

ON THE APPLIED BIOMECHANICS OF WEIGHTLIFTING

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INTRODUCTION: The aim of the study is to propose and test a simple low-cost experimental method for practical issues related to coaching. The data were obtained for 20 young top-class Bulgarian athletes during training in the Sofia Olympic Center. Selected kinematic variables and individual anthropometric parameters were used to obtain heuristic models with the purpose of improving individual lifting technique.

METHODS: Four external active LED markers were placed as follows: marker No 1 - on the end point of the bar; marker No 2 - on the elbow; marker No 3 - on the pelvis; marker No 4 - on the shoulder. A low-cost two solid-state camera based motion measurement system, was developed. A Pentium 75 MHz based computer was used. Software for marker identification and data analysis was developed. The anthropometry of the study athletes is presented by 19 parameters. We have to note that for quick analysis a software for anthropometry calculation using only the body mass and the body height was developed.

Lifts chosen for analysis (80 lifts) include successful (54%) and unsuccessful (46%) snatch (50 lifts) and jerk (30 lifts) during training of 20 athletes on maximal weights in 56 kg (10 athletes) and 75 kg (10 athletes) divisions. For each marker the displacements, velocities and accelerations were calculated on-line.

RESULTS: The results relative to the bar's trajectory and velocity (Marker No 1) are shown in the present paper. Fourteen snatch kinematic parameters are determined (Fig. 1a): positions (X_{SN}, Z_{SN}) and velocities (V_{SN}) for the points A, B, C, D, E, F, G. Eighteen jerk kinematic parameters are determined (Fig.1b): positions (X_{JE}, Z_{JE}) and velocities (V_{JE}) for the points A,B,C,D,E,F,G,H,I.

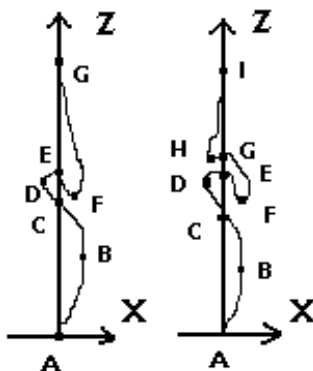


Fig. 1a

Fig.1b

Two additional variables are introduced: RES - the barbell weight in [kg]; SUC (1 or 0) - successful or unsuccessful lift. So the statistical 'mean-optimal' snatch model consists of 35 parameters: 19 constants (anthropometric); 14 kinematic variables; two formal variables: RES and SUC. The jerk model consists of 39 parameters.

A heuristic approach developed by the author is used to obtain the statistical "optimal" models. The individual differences in technique for every athlete could be recommended.

CONCLUSIONS: The results of this study show that using a low-cost measurement system and a heuristic approach to obtain an individually-oriented model (in this paper only for the bar's trajectory) we can help coaches to improve the competition performance.