ELECTRONICS AND ELECTRICAL ENGINEERING
ISSN 1392 – 1215 *2010. No. 10(106)*
ELEKTRONIKA IR ELEKTROTECHNIKA

EDUCATION IN ELECTRONICS AND ELECTRICAL ENGINEERING
T 000
MOKYMAS ELEKTRONIKOJE IR ELETROTECHNIKOJE

Using Electronic Device for Muscular Strenght Determination

F. Benedek, F. V. Leuciuc
Faculty of Phisycal Education and Sports, University Stefan cel Mare of Suceava,
Universitatii str. 13, 720225, Suceava, Romania, phone: +40 723 823 539, e-mail: florianb@usv.ro

Introduction

Introducing the latest equipments and technologies în sport activities has considerably increased the quality of these activities, especially by developing sports people's performance. In this way, we consider adequate the configuration and accommodation of these equipments for analising sports people's performance.

The first equipment called Miron Georgescu Jump Carpet is designed for performant jumps in which there are evaluated series of repeated jumps, the contact time, respectively the flight time.

Another equipment called Optojump monitorizes precisely the time of flight and the time of contact, obtained by the subjects.

Polar Team 2 is another machine designed for monitorising cardiac frequency for 10-28 subjects, helping an efficient estimation of optimal effort in sport qualification.

The electronic device Myotest (Fig. 1) is used in physical education activities and performance sports to obtain useful information regarding requested physical effort.

Having the anthropometrical aspects, the subjects make some predetermined movements and Myotest determines the force (mass x acceleration). Knowing the acceleration, we can determine the speed of execution (expressed în cm/s) and in this way we can calculate the power (force x speed).

Using the attached soft of this device, the information can be downloaded and it is possible to create a database which will permit monitorising the activity and the achieved progresses.

Among the advantages of using Myotest device we could mention: reduced size, portability, quick testing and by using the software, data can be analysed în useful time în order to appoint the preparation sessions.

The device has 7 preprogrammed testing protocols which are often used in motric activities and are frequently associated to power's development.

Besides the 7 tests, Myotest device has a separated way of working – trainer mode – leading to adapting the test to a sport branch's specifics, being very useful in performance sport.

Fig. 1. Myotest device

Strength tests by Myotest device

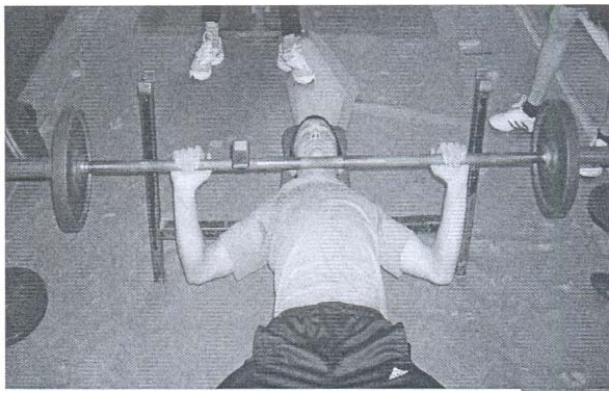
The seventh preprogrammed testing protocols include the following tests: bench press, half-squat, counter movement jump, squat jump, plyometric jump, muscular profile, 1RM (1 repetition maximal).

According to each test's characteristics there is information concerning: Power (Watts), Force or Strength (Newton), Velocity or Speed (cm/s), Vertical height (inch or cm), Contact Time (ms), Flight Time (ms), Muscle Stiffness, Reactivity. The movements should be correctly done and the testing conditions be optimal and in this way the accuracy of the acquired data will increase.

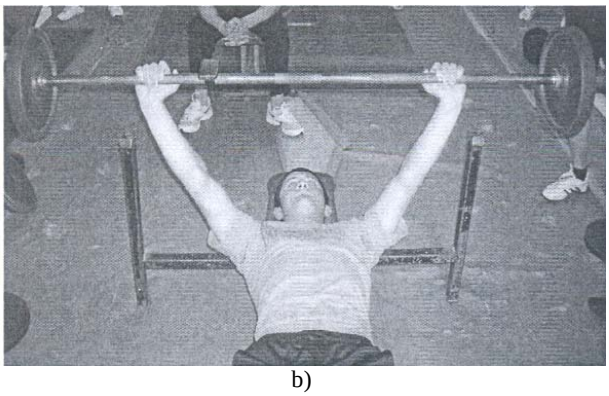
In our study we used 4 tests in order to determine the muscular strength like: Bench press, Plyometric jump, Counter movement jump, Squat jump.

