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MOTOR CO-ORDINATION IN CHILDREN PERFORMING FOLK DANCES

GIBALNA KOORDINACIJA PRI OTROCIH PLESALCIH LJUDSKIH PLESOV

Abstract

Folk dancing adapted for the ballroom is a contemporary, developing type of motor activity. The aim of the article is to analyse the effect of this form of exercise on the development of selected co-ordination abilities in children. The tests were carried out twice on 33 dancers of both sexes and 52 non-dancing children, aged 8 and 9 years. The discussion is focused on the analysis of global motor co-ordination. In order to determine it, a test of a maximum turn in jump and test of 12 specific movements of lower limbs were used. The components of motor co-ordination, such as static and dynamic balance, as well as rhythmisation were also studied. The level of mean measure of having an 'ear for music' was also established. After a year-long training, an improvement in the studied characteristics was slightly greater in dancing children than in non-dancing children. The results of the global co-ordination studies and its components clearly differed between groups of dancers and non-dancers. The mean measure of having an ear for music does not differentiate the studied groups, but correlates most with other studied characteristics. Static balance correlates least with other characteristics. A small, inversely proportional correlation was found between height and weight and the results of the static balance test and between body height and rhythmisation. The results of the tests show that progress in dancing skills does not always accompany development of co-ordination motor abilities.

Key words: motor co-ordination, rhythmisation, children, Polish folk dances adapted for the ballroom, ear for music

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Povzetek

Ljudski plesi, ki so prilagojeni plesnim dvoranam so sodoben, razvijajoči se tip gibalne dejavnosti. Cilj članka je analizirati učinke vadbe tovrstne dejavnosti na razvoj določenih koordinacijskih sposobnosti pri otrocih. Meritve so potekale dvakrat, vključenih pa je bilo 33 plesalcev in plesalk ter 52 otrok starih med 8 in 9 let, ki ne plešejo. Diskusija je osredotočena na analizo splošne gibalne koordinacije, ki smo jo ugotavljali s testom maksimalnega obrata v skoku in s testom 12 specifičnih gibanj spodnjih okončin. Proučevali smo tudi komponente gibalne koordinacije kot so statično in dinamično ravnotežje ter ritmičnost. Ugotovljeno je bilo tudi povprečna mera posedovanja 'ušesa za glasbo'. Po enoletnem treningu se je pokazal nekoliko večji napredek v proučevanih značilnostih pri plešočih učencih in učenkah. Rezultati merjenj splošne koordinacije in njenih komponent so jasno diferencirali skupino plesalcev od skupine neplesalcev. V povprečni meri posedovanja 'ušesa za glasbo' med obema skupinama ni bilo razlik, opazili pa smo njeno povezanost z ostalimi proučevanimi značilnostmi. Statično ravnotežje je najmanj povezano z ostalimi značilnostmi. Majhno, obratno sorazmerno povezanost je bilo mogoče opaziti med telesno višino in težo in rezultati statičnega ravnotežja ter med telesno višino in ritmičnostjo. Rezultati testov kažejo na to, da napredka v plesnih spretnostih ne spremlja vedno tudi razvoj koordinacijskih gibalnih sposobnosti.

Ključne besede: gibalna koordinacija, ritmičnost, otroci, poljski ljudski plesi prilagojeni plesnim dvoranam, uho za glasbo

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INTRODUCTION

Folk dancing adapted for ballroom is a new dynamically developing form of exercise; it is enriched with the rudiments of classical dance and elements of competition. This made it possible to present national dance achievements at specially organised dance tournaments. These competitions were modelled on sports ballroom dancing tournaments. The technique of folk dances has been modified from typically stage techniques to tournament techniques, which requires even higher physical fitness and better technical skills in dancers (Różańska, 2005; Sroka, 2003).

Therefore, the level of dancing tournaments is currently rising, resulting in a search for new, more effective forms of training.

Contemporary knowledge of human movement tells us that the richer a sports discipline is in terms of motorics, the more significant the training of co-ordination motor abilities must be. They are particularly significant in sports disciplines with a technical nature, such as gymnastics and rhythmic gymnastics, figure skating and dancing (Starosta & Karpińska, 2002).

Polish dances adapted for the ballroom can be classified as a technical sports discipline, without any reservations. There are, however, no scientific studies of this form of exercise. Although it is known that motor co-ordination in general is very important in it, it is difficult to establish how important particular components of motor co-ordination are. However, there are few scientific studies which relate to motor co-ordination or its components in dancing. (Bobo & Yarbrough, 1999; Fostiak, 1990; Fostiak, 2001; Starosta & Karpińska, 2002; Golomer, Eveline, Dupui & Philipe, 2000; Donald, Fill & Fill, 1998).

