Bulletin of the *Transilvania* University of Braşov
Series IX: Sciences of Human Kinetics • Vol. 16(65) No. 1 – 2023
https://doi.org/10.31926/but.shk.2023.16.65.1.1

DYNAMICS OF THE PHYSICAL COMPONENT IN ATHLETES WHO PRACTICE RHYTHMIC GYMNASTICS – A LONGITUDINAL STUDY

R.M. TINCEA[1] L. BALINT[2]

Abstract: *The dimensions of a competitive performance in the specific context of rhythmic gymnastics are found in components such as: physical and biological condition, physiological factor, technical and physical aspects, and, above all, in the training process. In the long-term training process, the individual's consciousness is fully engaged at a high level of acuity, at the limit of possibilities, sports performance being multiple determined and conditioned. The purpose of this longitudinal study is to obtain confirmatory information regarding the level of development of the physical abilities of athletes who practice rhythmic performance gymnastics, starting from the smallest training category up to the last level, that of Seniors. Through the involvement of specialists at the national level, data was collected from 141 performance athletes, a fact that allowed the outline of a motor profile for all categories.*

Key words: *rhythmic gymnastics, physical component, development program, performance*

1. Introduction

Sports performance is a complex mixture of biomechanical functions, emotional factors and training techniques. Performance in an athletic context has a popular connotation of representing the pursuit of excellence, where an athlete measures their performance as a progression toward excellence or achievement. [13]

The essential characteristic of Rhythmic Gymnastics and what differentiates it from other sports disciplines is the interaction between body movement, movement of specific portable objects and musical accompaniment.

The technique in rhythmic gymnastics represents the system of motor structures that compose the specific motor content, realized through a varied and complex range of movements, organized into two

[1] PhD student, Department of Physical Education and Special Motor Skills, *Transilvania* University of Braşov.
[2] Department of Physical Education and Special Motor Skills, *Transilvania* University of Braşov.

large categories: body technique and object handling technique [10].

A 2019 study conducted during a stage of a world cup shows that gymnasts tend to use the same jumps, balances and rotation elements in all exercises, although the scoring code offers a wide variety of elements; [4] so the lack of variety and similarity of body elements in different rhythmic gymnastics compositions can compromise the originality, beauty and character of this sport.

Regarding the studies that analyzed the compositions in terms of the amount of elements used, many of them showed that jumps are the most used difficulties [1], [2], [3].

The training process in rhythmic gymnastics includes high expectations regarding technical elements with a high degree of complexity. According to Miletić, Katić et al. [11], adequate strength levels are a prerequisite for the proper functioning of all basic body elements in rhythmic gymnastics.

In order to achieve the desired performance, it is important to refer to athletes at a pre-existing above average level. In rhythmic gymnastics, the ability to learn motor skills is a big step in which coordination skills take a fundamental place [9]. Thus, the development of coordination ability at the right time is a determining factor in terms of achieving performance in rhythmic gymnastics.

In the studies aimed at the motor qualities in rhythmic gymnastics, the researchers "hit" on the lack of a battery of tests specific to the discipline, a fact that often pushed them to use means that are far from reality. [5] In order to help coaches and specialists, and standardization being necessary, the International Gymnastics Federation (FIG) has created a series of tests [7] with patterns of body movements and elements from rhythmic gymnastics, to ensure a result close to the context of the discipline.

The physical ability testing program proposed by the FIG comprises 10 tests for mobility and 6 tests for speed, strength and endurance (two tests for each motor quality). In the mentioned context, based on their ability, gymnasts have the opportunity to score from 1 to 10 points per test exercise. Such control procedures provide the possibility to compare the personal score with the best score for each component of the test.

The same reference from FIG also proposes a series of tests for technical skills; it comes to coaches as a tool to identify the technical elements that could score best in the compositions presented in the competitions.

2. The purpose of the Research

The purpose of the study is to obtain conclusive information regarding the level of development of the physical abilities of the athletes who practice rhythmic performance gymnastics, starting from the smallest category (Junior IV) to the last level, that of Seniors.

