ANALYSIS OF THE ELITE ATHLETES' SOMATOTYPES

Aleksandar Raković[1], Vladimir Savanović[1], Daniel Stanković[1], Ratko Pavlović[2], Aleksandar Simeonov[3] and Emilija Petković[1]

[1] Faculty of Sport and Physical Education, Niš, Serbia
[2] Faculty of Physical Education and Sport, East Sarajevo, Bosnia & Herzegovina
[3] Faculty of Physical Culture, Skopje, Macedonia

Review paper

Abstract
In many sports somatotype components are not homogeneous, not even in the groups that were singled out by the quality. There were significant differences within the same sport and in terms of the playing position. This is especially reflected in ball sports, team sports, while in individual groups somatotypes were becoming more homogeneous as a higher level of athletic performance was reached. In a review of research many comparisons of the somatotype of athletes in various sports were shown, obtained findings indicate the differentiation of sports according to the somatotype, and these findings are important in the selection of talents in the field of professional sports.

Key words*: sportsman, elite, morphology, somatotypes*

Introduction

First data on human somatotype, or constitution, originate from the time of ancient Greece, from Hippocrates (460-377 BC). The Roman physician Galen in the first century AD, also addressed issues of constitution. Significant scientific names who have addressed the issue of the constitution in the 19th and 20 century are Rosten and Sigaud (French School), De Giovanni, Viola and Pende (Italian School), and Conrad Kretschmer (German School), Sheldon, Rice and Ejzenk (American School) and Černorcki, Serebrovskaja and Krylov (Russian school). The above authors and many others who will not be mentioned here contributed to the emergence of currently valid and commonly applied Heath - Carter method for the determination of human somatotype. The data on the three components of somatotype, endomorphic, mesomorphic and ectomorphic originate from Sheldon (Sheldon et al., 1940) and were approved and modified by American scientists, Heath and Carter. The above authors, on the basis of certain anthropometric parameters determined somatotype using formulas, tables and nomograms Heath and Carter, 1967; Carter, 1983; Carter, 1984b; Carter, 1992). Endomorphic component is associated with the amount of body fat, muscle mass with mesomorphic, ectomorphic and the ratio of height and weight. If one of the components is dominant, then it is a "pure type" (endomorph 7-1-1 , 1-7-1 and 1-1-7 mesomorphic ectomorphic) . Most present constitution , which has the characteristics of the two (5-7-1), including all three components (4-4-4). Some authors relate solely constitution to a genetic basis, but it is certain that the development of somatotype depends on other internal and external factors (Bouchard et al., 1980). What is the proportion of the somatotype in the population of athletes is the question posed by Flavius Philostratus even in ancient Greece, who described how the athlete who will return from the Olympics as the winner should be built (Mišogoj-Duraković, 2008).

The literature presents conflicting thoughts on the role of somatotype decisive for the success in sport, but it certainly is a vital part of the mosaic that will along with other factors (training process, nutrition, motivation) be relevant to performance, and as Tanner claims "athletes are born and created (Tanner, 1964). Literature data suggest that anthropometric studies involving somatotype show differences in athletes and that it depends on the type of sports activities and competition ranks. In sports that are dominated by power mesomorphic component is characteristic, as the authors show in the Polish judo athletes with dominant somatotype 3, 5-5, 9-1, 8 which is very representable (Lewandowska et al., 2011). Mesomorphic component is linked to individual sports which require muscular strength and ectomorphic is associated with the collective sports which require precision and skill. The athletes are usually characterized by the mesomorphic somatotype with modifications to endomesomorphic and mesoectomorphic characteristics which depends on the type of activities. Mesomorphic component is associated with muscle strength, which is essential for top performance in runners, jumpers and throwers (Carter, 1990; Carter 1992). Analysis of somatotypes in the Winter Olympics (from 1948 to the London Olympics in Montreal) and other international competitions of those players who have won medals, or were at the very top , show the cluster around 2-5-2,5 in men and 3 - 4-3 in women, and that points to the central somatotype. Comparison of athletes of both sexes in all Olympics with reference groups shows that they are more mesomorphic and less endomorphic (De Garay et al., 1974, Carter et al. 1983). Analysis of athletes' somatotype in the national competitions shows the deviation from the central somatotype, which is characteristic of the Olympic athletes with superior results, as indicated above, and it ranges, depending on the sports disciplines from the dominant component to one of the two other.

