ISSN 2029-1701
ISSN 2335-2035 (Online)

Mokslinių straipsnių rinkinys
VISUOMENĖS SAUGUMAS IR VIEŠOJI TVARKA
PUBLIC SECURITY AND PUBLIC ORDER
2018 (20) Scientific articles

COORDINATION PERFORMANCE OF 11-15 YEARS OLD ATHLETES AND POPULATION

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Abstract. Authors present the result of the cross-sectional testing of the coordination abilities of young athletes and population aged 11 – 15 years. The coordination performance of sets was created by the sum of acquired points in seven item battery tests of the coordination abilities. The starting point for the creation of points scale was the average performance of a set of 11 years old population. Results of the research proved higher entry level of the coordination performance in a set of sportspersons, and its dynamic growth at the age of 11 to 15 years. The growth of the coordination performance of sets had a gradually growing character.

Keywords: young athletes, population, testing, coordination abilities, coordination performance.

INTRODUCTION

Sports performance means the final product of the coach's and athlete's effort, and meanwhile it is a decisive criterion of the efficiency of sports training. We understand it as a complex expression of the athlete's personality. The performance of an individual is influenced by innate dispositions, surrounding and training impact. Together they form a unity, they intersect and add to each other, and therefore it is not possible to determine and precisely quantify their proportional impact on the sporting performance[1]. Among the important factors that influence it are also coordination abilities. They create the basis for learning motion skills and the increase of their level is closely related to the process of improvement of sporting technique.

[1] Koštial J. Podiel faktoru kondícia na športovom výkone. In: Sedláček, J. a kol.: Kondičná atletická príprava a rekreačná atletika. Bratislava : UK, 2003.

In literature we encounter various approaches for expressing the proportion of particular factors, resp. their complexes at the level of competitive performance[2],[3],[4],[5]. Despite the various opinions of the authors, all consider the coordination abilities to be important. It is clear that coordination abilities are differentially interconnected with a complex of fitness abilities. Without an adequate level of fitness readiness, their further development is not possible.

Particular elements of preparation are represented in sports training in various proportions, depending on age, preparation phase, and period of annual training cycle. An opinion that one of the most important elements is fitness training prevails. However, recently the opinion[6],[7],[8],[9],[10] that coordination training is an equal precondition of sportspersons for the achievement of high motion performance applies. The most intensive development of basic coordination abilities and phase of high motor docility (formation of wide range of skills, "skills basis") takes place at the age of 7 – 10 (11), resp. 8 – 10 (11) years, and in the case of boys till 12 (13) years of age[11].

Targeted focus on their development must be done from the entry of children into sports training, it means from the stages of pre-preparation and basic sports training. From this point of view it is important to understand the meaning, and so to increase the representation of coordination preparation in training. It is necessary to bear in mind that a sufficiently high level of development of coordination abilities is a necessary precondition for achieving high sports performance.

Athletics[12],[13] offers a wide opportunity for the development of coordination abilities which, to a significant extent, influence the development of basic functions of human motion, resp. the acquiring and improvement of motion skills. Part of the basic motor demonstrations in athletics are elementary motion activities (run, jumps, throws), their combinations (run –

[2] Nabatnikovova M. J. *Osnovy upravlenija podgotovkoj junych sportsmenov*. Moskva : FiS, 1982.
[3] Balandin V. I.; Bludov J. M.; Plachtijenko V. A. *Programirovanije v sporte*. Moskva : FiS, 1986.
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[7] Zaťková V. a kol.: Rozvoj koordinačných schopností v hádzanej. *Acta Fac. Educ. Phys. Univ. Comenianae. XXXVII. Bratislava*. 1995, p.205 – 210.
[8] Šimonek, J. et al. Úroveň kondičnej pripravenosti mladých tenistov. *Tel. Vých. Šport.* 1997, (7) 1: 29-32
[9] Perič T.; Lukáš V. Přínos koordinačně náročných cvičení pro trénink ledního hokeje. *Tel. Vých. Šport.* 2003, 13: 22-26.
[10] Lehnert M. Stejskal P. Há, P. Vavák M. Load intensity in volleyball game like drills. *Gymnica - Acta Univ.* Palackianae Olomucensis 38. Olomouc : Palacky University, 2008
[11] Kohoutek M. a kol. *Koordinační schopnosti dětí*. Praha : FTVS UK, 2005
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[13] Hirtz P. Argumentationshilfen fr die Leichtathletik als Einstiegssportart fr Kinder aus bewegungswissenschaftlicher Sicht. *Kinder in der Leichtathletik*. Darmstadt : Deutscher Leichtathletik-Verband, 1997.