There are many authors, though, who write about motor co-ordination in general. They divide co-ordination into components in various ways. For example, Raczek, Mynarski & Ljach (2002) distinguish seven components of co-ordination. They are: the ability to link movements, the ability to adjust movements, the ability of kinesthetic differentiation, the ability of rhythmisation, the ability to maintain balance, the ability of high frequency of movements and the ability of time and spatial orientation.

Starosta observes that there are two ways of controlling co-ordination motor abilities. The first one is the local control. It relates to test tasks involving a smaller group of muscles, controlling a selected component of co-ordination. The other way is the global control, which relates to the whole body or its vast part (Starosta & Belej, 2000). Both ways seem to be very useful for scientific research. The first one allows for an accurate analysis of the level of one selected co-ordination ability, and the other one, by presenting globally the majority of co-ordination and fitness abilities, allows for discovering relations between them.

The results of scientific research still confirm great significance of balance as the basis for other co-ordination abilities of an athlete. They specify to a large extent the rate of development of sports mastery at subsequent stages of training (Kochanowicz, Zaporożanow & Bołoban, 1998). The results of studies prove that it is by all means possible to train the ability to keep the balance. Its development takes place by releasing involuntary neurological motor mechanisms securing the process of maintaining the balance (Golema, 2001). Sports technique significantly specialises athletes' abilities of economical and effective body stability, changing it and allowing it to achieve harmony of movements (Bołoban, Mistułowa & Wiśniewski, 2002).

Analysing more deeply the notion of balance theoreticians distinguished its two basic types: static balance and dynamic balance. Static balance is the type of balance in which the point of support is unchanging; it is the ability to maintain a stable body position. Dynamic balance is maintaining balance in the situation of changing point of support. In other words, it is maintaining or recovering the state of balance during or after carrying out a motor activity on small support planes (Pielka, Mynarski & 1990; Juras, Mynarski & Waśkiewicz, 1992; Rejniak-Zuber, 1991). Another component of co-ordination, the ability of rhythmisation, has not frequently been a subject of scientific studies.

A motor sense of rhythm is the ability to organise one's own movements or a consciously presumed or externally proposed rhythmic programme. It is a manifestation of various forms of rhythm by body movements. Such a form of rhythm could be, for example, a rhythm of sounds or rhythm of movements (Młodzikowska & Tukiendorf, 1991). A rhythm accompanies all motor activities and is particularly important in dancing. A sense of rhythm is a talent which involves perceiving, remembering and recreating rhythmic activities as faithfully as possible (Czabański & Świadek, 1995). In earlier scientific discussions (Jagusz, 1995), the significance of the level of rhythmisation, together with balance, was noticed in the training process of young rhythmic gymnasts. An attempt was made to answer the question of to what extent these abilities allow achievement of a sports success in this discipline. The author indicates rhythmisation as a very significant element of dancing preparation of gymnasts and sees it as a particular way of developing co-ordination abilities. It has been noted that this ability should be developed in early stages of the ontogenetic development of children. The sensitive period in the development of rhythmisation is between 7 and 12 years of age (Stronczyński & Starosta, 1998).

Rhythm can be considered as one of the components of motor co-ordination and, in musical terms, as the ear for music or sound rhythms (Czabański & Świadek, 1995).This study attempts to analyse the ability to recreate rhythms, both in the motor sense – as one of the co-ordination abilities, and in musical terms. The mean measure of ear for music, which is also the subject of the discussion, is the level of musical talents of a child in terms of listening to and recreating the heard rhythm and melody. Musical talents develop since the birth to about 9-10 years of age; later, the level increases much more slowly (Gordon, 1999; Kamieńska & Kotarska, 2000; Starosta, 2003).

The objective of the study is to obtain information on the level and mutual relations of selected co-ordination motor abilities in children performing national Polish dance adapted for the ballroom. It is significant to find the answer to the question of whether such components of co-ordination motor abilities as balance and rhythmisation are related to global co-ordination. How much is the ear for music related to the level of motor co-ordination? How do selected co-ordination abilities and the ear for music develop in dancing children compared to children who are not active in sport? Answers to these research questions will allow, although partially, dancing instructors to indicate the direction of training of young dancers. They will provide valuable practical tips for trainers.