It is considered that the diversity of somatotype in national sports is due to the differences in technical equipment, race and ethnicity of individuals, socio - economic status, selection methods and training process. Thus the difference in somatotypes in the national selections presents the problem in their comparison. There is a greater diversity of somatotypes in younger athletes of both sexes compared to the elderly, and sexual dimorphism is lower in younger than in the older athletes (Carter, 1990). Analysis of high-class swimmer shows the dominance of the mesomorphic somatotype (2,5-5-3) and the presence of differences in swimming styles (Carter, 1984b). It is pointed out that boys' somatotype is mesomorphic with a tendency towards ectomorphological components, and intensive training process changes somatotype to mesomorphic component, thus reducing endomorphism (Bagnall & Kellett, 1977; Kellett, 1978). However changes are observed only in 50% of boys, and in the other half no statistically significant differences were found. The difference in somatotype in swimming styles is emphasized by Araujo who says that young swimmers tend to be less mesomorphic and more ectomorphic (Araujo, 1978). Younger swimmers tend to be less mesomorphic and more ectomorphic than adults (Araujo, 1979). In his paper Stager examines the impact of somatic characteristics (age, height, weight, somatotype, length of arm, maturation) in male and female swimmers in the selection of potential elite swimmers. Examined were the characteristics of the Olympic Games in 1964 up to 1995 swimmers with excellent results with central somatotype and with the tendency of decrease of endomorphic and increase of ectomorphic components. Thus somatotype are applied in the selection of potential elite swimmers (Stager & Babington 1997). Due to the fact that certain professions such as military, police, and other require muscle strength individual somatotype for men and women regardless of age, are determined. Somatotypisation is also performed in children and the age of adolescents to guide the youth towards sports that suits their constitution (March, 2011). Somatotypisation is related to some diseases such as heart disease (SR Williams, 1997), analyzes of eating disorders, dyspepsia, (MS Maas et al. 2003 Tove JM et al. 2003). Differences are noticeable in somatotype of students of sports and other faculties (Mišigoj-Duraković, 1998), and between athletes and non-athletes, in various sports and disciplines (Rahmawati, et al. 2007). Numerous analyzes have shown that somatotype subject to changes that affect the way of life and biological acceleration (Jović et al., 2010; Lozovina et al., 1989, taken from Mišigoj-Duraković, 2008). Since the second half of the 20th century and extensively in the last thirty years one has been exploring quantitative analysis of body composition not only in sports medicine and kinesiology but also in clinical medicine (Mišigoj - Durakovic, 2008). The total body weight is divided into lean body mass (muscles, skeleton, internal organs) and fat mass of the body (essential fat - lipids in the cells) and irrelevant fat (subcutaneous fat and fat between internal organs), which is a two-component model of body composition. Based on the sum of skin folds determined by the caliper one can determine body fat % and based on these values, by using various equations, one can determine the absolute value in pounds of lean and fat mass. Body fat percentage is determined by Jacksin and Pollock' tables and age as well (Jacksin & Pollock, 1985). On the basis of all above mentioned, we considered it important to examine the distribution of body composition and somatotype of the elite athletes in the most cited and influential scientific research body available on the Internet from 2000 to 2012 so that this important area is more deeply explored. Based on the above problem, the object and purpose of the present study the paper will present the research results on somatotype of elite athletes and their representation in elite athletes in most frequent sports.

Subject and research problem

Subject
This research investigates somatotype of the elite athletes.

Research problem
The problem of this study was to analyze the research in the last 12 years dealing with the research on somatotype of elite athletes (defined by Heath-Carter method).

Research aim and tasks

Research aim
The aim of this paper is the analysis of the research on somatotype of elite athletes..

Research tasks
- Collection of literature using the key words: somatotype, elite athlete, morphological characteristics, body mass index, body composition, Health-Carter method, somatotype of elite athletes, etc.
- The selection of the high quality, most relevant and most cited papers
- Translation of the collected literature of the English language
- Analysis of results
- Classification based on papers found according to the writing and publishing year,
- Tabulation of the analyzed variables.

Methods

Research methods are:
- Method of papers selection
- Method of papers classification
- Descriptive method

The method of selection is related to the selection of collected papers dealing with the somatotype of elite athletes by Heath-Carter method in various sports which were available on the Internet library. Method of classification was made with respect to: the case study, sports that were included in the research and the age of the survey respondents.

