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Reliability of the Turkish Short Version of Activites-spesific Balance Confidence Scale in Patients with Diabetes Mellitus

Diabetes Mellitus Tanılı Hastalarda Aktiviteye Özel Denge Güven Ölçeği'nin Türkçe Kısa Versiyonunun Güvenilirliği

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ABSTRACT Objective: The Activity-Specific Balance Confidence (ABC) Scale is a useful test for assessing functional balance. Diabetic patients have balance disorders. The aim was to study the reliability of the Turkish version of the ABC short form (ABC-T6) in patients with diabetes mellitus (DM). **Material and Methods:** Thirty patients with Type II DM were examined and accepted into this study. All participants were assessed using the Turkish version of the ABC Test (ABC-T16) and ABC-T6. The Timed Go and Go (TUG) test was performed to assess mobility. The Cumulative Ilness Rating Scale (CIRS) was used to assess the number of system problems. **Results:** The mean age was 61.2±8.1 years. Eighty percent of the patients are women. The mean ABC-T6 score was 67.18±26.50. The mean duration of the TUG test was 10.3±2.7 (seconds). The average CIRS score was 6.4±3.5. The average intraclass correlation coefficient with 95% confidence interval for the ABC-T6 scale was 0.928. There was a statistically significant positive correlation between ABC-T16 and ABC-T6 ($p<0.05$). ABC-T6 showed a significant positive correlation with TUG. In contrast, ABC-T6 was negatively correlated with age, body mass index, and CIRS. **Conclusion:** ABC-T6 is a simple and reliable test to study activity-related balance in patients with type II diabetes. Activity-specific balance reliability is linked to the movement state.

Keywords: Postural balance; diabetes mellitus

ÖZET Amaç: Aktiviteye Özel Denge Güven Ölçeği [Activity-Specific Balance Confidence (ABC)], fonksiyonel dengeyi değerlendirmek için yararlı bir testtir. Diyabet hastalarında denge bozuklukları normal popülasyona oranla daha sık görülür. Bu çalışmada klinik pratikte kullanımı daha kolay olan ABC kısa formunun Türkçe versiyonunun (ABC-T6) diyabetli (DM) hastalarda güvenilirliğinin araştırılması amaçlandı. **Gereç ve Yöntemler:** Tip II DM'li 30 hasta değerlendirilerek çalışmaya kabul edildi. Tüm katılımcılar Aktiviteye Özel Denge Güven Testi [ABC Test (ABC-T16)] ve ABC-6'nın Türkçe versiyonu (ABC-T6) formlarını doldurdu. Hareketliliği değerlendirmek için Zamanlı Kalkıp ve Yürüme testi [Timed Go and Go (TUG)] yapıldı. Hastaların diyabet ve diğer vücut sistem hastalıkları ile ilgili sorunlarının sayısını değerlendirmek için Kümülatif Hastalık Derecelendirme Ölçeği [Cumulative Ilness Rating Scale (CIRS)] kullanıldı. **Bulgular:** Ortalama yaş 61,2±8,1 yıldı. Hastaların %80'i kadındı. Ortalama ABC-T6 puanı 67,18±26,50 idi. TUG testinin ortalama süresi 10,3±2,7 (sn) idi. Ortalama CIRS puanı 6,4±3,5 idi. ABC-T6 ölçeği için %95 güven aralığı ile ortalama sınıf içi korelasyon katsayısı 0,928 idi. ABC-T16 ile ABC-T6 arasında istatistiksel olarak anlamlı pozitif korelasyon vardır ($p<0.05$). ABC-T6, TUG ile anlamlı bir pozitif korelasyon gösterdi. Buna karşılık ABC-T6 yaş, beden kitle indeksi ve CIRS ile negatif korelasyon gösterdi. **Sonuç:** ABC-T6, tip II diyabetli hastalarda aktiviteye bağlı dengeyi incelemek için basit ve güvenilir bir testtir. Aktiviteye özel denge güvenilirliği hareket durumuyla bağlantılıdır.

