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A COMPARATIVE STUDY ON FEMALE GYMNASTS AND DANCERS

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Abstract

The study covered two groups of children aged 12 – 13 years, during a mesocycle training programme, namely from the beginning of the school year until winter break. The subjects followed specific training routines which also consisted of daily classical dance sessions. The research aimed at determining the similarities and differences between the two groups of subjects in point of the type of effort exerted during training, while referring to the type of effort specific to competitive events (in case of rhythmic gymnasts) and to the type of effort specific to performances (in case of the choreography high school students), respectively. We tested the subjects' cardiovascular fitness before and after training and determined the type of effort exerted during the training sessions. The measurements revealed a difference in training between the children practicing rhythmic gymnastics (who already participate in national and international competitive events), in whom we can notice cardiovascular adaptations, and the children practicing classical dance, who are at the beginning of their training (their artistic and competitive activity starts around the age of 16 – 18 years), who experience no changes in the cardiovascular system yet. Having in view the results, we can conclude that the gymnasts exert a significantly greater physical effort as compared to the little girl dancers. We can say that rhythmic gymnastics training routines are far more demanding and far better structured than the training programmes followed by the dancers, which consist mostly of classical dance routines.

Keywords: Cardiovascular system, physical effort, choreographic training, classical dance routines.

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1. Introduction

Scientific-based advanced knowledge of movement mechanisms is determinant in attaining performance both in sports and in arts. Rhythmic gymnastics, a highly complex sport, placed at the border of sports performance and art, requires an extremely logical and coherent organisation of the body elements teaching methods. Although a very unitary and homogenous system, classical dance presents a deficit in the teaching methods due to the lack of teaching materials.

Therefore, an insufficient research renders us unable to properly train rhythmic gymnastics and dance professionals. This results in the need of a collaborative relationship between rhythmic gymnastics specialists and dance specialists. Such a collaborative effort could lead to the elaboration of teaching materials, which would help improve motor performance of the subjects of both specialisations.

Theoretical fundamentals and problem statement in specialist literature:

1.1. Heart adaptation to physical exercise training:

It is common knowledge that the adaptation of the myocardium to physical exercise training is related to the so-called *Law of the heart*, according to which contraction of the heart muscle is all the more intense as the cardiac fibres are more elongated the moment contraction commences. This state of the cardiac fibres is influenced by the amount of blood pumped by the heart (Nenciu, 2009).

What is important in the proper function of the myocardium is the way in which it responds to excitation. Low-intensity physical exercise training does not cause the heart muscle to contract. Nevertheless, should the strength of the excitatory stimulus reach its peak, the myocardial contraction is complete, meaning it is the greatest possible contraction the myocardium can produce under such circumstances. This phenomenon is known by the name of the *All-or-none* Law (Netter, 2013). The maximal contraction is not a constant value, it varies according to numerous conditions, especially to the state of the myocardium.

Another characteristic of the myocardial contraction is the existence of the refractory period. During contraction, the myocardium, as all the other muscles in the human body, experiences an unexcitability state known as the refractory period (the muscle fails to respond regardless of the strength of the stimulus), therefore, during systole it does not respond to the excitatory stimuli. This is very important, for it ensures cardiac rhythmicity and the possibility of emptying and refilling the heart with blood as well as of pumping blood to the arteries.

After systole is completed, the myocardium becomes excitable. If excitation occurs before systole completion, it will give rise to an additional systole, called effort extrasystole.

Another particularity of the myocardial contraction is the fact that all atrial or ventricular fibres contract simultaneously (Nenciu, 2009). A successive contraction of the various fibres leads to dysfunctions in the blood circulation, resulting in extremely serious consequences. Following physical activity, the heart adapts its mechanical load.

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1.2. Measurement and assessment of the changes in cardiovascular system following physical exercise training:

The changes in the cardiovascular system of the subjects following physical exercise training depend on the type of physical effort exerted. The classical dance routines are demanding, which forces the cardiovascular system to adapt to effort. However, we must bear in mind that once the effort has ceased, the changes in the cardiovascular system wear off imperceptibly, slowly, at the same pace they occurred (Dragnea, 2006).

2. Problem Statement

This research assessed the late cardiovascular changes following physical exercise training. Such changes occur slowly and are an adequate response to the increased needs of the body imposed by the physical effort exerted. I will dwell on two aspects:

- *Low heart rate*

  Measurement of the heart rate before, during and after physical exercise training provides us information on the state of the body, on the one hand, and on how the body adapts to effort, on the other. At rest, a trained athlete has a slow heart rate called bradycardia. Bradycardia makes the longer time intervals between systoles allow a better relaxation of the heart muscle and a better recovery of the biological potential of the heart. Therefore, bradycardia indicates that the body is in an optimum state for physical exercise training.