jumps), differentiated motor activities (reflections on one leg and both legs, distance and height jumps, target and distance throws) and leading coordination elements with emphasized attributes such as support, use of swing parts of body, etc.

Besides the basic demonstration of coordination abilities, such as reaction, rhythmic, orientation and kinaesthetic-differentiation ability, in athletics are also applied combined coordination abilities. They are characterized by close connection with muscle tension, as well as rhythmic and differentiation abilities. We define muscle tension as a relatively fixed and generalized performance precondition for the intentional relaxation of muscles. We prefer economic, relaxed performance of speed and speed-strength exercises. Inadequate muscle tension in particular phases leads to non-economic, slowing and spasmodic performance of movements, and thus to the deterioration of motion performance[14].

As with each motion activity, also coordination abilities have their age dynamics of change which is closely related, especially, to the biological development of an organism. Researches[15],[16],[17],[18] point out the fact that the development of coordination abilities is different than the development of fitness abilities. The authors are unified in the opinion that the optimal period for the development of coordination abilities is from 7 to 12 years. The age dynamics of coordination abilities, for a period of 10 – 17 years in total, notes an increasing tendency with the exception of the rhythmic and kinaesthetic-differentiation ability of upper limbs in the case of boys. Riegrová-Ulbrichová[19] found out that in the period of adolescence there is a degradation of the coordination level. The most effected abilities in this period are balance and kinaesthetic-differentiation. After overcoming the period of boys' adolescence, it is possible to record again the favourable additions in the level of some coordination abilities, especially space-orientation, balance and reaction. Due to the complexity of the coordination abilities structure and complexity of their diagnosis, it is not easy to characterize their development curve lines. The results in the tests are not only dependent on the level of particular coordination ability, but also other motor abilities which participate in final performance[20].

[14] Hirtz P.,. *supra* note 12
[15] Hirtz P.,. *supra* note 11.
[16] Hartmann Ch. Diagnose und das Training koordinativer Fähigkeiten unter handlungsorientierter Sicht. In: Leipziger Sportwissenschaftliche Beitrage, 33, 1992, 1: 7-13.
[17] Ljach V. I.; Mynarski M.; Raczek J. Biopychiczne predyspozycje koordynacyjnych zdolnosci motorycznych – przeglad badaň w pismiennictwie rosyjskojezycznym. *Antropomotoryka.* 1995, (12)13: 83 – 103
[18] Šimonek J., *supra* note 8.
[19] Riegrová J.; Ulbrichová M. *Aplikace fyzické antropologie v tělesné výchově a sportu*. Olomouc. UP, 1998
[20] Šimonek J. ml. *Model rozvoja koordinačných schopností v dlhodobej športovej príprave v športových hrách*. Bratislava: Habilitačná práca, 2000.

According to the authors, Ljach V. at. al.[21], the level of coordination abilities is not significantly conditioned by physical development or by the somatotype of the trainee.

Hypothesis:

H1: we expect balanced entry level and dynamics of changes of physical development indicators in reference sets,

H2: we expect that the dynamics of the coordination performance will be smoother and the difference between the sets will gradually increase

The purpose of this paper - to identify the entry level and compare changes in the indicators of physical development and the coordination performance of the population and young athletes

Methodology. The set consisted of pupils of ES - population[22] and athletes from various youth clubs in Slovakia aged 11 – 15 years who were members of talented youth units (SG, SC, sports clubs). Basic characteristics of sets – number, average values of decimal age (DA), physical height (PH), physical weight (PW) and BMI is provided in tab. 1 and the results of testing in seven tests of the coordination abilities (according to Šimonek J.et al.)[23] in tab. 2. Through tests targeted on particular coordination demonstrations, we assessed the level of balance (LAVOBR), reaction (LAVLOP), rhythmic (SWING), space-orientation (RUNM), kinaesthetic-differentiation ability of lower limbs (SDDP), kinaesthetic-differentiation ability of upper limbs (HLP), and time estimation (TIMEST).

