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Original Article

The impact of special strength intervention in water on the flutter kicking performance in swimming

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Abstract
The aim of the research was to verify the vertical flutter kicks effectiveness included in the junior swimmers' training process (n = 11, height = 178.57 ± 7.12, weight = 72.06 ± 12.93, age 16.27 ± 0.70 years). We assumed that this special exercise in the training process will improve the performance of swimmers, what will result in improved times and decreasing number of kicks in the 50-meter test using flutter kicking. At the same time, we investigated whether the impact of this training would be more obvious when arms were close to the body or stretched upwards during swimming. The experiment was conducted for five months from October 2017 to early March 2018. The results confirmed the statistical significance of the given training method in favor of the swimmers experimental group in the number of kicks as well as in the 50m FK performance with both stretched arms and arms close to the body. The effect of the method had impact on the 50m FK test with stretched arms (Z = -3.251 ($p < 0.05$, r = 0.69 - great effect). The performance was improved and the number of kicks reduced.
Key words: vertical flutter kicking training, swimming velocity and power

Introduction

Swimming front crawl is the fastest swimming method because its technique is most effective in terms of biomechanics. The horizontal position of the body is associated with the alternating work of the upper and lower limbs, which allow to maintain a uniform velocity of the stroke force (propulsion) with minimal resistance (Ruzbarsky & Turek, 2006). Lower limbs maintain the right hydrodynamic position of the body in water and have a stabilizing and coordinating function. They perform alternating motion in the vertical plane. The propulsive phase of the front crawl is pointing down. This movement begins with flexion of the hip, the thigh of a swimmer starts to move down until the shin continues to move upward. The knee and ankle joints are extended and the feet are turned in. (Ruzbarsky & Turek, 2006). The alternating kick stroke phase starts by stabilizing the body center. The strength of the lower limbs depends on the activated abdomen. The kick itself starts with a slight extension in the hips. The lumbar muscles and the straight thigh muscle are flexed from this position. At the same time, the straight thigh muscle will cause knee extension, which is assisted by other parts of the quadriceps that are activated shortly afterwards. Engaging the entire quadriceps' thigh muscle increases the kick force. All of these muscles remain active throughout the whole stroke phase. The lower limb muscles keep the foot in a slight inversion and the triple calf muscle in the plantar flexion. In the resting phase, the work of the hip flexors ends in extension. The back thigh muscles (hamstrings) and gluteus maximus muscle are active only (McLeod, 2014).

The strength of the lower limbs helps not only to kick efficiently, but is also crucial for dive at the start and after the flip turn (Argus et al., 2010; Benjanuvatra, Edmuns, & Blanskby, 2007; Beretic et al., 2013; Cronin, Jones, & Frost, 2007; Ďurovic, Beretic,& Okicic, 2015; Haufler, 2007; Haycraft & Robertson, 2015).Haycraft & Robertson, 2015). Legs are often an overlooked part of the whole body kinematic chain. They balance the movement of the torso and upper limbs and contribute to the hydrodynamics of the entire body. Thus, the participation of arm performance is propotionally much higher than that of lower limbs. A research in Portugal attended by 24 swimmers (12 men and 12 women), convinced us. The propotion had been found out during a 50m front crawl sprint. Realization was carried out on a swimming expander in water. The results showed that the proportion of arms and legs work in men performance is 70.3% / 29.7%, whilst in women performance it is 66.6% / 33.4%. Women use legs to a greater extent than men in short-distance swimming (Marques et al. 2015). In another study, we learn about the relationship between power and flutter kick speed. 18 high-performance swimmers from the University of Bologna in Italy participated in this study. They found that the highest force (54 ± 8 W) was recorded at a swimming speed of 1.27 ± 0.08 m / s. The higher the speed, the lower the kick force. The force was reduced to 17 ± 10 at a speed of 2 m / s. In addition,the study showed a changing range of