- *Low blood pressure*

  Generally, blood pressure values are slightly influenced by physical exercise training. Blood pressure, particularly systolic blood pressure, decreases down to 100 – 110 mmHg while at rest. Blood pressure undergoes alterations during physical exercise training. The maximum (systolic) pressure increases according to the intensity and the length of the effort exerted, while the minimum (diastolic) pressure, as well, experiences small changes (Cordun, 2009).

The two groups of children subject to research were born between 2004 and 2006, which means they are aged between 12 and 13 years. This indicates that they are in the puberty stage, a stage in which their body undergoes significant morphofunctional and biological changes. That is why we notice in some children a slight unsteadiness and clumsiness in the performance of movements (occurring due to the growing pains). The pulse, namely the heart rate was measured during a 3-month interval and the outcomes are included in the Table 01, Table 02, Table 03 and Table 04 below:

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Table 01. Pulse variation before and after physical exercise training, recorded in the little girl gymnasts from Olimpia Sports Club, Bucharest

No.	Subject initials	September	October	November	September	October	November
		Before physical exercise training			After physical exercise training		
1.	G. I.	45	61	54	64	120	119
2.	B. A.	39	69	86	140	83	136
3.	G. A.	69	48	97	150	126	122
4.	I. C.	72	73	94	102	103	112
5.	H. I.	62	80	78	75	98	110
6.	V. A.	96	109	86	131	121	114
7.	P. A.	108	79	99	153	118	130
8.	I. I.	67	68	71	119	128	93
9.	C. S.	108	81	84	78	95	96
10.	C. E.	65	89	79	82	123	114
AVERAGE VALUES		**73.1**	**75.7**	**82.8**	**109.4**	**111.5**	**114.6**

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Table 02. Pulse variation before and after physical exercise training, recorded in the little girl dancers from *FloriaCapsali*Choreography High School, Bucharest

No.	Subject initials	September	October	November	September	October	November
		Before physical exercise training			After physical exercise training		
1.	D. A.	88	83	52	103	135	135
2.	S. V.	86	89	78	77	136	114
3.	C. O.	96	90	80	136	158	143
4.	S. A.	70	87	79	130	139	139
5.	T. D.	92	96	78	108	124	115
6.	A. L.	68	75	66	75	114	87
7.	S. A.	93	80	83	107	112	97
8.	C. O.	87	87	98	73	118	110
9.	B. L.	80	92	83	108	92	117
AVERAGE VALUES		**84**	**87**	**80.88**	**101.75**	**124.25**	**115.25**

(Systolic and diastolic) blood pressure was also measured during the 3-month interval, and the outcomes are included in the tables below:

Table 03. Blood pressure variation before and after physical exercise training, recorded in the little girl gymnasts from Olimpia Sports Club, Bucharest

No.	Subject initials	Before physical exercise training						After physical exercise training					
		September		October		November		September		October		November	
		S	D	S	D	S	D	S	D	S	D	S	D
1.	G. I.	4.7	11	4.7	9.9	7.5	13.5	6.1	11.2	6.7	15.2	10.8	15.2
2.	B. A.	4.7	9.9	5.5	8.9	6.1	9.9	7.8	13.7	7.7	11.9	8.1	11
3.	G. A.	6.2	12.3	5.5	11.3	8.8	13.4	8.7	12.6	8.2	13.1	5.5	13.8
4.	I. C.	4.2	7.8	4.5	7.5	5.4	9.8	8.2	13.1	7.3	11.5	6.7	10.8
5.	H. I.	5.4	9	5.7	9.2	6.8	10.6	8.5	13	9	10.8	8.9	13.4
6.	V. A.	7.7	13.3	5.5	8.9	6	9.1	9.3	14.2	6.8	12.4	8.9	12.4
7.	P. A.	8.7	13.2	7	12.1	7.1	10	9.6	14.7	9.9	14.2	8	11.3
8.	I. I.	6.1	10.1	6.2	10.3	6.2	11.4	8.6	12.5	7.3	10.7	7	12.2
9.	C. S.	4.4	7.8	6	12	6.8	9.6	7.6	13.7	6.8	12.6	7.8	11.3
10.	C. E.	5.7	10	7.9	11.6	6.7	10.4	7.9	12.3	9	13.1	9.1	12.1
AVERAGE VALUES		**5.78**	**10.54**	**5.85**	**10.17**	**6.74**	**10.77**	**8.23**	**13.10**	**7.87**	**12.55**	**7.64**	**12.35**

Caption: S = systolic blood pressure; D = diastolic blood pressure.

