Performance Analysis in Long and Triple Jumps

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The progression of horizontal jumps in athletics, especially in triple jumping, has taken place during the last two decades. Long (LJ) and mainly triple jump (TJ) include the specificity of complex coordinative and technical abilities, particularly the jumping rhythm and time management, the good take-off coordination as well as the balance (equilibration) during jumping flight. Achieved distances in LJ and TJ depend upon ideal kinetic energy production and conversion into height and distance through approach speed in the one or every take off (TO) (2). Scientists quote and refer to numerous criterions and influences, mainly kinematic movement characteristics (1, 9, 10).

In contrast to well known statements regarding dependency of achieved jump distances upon available horizontal velocity in run-up in general (2) and each of the take-offs in particular (5,6) there is limited information about velocity profiles, stride pattern and time management (TM) in preparation for TO in elite jumpers. The behavior and influence of selected horizontal speed profiles and individual TM in different performance levels, techniques and between genders well be shown.

Numerous competition-velocity profiles (CVP) were compiled among selected elite LJ and several elite TJ during outdoor-seasons between 2002 and 2007 (4, 5, 6, 7, 8), supported by grants of the Federal Institute of Sports Science of Germany. Velocity (v (m/s)) was registered by a laser distance device, placed in approach direction and focused on the lower back of the athlete. Speed curves were edited and filtered by 9 pt / 67pt moving average of distance and speed. Additional 2D-kinematic video-analysis of side movement was performed (4). Descriptive and group-specific parametric statistics were applied.

An important factor in elite jump performance is the execution of a fast, accurate and controlled approach run, even when wind conditions are inconsistent. In male and female TJ the time management profiles were similarly, but point out significant differences in run-up and hop to step transition findings between various levels. For elite TJ performance the high v_{max} combined with its maintenance during hop (H), step (S) and jump (J) by short contact times enable good prerequisites. World class TJ performances reached peak velocity values in run-up (v_{max}) of > 10.2 m/s in men (TJ > 17 m) resp. > 9.1 m/s in women (TJ > 14.5 m). No statistically relevant relationship was noticed between v_{max} and effective distance (D_{eff}: official plus toe-to-board distance) in elite TJ (3, 6). Maximum speed of >10 m/s needs to be achieved between 6 and 7.5 m prior to the board (POS_{vmax}) in order to hit this accurately and relatively flat to hop TO. The faster the athlete, the broader away Pos_{vmax} and the more precisely steering on stride pattern with less speed drop to H TO due to time pressure. Somewhat slower athletes have also to render more accurate pattern of the last two strides to compensate distance pressure due to nearer Pos_{vmax}. Elite female TJ attain lower v_{max} and therefore closer Pos_{vmax} compared to elite male TJ (7). Furthermore decisive the higher absolute horizontal velocity combined with an optimum TO angle at TO H and TO S the bigger phase distances of hop and step.

Summarizing, selected visualization techniques (4) as well as the analysis of velocity profiles (especially last strides of run-up and TO H & S) and time management give excellent multiple information to coaches and athletes, which helps to individually adjust training and ultimately jump performance.

References

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