Motor Performance of Young Soccer Players Depending on Biological Age

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Abstract

The main purpose of our article was to broaden the knowledge of the level of the motor performance of young soccer players in puberty, taking into account their biological age. The object of our research was 18 soccer players in the U 15 category of the soccer club ŠK Slovan Bratislava divided into a subset with accelerated development (n=10) with body height 177,4 ± 5,1 cm, body weight 65,8 ± 7,5 kg and a subset with retarded development (n=8) with body height 170,9 ± 7,3 cm, body weight 63,9 ± 7,7 kg. To assess the motor performance, a set of 3 tests to evaluate speed and speed-coordination (agility) capabilities was applied. The set of tests contained a 10 m run (n=10 - average value of 1.61 s, n=8 - average value of 1.62 s), a 30 m run (n=10 - average value of 4.13 s, n=8 - average value of 4.16 s) and a 5 x 10 m run with a change of direction (n=10 - average value of 11.55 s, n=8 - average value of 11.70 s).

Using the Mann-Whitney U test, we did not confirm in our case a statistically significant different level in the motor performance of the moni-tored sets with regard to the degree of their biological maturity.

Introduction

In many research papers and in practice itself, the motor performance of the school population as well as of youth doing sports is assessed particularly by the calendar (chronological) age. However, it is generally known that biological growing up of youth is characterized by individual differences, which the level of the motor performance depends on (Havlíček, Šelingerová, & Ramacsay 1989, Gaetano 2016).

The motor performance in puberty is significantly determined by the level of somatic development, and therefore the acceleration or retardation of the development is often the cause of different sports performance of children and youth of the same chronological age (Šelingerová, Havlíček & Moravec 1995).

The chronological age has a limited use as an indicator of the individual status (Beunen & Malina 1996). In sports practice it is therefore replaced by the biological (functional, real) age. The biological age is the most important indicator in detecting the interindividual variability of motor performance of children and youth doing sports, especially during pre-puberty and puberty.

According to Dobisíková (1999), the biological

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age can be defined as the summary of the wear and tear of the physiological, chemical and psychological functions of the organism. It is influenced by genetic factors, nutrition, social (living) conditions, diseases, and in our case, also probably by load during trainings and matches. The biological age cannot be measured by the number of years (months, days) that have elapsed since birth as in the case of chronological age. Therefore, their numerical value may not always match. The biological age thus differs from the chronological age in most people. Developmental acceleration or developmental retardation may occur. The most significant differences between the chronological and biological ages due to the intensity of biological changes occur between 10 and 16 years of life (Reiter & Lee 2002).

The biological age is not only interesting for pediatricians or parents, but also for coaches. In growing pubertal children, knowledge about the biological age is important for assessing and predicting their possible future physical growth (height), as well as the load that can be put on them in the training process. They enable to predict the period of the fastest development, the period when the physical growth ends as well as the period of optimal disposition for the best personal sport performance.

Our paper aims to broaden the current knowledge about the level of the motor performance of young soccer players in the puberty stage, taking into account their biological age. By studying young (15-year-old) talented soccer players, we want to supplement the spectrum of knowledge from individual sports, which has been acquired to date by Šelingerová (1992), Šelingerová & Havlíček (1992), Šelingerová, Havlíček, & Moravec (1995), Šelingerová & Šelinger (2004; 2005; 2009) as well as Zapletalová (1990), Doležajová (2002), Demcenco (2017) and Gomez-Lopez et al. (2017) through their active research activities in sports.

Method

Monitoring relationships between the chronological and biological ages in puberty is one of the most interesting issues in the process of growing and maturing of young athletes. Various available, various invasive and various accurate methods for determining the biological age are used in researches. From the methodological point of view the most accurate way (procedure) for determining the biological age is the bone age (Šelingerová &

Šelinger 2005). The world-wide accepted method for determining the bone age is the TW3 method (Tanner et al., 2001). This method uses a radiographic image of wrist bones and fingers on the left hand (non-dominant) to determine the degree of their ossification (scoring-system). This method has a significant role in choosing children talented in sports, especially in the pre-puberty and puberty stages (age 10-15 years).

According to Šelingerová & Šelinger (2005) it enables to:

- identify the developmental position the individual is in compared to their chronological age at the time of the measurement (the individual is in limits, they are accelerated, or retarded),
- determine the rate of growth,
- predict adult body height.

Although the process of maturation and growth is generally independent of the physical activity, the degree of biological maturity determines the motor performance (Šelingerová & Havlíček 1992). This means that children of the same chronological age but of different biological ages show or may show different motor performance in fitness tests (Šelingerová & Šelinger 2005).

Based on the above, we assume that the level of the motor performance of young soccer players will depend on their biological maturity expressed in the bone age. In the group of developmentally accelerated soccer players, we expect from the statistical point of view a significantly higher level of the motor performance in speed and speed-coordination manifestations than in the group of developmentally retarded soccer players.

