

ANALYSYS OF STATIC BALANCES IN RHYTHMIC GYMNASTICS IN CHILDREN AGED BETWEEN 6 TO 8 YEARS

Roxana-Maria TINCEA¹

Abstract: *Rhythmic gymnastics is a sport whose complexity is given by the combination of body technical elements with the technical elements of handling objects and the features of form and content of the musical accompaniment. The harmonious combination of balance, along with agility and motor control leads this sport branch to virtuosity and mastery, especially in the conditions of current international requirements. Thus, the purpose of this paper is to develop new training programs and highlight the existing relationship between new assessment methods and sport results. This approach is transposed especially in the competitive results, by identifying and early correction of the main variables that cause execution errors during body elements.*

Key words: *rhythmic gymnastics, balance, biomechanics*

1. Introduction

Rhythmic gymnastics is an artistic and aesthetic sport with a particular training process (very young athletes, early specialization before bone maturation, high training volume, many intensive training hours per week, many repetitions, high level of technical elements performed, various skills necessary, etc.). Moreover, high levels of physical and psychological stress are required in competition. [1]

This branch of gymnastics is characterized by an abundance of motor information. The information acquired in

the first years, between the ages of 5 and 8, contributes significantly to the success in this sport. In the case of experienced athletes (internationally and elite), the separate performance of the elements is strongly influenced by endurance, strength and flexibility, and the overall efficiency in rhythmic gymnastics is strongly influenced by coordination and rhythmic coordination. From an anthropometric point of view, sportswomen are characterized by a below average percentage of subcutaneous fat and body height and weight also below average. [5]

Posture and balance control are

¹ *Transilvania* University of Braşov.

fundamental in daily life to safely perform any type of movement and motor load that involves moving body segments or the whole body. Balance is the process of maintaining the center of gravity of the body, vertically based on the support and is based on fast and continuous feedback from the visual, vestibular and somatosensory structures for the subsequent execution of smooth and coordinated neuromuscular actions. An effective postural balance not only reduces the risk of body imbalance, fall or subsequent injuries, but also contributes to optimizing motor performance in several sports. [2]

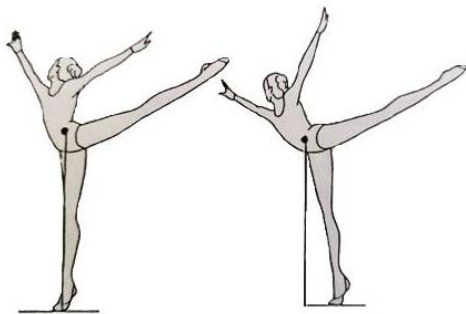


Fig.1. *Deviations of the center of gravity* [3]

Repetition, which is at the heart of gymnastic training, helps the athlete maintain balance through a routine. The bodily mechanism of muscle memory, also known as proprioception, is the body's ability to understand and coordinate each part of the body, relative to each other, without reference to the traditional senses of sight, sound, smell, etc. If a gymnast repeatedly understands where the musculoskeletal elements are positioned as a movement is performed, the body will reach balance without relying on the other senses. [10]

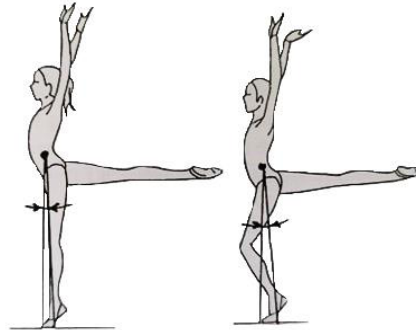


Fig.2. *Heights of the center of gravity* [3]

From a biomechanical point of view, the distribution of the center of gravity above the support surface is the main condition for maintaining balance. As can be seen in Figures 1 and 2, a distribution of CG outside the support surface results in the loss of the gymnast's balance. The stability of the athlete is determined by the size of the support surface, the height of the center of gravity above this surface, and the alignment of the center of gravity.

2. Research Objectives

Therefore, starting from the hypothesis that, using the training models proposed in this project, we assume that the test sample will obtain superior results both in learning some technical body elements and in national competitions.

- Analysis and generalization of the data of the specialized literature and of the advanced experience of the specialists in the field regarding the determinants of a successful performance in rhythmic gymnastics;
- Determining the main biomechanical indicators that intervene in the correct execution of the balance elements;
- Identifying the motor behaviour of female athletes following the

application of the proposed training models;

- Presentation and description of the results obtained in the equilibrium tests following a biomechanical analysis and evaluation in accordance with the rules specific to rhythmic gymnastics contained in the Code of Points;
- Arguing the efficiency of the application of the new training programs through statistical and graphical representations of the results.