METHOD

Participants

Four groups of children took part in the study:

GD – dancing girls (N=16)

GN – non-dancing girls (N=25)

BD – dancing boys (N=17)

BN – non-dancing boys (N=27)

The study was carried out twice, first when the children were eight years old, then after a year, when the children were nine years old.

The numbers presented above refer to the second date of tests. In calculations comparing the results of tests performed on the first and the second dates, only children who took part in both studies were taken into account. The numbers in these comparative calculations were as follows: GD – 14, GN – 19, BD – 13, BN – 22.

The choice of children of this age for the study was determined mainly by the fact that this is the first very significant stage of training, which is the basis for further dancing development. Secondly, the age of eight to nine years is considered to be very sensitive, as it is when motor training gives fast and good effects. The studies carried out in groups at similar ages in other sports disciplines indicate that this age is very significant for the development of static and dynamic balance. In children at the age of 11, these abilities are stable (Kochanowicz, Kruczkowski, Mistułowa & Bołoban, 2000; Kochanowicz, Zaporożanow & Bołoban, 1998; Juras, Mynarski & Waśkiewicz, 1992), so their development should be studied earlier.

The dancing participants of the study are the youngest dancers taking part in tournaments of Polish folk dance adapted for the ballroom. They represented the highest level of training in the first dancing category in Poland. The control group consisted of children at the same age who do not attend any dancing or sports classes.

Instrument

In order to monitor the level of co-ordination motor abilities, two types of tests were used. The first group of tests related to the assessment of global co-ordination motor abilities and tested a few of them at the same time. Two tests were used here:

TS – a test developed by Starosta (2003) – a jump with a maximum turn. An easier version of the test was chosen, that is a two-legged jump. The subject performed three jumps with a right turn and three with a left turn on a special wooden platform (TSleft and TSright). The best result in each direction was taken into consideration in the analysis. The greater the degree of turn of the subject, the better the result.

TB12 – the second global test was Bołoban's test of co-ordination of 12 movements (Bołoban, 1990; Bretz, 1997). The subject was asked to perform from standing to attention a set of 12 movements in a strictly specified order. Each movement was accompanied by a jump. The order of movements, rhythm and combining it with single jumps were important.

Apart from the global assessment of motor co-ordination, selected components of co-ordination, that is rhythmisation and balance, were measured.

Tap – in order to assess rhythmisation a tapping test was used, involving rhythmical tapping with hands (Raczek, Mynarski & Ljach, 2002). The test involved the fastest possible reconstruction of the previously learned sequence of taps with hands on a table within 20 seconds. The more correct cycles were performed in this time, the better the result of the test.

TRomb – in order to measure static balance the Romberg test was used (Mistulowa, 1996). It involved maintaining the body position described by the author of the test for 10 seconds with eyes open and then for another 10 seconds with eyes closed.

Ros – in order to monitor the level of dynamic balance the test called "march on a figure of rosette" was used (Raczek, Mynarski & Ljach, 2002). A subject's task was to make as many steps as possible on a specially prepared hexagonal rosette.

MeRh – apart from motor tests, a musical test was carried out to monitor the level of mean measure of ear for music (Gordon, 1999; Kamińska & Kotarska, 2000). It involved correct recognition of specific fragments of music. The test was made up of two parts: a melody test (Me) and rhythm test (Rh). The sum of these two tests gave the total result; that is, the level of mean measure of ear for music MeRh.

The subjects' weight and height were also measured.

Procedure

For calculation, the Statistica 6.0 programme was used. The consistency of distribution of results with a normal distribution was checked using the Kolmogorow-Smirnov test. Because in some of the studied groups the distributions were inconsistent with the Gauss curve, the decision was made to use non-parametric statistical tests. An example of distribution of results is presented in Figure 1.

