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Assessment of the impact of one-year training in acrobatic rock'n'roll on overall motor coordination in eight-year-old children

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Assessment of the impact of one-year training in acrobatic rock'n'roll on overall motor coordination in eight-year-old children

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A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

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Key words: *sport dance, acrobatic rock'n'roll, motor coordination, children.*

Abstract

Background: *The purpose of the research was to assess the level of overall motor coordination in children practising sport dance – namely, acrobatic rock'n'roll – against the background of their peers who did not dance. The evaluation also included the lateral differentiation of overall motor coordination and skills of kinaesthetic movement differentiation.*

Material/Methods: *The research was conducted in a group of 64 persons aged eight. The research group consisted of thirty children who had practised acrobatic rock'n'roll for a year. The clinical control group was formed by nineteen schoolgirls and fifteen schoolboys who did not practise any sport dance. The research participants' motor coordination level was evaluated by means of a test with the use of Starosta's coordination-meter. The same test was used to assess the lateral differentiation of the turning jump and to evaluate the participants' skill of kinaesthetic movement differentiation.*

Results: *After one year of practice the research group achieved better results as far as their skills of kinaesthetic differentiation and of movement symmetrisation were concerned.*

Conclusions: *After one-year training, both the boys and girls who practiced sport dance showed a higher level of overall motor coordination than non-training children of the same age.*

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Introduction

Motor coordination is an indispensable element of life for every human being, as it significantly determines the effectiveness of his or her actions and behaviour. The quality of the performed movements, their smoothness and harmony, are outward signs of the efficiency of the nervous system which is a pre-requisite for a high level of motor skills, and of motor coordination in particular [1, 2, 3, 4, 5].

In recent years, many scholars and researchers have focussed on the physical condition requirements of human competence, i.e. fitness [6]. Meanwhile, it is the motor coordination that influences the proper utilization of the human energy supply system and the motion economy. Its essence is manifested in every motoric activity, above all, in sports [7]. Rynkiewicz [4] points out to the primary significance of motor coordination in the structure of human gross motor skills. He proposes a hierarchical view of motor abilities, with the motor coordination as the skill which combines and integrates other abilities ensuring their collaboration during the performance of various motoric tasks. Currently, an opinion that, in the face of equalization of fitness skills, motor coordination is the decisive factor in achieving a high sports level is gaining prominence [8, 9].

An especially high level of motor coordination is required in technical sport events that involve overall motion of the whole body [10]. These include acrobatic rock'n'roll, a sport dance which is extremely complex as far as motor coordination is concerned [11]. To date, there have been few scientific reports concerning any research on motor coordination in children practising sport dance or ballroom dance [12, 13, 14, 15, 16, 17]. The present authors' assumption was that such a form of dance sport may significantly modify motor coordination which is conditioned, first of all, by inborn predispositions. This is suggested by, among others, the research by Rozanska [18] which proved that after a year of dance training the dancing children differed from their non-dancing peers in their level of motor coordination.

The authors' own research was conducted with the help of Starosta's overall motor coordination test [9]. This is used for a complex assessment of motor coordination, since during its performance the coordination skills manifest themselves in an integrated way. The purpose of the research was to assess the impact of one-year training in acrobatic rock'n'roll on the level of overall motor coordination in eight-year-old children against the background of their non-dancing peers. Besides, the lateral differentiation of overall motor coordination and the skill of kinaesthetic movement differentiation were also evaluated.

Material and methods

Participants

The research was conducted in a group of 64 children aged eight. The research group was composed of thirty children from the Acrobatic Rock'n'Roll Club of the University School of Physical Education in Krakow: fifteen girls (aged 7.97±0.34) and fifteen boys (aged 8.09 ±0.36). They were pupils attending a sports class, whose physical education lessons consisted in participating in acrobatic rock'n'roll trainings lasting for two 45-minute didactic units five days a week. The control group consisted of nineteen schoolgirls (aged 8.01±0.33) and fifteen schoolboys (aged 8.08 ±0.37) from a primary school who only attended the regular, obligatory physical education lessons (three didactic hours per week). The tests in both the research group and the control group were conducted first before the enrolment in the acrobatic rock'n'roll club and then after one year of training. Left-footed persons were excluded from the research by means of test trials conducted in accordance with Koszczyc and Sekita [19]. The authors' assumption was to conduct the research among children of the same age, thus the possibility of acquiring more research material in the only club of acrobatic rock'n'roll in Krakow was quite limited.