We used the Mann-Whitney U-test to determine the relationship between motor performance and biological age. We determined the level of statistical significance at $p < 0.05$.

From the above hypothesis, the following tasks have emerged for our research:

1) identify the level of the motor performance of soccer players through special motor performance tests applicable for testing in divisions of youth talented in soccer using photocells,
2) identify the bone age of soccer players based on X-ray imaging via the TW3 method,

3) identify the correlation dependence between the bone age and selected special motor performance tests.

The subject of our research project was young soccer players in the U 15 category in ŠK Slovan Bratislava soccer club, who played in 2015/2016 competition year in the first league of older pupils. The difference between chronological and biological age allowed to divide the set into a developmentally accelerated subset (As-n = 10) and a developmentally retarded subset of retarded (Rs-n = 8). The mean value of the acceleration stage AS was +1.07 years, the mean value of the retardation stage Rs was -0.55 years.

Results and Discussion

To find out the motor performance level of 15-year-old soccer players, a set of three tests for speed and speed-coordination capabilities was used - a 10 m run, a 30 m run, and a 5 x 10 m run with a change of direction.

Table 1. Descriptive statistics of soccer players

Variables	Developmentally accelerated soccer players (N=10)				Developmentally retarded soccer players (N=8)			
	mean	SD	MIN	MAX	mean	SD	MIN	MAX
10m (s)	1.61	0.21	1.49	1.70	1.62	0.18	1.53	1.71
30m (s)	4.13	0.65	3.84	4.49	4.16	0.37	3.96	4.33
5x10m (s)	11.55	1.32	11.19	12.51	11.70	1.60	11.30	12.90
Bone age (years)	15.95	3	14.7	17.7	14.41	1.2	13.7	14.9
Height (cm)	177.4	16.1	166.4	182.5	170.9	22.1	162.7	184.8
Weight (kg)	65.8	27.1	52.6	79.7	63.9	25.4	53.9	79.3
BMI (kg/m^2)	20.84	4.94	18.99	23.93	21.77	3.27	19.95	23.22

Legend: SD – standard deviation; Min – minimum; Max – maximum; N – number of participants

The group of developmentally retarded soccer players achieved an average of 1.62 s in the 10 m run. The lowest measured value was 1.53 s and the highest measured value was 1.71 s.

In the 30 m run, the average value was 4.16 s. The lowest measured value was 3.96 s and the highest was 4.33 s. The extent of variation in this test was 0.37 s.

In the 5 x 10 m run with a change of direction we recorded an average value of 11.70 s. The lowest measured value was 11.30 s and the highest measured value was 12.90 s. The extent of variation for this test was 1.60 s.

The average body height was 170.9 cm when one player reached a height exceeding 180 cm, namely as many as 185 cm. The height of the lowest player in this group was 162.5 cm.

In the 10 m run, the group of developmentally accelerated soccer players compared to the group of retarded soccer players achieved a better time by only 0.01 second. Therefore, the value obtained is not statistically significant. Since it is the shortest running section, the measured difference value is more or less clear. Interestingly, however, the second highest player of the group of accelerated soccer players (182.1 cm) achieved the worst time (1.70 s) at this distance within the introductory group.

Equally interesting is the fact that the body height (173 cm) of the player with the best achieved time (1.49 s) is lower than the average body height in the group of developmentally accelerated soccer players (177.4 cm) in this subset. The second-best time for this distance (1.53 seconds) was reached by the player with the highest body height - 185 cm.

Research results therefore show that for the monitored set in the 10 m run, neither the biological age nor the body height were the main factor in achieving the motor performance.

