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Scientific review article

THE USE OF THE CORE TRAINING METHOD IN BODY MUSCLE POWER DEVELOPMENT IN SIXTH GRADE ELEMENTARY SCHOOL CHILDREN

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Abstract: In physical education classes in the Republic of Serbia the development of strength belongs to the first thematic area of physical education teaching, and it belongs to the development of physical abilities, which apart from strength includes speed, endurance, coordination, agility and balance. The most frequently used method in classes where the strength of body musculature is being developed is the method of dynamic repetitions. Working with these parallel groups, we wanted to show the influence of the Core Method and its advantages and benefits in body musculature strength development compared to the formerly used methods. The experimental group was systematically subjected to the experimental Core Method of physical strength development. The control group was subjected to the dynamic method – repeated strains (the development of repetitive physical strength). At the initial and final measuring the pupils were tested by the elements of the Eurofit battery and IPFT test. The progress we made after a four-month-research in motor variables with the sixth grade elementary school pupils can be entirely attributed to the use of the experimental core training method in physical education classes.

Key words: *physical education, physical development, muscle strength, comparative testing*

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INTRODUCTION

Physical strength is man's ability to overcome external resistance by using muscular contractions or oppose that very same resistance.

In physical education (hereinafter: PE) classes, physical strength development belongs to the first thematic area of the PE curriculum in Serbia (the development of physical abilities). Physical strength is considered to be the dominant motoric ability as it enables all the movements of man.

"Physical strength is the ability of an individual to create muscle force" (Barov, McGee, 1975).

There are a few methods for physical strength development:

- the method of maximum strain
- the method of repeated strain (70-80% straining of the maximum)
- the method of dynamic strain (developing speed and explosive strength)
- the plyometric method (uses eccentric contractions for physical strength development)
- the method of isometric strain (static work regime - different ways of keeping the body still in one position)
- the core training (proprioreceptive) method for deep muscles development – stabilizers;

At the elementary school age, the most applied exercises for physical strength development are repetitive exercises (the dynamic work regime), dynamic fast movements important for explosive strength development and to a lesser extent, the static work regime - different ways of keeping the body still in one position.

The core training method was taken from physiatrist medicine and physical therapy –using this method a patient functionally recovers much faster than by applying earlier methods. It is also characterized by a large engagement of the proprioreceptors (Grey, Norris, 2003).

Apart from the superficial trunk muscles which are active while performing exercises, the core training method activates proprioceptors which then activate deep layers of muscles and joint connections. The movements are multidimensional and are frequently made in two or three planes (frontal, sagittal and vertical). In the majority of applied exercises, the abdominal muscles and the muscles of the back maintain the position of the body and they are in the constant isometric work regime. Gray calls these exercises 2D or 3D exercises (2013). The core training method activates proprioreceptors which then activate deep layers of muscles and joint connections.

The method is also very efficient in injury prevention and rehabilitation. In their tests, G. Cook (1997) and M. Boyle (2003) also justified the use of the core training method.

In the area of physical education and sports it is a training used for deep muscles-stabilizers (core muscles) development.

In PE classes, most frequently used for developing the strength of the trunk muscles (abdominal, back, pectoral and shoulder) is the method of dynamic strain.

This paper tests the possibility of developing the strength of the mentioned muscle groups by way of the Core method in PE classes.

Foreign literature calls this method Core preformance (Verstegen, 2005). This method for developing strength is considered by some authors more economic and quicker for developing strength in children of school age as well as those involved with recreational sports and athletes.

METHODOLOGY

The research was of an experimental type, lasting one whole half-term, from February 1 to May 31, 2012/2013.

Sample and participants

The subject sample, defined as suitable, was created by sixth grade elementary school children divided into the experimental and control group. The experimental group numbered 99 pupils and the control group contained 92 pupils. The experimental group was systematically subjected to the core method of physical strength development. The control group was subjected to the dynamic method – repeated strains (the development of repetitive physical strength).

Variables

The motor space contained changes of the following variables:
- The test of repetitive abdominal musculature strength;
- The test of repetitive back musculature strength;
- The test of repetitive chest and shoulder strength and arm extension strength test of repetitive chest and shoulder strength and arm extension strength.

The morphological space contained changes of the following variables:
- Body height;
- Body weight;
- BMI (body mass index).

Study instruments

At the initial and final measuring, the pupils were tested by the elements of the Eurofit battery and IPFT test: Body bend in 30 seconds (test of repetitive abdominal musculature strength), PRC – DTE – test (test of repetitive back musculature strength), Push-ups on a chair in 30 seconds (test of repetitive chest and shoulder strength and arm extension strength), Body height, Body weight, BMI (body mass index.