Procedure

By means of a test using Starosta's coordination-meter [9], the level of the subjects' overall motor coordination, their lateral differentiation of the overall motor coordination, and their skill of kinaesthetic movement differentiation were evaluated. The reliability of the maximum left-hand and right-hand turning jump with both legs in the test is 0.94 according to Rynkiewicz [4], or 0.99 according to Maric et al. [20].

Examination of the level of overall motor coordination: arms-assisted turning jump with two legs

The subjects put their feet within an outline marked on a platform and then, with an unrestricted half knee bend and arm swing, performed a vertical jump with a maximum turn of their body. If the turn was to the left, the subject had a straight line drawn with chalk along his left foot running from the mid-heel in the back to between the first and second toe in the front. In the event of a right-hand turn, the procedure was analogous, with the line being marked on the right foot. While landing, the subject left a trace of the line on the black circle in the centre of the coordination-meter, which facilitated a precise measurement of the turn angle. The subjects took the test three times in one and then three times in the other direction. In the event of an unsuccessful attempt, the test was repeated, but not more than five times altogether. The subjects chose the direction of the first turning jump by themselves.

In subsequent calculations, only the best results of the left-hand and right-hand turning jump were taken into consideration. The angles of the two turns were then added up and converted into points following the one hundred point 'T' scale worked out and verified by Starosta [9]. This enabled the authors to find the point counterpart of a given result expressed in degrees.

Examination of the lateral differentiation of overall motor coordination

Subjects performed their maximum left-hand and right-hand turning jumps; next, the differences in the turn angles were analysed. The smaller the angular difference of the left-hand and right-hand turning jump, the higher the level of motion symmetrisation skill perceived as the equalization of the motor fitness of the two sides of the body. Besides, the discussed motor task was used to determine the dominating direction of the turning jump among the subjects. In order to achieve this, a subject's best left-hand and right-hand turning jump results were compared and the direction of the better attempt – that is, of the bigger turn – was considered dominant.

Examination of the kinaesthetic movement differentiation skill level – a 50% 'portioned' turning jump

The examination of the kinaesthetic movement differentiation skill level was also conducted on the basis of a test with the use of Starosta's coordination-meter. The general methodology was very similar to the one applied in the maximum turning jump test. A basic difference, though, was that this time the subjects performed just a 'portion' of the turn; namely, a turn of a given proportion. The subjects' task was to reproduce a turning jump constituting 50% of their maximum left-hand and right-hand turning jump following the method of Schulte – Puni – Starosta [21]. After the first attempt, the subject was informed about his/her result in relation to the expected pattern. Next, the subject took two more attempts without any feedback and the best result was taken into consideration in the subsequent calculations. During the 'portioned' turning jump in the other direction, the procedure was analogous.

The task performance precision rate was then calculated according to the following formula: the absolute value of the difference between the expected pattern and the 'portioned' turning jump x 100/50% of the maximum turning jump.

For example:

Maximum right-hand turn: 340°

50% of the maximum (expected pattern): 170°

'Portioned' turn result: 180°

[(180 - 170) x 100] / 170 = 5.9% of incorrectness, i.e. 94.1% precision

Instrumentation

Starosta's coordination-meter [9] is a square linoleum platform measuring 100 x 100 cm, with an inscribed circle with the diameter of 80 cm. The circle determines the 'landing' area, thus making the test tasks more difficult. Outside of the circle, there are separate angular graduations for the left-hand and right-hand turns. In the centre of the circle there is an outline of the feet, marking the place of take-off (Fig. 1). The measurements taken were exact to 10°.