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kicks when changing speed. The angle between the horizontal line joining the lowest and the highest ankle points in the movement trajectory was significantly wider (75 ± 4 °) at a speed of 1.2 m / s than at 2 m / s (63 ± 6 °)(Gatta, Cortesi & Di Michele, 2012).The results of the study by Baumrtová, Jebavý & Hojka (2017) did not confirm the effect of the lower limbs explosive force on the performance in 50m pool ($p = 0.25$; $r2 = 0.08$).On the other hand, the results of swimmers in the 25m pool confirmed the statistical dependence of the lower limbs performance on their strength ($p <0.001$; $r2 = 0.85$).In recent years, great emphasis has been put on underwater swimming after the dive start and flip turn. Swimming over the permitted 15 meters underwater requires a lot of stress to the performance and strength of the legs and high oxygen consumption.Especially inbackstroke disciplines the swimmer is 60% underwater. If a swimmer who has not been strengtheninglegsduring the training starts to engage his legs more in the race, he will not be able to make the race (Atkinson & Sweetenham, 2006).The development of swimming strength in water can be a very challenging yet varied form of training.There are many exercises that have an impact not only on improving swimming strength, but also on improving core stability and lung capacity.It is essential for each exercise to maintain swimmers' interest, concentration, and the associated intensity of exercise (Václavíková, 2012).

The classic strengthening of legs in the pool is a partial swimming with a swimming board. It can be used by every trainer during the preparation of children. Another form of strengthening is with the help of flippers. It is possible to practice so-called "wall kicking", which means kicking against the wall with or without flippers. To increase the strength of the lower limbs, we can also use *swimming on a flexible suspension* with a rubber rope.Short periods of time (approx. 10 s) are quite sufficient, because it is very difficult to keep the maximum intensity against so much resistance. Another way of strengthening is also kicking legs in a vertical position, whereby it is more difficult to keep on the surface due to reduced hydrostatic buoyancy. Vertical kicks training allows improving the swimming propulsive power of legs (Olivier Poirier & Leroy, 2016).Swimmers who have not correct kicking technique, such as a kick done only from the knee or a kick with almost straight legs, are forced to engage the core of the body and transfer the entire kick from hips in the vertical position (www.yourswimlog.com). Younger swimmers can with the help of arms while exercising, so that they do not dive too much.Better swimmers should minimize arm rowing and focus on the correct kicks. They should eliminate upper body movements and put hands close to the body underwater.

The difficulty can be increased by pulling hands out of the water and gradually the whole arms (www.triathlete.com). For even more difficulty of the exercise, swimmer may raise hisarms beyond the head, stretch or hold a weightin the arms, e.g.a medicine ball.Vertical flutter kicks can also be performed with flippers.Steve West, who has beaten several world records in his age category,swam vertical kicks using breaststroke technique. His training consisted of seven series of 30 second vertical breaststroke kicks performance with a 5 kg weight overhead and a 30 second rest.After completing these training series, he qualified in U.S. Pat. Olympic trials in a 100 meter breaststroke discipline (Commings, 2012).Hannula (2005) stated that vertical flutter kicks should be performed in series for more than 10 seconds. The difficulty can be increased by holding aweight overhead. Bob Bowman, the trainer of Michael Phelps, recommends vertical flutter kicking with weight to build lower limbs' strengthand speed.Gary Hall, American swimmer who own 10 Olympic medals, recommendsseries with a longer swimming interval up to 45 seconds and a 15 second rest.One alternative method to increase the weight when performing vertical flutter kicks is to change the arm position.Arms are crossed on the chestduring the first 1 minute series with a 30 seconds rest. Arms are crouched behind the headin the second series and in the third series;arms are lifted from the water to the elbows. In the last series, arms are stretched. [http://effortlessswimming.com/freestyle/swim-kick-technique].

Material & methods

The aim of the research is to verify the effectiveness of the vertical flutter kicks inclusion on the experimental group of 14-17 year-old sports swimmers in training.

H1: We assume that applying vertical flutter kicks to the swimmers' training process will improve the times in the 50 meter test.
H2: We assume that by applying vertical flutter kicks to the swimmers' training process will reduce the number of kicks performed in the 50 meter test.

The research group consisted of 22 swimmers from the Nereus Swimming Sports Club in Žilina, who regularly participated in trainings, concentration, regional, national and foreign races.The experimental group and the control group consisted of 11 swimmers, including 3 girls and 8 boys.Swimmers in the research group were in the category of older pupils and junior categories, which is the age 14-17.The average Body Mass Index (BMI) was 20, 28.The average number of FINA points in the research set during the experiment was 460 points. Swimmers had the same number of trainings in water and on the ground. Swimmers underwent 7 trainings in water during 8.5 hourswithin one microcycle. They implemented three trainings (45min) on the ground with a focus on self-weight training, theraband exercises, TRX exercises, exercises with fitballs and medicine balls within the microcycle. They made 30 minutes of quality stretchingtwice a week after the afternoon training.