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Table 04. Blood pressure variation before and after physical exercise training, recorded in the little girl dancers from *FloriaCapsali*Choreography High School, Bucharest

No.	**Subject initials**	**Before physical exercise training**						**After physical exercise training**					
		September		**October**		**November**		**September**		**October**		**November**	
		S	D	S	D	S	D	S	D	S	D	S	D
1.	D. A.	7.1	12.5	6.9	11.4	6.5	10.7	7.5	11.3	8	11.7	4.7	14.6
2.	S. V.	8.1	14	7.9	11.2	7.9	12.2	6.7	12.8	8.7	13	9.4	13.7
3.	C. O.	7.1	11.2	7.3	11.3	7.4	11.9	8	12.2	7	9.7	9.9	13.5
4.	S. A.	6.1	12.3	7.5	11.1	5.9	10.4	7.5	12	6.7	10.5	8.7	12
5.	T. D.	7	12.3	5.7	10.1	4.8	8.5	7.4	10.6	8	11	8.1	12.3
6.	A. L.	7.2	14.2	7.4	12.1	7.4	12.9	6.4	13.5	7.8	12	7.4	14.7
7.	S. A.	6.7	11.7	7.1	12.4	6.6	11.6	5.8	10.8	7.5	10.9	5.4	9.5
8.	C. O.	7.1	11.8	7.1	11.4	6.6	8.9	6.2	11.7	6.2	9.9	7.5	11.2
9.	B. L.	7.9	12.6	7.4	12.1	7.1	11.9	8.2	11.7	7.1	11.9	6.3	10.9
AVERAGE VALUES		**7.14**	**12.51**	**7.11**	**11.46**	**6.69**	**11**	**7.08**	**11.84**	**7.44**	**11.18**	**7.49**	**12.49**

Caption: S = systolic blood pressure; D = diastolic blood pressure.

3. Research Questions

Is there a link between the technical execution of the movements and the type of effort exerted by the subjects?

What should the rhythmic gymnastics and dance coaches / teachers do to improve the motor performance of the subjects?

4. Purpose of the Study

The research aimed at determining the similarities and differences between the two groups of subjects in point of the effort exerted during physical exercise training while referring to the type of effort specific to competitive events, in case of rhythmic gymnasts (taking the Romanian Cup as a reference event) and the type of effort specific to performances, in case of the choreography students (taking the semester exam as a reference event).

To this end, we tested the subjects' cardiovascular fitness, determining the type of effort involved in the classical dance routines.

5. Research Methods

5.1. Subjects of the research and the type of training:

The research started from the comparative analysis of two groups of children aged between 12 and 13 years old: a group of 4th year students from *FloriaCapsali*Choreography High School in Bucharest and a group of 3rd class junior gymnasts from the Rhythmic Gymnastics Department of the Olimpia Sports Club of Bucharest.

Measurements were conducted during a mesocycle training programme, namely in the first part of the school year. They were performed at the end of September, October and November. The subjects practiced the classical dance steps for one hour per day. Their pre- and post-exercise pulse and blood pressure were measured. We mention that during the entire mesocycle training programme the two groups of children performed specific training routines which also consisted of daily classical dance sessions.

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As part of the research, we measured a physiological parameter of the subjects in order to collect information on how the human body functions when subject to effort. Therefore, we assessed the changes in the cardiovascular system of the subjects following physical exercise training by using a bracelet-type blood pressure monitor.

5.2. Bracelet-type blood pressure monitor

Properties: the bracelet-type blood pressure monitor is an automatic digital device which straps on the person's wrist. The device quickly measures the systolic and diastolic blood pressure as well as the heart rate, through the oscillometric measurement method. It is accurate, being clinically tested, and it is designed to be easy to use.

How to use the blood pressure monitor:

- The device is placed on the child's wrist.
- The child sits on a chair, holding their forearm horizontal resting on the table, palm turned upward.
- After pressing the 'start' button, the pump starts inflating the cuff. As soon as the maximal inflation pressure is reached, the pump will automatically stop, the cuff starts deflating and the pressure slowly decreases.
- When measurement is completed, the monitor screen reads the systolic (maximum) blood pressure and the diastolic (minimum) blood pressure as well as the heart rate (pulse) values.

6. Findings

In point of the heart rate, we notice the following:

- Rhythmic gymnasts experience bradycardia (the tables fail to read that because the classical dance routines usually took place after the gymnastics training routine; nevertheless, previous measurements conducted on this group of children reflect this condition).
- The choreography students do not have athletic bradycardia, only one child experiencing this exercise training-based alteration of the heart rate, not sooner than November.

Having in view the aforementioned, we can conclude that rhythmic gymnastics training routines are far more demanding and, theoretically, much better structured. Besides the classical dance routines and the rhythmic gymnastics specific training, the subjects also follow strength and mobility development programmes, which obviously makes the training process more complex (Macovei, 2007). However, there are flaws in the execution of movements due to practicing under excessive tiredness conditions.