3. Material and Methods

The pedagogical research took place within the ACS RITMIC ALY GYM Braşov sports club for a period of 14 months (January 2019 - March 2020), and the subjects subjected to the research were 10 sportswomen of the category Little gymnast (equivalent to the Children's sports classification) within the rhythmic gymnastics section. The subjects are at the beginning of the preparation for what means rhythmic performance gymnastics, being selected from a number of 276 athletes who work in the initiation groups.

The training program was applied in order to develop mobility in several joints, to shape a higher amplitude in motion, but also in order to develop optimal muscles to maintain balance in various positions. To support the efficiency of this research, several specialized software in the field of sports technique were used - Dartfish and AngulusPRO.

3.1. Tests

The bridge is a crossing position for many other gymnastic movements [8]. The training and improvement of the

bridge must be done after a good warm-up, in parallel with a proper training of the back muscles. To assess the mobility of the spine, the distance between the palms and the level of the gymnasts' heels during the execution of the "bridge" element was measured, using a roulette wheel; also, the opening at the knee joint was followed, this being measured through the AngulusPro application.

The split is a static acrobatic element that represents the mobility movement of the hip joint and the elasticity of the leg muscles. For the intermediate and final tests, a 45 cm high gym bench was used and the evolution of hypermobility at the hip level was followed.

Pre-acrobatic elements are elements contained in the International Scoring Code and used in rhythmic gymnastics as connecting elements and as part of dynamic elements with rotation or object difficulties [9]. The elements tested in this paper were: side wheel with palm support, slow turn forward and slow turn backward. Out of a number of 10 repetitions, only the executions performed without technical errors were taken into account, such as: body segments positioned incorrectly during the execution of the body action, asymmetrical position of the torso/shoulders, heavy landing or walk in hands.



Fig.3. *Slow turn forward* [6]

In rhythmic gymnastics, according to the score code, **the balance elements** represent a fundamental group of body technical elements. They are motor

structures characterized by keeping body segments in a certain position on a small support surface, usually represented by the sole, toe or knee. [4]

As there are a multitude of variants of execution within this fundamental group, within this project the following balance elements were chosen for study, representative for the Small Gymnast category, which are also found in the Internal Technical Regulations, namely:

- Side split balance performed on whole sole, with hand support (value 0.20p)
- Nest balance, performed on the whole sole, with hand support (value 0.20p)
- Arabesque balance with the foot and trunk at horizontal level, performed on the whole sole (value 0.20p)
- Arabesque balance with the free foot on split and the trunk at horizontal level, performed on the whole sole (value 0.40p)

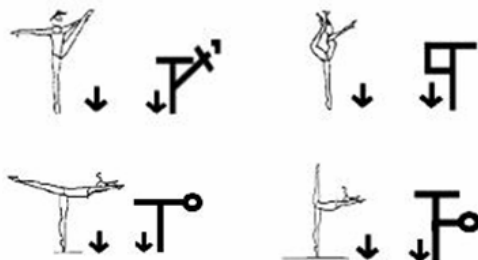


Fig.4. Symbols of the tested balances [9]

In a first stage, the number of correctly executed balances was noted from the 10 repetitions for each subject, then in the second stage of grading was calculated the projection of the center of gravity on base support and the angular opening at the hip - except for the facial plate balance, for which the opening in the joint is not relevant. To obtain these values, the platform provided by the Dartfish and AngulusPro software was used.

4. Results

For the mobility and pre-acrobatic elements, there were 3 sessions, over a period of 12 months (initial, intermediate and final testing) - this period also included the acquisition of the main body technical elements: balance, jumps, rotations. The mobility of the spine and the hip joint plays an essential role in the subsequent realization of all the elements of rhythmic gymnastics. Mobility being a quality that can be educated and developed, we directed this test to hypermobility, so several subjects were identified in the final test who reached the maximum level from the ground (+45 cm.) Both in the sagittal strings and in the lateral string, and in general, the whole group obtained values well above the value of 0 cm. of the carpet, as seen in figure 5.

