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SPEED AND SPEED-STRENGTH ABILITIES OF THE REPRESENTATIVES FOR SLOVAKIA IN SHORT-DISTANCE RUNS IN THE PUPILS CATEGORY IN ATHLETICS

Ivan Čillík[1], Martin Pupiš[1], Ondrej Ďurják[1], Ratko Pavlović[2] and Dobromir Bonacin[3]

[1] Department of PE and Sports, Faculty of Humanities, Matej Bel University in Banská Bystrica, Slovakia
[2] Faculty of Physical Education and Sport, University of East Sarajevo, Bosnia and Herzegovina
[3] Faculty of Education, University of Travnik, Bosnia and Herzegovina

Original scientific paper

Abstract
This contribution deals with speed and speed-strength abilities of the pupils in short-distance runs in athletics. The main purpose of our contribution was to determine the performance and the correlations between the indicators of speed: accelerating speed, maximum running speed and the indicators of speed-strength: explosive power of lower limbs. We investigated speed abilities using the 50 m sprint with a standing start and speed-strength abilities by performing 10 repetitive squat jumps without the help of the upper limbs. The sample of subjects consisted of the pupils – competitors for Slovakia in the Youth category in athletics. Overall, physical demands of tested athletes were found to be average. Short-distance runners have better speed indicators than hurdle runners and long-distance runners; however, they achieve worse performance in speed-strength abilities. Contact time during the repetitive squat jumps is one of the decisive factors that significantly affect the level of speed and speed-strength abilities.

Key words: *athletics, pupils, speed, speed-strength, short-distance runs*

Introduction

According to some authors, 14 -15 years old children are included at the stage of specialized training (Perič 2004, Pavlović, 2008) and according to others, with whom we sympathize; children are included at the stage of basic training (Bompa, 2000; Čillík 2004). A division as such is based on the methodological and the organizational point of view. It was also confirmed by (Millerova et al.2001; Tončev i Mihajlović, 2002) that this age is included at the stage of specialized training but they recommend the ratio of general sport training to special sport training 60:40%. So, the content of the stage is important, not the name. Competence and movement from one stage to another depends on the level of adaptive abilities and the degree of biological development. This should correspond with the sport training of an appropriate training load, racing and other external factors of training. Recently, there has increased the pressure for an early specialization which relates to including of world events in the Youth categories (World Youth Championships in Athletics, Youth Olympic Games and European Youth Championships – events for 17years old athletes or younger ones). These changes also affect the sport preparation in younger categories. Therefore, the whole long-term preparation needs to be adapted from the youngest categories and not only in older categories (14-15 years old). One of the way, how to ensure a smooth entry and movement of children between individual categories is e.g. Kids´ Athletics Project. Experience and results in Slovakia but mainly in Czech shows the right way of doing it. Moreover, researches of some authors e.g. Kaplan, Válková (2009); Vindušková, Křivohlavá (2010); Švachová (2011; 2012) confirm it as well.

This project is followed by category of the youngest pupils (10-11) and younger pupils (12-13 years old). Projects in other countries have the same name and focus. The main motive is to get the children to regular training with the aim of increasing performance in older categories prospectively. In Poland, the issue of the sport preparation at this age was solved by authors e.g. Iskra et al. (2008a, 2008b), in other countries e.g. Corbin, Pangrazzi (1998), Balyi, Way (2002), Mihajlović, 2003; Balyi, Hamilton (2004), Grasso (2010), Pavlović, (2010). Performance, advanced technique and conditional preparation of the best pupils at the age of 14-15 years confirm that it is important to have a few years of training experience at this age. The training should be predominantly of a general character with a perspective performance focus. Monitoring the performance in athletics competitions is one side of talent and determining physical demands by using motor tests, which ascertain the level of selected demands, is the other side. These tests are often better indicators of demands, especially when finding out significantly genetically determined ones, therefore hardly affected by training. They show a lot about the prospect of each individual besides others e.g. somatic, technique, tactic, health, social and other factors. It is different in short-distance runs, in which a big genetic determinism of all factors affecting the performance occurs. This contribution was written with the support of GÚ VEGA 1/1158/12 Adaptive effect of training load in individual sports. The main purpose of this paper was to find out and evaluate the level and correlations of speed and speed-strength abilities in athletics. Short-distance runners representing Slovakia in the Pupils category in athletics were tested.

