THE EFFECTS OF NEURO-MUSCULAR CONTROL TRAINING IN LEARNING THE HANDLING OF SPECIFIC OBJECTS OF RHYTHMIC GYMNASTICS

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ABSTRACT

The progress of the sport disciplines, the hopes towards new heights in achieving competitive success, all these open new roads and new horizons of knowledge. We have approached this topic because of the need for faster learning of bodily elements and the use of portable objects from a young age according to the scoring code and the much more evolved regulation compared to previous years that "obliges" us to discover new processes and models of training for the highest performance. The paper proposes a proper analysis of the aspects related to motor quality and the development and experimentation of a training model designed to optimize the training of athletes based on the effect of neuro-muscular control exercises in learning the actions of handling portable objects in rhythmic gymnastics. The use of specific learning development methods leads to the improvement of the gymnasts' training process. The obtained results encourage us to make the proposal to introduce this kind of training in the rhythmic gymnastics training program, but also to study their influence on other categories of sports, the importance of training and the methodology for conducting theneuro-muscular control exercises.

KEYWORDS: *neuro-muscular control; rhythmic gymnastics; portable objects; training; learning;*

INTRODUCTION

Today the development of motor skills acquired new major meanings, applicable to life in general. A major requirement in the selection of exercises (means) for improving a quality or the other, in the various fields and sports events, is the selection of those types of exercises whose outer structure and features of the interior, represented by their physiological and biochemical noise, correspond completely to the demands during a competition [1].

Current development of sport in general highlights the unprecedented development of the ability to move of the body and the exceptional level of expression of the different motor skills.

From a technical standpoint, every sport, framed in its organizational and competitive system, offers a sports show that often reaches or exceeds perfection and rigors of the art.

Many specialists say that practice in this sport has managed to change the body perception and its representation, immersing us in an area larger than fighting against time and space. The authors thus speak about "poetry of the sport" which emphasizes artistic revelation. This is evoked by the metamorphoses that "muscle imagination" manifests on the human body and its segments in a technical repertoire purchased by practicing physical exercise and development of each sport.

The literature related to the study of the motric ability is extremely large, focusing on the overall treatment capacity for motric capability and the deepening of the knowledge of each of its parts. The continuous evolution of each sport, the aspirations towards new dimensions in displaying superior competitive performance open new avenues to investigate as many points of view and ways of knowing.

Aura Bota [2] in the book entitled Kinesiology states that "cognitive activities fosters an evident intellectual development influenced by a great plasticity of the nervous system - functional advantage that gives the child a greater receptivity compared with adults."

Another author describes that "learning is an important process by which an individual acquires skills and knowledge, based on a set of events, occurrences and changes that appear when practice allows people to acquire certain tasks." Maroti Stefan (2003) - *Motor learning*

In the volume *Biology du Sport*, Jurgen, Weineck [3] describes that "the capacity of human movement is based on a multitude of contractions and relaxations of hundreds of muscles, each involving thousands of fibers. The central nervous system allows the transforming of an enormous reservoir of simple motric actions into a coherent

whole. The program of the voluntary movement coordinates the antagonists and agonists muscles. Nervous excitation and inhibition processes are interlinked."

Thus, Sbenghe Tudor [4] describes in his volume *Kinesiology* the "movement as" center of human life". In order to build robots that mimic human capabilities, it is important to first understand how complex actions coordinated by nerves, muscles, tendons, bones and other components result in physiological movements."

"Producing a muscle contraction, which is the fundamental aspect of human motricity, is subject to the submission of motor nerve impulses to the central nervous system. This one, as an upper body, is the center of decision and control of an infinity of first moves. Where necessary, it is able to select a number of them to turn to a specific objective and coordinate them among themselves." Jurgen, Weineck (1995) - *Biologie du Sport* [3].

The necessity of learning much faster so the body movement elements and drive object portable since an early age under the Code, and the rules more evolved compared to previous years we "binds" to discover new methods and models training for The higher performance.

The necessity of increasingly faster learning of both body elements and the handling of portable objects from a young age, according to the Code of Points [5] and adhering to much more evolved regulations than in previous years, “forces” us to uncover new methods and preparation manners, in order to achieve higher performances.[6]

The introduction of specific neuro-muscular training within preparation program, undertaken in specially equipped laboratories, thoroughly reduces the learning time of technic and specific elements and increases the efficiency of these exercises.

