

## ORIGINAL SCIENTIFIC PAPER

# Analysis of Trends in Anthropometric Characteristics of Montenegrin Recruits from Bar in Period from 1979 to 1987

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## Abstract

The aim of this study is to observe the trend of anthropometric characteristics in Montenegrin recruits born from 1957 to 1969 from Bar. The sample of respondents in this study numbered a total of 3,670 future soldiers with an average age of  $18.19 \pm 0.69$ , who were tested for military service in the period from 20 February 1979 to 21 April 1987. The average body height of the total sample of future soldiers was  $175.82 \pm 7.04$ , the average body weight was  $68.33 \pm 9.73$ , and the average value of body mass index was  $22.06 \pm 2.58$ . The highest body height ( $178.06 \pm 8.67$ ) was in the group of recruits born in 1960. The highest body weight ( $75.14 \pm 5.87$ ) and body mass index ( $23.96 \pm 1.84$ ) was in the group of recruits born in 1957. The value of the body mass index of all future soldiers shows that everyone was in the zone of normal weight. It should be noted that some of these respondents were measured before the age of 18. This means that their growth was not complete. There is a possibility that they on average had a higher body height with the completion of growth and development than this research shows. The results show that all generations of young men from Bar were at that time of a normal weight. This fact is not surprising because it is known that life was different then than it is now. The results of this study are very important in monitoring the trend of these 3 variables in the Montenegrin population, but they also have some limitations. As mentioned above, the rule for recruiting future soldiers was to be tested before the age of 18, when growth and development were not complete yet, and the results after the completion of the growth and development of the respondents would probably be slightly different from these results. Also, some generations had a small number of recruits.

**Keywords:** *Anthropometric characteristics, Secular trend, Montenegrin recruits*

## Introduction

The results of many recent studies show a trend of growth in average body height in adults in countries with economic growth (Milasinovic, Gardasevic, & Bjelica, 2017; Arifi et al., 2017; Masanovic, Bavcevic, & Prskalo, 2019a; Gardasevic, 2019a; Gardasevic, 2019b). Better conditions of life and a better lifestyle have a positive impact on increasing the average body height of the pop-

ulation. The same is the case with adults in Montenegro (Popovic, 2017). Many researchers around the world are determining and analysing body height of adults for more than 2 centuries (NCD Risk Factor Collaboration, 2016). The researches, carried out by European anthropologists a century ago, have proved the assumption that the tallest people are living in the Dinarides (Pineau et al., 2005), among whom are the Montenegrins, and

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among first their body height was recognized by Robert Ehrlich at the beginning of the 20th century (Coon, 1975). Considering that Montenegro was a part of a great state of Yugoslavia until 2006, there is not much preserved data on the body height of Montenegrins. Only since the independence of Montenegro, the number of studies on the body height of Montenegrins has increased and all of them confirm that Montenegrins are one of the highest nations in the world (Bjelica et al., 2012; Milasinovic, Popovic, Matic, Gardasevic, & Bjelica, 2016). This study should contribute to the small amount of data in recent decades on the average height of men in Montenegro.

Body mass index represents the ratio of body weight to body height. It is a parameter that provides information on 4 levels of nutrition, and 3 of these 4 levels of body mass index can show a health risks throughout life (NCD Risk Factor Collaboration, 2017). Underweight, overweight, or obesity are categories of body mass index which can show a health risk. Deficiency or excess of adipose tissue have detrimental consequences for human metabolism (Masanovic, Bavcevic, & Prskalo, 2019b). In

children, underweight gives a higher risk for infectious diseases, in youth underweight can also endanger reproductive ability (Han, Mulla, Beiene, Liao, & McDonald, 2010; Masanovic, Milosevic, & Corluca, 2018; Masanovic, Corluca, & Milosevic, 2018). Overweight and obesity can cause a variety of cardiovascular and chronic diseases (Singh, Mulder, Twisk, Van Mechelen, & Chinapav, 2008).

Searching index databases, the authors of this study did not find enough researches on trends in body mass index of the population in Montenegro. Considering the very specific body height and appearance of Montenegrins, it was very interesting to observe the trend of body height, body weight, and body mass index in this population in previous decades. The data the authors used for this study will help eliminate the problem of deficiency of these kind of data for the entire male population in Bar from 1979 to 1987. Bar is the city on the coast of Montenegro (Figure 1). In these 8 consecutive years, in the second half of the last century, trend of variables of body height, body weight and body mass in the male population will be presented.



