RELIABILITY OF DROP JUMP VARIATIONS IN PERFORMANCE DIAGNOSTICS

Gunther Kurz, Diana Lang, Anne Richter and Hermann Schwameder

BioMotion Center, Department of Sport and Sport Science, Karlsruhe Institute of Technology (KIT), Germany

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INTRODUCTION: In several sports athletes have to produce maximal power for accelerating the body and/or sport equipment (e.g. long jump, shot putt, basketball, etc.). The primary indicator used for estimating power output in drop jumps are the peak force rate (Fex) and the peak force (Fmax). These variables also characterise the reactive force ability of an athlete during a stretch-shortening-cycle (SSC). In order to use the accumulated energy produced in the eccentric phase during the concentric contraction, the contact please revise must not be longer than 200 ms (Komi 1984). Reactive force abilities are commonly tested in drop jumps (DJ). The accomplishment of DJ is variously described in the literature, so no standardized conditions are given (Baca 1999). One corresponding aspect is the arm position (free arm-swing vs. arms akimbo). Particularly, jumps with arm-swing require a higher grade of coordination (e.g. basketball) and are associated with an enhanced jump height. DJs with arms akimbo are often used in subjects with less sports experience or if the performance diagnostics primarily focuses on the power output in isolated leg extensions. Another aspect is the method of calculating the jump height from the measured force data. The calculation of the jump height from the momentum (based on the force-time-curve) might be inaccurate as the exact drop height is not known. Consequently, the jump height often is calculated from the flight time. This method, however, is also inaccurate if the landing position differs substantially from the take-off position. This problem might be solved performing a consecutive double DJ. Thus, the aim of the study is to investigate different DJ variations with respect to reliability.3

METHODS: 42 students experienced in DJ (Age=23.4 $\pm$ 2.6 yrs) participated in this study. All subjects were asked to perform three drop jumps in four different conditions: arm-swing - single contact (AS), arm-swing - double contact (AD), arm-akimbo - single contact (NAS), arm-akimbo – double contact (NAD). The measurements were repeated one week later for the same conditions. The subjects were asked to jump as high as possible. The ground reaction force was measured with an AMTI force plate (1000Hz). Flight time and ground reaction time were calculated from the recorded force-time curves. Data were analysed via Perason correlation.

RESULTS AND DISCUSSION: Test-retests correlated as follows: r_{AS}= 0.737; r_{AD}= 0.001; r_{NAS}= 0.727; r_{NAD}= 0.820. The correlation between single and double support conditions were: $r_{NAS\text{-}NAD}$= 0.836 and $r_{AS\text{-}AD}$= 0.852. Jump height with arm-swing was higher than jump height with arms akimbo (0.347 $\pm$ 0.067 m vs. 0.287 $\pm$ 0.053 m). This is in line with previous studies (Harman et al., 1990, Gerodimos et al., 2008). In conclusion, single contact jumps (AS, NAS) are sufficient for determine the reactive ability of an athlete. Only jump experienced athletes or specific movements in sports justify double contact jumps with arm-swing.

REFERENCES:

Baca, A. (1999). A comparison of methods for analyzing drop jump performance. *Medicine and Science in Sports and Exercise.* 31(3), 437-442

Gerodimos, V., Zafeiridis, A., Perkos, S., Dipla, K., Manou, V. & Kellis, S. (2008). The contribution of stretch-shortening cycle and arm-swing to vertical jumping performance in children, adolescents, and adult basketball players, Pediatric Exercise Science, 20, 379-389.

Harman, E.A., Rosenstein, M.T., Frykman, P.N. & Rosenstein, R.M. (1990). The effects of arms and countermovement on vertical jumping. *Medicine and Science in Sports and Exercise*, 22(6), 825-833.

Komi, P.V. (1984). Physiological and biomechanical correlates of muscle function: effects of muscle structure and stretch-shortening cycle on force and speed. In R.L. Terjung (ed.). Exercise and Sports Sciences Reviews. Vol 12, pp. 81-121. Collamore Press, Lexington, Mass.