The experimental group carried out strength exercises during the period of 4 months, 3 times a week at the end of the preparatory stage of the lesson. This is an example of a weekly exercises program:

1. Support on the forearms;
2. Support on a ball, medicine ball, or a sideway bridge;
3. A little candle with knees bent, lowering them to the angle of 90 degrees;
4. Lying on the back, children touch their soles, lifting the shoulder blades and delaying them at the upper point with legs bent in hips and knees;
5. Dead lifting with a ball on one leg;
6. Lifting to a position of a bridge on the shoulder blades with a delay at the upper point;
7. Trunk twist with a medicine ball.

All the exercises were done in two series, lasting 30 - 45 sec each.

The control group was practicing within the same time interval 3 times a week. The following is an example of a weekly exercise program:

1. Bend body at an angle of 45 degrees.
2. Lift legs at an angle of 45 degrees while lying on the back.
3. Contract and stretch legs while sitting.
4. Extend and lift the opposite leg and arm while lying on the stomach.
5. Hyperextend back with palms on the floor, imitating breaststroke swimming with the chest lifted from the floor.
6. Lift the ball with extended arms to a forehead level while standing.
7. Sideway arms lifting from the position of arms extended to the level of shoulders to the positon of arms above the head (sideway arms lifting).

The exercises were done in three series of 15-20 repetitions at the same lesson stage as in the experimental group.

Data analysis

The data obtained during the study were analyzed using descriptive and comparative statistics.

As for descriptive statistics, we used the following representative and dispersion parameters to analyze each variable:

– The distribution of frequencies
– Mean
– Standard deviation and variance
– Standard error of the mean
– Variation width (minimum and maximum)
– Measuring normality schedule - Skwens & Curtosis

From the area of comparative statistics, we used the discriminate procedure by which we tested the differences among the mean values between groups and within them, as follows:

– T - test for independent samples - when testing the significance of differences between the average results of the experimental and control groups received at the initial and final measurement for each variable;
- T - test for dependent samples - when testing significance between the average results obtained at the initial and final measurement for each variable, separately for control and separately for the experimental group;
- Analysis of variance - F test.

Both discriminant procedures were carried out in the process of analysis of co-variation.

RESULTS

The charts below show the research results.

Table 1. *Descriptive statistics at the final measurement for both groups of sixth graders*

GROUP	EXPERIMENTAL (N = 92)				CONTROL (N = 99)			
VARIABLES	M	SD	MIN	MAX	M	SD	MIN	MAX
Repetitive strength of abdominal musculature	24,46	1,95	21,00	29,00	23,41	4,81	9,00	36,00
Repetitive strength of back musculature	44,51	5,84	28,00	55,00	40,56	4,48	28,00	50,00
Repetitive strength of arms and shoulders	14,36	2,68	10,00	21,00	16,61	5,00	5,00	29,00
Body height	161,91	5,29	151,00	170,00	159,36	8,29	141,00	176,00
Body weight	56,97	7,12	42,00	67,00	48,10	10,19	16,00	73,00
BMI	21,73	2,32	18,01	25,23	18,66	3,54	2,05	27,10

Table 2. *The results of t-test for independent samples used for the final measuring of both groups of sixth grade boys*

	t	p
Repetitive abdominal musculature strength	1,986	0,049
Repetitive strength of back musculature	5,224	0,000
Repetitive strength of arms and shoulders	-3,909	0,000
Body height	2,553	0,012
Body weight	7,012	0,000
BMI	7,128	0,000

Table 3. *t – test for dependant samples – establishing the importance of differences in arithmetic means at the initial and final measuring in the control group (N=92; df=91)*

	t	p
Repetitive abdominal musculature strength	-5,938	0,000
Repetitive back musculature strength	-17,241	0,000
Repetitive strength of arms and shoulders	-8,499	0,000
Body height	-4,079	0,000
Body weight	-0,815	0,417
BMI	0,968	0,335

Table 4. *t – test for dependent samples – establishing the importance of arithmetic means differences at the initial and final measuring in the experimental group (N = 99; df = 98)*

	t	p
Repetitive abdominal musculature strength	-37,923	0,000
Repetitive back musculature strength	-15,665	0,000
Repetitive strength of arms and shoulders	-14,862	0,000
Body height	-8,998	0,000
Body weight	-6,405	0,000
BMI	2,664	0,009

After four months of research (one term) and the obtained results, we can conclude that the t-test for independent samples (Tables 1. and 2), when the final measuring of pupils (experimental group N=92 and control N=99) are compared, showed statistically significant differences in the following variables:

Repetitive abdominal musculature strength: the sixth graders in the experimental group had an approximately better score (M=24.46; SD=1.95) compared to the sixth graders in the control group (M=23.41; SD=4.81) - $t=1.986$; $p < .049$ at the final measuring, which we can consider a result of the applied experimental core training method of practice.