Methods

The testing of athletes was performed on the 27th September 2012 at the athletic stadium in Nitra during the meeting of competitors. They were tested before the international meeting of pupils from 5 countries CZE-CRO-HUN-SLO-SVK. All Slovak representatives took a part, except 2-3 athletes who had apologized themselves due to health issues. In this paper we present results achieved by pupils competing in Slovakia in short-distance runs. All of them were 15 years old, only the athlete M.K. was 14years old. We used the following tests: 1) The 50 m sprint with a standing start: photocells were placed at the start line, in distances 20 m, 40 m and 50 m. We monitored accelerating speed 0-20 m, maximum speed 20-40 m and 40-50 m, and the overall performance during 50 m sprint. We used the 50 m sprint test as a complex indicator of running speed, accelerating speed (0-20 m) and maximum running speed (20-40 m); 2) 10 repetitive squat jumps on the jump ergometer "Myotest" (Fig. 1).

A test of repetitive squat jumps was used for the assessment of the explosive power of the lower limbs. We included the following indicators in this contribution: height of the jump – h (cm), contact time – tc (ms), reactivity (index = flight time/contact time), muscular rigidity (stiffness – indicator of muscle tension in the take-off leg) (kN.m^{-1}) (www.verticaljumping.com). To evaluate the results, we used logical methods and correlations between individual monitored indicators of speed and speed-strength abilities.

Figure 1. The device "Myotest" (www.verticaljumping.com)

Results

Table 1. The basic somatic characteristics and indicators of speed abilities

Name	Disciplines	Body height (cm)	Body weight (kg)	50m (s)	Order	0 -20m (s)	Order	20 - 40m (s)	Order
T.P.	100m, 4x100m	175	67	6,250	3	2,974	5	2,210	3
S.V.	100m, 4x100	174	68	6,094	1	2,863	1	2,138	1
P.G.	4x100	172	63	6,229	2	2,940	2	2,204	2
P.H.	300m	181	61	6,407	6	3,061	6	2,242	4
M.Ku.	300m, 1000m	172	56	6,256	4	2,969	4	2,257	5
M.Ka.	100 and 300m hurdle	180	73	6,336	5	2,914	3	2,320	6
M.M.	100m hurdle	189	81	6,737	7	3,165	7	2,394	7

Table 2. Indicators of speed-strength abilities

Name	Body height (cm)	Order	Contact time (ms)	Order	Reactivity (index)	Order	Rigidity (kN.m^{-1})	Order
T.P.	28,1	6	131	4	3,62	7	50,8	3
S.V.	28,8	5	129	3	3,77	5	49,3	4
P.G.	26,4	7	112	1	4,12	2	53,8	2
P.H.	36,7	1	134	6	4,09	3	44,9	6
M.Ku.	32,7	4	132	5	3,92	4	38,8	7
M.Ka.	36,6	2	116	2	4,72	1	64,1	1
M.M.	36,5	3	148	7	3,68	6	46,2	5

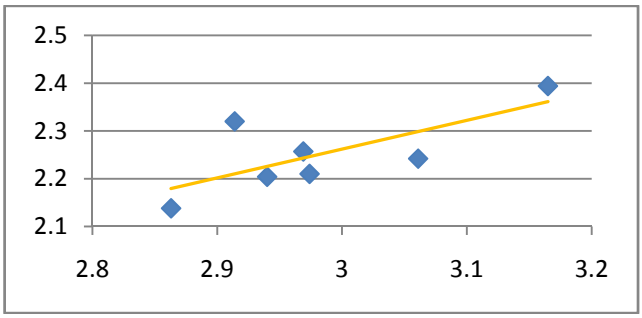

Figure 2. Correlations between accelerating speed and maximum running speed (R = 0,72 very strong correlation, reliability 52,2 % ; statistically sign. model)

