Research Paper Physical Education

Maturity-Associated Differences in Anthropometric Characteristics and Physical Performance of Youth Croatian Soccer Players

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ABSTRACT

The basic aim of this study was to ascertain the differences of the morphological features and motor and aerobic abilities of U-14 soccer players of different biological age. The research was conducted on 21 young soccer player, whose average age was 13.4 years. The biological maturity was visually estimated by using the sexual maturity phase classification according to Tanner, and they were tested by six anthropometric characteristics tests and seven motor ability evaluation tests. The data was analysed by using one-way ANOVA and Post Hoc unequal HSD test. The results show that there are three different biologically mature groups within the same chronological group of examinees (pre-puberty – Tanner classification I, early puberty – Tanner classification II, and middle puberty – Tanner classification III). The greatest differences between the groups were manifested through morphological characteristics and explosive power. The research confirmed that there was a danger of perceiving biologically less mature children as less talented because of their size and strength disadvantages comparing to early mature players.

Keywords : biological age, morphological characteristics, aerobic abilities

INTRODUCTION

Biological age determines the degree of biological maturity of a child's organism. It characterises the complex state of an individual's growth and development and may differ significantly from chronological age. Tanner scale is a scale that estimates biological maturation based on primary and secondary sex characteristics such as size and volume of genitals and development of pubic hair. The span of Tanner scale is 1-5, one marking pre-puberty, and five mature age. Maturity-associated differences in body size are apparent at 6 or 7 years of age, increase with age, and are greatest during adolescence due to individual differences in the timing and tempo of the adolescent growth spurt (Malina et al., 2005). Boys who are advanced in maturity tend to perform better in tasks requiring strength, power, and speed compared with average and late maturing boys of the same age (Chuman et al., 2012; Jones, Hitchen, and Stratton, 2000; Malina et al., 2005, Figuerido et al., 2009). Because of this in soccer (Malina et al., 2004; Gil et al., 2007; Wong et al., 2009; Chuman et al., 2012), as well as in other sport games (Sherar et al., 2007), early mature players are systematically favorised during the selection process. Malina et al. (2004), comparing the percentage of late and early mature youth Portuguese soccer players in different age groups (11-12 years, 13-14 years and 15-16 years) ascertained that the sport of soccer systematically excludes late maturing boys and favours average and early maturing boys, as chronological age and sport specialization increase. To avoid this, it is very important to precisely define the degree of biological development of young soccer players, with the aim of more exact evaluation of their players potential (Erceg et al., 2013).

METHODS

The basic aims of this research were evaluating the biological maturity of young soccer players and determining the differences in morphological and motor abilities of U-14 soccer players of different biological age. The sample of examinees consisted of 23 youth soccer players whose average age was 13.8 years, members of FC Dalmatinac soccer school from Split.

They participate in soccer practice 4 times a week, with one competitive match a week. The biological maturity was evaluated visually, using the sexual maturity phase classification according to Tanner. The biological maturity evaluation was performed by a doctor of medicine, with specialization in paediatrics. The examinees were divided into three groups by their biological age (pre-puberty – Tanner classification I, early puberty – Tanner classification II, and middle puberty – Tanner classification III). The anthropometric characteristics of examinees were evaluated by the following tests: body height (BH), body mass (BM), arm girth (AG), forearm girth (FG), thorax girth (TG) and calf girth (CG). Basic motor abilities were evaluated by the following tests: 20 meters sprint (20 m), 60 meters sprint (60 m), standing long jump (SLJ), high jump (HJ), agility T-test, throwing medicine ball from the chest (MBT), push ups (PU). The differences between the groups of biologically different mature U-14 soccer players were determined by using one-way ANOVA and Post Hoc unequal HSD test. A statistical program Statistica for Windows, ver. 10.0 was used in entering and processing the data.

