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Why is the human gluteus so maximus?

Daniel E. Lieberman, Herman Pontzer, E. Cutright-Smith, David A. Raichlen

Abstract:
One of the most distinctive features of humans relative to other apes is a greatly expanded gluteus maximus. We examined the role of this muscle in walking and running humans to test the hypothesis that the derived expansion of the gluteus maximus may be related to various musculoskeletal specifications for endurance running. During a walk, the trunk is relatively vertical, positioning the upper body's center of gravity over the hip joint: during a run, the trunk is more forwardly inclined, with the upper body's center of gravity well in front of the hip joint. This inclination causes the trunk to have an inertial tendency to pitch forward at foot strike. Although the gluteus is well know to be a hip extensor, its contraction will also counteract pitching of the trunk when the leg is on the ground.
The hypothesis was tested using EMG and kinematic analysis of human subjects during walking and running under various conditions. The results indicate that the gluteus maximus contracts bilaterally at foot strike during running but not walking. On the stance side, the gluteus maximus functions to stabilize the trunk against its inertial tendency to pitch at foot strike. On the swing side, the gluteus maximus may contract to help decelerate the leg prior to foot strike. Presence of an enlarged surface of attachment for this muscle in Homo erectus suggests that the expansion of this muscle may have played an influential role in early human endurance running capabilities.