STUDY ON THE USE OF PLIOMETRIC EXERCISES IN THE SPECIFIC TRAINING OF TAEKWONDO

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Abstract: The concept of the method used for this application and carried out on a sample of Taekwondo athletes is trying to identify the adequate solution by simultaneously considering two criteria: the attribute of significance of the motricity investigation and the feature of practicality – in the sense of achieving an acceptable level of reliability and adequacy of the data while using a noninvasive device, which is also as less obtrusive as possible to the subjects.
The study was conducted on 8 students, members of the taekwondo (TKD) team, of the Carol Davila University of Medicine and Pharmacy, with a competitive experience of 10 to 12 years. The Jump Pliometry assessment in anaerobic effort was performed using the Myotest PRO device. Two tests were performed, an initial one to determine the stadium level for jump pliometry, and a final test to determine the level of progress. The main objectives pursued by this test are: to measure the contractile and inter-muscular muscle coordination in the lower limbs and the values provided information on the quality of the jump that influences the sport performance. As a conclusion, by applying a centralized training program including pliometric exercises even in the specific part, significant changes in expansion, contact time, response and distribution of the load can be generated in the lower limbs.
Keywords: *taekwondo, sports, sports performance in taekwondo, myotest PRO.*

Introduction

Taekwondo is a sport that has positive influences on the vitality and health of those who practice it, all techniques engaging in working the whole body in a balanced and coordinated manner, resulting in a natural position and economic movements at all levels. Specific physical training requires a great deal of workout, possibly by decreasing intensity, and has a content focusing on the development of specific exercise capacity as well as the combined motor skills [1]. Pliometric exercises are a method of developing explosive power, being an important element in most sports performances [2].
Thus, combined training program increases vertical jump and medicine ball put performance. Rephrasing, we can say that this type of training program improves the explosive strength level of upper and lower extremities. These strength level improvements are usually essential in Taekwondo[3].
Use of plyometrics can improve strength and explosiveness while working to become more agile. Improvements in agility can occur in as little as 6 weeks of plyometric training which can be useful during the last preparatory phase before in-season competition for athletes[4].
Therefore, it is important to consider the movement specific character when the muscular strength training of Taekwondo athletes[5].
Explosive force and execution speed are essential to maintain the impact strength and withstand resistance to fatigue during combat. Obviously, this requires prior training aimed at the exposure force of specific actions. Explosive force is one of the main features that each Tkdist has to develop, because combat effectiveness will largely be determined by the explosive execution of various techniques [6].

Materials and methods

In this research we start from the hypothesis that: by applying a programme of the plyometric exercise in specific training, significant changes can be generated on some motric characteristics of the medical students representing the university at national competitions.
The research was carried out on 8 students, members of the taekwondo (TKD) team, the Carol Davila University of Medicine and Pharmacy, with a competitive experience of 10 to 12 years.
Jump Pliometry assessment in anaerobic effort was performed with the Myotest PRO [7].This device does not only measure muscle performance, it is also an amelioration tool [8]. The device includes computerized analysis software to optimize training time with a 230-note memory. Myotest PRO calculates, for Jump Pliometry, detent, contact time, reaction, load distribution using a three-dimensional accelerometer. The sensor can detect the acceleration during the movement. The information obtained is transferred to the computer via a USB connection.

The main objectives pursued by this test are: to measure the contractile and intermuscular muscle coordination in the lower limbs and the values provide information on the quality of the jump that influences the sport performance.
In the test, five repetitions are executed to reach the maximum jump height and the contact time with the soil is minimal, each subject performing three attempts, giving the best result.
With the help of this measuring and evaluation apparatus, the level of progress of the subjects under investigation will be determined by applying a pliometric exercise program, integrated into a centralized training course over 18 weeks, to participate in the National Taekwondo University Championship. In the programme of the plyometric exercises used means as: speed ladder agility, fitness stepper, agility hurdles, agility hurdle cones, used together with tkd's specific technical actions.Two tests were performed, an initial one to determine the stadium level for jump pliometry, and a final test to determine the level of progress.