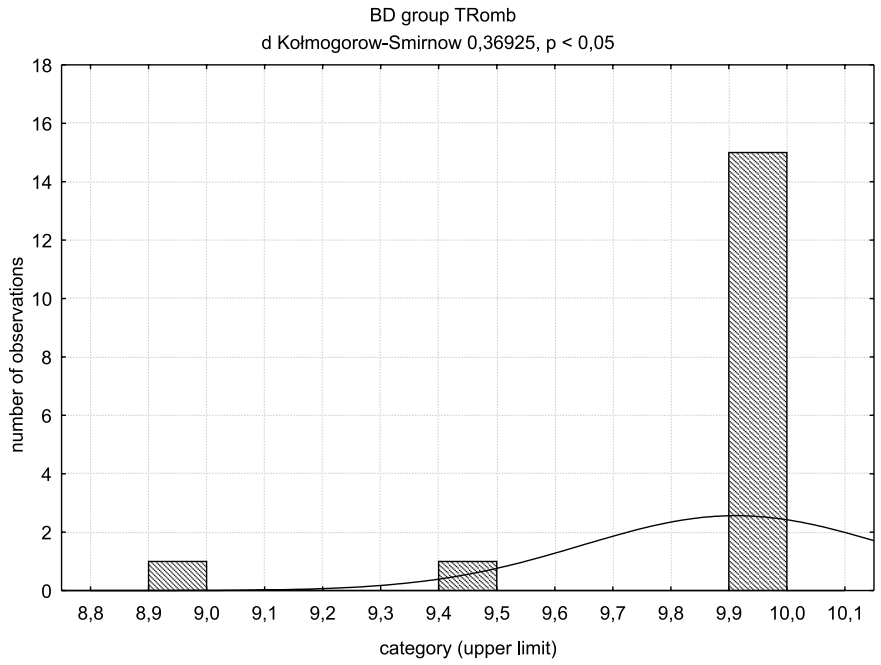

Figure 1: Distribution of results of static balance TRomb test in dancing boys, BD group, compared to normal distribution

For the same reason, in diagrams in the tests medians, quartiles and range, i.e. minimum and maximum values, were shown, instead of arithmetic means.

Results

The results of the tests on the first date of studies were compared to the results of tests on the second date of tests. Wilcoxon's signed rank test was used (see Table 1). Rhythmisation was not compared as on the first date of studies it was checked with a different test.

An improvement in the results of tests between the first and second test occurred both in dancing and non-dancing children. An improvement was noted more often in dancing children; however, it is difficult to see any clear principle, which would indicate that in dancing children the results improve more year after year than in non-dancing children. This may be related to the fact that the age of eight to nine years is a sensitive period in terms of the development of the studied co-ordination abilities. These dynamic changes relate not only to children who attend dancing classes, but also children who do not attend additional exercise classes. The improvement in results was the least in the GN group. Statistically significant improvement was noted most often in the GD group. This allows for stating that the studied girls are more susceptible to the effect of dancing exercises than the boys.

As the differences between the results of the tests on the first and second dates rarely achieved the level of $p<0.01$, the results of the tests on the first date were not presented graphically. Such diagrams would be very similar to the diagrams of results of the tests on the second date. This indicates only a partial effect of dancing classes on the development of the studied characteristics.

Table 1: Comparison using Wilcoxon's test of the results from the first and second date of studies (** $p<0.00$, no asterisk – improvement of $p<0.05$)

	group GD		group G N		group BD		group BN	
test	Z	p	Z	p	Z	p	Z	p
TSleft	2.6	0.00 upturn**	no change		2.5	0.01 upturn	2.5	0.01 upturn
TSright	no change		no change		2.2	0.03 upturn	no change	
TB12	2.7	0.00 upturn**	no change		2.2	0.02 upturn	no change	
TRomb	2.5	0.01 upturn	no change		2.8	0.00 upturn**	no change	
Ros	2.8	0.00 upturn**	3.0	0.00 upturn**	no change		2.1	0.03 upturn
Me	no change		2.5	0.01 upturn	no change		3.9	0.00 upturn**
Rh	no change		no change		2.0	0.04 upturn	3.2	0.00 upturn
MeRh	no change		no change		no change		3.9	0.00 upturn**

The following discussion focused on the analysis of the test results on the second date, which are more informative about the effects of one-year training. The next step was to compare to results between the groups on the second date of tests. The results of the first date of tests were not checked in this way, as the comparison of both dates of tests provides sufficient information. The results of the tests on the second date were presented in Figures 2 to 6.

The results of TSleft and TSright (see Figure 2) of the dancing groups were very similar; in these groups the results of left and right turns were also similar. In non-dancing groups, the results were significantly lower and differed between right and left turns. In the TB12 test, children in dancing groups almost always had a maximum result (see Figure 2). In control groups, the results had a greater range.

