APPLICATION OF VORTEX AS AUXILIARY PROP IN JAVELIN THROW TECHNIQUE TRAINING AT KINESIOLOGY STUDENTS

PRIMJENA VORTEXA KAO POMOĆNOG REKVIZITA PRI OBUČAVANJU TEHNIKE BACANJA KOPLJA KOD STUDENATA KINEZIOLOGIJE

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ABSTRACT

Javelin throw is a complex athletic discipline that requires several years of training to master a throw technique. Since teachers are time-limited, problem occuring in the teaching is how to train students to proper javelin throw technique as quickly as possible. Given that it is difficult to master a javelin as prop, research has been conducted to determine efficiency of vortex application as auxiliary prop in javelin throw technique training. The total number of respondents were 30 students of the first year of undergraduate Kinesiology study at University of Mostar in academic year 2016/2017. The initial measurement was made at the beginning of the classes. During the classes general exercises were used as well as vortex application as auxiliary prop in throw technique training. The final measurement and evaluation of javelin throw technique was made by three referees at the end of classes. Statistically significant difference between the initial (31,1m) and final (33,9) measurement was obtained by using the T-test . Results show that students have improved an average score in the final comparing to the initial measurement and based on obtained results it can be concluded that use of vortex has a positive effect on javelin throw training for beginners and it would be beneficial to include the prop in teaching when training students as well as younger children.

Keywords: *javelin throw, vortex, students, throwing technique, performance evaluation methods*

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INTRODUCTION

Throws in kinesiology sense are an elementary forms of movements to manipulate specific object in a space. Athletic throws are a complex movements of acyclic-cyclic nature and include throw of discus, javelin, shot puts and hammer (Pavlović, 2015). Javelin throw is an athletic discipline in which a thrower by approach and specific movements tries to reach the highest speed in the throw moment to achieve the longest possible shot (Zdravković i Matić, 2012). When throwing a javelin, there are four connected structural phases: preparation phase, cross-over phase, maximum effort phase and balancing phase (Bošnjak, Tešanović i Jakovljević, 2015). In javelin throw training, specific props smaller than javelin are increasingly in use. It is hard for students and youngers to control javelin and therefore it is more difficult to learn throwing technique. For this purpose, light-weight balls and recently vortex-rockets are in use (Tešanović, 2009). According to (Atwater, 1979; Menzel 1987) movement pattern used in javelin throw is similar to other movements used when striking or throwing objects. A previous researches showed that throwing balls and vortex makes sense to be used in students training. Puklavec (2010) obtained a high statistically significant correlation between throwing a ball and vortex (r=0,97). Tešanović (2009) in his research obtained high mutual correlation between variables of javelin and vortex throw and it can be assumed that for top results in vortex throw the anthropomotoric capabilities characteristic for javelin thrower are crucial. The most of researches on correlation between motoric characteristics and results in throwing athletic disciplines have confirmed the information on leading impact of explosive power factors (Milanović and Hofman, 1986). Žuvela, Borović and Foretić (2011) indicated that selected set of motoric capabilities (start acceleration and explosion power) have significant effect on score in javelin throw discipline only at students with above average knowledge in javelin throw. Ivanović (2009) conducted a research to determine impact of 12 motoric tests on score in javelin throw discipline. Regression analysis results have confirmed: (a) statistically significant positive linear correlation between predictor variables and criterion variable. The results of research conducted by Alujević, Vukušić and Žuvela (2013) made measure instruments for assessment of adoption level of specific motoric knowledges of javelin throw at kinesiology studenrs and assume that a new test based on principle of accepting (1-criterion is present) and rejection (0-criterion is not present) has a good independence of measurement results from a measurer.

The aim of this paper is to determine efficiency of vortex application as auxiliary prop in javelin throw technique training.

METHODS

The research was conducted on a sample of 30 respondents, students of the first year of undergraduate study of Kinesiology at University of Mostar in the academic year 2016/2017. All students had prior knowledge since they had classes in courses Athletics I and Athletics II. Students were not included in training processes, but they were included in sport activities through classes. Also, they were good health and without any locomotor system injuries.

