

EVALUATION OF CHANGES IN MUSCULAR STRENGTH DURING BENCH PRESS

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1. Introduction

The performance of our motor system is essential for movement and vital activities [1, 2]. The muscular contraction and relaxation allow not only movement, but also weight-lifting, lifting or grabbing. Evaluating the achievable strength allows to determine endurance limits in sports and use the results to further develop the body and increase the muscular strength. One of the most common method of checking and developing arms and chest strength in sport is a bench press [3-5]. It is a simple exercise which allows to quickly improve and develop those muscles. Evaluation of the muscular strength during bench press extends the knowledge on the endurance of our bodies, strength at a specific elbow joint flexion angle and helps to prevent undesirable contusions and injuries.

2. Material and Method

The tests were carried out on 20 men aged 22-23, including men regularly practicing volleyball in the university club (10 men - TG group) and 10 men without any training (NTG group) - students at the Faculty of Mechanical Engineering at the University of Technology and Life Sciences in Bydgoszcz. The aim of the person doing exercise was to press a bar upwards from a supine position using strength of the muscles.

The test was carried out using a test stand designed by the authors of the study including a horizontal bench with a bar placed on two supports, two mechanical force gauges and a goniometer (for measuring elbow joint flexion angle). Fig. 1 shows the test stand.

Principle of measurement: The bar is fixed in position with two upper force gauge mounts.

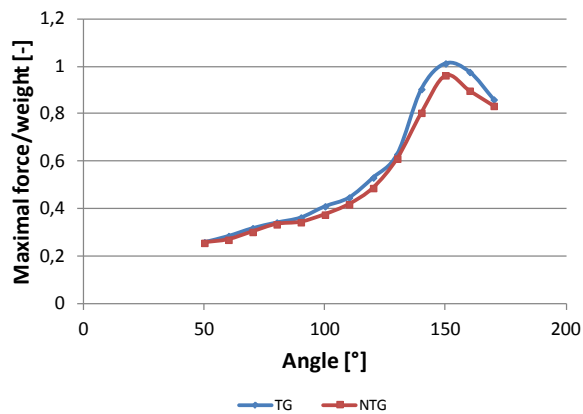
Lower force gauge mounts are fixed to the test stand frame (rack). The person under test presses the bar upwards from a supine position and the movement is counteracted by the force gauges. The force gauges record the maximum force exerted by the person on the bar during the test. The arm flexion angle is adjusted by changing the bar height over the bench. In its initial position, the bar rests on the chest of the person under test. The elbow joint flexion angle during the test is adjusted by changing the support height, until the joints are near the fully extended position. The tests were carried out at the flexion angle of 50-170°, every 10 degrees. Before the person under test starts to press the bar upwards in this position, the elbow joint flexion angle is measured using the goniometer.



Fig. 1. The test stand.

3. Results

Graph 1 shows the test results including an average force obtained by both groups at a specific elbow joint flexion angle. Before calculating an average for both groups, the measurements were normalized by dividing the force recorded for each person under test at a specific flexion angle by the person's weight.



Tab. 1. The results obtained for both groups.

4. Discussion

The force variability is affected by external and internal factors. The internal factors include sex (due to the constitution), height and weight. For men, the muscular strength is higher due to the higher muscle mass. The person's height also affects the muscular strength during bar pressing. Shorter people have a higher maximum strength, since the lower the height, the shorter the limbs, muscles and smaller joint levers, resulting in the lower movement range. Thus, shorter people use less force than taller people.

The tests carried out as part of the study may be used not only to improve the training programs, but also in rehabilitation, as well as to create various test stands for similar tests.

The analysis of the tests allows to evaluate the changes in muscular strength during bench pressing. Despite different constitution of the persons under test, the higher the joint flexion angle, the higher the instantaneous force. In each case, the maximum force was recorded between 140° and 160°. The persons regularly practicing sports achieved better results, and the distribution of the results was more regular.

The preliminary assessment showed the suitability of the designed test stand for the

evaluation of the muscular strength during bench pressing. Further studies will involve EMG to evaluate the activity all chest and arm muscles during the tests and will cover different age groups practicing different sports.

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