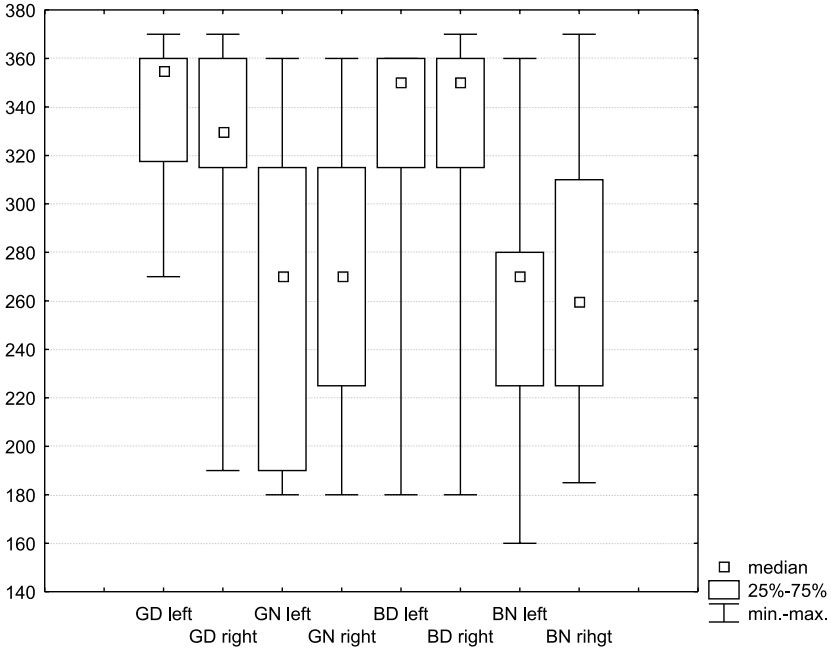

Figure 2: The results of the turning tests TSleft and Tsright

The results of the Tapp rhythmisation test (see Figure 4) were higher in the dancing groups and lower in non-dancing groups.

The results of both balance tests were better in dancing groups (see Figure 5). The test of TRomb static balance in non-dancing groups showed a greater range of results.

The results of the tests for melody and ear for music and their totals, that is the mean measure of ear for music (see Figure 6) are the only test results which do not differentiate between the dancing and non-dancing groups. However, a Tapp rhythmisation test similar to the Rh test (see Figure 4) clearly indicated differences between study groups and control groups.

In tests TS, TB12 and TRomb characteristic features are a greater concentration of results in dancing groups and great range of results in non-dancing groups. In the case of other studied characteristics, no such phenomenon is observed. This indicates the evening out of the level of global co-ordination and static balance in dancing children; that is, children with higher abilities in terms of these characteristics.

A comparison with the U-Mann-Whitney test of all nine of the studied characteristics on the second date of tests between the groups of dancing girls and boys (GD and BD) did not show any statistically significant differences. In the same way, the comparison of non-dancing groups (GN and BN) did not show any statistically significant differences.