Anahtar Kelimeler: Postüral denge; diyabet

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Diabetes mellitus (DM) is a chronic disease that affects many body systems and functions. Cardiovascular disease, diabetic retinopathy, nephropathy, and neuropathy are frequent complications of the disease. Because of diabetic retinopathy and/or neuropathy, balance and coordination disorders can be

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seen. Eventually, patients with diabetes are at increased risk of falls.[1-4] A previous study found an increased risk of falls in elderly patients with diabetes. Additionally, this study found that patients treated with insulin had a higher risk of falls compared with patients treated without insulin.[2] Widely known risk factors for falls include balance disorders, reduced gait speed, peripheral neuropathy, as well as lower extremity pain, being overweight, and increased comorbidities in patients over 50 years of age and older (≥50 years old) with type II diabetes.[3] Various tests may be used to evaluate balance confidence in people with type II diabetes. These include the Dynamic Balance Test, balance walk, tandem and unipedal stance, Functional Reach Test, Clinical Test of Sensory Interaction and Balance, Berg Balance Scale, Tinetti Performance-Oriented Mobility Assessment, Activity-Specific Balance Confidence Scale (ABC), Timed Up and Go (TUG) test, and the Dynamic Gait Index.[5]

The ABC is a self-assessment tool to assess functional balance and fall risk in older adults with active lifestyles.[6,7] Maintaining balance is a complex process involving several systems, although balancing tests often cannot measure the state of all functionally relevant systems. Additionally, tedious testing poses challenges to clinical practice. The validity and reliability of the Turkish version of the 16-item ABC scale (ABC-T16) were studied in both patients with knee osteoarthritis and unilateral peripheral vestibular disease.[8,9] Furthermore, the short version of the 6-item ABC scale (ABC-T6) has been studied across different diseases and in different languages.[1,10-16] ABC-T6 is valuable for showing balance confidence and advantageous for clinical practice because it can be completed in a short time. Although the patients with DM have increased fall risk, according to our knowledge, there is only one study that investigated the validity of ABC-6 in a limited number of participants. Therefore, the purpose of this study was both to investigate the reliability of the ABC-T6 and also the factors correlated with balance confidence in patients with type II DM.

MATERIAL AND METHODS

Thirty patients with type II DM admitted to the outpatient clinic of our rehabilitation hospital from March 2020 to December 2021 were included in this study. Inclusion criteria were being 40-75 years, having type II DM for at least 1 year and using antidiabetic agents. The exclusion criteria were ambulating with a mobility aid, having lower extremity joint replacements or amputations, or neurological disorders such as Parkinson's disease, stroke, multiple sclerosis, lower-limb arthritis or amputations, as well as any other conditions that affect balance. All participants were assessed using the ABC-T16, ABC-T6, and TUG tests. The Cumulative Illness Rating Scale (CIRS) was used to assess system involvement. Glycated hemoglobin (HbA1c) values in the past 3 months were recorded from the patient records. This study was approved by the Ethics Committee of the SBU Sadi Konuk Training Hospital. Informed consent was obtained from the participants.

In this study, according to the calculations made using power analysis (G*Power software latest version 3.1.9.7; Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany), considering the Cronbach alpha value of 0.97 and the interclass correlation coefficient of 0.95 in our previous study, it was seen that at least 26 participants were needed to reach a high effect size (f^2=0.5), a significance level of 0.05 and a power level of 0.80.[8] Therefore, 30 patients were included in this study.[17,18]

ABC SCALE

The ABC scale is a 16-item self-assessment test that evaluates both balance disorders and fall risk. The scale also measures an individual's level of confidence in certain activities, both indoors and outdoors. The total score varies between 0 and 100.[6] Maintaining balance is related to the functional status of the elderly. An ABC score below 50 indicates low-level functionality, above 80 indicates high-level functionality, and values between 50 and 80 indicate medium-level functionality.[7]

TUG

The TUG test evaluates walking speed and balance. In community-dwelling older adults, completing the TUG test in more than 12 seconds has been associated with an increased risk of falling.[19] This test is known for its simplicity and reliability.[20] For the test, the patient is

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asked to stand up from his seat without holding the armrest of the chair, walk 3 meters, turn around and walk again and sit on the same chair. The duration of each trial was recorded using a stopwatch, and the test is repeated 3 times. The average of these measurements is taken to determine the average TUG value.[21]

CIRS

The CIRS scale, developed by Miller and colleagues to classify comorbid diseases, has been modified to examine problems involving 14 systems, including cardiovascular, hematological, respiratory, ophthalmological and otorhinolaryngological ENT, upper and lower digestive tract, liver and pancreas, renal, urological, musculoskeletal systems and dermatological, neurological, endocrine, metabolic, breast and psychiatric diseases.[22] Higher scores indicate serious problems with comorbid diseases.

