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ORIGINAL ARTICLE

Analysis of Dynamic Postural Stability through Y-Balance Test among Patients with Type-II Diabetes Mellitus: An Observational Study

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ABSTRACT

Aim: Different training tests are used to measure and train an individual for improvement in stationary and dynamic postural stability. Y-balance test has been utilized to test the dynamic postural stability among healthy individuals and athletes. Patients suffering from diabetes mellitus due to muscular weakness are prone to have altered dynamic postural stability. The primary objective of this study is to test the dynamic postural stability status of patients with Type-II diabetes mellitus through the Y-balance test.

Methods: This cross-sectional observational investigation was conducted from June 2022 to November 2022 at Shalamar Hospital, Pakistan on 33 participants of both genders between the age group of 45-60 years. of both genders amid the age group of 45-60 years from the Diabetic Institute of Pakistan. A measuring tape was used to measure Y-balance test readings. SPSS software version 22 was used to analyze the results. Mean and standard deviation was calculated and independent and paired t-test were used to compare results.

Results: Out of 33 study participants, 48.5% were male, and 51.5% were female. The findings of this study show that interlimb leg length differences were not noteworthy but both limbs had substantial results in the anterior direction ($P \leq 0.06$). Furthermore, both males and females showed no interlimb differences in leg length in the posteromedial direction, however; females showed greater interlimb differences in the anterior and posterolateral direction ($P \leq 0.05$).

Practical Implication: Reference standards are indispensable for the accurate interpretation of the inspection results. Clinicians would use these normative numbers to institute a patient's performance level. Since YBT enactment differs in diverse cultures, precise YBT reference standards must be recognized.

Conclusions: Dynamic postural stability status of patients with Type-II diabetes mellitus through the Y-balance test showed significant differences appearing in the anterior reach distance than posterolateral and posteromedial reach distances, especially in females.

Keywords: Diabetes Mellitus, Dynamic Postural Stability, Physiotherapy, Physical Therapy, Type II Diabetes Mellitus, Y-Balance Test.

INTRODUCTION

Dynamic postural stability determines the status of balance maintained when a person changes his transition from a dynamic to a static state. It tells us about neuromuscular control and provides information about lower extremity muscular status for decelerating and stabilizing the body's center of gravity.[1] Dynamic stability depends on many factors such as the body's muscular strength, joint stiffness of lower limbs, muscle flexibility, and pelvic stability. Various healthcare providers frequently face lower extremity musculoskeletal dysfunctions.[2] These effects are recognized to have a detrimental effect on one's quality of life. Conferring to the international categories of functioning disability and impairment model of health (ICF), a thorough examination of clinicians must quantify musculoskeletal dysfunctions. The dysfunction includes several aspects of health deterioration of bodily organization and function. Activity and participation restraints are all examples of restrictions.

To test dynamic postural stability different tests are used, for instance, the Y-balance test, star excursion test, as well as modified bass test. Completing a practical assignment, while maintaining one's center of provision is a frequent illustration of dynamic postural constraint. The benefit of evaluating dynamic postural constraint is that it places extra burdens on proprioception, an array of movements, and potency, in addition to the capacity to stay erect and stable. Many examinations have been designed to evaluate dynamic postural constraints in children and the elderly but few adequately accentuate the vigorous balancing abilities of the fit athletic population. The star excursion test and Y-balance tests are two tests that can test a sportsperson's postural control structure.[3] Additionally, patients with foot and ankle disturbed proprioception and peripheral neuropathy feel difficulty in balance. [4] Patients with Type-II diabetes mellitus are more prone to peripheral neuropathy and muscular weakness and consequently suffer balance and gait problems which can ultimately lead to the risk of collapse. The estimated prevalence of diabetes mellitus in Pakistan is 9.8% which is impacted by 10% of males and 9.7% of females.[5-7]

The worldwide prevalence of diabetic neuropathy is 21.3% - 34.5% while the male-female ratio is 1:1.1 which in other words implies that diabetes is further predominant in females (54%) than in males (46%).[8] In patients with Type-II diabetes mellitus due to decreased sensory function of the foot and ankle, a decline in the static and dynamic postural stability performance is noticed.[9] To check the clinical picture of dynamic postural stability in patients with Type-II diabetes mellitus Y-balance test is used. It is an effective and dependable test to appraise neuromuscular dynamic stability in which the reach distance is measured on a positioned platform marked in centimeters in three directions; anterior, posteromedial, and posterolateral.[10]

The Y-balance test (YBT) is a derivative of the Star Excursion Balance Test (SEBT) which is linked to lower-extremity deficits as well as it is an injury predictor. Reference values are essential for the correct understanding of the examination findings when using the YBT in day-to-day medical practice. Clinicians would use these normative numbers to establish a patient's performance level. Since YBT performance varies in different societies, specific YBT reference values must be established.[10] Presently, no reference standards exist for YBT in patients with Type-II diabetes mellitus. Consequently, the objective of this study is to check the dynamic neuromuscular postural stability in patients with Type-II diabetes mellitus.

