

Jump high, fail hard: Investigating the correlation of jump rope patterns

Jump rope is a widely adopted sport activity because of its low cost and high exercise efficiency. Various research shows that including jumping rope to physical activities provides better result in physical fitness and its overall benefits for all ages has been very well documented (Eler & Acar, 2018; Yang et al., 2020). During the exercise, the arms rotate the rope and legs perform the repetitive jumping action while trying to maintain the take-off and landing movement. The body also coordinates the balance of the upper and lower body muscles to achieve a successful repeated action (Kirthika et al., 2019). Most of the research concentrates on the optimal body positioning and execution techniques in jumping rope, and mostly rely on intuitive methods. However, limited research delves into assessing jumping rope success through statistical calculations to offer precise insight into ideal body positions and performance metrics. Jump rope exercise requires balance, coordination and precision of multiple muscle groups. A successful jumper needs to balance their upper and lower body, coordinate hand and foot movements, maintain overall balance, and have a good sense of timing (Lee, 2010). While numerous sources emphasize the importance of precision in these techniques, only few provide specific numerical measurements.

In this project, the main aim is to evaluate whether there are specific motion patterns and coordination factors that significantly influence the success of jumping rope, and whether statistical methods can effectively identify and quantify these patterns to understand their impact. To validate these research objectives, a study was conducted using the Qualisys motion capture system to record data in the Media Lab Studio at the University of Vienna. The sample for the study was made of seven participants, 3 females and 4 males. Each participant completed a consecutive 1-minute session of jumping rope. The analysis of the collected data will be conducted using JASP, an open-source statistics program, while employing correlation analysis as methodology.

During the preliminary analysis, an exploratory investigation was conducted on 2 participants that focused on motion patterns along the Z axis during jumping rope. The investigation primarily targeted correlations between hand movements and other body parts. Results showed a notable decoupling of hand motion along the Z axis from the rest of the body. Correlation analysis displayed a consistent positive correlation among all body parts, except the hands, with statistically significant results with p-values below 0.05. Specifically, correlations between the hands and the other body parts yielded Pearson's r values close to zero, with p-values significantly below 0.05. The correlation between hands and feet resulted in p-values above 0.05 for both left and right hands.

In conclusion, the initial findings suggest a separation between hand motion along the Z axis and the overall body movement. However, this preliminary analysis was limited to only two participants and focused on motion patterns only along the Z axis and correlations between hand and other parts during jumping rope. Further investigation on all participants and multiple axes are necessary to validate and expand upon these initial observations.

Keywords: Jumping Rope, Physical Activity, Motion Patterns, Correlation Analysis, Qualisys Motion Capture

References

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