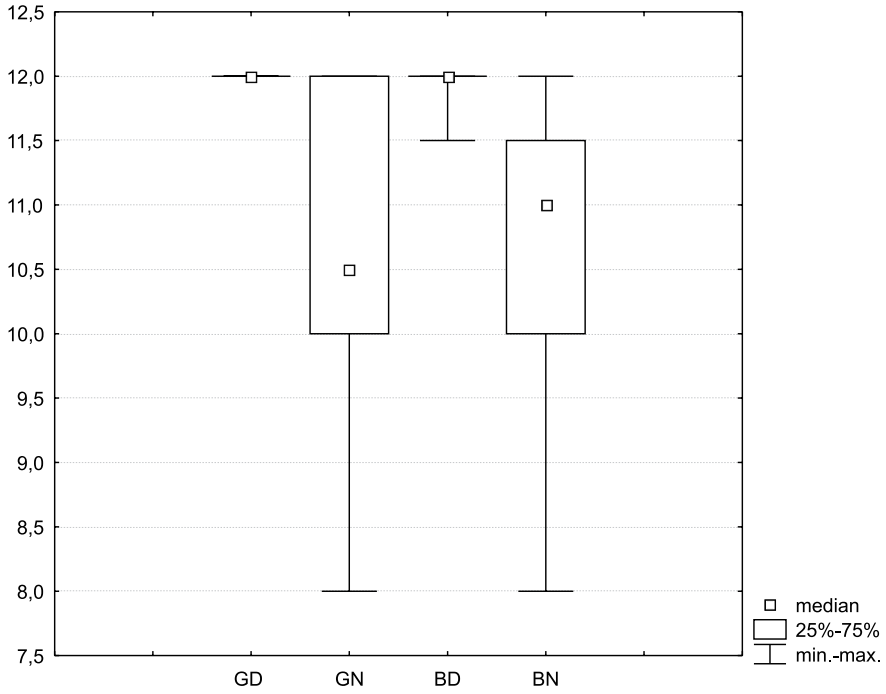

Figure 3: The results of the TB12 test

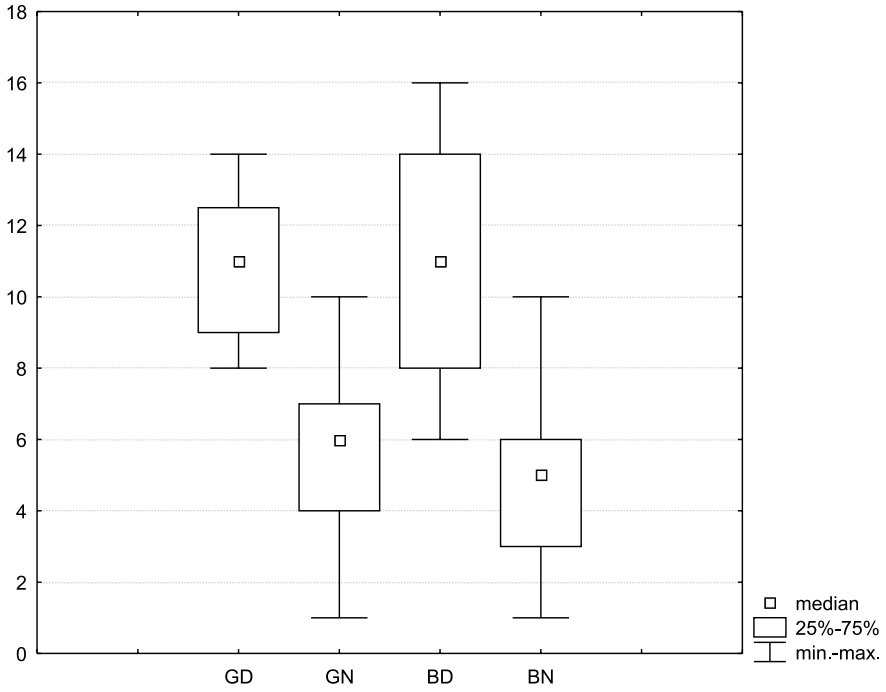

Figure 4: The results of the rhythmisation test – the Tapp test

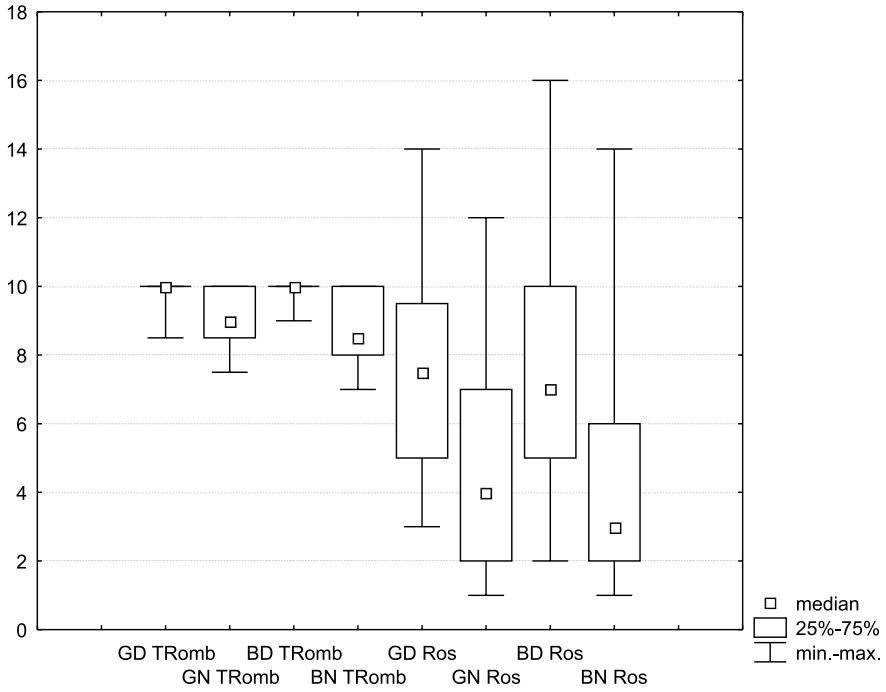

Figure 5: The results of the TRomb static balance and Ros dynamic balance tests

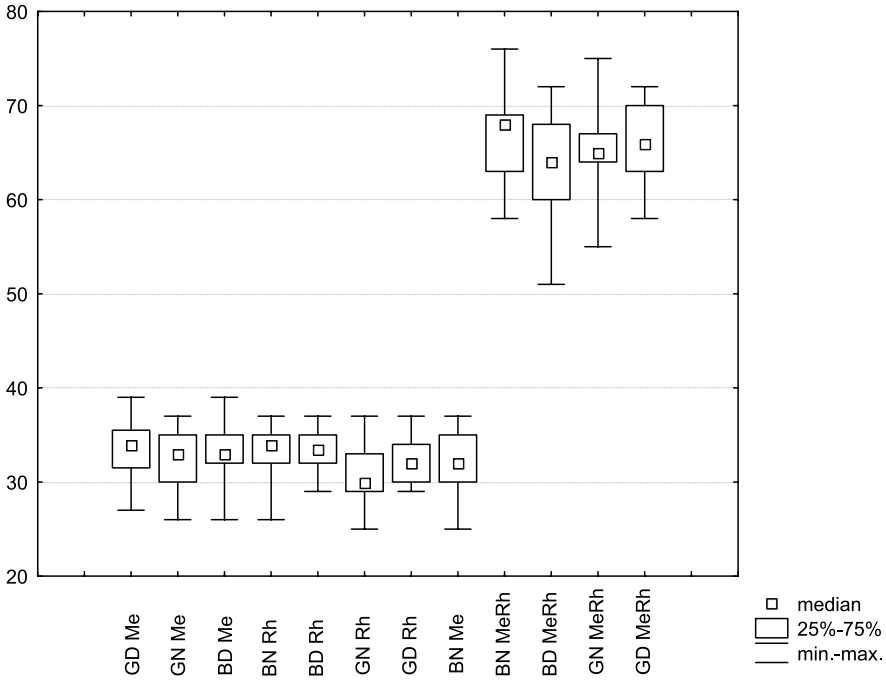

Figure 6: The results of tests for melody and ear for music and their totals MeRh

A comparison with the U-Mann-Whitney test of all nine of the studied characteristics on the second date between the groups of dancing and non-dancing girls (GD and GN) showed statistically significant differences in the majority of characteristics (see Table 2). This indicates a significant effect of dancing classes on the level of studied co-ordination abilities in dancing girls.

No statistically significant difference was found in the melody tests, and thus in the mean measure of having an ear for music. Similarly, between dancing and non-dancing boys, only the components of mean measure of having an ear for music and their total did not show a statistically significant difference (see Table 2).

Table 2: Statistically significant differences in studied characteristics between groups GD and GN and BD and BN (second date of tests)

Test Groups	TSleft		Tsright		TB12		Tapp		TRomb		Ros		Rh	
	Z	p	Z	p	Z	p	Z	p	Z	p	Z	p	Z	p
GD and GN	4.0	0.00	2.7	0.00	3.9	0.00	5.0	0.00	3.6	0.00	2.5	0.01	2.5	0.01
BD and BN	3.8	0.00	3.7	0.00	4.6	0.00	4.9	0.00	3.7	0.00	2.9	0.00	-	-