PATIENTS AND METHODS

This cross-sectional observational investigation was conducted from June 2022 to November 2022 at Shalamar Hospital, Pakistan on 33 participants of both genders between the age group of 45-60

years. These participants were enrolled in the Diabetic Institute of Pakistan. After approval from IRB (letter No. SSAHS-IRB/AL/36/2022), data was collected from the Diabetic Institute of Pakistan. From that center, patients with Type-II diabetes mellitus were recruited based on inclusion and exclusion criteria and purposive sampling was used. The intention and technique of the research were described to the participants and informed consent was sought beforehand.

After signing the consent form, basic demographic details were noted. Then the participants were guided about the test and demonstrated how to perform the Y-balance test. In the Y-balance test, measuring tapes marked in centimeters were placed in anterior, posteromedial, and posterolateral directions on the floor in such a way that each posterior direction is positioned at 135 degrees and the angle between them is 90 degrees. The participants were requested to position on the concurrent point of Y and to move one limb in each direction while balancing the second limb with the knee semi-flexed on the ground. Readings in each direction with each limb were taken at ten-second intervals with the help of measuring tape. The data was collected and analyzed by SPSS version 22. Frequencies were determined for qualitative data whereas mean and standard deviation were computed for quantitative variables.

RESULTS

In the current study, there were a total of 33 patients with Type-II diabetes mellitus of which 16 were male and 17 were female with an age limit of 45-60 years. Table-I reveals that out of 33 study participants, 48.5% were male, and 51.5% were female. The average age of males was 55.19 ± 2.69 and for females was 47.18 ± 6.26. The mean BMI of males was 27.00 ± 2.91 and for females was 27.92 ± 3.23 (Table-II). The interlimb leg length differences were not found to be significant but both limbs had noteworthy results in the anterior direction (Table-III). This means that the anterior reach distance was greater than in the other two directions. Table-IV shows the interlimb leg length variances in the instance of males and females while Table-V shows the correlations among interlimb leg length variances in the instance of males and females.

Table-I: Frequency Distribution Of Study Population

Gender	Frequency	Percentage
Male	16	48.5%
Female	17	51.5%
Total	33	100%

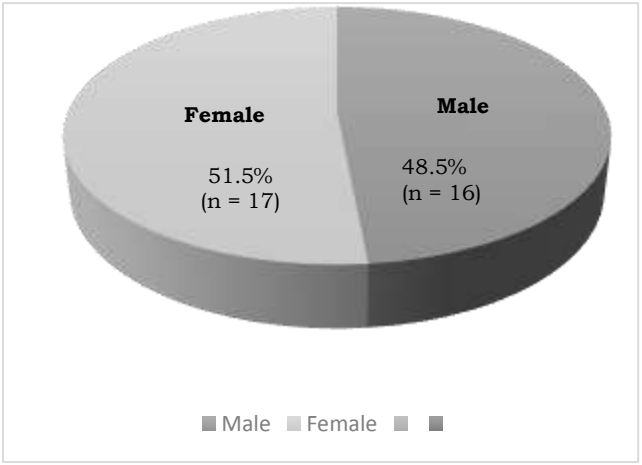

Figure-1: Frequency Distribution Of Study Population As Gender

Table-II: Age & BMI Of Study Population Using Independent Sample T-Test

	Gender	Male	Female	P-Value
	N	16	17	48.5
Age (Years)	Mean	55.19 ± 2.69	47.18 ± 6.26	0.001*
BMI		27.00 ± 2.91	27.92 ± 3.23	0.396

*P is significant at the 0.05 level

Table-III: Interlimb Leg Length Differences Using Paired T-Test

	Left	Right	P-value	Correlation
Leg Length (cm)	81.27 ± 7.11	81.67 ± 7.23	0.266	0.961
Anterior (cm)	57.00 ± 10.62	54.39 ± 6.77	0.064	0.680
Posterolateral (cm)	56.48 ± 11.63	57.70 ± 10.68	0.507	0.569
Posteromedial (cm)	51.03 ± 13.05	49.55 ± 13.50	0.420	0.691
Composite (%LL)	67.06 ± 9.97	65.70 ± 9.78	0.379	0.605