Descriptive method was applied for selected papers to be analyzed and described and this paper gives a brief overview of the research by different authors. Literature was collected by searching the Internet as well as searching for papers available in the database Kobson, Google Scholar, then searching for the available papers in the field of sports and medical journals with the highest impact factor in the world, and in our country (Journal of Science and Sports Medicine, International Journal of Sports Medicine, School of Journal of Srenght and Conditioning, Journal of Human Kinetics ...). Our search was limited to the papers in Serbian and English, and those that have been published since 2000 until 2012 (in the last twelve years), with the exception of one which was included because of the favorable variables and a wide range of sports processed (which is from 1985).

Authors (publishing year)		Subject Sample			Variable sample				
	sport	number	age	sex	height	weight	BMI	% fat	somatotype
Can, F., Yilmaz, I., & Erden, Z. A. F. E. R. (2004). Morphological characteristics and performance variables of women soccer players	football	34 A) 17 B) 17	/	F	/	/	/	/	a) 3.07-3.55-2.43 b) 3.57-3.35-2.90
Giampietro, M., Pujia, A., & Bertini, I. (2003). Anthropometric features and body composition of young athletes practicing karate at a high and medium competitive level.	karate	35 A) n=14 B) n=21	16.0 - 32.5	M	/	/	/	A) J-P=8.1±2.4%; S-W=8.9±3.3%) b) J-P=9.8±1.6% S-W=11.2±3.7%)	A) mesomorphic-ectomorphic 2) balanced mesomorphic
di Cagno, A., Baldari, C., Battaglia, C., Guidetti, L., & Piazza, M. (2008). Anthropometric characteristics evolution in elite rhythmic gymnasts	rhythmic gymnastics	63	/	F	/	/	/	/	/
Barbieri, D., Zaccagni, L., Cogo, A., & Gualdi-Russo, E. (2012). Body Composition and Somatotype of Experienced Mountain Climbers.	free climbing	10	/	M	/	/	/	11.76%±2.93	Mesomorphism (5.28±1.10) endomorphism (1.55±0.49)
Peeters, M. W., & Claessens, A. L. (2012). The Left Hand Second to Fourth Digit Ratio (2D: 4D) Does Not Discriminate World-Class Female Gymnasts from Age Matched Sedentary Girls	rhythmic gymnastics	258 A) 129 B) 129	A) 16.1±1.2 B) 16.1±1.3	F	A) 161.9±6.4 B) 155.4±6.6	A) 53.9±7.6 B) 46.2 6.3	A) 19.05±1.56 B) 20.51±2.41	/	A) 1.7/3.7/3.2 B) 4.0/3.0/2.9
Lefevre, J., Beunen, G., & Malina, R. M. (1999). The contribution of anthropometric characteristics to performance scores in elite female gymnasts.	rhythmic gymnastics	168	16.5 +/- 1.8	F	/	/	/	/	/
Zuniga, J., Housh, T. J., Camic, C. L., Mielke, M., Russell Hendrix, C., Johnson, G. O., ... & Housh, D. J. (2010). Gender Comparisons Of Anthropometric Characteristics Of Young Sprint Swimmers	swimming	A) n = 38 B) n = 31	A) 11.03 ± 2.29 B) 10.45 ± 2.29 years	/	/	/	/	A) 9.40 ± 5.35% B) 12.73 ± 6.19%	Endomorphism a) 2.87 ± 0.96 b) 4.29 ± 1.22
Morouço, P., Neiva, H., González-Badillo, J. J., Garrido, N., Marinho, D. A., & Marques, M. C. (2011). Associations Between Dry Land Strength and Power Measurements with Swimming Performance in Elite Athletes: a Pilot Study.	swimming	10	14.9 ± 0.74	M	171.9 ± 6.26	60.0 ± 6.26	/	/	/
Knechtle, B., Baumann, B., Knechtle, P., Wirth, A., & Rosemann, T. (2010). A comparison of anthropometry between Ironman triathletes and ultra-swimmers.	triathlon, swimming	A) 98 B) 38 V) 28 G) 17	A) 41.5 (8.9) B) 38.1 (9.0) V) 36.8 (6.2) G) 39.4 (10.7)	A) m B) f V) m G) f	A) 1.80 (0.07) B) 1.82 (0.08) V) 1.66 (0.06) G) 1.68 (0.05)	A) 77.3 (8.9) B) 85.3 (10.6) V) 60.1 (6.1) G) 71.0 (6.4)	A) 23.7 (2.1) B) 25.7 (2.8) V) 21.6 (1.2) G) 25.1 (2.1)	A) 15.7 (4.6) B) 20.1 (6.1) V) 24.9 (6.4) G) 31.4 (3.7)	/
Sterkowicz-Przybycień, K. L., Sterkowicz, S., & Żarów, R. T. (2011). Somatotype, Body Composition and Proportionality in Polish Top Greco-Roman Wrestlers.	wrestling	23 A) (n=12) B) (n=11) V) (n = 165)	A) 24.9±5.5 B) 20.6 ±0.97	M	A) 1.75 ±0.09 B) 1.79 ±0.06	A) 81.8 ±14.29 B) 72.1 ±8.96	A) 26.3 ±2.16 B) 22.4 ±2.46	A) 12.1 ±1.95 B) 15.7 ±2.74	A) 2.0 – 6.6 – 1.2 (± 0.5– 0.9– 0.5) B) 3.7 – 4.3 – 3.1 ± 1.5– 1.2– 1.2
Ferragut, C., Abraldes, J. A., Vila, H., Rodríguez, N., Argudo, F. M., & Fernandes, R. J. (2011).	water-polo	19	24.0±5.1	M	187.1± 7.1	89.8±1 2.2	25.6±2.6	10.6±2.2	Ec 2.93±0.85 Ms5.53±1.32