Table 1 Special training indicators during the research time

	Warm up exercises	*Elementaryendurance 50-70%*	*Special Endurance 70-80%*	*Special Endurance 80-90%*	*Max. Speed 95-100%*	*Arms*	*Legs*	*Overall*
km	132	109	28	27,4	8	15,5	20	305
%	43,28	35,74	9,28	8,98	2,28	5,08	6,55	100

We have conducted the research from the 7th of October 2017 to 6th of the March 2018 at the City Covered Swimming Pool in Žilina in an eight-lane 50-meter pool with a standard water temperature of 27 ° C.Research was conducted in three stages.The first stage took place onthe 7th of October 2017. 22 swimmers from the experimental and control group passed the 2 x 50 meter the front crawl test using their legs. Swimmers with a snorkel swam the first 50 meters with their arms close to the body. In order not to affect the performance of swimmers, we decided to measure the time and count kicks after the first five meters.After substitution of all the swimmers swam another 50 meters with stretched arms. We chose one test with arms close to the body and the other withstretched arms, because the position of arms during vertical flutter kicks is not like a classic swimming, and we were interested in how this exercise affects swimming when changing arms position.We recorded the time and number of kicks on each 50-meter section. We measured the time with a stopwatch for each swimmer. We also used a fraudulent camera to take a shot of the kick at a distance of 25 meters.The test should be swam as quickly as possible.The second stage of the research took place on the 21stof December 2017 using the same conditions and test. The time and number of kicks were recorded as in the first test, but we left out the camera in the second test.This test followed after a one week elimination of the experimental factor from the training process. The third stage of the research was held on the 6th of March 2018. The test with the same content and the same conditions was re-conducted and attended by the same swimmers from the experimental and control groups. We used the fraudulent camera again in this output test.The final test was also carried out after one week ellimination of the experimental factor from the training process.Vertical flutter kicks were performed in the experimental group of swimmers twice a week, therefore on Tuesdays and Thursdays after awarm up swimming.This part of the training consisted of 8 series,each containing between 20 and 30 seconds of flutter kicks in a vertical position in place and 1 minute rest. We increased the difficulty after 3 weeks. The performance time was 20 seconds at the beginning of the research and was gradually increasing by 5 seconds. We increased the weight by adding medicine ball to the swimmers' hands after 30 seconds of performance. Then we set the kicking time again for 20 seconds and sequentially increased it. Swimmers had their arms raised over the water during kicking. The higher their arms were stretched, the higher the difficulty of the exercise (e.g. tab. 2).

Table 2 Increasing the difficulty in experimental group

3 weeks	3 weeks	3 weeks	3 weeks	3 weeks	3 weeks
20s/40s	25s/35s	30s/30s	20s/40s Medicine ball	25s/35s Medicine ball	30s/30s Medicine ball