*P is significant at the 0.05 level

Table-IV: Interlimb Leg Length Differences In Gender Using Paired T-Test

	Male			Female		
	Left	Right	P-Value	Left	Right	P-Value
Leg Length (cm)	80.06 ± 61.61	80.69 ± 6.94	0.378	82.41 ± 7.58	82.59 ± 7.58	0.422
Anterior (cm)	54.25 ± 10.07	53.44 ± 6.88	0.642	59.59 ± 10.76	55.29 ± 6.74	0.053
Posterolateral (cm)	55.38 ± 13.12	53.31 ± 11.49	0.515	57.53 ± 10.33	61.82 ± 8.19	0.025*
Posteromedial (cm)	48.94 ± 9.64	46.94 ± 12.06	0.376	53.00 ± 15.65	52.00 ± 14.65	0.737
Composite (%LL)	65.94 ± 10.54	63.38 ± 10.17	0.284	68.12 ± 9.60	67.88 ± 9.16	0.910

*P is significant at the 0.05 level

Table-V: Correlations In Interlimb Leg Length Differences In Gender

Gender			N	Correlation	Sig.
Male	Pair 1	Leg Length Left (Cm) & Leg length right (Cm)	16	0.919	0.000
	Pair 2	Anterior (Cm) and anterior (Cm)	16	0.735	0.001
	Pair 3	Posterolateral (Cm) and Posterolateral (Cm)	16	0.501	0.048
	Pair 4	Posteromedial (Cm) and Posteromedial (Cm)	16	0.695	0.003
	Pair 5	Composite (%LL) and Composite (%LL)	16	0.603	0.013
Female	Pair 1	Leg Length Left (Cm) & Leg length right (Cm)	17	0.993	0.000
	Pair 2	Anterior (Cm) and anterior (Cm)	17	0.619	0.008
	Pair 3	Posterolateral (Cm) and Posterolateral (Cm)	17	0.723	0.001
	Pair 4	Posteromedial (Cm) and Posteromedial (Cm)	17	0.684	0.002
	Pair 5	Composite (%LL) and Composite (%LL)	16	0.596	0.012

DISCUSSION

Patients with Type-II diabetes mellitus have poor dynamic control and are at high risk of fall or lower limb injuries.[11] The Y-balance test (YBT) is linked to lower-extremity deficits and is an injury predictor. Reference values are essential for the correct understanding of the examination findings when using the YBT in day-to-day medical practice.[11] The present study measures the dynamic postural stability status of patients with Type-II diabetes mellitus by the Y-balance test tool while using this tool for the evaluation of dynamic postural stability among healthy individuals and athletes. In the present study, the interlimb leg length between male and females were not found to be significant but noteworthy differences were found in anterior reach distance in both males and females which were seen to be comparatively greater in females. Furthermore, interlimb anterior reach distance and posterolateral reach distance were seen to be significant and relatively greater in females.

In the previous studies carried out, healthy individuals and athletes were subject to perform Y-balance and their study results contradict our study results.[12] These studies employed the Y-Balance test for the lower extremity in young and fit grown people and a comparison was drawn between males and females. The results disclosed that the females displayed no interlimb variances (right versus left) or (dominant versus non-dominant leg) in each course of the YBT, however, males displayed noteworthy interlimb

variances merely in the posteromedial direction.[13] Established on these consequences, reference values were attained for both legs. In both the anterior and posteromedial directions of YBT, males presented improved presentation than females. Furthermore, males were also seen to show improved presentation in the posterolateral direction of YBT.[13]

Another study was conducted using the Y-balance examination score which made an appraisal between pre-season and in-season in early stages sportspersons.[14] This study showed that the Y-test result was considered as an amalgamated total and anterior distance unevenness was computed between the dominant and non-dominant limb. The results of this study disclosed statistically noteworthy variances in the amalgamated total and anterior distance unevenness.[14]

CONCLUSION AND RECOMMENDATIONS

Dynamic postural stability status of patients with Type-II diabetes mellitus through the Y-balance test showed significant differences in anterior reach distance than posterolateral and posteromedial reach distances especially in females. This study has evaluated patients who have poor dynamic control and are at high risk of fall or lower limb injuries and would add to the available literature on dynamic stability testing, particularly among patients with Type-II diabetes mellitus.

Conflict of interest: None
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