Figure 1. Comparison between two soccer groups
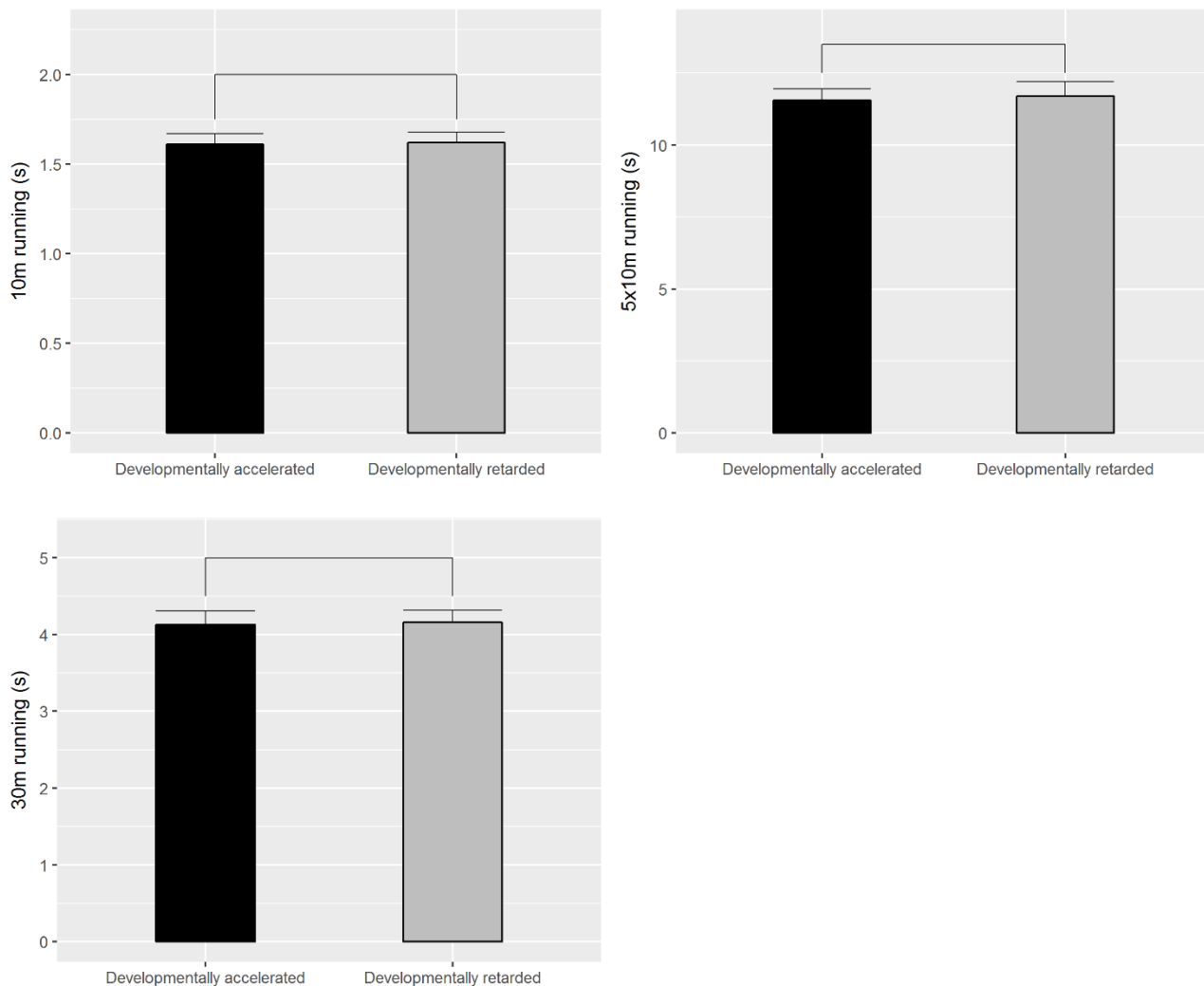
In the 30 m run, the group of developmentally accelerated soccer players compared to the group of retarded soccer players achieved a better time by 0.03 second. Although the time difference increased compared to the 10 m run, the achieved value is not statistically significant again. This fact is a considerable surprise given the longer running section. Interestingly, in this case again, the second-highest player (182.1 cm) from all the observed soccer players, achieved the worst time of all probands - 4.49 seconds.

Similarly as in the 10 m run, the fastest time in the 30 m run (3.84 s) was achieved again by the player with a height of 173 cm from the group of developmentally accelerated soccer players, who did not reach the average body height of this group. The player with the highest body height of 185 cm achieved the fourth fastest time - 3.97 seconds.

Based on the results acquired in the 30 m run we can state likewise as in the 10 m run that the biological age and the body height in this test were not the main factors of the level of the motor performance.

In the 5 x 10 m run with a change of direction, the group of developmentally accelerated soccer players had a better time compared to the group of retarded players. In this case, it is the most significant time difference of 0.15 s from all measured running sections. In this case, however, the value achieved is not statistically significant.

The fastest time, as in the 10 m and 30 m runs, was achieved by the player B.R. with a value of 11.19 s and a body height of 173 cm. The player with the highest body height of 185 cm reached in this case the 15th time in the order.

The assumption concerning the positive impact of the biological age on the motor performance has not been confirmed in the set of young soccer players we monitored.

Conclusion

The level of the motor performance of youth both doing and non-doing sports in different age and performance categories is often studied and also often discussed by professionals. The biological age becomes one of the most important indicators in determining the inter-individual variability of motor performance in that period.

Although statistical significance was not proved in any of the tests used, the results clearly show gradual increases in performance differences between the two groups of young soccer players (0.01 s → 0.03 s → 0.15 s). The increasing extent of variation (0.18 s to 1.60 s) between the values obtained in the applied tests, although only minimally, points to different motor performance of the subsets.

This diversity of 15-year-old soccer players' motor performance depending on the biological maturity was not confirmed in our research. We believe that, contrary to the quoted findings from research measurements of other authors, the non-confirmation of the results we expected occurred mainly due to the following reasons:

- lower quantity of the examined set divided into two subsets,
- considerable homogeneity of the examined set in terms of the training load,
- lower motivation of the probands because they completed their activities in the given age category.

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