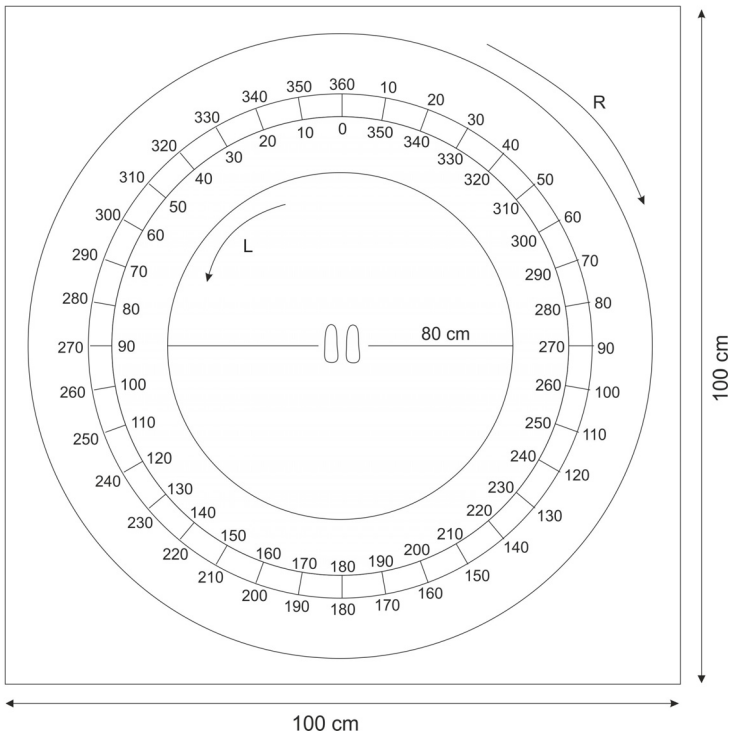

Fig. 1. Starosta's coordination-meter

The tests discussed above were conducted in the morning, before any serious physical exertion on the subjects' part. All the subjects performed the tasks in sportswear, with their shoes off. The subjects' height and weight was also measured – in centimetres and kilograms, respectively – with the help of an anthropometer and medical scales.

Statistical analyses

The basic statistical instruments were used to analyse the results. With the help of the t-Student test [22], the arithmetic mean ($\bar{x}$), the standard deviation (s), and the significance of differences were calculated. The significance level was set at $p \leq 0.05$.

Results

The absence of statistically significant differences in the examined coordination parameters between the research group and the control group, which was noted during the first examination (Tables 1 and 2), enabled the authors of the present paper to evaluate the real impact of acrobatic rock'n'roll on the changes in motor coordination after one year of regular sport training.

Results of the second examination of overall motor coordination, lateral differentiation of overall motor coordination, and kinaesthetic movement differentiation skill in girls are presented in Table 3.

The sum of the maximum left-hand and right-hand turning jumps in the girls practising acrobatic rock'n'roll converted into 54 points on the 'T' scale while in their non-training peers – into 47 points. The difference was statistically significant. The average difference between the right-hand turn and left-hand turn in the dance training girls was 15.27°; in the non-training girls it was 32.63°. Thus the smaller lateral differentiation of overall motor coordination occurred in the girls practising acrobatic rock'n'roll. The difference between the results of the research group girls and control group girls was statistically significant. The range of the maximum right-hand and left-hand turning jump was very similar in girls of the research group. This indicates a considerable symmetry in performing the motoric task. The dominant turn direction for 53.3% of the dance training girls was to the right. The control group girls also performed their right-hand turning jumps better. This was the dominant turn direction for 68.8% of the girls from that group. In the acrobatic rock'n'roll practising girls the average precision of the left-hand turning jump to 50% of their

maximum was 91%; of their right-hand turning jump it was 90.4%. The non-training girls made the 'portioned' left-hand turning jump with the average precision of 74.3%, and the 'portioned' right-hand turning jump with the average precision of 76.5%. The differences between the results of the research group girls and the control group girls were statistically significant. Results of the second examination of overall motor coordination, lateral differentiation of overall motor coordination, and kinaesthetic movement differentiation skill in boys are presented in Table 4.