As regards blood pressure, a decrease is recorded in both the gymnasts and the dancers, therefore adaptation to effort occurs. The post-exercise blood pressure values indicate that the children exert a moderate / high effort (an interpretation conducted according to Professor A. Demeter) (Predescu, 2011).

Following the analysis of the data gathered and the careful observation of the rhythmic gymnastics subjects, we notice:

- The need of a properly structured teaching system, enabling the learners acquire the classical dance movements in a logical order and in a step-by-step manner.

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- The need to learn the elements in a sound and constant manner, with emphasis on repetitions for a better execution of movements, to ensure a balanced volume of work.
- The need to periodically assess the skills acquired; rapid corrective interventions, when appropriate, are permitted.

Following the analysis of the data gathered and the careful observation of the choreography high school students, we notice:

- The need to introduce new aerobic strength development methods by alternating the continuous aerobic training (to adapt the autonomic nervous system to oxygen uptake), the variable training and the interval training (which involves repetitions at certain intervals without allowing a full body recovery between repetitions).
- The introduction of mobility development exercises, by alternating passive mobility exercises with active mobility exercises and with body reflex development programmes.

7. Conclusion

Having in view the measurements results, we can conclude that the gymnasts exert a significantly greater physical effort as compared to the little girl dancers (Macovei & Butu, 2018). This reveals the complex nature of training in rhythmic gymnastics. The training routines are far more demanding and much better structured. Paradoxically, in point of technical execution, the choreography students perform much more correctly. This indicates that in the dance world, at this age category, emphasis is placed on the correctness of the performance instead of on the high volume of work.

Another aspect that differentiates the two groups of children is the time assigned for training routines. The gymnasts practice at least 3 hours per day, 7 days per week, covering technical training, choreographic training, physical training, mobility development. The little girl dancers practice approximately one hour and a half per day, 6 days per week. Training consists of classical dance routines and passive mobility exercises.

The research conducted on the two groups of children shows us that the movement teaching method is very important. All movements force the locomotor system to morphologically adapt and contribute to the achievement of a perfect nervous coordination of the body segments or of the body as a whole (Nenciu, 2014). This means that the teaching – learning process must be properly structured both in rhythmic gymnastics and in dance.

The technical execution of the body elements in both disciplines involves an accuracy which requires patience and persistence for achieving movements of great finesse. These movements will expressively convey the desired message (Vaganova, 2017). The bodily expression, both in gymnastics and in dance, gives shape to an internal project, yet the process involves a certain amount of control, at least because the technical and artistic tasks differ from one routine to another. Therefore, between the internal elaboration of the movements and their actual performance, there is a complex process which is basically driven by representations and which is the essence of psychomotor learning. The transposition of the project into expression can be rethought the moment obstacles occur at the behavioural level. Suggestions may be implemented according to the external resources, the result being the collaboration of the behavioural ability and the internal elaboration project.

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References

Cordun, M. (2009). *Kinantropometrie*, [Kinantropometrie], Bucureşti: Editura CD PRESS.

Dragnea, A., Bota A., Stanescu, M., Teodorescu S., Serbanoiu, S., & Tudor, V., (2006). *Educaţie fizică şi sport. Teoria şi didactica*, [Physical education and sport. Theory and didactics], Bucureşti: Editura FEST.

Macovei, S. (2007). *Antrenamentul în gimnastica ritmică: repere teoretice şi metodice*, [Rhythmic gymnastics training: theoretical and methodical reference], Bucureşti: Editura Bren.

Macovei, S., & Buţu, I. M. (2018). *Tehnica de mânuire a obiectelor în antrenamentul de gimnastică ritmică,* [The technique of handling objects in rhythmic gymnastic training], Craiova: EdituraUniversitaria.

Nenciu, G. (2009). *Biomecanica în educaţie fizică şi sport. Aspecte generale*, [Biomechanics in Physical Education and Sports. General aspects] Bucureşti: Editura Fundaţiei România de Mâine.

Nenciu, G. (2014). *Biomecanică – Curs în tehnologie IFR*, [Biomechanics - IFR Technology Course], Bucureşti: Editura Fundaţiei România de Mâine.

Netter, F., H. (2013). *Atlas de anatomiea omului*, [Atlas of human anatomy], Bucureşti: Editura Medicală Callisto.

Predescu, C. (2011). *Fiziologia şi biochimia efortului sportiv*, [Physiology and biochemistry of sports effort], Bucureşti: Editura Discobolul.

Vaganova, A. (2017). *Basic principles of Classical Ballet – Russian Ballet Technique,* New York: Dover Publications, INC.