Starting from the hypothesis that, by applying at the national level a specific program of testing and developing physical abilities valid for all age categories, on a sample of professional athletes, we will obtain an extended motor profile, which will allow observation in time of certain physical aspects of interest in this sports discipline.

Research tasks:

- Identifying, through the bibliographic study method, the way in which motor qualities are manifested in rhythmic gymnastics and the manner in which they intervene in shaping the physical component;
- Identifying the level of development of the physical abilities of the targeted subjects, who practice rhythmic gymnastics at a professional level;
- Highlighting the current training trend of coaches to put more emphasis on the development of certain physical aspects, to the detriment of others.

3. Materials and Methods

The research was carried out during the year 2022 (12 months), focusing mainly on the domestic competitive calendar, spread over two cycles - one in the first part of the year and the other in the second.

In a first stage, the affiliated members of the Romanian Rhythmic Gymnastics Federation were contacted. Out of 28 affiliated clubs and 23 active clubs, participating in the national competition system, 10 responded to our invitation to take part in the program of testing and developing physical skills. Thus, data were collected from 141 athletes of all ages, starting from Junior IV to Senior category, participants in national and international competitions. The measurements were carried out at the assistant clubs, and the data were transmitted in electronic format, by e-mail and later processed.

3.1. Tests

The purpose of the Physical Skills Development and Testing Program includes the following points:

- Shows what are the requirements for developing mobility and strength skills;
- The selection of test exercises is based on experiences over many years and is an extract from training programs for developing the prerequisites of physical capacity for performance;
- Mobility testing exercises focus on the level of development of passive and active hip and shoulder flexibility;
- Strength skills testing exercises are based on determining the level of development of explosive power in jumps and jumps, specific resistance and the level of static and dynamic components of the exercises.

Mobility and balance exercises included in the program:

– sagittal split from height on the right leg and on the left leg (figure 1)
– lateral split from height on the right leg and on the left leg (Figure 1)
– raising the leg forward (figure 2)
– spine mobility test – the bridge (figure 3)
– walkover forward (figure 4)
– walkover backward (figure5)
– trunk flexion (figure 6)
– shoulder extension (figure 7)
– balance test (figure 8)

Fig.1. *Sagittal/lateral split*

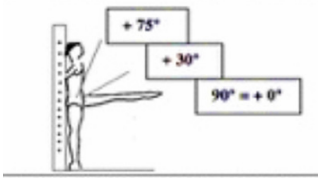

Fig.2. *Raising the leg forward*

Fig.3. *The bridge*

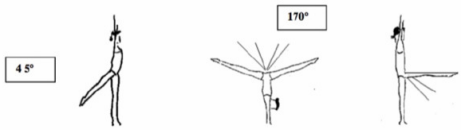

Fig.4. *Walkover forward*

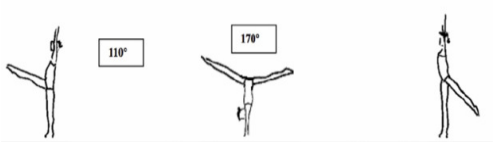

Fig.5. *Walkover backward*

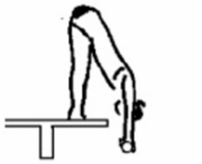

Fig.6. *Trunk flexion*

Fig.7. *Shoulder extension test*

Fig.8. *Balance test*

Exercises for strength, speed and endurance included in the program:

- speed run 200m
- strength test for abdomen
- standing on hands (figure 9)
- trunk extension (figure 10)

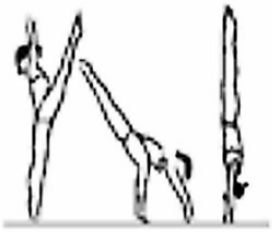

Fig.9. *Standing on hands*

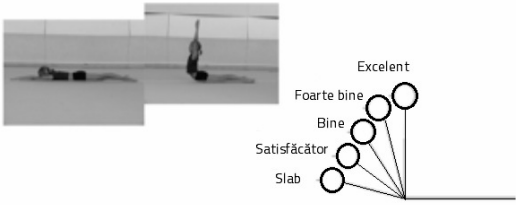

Fig.10. *Trunk extension test*

The measurements were made according to the indications of the Physical Skills Development and Testing Program, presented in Table 1, and using measuring tools such as: centimetre / tape measure / ruler, stopwatch, etc., according to the specifics of the testing.

