

STATURE AND ITS ESTIMATION UTILIZING ARM SPAN MEASUREMENTS OF BOTH GENDER ADOLESCENTS FROM SOUTHEAST REGION IN KOSOVO

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Abstract

This study is based on measurements of Southeast region Kosovar adolescents. The aim of this study was to examine the stature of adolescents from Southeast region as well relationship between arm span and stature in both Kosovar genders. A total measured subject participated in this research was 190 out of which (100 girls and 90 boys), females average of age is 18.17 ± 0.37 years old (range 18-20 years) and for male 18.25 ± 0.43 years old (range 18-20 years). The anthropometric measurements were done by trained people and were taken according to the ISAK manual. Relationship between stature and arm span has been analyzed by the simple correlation coefficient at a 95% confidence interval. The linear regression analysis was carried out to examine extent to which arm span can reliably predict of stature. Statistical importance was placed at level $p < 0.05$. As a result anthropometric measurements for both sexes showed that the average of stature for boys adolescents from Southeast region are 177.68 ± 6.65 centimeters and have the arm span average of 179.46 ± 7.80 centimeters, while girls from Southeast 164.10 ± 4.61 centimeters tall, and have the arm span average of 164.05 ± 5.81 centimeters. The results have shown that the arm span was estimated as a reliable indicator of stature assessment to the both genders adolescents from Southeast region of Kosovo population. This study also confirms the necessity for developing separate height models for each region in Kosovo.

Key words: stature, arm span, region, boys and girls, Kosovo.

Introduction

Kosovo is geographically clearly defined at the center of the Southeast part of the Balkan Peninsula. Throughout Kosovo's territory pass roads, which connect Adriatic Sea, Aegean Sea with the center of Balkan Peninsula. Mountain ranges consist of about 63% of the Kosovo's territory. Sorted by their location or altitudes, they would be: peripheral and central mountains, high, average and low mountains. Dinaric Mountains extend in the western and interior part of the land. In central part of the land, such as Mokna Forest, Dry Forest (Mali i Thatë) and Cursed Mountains (Bjeshkët e Nemura), with their geographical position create special climate conditions in Kosovo. Considering that Kosovo's population is part of the central area of population from the Dinaric Race, it was of special significance to complete a professional study and a realistic assessment of morphometric evaluation adolescents from the Southeast Region of Kosovo, mostly due to the reason some regional differences were confirmed in Montenegro (Bubanja, Vujovic, Tanase, Hadzic, & Milasinovic, 2015; Milasinovic, Popovic, Jaksic, Gardasevic, & Bjelica, 2016a; Milasinovic, Popovic, Matic, Gardasevic, & Bjelica, 2016b; Popovic, 2017; Popovic, Bjelica, Tanase, & Milasinovic, 2015; Vujovic, Bubanja, Tanase, & Milasinovic, 2015) as well as some socio-demographic characteristics (Quanjer et al., 2014). In scientific literature is known that the measurement of stature is important in many settings: it is an important measure of body size and gives an assessment of nutritional status (cited in Datta Banik, 2011;

Bjelica, Popovic, Kezunovic, Petkovic, Jurak, & Grasgruber, 2012; Gardasevic, Rasidagic, Krivokapic, Corluca, & Bjelica, 2017), as well as in the determination of basic energy requirements, physical capacity abilities based on drugs quantity, as well as the evaluation of children growth, predicting and standardization of physiologic standards such as lungs capability, muscle strength, glomerular filtering, metabolism, etc (cited in Popovic, Bjelica, & Hadzic, 2014a; Golshan, Amra, & Hoghogi, 2003; M. Golshan, Crapo, Amra, Jensen, & R. Golshan, 2007; Mohanty, Babu, & Nair, 2001; Ter Goon, Toriola, Musa, & Akusu, 2011). The Stature might also be a relevant factor that can success of some athletes in various sports (Popovic, Bjelica, Petkovic, & Muratovic, 2012; Popovic, Bjelica, Jaksic, & Hadzic, 2014b). The researches by European anthropologists a century ago, which have studied body height of the population living in the surrounding of Dinaric Alps (Pineau, Delamarche, & Bozinovic, 2005). As the modern Kosovars, belongs Dinaric racial classification, it is assumed by the authors of this study that adolescents that live in Southeast region, It can be as tall from other parts of Kosovo and might by equally tall or at least very close to Europe's top nations (Popovic, 2016; Popovic, Bjelica, Tanase, & Milasinovic, 2015), Bosnian and Hercegovinians (male 183.9 cm; female 171.8 cm) Dutch (male 183.8 cm; female 170.7 cm), Montenegrins (male 183.21 cm; female 168.37 cm) and Serbians (male 182.0 cm; female 166.8 cm).

