INFLUENCE OF TRAINING OF RHYTHMIC GYMNASTICS FUNDAMENTALS ON CERTAIN MOTOR ABILITIES IN GIRLS 8-9 YEARS OF AGE

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Abstract:

The paper analyses the influence of a rhythmic gymnastics (RG) programmed training on the motor abilities in 36 girls, 8-9 years of age. Since the RG-specific motion structures are based on jumps/leaps, turns/pivots, balances and flexibilities, the battery of measurement instruments was composed of 13 variables assessing explosive power, coordination, balance and flexibility. Between two measurement points the examinees participated in the nine-month training programme consisiting of the RG fundamentals. Statistical significance of differences between the initial and the final motor status was tested by *t*-test, and significant changes occurred in 7 motor tests. The largest positive changes were registered in all the tests assessing flexibility of the entire body, then in one test of leg explosive power and in two tests of coordination, in descending order. The balance tests displayed insufficient reliability. The findings indicated that the initial motor status of the examinees was comparable to the status of a normal peer population, except for the better flexibility of the observed sample. The applied training programme, consisting of the RG specific contents, failed in complying with expectations. Although all the motor abilities were improved after the nine-month training treatment, the participants did not display any considerable difference from the average population. The progress was insufficient to support quality sport selection. Hence, the existing programme should be expanded to include contents that will enable a balanced influence and enhancement of all the motor abilities relevant to RG. The motor complexity of the sport may be a limiting factor of early selection, especially with regard to such a small sample.

Key words: *rhythmic gymnastics, young girls, motor abilities, training*

EINFLUSS DES TRAININGS IN DER BASISCHEN RHYTHMISCHEN GYMNASTIK AUF EINIGE MOTORISCHE DIMENSIONEN BEI DEN 8- UND 9-JÄHRIGEN MÄDCHEN

Zusammenfassung:

Diese Arbeit analysiert den Einfluss des programmierten Trainings in rhythmischer Gymnastik (RG) auf die motorischen Fähigkeiten bei 36 8- und 9-jährigen Mädchen. Da die spezifische Motorik der rhythmischen Gymnastik auf Springen/Hüpfen, Drehen/Rotation, Gleichgewicht und Flexibilität beruht, wurde eine Batterie von 13 Variablen zur Bewertung der Explosivkraft, der Koordination, des Gleichgewichts und der Flexibilität geschildert. Zwischen zwei Messpunkten nahmen die Mädchen an einem neunmonatigen Trainingsprogramm teil, das die Basiselemente der RG umfasste. Die Bedeutung der Unterschiede zwischen dem initialen und endlichen motorischen Zustand wurde mittels des *t*-Tests geprüft. Statistisch bedeutende Unterschiede wurden in 7 motorischen Tests gefunden. Die größten bedeutenden positiven Unterschiede wurden in allen Tests zur Bewertung der Flexibilität des ganzen Körpers, in einem Test der Explosivkraft der Beine und in zwei Koordinationstests, in der genannten Ordnung, festgestellt. Die Tests des Gleichgewichts hatten ungenügende Zuverlässigkeit. Die Ergebnisse wiesen darauf auf, dass der motorische Anfangszustand der geprüften Stichprobe, die bessere Flexibilität ausgenommen, mit dem Zustand normaler Altersgenossen vergleichbar war. Das angewendete RG-spezifische Inhalte umfassende Trainingsprogramm erfüllte die Erwartungen nicht: obwohl die motorischen Fähigkeiten nach neunmonatigem Training verbessert waren, zeigten die Teilnehmerinnen keine bedeutenden Unterschiede von der durchschnittlichen Population. Der Fortschritt war ungenügend, um eine qualitative sportliche Auswahl zu unterstützen. Deswegen soll das vorhandene Programm mit solchen Inhalten erweitert werden, die einen gleichmäßigen Einfluss sowie Anregung aller RG relevanten motorischen Fähigkeiten ermöglichen werden. Die motorische Vielfältigkeit dieses Sports kann ein begrenzender Faktor der frühen Auswahl sein, besonders in so einer kleinen Stichprobe.

Schlüsselwörter: *rhythmische Gymnastik, Mädchen, motorische Fähigkeiten, Training*

Introduction

Although rhythmic gymnastics (RG) started to develop on a large scale at the end of the 19th century, due to the numerous European schools of RG, it actually flourished only when it was included in the physical education (PE) of girls. In 1934 a cathedra of RG was established in Moscow at the Institute of Physical Culture, and in Petersburg the first school of RG was opened. The sport assumed a competitive character only in 1963 through the first Code of Points of RG, accepted and implemented at the First World Championship held in Budapest. Another twenty years had passed before RG joined the family of Olympic sports in Los Angeles in 1984.

Rhythmic gymnastics pertains to the family of conventional sports and consists of:

- motion performance harmonized with musical accompaniment in unity and
- handling of apparatus (rope, hoop, ball, clubs, ribbon).