MATERIAL AND METHODS

The following research methods have been used:

- Bibliography study;
- Conversation method;
- Observation method;
- Experiment method;
- Statistical mathematics method

The study took place within the rhythmic gymnastics department of the Oradea University Sporting Club, and it targeted the initiation group, aged 5 to 7.

The research spanned a timeline of 3 months and encompassed a number of 16 girls, divided into two groups, with 8 being in the control group and the other 8 in the experiment group.

The subjects performed two rhythmic gymnastics training sessions per week, each session being about 1 - 1:30 hours long, and taking place in the gym hall of the Oradea University, under the guidance of the coach. The experiment group has also performed one neuro-muscular training session per week, with duration between 30 minutes and 1 hour, within the Human Performance Research Center, under the guidance of the center’s director.

Description of the experiment

At the beginning of the study, the subjects were divided into two groups, identical from an age and preparation standpoint. When forming the groups, a balance has been reached between the subjects from the control group and the ones from the experiment group, by taking into account their systemic particularities. The above mentioned groups have been tested twice under the same criteria: initially at the beginning of the research and the final tests took place, of course, at the end of the experiment. The training content comprised learning and consolidating technical elements of handling portable objects, specific to rhythmic gymnastics, according to the regulations settled upon by the Romanian Federation of Rhythmic Gymnastics and the scoring code agreed upon by the International Gymnastics Federation.

The neuro-muscular training was conducted weekly and took place in the Biomechanics and movement analysis laboratory of the CCPU. The training itself consisted of performing some exercises modelled after a predetermined pattern. The exercises enclosed 10 repeated actions per series, with the series number starting at 3, then 4 and later 5 series per training session.

The created patterns had variables such as distance and velocity speed, each resulting movement being recorded in the shape of a curve. Taking into account that the level of difficulty for each movement is conditioned by the execution speed, when choosing the pattern we opted for one with the following characteristics: speed 200 mm/s and distance 600 mm, This pattern has remained constant throughout the study, except for the speed, which has increased to 400 mm/s, considering that we should maintain the same training conditions for this given age and length of duration of the study, from a methodical standpoint.

The equipment is built in such a way as to automatically grade and graphically register the movement curve within the given pattern. By the end of the series it calculates the average grade sum for the respective series, in this way being able to view all the movement curves on the computer’s

monitor as well as evaluate the accuracy of the exercises. (fig. 1)

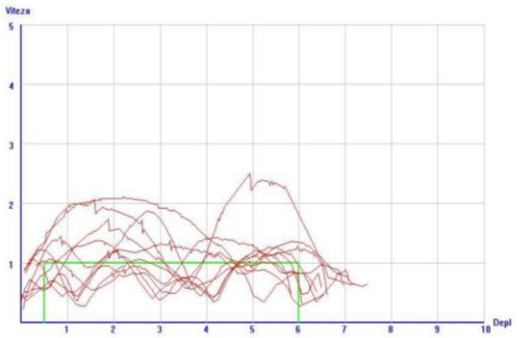

Fig. 1 Curves of movements in a series

We have opted for certain tests which helped us demonstrate the influences neuromotor control exercises have upon learning and properly performing specific Rhythminc Gymnastics handling actions. The tests were as following:

- Swings in eight
- Passing over the rope turning forward
- Skips over the rope
- Rotation of the hoop around the hand
- Passing through the hoop with skips
- Rolling the hoop on the floor
- Bounces
- Rolling the ball on the arms
- Rebounds

Demonstration evaluation

Demonstrations have been graded as following:

Developing the ability to handle all objects diversely and differently ensures a general basis and knowledge of the technique. Based on this experience, we can subsequently engraft specific handling actions for each object.

ROPE

Swings in eight. Swings in eight need to use movement inertia, by holding the rope folded up and upwards. The handling speed depends on the repeated input tempo.

Passing over the rope turning forward involves spinning the rope using fist level circling actions, performed with two hands facing forward and passing over the rope by lifting the toes up off the floor and tiptoeing over it.

Skipping over the rope involves holding the rope with one hand by each end, and spinning it forward with consecutive wrist rotations.

HOOP

Hoop rotation on the handmeans spinning the object around a rotating ax, the position of the ax maintaining perpendicular work trajectories and planes.This action centers around the hand. It's characterised by movement accuracy and regularity, and vibrations or slips from the initial contact points are not allowed.

Passing through the hoop with skips involves holding the object with two hands and passing the entire body through the hoop, by skipping.

