

Effects of Obesity on Stability Control among Young Adults in Responding to a Simulated Slip Induced in Gait

Kim JE, Munoz J, Villa C, and Yang F

Stanley E. Fulton Biomechanics and Motor Behavior Laboratory; Department of Kinesiology; University of Texas at El Paso; El Paso, Texas

Category: Masters

Advisor / Mentor: Yang, Feng (fyang@utep.edu)

ABSTRACT

Falls among older adults present a significant medical, societal, and economic challenge affecting not only the frail or impaired, but the active and vigorous. Falls initiated by slip account for about 25% of all falls among older people. Obesity has been regarded as a significant health problem. It has been reported that obesity causes muscle weakness, abnormal body mass distribution, and postural instability. Dynamic gait stability has been identified as a key factor leading to falls during slip in gait among both young and old adults. Despite the fact that obese individuals suffer higher risk of falls compared to non-obese individuals, little is known about the possible impact of obesity upon dynamic gait stability control. The purpose of this study was to examine if and to what extent the dynamic gait stability control during a slip-initiated fall differs between young obese and non-obese individuals. Twelve healthy young adults including 6 non-obese and 6 obese participated in the study approved by the Institutional Review Board. The subjects were classified as obese with a body mass index ≥ 30 kg/m² and a body fat percentage $\geq 30\%$. Subjects were informed that they would be performing normal walking initially and would experience simulated slip later without knowing when, where, and how that would happen. They were also told to try to recover their balance on any slip incidence and then to continue walking. All trials were performed on an Activestep treadmill and were under protection of a safety harness connected to a load cell and then to an overhead arch. After 6-8 normal walking trials, a 24-cm and 12 m/s² unexpected slip was induced within 0.2 s. A fall in responding to the slip was identified if the load cell force exceeded 30% of the subject's body weight. Dynamic gait stability was calculated, at touchdown (TD) of the leading foot and liftoff (LO) of the trailing foot upon the slip trial, by using the collected center of mass kinematics. Independent *t*-tests results indicated that dynamic stability control did not display significant between-group difference at TD (immediately before the slip onset) upon the slip trial (0.86 ± 0.03 vs. 0.86 ± 0.04 , $p > 0.05$). However, the non-obese group was more stable than the obese group at LO (~180 ms after slip onset) as evidenced by the higher stability values within the non-obese group in comparison with the ones in obese group (0.14 ± 0.03 vs. 0.01 ± 0.08 , $p < 0.01$). As a result of the better control of the dynamic stability, fewer subjects in the non-obese group fell than in the obese group when exposure to the unannounced slip. In particular, five out of 6 (83%) participants in the obese group fell while only one out of 6 (17%) fell within the non-obese group ($p < 0.05$). Our results revealed that obesity affects the dynamic stability control and consequently increases the likelihood of slip-related falls among young adults during gait. Findings from this study could provide some guidance to train individuals with obesity to reduce their risk of falls.