Bench press test (Fig. 2) is used to evaluate the muscular performancies of the superior part of the body (pectorals, triceps) using movements that highlight theses muscular groups' explosive force availabilities.

Plyometric jump measures the inferior muscles' stiffness when using plyometric movements that have on their basis the stretch – shorten cycle. The results emphasize the bounce quality and intermuscular coordination quality. There is information about the flight and the contact time.



a)



b)

Fig. 2. Bench press movement

Counter movement jump (Fig. 3) determines the jump's height, supported by the details regarding the power, force and speed.

a) b)

Fig. 3. Counter movement jump

Squat jump measures the detenta's availabilities for the inferior limbs (explosive stato – dinamic force), being very important in most of the daily activities and performant sports' movements.

All the tests have been performed with minimal loads for intermediate level (30 kg).

Test results

In this research there were involved 10 subjects divided into 2 groups: the first one had 5 students who practised only the motric activities required by the curriculum, the second group included 5 students who practised sport not only in school activities, but also in their free time.

The results obtained for the applied test sat the initial testing show better performances for group 1 comparing to the group 2 (Table 1).

Table 1. Strength evaluation for applying tests

Tests	Parameters	Initial testing		Final testing	
		Group 1	Group 2	Group 1	Group 2
Bench press	Power (W)	597.6	637.4	603.5	673.1
	Force (N)	487.3	504.9	497.0	538.2
	Velocity (cm/s)	163.6	172.5	165.7	179.8
Plyometric jump	Height (cm)	33.6	35.3	34.0	37.3
	Time of contact (ms)	140.7	136.3	139.3	134.9
	Reactivity	3.7	3.4	3.6	3.2
	Stiffness (kN/m)	47.3	44.5	47.1	43.3
Counter movement jump	Height (cm)	31.2	34.6	31.5	35.8
	Power (W/kg)	47.1	49.7	48.3	51.1
	Force (N/kg)	23.3	24.8	23.6	25.8
	Velocity (cm/s)	258.1	261.4	261.1	267.4
Squat jump	Height (cm)	34.7	36.2	35.2	37.1
	Power (W/kg)	46.4	47.7	46.7	48.3
	Force (N/kg)	26.9	28	27.5	28.7
	Velocity (cm/s)	261.3	264.2	266.5	273.6

The second group's results could have some reasons: practicing physical activities contained in the curriculum or in the specific training sessions for the amateur level of the sport.

Group 1 practised physical exercises during only university studies.

The differencies between the two groups for the initial testing can be explained from the point of view of a greater number of exercises used by the subjects from the second group.

Myotest's soft permits to analyze the achieved results. The data is stored in the device's memory and transferred to a computer using an USB connection. After analyzing the results, the testers create graphics (Fig. 4), hystogrames (Fig. 5); data can also be compared (Fig. 7) and be created individual reports for every tested subject (Fig. 6). For more complex situations muscular profiles for

the tested subjects could be created, very useful in performance sports.

Fig. 4. Software data analysis (chart)

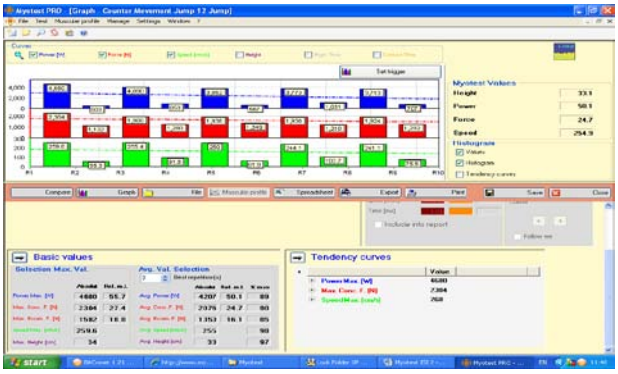


Fig. 5. Software data analysis (hystogram)

For the final testing the progresses for each group are as following (Table 2).

Fig. 6. Individual athlete test information

Fig. 7. Comparative analysis

Table 2. Progress obtain between initial and final testings

Tests	Parameters	Progress (%)	
		Group 1	Group 2
Bench press	Power	0,99	5,60
	Force	1,99	6,60
	Velocity	1,28	4,23
Plyometric jump	Height	1,19	5,67
	Time of contact	1,00	1,03
	Reactivity	2,70	5,88
	Stiffness	0,42	2,70
Counter movement jump	Height	0,96	3,47
	Power	2,55	2,82
	Force	1,29	3,47
	Velocity	1,16	2,30
Squat jump	Height	1,44	2,49
	Power	0,65	1,26
	Force	2,23	4,03
	Velocity	1,99	3,56
Progress average		**1,46**	**3,67**

The obtained achievements between the two testings are significantly higher for the second group (3.67%), comparing to the first group (1.46%) as a consequence of a longer duration used for physical activities in group 2.