The fundamentals of RG are divided into:

- body movements (elements) and
- elements with apparatus.

The difficulty of an exercise is determined primarily by the body movements which should be coordinated with the handling of an apparatus. The Code of Points recognizes five degrees of difficulties – A, B, C, D, and E. The basic body movements are: jumps/leaps, balances, turns/pivots, and flexibilities/waves. These movements require motor abilities that have been described by Metikoš and associates (1982) as the basic motor abilities: explosive power, flexibility, coordination, and balance. According to Jastrjembskaiai and Titov (1999) these abilities should be the foundation of the RG training. Namely, only by means of a systematic and well-planned training of, primarily, the particular abilities, the top-quality sports result may be achieved. These authors have advocated for an even more strict and demanding training of basic motor abilities in young rhythmic gymnasts because of the sensitive development periods (Matveev, 1990; Table 1).

Girls of 8 and 9 years of age, being the age of the sample in this research, should work on speed, static endurance, average intensity endurance, elements of simple and more demanding coordination exercises, balances, accuracy and flexibility. The early onset of flexibility training, in a proper developmental phase, is extremely important since joints and connective tissue are still soft then.

According to Jastrjembskaia and Titov (1999), the coordination abilities are most sensitive to development from 6 to 12 years of age and their prime periods are as follows:

- Precision of space orientation – from 7/8 to 10 years; stabilized until the 13th year, will increase again after the 13th year;
- Precision of muscular efforts – from 8 to 12 years;
- Ability to reconstruct movements – from 7/8 years to 11/12 years;
- Ability to transfer movements from one body part to another – from 8 to 9 years only.

Unfortunately, too few research studies have so far investigated younger age categories in RG, either selected or non-selected (Dimova,1983; Kindij,1988, Furjan,1990; Miletić, 1999). Most of the previous studies have been performed on the selected samples of rhythmic gymnasts (Hume et al.,1993; Kioumourtzoglou et al.,1997; Rutkowska-Kucliarska,1998; Douda et al.,1998; Vajngerl, 1998, and others). Other research studies investigating RG on non-selected samples of late teenage categories (Wolf-Cvitak,1993, 1995; Srhoj, 1989) generally confirm the findings obtained in the previously mentioned studies.

Factors of success in RG have been so far determined and the base has been established for efficient orientation and selection in schools of RG.

Table 1. Sensitive periods in the development of physical abilities of girls (according to Matveev, 1990).

Physical fitness	Years / Physical abilities	7-8	8-9	9-10	10-11	11-12
Strength and power	Proper strength abilities			+	+	
	Power abilities			+		
Speed	Rate of movements			+	+	+
	Speed of a single movement			+	+	+
	Speed of reaction time	+	+	+	+	+
Endurance	Static regimen	+				
	Dynamic regimen			+	+	+
	High intensity			+	+	+
	Average intensity		+			
Coordination	Simple coordination	+	+			+
	Complex coordination		+			+
	Stability	+	+	+		+
	Precision of movements		+			+
Flexibility	Flexibility	+	+	+	+	+

The process of training and selection which avoids respecting research inferences and relies exclusively on a trainer's experience or is performed by the trial-and-error method, is hardly beneficial and effective in terms of sport achievements. Top-quality sport achivements in any sport, RG as well, is attainable only through correct training and selection methods' implementation. That implies scientific base for a programme design, thorough planning, constant monitoring of the trainees' progress and status of fitness, and evaluation of programmes and goals.

The goal of the present study was to test the effects of a nine-month RG training programme on complete beginners. The second goal was the verification of certain new or, until now, rarely used tests of explosive power and coordination. The explosive power test, known as *vertical jump*, was here performed and measured not only laterally, as usually done, but frontally as well. The authors supposed that such young girls might have found the latter version easier to perform due to the inherent symmetry of the task. The other newly employed test was modified according to Starosta (1989). It is a coordination test consisting of jumps with a twist/turn in the air to either the right or the left. One of the authors (Grčić-Zubčević, 1996) calls it "turn in the air" and she has utilized it in her investigation on the efficacy of versatile swimming learning programmes, with the aim of selecting young swimmers. The original test was constructed by the Russian Matorin (1965). Bulgakova and associates (1969) have reccommended the test to be implemented in the selection process in the swimming sport schools.

Methods and material

Sample of participants

Thirty six girls, 8 and 9 years of age, participated in the study. Intrinsically motivated, the girls freely chose to join the RG beginner's programme in the RG Club "Leda", in Zagreb, as an additional sport activity besides the regular PE classes at school. The only criterion regarding their programme participation eligibility was that the girls were clinically in good health without any aberrations and that they did not participate in any other extracurricular sport. They attended the RG classes two times a week over a period of nine months. The measurements (the initial and the final one) were performed at two time points – at the beginning and at the end of the nine-month training programme.

