

COMPARISON OF MAXIMUM ROTATIONAL SPINE ROM TO SPINAL MOVEMENT REQUIRED DURING SELF-SELECTED TREADMILL JOGGING BETWEEN AGE GROUPS

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Differences in gait parameters during walking and running have been reported with advancing age³, though little is understood of the effects of age on intra-trunk motions during running. Research has shown that spinal mobility, altogether, decreases with advancing age¹; however, the correlation between these decreases and the impact on running activities is less known. Additionally, the correlations between individual spinal segment range of motion (ROM) (cervical, thoracic, lumbar and sacral) and the effects of age are not known for running activities. Normative ROM of different trunk segments and the ROM during running can be essential in prescribing safe physical activities and for rehabilitation post-injury.

Purpose: Compare trunk ROM in the transverse plane during shod running at a self-selected running speed as a percentage of total available rotational ROM between age groups.

Methods: Two adult groups, *younger* (YA: n = 20; 21-40yr; 33.2±4.8yr) and *middle-age* (MA: n = 22; 41-65yr; 54.7±7.8yr), participated (respectively: mass = 68.9±15.4kg, 69.5±12.0kg; height = 1.7±0.1m, 1.7±0.3m; moderate to vigorous physical activity = 7.0±3.4hr/wk, 9.0±10.0hr/wk). Locations of 59 reflective markers in a full body anatomical model were captured (8-camera Vicon system, 120Hz) during participant running at self-selected speeds (respectively: running speed = 2.8±0.3m/s, 2.6±0.4m/s) and during maximal trunk ROM tasks in the transverse plane. Relative angles between adjacent trunk segments (upper [UP]: C7- T8; middle [MID]: T9-T12; lower [LOW]: L1-L5) and pelvis (PEL) were calculated; maximum angular displacements were averaged across 10 strides. ROM in running as a percentage of total available ROM from the rotation trials were compared between groups using MANCOVA ($p < 0.05$; running speed = covariate) and 95% confidence intervals of mean difference (95% CI). Displacements in the 3 planes were compared between groups using MANOVA ($p < 0.05$, 95% CI). Running speeds were compared between groups using an Independent t-test ($p < 0.05$).

Results: No group differences were reported for transverse plane trunk angles in maximum rotation ROM task ($F(3,38) = 1.852$, $p = 0.154$, Power = 0.442) or in running ($F(3,37) = 2.182$, $p = 0.107$, Power = 0.510). YA ran faster than MA (2.779±0.259m/s, 2.565±0.385m/s, respectively, $p = 0.042$).

Conclusion: Results depict no significant trunk movement differences for running or total ROM between age groups in the rotational plane. Despite existing literature claiming decreasing spinal ROM in all 3 planes with age^{3,4}, this data shows advancing age to not be a significant factor affecting trunk ROM necessary to perform running activities at self-selected speeds. A potential explanation is our participants being healthy, active individuals. They may not exhibit the structural spinal changes that we expect with advancing age as those expected in a sedentary population, therefore, contributing to the lack of difference between groups. Alternately, running trials at self-selected speeds may not be fast enough to elicit potential age-related changes known to occur at the spine. The overall similarity of percentage trunk movement during running and intersegmental rotational ROM could support the safety and efficacy of running at self-selected paces with advancing age. Further research is warranted to test the findings in older and physically active adults as well.

¹Einkauf D, Gohdes M, Jensen G, Jewell M. Changes in spinal mobility with increasing age in women. *Physical Therapy*. 1987;(67)370-375.

²Schmid S, Bruhin B, Ignasiak D, et al. Spinal kinematics during gait in healthy individuals across different age groups. *Hum Mov Sci*. 2017 Aug;54:73-81.

³Vachalathiti R. An investigation of age-related changes in three-dimensional kinematics of the spine. Unpublished PhD thesis, University of Sydney, Australia, 1994.

⁴Van Herp G, Rowe P, Salter P, Paul J.P. Three-dimensional lumbar spinal kinematics: a study of range of movement in 100 healthy subjects aged 20 to 60+ years. *Rheumatology (Oxford)*. 2000 Dec;39(12):1337-40.