THE EFFECTS OF AGE AND RUNNING SPEED ON ANGULAR DISPLACEMENTS OF THE SPINE DURING TREADMILL RUNNING

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BACKGROUND: Differences and possible limitations in gait during walking and running have been reported in concurrence with advancing age; however, there is a limited amount of literature on truncal movements of individuals while running, and more specifically, across advancing age groups. At maximal running speed, it was expected that those of the older group would experience a decrease in range of motion (ROM) when compared to that of the younger group. These changes may be mediated through differences in total spinal ROM due to degenerative changes, the narrowing of vertebral spacing through fluid loss in intervertebral discs, and muscular weakness caused through sarcopenia, amongst other common changes with aging. In thoracic segments, it is expected that aging may cause deterioration of rib joints which may further limit range of motion.

PURPOSE: The purpose of this study is to determine if advancing age influences decreased motion between truncal segments of the body during treadmill running. Subsequently, this provides information that could be used for further research in running mechanic modifications throughout the aging process.

METHODS: Participants were recruited into 2 groups: young (18-24 years) and middle age (30-50 years) (n = 30, 15/ group; age = 20.8±1.5 yr, 36.1±6.2 yr; mass = 76.2±3.8 kg, 76.6±4.0 kg; height = 1.7±0.3 m, 1.9±0.4m; moderate to vigorous physical activity = 5.4±2.9hr/wk, 5.9±.6hr/wk) respectively. Locations of 24 reflective markers placed on the trunk and the pelvis were captured by a 7-camera Vicon system (120 Hz) during a self-selected maximal treadmill running speed (4.4±0.6m/s, 3.9±0.6 m/s respectively). Relative angles between adjacent trunk segments (upper [UP]: C7 to T8; middle [MID]: T9 to T12; lower [LOW]: L1 to L5; and pelvis [PEL] were calculated; maximum angular displacements were averaged across 10 strides. Displacements in the 3 planes of motion were compared between groups using MANCOVA ($p<0.05$; running speed = covariate), Tukey's HSD posthoc test ($p< 0.05$), and 95% confidence intervals of mean difference (95%CI). Maximal running speeds between the groups were compared using One-way ANOVA ($p<0.05$).

RESULTS: The younger group ran at a faster speed than the older group (p = 0.019; mean difference: 0.54 ± 0.01 m/s) but no significant group differences in the trunk displacements were reported ($F(9,19) = 1.549$, $p = 0.201$, Power= 0.533). Posthoc comparisons showed only reduced Up-Mid trunk displacement in the transverse plane for the old group ($p = 0.05$; mean difference: 6.5°; 95%CI= 0.01°–13.05°).

CONCLUSION: Results depict minimal to no reduction in trunk motions at self-selected

maximal running speeds. One explanation could be that the spinal range of motion observed during treadmill running is less than the individual's total spinal range of motion, implying that running does not require full use of this range. This could explain the lack of difference between age groups, since any changes in full spinal range of motion does not affect an individual's ability to achieve the required ROM to run on a treadmill. However, individuals who maintain appropriate running mechanics should be able to continue exercising without experiencing any biomechanical limitations. Since there is not a perfect running mechanic, modest differences between groups in upper thoracic and cervical segment rotation could be because of inter-participant variability in running technique or skills.

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