The time and the number of kicks were counted individually for each swimmer from the control group. This result was recorded as a score and was used to show the differences between the first input test and the final output test. The lower was the score in the output test, the greater the improvement was made by the tested subject.We used arithmetic mean (x) of position rates and standard deviation (SD) from variability rates within the descriptive statistics. The data distribution normality was verified by Shapiro-Wilk test in all statistical analyzes.One-way ANOVA was used to determine the significance of the differences between the input, half-time and output tests using the parameters (time with arms close to the body, the number of kicks with arms close to the body, the number of kicks with stretched arms above the head recorded in the experimental group and time with arms above the head, the number of kicks with arms close to the body, the number of kicks with stretched arms above the headrecorded in the control group). Homogeneity of variance was verified by Leven test. Substantive significance was calculated by the effect size coefficient "Eta Squared - η2".The coefficient "η2" was interpreted as follows: η2 = 0.01 - small effect, η2 = 0.06 - medium effect, η2 = 0.14 - great effect (Cohen, 1988).The Friedman test was used to determine the significance of the differences between the input, half-time and output tests using the parameters (time with stretched arms in the experimental group and time with arms close to the body in the control group). Substantive significance was calculated using the Kendall rank correlation coefficient "W" (Green - Salkind, 2008).The coefficient "W" was interpreted as follows: W = 0 - 0.20 - very small effect, W = 0.20 - 0.40 - small effect, W = 0.40 - 0.60 - medium effect, 0.60 - 0.80 - big effect, 0.80 - 1.00 - great effect (Rovai - Baker - Ponton, 2014).The Wilcoxon test with Bonferroni correction was used as a post hoc test in the time parameter in the experimental group to determine the significance of the differences between the measurement pairs (input, half-time, output).The coefficient "r" was used as the substantivesignificance (Corder - Foreman, 2009) and interpreted as follows: r = 0.10 - small effect, r = 0.30 - medium effect, r = 0.50 - great effect 1988).An unpaired t-test was used to compare the significance of the experimental and control group effect in the number of kicks with stretched arms parameter. Substantive significance was determined by the Cohen coefficient "effect size" - "d", which was interpreted as follows: d = 0.20 - small effect, d = 0.50 - medium effect, d = 0.80 - great effect (Cohen, 1988).The Mann-Whitney U test was used to compare the effect of the experimental and control groups in the time with arms close to the body, time with stretched arms, and number of kicks with arms close to the body parameters with the substantive significance coefficient effect size "r". The probability of of Type I error was set to α = 0.05 in all analyzes and 0.017 in Bonfferoni correction.Statistical analysis was performed via the computer program IBM® SPSS® Statistics V19.

Results

The aim of the research was to verify the vertical flutter kicks influence as a training method included in the experimental group of swimmers' training process on their performance, meaning the time and the number of kicks and in the 50m flutter kick test with arms close to the body and the same test with stretched arms above the head. An unpaired t-test was used to compare the significance of the experimental and control group effect in the parameter performing flutter kicks with stretched arms above the head. The Mann-Whitney U test was used to compare the effect of the experimental and the control group using other parameters (Table3,4).To make the results more transparent we usedso-called "scores" that we get by the sum of the performance (seconds) and the number of kicks per distance (Atkinson, Sweetenham, 2006).The smaller the score, the better the performance.Thus, if this number is smaller in the output test, the swimmer has fulfilled the expected positive result.If the time remained unchanged but the number of kicks decreased, we achieved a better flutter kick efficiency.

Table 3 Differences between the control group and the experimental group

Group Statistics - differencesbetween exp and congroup					
	Groups	N	Mean	Std. Deviation	Std. ErrorMean
time with arms close to the bodydifference	exp	11	2,83	2,97	0,89
	con	11	2,72	8,14	2,45
timewith stretched arms difference	exp	11	2,32	2,98	0,90
	con	11	-,63	1,21	0,36
numberof kicks with arms close to the body difference	exp	11	3,54	7,91	2,38
	con	11	-1,09	11,60	3,49
numberof kicks with stretched arms difference	exp	11	7,54	5,52	1,66
	con	11	-1,09	7,64	2,30

Legend: *time with arms close to the body difference - time in the 50m flutter kick test with arms close to the body, number of kicks with arms close to the body difference - number of kicks in the 50m flutter kick test with arms close to the body, time with stretched arms difference - time in the 50m flutter kick test with stretched arms above the head, number of kicks with stretched arms difference - number of kicks in the 50m flutter kick test with stretched arms above the head*

Table 4 Comparison of the performance improvement difference in 50m flutter kicks in the control and the experimental group.

Test Statistics	**Time w/ arms close to the body difference**	**Time w/ stretched arms difference**	**Number of kicks w/ arms close to the body difference**
Mann-Whitney U	33,00	11,00	35,00
Wilcoxon W	99,00	77,00	101,00
Z	-1,806	-3,251	-1,680

Legend*: time w/ arms close to the body difference - time in the 50m flutter kick test with arms close to the body, number of kicks w/ arms close to the body difference - number of kicks in the 50m flutter kick test with arms close to the body, time w/ stretched arms difference - time in the 50m flutter kick test with stretched arms above the head, number of kicks w/ stretched arms difference - number of kicks in the 50m flutter kick test with stretched arms above the head*

The time-experimental group improved by 3.23% in a 50m flutter kick test after a five-month special leg training.There was a 2.64% improvement in the control group without the special training. The difference found between the groups in this parameter is 0.59%.The results were confirmed relevant at 0.05 level of statistical significance: Z = -1,806 (p> 0.05, r = 0.39 - medium effect).It means that swimmers who have undergone a special program with a focus on the lower limbs have proven to be effective in terms of time achieved (Table 5).