RESULTS AND DISCUSSION

Table 1 Descriptive statistics of U-14 soccer players (N=23)

	Mean	SD	Min	Max
BH (cm)	166.7	10.98	146.0	189.0
BM (kg)	56.1	12.51	38.0	85.0
AG (cm)	24.0	3.18	19.0	32.0
FG (cm)	22.7	2.15	19.0	26.0
TG (cm)	82.3	7.47	69.0	96.0
CG (cm)	46.3	4.99	35.0	56.0

SLJ (cm)	193.5	21.75	160.0	230.0
HJ (cm)	34.0	7.12	20.0	46.0
20m (s)	3.5	0.25	3.1	4.1
60m (s)	9.9	0.83	8.3	11.8
T-Test (s)	9.1	0.54	8.3	10.6
MBT (m)	5.1	1.08	3.3	7.0
PU (1/beats)	19.1	8.51	8.0	37.0

Mean – arithmetic mean, SD – standard deviation, Min – minimum measuring results, Max – maximum measuring results

The examination of Table 1 shows that the average body height (166.7 cm) and body mass values (56.1 kg) are within the referent values for the observed age, but they are close to the upper limit of 75 percentiles (Centers for Disease Control and Prevention, 2000). The obtained results are higher than those in previous research (Coelho e Silva et al., 2010; Valente dos Santos et al., 2011) and are closer to the results of biologically and chronologically older soccer players (Malina, Bouchard and Bar-Or, 2004; Malina et al., 2007; Coelho e Silva et al., 2010).

Table 2 Analysis of variables differences in soccer players, senior pioneers of different biological age, N=23

	Pre-puberty N=5	Early puberty N=9	Middle puberty N=7
	Mean±SD	Mean±SD	Mean±SD
BH (cm)	154.8±5.5†	168.0±5.4*	179.6±6.6[1]
BM (kg)	43.8±4.8†	51.6±5.2*	70.7±8.0[1]
AG (cm)	21.0±1.6†	23.3±1.6*	27.0±3.2[1]
FG (cm)	20.2±1.3†	22.4±1.5*	24.7±1.1[1]
TG (cm)	74.2±4.3†	80.6±3.6*	90.4±4.5[1]
CG (cm)	42.2±4.1†	45.1±3.4*	50.7±4.2[1]
SLJ (cm)	177.4±16.1†	192.8±19.5	206.0±22.3
HJ (cm)	33.2±8.4†	30.7±5.2	39.0±6.3[1]
20m (s)	3.6±0.4	3.5±0.2	3.4±0.2
60m (s)	10.4±1.0	9.7±0.4	9.8±1.1
T-Test (s)	9.5±0.6	8.9±0.4	8.9±0.5
MBT (m)	4.1±0.8†	4.9±0.9*	6.1±0.7[1]
PU (1/beats)	14.4±3.8	22.1±8.3	18.6±10.4

Mean – arithmetic mean, SD – standard deviation

*p<0,05 – difference significance between pre-puberty and early puberty soccer players; [1]p<0,05 - difference significance between early puberty and middle puberty soccer players; †p<0,05 - difference significance between pre-puberty and middle puberty soccer players.

Table 2 shows the variables differences of soccer players of same chronological (U-14) but different biological age (pre-puberty, early puberty, middle puberty). It is obvious that biologically the most mature (Tanner 3) U-14 soccer players achieve better results in almost every variable in comparison to less mature peers (Tanner 1 and 2). The average height (179.6 cm) and weight (70.7 kg) of middle puberty soccer players (Tanner 3) were higher in relation to American referent values and were above the 90 percentiles line (Centers for Disease Control and Prevention, 2000). This leads towards the conclusion that U-14 middle puberty soccer players are a part of a accelerant group, that is, group of soccer players in the phase of early maturation. The assumption is that the significant circumference advantages of accelerants (Tanner 3) was a consequence of the augmentation of muscle mass caused by the testosterone hormone, and the similar results were obtained in the studies by Figueiredo et al. (2010), Malina et al. (2012), and Erceg et al. (2013). Greater transverse section caused by the muscle hypertrophy enables greater strength (power) of biologically more mature children, who achieve better results in the explosive power variables of SLJ (standing long jump), HJ (high jump), MBT (medicine ball throw). All of this encourages the biological accelerators in achieving better results in sprint and explosive power, compared to late maturing boys, increasing their chance to be chosen into the better teams (Malina et al., 2005; Figuerido et al., 2009; Wong et al., 2009; Coelho e Silva et al., 2010; Chuman et al., 2012).

Better results of biologically more mature soccer players can lead to wrong choice (selection) of young soccer players. Therefore, coaches of younger age categories should not pay attention to short-term impacts and/or abilities of the players, but final results and possibilities of youth soccer players. Such attitude would surely decrease the dominance and favouritism of biological accelerators who base their current success on favourable body dimensions and strength. Also, coaches should keep track of their players and know the exact degree and tempo of players` biological development, so as not cause unnecessary withdrawal from sport in cases of young talents who mature more slowly.