The basis of the coordination performance assessment in particular age categories was the average performance of the 11-years old population in examined demonstrations of the coordination abilities. We rated the average performance of the population (x11) in this age category in each test with 5 points. One half of standard deviation (s) was the basis in determination of the points scale. For example, the points range 4.6 – 5.5 points was determined by the formula x11±0.25 s, zone 5.6 – 6.5 points in the interval of performances from x11+0,25s to x11+0,75s, etc. Sum of the points from all tests was the indicator of the coordination performance of the particular age groups sets..

RESULTS AND DISCUSSION

The majority of the respondents (87.2%) statistically reliably ($p < 0.001$) stated that they cared for their health. In terms of gender, there was no statistically significant difference

[21] Ljach V., *supra* note 17
[22] Šimonek J. *op. cit.*
[23] Šimonek J. *op. cit.*

between men (89.5%) and women (85%) caring about their health ($p > 0.05$). Most of students engaged in sports (94.8%) ($p < 0.001$) take care of their health in comparison with the students not engaged in sports (65%) .

In the assessment of the physical development indicators (tab. 1) between particular age categories, the gradual increase of physical height and physical weight indicators of probands in both groups is visible. Also due to this proportional addition, the BMI, which placed the population and athletes into the average zone, has not changed significantly. The average values of athletes' physical development are at a higher level in each age, which is a result of the specialization requirements in the selection of young sportspersons.

More objective evaluation of BMI changes would require finding out fat share, resp. active muscle mass of physical weight increase.

During the entry of children into sports classes around the age of 10 – 11 years, most have already completed the basic preparation phase[24]. However, experience shows that currently it moves in certain specializations to lower age categories. Young athletes usually take their first athletic steps before entry into the sports unit. Therefore in this period we cannot talk about athletes, but rather children who would like to practice athletics.

Table 1. Indicators of physical development of population (P) and athletes (A)

age		n	Indicators			
			DA (years)	PH [cm]	PW [kg]	BMI (I)
11-years old	P	108	10.52	143.50	36.35	17.65
	A	52	11.05	147.12	39.45	18.08
12-years old	P	186	11.62	150.40	40.85	18.06
	A	75	11.99	150.93	40.71	17.77
13-years old	P	327	12.50	154.90	44.00	18.34
	A	92	13.01	160.21	47.28	18.11
14-years old	P	235	13.50	163.10	50.43	18.96
	A	73	14.01	166.31	52.59	18.79
15-years old	P	530	14.50	170.20	57.31	19.78
	A	50	14.99	175.25	61.23	19.83

During the assessment of the coordination performance of the sets, we started from the assumption that the motion activity of sports children will positively occur at its higher level (sum of points) in comparison to population (tab.2). The results analysis proved H2 that 11-year old athletes exceeded the basic 35 points limit of the population (39.23). Athletics comprises a wide range of disciplines in which a large number of motion abilities is applied.

[24] Perič T. *Výběr sportovních talentů*. Praha: Grada, 2006.

We recorded the biggest differences of performance in tests which have hybrid (fitness-coordination) character (LAVLOP and RUNM), and in balance test (LAVOBR).

A test with the lowest score was the kinaesthetic-differentiation test of upper limbs where the beginning athletes achieved only 2.54 – 3.56 points. The results in the rhythmic test (SWING) and time estimation on stopwatch (TIMEST) did not significantly differ from the results of the population.

The score of general coordination performance showed that sports training does not have to ensure its higher level at the beginning, especially in tests of fine motor skills. However, it is a necessary basis and precondition of effective transfer from general coordination performance towards the learning of specific skills of concrete sports specialization.