Table 5 Significance of Test Difference inthe 50m flutter kick test - Time

50 m FK arms to the body - time	Experimentalgroup	Controlgroup
Improvement of time in %	3,23%	2,64%
Z	-1,806(p > 0,05, r = 0,39 –mean effect	

We took into account the number of kicks the swimmers did in the same test. The experimental group improved their performance by 3.35% and the control group worsen by 0.90%.The difference between the groups is 4.25%.The results also confirmed their relevance at the level of significance of 0.05: Z = -1.680 (p> 0.05, r = 0.36 - mean effect) (e.g.Table 6). We confirmed that the swimmers who had a special program of vertical flutter kicks proved this program effective in terms of the number of kicks achieved.

Table 650m flutter kick test - the number of kicks

50 m FKstretched arms Number of kicks	Experimentalgroup	Controlgroup
Improvement of time in %	3,35%	-0,90%
Z	-1,680(p > 0,05, r = 0,36 - meaneffect)	

The score results (Fig. 1) confirm that the experimental group achieved a lower output test score (1766.48 - 3.44% improvement) than a control group (1982.29 - 0.12% improvement or rather worsening50m flutter kick test,and therefore better performance.The overall difference is 3.56% between these two groups.

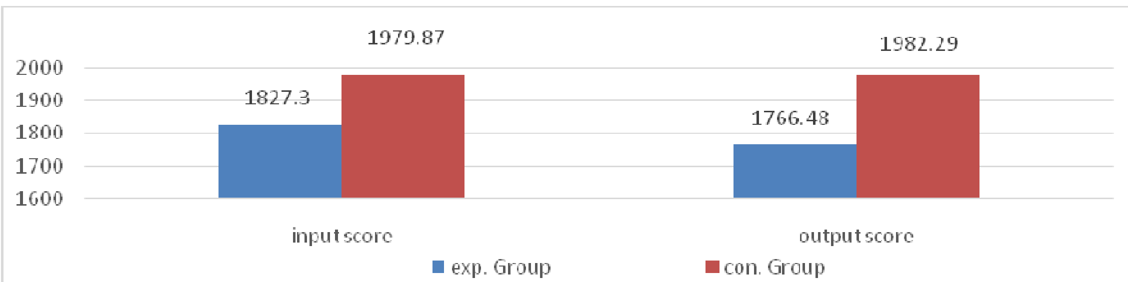


Fig. 1 Difference in 50m flutter kick with arms close to the body test score

The swimmers took part in the 50m flutter kick test with arms stretched above the head. In terms of time, the experimental group improved by 4.56%. We recorded a minor worsening of 1.15%in the control group. The difference we found between the groups in this parameter is up to 5.71%.The results of the significance test confirmed its relevance at 0.05 level of statistical significance: Z = -3.251 (p <0.05, r = 0.69 - big effect). We were confirmed that the experimental factor had a positive effect on the performance,even when the swimmers had arms stretched above their heads (e.g.Table 7).

Table 750m flutter kick test with arms stretched above the head – time

50 m FK stretched arms time	Experimentalgroup	Controlgroup
Improvement of time in %	4,56 %	-1,15%
Z	-3,251 (p < 0,05, r = 0,69 - largeeffect)	

We used an unpaired t-test to calculate the significance difference of the test between the experimental and the control group in the in the50m flutter kick testwith arms stretched above the head. The experimental group improved by 7.23% in this test and the control group worsen by 0.93%.Thus, the difference between the two groups is 8.16% in the number of kicks per 50 meters of flutter kicks in the output test, which confirmed its relevance at the significance level of 0.05: t = 3.037 (p <0.05). , d = 1.42 - large effect) (Table 8).