Table 1. Results of the test of overall motor coordination, lateral differentiation of overall motor coordination, and kinaesthetic movement differentiation skill in girls; first test

Kind of motoric task	Dance-training girls N = 15		Non-training girls N = 19		Difference	t	p
	$\bar{x}$	s	$\bar{x}$	s			
Sum of maximum turning jumps with both legs [°]	594.78	28.07	570.34	64.25	24.44	1.31	0.18
Difference between right-hand and left-hand turning jump [°]	26.58	12.97	32.15	26.19	5.57	0.73	0.46
'Portioned' (50% of the maximum) right-hand turning jump precision [%]	79.90	4.98	72.84	12.02	7.06	2.07	0.04*
'Portioned' (50% of the maximum) left-hand turning jump precision [%]	77.53	4.87	75.03	13.02	2.50	0.68	0.49

*Significance level: * $p \leq 0.05$*

Table 2. Results of the test of overall motor coordination, lateral differentiation of overall motor coordination, and kinaesthetic movement differentiation skill in boys; first test

Kind of motoric task	Dance-training boys N = 15		Non-training boys N = 15		Difference	t	p
	$\bar{x}$	s	$\bar{x}$	s			
Sum of maximum turning jumps with both legs [°]	603.12	29.03	583.44	78.74	19.68	0.81	0.37
Difference between right-hand and left-hand turning jump [°]	35.94	24.20	34.46	25.03	1.48	0.15	0.87
'Portioned' (50% of the maximum) right-hand turning jump precision [%]	82.16	6.43	81.10	10.07	1.06	0.33	0.91
'Portioned' (50% of the maximum) left-hand turning jump precision [%]	86.77	5.04	83.17	7.69	3.60	1.46	0.14

*Significance level: * $p \leq 0.05$*

Table 3. Results of the test of overall motor coordination, lateral differentiation of overall motor coordination, and kinaesthetic movement differentiation skill in girls; second test

Kind of motoric task	Dance-training girls N = 15		Non-training girls N = 19		Difference	t	p
	$\bar{x}$	s	$\bar{x}$	s			
Sum of maximum turning jumps with both legs [°]	651.13	33.01	568.11	73.54	83.02	3.93	0.00***
Difference between right-hand and left-hand turning jump [°]	15.27	11.53	32.63	26.66	17.36	2.28	0.03*
'Portioned' (50% of the maximum) right-hand turning jump precision [%]	91.00	5.32	74.30	12.22	16.70	5.00	0.00***
'Portioned' (50% of the maximum) left-hand turning jump precision [%]	90.40	5.42	76.50	13.20	13.90	3.82	0.00 ***

*Significance level: * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$*

Table 4. Results of the test of overall motor coordination, lateral differentiation of overall motor coordination, and kinaesthetic movement differentiation skill in boys; second test

Kind of motoric task	Dance-training boys N = 15		Non-training boys N = 15		Difference	t	p
	$\bar{x}$	s	$\bar{x}$	s			
Sum of maximum turning jumps with both legs [°]	654.46	31.53	589.60	82.90	64.86	2.74	0.01*
Difference between right-hand and left-hand turning jump [°]	21.53	14.80	32.27	24.57	10.74	1.45	0.16
'Portioned' (50% of the maximum) right-hand turning jump precision [%]	89.80	7.47	83.50	11.69	6.30	1.76	0.09
'Portioned' (50% of the maximum) left-hand turning jump precision [%]	91.00	5.32	84.00	8.00	7.00	2.82	0.01*

*Significance level: * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$*

The sum of the maximum left-hand, and right-hand, turning jumps in the boys practising the acrobatic rock'n'roll converted into 55 points on the 'T' scale while their non-training peers scored 49 points in the 'T' scale. The average difference between the research group boys and the control group boys was 67.86° and was statistically significant. The average difference between the right-hand and left-hand turning jump in the boys practising sport dance was 21.53°, while in their non-training peers it was 32.27°. The lateral differentiation of overall motor coordination was then smaller among the research group boys. Although the difference between the two groups' results was 10.74°, it was not statistically significant. Among the research group boys, the dominant direction was the right-hand turn; 66.6% of the boys practising acrobatic rock'n'roll performed their right-hand turns better. Meanwhile, in the control group a slight prevalence of the left-hand turns was observed (53.3%). The research group boys performed the 'portioned' left-hand turning jump to the 50% of their maximum with the average precision of 91%, and the analogous right-hand turning jump with the average precision of 89.8%. The average precision for the 'portioned' left-hand turning jump in the control group boys was 84%; for the analogous right-hand turning jump it was 83.5%. Thus the boys practising acrobatic rock'n'roll demonstrated a higher precision while performing the 'portioned' right-hand and left-hand turning jumps than their non-training peers. However, Only in the case of the 'portioned' left-hand turning jump the difference was statistically significant.