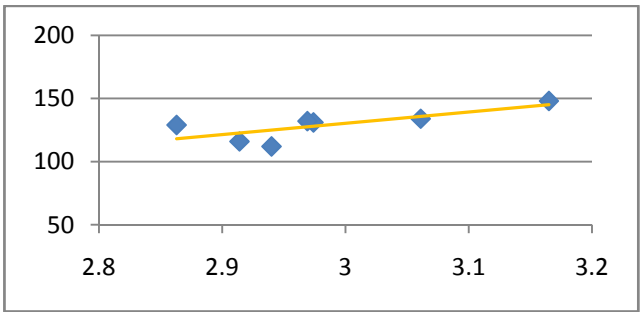

Figure 3. Correlations between the contact time and accelerating speed (R = 0,75 strong correlation, reliability 56,6% ; statistically significant model)

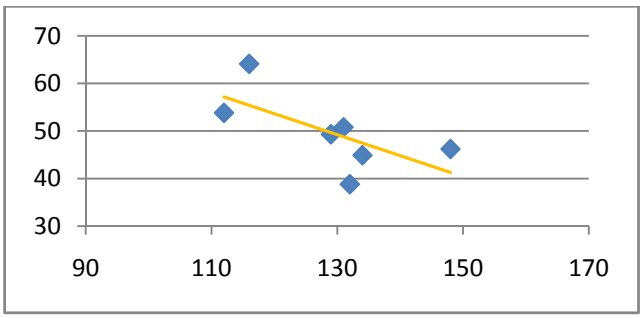

Fig. 4 Correlations between the contact time and muscular rigidity (R = 0,66 strong correlation, reliability 32,7%; statistically significant model)

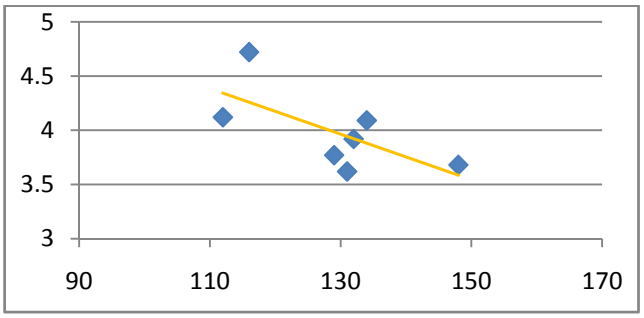

Fig. 5 Correlations between the contact time and reactivity (R = 0,67 strong correlation, reliability 44,9%; statistically significant)

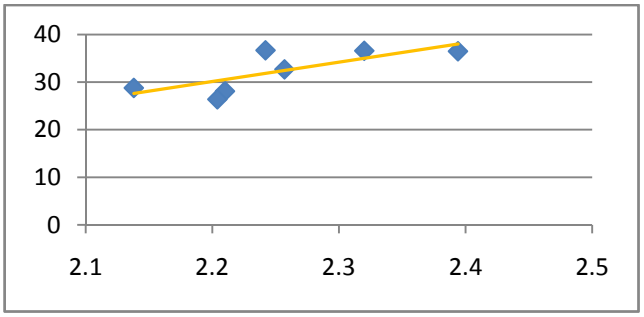

Fig. 6 Correlations between the height of the jump and maximum running speed (R = 0,76 strong correlation, reliability 57,6%; statistically significant model)

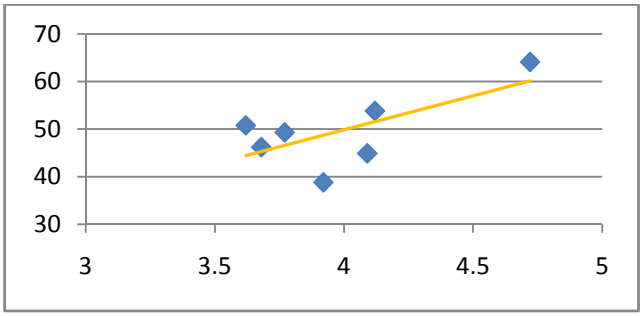

Fig. 7 Correlations between reactivity and muscular rigidity (R=0,675 strong correlation, reliability 45,5%; statistically significant model)