Anthropometry and throwing velocity in elite water polo by specific playing positions.									En 2.04±0.91
Alacid, F., Marfell-Jones, M., López-Miñarro, P., Martínez, I., & Muyor, J. (2011). Morphological characteristics of young elite paddlers.	paddling	A)124 m B) 63 ž A1) 60 A2) 64 B1) 32 B2) 31	A1) 13.15 ± 0.31 A2) 14.16 ± 0.311 B1) 13.11 ± 0.27** B2) 14.11 ± 0.32	/	163.49 ± 7.71 169.12 ± 7.391 62.41 ± 5.65 164.86 ± 5.26	54.73 ± 10.67 60.44 ± 10.49 54.85 ± 8.17 56.27 ± 7.46		/	2.7-4.8-3.1 2.6-4.6-3.1 3.8-3.8-2.8 3.6-3.7-3.0
Diafas, V., Dimakopoulou, E., Diamanti, V., Zelioti, D., & Kaloupsis, S. (2011). Anthropometric characteristics and somatotype of Greek male and female flat-water kayak athletes.	kayak	83 A) n=13; B) n=15; V) n=27; G) n=28;	22.7 ± 3.1 16.2 ± 1.1 23.7 ± 4.6 16.3 ± 1.2	M / F	165.8± 7.2 167.1± 6.1 176.9± 4.5 175.6± 4.4	65.9±1 0.1 59.0±9. 0 78.8±7. 3 73.1±7. 5	23.8 ± 2.3 21.04 ± 2.2 25.1 ± 1.8 23.6 ± 2.3	26.4±4.4 25.9±3.1 23.7±3.9 22.7±4.0	3.9-3.8-1.9 3.2-2.4-2.8 3.0-4.7-1.7 2.5-4.2-2.2
Nikolaïdis, P. T., Fragkiadiakis, G., Papadopoulos, V. E., & Karydis, N. V. (2011). Differences in force-velocity characteristics of upper and lower limbs of male kick boxers	kickbox	14	21.77 (5.19)	M	1.78 (0.067)	75.4 (8.9) kg	/	14 (5) %	3.5-4.9-2.3
Varamenti, E., & Platanou, T. (2008). Comparison of anthropometrical, physiological and technical characteristics of elite senior and junior female water polo players: A pilot study.	water-polo	26 A) 13 V) 13	26.3 ± 4.4 17 ± 1.2	F	171.3 ± 5.9	66.2 ± 8.4	22.5 ± 2.3	23.6 ± 5.2	4.6 ± 1.1 5.0 ± 1.5 2.5 ± 1.0
Hazir, T. (2010). Physical characteristics and somatotype of soccer players according to playing level and position.	football	305 (SL) n = 161 (FL) n = 144	25.7±3 .73 24.1±4 .27	M	178.4± 5.66 178.4± 5.90	76.1±6. 18 73.9±6. 34	23.89±1. 38 23.21±1. 53	/	2.4-4.8-2.3 (0.9-0.8-0.7) 3.0-4.5- 2.6 (0.9-0.9-0.8) in FL
Carvajal, W., Ríos, A., Echeverría, I., Martínez, M., Miñoso, J., & Rodríguez, D. (2009). Body type and performance of elite Cuban baseball players.	baseball	20 (1B) 7 (2B) 7 (3B) 6 (SS) 6 (CF) 14 (LF /RF) 20 (C) 20 (P)	28.56± 5.2	M	183.7± 4.85 179.0± 4.09 179.2± 4.40 177.1± 4.04 181.5± 4.76	98.3±5. 76 82.7±5. 22 90.16± 5.62 88.3±5. 13 87.6±4. 57		22.93±4.21 17.01±6.67 25.04±2.00 23.06±5.01 20.77±5.01	According to the success Endomorphy 3.18±1.12 3.50±0.92 Mesomorphy 4.23±1.01 6.20±1.03 Ectomorphy 1.67±0.98 1.08±1.00 According to the playing position : First Base (1B) 3.38±0.41 6.83±0.42 0.60±0.39 Infield (IF) 2.86±0.24 5.91±0.24 1.54±0.23 Catcher (C) 4.08±0.31 6.84±0.21 0.32±0.29 Outfield (OF) 2.96±1.31 6.66±0.23 0.66±1.07 Pitcher (P) 3.26±0.16 5.66±0.17 1.47±1.16
Sánchez-Muñoz, C., Sanz, D., & Zabala, M. (2007). Anthropometric characteristics, body composition and somatotype of elite junior tennis players.	tennis	123 A) 57 B) 66	16.2 (0.4) 15.9 (0.6)	M F	176.8 (6.4) 165.4 (6.3)	69.9 (6.8) 59.9 (6.2)	22.3 (1.4) 21.9 (1.7)	15.8 (3.6) 28.5 (3.7)	M 2.4 (0.7) 5.2 (0.8) 2.9 (0.7) F 3.8 (0.9) 4.6 (1.0) 2.4 (1.0) En-m-ec
Slater, G. J., Rice, A. J., Mujika, I., Hahn, A. G., Sharpe, K., & Jenkins, D. G. (2005). Physique traits of lightweight rowers and their relationship to competitive success.	paddling	107 A) n = 35 A1)n = 28 B) n = 27 B2) n = 17	/	M F	181.6 5.2 180.7 3.9 170.0 5.3 170.3 3.5	70.6 1.9 71.2 1.1 57.4 1.6 57.9 1.1	/	5.4 0.7 5.2 0.7 7.1 1.3 6.8 1.4	Endomorphy 1.4 0.3 1.4 0.4 Mesomorphy 4.4 0.8 4.8 0.8 Ectomorphy 3.6 0.8 3.4 0.6 Endomorphy 2.5 0.6 2.4 0.7 Mesomorphy 3.3 0.9 3.3 0.7 Ectomorphy 3.7 0.9 3.7 0.6