Discussion

The research results testify to a large impact of sport training on motor coordination. The level of overall motor coordination in the group of children practising acrobatic rock'n'roll turned out to be higher than in the control group. Although the research group members had been practising the sport dance for only one year, their results were much better than those achieved by the non-training children. One of the reasons behind such marked differences was perhaps the examined children's age, who were still in a sensitive (critical) period of their development. This phase, lasting from the seventh to the eleventh year, offers the best conditions for developing motor coordination [23]. Raczek et al. [2] note that it is in that phase that some indices of motor coordination abilities increase by twenty to thirty percent, while others by as much as 600 percent. Children within that age bracket are characterised by high sensitiveness to the impact of environmental factors, and above all, to training.

While analysing the results of the overall motor coordination test, it should be noted that boys performed better in both the research group and the control group. This confirms the tendency that has been described in scientific reports by other authors. Starosta [9] has noted that boys aged six to eleven tend to make wider-range turning jumps than girls of the same age. Similar conclusions have been advanced by Fostiak [24] on the basis of her research. She analysed the results achieved by boys in different age brackets and observed that they showed higher motor coordina-

tion skills than girls in the test of the maximum turning jump. In her opinion, it was due to the greater strength developed by males.

The evaluation of the lateral differentiation of overall motor coordination demonstrated a greater asymmetry of turning jumps with two legs – in both directions – in the control group than in the research group. The greatest symmetry in performing the test task was observed in the group of dance-training girls. The average difference in the range of their right-hand and left-hand turning jump was 15°. In the control group, the average difference between the ranges of the turning jumps to the right and to the left was 32° and, as such, was twice bigger. A similar tendency was observed in the research by Starosta [9] conducted on 1,488 pupils from Warszawa and on 323 children from Gdansk and Gorzow Wielkopolski (Poland). On the basis of such an extensive research material, Starosta concluded that children aged six to ten were characterised by statistically insignificant differences in the results of the overall motor coordination test consisting in the right-hand and left-hand turning jump. This suggested a high symmetry of complex movements involving body turn in the examined schoolchildren. Numerous research projects in that field have pointed out to a great importance of symmetrisation exercises in the training process of many sport events [25]. On the basis of those examinations, a new concept of teaching and improving motor techniques has been elaborated that focuses upon equalizing the competence of the two sides of the body [26].

The results of the authors' own research presented in the current paper have demonstrated that the right-hand turning jumps dominated in the majority of the examined persons. The many years' research by Starosta [21] have allowed us to conclude that both the right-hand and left-hand turns can be dominant in a human. There is no such thing as genetic predisposition to performing larger turns in this or that direction [27]. Mleczko [28] contends that motor coordination skills are the most variable skills from the point of view of genetics. Their low heredity level suggests that they can be improved. Thus the 'better' direction is socially conditioned and can be modified through training. This has been confirmed by research conducted in persons practising ice-skating or ballet. Due to the nature of the training process, or the requirements of a given sport event, the dominant turn direction in figure-skating is to the left, while in traditional dance – to the right [9].

The kinaesthetic movement differentiation skill is considered one of the most important motor coordination skills that determine the chances for achieving a high level in sports [29]. The results concerning the precision of the 'portioned' (50% of the maximum) turning jump have demonstrated the superiority of the research group over the control group; at the same time, however, though the differences between the dance-training and non-training girls were statistically significant, the differences between the dance-training and non-training boys were statistically significant only in relation to the left-hand turns. The better 'instinct', or 'sense', for the 'portioned' turns in the children practising the acrobatic rock'n'roll was most probably due to their larger motor experience. Sequences of dance movements in that sport discipline include turns in both directions. In the age category of youngsters, to which the subjects belonged, mostly half-turns or quarter turns are performed [30].