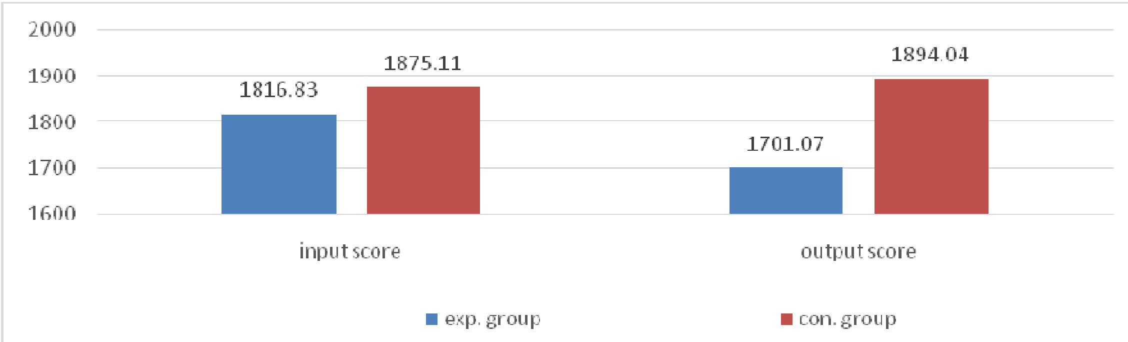
Table 850m flutter kick test with arms stretched above the head – the number of kicks

50 m FKstretched arms Number of kicks	Experimentalgroup	Controlgroup
Improvement of time in %	7,23%	-0,93%
Z	3,037(p < 0,05, d = 1,42 –large effect)	

The results achieved in the 50m flutter kick with arms stretched above the headtestscore confirmed these results (Fig. 2).The experimental group improved to a much greater extent (1701.07, an improvement of

6.81% compared to input test score) than the control group on which we recorded an increase in score (1894.04 – worsening by 1%).The difference is therefore greater in the 50m flutter kick test with arms stretched above the head.

Fig. 2 Input and output scores in the 50m flutter kick test with arms stretched above the head



We also created videos for the tests, which were recorded with a fraudulent camera.We placed this camera at the 25 boundary line on both 50 meter sections during both input and output testing. We have determined the angle of the kick range from each swimmer's recordin the Kinovea program. When comparing the results, 9 swimmers from 11increased the angle of the kick range when swimming with their arms stretched. This fact is also related to the reduced number of kicks achieved by swimmers in the final test.If a swimmer reaches a smaller number of kicks, it means that the quality and effect of the kick has improved.If time also improves, then kick improvement is even more visible.The training of vertical flutter kicks improves the propulsive and total strength of the kick, which can swimmers use in a position that is similar to swimming i.e. with stretched arms above the head. Body stability is better, therefore all energy is concentrated in high quality flutter kicks.