STATISTICAL ANALYSIS

Normality was examined using the Shapiro-Wilk test. Depending on the normality of the data, the quantitative data were given as either the median (interquartile range) or as the arithmetic mean and standard deviation. Categorical data are summarized as frequency (percentage). The Spearman rank correlation coefficients were calculated for the comparison of ABC-T6, ABC-T16, and TUG. Intraclass correlation coefficient (ICC) estimates and their 95% confident intervals were calculated using a single-rating, consistency, 2-way mixed-effects model. Values less than 0.5 are indicative of poor reliability, values between 0.5 and 0.75 indicate moderate reliability, values between 0.75 and 0.9 indicate good reliability, and values greater than 0.90 indicate excellent reliability.[23] The statistical significance was set at $p<0.05$. Data management was performed using the PASW Statistics for Windows, Version 18.0 (SPSS Inc, Armonk, NY, USA).

ETHICS COMMITTEE APPROVAL

Ethics committee approval was obtained from the Bakırköy Dr. Sadi Konuk Training and Research Hospital (date: June 11, 2018, no: 2018-211) and that it conforms to the provisions of the Declaration of Helsinki. The participants to be included in the study were informed before the survey, and a consent form was signed.

RESULTS

Demographic and clinical characteristics are shown in Table 1. Of the patients, 22 (80%) were female and 8 (20%) were male. Also, 22 patients (80%) were married, and 29 patients (96.7%) lived in a city. A momentous larger part, 92.9% of patients had at least one additional disease. The mean TUG score was 10.3±2.7 seconds with a run of 6.26 to 19 seconds. Four patients (13.3%) reported at least 1 fall within the past year, and 80% of the patients complained of pain in the lower extremities. The ABC-T6, ABC-T16, and TUG scores are summarized in Table 1. The single rater test-retest reliability for the ABC-T6 scale was great to excellent. The ICC coefficient with 95% confidence interval (CI) for the ABC-T6 scale was 0.928 (0.855-0.965) (Table 2). The results of the Spearman test revealed a statistically significant positive relationship between ABC-T6 and ABC-T16 ($r=0.961$ $p<0.001$). There was a statistically significant negative relationship between ABC-T6 and the TUG test ($r=-0.537$ $p<0.01$) (Table 3).

DISCUSSION

In this study, ICC coefficient scores for ABC-T6 were extended from 0.855 to 0.965 inside a CI with

TABLE 1: Demographic and clinical characteristics and ABC-T6, ABC-T16 and TUG test scores

	$\bar{X}$±SD	Minimum	Maximum
Age (years)	61.2±8.8	44	75
Height (cm)	160±10	150	172
Weight (kg)	82.9±13.8	60	120
BMI (kg/m^2)	32.3±5.8	23.73	45.72
DM duration (months)	129.1±86.3	12	420
FPG (mg/dl)	153.4±51.4	76	300
HbA1c (%)	7.6±1.5	5.2	11.1
CIRS	6.4±3.5	2	15
ABC-T6	67.18±26.50	5.00	100.00
ABC-T16	78.16±20.39	12.50	100.00
TUG test(sec)	10.3±2.7	6.26	19

SD: Standard deviation; ABC-T6: 6-item Activity-Specific Balance Confidence scale; ABC-T16: 16-item Activity-Specific Balance Confidence scale; TUG: Timed Up and Go Test; BMI: Body mass index; DM: diabetes mellitus; FPG: Fasting plasma glucose; HbA1c: Glycated hemoglobin; CIRS: Cumulative Illness Rating Scale

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TABLE 2: ICC between the ABC-T6 and ABC-T16 scales

		95% Confidence interval		F test with true value 0			
	ICC	Lower bound	Upper bound	Value	df1	df2	Sig
Single measures	0.928	0.855	0.965	26.828	29	29	**0.0001**

ICC: Intraclass correlation coefficient, df: degrees of freedom, Sig: p value

TABLE 3: Spearman's rho correlation analysis between the ABC-T16, ABC-T6, FAS and TUG tests.