Constant improvement of technique in any kind of dance leads to a development of motor fitness and, above all, motor coordination. In spite of that, few attempts can be found in the professional literature at evaluating the motor coordination level in dancers. Research in that field was conducted by, among others, Starosta [31], Starosta and Karpinska [17], and Fostiak [24], and was related to contemporary dance, classical dance, and sport ballroom dance. A comparison of the results achieved by dancers and by representatives of eight other sport disciplines demonstrated that the former had a very high level of overall motor coordination as measured by the maximum turning jump. In fact, the representatives of contemporary dance and classical dance scored the best results. This testifies to the favourable impact of specialist dance training on the development of motor coordination. Rozanska [18] made it the aim of her one-year research to evaluate the impact of dancing classes, with a component of coordination exercises, on the level of motor coordination skills in children aged eight. The experimental group was composed of sixteen girls and seventeen boys attending dance classes intended to prepare them to ballroom dance competitions, while the control group – 25 girls and 27 boys – was formed by primary school pupils participating only in regular physical education lessons. After the examinations, it turned out that there

was a statistically significant difference between the dancing children's level of motor coordination and that of their non-training peers. Similar results, confirming the positive impact of sport dance on the improvement of motor coordination, were obtained by Zabrocka and Sawczyn [32], who – just as the authors of the present paper – used Starosta's coordination-meter in their research.

In the literature presenting results of research on the motoric value of various forms of dance, reports of scholars and researchers from the Balkan Peninsula abound. Uzunovic [33], on the basis of research in two groups of girls aged thirteen and fourteen (the first, experimental, one attended a one-hour sport dance class twice a week for eighteen weeks; the second, control, one attended just the regular physical education classes in a primary school), proved – by means of the covariance analysis – a greater improvement of motor coordination, movement speed, and muscular strength in the girls practising sport dance than in those forming the control group. Also, by means of the regression analysis, Uzunovic et al. [34] evaluated the impact of motor skills level on the achievements in sport dance in 47 girls and 48 boys aged fifteen to eighteen. The motor skill level was assessed with the help of as many as 21 tests and then correlated with the number of points scored by the examined dancers during dance competitions. Among other things, it was then observed that – particularly in girls – there occurred a statistically significant impact of the coordination skill level on the quality of dancing presented during competitions. Mihaljević et al. [35], having examined girls from the fifth and sixth form of primary school, discovered significant connections between the upper extremities and lower extremities motor coordination, or agility, and the sport level achieved in the belly dance. Kostic et al. [36] examined the impact of a four-month dance practice (three hours a week) on selected motor skills in pre-school children. The measurements of muscular strength, flexibility, balance, and motor coordination taken at the end of the training cycle showed statistically significant differences in relation to the measurements taken before the commencement of the experiment. The values of the above parameters had markedly increased. In 2002, the favourable influence of the 'Cicilion' folk dance on motor skills, and particularly on coordination skills, in girls aged eleven was also demonstrated by Srhoj [37], who had examined a group of 101 fifth-form girls from primary schools with a set of 21 motor tests.

The results confirm the great efficiency of the acrobatic rock'n'roll in improving the level of motor coordination which is the biological foundation of the whole process of teaching and perfecting the technique. In this kind of sport dance, it is crucial to skilfully pass from one motor action on to another – smoothly, quickly, and in accordance with the rules of the technique that the dancer has mastered. Therefore, a high level of motor coordination can lead to sport successes and the improvement in coordination skills should be a major component in the training process aimed at achieving the master level in sport. Regular training of motor coordination, begun at a young age, allows the trainee to improve his/her level significantly and maintain it over a long period of time.

Conclusion

To sum up, the results obtained by the authors of the present paper tend to confirm the reports by the above-mentioned writers: after a year of training, the level of motor coordination is higher in the research group than in the control group. Both the girls and the boys who practised sport dance have shown a higher level of overall motor coordination than their non-training peers. The analysis of individual results has demonstrated that smaller lateral differentiation in the performance of the right-hand and left-hand turning jump occurred in the research group. The difference in lateral differentiation of overall motor coordination between dancing and non-dancing girls was statistically significant; whereas a statistically significant difference between dancing and non-dancing boys occurred only in the case of the left-hand turning jump. The children practising acrobatic rock'n'roll were characterised by a higher level of kinaesthetic movement differentiation. Statistically significant differences between the examined girls occurred both in right-hand and left-hand turning jumps; in boys the differences were statistically significant only in the case of the left-hand turning jumps.

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