The distance walked in 6 minutes was recorded. The oxygen saturation was also recorded.

The quality of life was assessed with the Assessment of quality of Life (AQoL)-4D questionnaire. This questionnaire evaluates four dimensions of the health-related quality of life – independent living,

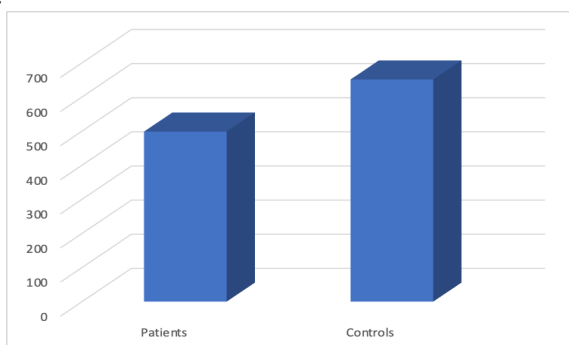
social relationship, physical senses and psychological well-being. The score is ranging from -0.04 (worst possible quality of life) to 1 (full quality of life) (14,15).

The statistical analysis was performed with the MedCalc software. Data were compared between groups, using the Student t-test. The statistical significance was set at  $p < 0.05$ .

### Results

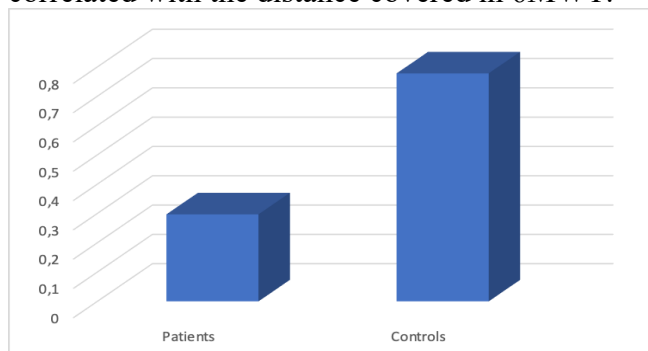
There were no significant differences between groups in terms of anthropometric characteristics. Mean age in patients' group was  $62.35 \pm 5.21$  years and in control group  $61.82 \pm 4.89$  years. All participants were overweight with a mean BMI of  $28.87 \pm 3.1$   $\text{kg/m}^2$  in patients' group and  $27.23 \pm 4.2$   $\text{kg/m}^2$  in control group.

All participants performed the 6MWT. None of the women evaluated in this study accused any symptoms that could interfere with the test's results (chest pain, dyspnoea, leg pain or cramps). The distance covered by the diabetic patients was  $498.56 \pm 58.3$  meters, significantly shorter than that covered by the control group -  $651.34 \pm 42.5$  meters ( $p < 0.05$ ) (Figure 1). No significant reduction in oxygen saturation was recorded during and after the test.



**Figure 1. The 6MWT results for patients and controls**

The AQoL-4D scores were significantly lower in patients' group compared to controls ( $0.297 \pm 0.089$  vs  $0.778 \pm 0.091$ ) (Figure 2) and were significantly correlated with the distance covered in 6MWT.



**Figure 2. The quality of life results for patients and controls assessed with AQoL-4D questionnaire**

### Discussion

The aim of the present study was to assess de functional exercise capacity in a sample of patients with type II diabetes mellitus. The results demonstrated a significantly lower functional exercise capacity in diabetic patients compared to healthy age matched controls.

The six-minute walk test is reliable easy-to use test recommended to evaluate the physical function and walking endurance in different adult population with a wide variety of cardio-pulmonary diseases (16–18). The previous studies that used the 6MWT to assess the physical capacity found significant lower distances covered by the patients with diabetes mellitus compared to controls. Kuziemski et al showed that diabetes patients had a 109 m shorter distance covered during the 6MWT than the healthy controls, as well as a pulmonary function (19). Awotidebe et al also found that patients with type II diabetes demonstrated lower functional exercise capacity than healthy controls (20). Similar results were also found by other authors (21–23).