Description of experimental treatment

The testing was carried out as a part of classes in the course Athletics II. The initial measurement was made at the beginning of a practical classes and

students had three throws. The best throw of each student is taken as their result. After five weeks or 15 hours of exercises, students began the final measurement where they had only one attempt that was measured and later evaluated by three referees. A javelin throw technique is divided in five phases as follows: initial position and javelin grip, the first part of approach, cross-over of javelin, javelin throw and balance. A qualitative approach was used in evaluation of each phase and with grades 0,1 or 2. Referees have evaluated each part via video: grade zero (0) is given to a student who did not meet the criterion, grade one (1) is given if he/she partially met criterion and grade (2) for completely done technique. A completely done technique of javelin throw was evaluated by the sum of all individual grades (scale from one to ten). Given that javelin throw is technically very demanding discipline, in throwing technique training, in addition to general exercises, the emphasis was on application of auxiliary prop – vortex. Immediately after the first methodics classes for javelin, vortex was used, weighing 135 g, lenght 34 cm,and shape requires the same grip as for the javelin and therefore it is a perfect auxiliary device whose lenght allows easy maneuvering and focusing on learning proper movements stages. Use of vortex when training students allows maximum commitment to mastering technical skill and developing sense for a device and precision. The following exercises for students training with vortex were used: 1. Throw from a place with both hands above the head; 2. Throw from a place with one hand above the head; 3. Throw from a place with one hand above the head with step forward; 4. Throw from a place with one hand above the head over leading hip; 5. Throw from a place after withdrawal; 6. Throw from a place by hip turned in throwing direction; 7. Throw from a place by hip turned in throwing direction with raised front leg; 8. Throw from a place – target on the wall; 9. Throw from a place – higher target on the wall; 10. Throw from a place by kneeling on the mat.

STATISTICAL EVALUATION

To determine a metric characteristics of the test, the following metric characteristics are calculated:

- In order to measure objectivity of the particles the following was calculated; matrix of intercorrelation of particles for each test, Inter item correlation (II r) i Cronbachalpha (α)
- In order to determined homogenity of referees the average correlation between test particles was calculated
- In order to analyse sensitivity of variables to determine sensitivity of each variable the following parameters were calculated: mean (AS); standard deviation (SD); minimum and maximum score (MIN i MAX); asymmetry measures (SKE) i kurtosis (KURT); normality of distribution (KS-test).

Descriptive statistics, K-S test and T-test for dependent samples were calculated to calculate differences between the initial and final measurement of javelin throw.

RESULTS AND DISCUSSION

In order to analyse objectivity of referees the following were calculated: intercorrelation assessments of referees, average inter-item correlation and Cronbachalpha coefficient and based on obtained results it can be concluded that thete is a satisfactory objectivity.

Table 1. *Variable objectivity measures for assessment of knowledge in specific stages of javelin throw (S1-S3 – intercorrelation of referees; II r – inter-item correlation; α – Cronbachalpha coefficient)*

Variables	S1	S2	S3	II r	α
PPIDK	1,000	0,749	0,599	0, 697	0,870
	0,742	1,000	0,737		
	0,599	0,737	1,000		
ZALET1	1,000	0,709	0,683	0,654	0,847
	0,709	1,000	0,558		
	0,683	0,558	1,000		
PK	1,000	0,793	0,685	0,752	0,898
	0,793	1,000	0,769		
	0,685	0,769	1,000		
IK	1,000	0,737	0,613	0,750	0,892
	0,737	1,000	0,853		
	0,613	0,853	1,000		
OR	1,000	0,780	0,555	0,659	0,843
	0,780	1,000	0,613		
	0,550	0,613	1,000		

(PPIDK –initial position and grip, ZALET1 – the first part of approach, PK – cross-over of javelin, IK – javelin throw, OR – balance)