Discussion

Swimming performance is a multifactorial phenomenon that depends on energy, biomechanical, hydrodynamic, anthropometric and strength parameters (Barbosa et al., 2009; 2010).According to the authors (Tanaka et al., 1993; Trappe and Pearson, 1994) the two main factors that determine the performance of a swimmer are strength and speed.Sports swimming takes place in a specific aquatic environment that gives the swimmer much more resistance than the natural dry environment.Swimming is characterized by the ability to transform its strength capabilities into a propulsive force, while reducing the resistance of the aquatic environment, which is caused by the swimmers moving forward (Maglischo, 2003).Strength abilities are the basic and decisive abilities of a person without which other movement abilities cannot manifest and develop.Peric et al. (2012) emphasizes that the development of speed capability from the age of 14 is only possible on the basis of supporting factors and strength capabilities in particular. For the diagnostic purposes of strength abilities in performance and top swimming, various swimming aids were constructed on the ground as well as in the water (biokinetic bench, ergometers, strain gauges, flexible suspension, etc.).Most studies are investigating the impact of a power program on theground or rather a combination of specific strength training directly in the water and its transfer to swimming performance.Several studies have noted the positive effects of strength training on the ground (Garrido et al., 2010; Girold et al., 2007; (Costill, 1999; Pichon et al., 1995; Strass, 1988) on the development of swimming performance.Authors (Costill, 1999; Pichon et al., 1995; Strass, 1988) confirmed the effect of strength training on the ground using self-weight training for swimmers in sprint disciplines 25 and 50 m freestyle.Swimmers‘ performance increasedat the level1.3 and 4.4%.The authors Popovici & Suciu, (2013) confirmed the significant impact of the 4-week strength program on 11 -12 year old children using a biokinetic swimming bench - a swimming bench to improve the propulsive power in water and swimming performance mainly on short disciplines (50 m butterfly stroke).However, most authors and trainers (Salo, 2008; Vanečková, 2009, Václavíková, 2012) agree that it is necessary to combine strength training on the ground and in the water.Tanaka et.al (1993) found that specific training in water was much more effective than developing strength on the ground. Traditional weight training on the ground combined with swimming training has shown an improvement in the strength of the upper limbs of about 30%, but has not shown faster times compared to pure swimming training without strength intervention.Suciu & Popovici (2014) confirmed the effect of a 6-week special strength intervention in water by using vertical flutter kicks (vertical water training with weight belts) 3 times a week to improve the lower limbs strength (increasing maximum force knee extensors strength) and sprind performance in butterfly stroke. Aspenes et al. (2009) examined the impact of an 11-week intervention of combined strength and endurance training. The effect of the program on strength parameters, the propulsive power measured on the flexible suspension in water and the 400m freestyle in contrast with the control group of young performance swimmers was confirmed in this study. They did not notice changes in the length and frequency of the stroke and performance in 50m and 100m freestyle.Gatta et al. (2014) pointed to the transfer of training methods based on a combination of maximum strength training on the ground immediately followed by training at the anaerobic threshold in water.There was recorded a significant improvement (11.7% p <0.05; rate 4.99% p <0, 05) of swimming performance at masters swimmers.Macejková - Putala (2014) found a higher maximum force of 135.5 N in isokinetic regimen during breastrke, a higher minimum force of 19.5 N during breastroke and a higher average force of 42 N while swimming freestyle.They found that with increasing swimming speed, the power [W] increases to a limiting speed and then decreases againin both methods. The results of the study by Macejková, Y., Putala, M. & Grznár, Ľ. (2012) showed that the optimal speed for the students to swim objective evaluation of force parameters 0.4 ms-1, and for female students 0.3 ms-1.

Conclusion

The aim of our study was to determine the effectiveness of vertical flutter kicks on leg performance during swimming.We chose swimmers about 15 years old to experiment.We assumed that this special exercise in the training process will improve the performance of swimmers, what will result in improved times and decreasing number of kicks in the 50-meter test using flutter kicking. We have also examined whether the impact of this training will be more visible while swimming with arms close to the body or stretched above the head. Therefore swimmers swam the first 50 meters with arms close to the body and the other 50 meters with stretched arms.This experiment was conducted for five months from October 2017 to the beginning of March 2018. We can confirm both hypotheses on account of the results of the input and output tests. Swimming experimental groups trying to make vertical flutterkicks visible are improving time when they reach 50 meters. The group improved the time by 3.23% when swimming with arms close to the body and by 4.56% with stretched arms. The group improved by 3.35% in the number of kicks with arms close to the body and similarly improved the times.The improvement of swimming with stretched arms was 7.23%.The results were confirmed relevant at 0.05% level of statistical significance: Z = -1.806 (p> 0.05, r = 0.39 - mean effect) in a 50-meter flutter kick test in both swimming with arms close to the body and time Z -1.680 (p> 0.05, r = 0.36 - mean effect) in favor of the experimental swimmers group. The effect of the special program was more pronounced in a 50-meter flutter kick test; we saw a 5.71% reduction in time in the experimental swimmers group.The significance test results confirmed the relevance at 0.05 level of statistical significance: Z = -3.251 (p <0.05, r = 0.69 - large effect).Regarding the number of kicks in the 50 meter flutter kick test, we noted the difference between the experimental and the control group of 8.16% in the output test, which was statistically significant at 0.05: t = 3.037 (p <0.05, d = 1.42 - great effect) in favour of the experimental swimmers group.The results of the score achieved showed a more positive impactof 6.81% in the 50m test with stretched arms compared to swimming with arm close to the body with improvement of 3.44%. Performance improvements were affected equally in time and kicks in arms close to the body test. In the case of the stretched arms, the performance was more influenced by the reduction in the number of kicks, which resulted in a greater improvement in times.This fact can also be connected with increased angle of the kick range, which we noticedmost swimmers did.For comparison, we saw only improvement in the flutter kicksin the control group. We did not notice any positive changes or influence of classic training.Based on the results of the research, we recommend to include the vertical flutter kicks in the swimmers' training to strengthen and improve flutter kicking with a consequent positive effect on performance.

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