Our results showed a lower quality of life in patients with diabetes mellitus compared to controls, as assessed by the AQoL-4D questionnaire. Similar results were reported in previous studies, a poorer quality of life being associated with adverse outcomes, like disease progression, low response to therapy, mortality (24–26). Health-related quality of life is an important outcome in patients with chronic diseases, assessing multiple domains like physical and mental health, social functioning (27–29).

The functional exercise capacity should be tested in all diabetes patients, with or without cardiovascular associated diseases or complications. Along with the tests used for the exercise capacity testing, balance and muscular strength assessments should also be performed in people with diabetes mellitus (20,30–32). All these will allow a better, individualised exercise programme prescription. Participating in regularly exercise programmes has been proved to have beneficial health effects in all categories of population, younger and older, with metabolic, cardiovascular or musculoskeletal disorders, improving the quality of life and decreasing the mortality (1,33–36).

The limitations of the present study should be noted. The study sample comprised a relatively small number of female patients and this aspect could limit the generalizability of our findings to male diabetes mellitus patients, or to other age groups.

## Conclusion

The functional exercise capacity and the quality of life are reduced in patients with type II diabetes mellitus compared to healthy controls. Further studies are needed to identify the risk factors for the low functional capacity in order to improve the quality of life in diabetic patients.

## REFERENCES

1. Awotidebe TO, Adedoyin RA, Oke KI, Ativie RN, Opiyo R, Ikujeysi EO, et al. Relationship between functional capacity and health-related quality of life of patients with type—2 diabetes. *Diabetes Metab Syndr Clin Res Rev.* 2017;11: 1–5. doi:10.1016/j.dsx.2016.06.004
2. Pah AM, Bucuras P, Buleu F, Tudor A, Iurciuc S, Velimirovici D, et al. The importance of DS-14 and HADS questionnaires in quantifying psychological stress in type 2 diabetes mellitus. *Med.* 2019;55: 569. doi:10.3390/medicina55090569
3. Grandy S, Chapman RH, Fox KM. Quality of life and depression of people living with type 2 diabetes mellitus and those at low and high risk for type 2 diabetes: Findings from the Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes (SHIELD). *Int J Clin Pract.* 2008;62: 562–568. doi:10.1111/j.1742-1241.2008.01703.x
4. Liu S, Tinker L, Song Y, Rifai N, Bonds DE, Cook NR, et al. A prospective study of inflammatory cytokines and diabetes mellitus in a multiethnic cohort of postmenopausal women. *Arch Intern Med.* 2007;167: 1676–1685. doi:10.1001/archinte.167.15.1676