In *Table 1* it can be seen that results are on acceptable level, i.e. they show statistically significant correlation between referees in all test for assessment of javelin throw knowledge at kinesiology students. The values of inter-item correlation are in the range between 0,659 for knowledge assessment in the balance phase to 0,752 for knowledge assessment in javelin withdrawal sphase. In accordance with values of inter-item correlation, values of Cronbachalpha coefficient are in the range of 0,843 to 0,898 what is considered as high value of correlation. Božanić (2011) states that according to Dizdar (2006) objectivity is the most important metric characteristic since test can be used only in the case when different measurers obtain the same or similar results when using the same test for the same respondents. In this research, it is about qualitative assessment of referees not quantitative measurement, and larger discrepancy in grades is acceptable.

Table 2. *Average correlation between test particles to determine referees homogenity*

Variables	ZBROJ S1	ZBROJ S2	ZBROJ S3
ZBROJ S1	1,00	0,86	0,79
ZBROJ S2	*0,86*	*1,00*	*0,87*
ZBROJ S3	*0,79*	*0,87*	*1,00*

(ZBROJ S1-S3 – total grades of each referee)

The results of average correlation between particles (*Table 2*) is within the range of 0,79 and 0,86 that indicates that there is statistically significant correlation between all particles and measure instruments are homogeneous. This can be attributed to the fact that referees are familiar with an „ideal“ performance and evaluation criteria of each javelin throw phase.

Table 3. *Results of variable sensitivity to assess level of javelin throw knowledge (AS – mean; MIN – minimum score; MAX – maximum score; SD – standard deviation; SKE – asymmetry measure; KURT – kurtosis; K-S – normality distribution test)*

Variables	AS	MIN	MAX	SD	SKE	KURT	K-S
S1	7,70	5,00	10,0	1,44	-0,25	-0,33	0,215
S2	7,73	5,00	10,0	1,46	-0,14	-0,76	0,172
S3	7,80	5,00	10,00	4,45	-0,28	-0,86	0,196

(S1-S3 – Referees grades 1-3)

In *Table 3* it can be seen that no distribution deviates significantlly from the normal, that is verified by K-S test that defines good sensitivity.

Tablica 4. *Descriptive parameters of javelin throw at initial and final measurement (N – number of respondents; AS – arthimetic mean; MED – mean value of scores; MOD – dominant value; MIN – minimum score; MAX – maximum score; SD – standard deviation; CV – variability coefficient; SKE – asymmetry measure; KURT – kurtosis; K-S – normality distribution test)*

Variables	N	AS	MED	MOD	MIN	MAX	SD	CV	SKE	KURT	maxD
BK I	30	31,1	30,7	27,4	23,2	43,4	4,3	13,7	0,6	0,9	0,09
BK II	30	33,9	34,1	38,4	24,6	47,9	4,7	14,6	0,5	1,3	0,07

(BK I – initial scores of javelin throws; BK II – final scores of javelin throws)

It is evident from the table of descriptive data (*Table 4*) that both variables have normal distribution. The average score of javelin throw is 31,1m, while average score of the final measurement is longer for 2,8m and it amounts 33,9m. The range of scores is within 23,2 and 43,4m in the inital and 24,6 to 47,9 in the final measurement. The reason for this large range is in impact of other sport activities on scores in javelin throw. Student who achieved a high result was engaged in handball, where hand movements (handball throwing) are similar to javelin throw movements. The similar results were obtained by Žuvela, Borović and Foretić (2011) who determined correlation of motoric capabilities and javelin throw scores at kinesiology students. The average javelin throw score in their research was 33,53m, while the lowest score was 22,70m, and the best was 43,20. Significantlly lower scores were obtained by Moguš, Jukić and Šušnjerga (2017) who also tested kinesiology students. The results of javelin throw were within the range of 19,00m to 29,95m.

