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Does physical fitness affect the locomotion kinematics of lower limbs in healthy adults?

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It is well known that obese and elderly subjects show modifications in joint range of motion (ROM) and spatio-temporal gait parameters. This is presumably due to a reduction in muscle strength and flexibility [1], but there are few quantitative studies that objectively measure the influence of physical performance on gait pattern.

In this study, we investigated if different levels of strength and flexibility could affect the kinematics of lower limbs in a group of healthy adults. Sixteen normal-weight subjects (age, 27.1±5.0 yr; BMI, 22±2.1 kg/m^2; preferred walking speed 5.5±0.5 km/h) performed an isometric maximal voluntary contraction (iMVC) on a horizontal leg press equipped with two force plates. The V-sit and reach test was used to assess flexibility. An optoelectronic system was used to measure kinematics while subjects performed 10 min of treadmill walking at 5.5 km/h. We calculated the main spatio-temporal parameters, the ROM and the angular values of pelvis and lower limbs joints at heel strike and toe off events.

To find possible associations between physical fitness and biomechanical values, we used the stepwise backward logistic regression analysis, adjusted for age, height and weight. Significant negative associations were identified between iMVC and knee angle at heel strike ($F=7.831$, $p<0.01$). Pelvic rotation ROM ($F=7.31$, $p<0.01$), knee ROM ($F=5.061$, $p<0.05$) and plantarflexion at heel strike ($F=4.154$, $p<0.05$) were positively associated with iMVC, as much as flexibility with hip extension at toe off ($F=4.355$, $p<0.05$). We found that, in accord with Ko et al. [2], the maximum knee extensor strength was related to modifications of knee ROM. In conclusion, it seems that even in adulthood, different values of strength and flexibility could affect some components of gait kinematics.

References

[1] Daley MJ, Spinks WL (2000) Sports Med 29(1): 1-12.
[2] Ko SU et al. (2012) Arch Gerontol Geriatr 55(2): 474-9.

Key words
Physical fitness, treadmill walking, gait kinematics, motion analysis.