Rolling the hoop on the floor – the hoop is thrown to the desired distance, using a lively forward motion of the arm, which is then accompanied by a specific impulse of the wrist, which in its turn, imprints a rotation of the hoop, in the opposite moving direction. This determines the hoop to roll backwards to the impulse position.

BALL

Bounces - are actions where the objects is pushed, controlled towards the bouncing surface (floor). They are performed from a standing position, in series, with the arm making a pushing motion of the object toward the floor. The hand has a soft yet controlled motion, with fingers slightly separated, moulding themselves on the ball's surface.

Rolling the ball on the arms – is an action where the object moves from a chest level on both arms extended forward, using a rotation around its own circumference, during which all its points come into contact with the support surface, reaching all the way to the palms, where the actions is finished.

Rebounds - are actions that involve projecting the object into space, losing physical contact with it, followed by recovery of said object.

Evaluation of the technique for handling the object held as follows: From a total of 10 repetitions of each share of handling the objects specified above, there were quantified the number of correctly performed repetitions. This evaluation was performed by a specialist in his field.

RESULTS

In light of presenting results in the most objective way possible, during the initial and final testing, I have opted for data tables and graphic result representation.

I took into account 4 criteria: average sum, maximum value, minimum value and standard deviation.

Taking a look at the tests, we stopped upon object technique: Rope - swings in eight, passing over the rope turning forward, skipping over the rope; Hoop - rolling the hoop on the hand, passing through the hoop with skips, rolling the hoop on the floor and Ball- bounces, rolling on the arms, rebounds.

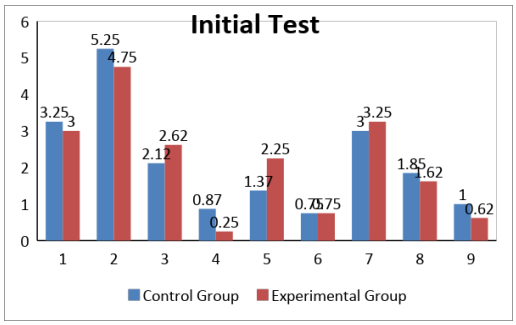

Fig. 2. Average grade values of number of correctly performed repetitions for the two groups in the initial testing

Notice there is a difference on tested actions, with the medium value per groups being almost equal.

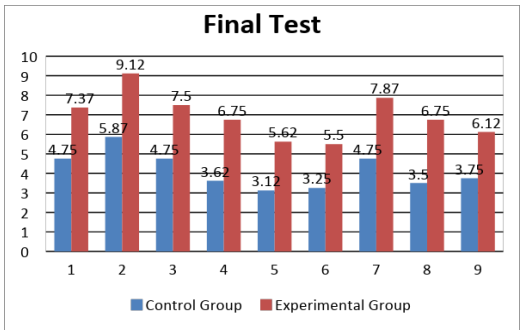

Fig. 3. Average grade values of number of correctly performed repetitions for the two groups in the final testing

If the final values of the average movement technique performances have increased from the initial ones, we can safely say the final values in the object handling technique have been far more evident.

Regarding the rope, we can see a higher increase than with the other two objects. The medium value in the initial testing for swings in eight was 4.75 number of correctly performed repetitions, and the final one is 7.37 number of correctly performed repetitions, thus showing an increase of 2.62 number of correctly performed repetitions. Regarding passings over the rope, the medium final value is 9.12 number of correctly performed repetitions, noticing an increase of 3.25 number of correctly performed repetitions than the initial value of 5.87 number of correctly performed repetitions. Initial results in the skipping over the rope category were 4.75repetăricorecte, and final ones are 7.5 number of correctly performed repetitions, with an increase of 2.75 number of correctly performed repetitions.

The hoop shows an increase of final values, but a less obvious one in comparison with the rope or ball. Rolling the hoop around the hand is the action where we have the highest increase level, of 3.13 number of correctly performed repetitions. Regarding passings through the hoop with skips, we have results of 3.12 number of correctly performed repetitions at the initial testings and final values of 5.63 number of correctly performed repetitions, showing an increase of 2.5 number of correctly performed repetitions. The values for rolling the hoop on the floor are 3.2 number of correctly performed repetitions at the initial testing and 5.5 number of correctly performed repetitions at the final one,with an increased difference of 2.25 number of correctly performed repetitions.

