INFLUENCE OF AGE AND GENDER ON INTERLIMB ASYMMETRY IN RECREATIONAL RUNNERS

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INTRODUCTION

Although there are numerous health benefits associated with running, the high risk of developing running related injuries is well documented. [1] Previous studies have reported that men and women demonstrate distinctly different biomechanics during running and that older runners use a variety of biomechanical adaptations compared with younger runners. [2,3] It is hypothesized that excessive asymmetry due to biomechanical and anatomical abnormalities contributes to increased risk of injuries, however it is still unclear how age and gender might impact this. [4,5] Symmetry Angle(SA) has been used to quantify the level of bilateral asymmetry within each runner where the value of 0% indicates perfect symmetry and a value of 100% reflects two values that are equal and opposite in magnitude. [6] The purpose of this study was to understand the influence of age and gender on interlimb asymmetry in four distinct demographic groups of recreational runners.

METHODS

A cross-sectional study design was employed. Healthy recreational runners running at least 10km per week were recruited. Runners were categorized into four groups based on age and gender: young women under 30(YW), young men under 30(YM), older women over 45 (OW), and older men over 45 (OM). Subjects were provided with standard neutral footwear. 3D gait analysis was conducted on an instrumented treadmill (Treadmetrix, UT, USA). A 30 second trial using a 5-camera motion analysis system (Qualisys, Goteborg, Sweden) was collected as participants ran at their preferred pace. Standard motion analysis software (C-Motion, MD, USA) was used to calculate peak hip adduction angle (HA), peak knee adduction moment (KAM), peak knee flexion angle (KF), and peak vertical ground reaction force (VGRF). These variables were chosen because they have demonstrated differences across the aging and gender spectrum. [2,3] SA for HA was computed using the peak HA for both limbs with X_{left} being the peak HA for the left lower limb and X_{right} the peak HA for the right lower limb (X_{left} and X_{right}).SA= $(45°-\arctan(X_{left}/X_{right}))/90°\times100\%$. [6] Similarly, SA was calculated for the other variables. Two-way multivariate analysis of variance was performed with age and gender as factors and SA values as dependent variables. Since running speed has been demonstrated to influence gait mechanics it was included as a covariate.

Table1: Mean(SD)of demographic variables.

Group	Age (yrs)	Height(m)	Weight (kg)	Speed(m/s)
YM	22.6(2.5)	1.8(0.07)	75.6(11.1)	3.3(0.5)
YW	25.06(3.3)	1.65(0.05)	61.35(9.08)	2.71(0.38)
OM	49.53(4.1)	1.75(0.04)	78.4(8.94)	2.91(0.38)
OW	52.6(3.2)	1.65(0.05)	65.2(11.9)	2.34(0.3)

Table2: Mean(SD)of Interlimb Asymmetry.

Group	HA (%)[g]	KF (%)	KAM (%)[i]	VGRF(%)
YM	15.60(11.99)	4.81(3.29)	29.59(10.43)	1.42(0.85)
YW	7.17(5.13)	4.26(2.91)	14.98(11.57)	0.98(0.50)
OM	12.33(10.00)	2.60(2.41)	16.21(13.95)	1.29(0.96)
OW	11.30(8.38)	4.67(4.48)	14.78(12.84)	0.93(0.63)

[i]significant interaction effect, [a]significant main effect of age, [g]significant main effect of gender

RESULTS

Fifteen runners in each group participated in this study. (Table 1). Overall, gender had a significant effect on HA asymmetry ($p=0.02$) and both gender and age showed a significant interaction effect on KAM asymmetry ($p=0.04$). (Table 2) Neither age nor gender were related to KF or VGRF asymmetry. Speed did not impact asymmetry for all the variables in the four groups.

DISCUSSION / CONCLUSIONS

Previous studies have suggested that women have greater HA and older women demonstrate differences in KAM magnitude than men. [2,3] This study suggests that interlimb asymmetry in running gait for KAM and HA also differs with aging and gender. Understanding age and gender related adaptations in interlimb asymmetry will help improve running performance and develop programs aimed at reducing injury rates.

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