Somatic characteristics of tested athletes are suitable (Table 1). Short-distance runners at the age of 14-15 years have body height 172-181 cm. So, these athletes are supposed to reach an adequate body height for short-distance runs in adulthood. Hurdle runners are higher (180 -189 cm) and this is necessary for hurdle races. Body weight is lower (index 6-20 cm), which gives perspective possibilities for muscle growth and the achievement of optimum height and body weight index. All three athletes have the same order of indicators of speed abilities. What refer to other athletes there are slight differences in the order. Sprinters for short distances achieve the best results, except the athlete T.P. in accelerating speed. Hurdle runners and longer sprint runners achieve lower performance in all parameters, except the athlete M.Ku. in two indicators and M.Ka. in accelerating speed. The best coefficients from all of tested athletes were reached by the athlete S.V. and good coefficients were also achieved by sprinter M.Ku., who is only 14 years old. What refer to indicators of speed-strength abilities, the best performance was achieved by hurdle runner M.Ka. (table 2). Overall, in the individual indicators this athlete took 1.-2. place and he is the best in complex indicators: reactivity and muscular rigidity. In these indicators he is significantly better to compare him with other athletes. On the other hand, short-distance runners achieve worse performance in indicators of speed-strength abilities, except the athlete P.G. We are dealing with correlations between all speed and speed-strength indicators. As shown in figure 2 – 7, we use only those indicators in which we found out statistically significant correlation. Next, we have also stated moderately strong correlation R = 0,5 in following relationships: correlations between the contact time and maximum running speed, correlations between the height of the jump and accelerating speed, however, these correlations were statistically insignificant. Even though, there is generally accepted relative independence between accelerating speed and maximum running speed, some relativity does exist. In our case, very strong correlation between accelerating speed and maximum running speed came out (Figure 2). In short-distance runs, the contact time during running is a limiting factor of maximum running speed. In our research we investigated the contact time during repetitive squat jumps. This indicator had proved to be important in a relation to other indicators. Strong correlation between the contact time and accelerating speed was confirmed (Figure 3). In tested subjects, statistically significant relationship between the contact time during repetitive squat jumps and complex indicators – muscular rigidity (Fig. 4) and reactivity (Fig. 5) has proved as well. Indirect relation is in both cases, it means shorter the contact time, the higher the value of muscle-tendon stiffnss and reactivity index. Both correlation lines in our sample of subjects are very similar. Correlations between the height of the jump and maximum running speed showed to be statistically significant (Fig. 6). It can be explained by the confirmation of known knowledge that at maximum running speed the length of the stride, which depends on the strength when the athlete

pushes the ground and the take-off angle, is crucial despite the fact that the best athletes differ from weaker ones in stride frequency. In our study we only deal with the Youth category, however; the fact about the influence of reflective explosiveness on maximum running speed of Caribbean children at the age of 13-15years was also stated by Babel Copaver, Hertog, Hue (2012). Reactivity and muscular rigidity are more complex indicators of speed-strength. In our sample of subjects, there is a nearly linear correlation (Fig.7). It means, with increasing level of reactivity is also growing muscular rigidity – muscle-tendon stiffness or preparedness for the take-off. Athlete, who is able to create a suitable bias, achieve better reactivity index. This ability is really important especially in reflective exercises and from athletics disciplines in jumps. However, optimum muscle bias is also important in short runs and in hurdle races it is as important as in jumps.

Disscussion

Monitoring the level of speed and speed-strength abilities at this age is important in all athletics disciplines. It is particularly important in disciplines requiring speed-strength – in short-distance runs as well. Generally, there is a relatively small base of athletes in Slovakia and so the number of athletes e.g. in the Czech Republic seems to be invincible for us. For example, the authors Vindušková, Rus (2010) state the participation of about 2000 pupils when selecting children for sixth grades of sport classes. So, we must take care of young athletes more. Unfortunately, higher the number of athletes, the quality drops. This is proved by the results of our study in which the sample of subjects consisted of the best pupils. All subjects, except one of them, attained the standards in the 50m running to be selected for sprinting disciplines (Perič, 2006). However, this is only an orientation standard, as these athletes are the best in Slovakia. Then it is also important to know whether achieved performance is the result of hard work and specialized training, somatic characteristics or specific characteristics for sprinting.

Two best sprinters from all tested subjects lagged behind the standards in the 100m sprint as the criterion of selection and one of the hurdle runners lag behind the standards as well. The authors Zeličenok, Nikituškin, Guba (2000) assume that the performance of the best world runners is 11,86 s for 100 m at the age of 14,6 years in characteristic of age dynamic performance. Our athletes achieved during the international meeting only the performance at the mentioned level, respectively weaker. Even the results gained from repetitive squat jumps tests do not support high level of talent referring to the force of reflection - these athletes were overcome in three indicators by athletes competing in other disciplines. Only two athletes significantly came closer to 100ms in the length of contact with reflections.