For tests T6, T7, T8 and T15 intermediate points are determined by the evaluator/coach.

Table 1

Evaluation protocol

Tests										
Sagittal split	0 cm	-2 cm	-4 cm	-6 cm	-8 cm	-10 cm	-15 cm	-20 cm	-25 cm	-30 cm
Rating T1/2	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Lateral split	0 cm	-2 cm	-4 cm	-6 cm	-8 cm	-10 cm	-15 cm	-20 cm	-25 cm	-30 cm
Rating T3/4	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Leg raised fw.	0°	+5°	+10°	+20°	+30°	+40°	+50°	+60°	+70°	+75°
Rating T5	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
The bridge	weak	-	-	Satisf.	-	-	Good	-	-	VG!
Rating T6	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Walkover forward	weak	-	-	Satisf.	-	-	Good	-	-	VG!
Rating T7	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Walkover backward	weak	-	-	Satisf.	-	-	Good	-	-	VG!
Rating T8	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Trunk flexion	0 cm	-2 cm	-3 cm	-4 cm	-5 cm	-6 cm	-8 cm	-10 cm	-12 cm	-14 cm
Rating T9	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Shoulder extension	4 cm	6 cm	8 cm	10 cm	12 cm	14 cm	16 cm	18 cm	20 cm	22 cm
Rating T10	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Balance test	2s.	4 s.	6 s.	8 s.	10 s.	12 s.	14 s.	16 s.	18 s.	20 s.
Rating T11	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Speed run	4.5s.	4.4s.	4.3 s.	4.2 s.	4.1 s.	4.0 s.	3.9 s.	3.8 s.	3.7 s.	3.6 s.
Rating T12	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Strength test	20	22	24	26	28	30	31	32	33	34
Rating T13	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Standing on hands	1 s.	2 s.	3 s.	4 s.	5 s.	6 s.	7 s.	8 s.	9 s.	10 s.
Rating T14	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p
Trunk flexion	weak	-	Satsif.	-	-	Good	-	-	VG!	EX!
Rating T15	1p	2p	3p	4p	5p	6p	7p	8p	9p	10p

4. Results and Discussions

The collected results were grouped according to the existing age categories at the national level in the Internal Technical Regulations of the Romanian Rhythmic Gymnastics Federation, namely:

- Junior IV (6-7-8 years old)
- Junior III (9-10 years old)
- Junior II (11-12 years old)
- Junior I (13-14-15 years old)
- Seniors (≥ 16 years old)

Of the 141 subjects, 46 belong to the range between 6-8 years; for this category average values in the upper segment were recorded in all mobility tests, while rather poor results were recorded in strength and endurance tests (Table 1, Figure 11). The coefficient of variation is over 50% in the case of several tests, indicating a large spread of data around the mean value. This index gradually decreases within the following categories.

In both 9- and 10-year-old subjects (Table

1, Figure 12), what studies from around the world show is observed, [5], [6], [8], [12] namely the fact that coaches put a lot of emphasis on the development of mobility in the first years, and the other qualities are not so much taken into account.