Sample of variables

Most of the variables used in the research were selected from the battery of standard motor measurement instruments as described in Gredelj and associates (1975). Three tests were added – one, an adaptation of the well known *vertical jump (the frontal version of vertical jump)*, and two new coordination tests: *twisted (turn) jump to the right* and *twisted (turn) jump to the left*, as described in Starosta (1994). The selected thirteeen motor tests covered the space of latent dimensions that had already been proved to be important in RG.

Tests assessing explosive power:

1. Horizontal jump (HORJ)

2. Vertical jump (VERJ) – usual procedure: an examinee is standing with his/her side to the wall;

3. Frontal vertical jump (FVJ)
The measuring procedure is the same as in the common vertical jump except for the posture of an examinee - she is facing the wall.

Tests assessing coordination:

4. Twisted (turn) jump to the left (TWJL)

5. Twisted (turn) jump to the right (TWJR)

Prior to both tests, the special measuring instrument, which Starosta (1994) described and named "coordinationmeter", was constructed by the authors themselves.

Coordinationmeter. A circle, 80 cm in diameter, was drawn on soft, plastic-coated surface, 1 x 1 m in size, and divided into angular degrees at every 10^{th} degree (0-360°). Two scales were drawn: the outer one for measuring jumps to the right, and the inner scale for jumps to the left. In the middle of the circle, 2 cm apart, two soles of the feet were drawn to denote the starting position of the feet (legs) in the test. The pad was fixed by duct-tape to the floor.

Description of the tests TWJL and TWJR. An examinee is barefoot. She is standing on the marks ("feet") drawn on the coordinationmeter. She pushes herself off the ground from a half-squat and, when in the air, she performs a maximum twist (turn) either to the left or to the right around her longitudinal body axis. On her landing on both feet parallelly, she must keep her balance. Both arms perform a swing up to a raise. The task is performed three times and the examinee rests while a measurer is registering the result. If the examinee has failed to land on parallel feet, a ruler is put inbetween the feet so as to be at the equal distance from heels and toes. When the ruler is set, the examinee leaves the pad, and the ruler is translated to

the centre of the circle by means of a right-angle triangle, the degrees are read off and registered. If the examinee fails to maintain her balance, she must repeat the task. No previous tryout is allowed. Starosta has proposed (1989) an orientation scale for assessing coordination in athletes and non-athletes (Table 2).

Table 2. Orientation scale for assessing coordination by means of the twisted jump (according to Starosta, 1989).

Maximum turn in twisted jump with landing on both feet (degrees)		
Grade	**Athletes**	**Non-athletes**
1	< 260	< 180
2	261-340	181-270
3	341-420	271-360
4	421-500	361-450
5	501 <	451 <

The modification of arm work has been introduced to the test performance in this study due to the fact that the examinees are very young. In the original test (Matorin, 1965) arms should be held on the hips all the time. In the present study examinees perfomed an arm swing up to a raise. The modification was introduced because Starosta and Wolf-Cvitak (1997) had found in their previous research that the arm position is mostly responsible for any uncertain landing and failure to maintain balance.

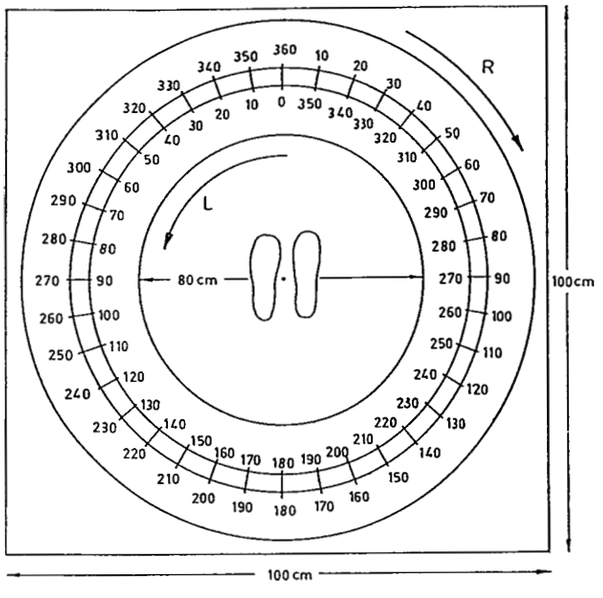


Figure 1. Coordinationmeter, according to Starosta (1989).

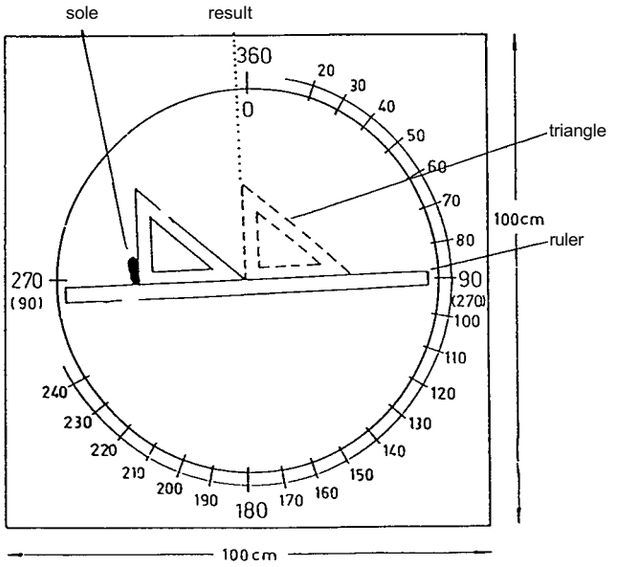
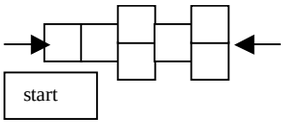


Figure 2. An example of measuring procedure at the twisted jump to the left.