In all studied groups on the second date of tests, relations between studied characteristics were sought for using Spearman's rank correlation test. Some characteristics show mutual relation, always positive; that is, an improvement of the value of one characteristic is accompanied by an improvement in the value of the other characteristic (see Table 3). The mean measure of having an ear for music is a characteristic that correlates most with other characteristics. The TRomb test (static balance) shows the least relation with other characteristics.

Table 3: Statistically significant correlations between studied characteristics

	STright			Tapp			Tromb			Ros			MeRh		
	Gr.	R	p	Gr.	R	p	Gr.	R	p	Gr.	R	p	Gr.	R	p
TSleft	BD	0.5	0.02				BD	0.5	0.04	GN	0.5	0.02	BD	0.6	0.00
	GN	0.6	0.00										GN	0.6	0.00
	BN	0.7	0.00												
TSright				GD	0.7	0.00							BD	0.7	0.00
				BD	0.6	0.02							GN	0.4	0.03
				GN	0.4	0.03									
TB12													BN	0.4	0.03
Tapp													BD	0.6	0.02
													GN	0.5	0.03
Ros													GN	0.4	0.04

Because the mean measure of having an ear for music is present most often in relation with other studied characteristics, the decision was made to check which of its components, melody of rhythm, have more impact on other studied characteristics. It turned out that it is mainly the rhythm that correlates with the turn test (Spearman R 0.53-0.68 with p=0.00). In one case (BN group) Rh correlated with TB12, R=0.40. In the BD group TSright correlated with Me (R=0,53). However, the Tapp rhythmisation test, seemingly similar to Rh, does not correlate with the turn test.