Wherefore, the first purpose was to examine the stature in Kosovar adolescents from Southeast region as the authors did believe this is the place where the population can reach the full potential of the Kosova plane, while the second purpose of this research was to examine the stature in both Kosovar genders and its relationship between arm span.

Materials and methods

The subject of this study was 190, students from high schools, in total there, Included are from Southeast region of Kosovo Gjilan, 90 are male and 100 females average of age is 18.17±0.37 years old (range 18-20 years) and for male 18.25±0.43 years old (range 18-20 years). The Criteria for the selection was that the researches have excluded from the data analysis the individuals with physical deformities as well as those without informed consent. The exclusion criterion was also being non-Kosovar and non-Southeast region. Anthropometric measurements of stature and arm span have been conducted according to the protocol of the International Society for the Advancement of Kinanthropometry (Marfell-Jones, Olds, Stewart, & Carter, 2006). The trained measurers have measured selected anthropometric indicators (same measurer for each indicator), while the quality of their performance was evaluated against the prescribed "ISAK Manual". The data was analyzed by Statistical Package for Social Sciences (SPSS) for Windows 23.00. The results obtained were analyzed through descriptive parameters: Means and standard deviation (SD) of the stature and arm span of Kosovars, the ratio between stature and arm span have been analyzed through correlation coefficient according to Pearson with reliability level of 95%. The linear regression analysis was carried out to examine extent to which arm span can reliably predict of stature. In the end, these relationships were plotted as scatter diagram for both genders. Statistical significance was set at p<0.05.

Results and discussion

Table 1. Anthropometric Measurements of the Adolescents

Subjects	Stature Range (Mean±SD)	Arm Span Range (Mean±SD)
Male	161.40-191.1 (177.68±6.65)	158.40-196.7 (179.46±7.80)
Female	153.30-173.40 (164.10±4.61)	148.90-176.50 (164.05±5.81)

A summary of the anthropometric measurements for both sexes is shown in Table 1. Arithmetic average of stature for boys is 177.68±6.65 centimeters, ranked with minimum and maximum results as 161.40-191.1 centimeters. For girls the average was 164.10±4.61 centimeters, ranked with minimum and maximum results as 153.30-173.40 centimeters. These are the results of the arm span for both sexes; the arm span arithmetic average

length for boys is 179.46±7.80 centimeters, ranked with minimum and maximum results 158.40-196.7 centimeters. For girls this was 164.05±5.81 centimeters, ranked with minimum and maximum results 148.90-176.50 centimeters. The simple correlation coefficient and their 95% confidence interval analysis between the anthropometric measurements are presented in Table 2. For both sexes correlative relation between stature and arm span is significant (p<0.000), with these correlation coefficients (boys 0.862; girls 0.794).

Table 2. Correlation between Stature and Arm Span of the Study Subjects

Subjects	Correlation Coefficient	95% confidence interval	Significance p-value
Male	0.862	0.644-0.826	<0.000
Female	0.794	0.533-0.727	<0.000

Table 3. shows the results of linear regression where high values of regression coefficient are shown suggesting a positive relation (boys 0.862; girls 0.794) which shows that arm span predicts stature for both Kosovar sexes (boys t=15.983, p<0.000, girls t=12.937, p<0.000), which confirms the R-square (%) for boys (74.4), and for girls (63.1).

Table 3. Results of Linear Regression Analysis Where the Arm Span Predicts the Stature

Subjects	Regression Coefficient	Standard Error (SE)	R-square (%)	t-value	p-value
Male	0.862	3.386	74.4	15.983	0.000
Female	0.794	2.818	63.1	12.937	0.000

The relationships between armspan measurements and stature among the above models is plotted as a scatter diagram.

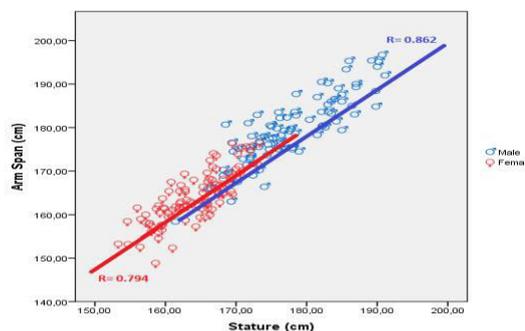


Figure 1. Scatter Diagram and Relationship between Arm Span Measurements and Stature among the Above Models

Conclusion

Throughout this work we can prove that the adolescents from Southeast region of Kosovo are tall with an average of 177.68 centimeters for boys and 164.10 centimeters for girls.