In this group of sprinters nobody show to be a significant talent for sprinting. Above the average abilities in speed indicators were achieved by the athlete S.V. and in speed-strength indicators by the athlete M.Ka., The athlete M.Ku. can be judged with them considering the age and specialization. Anyway, we are aware of the fact that by realization of one testing we can neither solve the question of complex diagnosis of young athlete nor to determine the level of his/hers talent. However, it is important to identify the level of talent of each individual person also from the point of view of his actual and prospective specialization. Numbers of authors were dealing with questions of selecting talented athletes. Nevertheless, the identification of talented athletes and the success of training programs were rarely evaluated. Therefore, the questions dealing with identification of talented children are still topical and discussed. Correlation between speed and speed-strength abilities was confirmed in several cases. Despite of relative independence of acceleration and maximum running speed, statistically significant dependence was confirmed. From all indicators of speed-strength abilities, the length of the take-off during repetitive squat jumps showed to be the key factor which is related to all speed and speed-strength indicators, except the height of the jump. We state that the contact time in used test is equally important during running.

Conclusion

Short-distance runners have better speed indicators than hurdle runners and long-distance runners. On the other hand, short-distance runners achieve worse performance in speed strength abilities. Somatic characteristics of tested athletes are suitable. As shown by the athlete M.M., the main criterion for selecting him for hurdle-race specialization was mainly somatic characteristics and not motor performance. All in all, we evaluate the level of speed and speed-strength abilities of short-distance runners competing in Slovakia as an average. There are three athletes with more than average abilities: the athlete S.V. in speed abilities, the athlete M.Ka. in speed-strength abilities and the athlete M.Ku. in both - speed and speed-strength abilities considering the age and specialization. The performance of tested pupils does not achieve the basic recommended standards mentioned in literature, or it exceeds the standards just a little bit higher. We noted statistically significant correlations between the acceleration and the maximum running speed. Furthermore, we also found out significant correlations between the contact time and other speed and speed strength indicators, except the height of the jump. We assume, according to this, that the contact time during repetitive squat-jumps is one of the main factors which significantly influence the level of speed and speed strength abilities. Because of the small number of tested athletes, we cannot generalize the results. Therefore, there are required other measurements.

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SPOSOBNOSTI BRZINE I BRZINSKE IZDRŽLJIVOSTI KOD REPREZENTATIVACA SLOVAČKE U SPRINTU U KATEGORIJI UČENIKA U ATLETICI

Sažetak

Ovaj je prilog posvećen sposobnostima brzine i brzinske izdržljivosti učenika u sprintu u atletici. Glavna svrha i doprinos rada bio je utvrditi učinkovitost i korelacije između pokazatelja brzina: ubrzanje, brzine trčanja i brzinske izdržljivosti i eksplozivne snage nogu. Istražili smo brzinu pomoću 50 m sprinta od starta pa sve do brzinske izdržljivosti, a eksplozivnost izvođenjem 10 ponavljanja čučanj-skokova bez pomoći gornjih ekstremiteta. Uzorak ispitanika sastojao se od učenika - natjecatelja za Slovačku u kategoriji mladih u atletici. Sveukupno, utvrđeno je da su fizički zahtjevi za testirane sportaše prosječni. Rezultati su pokazali da sprinteri imaju bolje indikatore brzine od preponskih trkača i dugoprugaša, međutim, oni postižu lošije rezultate u brzinskoj izdržljivosti. Konačno, može se reći da je vrijeme kontakta ključna stvar tijekom ponavljanja čučanj-skokova i jedan je od presudnih faktora koji značajno utječe na razinu brzine i eksplozivnosti.

***Ključne riječi**: atletika, učenici, brzina, brzinska izdržljivost, sprint*

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Correspondence to:
Martin Pupiš, PhD
Matej Bel University
Faculty of Humanities (Dep. Of PE and Sport)
97404 Banska Bistrica, Tajoveského 40, Slovakia
Phone: ++ 38+ 048 446 7563
E-mail: Martin.Pupis@umb.sk