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**Comparative Analysis of the Tour Jete and Aerial with Detailed Analysis of Aerial Takeoff Mechanics** MIMI PIERSON, KIM COPLIN, Denison University — Whether internally as muscle tension or from external sources, forces are necessary for all motion. This research focused on athletic rotations where conditions of flight are established during takeoff. By studying reaction forces that produce torques, moments of inertia, and linear and angular differences between distinct rotations around different principle axes of the body (tour jete in ballet - longitudinal axis; aerial in gymnastics - anteroposterior axis), and by looking at the values of angular momentum in the specific mechanics of aerial takeoff, we can gain insight into possible causes of injury, flaws in technique and limitations of athletes. Results showed significant differences in the horizontal and vertical components of takeoff between the tour jete and the aerial, and a realization that torque was produced in different biomechanical planes. Both rotations showed braking forces before takeoff to counteract forward momentum and increase vertical lift, but the angle of applied force varied, and the horizontal components of velocity and force and vertical velocity as well as moment of inertia throughout flight were consistently greater for the aerial. Breakdown of aerial takeoff highlighted the relative importance of the takeoff phases, showing that completion depends fundamentally upon the rotation of the rear foot and torso twisting during takeoff rather than the last foot in contact with the ground.

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