The results proved that the adolescents from Southeast region are tall on average, but not taller than male population in Macedonia with 178.10 centimeters and is very closed to the data that was reached in the measurement of Macedonias female h 164.58 centimeters (Popovic, Bjelica, Georgiev, Krivokapic, & Milasinovic, 2016), but not taller than Serbians female 166.8 centimeters (Popovic, Bjelica, Molnar, Jaksic, & Akpinar, 2013), but not taller than male population. However, there is a hypothesis that both sexes adolescents from Southeast region of Kosovo did not reach their full genetic potential yet, since they have been influenced by various environmental factors (wars, in the former Yugoslavia, poor economic situation, etc.) in the last few decades (Popovic et al., 2016). Wherefore, the authors believe that these

circumstances had a negative bearing on the secular trend in Kosovo, while it is expected that the secular changes influencing stature will ascend in following two decades, comparing it to developed countries where this trend has already completed such as Dutch (Schonbeck et al., 2013). The results of this study confirm that the arm span reliably predicts stature, with significant (p-value 0.000) by linear regression analysis based on results achieved for male and female. The relationship between stature and arm span we have been able to verify throughout Pearsons' correlation analysis with validity of 95% in male as well as female, which have given very high value (0.862 and 0.794) of correlations between them. The results of this study confirm the necessity for developing height models for each region in Kosovo.

References

- Bjelica, D., Popovic, S., Kezunovic, M., Petkovic, J., Jurak, G., & Grasgruber, P. (2012). Body Height and Its Estimation Utilizing Arm Span Measurements in Montenegrin Adults. *Anthropological Notebooks*, 18(2), 69-83.
- Bubanja, M., Vujovic, D., Tanase, G. D., Hadzic, R., & Milasinovic, R. (2015). Body Height and Its Estimation Utilizing Arm Span Measurements in Female Adolescents from Central Region in Montenegro. *Sport Mont*, 43(12), 277-282.
- Datta, S.B. (2011). Arm span as a proxy measure for height and estimation of nutritional status: A study among Dhimals of Darjeeling in West Bengal India. *Ann Hum Biol*, 38(6), 728-35.
- Gardasevic, J., Rasidagic, F., Krivokapic, D., Corluka, M., & Bjelica, D. (2017). Stature and Its Estimation Utilizing Arm Span Measurements in Male Adolescents from Herzeg-Bosnia Entity in Bosnia and Herzegovina. *Montenegrin Journal of Sports Science and Medicine*, 6(1).
- Golshan, M., Amra, B., & Hoghogi, M.A. (2003). Is arm span an accurate measure of height to predict pulmonary function parameters? *Monaldi Arch Chest Dis*, 59(3), 189-92.
- Golshan, M., Crapo, R.O., Amra, B., Jensen, R.I., & Golshan, R. (2007). Arm span as an independent predictor of pulmonary function parameters: validation and reference values. *Respirology*, 12(3), 361-366.
- Marfell-Jones, M., Olds, T., Stewart, A., & Carter, L. (2006). *International standards for anthropometric assessment*. Potchesfroom: International Society for the Advancement of Kinanthropometry.
- Milasinovic, R., Popovic, S., Jaksic, D., Vasiljevic, I., & Bjelica, D. (2016a). Body Height and its Estimation Utilizing Arm Span Measurements in Female Adolescents from Southern Region in Montenegro. *Sport Mont*, 14(3), 15-18.
- Milasinovic, R., Popovic, S., Matic, R., Vasiljevic, I., & Bjelica, D. (2016b). Body Height and its Estimation Utilizing Arm Span Measurements in Male Adolescents from Southern Region in Montenegro. *Sport Mont*, 14(2), 21-23.
- Mohanty, S.P., Babu, S.S. & Nair, N.S., (2001). The use of arm span as a predictor of height. A study of South Indian women. *J Orthop Surg (Hong Kong)*, 9(1), 19-23.
- Pineau, J.C., Delamarche, P., & Bozinovic, S. (2005). Average height of adolescents in the Dinaric Alps (in French). *Comptes Rendus Biologies*, 328(9), 841-846.
- Popovic, S. (2017). Local Geographical Differences within Adult Body Heights in Montenegro. *Montenegrin Journal of Sports Science and Medicine*, 6(1).
- Popovic, S. (2016). Body Height and its Estimation Utilizing Arm Span Measurements in Montenegrin Adults: National Survey. In *Book of Summaries of 11th FIEP European Congress "Anthropological Aspects of Sport, Physical Education and Recreation"* (5-6), Banjaluka: University of Banjaluka, Faculty of Physical Education and Sport.
- Popovic, S., Bjelica, D., Georgiev, G., Krivokapic, D., & Milasinovic, R. (2016). Body Height and its Estimation Utilizing Arm Span Measurements in Macedonian Adults. *Anthropologist*, 24(3), 737-745.
- Popovic, S., Bjelica, D., Tanase, G. D., & Milasinovic, R. (2015). Body Height and Its Estimation Utilizing Arm Span Measurements in Bosnian and Herzegovinian Adults. *Montenegrin Journal of Sports Science and Medicine*, 4(1), 29-36.
- Popovic, S., Bjelica, D., & Hadzic, R. (2014a). Average body height of adolescents in Montenegro. *Proceedings book of the 13th International Sport Sciences Congress (462-463)*. Konya: Selcuk University.
- Popovic, S., Bjelica, D., Jaksic, D. & Hadzic, R. (2014b). Comparative Study of Anthropometric Measurement and Body Composition between Elite Soccer and Volleyball Players. *International Journal of Morphology*, 32(1), 267-274.
- Popovic, S., Bjelica, D., Molnar, S., Jaksic, D., & Akpinar, S. (2013). Body Height and Its Estimation Utilizing Arm Span Measurements in Serbian Adults. *International Journal of Morphology*, 31(1), 271-279.