Repetitive back musculature strength - the sixth graders in the experimental group had an approximately better score (M = 44.51; SD = 5.84) compared with the sixth graders in the control group (M = 40.56; SD = 4.48) – t = 5.224; p < .000 at the final measuring. We can notice the advantage of the applied experimental core training method in this motor variable, compared with the programs for strength development used before with children of this age.

Repetitive strength of arms and shoulders: the sixth graders in the experimental group had an approximately lower score (M = 14.36; SD = 2.68) compared with the sixth graders in the control group (M = 16.61; SD = 5) – t = -3.909; p < .000 at the final measuring. As for this variable, the core training method increased the strength with the experimental group but the control group showed better results in this variable.

Body height – the sixth grade pupils in the experimental group were approximately taller (M=161.91; SD=5.29) compared to the control group pupils (M=159.36; SD=8.29) –t = 2.553; p < .012 at the final measuring.

Body weight – the sixth grade pupils in the experimental group were approximately heavier (M = 56.97; SD = 7.12) compared to the control group pupils (M = 48.1; SD = 10.19) – t = 7.012; p < .000 at the final measuring.

BMI – the sixth grade pupils in the experimental group had an approximately better score (M = 21.73; SD = 2.32) compared to the experimental group pupils (M = 18.66; SD = 3.54) – t = 7.128; p < .000 at the final measuring.

DISCUSSION

The progress we made after a four-month-research in the motor variables - repetitive abdominal musculature strength (t = 1.986; p < .049) and the repetitive back musculature strength (t = 5.224; p < .000) with the sixth grade pupils can be completely attributed to the use of the experimental core training method in PE classes. The results of the t-test for independent samples used for the final measuring of both groups of sixth grade boys confirm this progress. During the four-month-period of the experiment, the experimental group pupils made bigger progress in repetitive strength development than the control group pupils, although progress in strength is visible in pupils of both groups (Tables 3 and 4).

Considering the fact that PE classes are specific, and the time pupils spend exercising actively (which is sometimes shorter than 25 minutes), the core training method can be used in every class, regardless of the planned unit, thus contributing to continuous physical strength development with the children. Former exercise methods demand a special organization (particular devices, props) which leads to much less time devoted to the main part of the class, and thus children fail to acquire the necessary skills and knowledge.

Development of physical strength with elementary school children is necessary for their growth and development. Body muscle power has a very important role in a child's growth process as that musculature itself enables a correct posture and decreases the possibility of spine deformities. The core training method in physical strength development is based on abdominal and back musculature strength development. Unlike the classic methods of physical strength development, this training method creates the same or even better results in physical strength development for the same period of time.

The applied exercises are easy for a pupil to carry out, as well as for a teacher (trainer) who controls him/her. The teacher (trainer) does not have to provide the rhythm, the pupils (sportspeople) perform the exercises in their own pace. Errors in performing are easily and quickly removed. The exercises are done in periods lasting from 35 to 40 sec at the beginning. Later the time for the exercises can be extended.

Unlike the classic methods for muscle power development, the core training method consists of three types of muscle contractions (static, exocentric and concentric). Former methods for physical strength development are based on concentric muscle contractions.

The exercises used in the core training method belong to a group of complex exercises because they engage more groups of muscles at the same time, which is very important for the muscle groups surrounding a child's spinal column. Performing exercises for abdominal musculature simultaneously develop the back and shoulder musculature.

The exercises can be easily and quickly modified (they can be made easier or more difficult) by changing the position of body parts or by shutting down one of the senses.

The differences in the variables of morphological space, especially if there have been changes in both groups (Tables 3 and 4) - (body height, body weight, body mass index (BMI)) cannot be attributed to the influence of the experimental method, but rather, they are a consequence of biological growth and student development.

Former research on the use of the core training method in PE teaching shows that there is not a single study about the influence of this method on physical strength development with elementary school children. The studies are based on the research carried out in professional sports and medicine – physical therapy.

CONCLUSION

The use of the core method resulted in better effects in all variables with pupils of this age except in the variable of repetitive strength of arms and shoulders.

This leads to the conclusion that the core training method of physical strength development with the children at this age gives better results than the former methods.

There are some advantages of this method we have not tested, but which are worth mentioning:

- Using this method, we can make exercises easier or more difficult, depending on the children's abilities.
- More muscle groups are treated simultaneously, which is possible due to the different positions of the body which activates the muscles.
- A pupil is completely focused on one exercise – the possibility of incorrect performance is less.
- The results of physical strength development are visible in a short period of time, which additionally stimulates the pupils.

The differences in morphological variables (body height, body weight, body mass index (BMI)) cannot be attributed to the use of this method. They depend on natural growth and development of the pupils individually.

All the above mentioned leads to the conclusion that the core training method used for physical strength development with sixth grade elementary school pupils gives better results than any other formerly used methods.

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