Conclusions

Research in this field reveals the fact that physical activities need scientific background and at the same time gives birth to the concept that a sportsperson's organism/body should be analyzed as something

hypercomplex and unique and that the entire physical activity must follow its course using biological, psychological, organizational and hygienical methods in a multidisciplinary research.

In this way, an indispensable contribution is attributed to mathematical and automatical process,

simulated on a computer, making possible to interpret a greater number of indicators.

It has been discovered that there are necessary more than 4000 motrical, biological and psychological indicators in order to monitorize physical activity.

The mass sport has become a social phenomenon and has reached the highest levels, but undoubtedly tightly connected to scientific research. Using engineering, including genetic and advanced engineering, the people's performance capacity will gain both a logistic support and a remarkable monitoring.

Acknowledgements

The device used in the research (Myotest) helps to get some valuable data regarding ways of manifesting the motric aptitude – force, an aptitude present in most of the motric activities. The obtained results allow practicing optimal physical exercises for recreation as well as performance at the highest level.

References

1. **Benedek F.** Amenajarea, administrarea si intretinerea bazelor sportive. – Editura Universităţii Ştefan cel Mare Suceava, 2008. –131 p.
2. **Jidovtseff B., Croisier J. L., Lhermerout C., Serre L., Sac D., Crielaard J. M.** The concept of iso–inertial assessment: Reproducibility analysis and descriptive data // Isokinetics and Exercise Science. IOS Press, 2006. – No. 14. – P. 53–62.
3. **Leuciuc F.** Musculaţie. – Editura Universităţii Ştefan cel Mare Suceava, 2010. – 174 p.
4. **Mohadjer S., Dittmar A., Mazet J., Machet–Pietropaoli H., Dejour H.** Myotest: an isokinetic and isometric testing device // Journal Medical and Biological Engineering and Computing. – Springer Berlin Heidelberg, 1990. – Vol. 28. – No. 3. – P. 264–268.
5. **Daniuseviciute L., Pukenas K., Brazaitis M., Skurvydas A., Sipaviciene S., Ramanauskiene I., Linonis V.** Wavelet-Based Entropy Analysis Of Electromiography During 100 Jump // Electronics and Electrical Engineering. – Kaunas: Technologija, 2010. – No. 8(104). – P. 93–96.
6. **Pukenas K.** Blind Separation of Noisy Pseudoperiodic Chaotic Signals // Electronics and Electrical Engineering. – Kaunas: Technologija, 2009. – No. 3(91). – P. 31–34.

Received 2010 08 20

F. Benedek, F. V. Leuciuc. Using Electronic Device for Muscular Strenght Determination // Electronics and Electrical Engineering. – Kaunas: Technologija, 2010. – No. 10(106). – P. 173–176.

Introducing the latest technologies and equipments în sport activities has considerably increased the quality of these activities. In our research we used 4 tests to determine the muscular strength: Bench press, Plyometric jump, Counter movement jump and Squat jump. The obtained achievements between the 2 testings are significantly higher for group 2 (3.67%), comparing to group 1 (1.46%), because longer duration for practising motric activities has increased the performance for those tests. The device used in the research (Myotest) helps to get some valuable data regarding ways of manifesting the motric aptitude – force, present in most of the motric activities. The obtained results allow practicing optimal physical exercises for recreation as well as performance at the highest level. Ill. 7, bibl. 6, tabl. 2 (in English; abstracts in English and Lithuanian).

F. Benedek, F. V. Leuciuc. Raumenų jėgos nustatymas naudojant elektroninį įrenginį // Elektronika ir elektrotechnika. – Kaunas: Technologija, 2010. – Nr. 10(106). – P. 173–176.

Sportinės įrangos technologijos ir įranga pastaruoju metu labai patobulėjo. Atlikti bandymai raumenų jėgai nustatyti naudojant keturis pratimus. Įvertinant rezultatus skirtingose testų grupėse pastebėta neatitikimų, kurie yra sąlygoti ilgesnės testų trukmės, kai siekiama padidinti šių testų našumą. Il. 7, bibl. 6, lent. 2 (anglų kalba; santraukos anglų ir lietuvių k.).