	ABC-T16	TUG (sn)	FAS	Age (year)	CIRS scores	BMI (kg/cm^2)
Correlation coefficient	0.961**	-0.537*	0.311	-0.405*	-0.475**	-0.607**
Sig. (2-tailed)	**0.0001**	**0.002**	0.094	**0.026**	**0.008**	**0.001**
Correlation coefficient		-0.507	0.311	-0.358	-0.414*	-0.620**
Sig. (2-tailed)		**0.004**	0.094	0.052	**0.023**	**0.001**

*Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed); ABC-T16: 16-item Activity-Specific Balance Confidence scale; ABC-T6: 6-item Activity-Specific Balance Confidence scale; Sig: significance; FAS: Functional Ambulation Scale; TUG: Timed Up and Go Test; BMI: Body mass index

a mean ICC of 0.928 among patients with DM. ABC-6 has been detailed as reliable for measuring balance confidence by past studies performed at different populaces and distinctive disorders.[10-14,16,24] Moreover, a strong relationship was found between ABC and ABC-6 in patients with or without DM in a prior study (r=0.969; p<0.001).[1]

According to Wood et al, patients with multiple sclerosis showed good internal consistency on the ABC-16 and ABC-6 scales, with Cronbach alpha values ranging from 0.832 to 0.975.[14] Additionally, they provided ICC scores, which ranged from 0.888 to 0.941 and showed good reliability. In another study, ABC-6 exhibited excellent test-retest reliability (ICC=0.964, 95% CI: 0.947-0.977) and internal validity (Cronbach α=0.938) in the elderly living in the community.[11] The Chinese and German versions of ABC-6 have been shown to have good validity for the elderly people's balance confidence in previous studies.[12,13] Moreover, the ABC-6 was found to be a valid and reliable scale by Schepens et al and Ishige et al for assessing balance confidence in elderly people living in the community and stroke patients, respectively, with noteworthy ICC and Cronbach alpha values.[10,11] Both of the ABC-6 Japanese and German versions demonstrated strong internal consistency and test-retest reliability, and the Brazilian versions were found to be reliable and valid for investigating balance confidence in the elderly.[11,12,16] In patients with vestibular pathology, ABC-6 demonstrated adequate psychometric properties for assessing balance confidence and fall risk.[16]

The reliability and validity of the Turkish version of ABC with 16 items has been studied in 49 patients>45 years who have symptomatic knee osteoarthritis.[8] In that previous study, the correlation coefficient was found to be high (p=0.001, r=0.953) and Cronbach alpha was found to be 0.97. The authors reported that ABC-T16 had excellent internal consistency and construct validity in patients with knee osteoarthritis.

One of the important findings of this study was that ABC-T6 shown a significant negative correlation with mobility as measured by the TUG test. This aligns with the findings of Hewston et al, where a significant correlation between ABC-6 and mobility in diabetic patients (r=-0.520; p=0.027) was reported.[1] Further research on elderly people has shown a strong relationship between ABC-6 and key factors such as balance and mobility, physical activity, physical fitness, cognition, and quality of life (-0.698<r< 0.720).[12] Ishige et al. also found ABC-6 to be associated with mobility in people with stroke.[11] In this study, significant negative correlations between ABC-T6 and age, BMI, and number of comorbidities (p<0.05) were determined.

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This study has some strengthful aspects besides some limitations. The strengthful side is performing all the assessments by the same investigator with face-to-face interviews. Besides, our study has some limitations. First, the patients with diabetic neuropathy are not differentiated. Furthermore, falling history was not evaluated in this study.

CONCLUSION

The strength of this study lies in its novelty, as it is among the very few studies measuring balance confidence in patients with DM. Conducting the study face to face and considering the systems affected by DM also enhance the credibility of our study. However, the exclusion of drugs used in the treatment of type II DM from the analysis is a limitation. The other limitation of the study is the relatively small sample size.

In conclusion, this study verifies the high reliability of ABC-in patients with type II DM and highlights its inverse correlation with mobility.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

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