6. Side steps (SIDS)

7. Hopscotch (HOPS)

Squares 30 x 30 cm are drawn one after the other in the direction of movement on the floor in a sequence 1.5m long:



On an audio signal, an examinee jumps into the first square on her left foot, then proceeds to the second. From it she jumps over and performs a straddle landing on both feet, each in one of the parallel squares (the third and fourth), then again on her left foot into the fifth square, and the straddle landing in the sixth and seventh square. She returns to the starting position backwards by hopping on her right foot this time. The time in 1/10 sec, needed to accomplish the task, is measured.

Tests assessing flexibility:

8. Straddle sit and reach (SSR)

9. Forward bend on a bench (FBB)

10. External arm circumduction with a bar (CIRCB)

Tests assessing balance:

11. One-legged stand along a bench with the eyes open (OLSEO)

12. Double-legged stand across a bench with the eyes open (DLSEO)

13. Double-legged stand across a bench with the eyes closed (DLSEC)

All the measures were taken three times. Both the initial and final measurements were performed by the same measurers at the same time point in the day.

Research design

Training programme. The examinees participated in a nine-month training programme, created for beginners who encounter RG for the first time. The purpose of the programme is to acquaint girls with the fundamentals of the sport. Throughout the entire programme the girls were working to a musical accompaniment, which is an indispensable component of RG.

4. Turns:
   By small steps to both sides; crossed-leg turn (each leg leads)
5. Balances:
   basic posture on the toes; flat-foot passing (each leg leads); flat foot support and front, side and back leg raise hold (each leg leads)
6. Flexibility:
   arm waves; side wave to the right and left; total body wave; over-shoulder bridges (big and small) from a lying position; sitting forward bends (deep down hold); splits – each leg leads; front split; flexibility of legs by the wall bars;

Table 3. The nine-month RG training periodization.

Periods	First	Second	Total
Duration	September 1 - December 12	January 15 – May 31	September 1 – May 31
Number of phases	2	2	4
Number of microcycles	15	18	33
Number of training days	116	135	251
Number of training sessions	30	34	64
Volume (min)	1800	2400	3840
Intensity (%)	50	60	55
Testing	August 31	May 31.	Aug. 31/May 31

Table 4. Distribution of the training contents.

CONTENTS		M	O	N	T	H	S		
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
Postures, gait	x	x	x	x	x	x	x	x	x
Hops	x	x	x	x					
Jumps/leaps				x	x	x	x	x	x
Turns/pivots	x	x				x	x	x	x
Balances				x	x			x	x
Flexibility	x	x	x	x	x	x	x	x	x
Semiacrobatic elements						x	x		
Ballet	x	x	x			x	x	x	x
Ball exercise							x	x	x

The training programme consisted of the following fundamentals:

1. Stances/postures, gait (walking and running):
   Proper body posture; arm carriage/positions; toes and heel walking steps; gymnastic step; proper gymnastic running;
2. Hops:
   double-legged hops; «children's» hops; one-legged hops; «gallop» forward and sideways (each leg leads);
3. Jumps / leaps:
   «scissor» forward; «cat's» leap; double-legged jump with a turn (180°); distant-high jump;
7. Semiacrobatic elements:
   forward roll; rolling sideways; cartwheel, shoulder stand;
8. Ballet:
   leg and arm positions; plié, demi and grand; battement tendu simple from the 1st position;
9. Ball exercise:
   grips and tossing; free roll on the floor; passive and active bouncing; a choreography with the ball.

The synthetic teaching method was the most frequently used method of work throughout the programme. Planning the volume of load appeared

to be the greatest problem in the training programme implementation. Namely, two one-hour sessions per week were insufficient to produce an adequate transformation of motor abilities. Just to start with learning the new motion structures, the participants were usually first subjected to a prolonged warm-up. The ballet exercises could not be shortened because they are indispensable at this age for proper motion acquisition and performance. So, about 30 minutes at best remained for motor learning and mastering. The volume of the load was progressively increased from session to session because repetitions of the already mastered contents were obligatory.

Data processing methods

The data were processed by the statistical software package *STATISTICA for Windows.* The standard descriptive parameters were computed. Reliability of motor tests was verified by Chronbach's index of generalizability (α). To determine the statistical significance of changes in motor status between the initial and final measurement the *t*-test for dependent samples was utilized.

