EVALUATION OF MECHANICAL POWER OUTPUT MEASUREMENT IN A BENCH PRESS EXERCISE UNDER VARIABLE LOAD

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INTRODUCTION: The study is aimed to investigate evaluation of mechanical power output measurement during bench press exercise by methods which are used at training practice. As the criterion of power output measurement evaluation we selected a method which estimates the output by means of empirical 3D mechanical model (work in progress).

METHODS: This study was performed on ten untrained middle-aged men. The power output was measured at following loads: 18.0; 26.5; 39.2 and 47.7 kg. The indirect power output method (indirect – used in training practice) employs indirect power output measurement which was performed on FitroDyne Premium (FDP, Slovakia) equipment. The output (**P**) is calculated from changes of vertical speed vector (**v**) of a dumbbell at time (**t**) and weight of a dumbbell (**m**) in the following way:

$$P = m\left(\frac{d\mathbf{v}}{dt} - \boldsymbol{g}\right)\mathbf{v}(t)$$

where (**g**) is a vector of gravitational acceleration. At combined method of mechanical power output measurement we needed to obtain a dumbbell position in space and time, so we used a kinematic analysis of movement, system Qualisys (Sweden). For direct power measurement a dynamometer AMTI was used. 3D mechanical model will be created on the basis of a dynamic analysis of bench press exercise in Visual 3D software.

RESULTS: An average mechanic power output measured by the indirect method was significantly lower at loads 18.0 and 26.5 kg, than the power output measured by the combined method (size effect = 1.41 and 0.59). With higher loads the output under-estimation of the indirect method subsides.

DISCUSSION: Our findings are in compliance with a research performed by Hori et al. (2007), who show that the indirect method under-estimates measured power output in comparison with a combined method - which was by Cormie et al. (2007) established as a criterion. The limitation to load movement speed, without reference to movement of body elements, can be a source of significant inaccuracies in mechanical power output measurement.

CONCLUSION: Methods used in a training practice for estimation of mechanical muscle power output, which are based on indirect power measurement, under-estimates mechanical muscle power output in a bench press exercise. This under-estimation can influence the load optimization at power training. Future research will be necessary to create 3D mechanical models which will help to estimate more accurately the applied power and speed of gravity centre movement of body elements system and the load applied during individual exercises.

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