Table 5. *T-test for dependent samples to determine difference between the initiaal and final state of javelin throw at kinesiology students (AS – mean; SD – standard deviation; p - significance level)*

Varijable	AS	SD	p
BK I	31,180	4,286	0,000
BK II	33,926	4,744	

(BK I – initial scores of javelin throws; BK II – final scores of javelin throws)

Table 5 shows the T-test scores for dependent samples that is used to test differences between the initial and final measurement scores of javelin throw. Results have shown statistically significant differences between the initial and final measurement at the significance level of $p<0,05$. Many authors agree with the fact that high level of motoric learning can be achieved only by a long-term practice (Žuvela et al, 2011). Čoh, Jovanović-Golubović and Bratić (2004) state that is it is necessary to do between 40.000 and 50.000 repetitions to achieve stability and automation of one single moving structure in sport that corresponds to a long period of time. Despite this, our research has shown statistically significant differences between the initial and final measurement, i.e. improvements in achieved scores of javelin throws, as well as good homogenity, objectivity and sensitivity of the test that can be attributed to insufficient knowledge of the throwing technique on the beginning of the classes in Athletics II. Also, we can assume that level of adoption of javelin throw is caused by using general and specific exercises (vortex-rocket throws) through methodics of javelin throw training. Based on existing researches (Tešanović, 2009) and our research, it can be concluded that vortex as throwing prop should be included in classes when training students.

CONCLUSION

A javelin throw is very complex and many existing researches showed that technically proper and long hits are achieved only by students with above-average knowledge of javelin throw. During classes of the course Athletics II, students went through the process of learning and adopting motoric knowledges, and given that for beginners it is difficult to control javelin as throwing prop due to its shape. In this research we have used a vortex-rocket as a specific prop in training. The vortex-rocket is spongy-shaped, weighing 135g and that is much easier to control for beginners than the javelin. The results of the final measurement and referees grades showed that students have improved javelin throw technique as well as their results, that can partially be attributed to the use of vortex-rocket in training process. A disadvantage of the ressearch is the lack of control group that would do classes only by performing general training exercises of javelin throw, thus providing more detailed information how much the use od vortex has helped to improvement of technique and throwing scores. No matter to this disadvantage, we consider that use of specific props like vortex and light-weight balls throwing should be an integral part of javelin throw training at students, as well as younge adults since they are more practical and easier to control for beginners.

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SAŽETAK

Bacanje koplja je složena atletska disciplina koja zahtijeva nekoliko godina treniranja kako bi se ovladalo tehnikom bacanja. Budući da su nastavnici ograničeni vremenom, problem koji se javlja u nastavi jest kako u što kraćem vremenu obučiti studente pravilnoj tehnici bacanja koplja. S obzirom da je kopljem kao rekvizitom teško ovladati, povedeno je istraživanje koje je imalo za cilj utvrditi efikasnost primjene vortexa kao pomoćnog rekvizita pri obučavanju tehnike bacanja koplja. Ukupan broj ispitanika bio je 30 studenata prve godine preddiplomskog studija Kineziologije Sveučilišta u Mostaru u akademskoj 2016/2017 godini. Na početku nastave odrađeno je inicijalno mjerenje, tijekom nastave koristile su se opće vježbe, kao i primjena vortexa kao pomoćnog rekvizita u obuci tehnike bacanja, a na kraju nastave je odrađeno finalno mjerenje i ocjenjivanje tehnike bacanja koplja od strane 3 suca. Primjenom T-testa dobila se statistički značajna razlika između inicijalnog (31,1m)i finalnog (33,9m) mjerenja.Rezultati pokazuju da su studenti poboljšali prosječan rezultat u finalnom u odnosu na inicijalno mjerenje te se na osnovu dobivenih rezultata može se pretpostaviti da korištenje vortexaima pozitivno djelovanje na obuku bacanja koplja kod početnika i da bi bilo poželjno taj rekvizit uključiti u nastavu prilikom obuke studenata, ali i mlađih uzrasta.

Ključne riječi: *bacanje koplja, vortex, studenti, tehnika bacanja, metode za procjenu izvođenja*

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