5. Kritchevsky SB, Cesari M, Pahor M. Inflammatory markers and cardiovascular health in older adults. *Cardiovasc Res.* 2005;66: 265–275. doi:10.1016/j.cardiores.2004.12.026
6. Gobjila C, Craina ML, Toader DO, Petre I, Andor CB, Tudor A, et al. Pro-inflammatory Cytokines (IL6, IL8 and TNF-a) in the Evaluation of Ovarian Endometriosis Cyst. *Rev Chim.* 2019;70: 2944–2847.
7. Spranger J, Kroke A, Mo M, Hoffmann K, Bergmann MM. Inflammatory Cytokines and the Risk to Develop Type 2 Diabetes. *Diabetes.* 2003;52: 813.
8. Mendes R, Sousa N, Themudo-Barata J, Reis V. Impact of a community-based exercise programme on physical fitness in middle-aged and older patients with type 2 diabetes. *Gac Sanit.* 2016;30: 215–220. doi:10.1016/j.gaceta.2016.01.007
9. Buleu F, Sirbu E, Caraba A, Dragan S. Heart involvement in inflammatory rheumatic diseases: A systematic literature review. *Med.* 2019;55: 249. doi:10.3390/medicina55060249
10. Alfonso-Rosa RM, Del Pozo-Cruz B, Del Pozo-Cruz J, Del Pozo-Cruz JT, Sañudo B. The relationship between nutritional status, functional capacity, and health-related quality of life in older adults with type 2 diabetes: A pilot explanatory study. *J Nutr Heal Aging.* 2013;17: 315. doi:10.1007/s12603-013-0028-5
11. Glasgow RE, Ruggiero L, Eakin EG, Dryfoos J, Chobanian L. Quality of life and associated characteristics in a large national sample of adults with diabetes. *Diabetes Care.* 1997;20: 562–567. doi:10.2337/diacare.20.4.562
12. AL-Aboudi IS, Hassali MA, Shafie AA, Hassan A, Alrasheedy AA. A cross-sectional assessment of health-related quality of life among type 2 diabetes patients in Riyadh, Saudi Arabia. *SAGE Open Med.* 2015;3: 2050312115610129. doi:10.1177/2050312115610129
13. ATS Statement. *Am J Respir Crit Care Med.* 2002;166: 111–117. doi:10.1164/ajrccm.166.1.at1102
14. Hawthorne G, Richardson J, Osborne R. The Assessment of Quality of Life (AQoL) instrument: A psychometric measure of health-related quality of life. *Qual Life Res.* 1999;8: 209–224. doi:10.1023/A:1008815005736
15. <https://www.aqol.com.au/index.php/aqolquestionnaires?id=54>
16. Jakicic JM, King WC, Gibbs BB, Rogers RJ, Rickman AD, Davis KK, et al. Objective Versus Self-Reported Physical Activity in Overweight and Obese Young Adults. *J Phys Act Heal.* 2015;12: 1394–1400. doi:10.1123/jpah.2014-0277
17. Tinius RA, Blankenship M, Maples JM, Pitts BC, Furgal K, Norris ES, et al. Validity of the 6-Minute Walk Test and YMCA Submaximal Cycle Test During Midpregnancy. *J Strength Cond Res.* 2019;Publish Ah. doi:10.1519/JSC.0000000000003263
18. Beriault K, Carpentier AC, Gagnon C, Ménard J, Baillargeon JP, Ardilouze JL, et al. Reproducibility of the 6-minute walk test in obese adults. *Int J Sports Med.* 2009;30: 725–727. doi:10.1055/s-0029-1231043
19. Kuziemski K, Słomiński W, Jassem E. Impact of diabetes mellitus on functional exercise capacity