Results and discussion

The analysis of metric characteristics of all the tests, especially those used here for the first time, was performed prior to the quantitative analysis (Table 5).

Table 5. Metric characteristics of the measurement instruments.

VARIABLE	ALFA	MSA	HOM
HORJ	0.98	1.00	0.99
VERJ	0.97	1.00	0.98
FVJ	0.93	0.99	0.97
TWJR	0.94	0.98	0.97
TWJL	0.95	0.99	0.98
SIDS	0.98	1.00	0.99
HOPS	0.97	1.00	0.98
SSR	0.98	1.00	0.99
FBB	0.96	0.99	0.98
CIRCB	0.98	1.00	0.99
OLSEO	0.90	0.96	0.95
DLSEO	0.62	0.57	0.79
DLSEC	0.65	0.67	0.87

The analysis of coefficients of reliability, representativeness and homogeneity reveals considerably low values in the *double-legged stand across a bench* coordination tests (DLSEO and DLSEC), therefore they are considered as unreliable. In some other studies on RG the coordination tests also appeared to be questionably reliable (e.g. Miletić, 1999). Hence, the interpretation of the results measured by the coordination tests should be considered here with restraint. Metric characteristics of all the other tests, assessing explosive power, coordination and flexibility, are of acceptably high values.

Table 6 makes it obvious that the girls experienced progress in all the measured variables between the two measurement points – all the mean scores of the final measurement are better.

A comparison of the *horizontal jump* test results between the sample and the normal school peer population (Findak et al., 1996) revealed that the observed sample achieved results below average in the initial measurement (HORJ1). After the training treatment their results (HORJ2) reached an average of the normal population.

The initial results of the coordination test *twisted jump* (TWJR1 and TWJL1) ranged from 266^{o} to 278^{o}. When compared to the reference scale of Bulgakova and associates (1969), these results showed to be correspondent to the results of non-athletic peers and could be graded as good. Grčić-Zubčević (1996) obtained the same results. The better results at both measurement points were obtained in the performance of a turn to the right. Despite the fact that the take-off in the test is performed double-legged, the authors presume that the left foot produced greater contribution to the force of the twisted jump directed to the right than to the opposite side. Since this was not the issue of the present study, it should still be explored. The authors comprehend the twisted jump test as a complex measure in which not only one ability (coordination) is measured, but it is saturated by explosive power and balance as well. Further, coordination is also related to cognitive abilities (Katić, 1995 and 1997). Further investigations of the test in question is needed on both the same and older samples in order to define its actual evaluation.

The initial mean result in the *straddle sit and reach* test (SSR1), quoting 62 cm, appeared to be an excellent result when compared to the results of the normal peer population (Findak et al., 1996). It is even an excellent result for somewhat older girls. The results obtained in the final measurement (SSR2) were further improved.

The results of comparisons made to available referent values of the normal peer populaiton revealed that the study sample may be considered as an average sample.

Table 6. Descriptive statistic parameters of the results of the motor tests obtained in the first (initial status) and in the second (final status) measurement.

	UNIT	Mean	Min	Max	SD	Skew	Kurt	Max D
HORJ1	cm	121.12	74	168.33	23.76	0.25	-0.95	0.16
HORJ2	cm	131.20	81.67	172.00	25.87	0.32	-0.21	0.12
VERJ1	cm	23.50	14.25	34	5.78	0.15	-0.72	0.09
VERJ2	cm	28.66	16.50	36.5	6.02	0.08	-0.30	0.07
FVJ1	cm	17.60	9.75	32.25	4.96	1.03	0.95	0.15
FVJ2	cm	21.72	15.25	34.75	4.65	0.77	0.33	0.12
TWJR1	degree	278.18	174	436.67	53.47	0.76	1.32	0.13
TWJR2	degree	294.11	186	476	61.16	0.63	1.62	0.11
TWJL1	degree	266.23	170	420.67	56.57	0.67	0.94	0.13
TWJL2	degree	290.25	189.67	461	58.94	0.86	1.19	0.11
SIDS1	sec	13.71	10.12	17.47	2.09	0.05	-0.97	0.08
SIDS2	sec	12.71	9.91	17.19	1.99	0.57	-0.68	0.10
HOPS1	sec	3.68	2.50	5.05	0.58	0.13	0.19	0.08
HOPS2	sec	3.30	2.34	4.47	0.48	0.46	0.24	0.09
SSR1	cm	62.21	47.67	76.33	6.82	-0.28	-0.01	0.10
SSR2	cm	67.60	54.67	80.33	6.74	0.15	-0.82	0.07
FBB1	cm	14.50	6.67	22	3.87	0.05	-0.09	0.13
FBB2	cm	18.74	9.33	27.67	4.34	0.24	-0.04	0.08
CIRCB1	cm	44.82	8	66	12.04	-0.83	1.31	0.07
CIRCB2	cm	38.68	5.33	56.67	11.87	-0.72	0.38	0.09
OLSEO1	sec	2.41	0.95	7.25	1.25	2.26	6.46	0.18
OLSEO 2	sec	3.43	0.92	25.51	4.02	4.98	27.51	0.26
DLSEO1	sec	2.39	0.94	5.86	1.19	1.35	1.74	0.15
DLSEO2	sec	2.63	1.11	6.28	1.07	1.16	2.17	0.11
DLSEC1	sec	1.44	0.66	3.02	0.52	0.79	1.39	0.14
DLSEC2	sec	1.71	0.80	2.77	0.47	0.18	-0.47	0.07