Table 2. Coordination performance (points) of 11 - 15- years old population and athletes

Population	11-years old	12-years old	13-years old	14-years old	15-years old
LAVOBR	5	5.35	7.18	7.89	8.42
LAVLOP	5	7.09	8.85	8.88	9.50
SWING	5	4.95	4.81	4.35	4.53
RUNM	5	5.28	5.50	6.06	6.94
SDDP	5	4.12	5.75	5.22	5.13
HLP	5	2.65	2.25	0.84	0.85
TIMEST	5	5.37	5.18	5.35	5.83
Total (points)	35	34.81	39.52	38.59	41.20

Athletes	11-years old	12- years old	13- years old	14- years old	15- years old
LAVOBR	9.43	9.75	10.10	10.01	10.16
LAVLOP	5.92	5.84	6.90	7.18	8.43
SWING	2.94	3.13	3.82	3.23	4.64
RUNM	6.58	6.63	7.29	7.34	7.28
SDDP	5.47	6.51	6.36	6.10	6.36
HLP	3.56	3.53	3.34	2.54	3.09
TIMEST	5.33	5.36	5.70	5.80	6.23
Total (points)	39.23	40.75	43.51	42.20	46.19

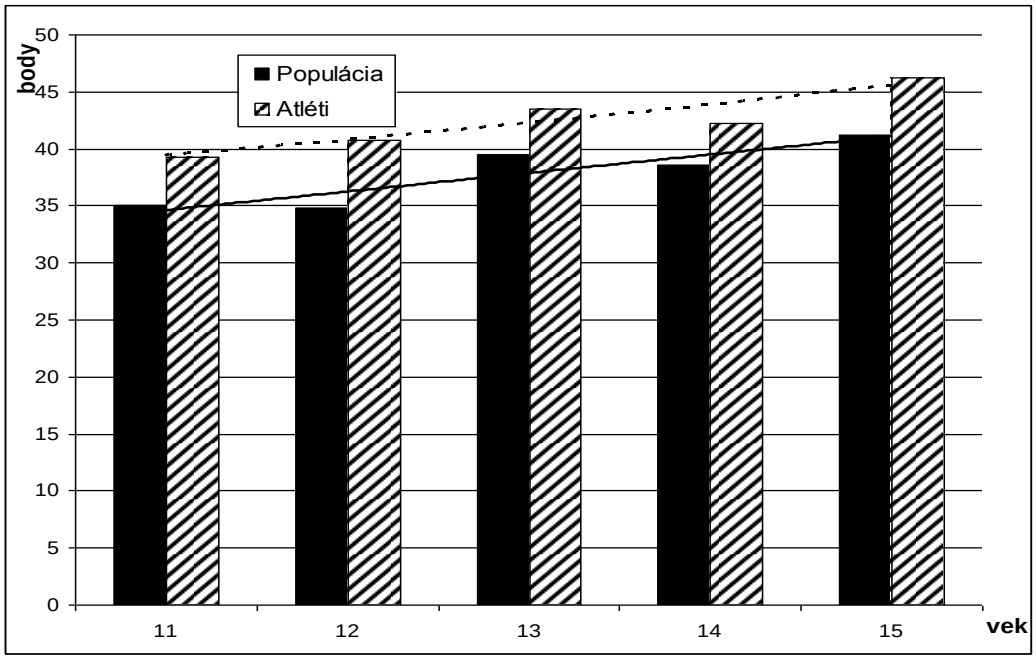
We understand the specifications of sports sectors as specific requirements for fitness condition, motion skills, as well as the level of realization of mental and tactical maturity in a particular sport[25]. Each specialization puts specific requirements on the sportsperson from the

[25] Perič T., *supra* note 24.

beginning of sports training. Despite the fact that during sports training the structure of sports performance changes, its important part should also be the development of all basic coordination abilities. While during the selection for the coordination tests, the test of speed-coordination character (run for 10x5m), running to targets, or overcoming various hurdling tracks are used. However, in such case it is problematic to diagnose the representation of particular fitness and coordination abilities. Testing of fine motor skills during the selection of children for sports training is not being used so far.

The group of tests, which focuses on the assessment of particular coordination demonstrations, used by us could be applied as a starting point for the determination of the comprehensive assessment of motion preconditions of those interested in entry to sports training.