- and pulmonary functions in patients with diabetes and healthy persons. *BMC Endocr Disord.* 2019;19: 2. doi:10.1186/s12902-018-0328-1
20. Awotidebe TO, Adedoyin RA, Yusuf AO, Mbada CE, Opiyo R, Maseko FC. Comparative functional exercise capacity of patients with type 2-diabetes and healthy controls: A case control study. *Pan Afr Med J.* 2014;19: 257. doi:10.11604/pamj.2014.19.257.4798
  21. Senefeld JW, D'Astice SE, Harmer AR, Hunter SK. Increased Cardiovascular Response to a 6-Minute Walk Test in People With Type 2 Diabetes. *Diabetes Spectr.* 2019; ds190002. doi:10.2337/ds19-0002
  22. Janevic MR, Janz NK, Connell CM, Kaciroti N, Clark NM. Progression of symptoms and functioning among female cardiac patients with and without diabetes. *J Women's Heal.* 2011;20: 107–115. doi:10.1089/jwh.2010.2123
  23. Tuttle LJ, Sinacore DR, Cade WT, Mueller MJ. Lower Physical Activity Is Associated With Higher Intermuscular Adipose Tissue in People With Type 2 Diabetes and Peripheral Neuropathy. *Phys Ther.* 2011;91: 923–930. doi:10.2522/ptj.20100329
  24. McEwen LN, Kim C, Haan MN, Ghosh D, Lantz PM, Thompson TJ, et al. Are health-related quality-of-life and self-rated health associated with mortality? Insights from Translating Research Into Action for Diabetes (TRIAD). *Prim Care Diabetes.* 2009/03/09. 2009;3: 37–42. doi:10.1016/j.pcd.2009.01.001
  25. Landman GWD, van Hateren KJJ, Kleefstra N, Groenier KH, Gans ROB, Bilo HJG. Health-related quality of life and mortality in a general and elderly population of patients with type 2 diabetes (ZODIAC-18). *Diabetes Care.* 2010/08/30. 2010;33: 2378–2382. doi:10.2337/dc10-0979
  26. Adriaanse MC, Drewes HW, van der Heide I, Struijs JN, Baan CA. The impact of comorbid chronic conditions on quality of life in type 2 diabetes patients. *Qual Life Res.* 2016;25: 175–182. doi:10.1007/s11136-015-1061-0
  27. Megari K. Quality of Life in Chronic Disease Patients. *Heal Psychol Res.* 2013;1: e27–e27. doi:10.4081/hpr.2013.e27
  28. Cevei M, Onofrei RR, Cioara F, Stoicanescu D. Correlations between the Quality of Life Domains and Clinical Variables in Sarcopenic Osteoporotic Postmenopausal Women. *J Clin Med.* 2020;9: 441. doi:10.3390/jcm9020441
  29. Todor A, Vermesan D, Haragus H, Patrascu Jr JM, Timar B, Cosma DI. Cross-cultural adaptation and validation of the Romanian International Knee Documentation Committee-subjective knee form. *PeerJ.* 2020;8: e8448–e8448. doi:10.7717/peerj.8448
  30. Stewart T, Caffrey DG, Gilman RH, Mathai SC, Lerner A, Hernandez A, et al. Can a simple test of functional capacity add to the clinical assessment of diabetes? *Diabet Med.* 2016;33: 1133–1139. doi:10.1111/dme.13032
  31. Muşat A, Popa Z, Craina M-L, Onofrei R, Ramona, Luca CT, et al. Identification Of Postural Changes During Pregnancy By Using Baropodometry - Case Presentation. In: Anastasiu D, Craina M, Hudita D, Russu M, editors. *The XV Conference of the Romanian-German Society of Obstetrics and Gynecology, Timisoara, 6-8 June 2019.* Timisoara: Filodiritto Publisher - International Proceedings; 2019. pp. 329–332. doi:ISBN 978-88-85813-76-2
  32. Chiriac VD, Craina ML, Stelea L, Onofrei RR, Radu D, Stoian D, et al. Physical Activity Level and Functional Status in Postmenopausal Women with Knee Osteoarthritis. In: Anastasiu D, Craina M, Hudita D, Russu M, editors. *The XV Conference of the Romanian-German Society of Obstetrics and Gynecology, Timisoara, 6-8 June 2019.* Timisoara: Filodiritto Publisher - International Proceedings; 2019. pp. 542–545. doi:ISBN 978-88-85813-76-2
  33. Church TS, Cheng YJ, Earnest CP, Barlow CE, Gibbons LW, Priest EL, et al. Exercise Capacity and Body Composition As Predictors of Mortality among Men with Diabetes. *Diabetes Care.* 2004;27: 83–88. doi:10.2337/diacare.27.1.83
  34. Nemes D, Catan L, Poenaru D, Dragoi M, Amaricai E, Popa D, et al. Life quality in patients with type III ankylosing spondylitis and secondary seronegative spondylarthropathies. *Proceedings of 6th World Congress of the International-Society-of-Physical-and-Rehabilitation-Medicine (ISPRM).* Edizioni Minerva Medica; 2011. pp. 9–11. doi:ISBN 978-88-7711-616-1
  35. Cevei M, Stoicanescu DC. Beneficial effects of exercise in postmenopausal osteoporosis. *Bone.* 2011;48: S2017–S208.
  36. Iurciuc S, Vlad A, Iurciuc M, Avram A, Cioraca G, Avram C, et al. Risk factor and lifestyle changes in high risk patients: PP.23.442. *J Hypertens.* 2010;28: E377–E378.