The question was then posed of whether the results of the tests show a relation with the height and weight of the studied children. The Spearman's rank correlation test was used. Only in the

GD group was a weak adversely proportional relation found between the height and the results of the Ros and Tapp tests and between weight and Ros tests (with $p<0.05>0.01$). This means that in dancing girls the greater the height and weight, the lower the results of the Ros and Tapp tests.

All four groups were joined into one group of N=85 and the relation between the height and weight and results of the tests were checked again. Similarly, the results of the TRomb and Ros tests were slightly correlated with the weight and the results of the Tapp tests with height and weight, always at the level of $p<0.05>0.01$.

The Body Mass Index was calculated for all groups. It turned out that it correlates slightly with dynamic balance only in the GD group. When all groups were joined into one group, the BMI did not show a significant correlation with the results of the tests.

DISCUSSION

The results of the study are to some extent surprising.

The first surprise is that only in dancing girls a slightly greater improvement of results after a year was observed when compared to non-dancing girls. In boys, the improvement is more distinct in the non-dancing group. This is information that indicates the small effects of a year-long training in terms of the studied characteristics. Therefore, a development of co-ordination may be noted both in dancers and non-dancing children. The development of the body is still the stronger stimulus for them than training. This may also be related to the short training period or a low frequency of training sessions.

The level of co-ordination motor abilities is statistically significantly higher in dancing boys and girls and lower in non-dancing boys and girls. However, the second surprise is the lack of differences in the studied co-ordination characteristics between the sexes, i.e. the results of girls and boys. For both dancing and non-dancing children, the results of boys and girls are similar.

In the results of the tests, there are no differences that would characterise in a different way the global and individual approach to co-ordination. The results of the TS and TB12 tests indicate similar phenomena that the rhythmisation and balance tests do.

The mean measure of having an ear for music does not indicate any significant difference between the groups. Its result does not depend on the sex or participation or in dancing. However, in boys it improves after a year.

The fact that the mean measure of having an ear for music is the characteristic that correlates most with other characteristics may indicate that in the future progress in dancing may be most determined by this characteristic. It may also be an indication for recruiting children for dancing groups. This is confirmed by the way of assessing dancing pair at dancing tournaments. The first and most important criterion of judges' verdict is the harmony of dancing with music. Probably the highest improvement in the ability to maintain this harmony takes place in the earliest training period. This may be the effect of the presumed work plan in the studied groups. The first, preliminary stage of dancing training involves classes introducing basic dancing and rhythmical classes no doubt improving this ability. Only after that is teaching of a complicated dancing technique started. Also, it is very significant that musical talents should be best developed by the age of 10 (Gordon, 1999). The mean measure of ear for music seems to be a characteristic

developed at a very early age, or to a very large extent an inborn ability. However, the decision of the authors of this study to test this characteristic turned out to be correct, as the results show other phenomena than a seemingly similar rhythmisation test.

Other interesting phenomena are characterised by the results of balance tests. The static balance TRomb test shows little relation to other characteristics, although it would seem that this is a characteristic that determines success in dancing. The results of the tests show that this is a characteristic which clearly improves after a year in dancing children, but not in non-dancing children. Dynamic balance clearly improved after a year in both groups of girls. In boys it, improves only slightly in the non-dancing group. This seems to be justified, as mainly dynamic balance is involved in dancing.

A higher level of static balance noted in dancing children may result from frequent mastering of the techniques of various dancing figures during dancing classes. Polish folk dancing adapted for ballroom is a technical discipline and precise mastering of the technique, including the dancing technique, depends on a high level of static body balance.

A high level of static balance makes it possible for the dancers to master the technique of new, more difficult dancing figures. The studied children in the dancing group represent a high level of technical preparation. Both tests were negatively affected to some extent by a large weight, but not height. The BMI was not particularly related to the results of the tests. Such a picture of results indicates the direction for further research, and contradicts the statements that a short and stocky child has better body balance. Similarly, the relation of the results of rhythmisation test and height poses a new research problem.

The instructors should try to find reasons why, if there is progress in dancing, the development of the studied characteristics in dancing children differs very little from that of non-dancing children. Should the focus in training be on the development of general and special co-ordination? Special co-ordination should be defined in this case as the studied components of co-ordination – static and dynamic balance and rhythmisation. The analysis of the results of the monitoring of the level of global co-ordination confirms that children who perform Polish folk dancing adapted for ballroom perform better and with greater ease tasks that involve a few motor abilities at the same time than their non-dancing contemporaries. Dancing requires the ability to perform complicated motor algorithms, while adjusting them to the external rhythm. Polish folk dancing adapted for ballroom is a form in which dancers present their abilities in pairs which additionally requires harmonising their movements with their partners.

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