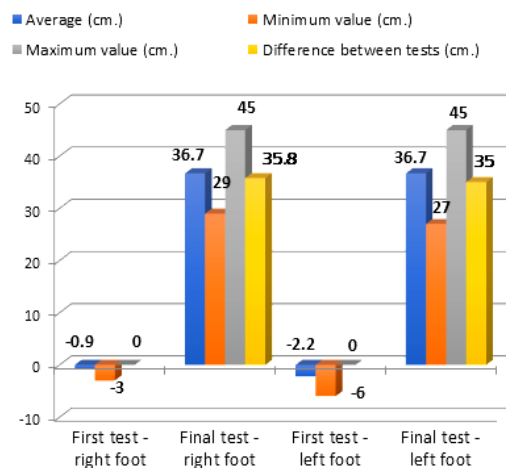


Fig.5. Graph of the results of mobility element sagittal split on the right and left leg

In the mobility test of the spine, all subjects performed the element after a very good pre-heating, and the results

obtained emphasize the following:

- In the period preceding the training period, which coincides with the period of selection in the performance groups, the group recorded an average of 24.6 cm, representing the distance between the palms of the athletes and the level of the heels, and the extreme limits are 18 cm. and 30 cm.
- At the last test there is a significant progress in the amount of 24.3 cm, the tested group decreasing to 3 cm, as shown in figure 6.

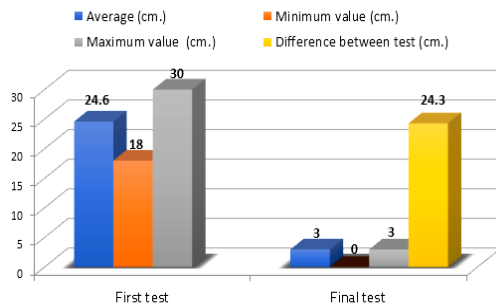


Fig.6. Graph of the results of mobility element of the spine

As the final results indicate, the development of mobility positively influences the execution of the balance elements, as a greater amplitude in movement reduces the risk of having form errors in execution.

The balance elements were tested in two phases - initial and final, after a period of 6 months between tests; the program captured their evolution from a technical point of view, through the deductions provided by the Scoring Code in force, without the intervention of a specialized apparatus; but also the evolution regarding the distribution of the center of gravity on the basic leg, with the help of Dartfish and Angulus Pro software.

The lowest extremes were obtained at

the nest balance (0 repetitions) and the panché balance (1 repetition), due to the difficulty of executing these types of elements; for both nest and panché balance, it is necessary to form good muscles in the back, shoulders and arms, in order to be able to support the trunk horizontally/vertically during the execution.

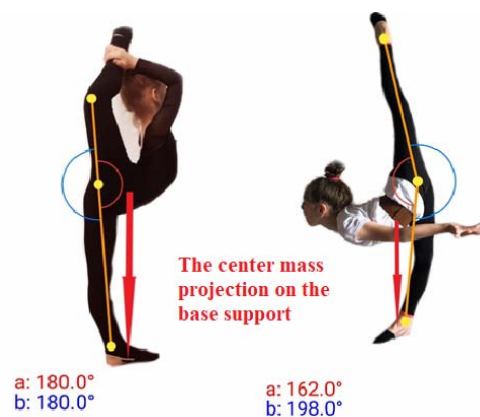


Fig.7. Nest balance and panché balance

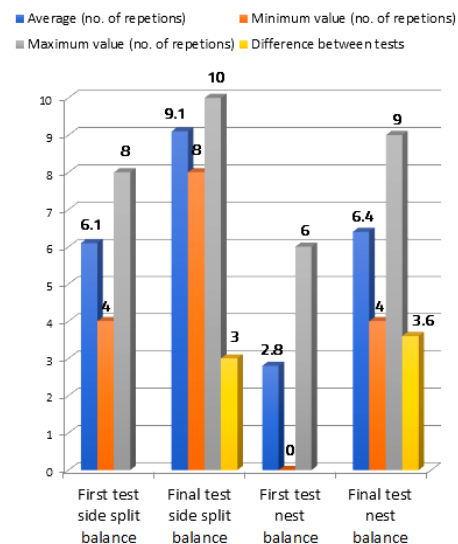


Fig.8. Graph results of the side split balance and nest balance

The final results showed good evolutions for all gymnasts, the average values depending on the number of repetitions being the following: lateral string balance = 9.1 out of 10, nest balance = 6.4 out of 10, facial plate balance = 9.1 out of 10 and balance panché = 7.3 out of 10.

Also, taking into account the statistical interpretation of the results, it is found

that the calculated value of "t", for the results obtained at all balances, is higher than the value of "t" in the equivalence table (Fischer's table [7]) (2,440), thus rejecting the null hypothesis. It can be stated, with a probability of over 95%, that the one foot balance and the muscles of the back and lower limbs have developed significantly, due to the training program used in training.