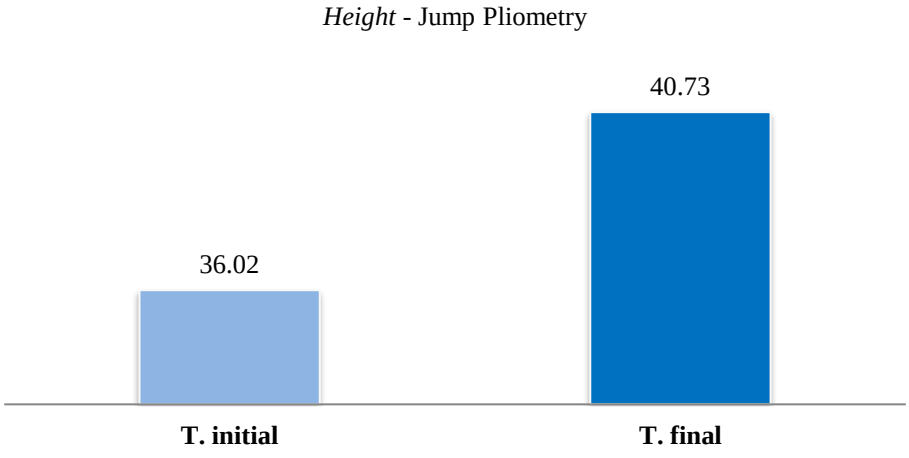
Results

Hereinafter we present the descriptive statistics of the research results at the sample of subjects.

Table 1. Height – Jump Pliometry

Test	*Minimum*	*Maximum*	*Mean*	*Std. Error Mean*	*Median*	*Std. Deviation*	*Difference*
Initial	31	42	36.03	1.34	35.55	3.8	4.71
Final	36	45	40.74	1.05	40.7	2.98	

It can be seen from table no. 1, that the minimum and maximum values increased with respect to the initial testing and the average values with a difference of 4.71 cm in favor of final testing, as can also be seen from graphno. 1.



Graph 1. Average values for the two tests

Table 2. Testul t pentru eșantioane-pereche. *Înălțimea* – Jump Pliometry

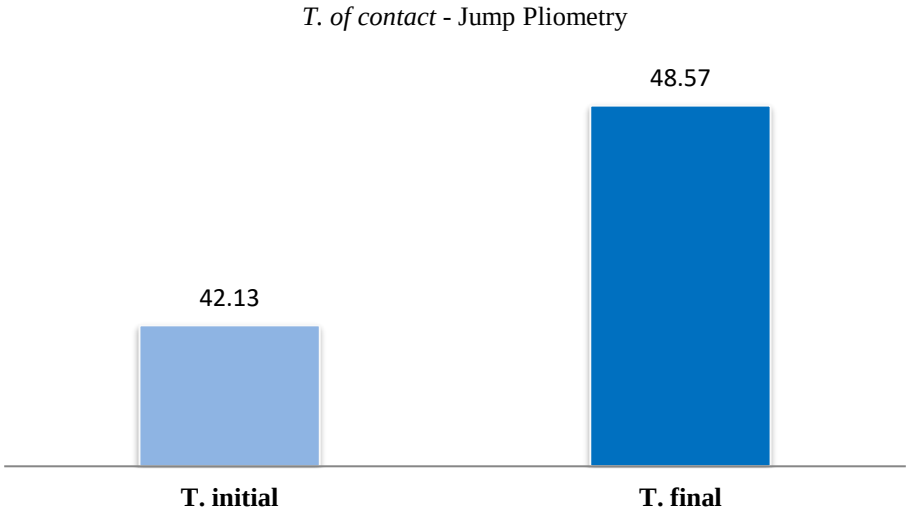
	Paired Differences					t	Df.	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
T.final – T. initial	4.712	1.445	.511	3.505	5.920	9.221	7	.001

The value of t is based on average divided by the standard error of the mean, giving the value 9.221. The results of the subjects, which are presented in Table 2, improved on average by 11.5% compared to the initial testing. From a statistical point of view, this increase is significant, the significance threshold p <0.001 <0.05 for t = 9.221 and df = 7. The mean values for initial testing (36.03) and final testing (40.74), with a difference of 4.71 cm. The 95% confidence interval for this difference varies from 3,505 to 5,920. Since it does not contain 0.00, the difference is statistically significant at a 2-tailed level of 5%.