In hypothesis H1 we assumed that in the group of 11-years old children, beginning athletes, their motion activity will not significantly show up yet, in comparison to the population. As shown in Figure 1, the hypothesis was not confirmed. The athletes were already at this age category at a higher performance level. It proves that children who started to do sports were motion talented. In hypothesis H2, we assumed that by training process action the group of athletes will significantly differ in their performance from their peers. This tendency was proved, even though the increase in differences was not significant. The lowest scores were achieved by young sportspersons in tests of kinaesthetic-differentiation ability of upper limbs (HLP) and in the test of rhythmic ability (SWING). The reason may be the fact that young athletes enter sports training later than other specializations, and also that school physical education at first grade does not provide sufficient opportunity for children to master the basic motion skills and extend the range of motion experience.



*(body – points; populácia – population; atléti – athletes; vek – age)

Figure 1. Points values and tendency of changes of population and athletes' coordination performance

Athletic training of the youth requires respecting a wide basis during the development of motion abilities, because in the period of 14-15 years athletes start to specialize according to disciplines (jumping, running-sprinting, resp. endurance, throwing).

Surprisingly, we recorded the best results of athletes in the test of balance ability (LAVOBR). Even though this ability does not significantly show at the level of sports performance, we suppose that this is due to the use of coordination exercises of a complex character, as in the test which assesses fine motor coordination. This result is a confirmation of the conclusions of Riegrovej-Ulbrichovej[26] that in adolescence boys have worse kinaesthetic-differentiation ability. The reason can be not only the lack of effective stimulus for development, but also testing conditions, motivation, and the concentration of probands may have an effect[27]

[26] Riegrová J., *supra* note 19.
[27] Lednický A.; Doležajová L.; Koštial J. Skúsenosti a odporúčania z diagnostiky koordinačných schopností. *Telesná výchova, šport a výskum na univerzitách*. Bratislava: STU, 2005.

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Table 3. Average performance of population (P) and athletes (A) in coordination tests

	Tests	Population (n=59)		Athletes (n=52)	
		x	s	x	s
11-years old	LAVOBR	21.92	5.150	10.47	1.949
	LAVLOP	134.7	13.60	184.65	30.00
	SWING	0.850	0.584	1.708	1.990
	RUNM	10.01	1.890	8.521	1.011
	SDDP	6.940	3.500	6.112	2.979
	HLP	55.75	21.04	70.93	30.87
	TIMEST	0.856	0.566	0.763	0.629
	Tests	Population (n=47)		Athletes (n=75)	
		x	s	x	s
12-years old	LAVOBR	21.02	7.900	9.640	2.508
	LAVLOP	120.5	24.62	185.50	24.082
	SWING	0.866	0.964	1.643	1.481
	RUNM.	9.750	1.510	8.465	0.982
	SDDP	8.480	6.090	4.305	2.548
	HLP	80.48	21.74	71.233	31.665
	TIMEST	0.751	0.737	0.753	0.499
	Tests	Population (n=60)		Athletes (n=92)	
		x	s	x	s
13-years old	LAVOBR	16.29	5.330	8.727	2.342
	LAVLOP	108.5	8.460	174.01	53.234
	SWING	0.905	0.765	1.408	1.155
	RUNM	9.540	1.670	7.847	0.876
	SDDP	5.630	3.370	4.565	2.629
	HLP	84.65	36.21	73.255	32.997
	TIMEST	0.804	0.562	0.658	0.484
	Tests	Population (n=48)		Athletes (n=73)	
		x	s	x	s
14-yers old	LAVOBR	14.45	2.830	8.963	2.181
	LAVLOP	108.3	15.05	170.99	22.11
	SWING	1.040	1.081	1.610	1.410
	RUNM	9.010	0.850	7.796	0.862
	SDDP	6.550	3.670	5.014	2.767
	HLP	99.52	41.25	81.677	30.545
	TIMEST	0.757	0.533	0.629	0.458
	Tests	Population (n=47)		Athletes (n=50)	
		x	s	x	s
15-years old	LAVOBR	13.05	3.820	8.592	2.499
	LAVLOP	104.1	21.86	157.40	28.66
	SWING	0.988	0.796	1.129	0.998
	RUNM	8.180	0.760	7.851	0.876
	SDDP	6.720	4.770	4.554	2.428
	HLP	99.38	34.61	75.858	29.311
	TIMEST	0.621	0.435	0.507	0.444

CONCLUSIONS

In the training of young sportspersons the requirement to create general coordination basis, which should be followed by special coordination training, is often not respected. Their sufficiently high level is a precondition of effective learning and improvement of specific skills of the selected sports sector. Based on this, we recommend the trainers of the examined age period to focus on the creation of a wide coordination basis.