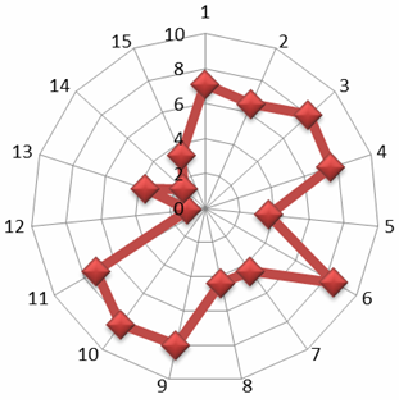

Fig. 11. *Distribution of mean values for 6-year-old subjects*

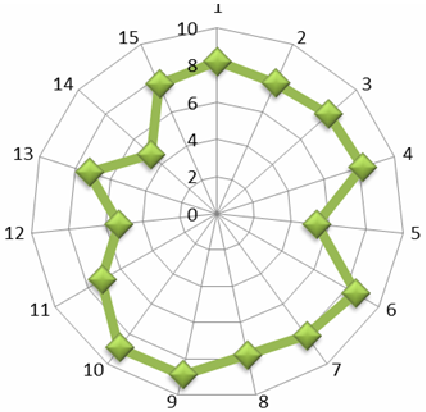

Fig.12. *Distribution of mean values for 10-year-old subjects*

The results showed that, starting from the age of 11-12 years, respectively Junior II category, all average values exceed the median value of the data string, the distribution of points on the graph being towards the maximum value (Table 1, figure 13).

Motor experience and maturity is best observed in subjects who fall within the age range of 13 years - 16 years. The athletes register a good to very good development of all the physical abilities targeted by the research program (Table 1, Figure 14).

Hip hypermobility is especially maximal on the dominant leg, which shows, once again, that coaches and athletes favour functional asymmetry.

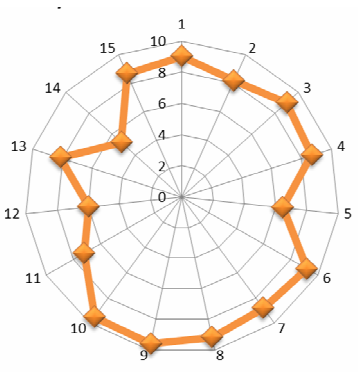

Fig.13**.** *Distribution of mean values for subjects aged 11-12 years*

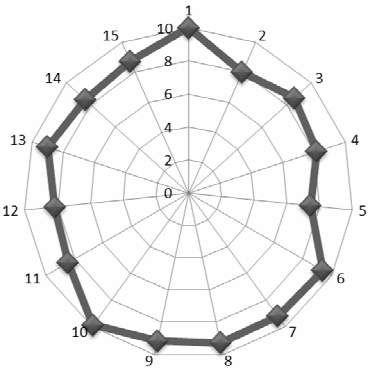

Fig.14. *Distribution of mean values for Juniors and Seniors*

In the present study, the results showed that the category that recorded the best values in the mobility tests had poor or average results in the strength tests. From the smallest category (Junior IV) to the last level of the study, the results at all tests improved by 80% following the training sessions (Figure 15).

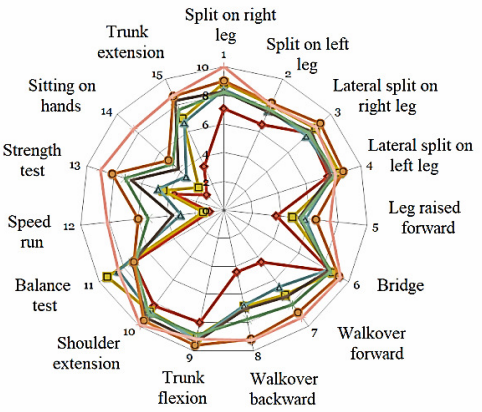

Fig. 15. *Comparison of mean values for all age categories*

The fastest jump in the development of physical abilities is recorded around the age of 8-9 years (figure 15). This age range coincides with the period when children begin to participate in national competitions with exercises with portable objects, a fact that favours this development.

Also the data show that, in the case of the subjects subjected to the research, who are athletes practicing rhythmic gymnastics at a professional level, the development of physical skills is carried out in an ascending, normal rhythm, without indices that record periods of regression.

The current trend in the development of physical skills is to reach maximum values in the shortest possible time, and the goal is to maintain them for as long as possible.

5. Conclusions

The International Gymnastics Federation draws attention to the fact that current information on the level of education in many countries shows that the development of performance preconditions for mobility and strength should receive more attention [7].