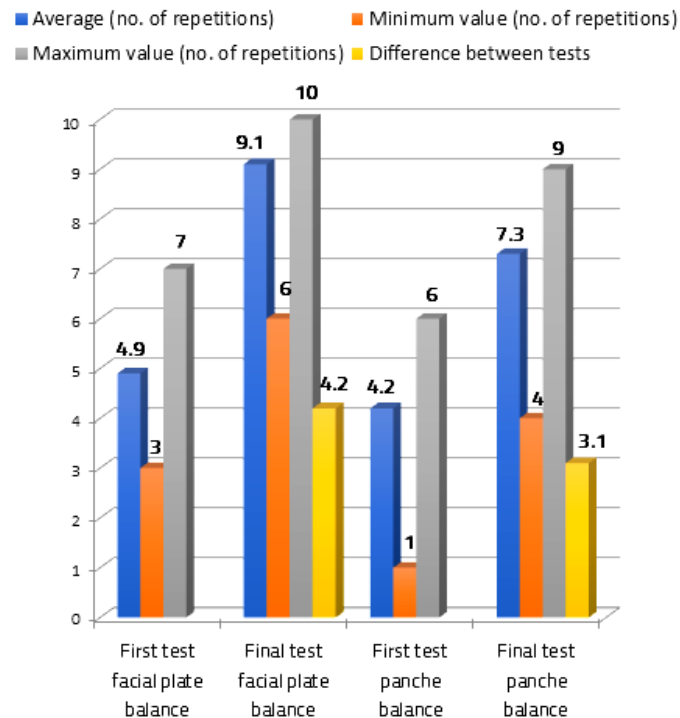


Fig.9. Graph results of the facial plate balance and panché balance

5. Conclusions

Following the experiment performed with the group of 10 female subjects, from the rhythmic gymnastics section, followed by the interpretation and evaluation of the results, several conclusions can be drawn that generalize some theoretical-methodical aspects, such as:

1. Permanent monitoring of athletes improves both the activity during training and during the competition.
2. The development of operational objectives is an important point in the process of modernizing the training program and is also a necessary condition for improving the results of each age group.

3. The elements of mobility represent a factor that constantly intervenes in the good execution of all bodily difficulties in rhythmic gymnastics, with more obvious accents in achieving the elements of balance.
4. It is beneficial to make the tests more difficult after reaching the initial maximum values, in order to obtain ascending values, a fact emphasized and demonstrated in this paper, in testing the mobility of the hip joint.
5. The introduction of technical evaluation tools, in this case state-of-the-art biomechanical analysis software, is a first step in modernizing the instructive-evaluative process in sports training.
6. The objectives of the efficiency of the proposed program on motor and psychomotor qualities were successfully met, as suggested by the statistical and graphical representations of the samples in the experiment.
7. A decisive element in the objective assessment of the balance elements was the biomechanical analysis of the organism in a one foot position, which provided important data on the position of the center of gravity during the realization of the difficulties.
8. The static balance developed at the level of the entire studied group, in different proportions for each element, a fact suggested in the statistical and graphical representations.
9. The evolution of these tests was also noticed in the evolution of the marks at competitive level, both for the individual and for the ensemble / duo / trio tests.

References

1. Bobo-Arce, M., Mendez-Rial, B.: *Determinants of competitive performance in rhythmic gymnastics: a review*. In: *Journal of Human Sport & Exercise*, Vol. 8, Proc 3, 2013, p. S711-S727.
2. Brachman, A., Kamieniarz, A., Michalska, J., Pawłowski, M., Słomka, K., Juras, G.: *Balance Training Programs in Athletes – A Systematic Review*, In: *Journal of Human Kinetics*, Vol. 58, 2017, p. 45-64.
3. Jastrjemskaia, N., Titov, Y.: *Rhythmic Gymnastics*. Human Kinetics. Campaign, IL, 2016.
4. Macovei, S.: *Gimnastica ritmică sportivă – curs de bază (Rhythmic sports gymnastics – basic course)*. București. National Academy of Physical Education and Sports, 1996
5. Miletic, D., Katic R., Males B.: *Some anthropologic factors of performance in rhythmic gymnastics novices*. Department of Physical Education, Faculty of Natural Sciences, Mathematics and Education, University of Split, Croatia, 2004.
6. Stroescu, A.: *Gimnastica (Gymnastics)*. București. Editura Didactică și Pedagogică, 1968.
7. Turcu, I.: *Metodologia cercetării în educație fizică și sport – curs pentru IFR (Research methodology in physical education and sports –course for IFR)*. Brașov. Transilvania University of Brașov, 2011.
8. Vieru, N.: *Manual de gimnastică sportivă (Sport gymnastics manual)*. București. Editura Driada, 1997.
9. https://www.gymnastics.sport/public_dir/rules/files/en_RG%20CoP%202017

2020%20with%20Errata%20Dec.%2017.pdf. Accessed: 26-03-2020.
10. <https://www.encyclopedia.com/sport>

s/sports-fitness-recreation-and-leisure-magazines/gymnastics-balance Accessed: 06-05-2020.