The precondition of the effective development of the coordination abilities is to focus on their versatile development over the sensitive period (phase of pre-preparation and basic sports training), as well as to respect the mutual conditionality of the development of fitness and coordination abilities.

During the diagnosing of coordination abilities, it is appropriate to focus on standardized tests, firstly of general and then specific character – such that will respond to the requirements of concrete sports performance in the best possible way. During their realization it is important to create such conditions that the motivation and concentration of probands attention is ensured, and the objectivity of testing results is not undermined.

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11-15 METŲ AMŽIAUS NESPORTUOJANČIŲJŲ IR SPORTININKŲ KOORDINACINIŲ GEBĖJIMŲ ANALIZĖ

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S a n t r a u k a

Straipsnyje analizuojami 11-15 metų amžiaus skirtingų sporto mokyklų lengvaatlečių ir nesportuojančių mokinių koordinacinių gebėjimų išugdymo lygio ypatumai. Tikslas - nustatyti mokinių ir jaunųjų sportininkų fizinio vystymosi ir koordinacinių gebėjimų rodiklių pradinį lygį bei palyginti pokyčius Tyrime buvo naudojama 7 koordinacinių testų baterija (pusiausvyrai - LAVOBR; greitumui - LAVLOP; judesių ritmui - SWING; erdvinei orientacijai - RUNM; kojų kinematinei diferenciacijai - SDDP; rankų kinematinei diferenciacijai - HLP; laiko pojūčio tikslumo nustatymui - TIMEST. Kiekvienos amžiaus grupės judesių koordinacinis produktyvumas buvo vertinamas pagal atskirame pratime surinktų taškų sumą. Kiekvienos grupės vidutinis rezultatas (X) buvo nustatomas pagal 5 taškų lygį. Kvadratinio nuokrypio ketvirtis buvo orientyru į aukštesnį (pvz. 6 taškai=x_{11}+0.25 s) arba žemesnį (pvz. 4 taškai= x_{11}-0.25 s) lygį.

Tyrimo rezultatai parodė, kad somatiniai rodikliai laipsniškai, proporcingai didėjo visose amžiaus grupėse. KMI dėl to, praktiškai, nekito. Visų tiriamųjų KMI nenukrypo nuo tos amžiau grupės vidurkio ribų. Buvo nustatyta, kad amžiaus grupėse nuo 12 iki 13 ir nuo 14 iki 15 metų koordinaciniai gebėjimai ženkliai pagerėjo, o grupėje nuo 13 iki 14 metų, pastebėta santykinė rezultatų stagnacija. Gauti tyrimo rezultatai leidžia teigti, kad aktyviau sportuojančių vaikų ir paauglių koordinacinių gebėjimų pranašumas, lyginant su kitais tiriamaisiais, kas metai didėjo daug ženkliau. Remiantis gautais duomenimis autoriai rekomenduoja, pradiniame vaikų fizinio ugdymo etape, suformuoti bendrą koordinacinių gebėjimų pagrindą, kurio pagalba galima būtų toliau lavinti koordinacinius gebėjimus reikalingus konkrečiai sporto šakai. Šių gebėjimų ugdymo efektyvumą apsprendžia savalaikis, kryptingas sensityvinių periodų privalumų panaudojimas (parengiamajame ir pagrindiniame treniruočių periode). Testuojant koordinacinius gebėjimus būtina taikyti standartinius, informatyvius, patikimus - praktikoje patikrintus testus, kurie tampriai susiję su sportine specializacija.

Pagrindinės sąvokos: jauni sportininkai, gyventojai, testavimas, koordinaciniai gebėjimai, koordinacinių pratimų atlikimas.

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