Analysing the ball actions, we notice an evolution from 3.12 number of correctly performed repetitions in the bouncing actions, with initial testing scores of 4.75 number of correctly performed repetitions and finals of 7.87 number of correctly performed repetitions. A great increase can also be noticed in the rolling the ball on the arms area, where the difference is very high, scoring a 3.25 number of correctly performed repetitions. Noticeable results have been registered also in the recovery performances, where initial values showed scores of 3.75 number of correctly performed repetitions and final values showed a grade of 6.12 number of correctly performed repetitions, with an increase of 2.37 number of correctly performed repetitions.

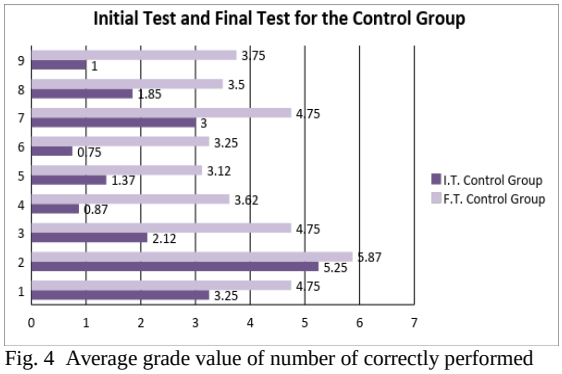

Fig. 4 Average grade value of number of correctly performed repetitions at the two testings for the Control Group

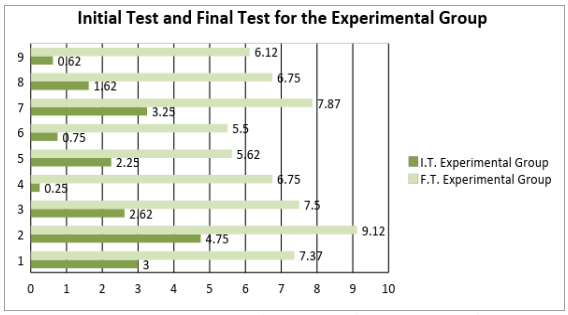

Fig. 5 Average grade value of number of correctly performed repetitions for the two testings within the Experimental Group

Charts numbers 4 and 5 present the average grades attained by the subjects from the control group, as well as their performance during initial

and final testing. For example, we can notice, during the swings in eight exercise, the average for the initial testing was 3.25 number of correctly performed repetitions, and for the final one it was 4.75 number of correctly performed repetitions. Chart number 11 shows an initial testing average of 3 number of correctly performed repetitions and a final one of 7.37 number of correctly performed repetitions. Thus showing the subjects from the control group have reached a progress of 1.5 number of correctly performed repetitions during the whole study, while the experiment group show a progress of 4.37 number of correctly performed repetitions

For the rolling the hoop on the arm exercise, the control group got an initial testing average of 0.87 number of correctly performed repetitions, and a final result of 3.62 number of correctly performed repetitions, with a 2.75 number of correctly performed repetitions progress point. However, the experiment group resulted an initial average value of 0.25 number of correctly performed repetitions, for the same exercise, and a final average of 6.75 number of correctly performed repetitions. The progress shows an increase of 6.50 number of correctly performed repetitions, far superios to the control group.

The initial average grade value for the control group during the bounce exercise was of 1 number of correctly performed repetitions, while the average for the experiment group was 0.62 number of correctly performed repetitions. At the final testing, the control group had an average of 3.75 number of correctly performed repetitions, with a progress of 2.75 number of correctly performed repetitions, while the experiment group had an average of 6.12 number of correctly performed repetitions, showing an increase of 5.5 number of correctly performed repetitions.

As presented in the two charts, the experiment group reached a far more consisten progress than the control group, in all the studied categories, which clearly shows neuro-muscular training had a beneficial effect.

CONCLUSIONS

The study allows us to put forth the following conclusions:

- Neuro-muscular training can begin as early as 5-6 years of age;
- The duration of such trainings should be set somewhere between 10-15 minutes for each subject, with a progressive increase until reaching 20 minutes per session;
- The repeteaing serioes should be alternated with short breaks;
- We have noticed positive effects in the accuracy of handling portable objects, specific to rhythmic gymnastics, even after only 15 trainings with neuro-muscular controlling equipment;

As a result of the study, we can confirm the hypothesis has been admitted, and neuro-muscular training facilitates learning specific rhythmic gymnastics movements, as well as increasing performance accuracy.

These results encourage us to propose the introduction of these training sessions within the preparation program for rhythmic gymnasts, but it also stimulates us to study the influence of such trainings in other sporting categories as well as within the neuro-muscular training methodology.

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