Max D = 0.26 N = 36 TEST = 0.33

Mean – arithmetic mean; Min – minimal result; Max: maximal result; Range – range between min. and max. result; SD – standard deviation; Skew – degree of asymmetry; Kurt – degree of peakedness; Max D – the biggest deviation of real and theoretical cumulative class proportion

Table 7. Results of t-test of the differences between the initial and final motor status.

	MEAN 1	MEAN 2	t-value	df	p
HORJ	212.12	128.21	-1.7223	70	0.08
VERJ	23.50	27.70	-0.8093	70	0.06
FVJ	17.60	21.72	-3.6366	70	**0.00**
TWJR	278.18	294.11	-11769	70	0.24
TWJL	266.23	290.25	-17639	70	0.08
SIDS	13.71	12.71	2.0838	70	**0.04**
HOPS	2.68	3.30	3.0677	70	**0.00**
SSR	62.21	67.60	-3.3724	70	**0.00**
FBB	14.50	18.74	-4.3790	70	**0.00**
CIRCB	44.82	38.68	2.1825	70	**0.03**
OLSEO	2.41	3.43	-1.4519	70	0.15
DLSEO	2.39	2.63	-0.9132	70	0.36
DLSEC	1.44	1.71	-2.3233	70	**0.02**

On the basis of the *t*-test for evaluating the differences in means between the first and the second measurement, the significant statistical differences were obtained in four variables at the probability error level of $p<0.01$, and in the additional three at the probability error level of $p<0.05$. The total of seven significant differences were obtained between the initial and the final measurement.

The most significant changes are obvious in the tests of flexibility of the spine column (FBB) and hip joint (SSR), and in flexibility of arms and shoulders (CIRCB). These changes can be attributed to the transformation (training) process, in which a significant portion of time was dedicated to the flexibility exercises. They are indispensable components of any RG training because they provide full range of motion, in the performance of both the body elements and elements with apparatus, which is essential for success in RG.

The next in the descending order of significance are the following coordination tests: *hopscotch* (HOPS) and *side steps* (SIDS). The performance of both tests is similar: in a short time period a lot of one- and double-legged take-offs are alternately performed together with quick changes of direction of movements. These motion structures are specific for RG and inherent to gymnastic gait (running), hops, leaps, and jumps. Therefore, they should be permanent contents of an each training session.

Progress in the test *twisted jumps* to both sides (TWJR and TWJL) was not statistically significant. Since the results in the test depended not merely on the power of a take-off, but also on the space orientation during rotation and on the ability to maintain balance on the landing, these additional components were probably the hindering factors which interfered with the task performance causing lower scores.

Among the *leg explosive power* tests, the statistically significant changes between the two measurement points occurred just in the test *frontal vertical jump* (FVJ). From descriptive parameters of the test, represented in Table 6, it becomes obvious that the obtained significance may be attributed to the low mean value of the initial measurement (caused by one extremely low result). Only the results the participants achieved in the second measurement became comparable to the average ones achieved by the school population (Findak, 1996; Vajngerl, 2001). The RG-specific training obviously failed to considerably improve leg explosive power in the examinees, whereas the test *frontal vertical jump* should be subjected to a further investigation and evaluation.

In the space of balance only one statistically significant change was noticed in the test *double-legged stand across a bench with the eyes closed* (DLSEC). The other two tests, performed with the eyes open, confirmed that the role of visual perception was not crucial, because the balance control obviously came from the kinaesthetic analyser. The similar results were obtained in the research study by Wolf-Cvitak and associates (2002) – the ballet elements, saturated by balance, were easier and more quickly mastered when the gymnast had her eyes closed than open. Nevertheless, the obtained results should be regarded with restraint due to the fact that all the applied balance tests displayed poor metric characteristics.

The non-selected girls, who intrinsically decided to start practicing RG, were the participants in the present study. In the beginning they did not differ significantly from their peers in population of girls 8 and 9 years of age, except for the better results in the flexibility tests. The applied training programme, consisting of the RG-specific exercise contents, unfortunately, failed to produce the expected results. After the nine-month period of practising RG, the participants, although with generally improved motor abilities, still did not differ markedly from the results of the average peer population. The level of progress was not enough to enable proper sport selection. Complexity of the sport might present a hindering factor in the early selection process for RG, especially with regard to such a small sample.

The target contents should be added to the existent programme which will then facilitate balanced improvement of all the motor abilities relevant to rhythmic gymnastics. In such a way the programme may become more suitable to provide a basis for quality selection of girls for this demanding, but nice sport for women.