All the data obtained following the collaboration with the specialists and technicians in the country within the program of testing and development of physical abilities allowed the outline of a motor profile for each age category, starting from the age of 6 years to over 16 years.

Following and analysing the data from all 141 subjects, a tendency of the trainers to educate mobility and even hypermobility in the case of certain joints, more than the other motor qualities, is observed; this produces an imbalance in the training and development of athletes, a fact that can also be observed in a thorough analysis of them during competitions.

Coaches are reminded through these physical component development applications to review the basic principles of tissue adaptation for strength, flexibility, power, and endurance training as presented by FIG's education programs.

Thus, gymnasts must be trained gradually, over several years, to be able to safely sustain and generate the forces required in rhythmic gymnastics, during jumps, landings (especially on one leg) and dynamic changes in body position.

However, the very high level from early age categories, both in our national and international system (Junior IV category - ages 6-8), pushes the coach to speed up the learning process many times, forgetting

about the needs and expectations of the child athlete.

References

1. Avila-Carvalho, L., Lebre, E.: *A dificuldade dos exercícios individuais e de conjuntos de elite de ginástica rítmica.* In: Motricidade. *II Simpósio Internacional de Performance Desportiva* 8(S1), 2012.
2. Avila-Carvalho, L., Leandro, C., Lebre, E.: *Portimão Rhythmic Gymnastics World Cup. Scores analysis*. Book of abstracts of the 16th Annual Congress of the European College of Sport Science. Liverpool, 2011, p. 579-580.
3. Avila-Carvalho, L., Palomero, M., Lebre, E.: *Difficulty score in group rhythmic gymnastics*. Portimão 2007/2008 world cup series. Palestrica Mileniului III Civilizatie si Sport, Anul X, 3(37): 261-7, 2009.
4. Batista, A.: *Body difficulties in rhythmic gymnastics routines*. In: Science of Gymnastics Journal, 2019, Vol. 11 Issue 1, p. 37- 55.
5. Batista, A., Garganta, R., Avila-Carvalho, L.: *Flexibility and Functional Asymmetry in Rhythmic Gymnastics*. In: Athens Journal of Sports, Volume 6, 2019, Issue 2, p. 77-94. https://doi.org/10.30958/ajspo.6-2-2,
6. Bobo-Arce, M., Mendez-Rial, B.: *Determinants of competitive performance in rhythmic gymnastics. A review*. (Performance Analysis Workshop), 2013.
7. Dias, H., Aleksandrova, N., Lebre, E., Bobo, M., Fink, H.: *Age group development and competition program.* Lausanne, Switzerland: Fédération Internationale de Gymnastique, 2019.
8. Donti, O., Tsolakis, C., Bogdanis, G.: *Effects of Baseline Levels of Flexibility and Vertical Jump Ability on Performance Following Different Volumes of Static Stretching and Potentiating Exercises in Elite Gymnasts.* In: Journal of Sports Science and Medicine, 2014, p. 105-113.
9. Iorga, A.: *The importance of coordination in the world of motion*. In: Journal of Physical Education and Sport, 2019, Vol. 19, Art. 326, p. 2173–2176.
10. Macovei, S.: Manual de gimnastică ritmică *(Manual of rhythmic gymnastics).* Bucharest, Editura BREN, 2007.
11. Miletic, D., Katic, R., Males, B.: *Some Anthropologic Factors of Performance in Rhythmic Gymnastics Novices*. In: Collegium Antropologicum, 2004, 28(2): 727-737.
12. Russo, L., Palermi, S., Dhahbi, W., Delas Kalinski, S., Bragazzi, N., Padulo, J.: *Selected components of physical fitness in rhythmic and artistic youth gymnast*. In: Sport Sciences for Health, 2020. https://doi.org/10.1007/s11332-020-00713-8
13. World of Sports Science. (2021). Sport Performance. Retrieved January 10, 2022, from Encyclopedia.com: https://www.encyclopedia.com/sports/sports-fitness-recreation-and-leisure-magazines/sport-performance