- Popovic, S., Bjelica, D., Petkovic, J., & Muratovic, A. (2012). Comparative Study of Anthropometric Measurement and Body Composition between Elite Soccer and Handball Players. *Proceedings Book of the 4th International Scientific Conference "Contemporary Kinesiology"* (102-108). Split: Faculty of Kinesiology, University of Split.
- Schönbeck, Y., Talma, H., Van Dommelen, P., Bakker, B., Buitendijk, S., Hirasing, R., & Van Buuren, S. (2013). The world's tallest nation has stopped growing taller: the height of Dutch children from 1955 to 2009. *Pediatric Research*, 73(3), 371-377.
- Ter Goon, D., Toriola, A.T., Musa, D.I., & Akusu, S. (2011). The relationship between a span and stature in Nigerian adults. *Kinesiology*, 43(1), 38-43.
- Quanjer, P.H., Capderou, A., Mazocioglu, M.M., Aggarwal, A., Popovic, S., Datta Banik, S., Tayie, F.A.K., Golshan, M., Ip, M. S. M., & Zelter, M. (2014). All-age relationship between arm span and height in different ethnic groups. *European Respiratory Journal*, 44, 905-912.
- Vujovic, D., Bubanja, M., Tanase, G.D., & Milasinovic, R. (2015). Body Height and Its Estimation Utilizing Arm Span Measurements in Male Adolescents from Central Region in Montenegro. *Sport Mont*, 12, 283-288.

TJELESNA VISINA I NJENA PREDIKCIJA KORISTEĆI MJERE RASPONA RUKU KOD OBA SPOLA ADOLESCENATA IZ JUGOISTOČNE REGIJE KOSOVA

Sažetak

Ovo istraživanje je temeljeno na mjerenjima u jugoistočnoj regiji kosovskih adolescenata a imalo je za cilj da se utvrdi tjelesna visina adolescenata iz jugoistočne regije Kosova, kao i međusobni odnos tjelesne visine i raspona ruku kao jednog od prediktora kod kosovskih adolescenata oba spola. Uzorak ispitanika je bio kreiran od 190 ispitanika, od koji je bilo 100 djevojaka prosječne starosti 18.17 ± 0.37 godina (raspon 18-20 godina) i 90 momaka prosječne starosti 18.25 ± 0.43 godina (u rasponu od 18- 20 godina). Antropometrijska mjerenja su provedena u skladu sa uputama ISAK priručnika, dok je odnos tjelesne visine i raspona ruku analiziran pomoću koeficijenta koleracije sa stepenom pouzdanosti od 95% i linearnom regresivnom analizom. Stepent statističke značajnosti je postavljen na novu od $p < 0.05$. Rezultati antropometrijskih mjerenja pokazali su da je prosječna tjelesna visina adolescenata iz jugoistočne regije kod muške populacije iznosila 177.68 ± 6.65 cm dok je raspon ruku u prosjeku iznosio 179.46 ± 7.80 cm. Kod ženske populacije iz jugoistocnog dijela Kosova, tjelesna visina je iznosila u prosjeku 164.10 ± 4.61 cm, dok je raspon ruku bio 164.05 ± 5.81 cm. Rezultati su također utvrdili da raspon ruku pouzdan pokazatelj kada je procjena tjelesne visine u pitanju kod oba spola adolescenata iz jugoistočne regije Kosovskog stanovništva. Ipak, ovo istraživanje je ukazalo na potrebu za kreiranjem posebnih modela odnosa tjelesne visine i raspona ruku za svaku od regiju na Kosovu posebno.

Cljučne riječi: visina, raspon ruku, regija, djevojke i momci, Kosovo.

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