Conclusion

The positive quantitative changes were found in all the observed motor abilities after the nine-month training programme of rhythmic gymnastics. The statistically significant changes were primarily obtained in all the flexibility tests. This motor ability is exceptionally important to RG because it has the greatest influence on performance of all the RG elements. The implemented training programme is suitably designed with regard to the flexibility exercises, which becomes obvious from the results obtained.

In the ranking order of significance then come the coordination tests. They represent the general ability of coordination required in performing the

complex RG motion structures. The training programme should be subjected to modifications in this space. Namely, the functional mechanisms underpinning coordination depend on the person's ability to quickly perform complex motor tasks and to reorganize motor sterotypes, then on agility, coordination between various body parts, and on the ability to learn and master new motor tasks.

The progress was also insufficient with regard to the leg explosive power enhancement. Despite the fact that the applied training programme consisted of a considerable amount of hops, leaps and jumps, it was still inadequate to produce expected considerable improvement in the respective motor ability.

The findings suggest further that the existent training programme of RG should be modified in the space of balance work as well. The authors presume that girls rarely had a chance to train balance prior to starting the RG school. Hence, a four-month period of the balance training was a too insufficient stimulus for inducing substantial progress.

Generally, the applied training programme produced improvements in the motor abilities specific for RG. Undoubtedly, it has a potential, provided that certain modifications are made, to assure basic preconditions for appropriate selection of girls for this nice, appealing sport for women.

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UTJECAJ TRENINGA OSNOVNIH ELEMENATA RITMIČKE GIMNASTIKE NA NEKE MOTORIČKE SPOSOBNOSTI DJEVOJČICA U DOBI OD 8-9 GODINA

Sažetak

Uvod

Ritmička gimnastika je konvencionalni sport koji objedinjuje: pokret u jedinstvu s glazbom i baratanje spravama (vijača, obruč, lopta, čunjevi, traka). Osnovni elementi ritmičke gimnastike se dijele na: elemente tijela i elemente sprava. Ta se dva elementa zajedno procjenjuju na natjecanjima prema Pravilniku za bodovanje kao «težine» A, B, C, D i E. Elementi tijelom određuju «težinu» cijelog elementa. Osnovni elementi tijelom su, prema Pravilniku za ritmičku gimnastiku, skokovi, ravnoteže, okreti i pokretljivost. To su neke od motoričkih sposobnosti koje su autori Metikoš i sur. (1982) opisali kao bazične motoričke sposobnosti, a koje odgovaraju eksplozivnoj snazi, fleksibilnosti, koordinaciji i ravnoteži. Samo sistematski i dobro planirani trening, u prvom redu baš tih motoričkih sposobnosti, može dati visoke sportske rezultate.

Ovo istraživanje je provedeno radi vrednovanja programa treninga u RG školi. Program se osniva na specifičnim elementima ritmičke gimnastike. Eksperimentalni kineziološki tretman imao je za cilj stimulirati pozitivnu transformaciju motoričkih sposobnosti kako bi ona bila temelj za selekciju djevojčica u kvalitetniju grupu. Drugi je cilj bila provjera nekih novih testova prvi puta korištenih u ritmičkoj gimnastici.

Materijal i metode

Uzorak ispitanika

Uzorak ispitanica činilo je 36 djevojčica u dobi od 8 do 9 godina. Ispitanice su se, intrinzično motivirane, upisale u početničku grupu ritmičke gimnastike zagrebačkog Kluba za ritmičku gimnastiku «Leda». Pored redovne nastave tjelesne i zdravstvene kulture u školi, one su redovno polazile (dva sata tjedno) treninge ritmičke gimnastike.

Uzorak varijabli

Za procjenu motoričkog statusa ispitanica primijenjeno je trinaest motoričkih testova koji su procjenjivali: eksplozivnu snagu, koordinaciju, ravnotežu i fleksibilnost. Testovi za procjenu eksplozivne snage bili su: skok u dalj s mjesta (HORJ), skok u vis s mjesta-bočno (VERJ) i skok u vis s mjesta-frontalno (FVJ). Testovi za procjenu koordinacije bili su: skok s okretom ulijevo (TWJL), skok s okretom udesno (TWJR), koraci u stranu (SIDS) i školica (HOPS). Tri testa TWJL, TWJR i HOPS novi su testovi, od kojih su prva dva prvi put korišteni u ritmičkoj gimnastici. Testovi skok s okretom izvode se tako da se, nakon sunožnog odraza u vis, tijelo okrene maksimalno oko uzdužne osi u jednu stranu. Mjeri se kut od odraza do doskoka. Test školica preuzet je iz dječje igre, a izvodi se naizmjeničnim jednonožnim i sunožnim skokovima, unaprijed i unatrag, u nacrtana polja na podlozi. Testovi za procjenu fleksibilnosti bili su: pretklon u sjedu raznožno (SSR), pretklon na klupici (FBB) i iskret palicom (CIRCB). Testovi za procjenu ravnoteže bili su: stajanje na jednoj nozi na klupici uzdužno otvorenih očiju (OLSEO), stajanje na obje noge poprečno na klupici otvorenih očiju (DLSEO) i stajanje na obje noge poprečno na klupici zatvorenih očiju (DLSEC).