Table 3. T. of contact – Jump Pliometry

Test	*Minimum*	*Maximum*	*Mean*	*Std. Error Mean*	*Median*	*Std. Deviation*	*Difference*
Initial	120	171	140.25	5.99	137.5	16.96	-7.5
Final	118	162	132.75	5.47	130	15.4	

It can be seen from table no. 3, both the minimum and maximum values decreased compared to the initial testing and the average values with an improvement of the contact time of -7.5 ms in favor of final testing, as can be seen also from graph no. 2.



Graph 2. Average values for the two tests

Table 4. T-test for pair samples. *T. of contact* – Jump Pliometry

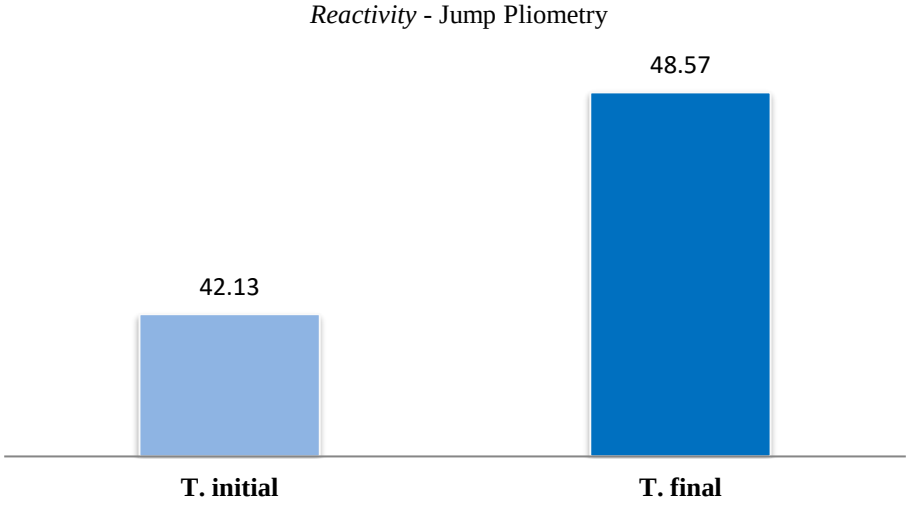
	Paired Differences					*t*	*Df.*	*Sig. (2-tailed)*
	Mean	*Std. Deviation*	*Std. Error Mean*	*95% Confidence Interval of the Difference*				
				Lower	Upper			
T.final – T. initial	7.500	4.440	1.570	3.788	11.212	4.778	7	.002

The value of t is based on the average divided by the standard error of the mean, giving the value 4.778. The results of the subjects, which are presented in Table 4, improved on average by 5.6% compared to the initial testing. From a statistical point of view, this decrease is significant, the significance threshold p <0.002 <0.05 for t = 4.778 and df = 7. The effect size index (1.72) shows that this difference is high to very high. Average values for initial testing (140.25) and final testing (132.75), with a difference of -7.5 ms. The 95% confidence interval for this difference varies from 3.788 to 11.212. Since it does not contain 0.00, the difference is statistically significant at a 2-tailed level of 5%.

Table 5. Reactivity – Jump Pliometry

Test	*Minimum*	*Maximum*	*Mean*	*Std. Error Mean*	*Median*	*Std. Deviation*	*Difference*
Initial	3.43	4.44	3.93	.13	3.86	.38	0.35
Final	3.89	4.91	4.28	.13	4.19	.39	

It can be seen from table no. 5, both the minimum and maximum increased values compared to the initial testing and the average values with a difference of 0.35 in favor of the final testing, as can also be seen from graph no. 3.