Vučetić, V., R Matković, B., & Šentija, D. (2008). Morphological differences of elite Croatian track-and-field athletes.	athletics	54	21.9±5.4	M	181.76 5.21	72.58 6.74	21.95 1.60	5.86 2.21	S_I – endomorph comp. 2.10 0.71 S_II – mesomorph comp. 3.77 0.98 S_III – ectomorph comp. 3.36 0.83
Malousaris, G. G., Bergeles, N. K., Barzouka, K. G., Bayios, I. A., Nassis, G. P., & Koskolou, M. D. (2008). Somatotype, size and body composition of competitive female volleyball players.	volleyball	163 A) 79 B) 84	23.8+/-4.7	F	177.1+/-6.5	/	/	23.4+/-2.8	balanced endomorphs (3.4-2.7-2.9)
Bayios, I. A., Bergeles, N. K., Apostolidis, N. G., Noutsos, K. S., & Koskolou, M. D. (2006). Anthropometric, body composition and somatotype differences of Greek elite female basketball, volleyball and handball players.	volleyball basketball handball	518	/	/	/	/	/	/	Volleyball balanced endomorph (3.4-2.7-2.9) Basketball mesomorph-endomorph (3.7-3.2-2.4). Handball mesomorph-endomorph (4.2-4.7-1.8)
Carvajal, W., Betancourt, H., León, S., Deturnel, Y., Martínez, M., Echevarría, I., ... & Serviat, N. (2012). Kinanthropometric profile of Cuban women Olympic volleyball champions.	volleyball	41	23.1 (4.0)	F	181.6 (3.9)	BMI 22.8 1.6	26.9 3.4	75.2 (5.8)	2.7 0.8 3.6 0.8 2.9 0.8 Centers (2.9–3.4–3.4) Setters (2.6–3.7–2.6) spikers (2.8–3.6–2.9)
Mathur, D. N., Toriola, A. L., & Igbokwe, N. U. (1985). Somatotypes of Nigerian athletes of several sports.	varied sports	131 badminton (n=18), basketball (n=30), hockey on grass (n=24), handball (n=16), judo (n=18), football (n=25)	24.2	M	badminton 172.4 ± 5.3 basketball 182.5 ± 6. hockey on grass 170.2 ± 3.8 handball 180.4 ± 4. judo 170.3 ± 4.4 football 175.1 ± 5.1	/	badminton 8.2 ± 1.7 basketball 7.6 ± 1.8 handball 7.8 ± 1.2 hockey on grass 10.5 ± 1.5 judo 12.2 ± 1.6 football 9.3 ± 1.5 (Kg)	badminton 67.9 ± 3.6 basketball 76.4 ± 4.9 handball 75.2 ± 4.7. hockey on grass 68.2 ± 5.2 judo 67.4 ± 3.8 football 72.9 ± 6.4	badminton 2.2 ± 0.9 3.9 ± 1.1 2.9 ± 0.6 basketball 1.9 ± 0.5 5.3 ± 1.7 3.4 ± 1.1 hockey on grass 1.9 ± 0.8 4.9 ± 1.8 3.2 ± 0.8 handball 2.9 ± 0.7 4.8 ± 2.1 2.7 ± 1.4 judo 3.6±1.1 5.1±1.1 2.6±1.0 football 2.2 ± 0.8 5.4 ± 1.5 2.9 ± 0.9
Lewandowska, J., Buśko, K., Pastuszak, A., & Boguszewska, K. (2011). Somatotype Variables Related to Muscle Torque and Power in Judoists.	judo	13	18.4±3.1		178.6± 8.2		25.65±3.59 10.8±4.0 %	82.3±15.9	3.5-5.9-1.8
Carter, J. E. L., Ackland, T. R., Kerr, D. A., & Stapff, A. B. (2005). Somatotype and size of elite female basketball players.	basketball	168	25,4 ± 3,3	F	1,72 ± 0,06	/	/	66,1 ± 6,2	2,9 - 3,9 - 2,6