Provedba istraživanja

Trening u školi ritmičke gimnastike trajao je devet mjeseci, a izvodio se dva puta tjedno po 60 minuta. Motorički status djevojčica izmjeren je na početku i na kraju eksperimentalnog trenažnog programa. Program devetomjesečnog treninga obuhvaćao je elemente ritmičke gimnastike u vidu slijedećih sadržaja: stavovi, hodanja, trčanja, poskoci, skokovi, okreti, ravnoteže, pokretljivosti, poluakrobatski elementi, balet i vježbe loptom.

Metode obrade rezultata

Podaci su obrađeni statističkim paketom *STATISTICA for Windows.* Izmjerene vrijednosti varijabli obrađene su standardnim deskriptivnim postupcima kako bi se utvrdile njihove osnovne statističke karakteristike. Pouzdanost svih motoričkih testova provjerena je Cronbachovim indeksom generalizabilnosti α. Za utvrđivanje statističke značajnosti promjena motoričkih sposobnosti izazvanih programom treninga između inicijalnog i finalnog stanja korišten je *t*-test za zavisne uzorke.

Rezultati i rasprava

Na temelju dobivenih rezultata može se zaključiti da su nastale pozitivne kvantitativne promjene u svim motoričkim sposobnostima.

Statistički značajne promjene ostvarene su u svim testovima fleksibilnosti koji su mjerili fleksibilnost ruku i ramenog zgloba (CIRCB), kralježnice (FBB) i zgloba kuka (SSR). Ova motorička sposobnost posebno je važna, jer ima veliki utjecaj na rezultate izvođenja svih elemenata u ritmičkoj gimnastici. Dakle, program treninga bio je vrlo dobro koncipiran što se tiče vježbi pokretljivosti.

Statistički značajne promjene zamijećene su i u dva testa za procjenu koordinacije: školica (HOPS) i koraci u stranu (SIDS). Oni označavaju opću koordinacijsku sposobnost za izvođenje kompleksnih gibanja karakterističnih za ritmičku gimnastiku. Prvi put primijenjeni testovi skok s okretom u desnu (TWJR) i lijevu stranu (TWJL) nisu se pokazali primjereni ispitanicama. Te testove treba dodatno provjeriti u idućim istraživanjima.

Što se tiče eksplozivne snage nogu, rezultati ispitanica pokazuju nedostatne vrijednosti. Iako su u trenažnom programu sadržaji poskoka i skokova bili znatno zastupljeni, on ipak nije doveo do značajnijeg poboljšanja te motoričke sposobnosti.

U prostoru ravnoteže uočena je statistički značajna promjena u testu koji se izvodio zatvorenih očiju (DLSEC), dok se testovi izvođeni otvorenim očima (OLSEO i DLSEO) nisu pokazali značajnim. Očito da uloga vidnog osjeta nije bila presudna jer se kontrola vršila iz kinestetičkog analizatora. Dobiveni rezultati ipak se moraju uzeti s dozom opreza jer su se testovi ravnoteže pokazali nisko pouzdanima. Postoji potreba da se program treninga korigira u području rada na ravnoteži. Može se pretpostaviti kako se ravnoteža premalo trenirala u prethodnoj životnoj dobi, pa su samo četiri mjeseca treninga ravnoteže tijekom devetomjesečnog treninga bila nedostatna za značajniji napredak.

Zaključak

Ispitanice ovog istraživanja bile su neselekcionirane djevojčice koje su se upisale u školu ritmičke gimnastike. Rezultati istraživanja pokazali su da se ispitanice na početku nisu značajno razlikovale od populacije školske djece njihove dobi, osim što su imale bolju gibljivost. Primijenjeni program treninga ritmičke gimnastike nije u potpunosti dosegnuo očekivane rezultate. Nakon devet mjeseci ispitanice, iako su poboljšale svoje motoričke sposobnosti, nisu previše odskočile od prosječne populacije. Napredovanje je bilo nedovoljno da bi se na temelju tih rezultata mogla provesti dobra selekcija za ovaj sport. Kompleksnost ritmičke gimnastike, nadalje, vjerojatno je bio ograničavajući faktor za ranu selekciju pogotovo na ovako malom uzorku ispitanica.

Postojeći program potrebno je nadopuniti ciljanim sadržajima koji bi jednakomjerno djelovali na podizanje svih motoričkih sposobnosti relevantnih za ritmičku gimnastiku. Tada bi program osigurao selekciju perspektivnih vježbačica za ovaj lijepi ženski sport.

Ključne riječi: ritmička gimnastika, djevojčice, motoričke sposobnosti, trening