Graph 3 Average values for the two tests

Table 6. T-test for pair samples. *Reactivity* - Jump Pliometers

	Paired Differences					t	Df.	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
T.final – T. initial	.345	.093	.033	.267	.423	10.488	7	.001

The value of t is based on the average divided by the standard error of the mean, giving the value 10.488. The results of the subjects, which are presented in table no. 6, improved on average by 8.1% compared to the initial testing. Statistically, this increase is significant, the significance threshold p <0.001 <0.05 for t = 10.488 and df = 7. Average values for initial testing (3.93) and final testing (4.28), with a difference of 0.35. The 95% confidence interval for this difference varies from 0.267 to 0.423. Since it does not contain 0.00, the difference is statistically significant at a 2-tailed level of 5%

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Table 7. Stiffness – Jump Pliometry

Test	*Minimum*	*Maximum*	*Mean*	*Std. Error Mean*	*Median*	*Std. Deviation*	*Difference*
Initial	34.10	60.20	42.13	2.90	40.85	8.22	6.44
Final	38.80	66.40	48.57	3.15	47.10	8.92	

It can be seen from table no. 7, that both the minimum and maximum values increased compared to the initial testing and the average values had a difference of 6.44 kn / m in favor of the final testing, as can also be seen from graph no. 4.

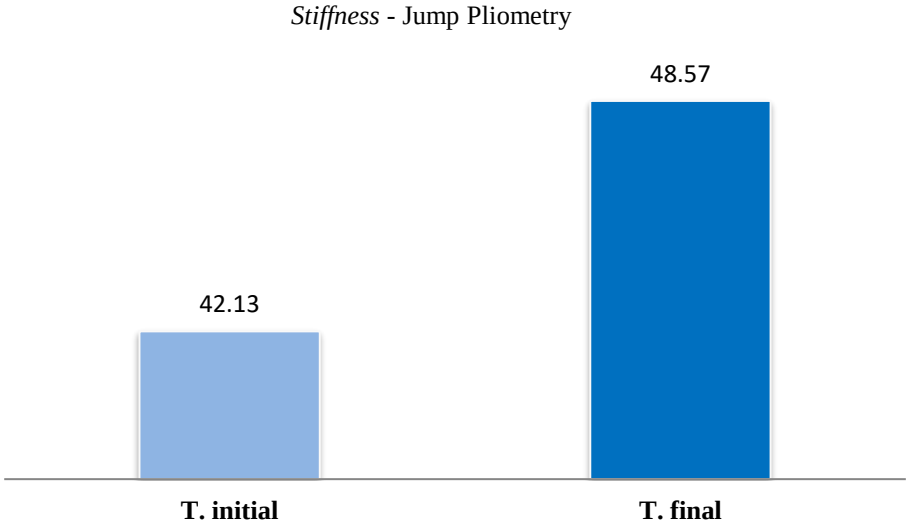

Figure 4. Average values for the two tests

Table 8. T-test for pair samples. *Stiffness* – Jump Pliometry

	Paired Differences					t	Df.	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
T.final – T. initial	6.48	1.759	.622	4.967	7.908	10.351	7	.001

The value of t is based on the average divided by the standard error of the mean, giving the value of 10.351. The results of the subjects, which are presented in table no. 8, improved on average by 13.2% compared to the initial testing. From a statistical point of view, this increase is significant, the significance threshold p <0.001 <0.05 for t = 10.351 and df = 7. Average values for initial testing (42.13) and final testing (48.57), with a difference of 6.44 kn / m. The 95% confidence interval for this difference varies from 4,967 to 7,908. Since it does not contain 0.00, the difference is statistically significant at a 2-tailed level of 5%.

Discussions

To achieve remarkable performance near anthropometric and somatic indexes that meet the requirements of taekwondo, there is still a need for motor capacity and a strong will, all of which are marked by perseverance, ambition, desire to overcome, to compete, but especially for athletic qualities that by far outweigh those of the opponents. Such athletes are distinguished by a special agility on the battlefield and on the action field, as well as by a particular capacity to achieve great victories and great performances.

Following the final testing was able to observe a significant improvement in the motor characteristics initially tested afterwards was observed: for height, the results improved on average by 11.5%, time of contact by 5.6%, reactivity by 8.1% and stiffness by 13.2%.

Conclusions

By comparing the descriptive sketch of the initial and final test results obtained with the Myotest instrument for the Jump-Pliometry sample, there are significant positive differences, so it can be argued that by applying a centralized training program including pliometric exercises, including the specific part, significant changes in detent, contact time, reaction and load distribution may occur in the lower limbs, so we can say that the hypothesis is confirmed.

Acknowledgement

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