Conclusion

Based on the analyzed papers, we have reached the conclusion that in many sports somatotype components are not homogeneous, not even in the groups that were singled out by the quality. There were significant differences within the same sport and in terms of the playing position.

This is especially reflected in ball sports, team sports, while in individual groups somatotypes were becoming more homogeneous as a higher level of athletic performance was reached. In a review of research many comparisons of the somatotype of athletes in various sports were shown, obtained findings indicate the differentiation of sports according to the somatotype, and these findings are important in the selection of talents in the field of professional sports. Elite athletes have significantly different body composition and somatotype when compared to the sedentary people of the same age. Many studies have shown positive tendency of modern sport pointing to the fact that athletes must be more mesomorphic and less endomorphic if we want to reach a high performance level leading to successful sporting results. This is especially related to athletics, gymnastics, volleyball, while women handball recorded the highest endomorphic component. Basketball players, volleyball players and footballers were taller and heavier and had a low body fat percentage value compared to other sports. Judoist and hockey players were endomesomorphic. Other sports groups are predominantly ectomesomorphic. Many studies were incomplete, but they were bearing a good idea, so it might be useful to repeat the same research with

better methodological approach and larger sample size so that the applied mathematical and statistical methods could add some more scientific validity and soundness to the obtained results. The data in this paper could be added to the international literature on the somatotype of the elite athletes.

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ANALIZA SOMATOTIPOVA ELITNIH SPORTAŠA

Sažetak

U mnogim sportovima komponente somatotipa nisu homogene, čak ni u skupinama koje su izdvojene po kvaliteti. Postoje značajne razlike unutar istog sporta te u pogledu položaja u igri. To se posebno ogleda u sportovima s loptom, momčadskim sportovima, dok su u grupama pojedinačnih disciplina somatotipi sve više homogena kako je postignut viša razina sportskih rezultata. Pokazan je pregled brojnih istraživačkih usporedbi somatotipova sportaša u različitim sportovima, a dobiveni rezultati ukazuju na diferencijaciju sportova prema somatotipu, i ti nalazi važni u odabiru talenata u području profesionalnog sporta.

***Ključne riječi**: sportaši, elitni, morfologija, somatotipovi*

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Correspondence to:
Assoc.Prof.Aleksandar Raković, PhD
Faculty of Sport and Physical Education
University of Niš
18000 Niš, Čarnojevića 10A, Srbija
Tel.: +381 18 511 940
E-mail: rakovicwalker@yahoo.com