LIMITS OF STABILITY USING THE MULTIDIRECTIONAL REACH TEST IN INDIVIDUALS AGED 50–79 YEARS

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DOI: https://doi-doi.org/101555/ijrpa.6590

ABSTRACT

This study examines age-related differences in the limits of stability (LOS) among adults aged 50–79 years using the Multidirectional Reach Test (MDRT). Mean ± SD values for forward, backward, right lateral, and left lateral reaches were extracted for three age groups (50–59, 60–69, 70–79 years). A one-way ANOVA ($df\_between=2$, $df\_within=27$) was conducted to evaluate group differences. Results indicated significant declines in mediolateral reach (right and left) with increasing age, whereas forward and backward reaches did not differ significantly. These findings suggest lateral stability is more susceptible to age-related decline and highlight the clinical utility of MDRT in fall-risk screening.

KEYWORDS: Multidirectional Reach Test; limits of stability; aging; lateral balance; falls.

INTRODUCTION

Maintaining postural stability is a fundamental requirement for performing everyday activities safely and efficiently. As individuals age, the ability to regulate balance and control one's center of mass within the limits of stability diminishes progressively. This decline is multifactorial, resulting from age-related changes in musculoskeletal strength, proprioceptive acuity, visual integration, vestibular processing, and reaction time. Such deterioration contributes significantly to reduced functional mobility and increases the likelihood of falls, which remain a major cause of injury, disability, hospitalization, and loss of independence among older adults.

The Multidirectional Reach Test (MDRT) expands upon the Functional Reach Test by assessing reach in four directions—forward, backward, right lateral, and left lateral—thereby

offering a more comprehensive evaluation of dynamic postural control. This is particularly relevant because real-life balance tasks require multidirectional adjustments, especially during turning, reaching, and side-stepping activities. Although normative MDRT values exist for broad age ranges, balance decline accelerates noticeably after the age of 50. Therefore, analyzing adults aged 50–79 provides targeted information for early detection and intervention. This study isolates the three older adult age groups (50–59, 60–69, 70–79) and reports extracted mean ± SD values and recalculated ANOVA results for these groups.

Methodology

Study Design: Cross-sectional observational study.

Participants: Thirty participants distributed equally across three age groups: 50–59 (n=10), 60–69 (n=10), and 70–79 (n=10).

Inclusion criteria: Individuals having Age 50–79, BMI 18.5–24.9, able to stand independently, and willing to participate.

Exclusion criteria: Individuals with any Neurological disorders, vestibular or visual impairment, recent lower-limb surgery, cardiovascular or metabolic disorders, or medications affecting balance.

Instrumentation: A 100 cm ruler was affixed to a wall at the subject's acromion height. Participants stood barefoot with feet shoulder-width apart and raised the dominant arm to 90° of shoulder flexion. Initial reach at fingertip was recorded. Participants then reached maximally in four directions—forward, backward, right lateral, and left lateral—without stepping. Final reach was recorded and the MDRT score for each direction calculated as the difference between final and initial reach (cm). Each direction was performed three times; the best score was used for analysis.

Procedure followed the protocols illustrated in the following figures.

Figure 1: Forward Reach

Figure 2: Backward Reach
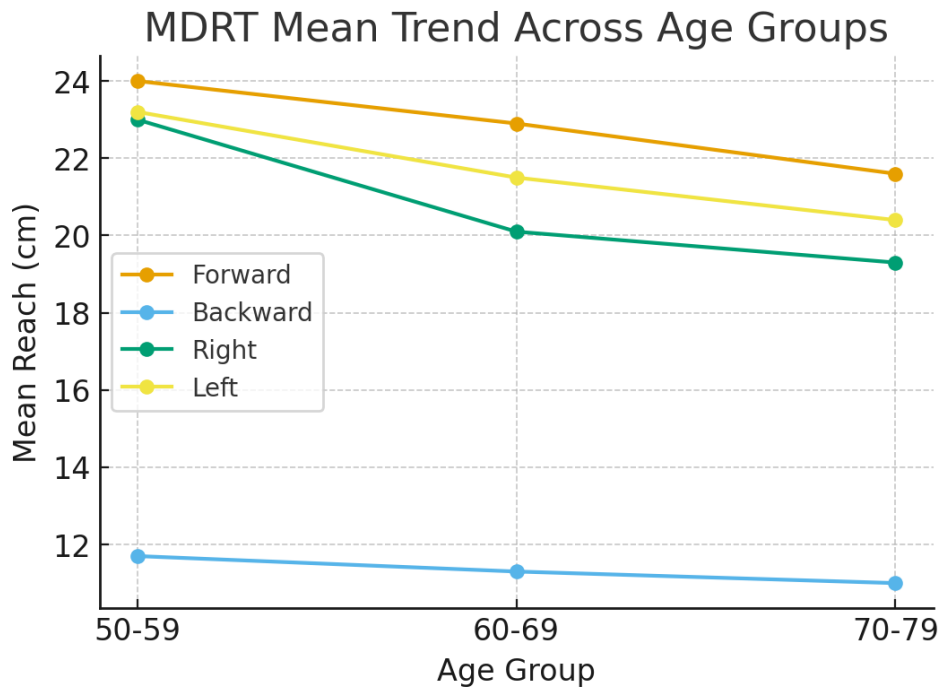
Figure 3. Right Lateral Reach

Figure 4: Left Lateral Reach

RESULTS

One-way ANOVA was conducted with df_between=2 and df_within=27. F-critical (α=0.05) = 3.35.

Direction	50–59	60–69	70–79
Forward	24.0	22.9	21.6
Backward	11.7	11.3	11.0
Right	23.0	20.1	19.3
Left	23.2	21.5	20.4

Direction	F-value	F-critical	Significance
Forward	1.34	3.35	NS
Backward	0.45	3.35	NS
Right	5.05	3.35	Significant
Left	3.51	3.35	Borderline

Figure: MDRT Mean Trend Graph

DISCUSSION

The analysis shows significant age-related declines in lateral reach (both right and left) among adults aged 50–79, while forward and backward reaches did not show statistically significant differences. Lateral declines likely reflect reductions in hip abductor strength, trunk control, and sensory integration that disproportionately affect mediolateral balance strategies. Forward reach advantages may be due to frequent functional use and enhanced visual feedback when leaning anteriorly. Backward reach remained the lowest across directions but did not vary significantly between groups, possibly due to universal biomechanical and perceptual constraints for posterior displacement.

Clinically, these results underscore the importance of including mediolateral balance training—such as side-stepping, hip abductor strengthening, and trunk stability exercises—in fall-prevention programs for older adults. The MDRT, being simple and inexpensive, is practical for routine screening in clinical and community settings.

Limitations: The sample size is modest (n=30), and participants were selected with BMI 18.5–24.9 which may limit generalizability. Future studies should include larger, more diverse samples and examine functional correlates of MDRT performance (e.g., gait speed, TUG).

CONCLUSION

In adults aged 50–79 years, mediolateral stability declines significantly with age, while sagittal-plane reach (forward/backward) remains relatively preserved. MDRT provides an efficient clinical assessment to detect these directional differences and guide targeted interventions to reduce fall risk.

ACKNOWLEDGMENTS

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