CONCLUSIONS

1. There are great differences in puberty onset and maturation tempo of U-14 soccer players of same chronological age.
2. U-14 soccer players of middle puberty period participating in this research are biological accelerants and are above referent values for the observed age.
3. There are statistically significant differences in body height and mass, as well as circumferences variables of U-14 soccer players of different biological maturity.
4. In this research, biologically more mature soccer players achieved better results in explosive power.

REFERENCES

1. Centers for Disease Control and Prevention (2000). National Center for Health Statistics CDC Growth Charts: United States. http://www.cdc.gov/growthcharts.htm | 2. Coelho e Silva, M.J., Figueiredo, A.J., Simoes, F., Seabra, A., Natal, A., Vaeyens, R., & Malina, R.M. (2010). Discrimination of u-14 soccer players by level and position. Int J Sports Med 31 (11): 790-796. | 3. Chuman, K., Hoshikawa, Y., Iida, T., & Nishijima, T. (2013). Relationship between sprint ability and maturity in elite and sub-elite pubescent male soccer players. Football science, 10: 10-17 | 4. Erceg, M., Miletić, A., Rađa, A., & Jelaska, I. (2013). Anthropological characteristics and biological age in soccer players. Proceedings Book of 3rd International Scientific Conference "Exercise and Quality of Life". Novi Sad: D. Madić (ed.). Faculty of Sport and Physical Education. University of Novi Sad. 83-89. | 5. Figueredo, A.J., .Goncalves, C.E., Coelho e Silva, M.J., & Malina, R.M. (2009). Youth soccer players, 11-14 years: maturity, size, function, skill and goal orientation. Ann Hum Biol 36 (1): 60-70. | 6. Figueiredo, A.J., Gonçalves, C.E., Coelho e Silva, M.J., & Malina, R.M. (2009). Characteristics of youth soccer players who drop out, persist or move up. J Sport Sci 27 (9): 883-891. | 7. Gil, S., Ruiz, F., Irazusta, A., Gil, J., & Irazusta, J. (2007). Selection of young soccer players in terms of anthropometric and physiological factors. J Sports Med Phys Fitness 47 (1): 25. | 8. Jones, M.A., Hitchen, P.J., & Stratton, G. (2000). The importance of considering biological maturity when assessing physical fitness measures in girls and boys aged 10 to 16 years. Ann Hum Biol 27 (1): 57-65. | 9. Malina, R.M., Eisenmann, J.C., Cumming, S.P., Ribeiro, B., & Aroso, J. (2004). Maturity-associated variation in the growth and functional capacities of youth football (soccer) players 13–15 years. Eur J of Appl Physiol 91 (5-6): 555-562. | 10. Malina, RM., Coelho e Silva, M.J., Figueiredo, A.J., Carling, C., & Beunen, G.P. (2012). Interrelationships among invasive and non-invasive indicators of biological maturation in adolescent male soccer players. J Sport Sci 30 (15): 705-717. | 11. Malina, R.M., Bouchard, C., & Bar-Or, O. (2004). Growth, maturation and physical activity. (2nd edition). Champaign, IL: Human Kinetics. | 12. Malina, R.M., Ribeiro, B., Aroso, J., & Cumming, S.P. (2007). Characteristics of youth soccer players aged 13–15 years classified by skill level. Brit J Sports Med 41 (5): 290-295. | 13. Malina, R.M., Cumming, S.P., Kontos, A.P., Eisenmann, J.C., Ribeiro, B., & Aroso, J. (2005). Maturity-associated variation in sport-specific skills of youth soccer players aged 13–15 years. J Sport Sci 23 (5): 515-522. | 14. Sherar, L.B., Baxter-Jones, A.D., Faulkner, R.A., & Russell, K.W. (2007). Do physical maturity and birth date predict talent in male youth ice hockey players? J Sport Sci 25 (8): 879-886. | 15. Valente-dos-Santos, J., Coelho-e-Silva, M.J., Duarte, J., Figueiredo, A.J., Liparotti, J.R., Sherar, L.B., Elferink-Gemser, M.T. & Malina, R.M. (2011). Longitudinal predictors of aerobic performance in adolescent soccer players. Medicina (Kaunas) 48 (8): 410-416. | 16. Wong, P.L., Chamari, K., Dellal, A., & Wisløff, U. (2009). Relationship between anthropometric and physiological characteristics in youth soccer players. J Strength Cond Res 23 (4): 1204-1210. |