

## Accelerometer Balance Study

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**Abstract:** A recent application has been developed to use the tri-axial accelerometers to determine a person's balance. The application measures the person's accelerations at the chest level. Alternatively, some research literature proposes that the best location to assess accelerations for balance is at a person's center of mass – estimated to be the lumbar-3 vertebrae (L3). It is unclear whether there exists a better location (ie., chest or L3) to assess balance. Purpose: To compare variances of accelerometers located at the chest and L3. Methodology: 26 college-aged subjects (14 male, 12 female) participated in the study. Zephyr's Bioharness™ 3 (BH3) were used to record tri-axial accelerations. BH3 accelerometers were placed on the subjects' mid- sternum and L3. BH3 placements were based on anthropometric measures. The subjects were instructed to stand on their non-dominant leg with their eyes open. Data was recorded for 10 seconds while the subjects tried to maintain their balance. Results: The mean variance of the accelerations in the frontal (X) and sagittal (Y) planes for the Chest accelerometer were  $0.0755 (\pm 0.252)$  and  $0.0202 (\pm 0.0492)$  respectively, and for L3 accelerometer were  $0.0176 (\pm 0.0411)$  and  $0.0361 (\pm 0.0765)$  respectively. Paired samples t-tests revealed no significant difference between the Chest X and L3 X ( $p = 0.174$ ) or between the Chest Y and L3 Y ( $p = 0.285$ ). A very high correlation was found between the Chest X and L3 X ( $r = 0.984$ ,  $p = 0.000$ ), however, a correlation between the chest Y and L3 Y was not observed ( $r = 0.365$ ,  $p = 0.067$ ). Conclusion: There is a correlation and no significant difference between the Chest and L3 frontal plane acceleration variances. Additionally, there is no correlation or significant difference between the Chest and L3 sagittal plane acceleration variances.