Imbalance of the whole body during obstacle crossing may cause inappropriate movement of the lower extremities and result in foot-obstacle contact and fall. Falls are among the most serious problems facing the aging population. However, there is a lack of knowledge about how dynamic stability of the whole body is regulated when negotiating obstacles and how muscle strength of the lower extremities is associated with control of motion of the whole body’s center of mass. In this proposed research we will investigate the effects of obstacle height and muscle strength of the lower extremities on balance control during gait and obstacle crossing. Body segment motion, ground reaction forces, and electromyography from lower extremity muscles will be collected during level walking and stepping over obstacles of different heights from both healthy young and elderly adults. Isometric strength of the lower extremity muscles will be measured bilaterally. A thirteen-link biomechanical model will be used to compute the three-dimensional motion of the whole body’s center of mass. The knowledge gained from this proposed research is important to the development of strategies aimed at preventing falls in the growing elderly population.