FIGURE 1. Bar is the city on the coast of Montenegro

## Methods

All young men ages from 1957 to 1969 from Bar, Montenegrin city on the coast, were included in the sample of this research. Respondents were measured during mandatory medical examinations that served to test their preparedness for military service. Usually, the testing of young men was done before the age of 18, and military service was served after the end of high school, at the age of 19. However, there was a rule that military service could be postponed until the age of 27, if there were some very important reasons, such as further education, etc. Therefore, many of the recruits whose results were included in this study, had medical examinations after the age of 18, which increased the average age of each generation and the complete sample in this study.

The sample of respondents in this study numbered a total of 3,670 future soldiers with an average age of  $18.19 \pm 0.69$ , who were tested for military service in the period from 20 February 1979 to 21 April 1987. Testing was conducted with 13 age generations. The complete sample of respondents was divided into 13 groups, in order to check the trend of body height, body weight and body mass index in all young men in this city in the mentioned 13 years. The first group numbered 7 respondents born in 1957 with an average age of  $21.87 \pm 0.62$ , the second group numbered 41 re-

spondents born in 1958 ( $22.02 \pm 1.19$ ), the third group numbered 28 respondents born in 1959 ( $21.13 \pm 1.54$ ), the fourth group numbered 31 respondents born in 1960 ( $19.84 \pm 1.17$ ), the fifth group numbered 253 respondents born in 1961 ( $17.74 \pm 0.44$ ), the sixth group numbered 417 respondents born in 1962 ( $18.27 \pm 0.21$ ), the seventh group numbered 439 respondents born in 1963 ( $18.41 \pm 0.45$ ), the eighth group had 270 respondents born in 1964 ( $17.70 \pm 0.27$ ), the ninth group had 260 respondents born in 1965 ( $18.27 \pm 0.29$ ), the tenth group had 447 respondents born in 1966 ( $18.09 \pm 0.34$ ), the eleventh group numbered 513 respondents born in 1967 ( $18.33 \pm 0.22$ ), the twelfth group numbered 439 respondents born in 1968 ( $18.10 \pm 0.37$ ), and the thirteenth group numbered 525 respondents born in 1969 ( $17.79 \pm 0.17$ ).

During the testing in the medical clinic, all subjects were in the underwear. Anthropometric measurements were performed according to the guidelines International Biological Program (IPB). Of all the variables measured by the subjects, body height and body weight were taken for the purposes of this study. An anthropometer was used to estimate body height, and a medical scale with moving weights with a stadiometer was used to estimate body weight. Body mass index is calculated as the ratio of body weight in kg and body height in  $m^2$ .

The analysis was performed by using the Statistical Pack-

age for Social Sciences (SPSS) version 20.0. Means and standard deviations (SD) were obtained for all anthropometric variables. Analysis of nutrition status was done based on body mass index (World Health Organization, 2010).

**Results**

Descriptive data of all respondents, members of 13 age groups, are shown in Table 1.

The Table 1 shows that the average body height of the total

**Table 1.** Descriptive data for a complete sample of recruits from Bar

Year of Birth	Mean±SD			
	Age	Body Height (cm)	Body Weight (kg)	Body Mass Index (kg/m <sup>2</sup> )
1957 (N=7)	21.87±0.62	177.14±5.52	75.14±5.87	23.96±1.84
1958 (N=41)	22.02±1.19	174.76±6.61	68.80±7.85	22.52±2.27
1959 (N=28)	21.13±1.54	176.93±6.93	70.96±10.11	22.58±2.16
1960 (N=31)	19.84±1.17	178.06±8.67	71.39±7.41	22.56±2.31
1961 (N=253)	17.74±0.44	175.22±7.22	66.68±9.11	21.66±2.19
1962 (N=417)	18.27±0.21	176.27±7.43	67.75±9.31	21.76±2.37
1963 (N=439)	18.41±0.45	175.57±6.69	68.59±10.25	22.20±2.67
1964 (N=270)	17.70±0.27	175.51±6.76	67.80±9.34	21.99±2.64
1965 (N=260)	18.27±0.29	176.01±6.99	67.90±8.78	21.91±2.48
1966 (N=447)	18.09±0.34	175.79±7.10	67.80±9.79	21.90±2.67
1967 (N=513)	18.33±0.22	175.26±7.01	69.11±10.43	22.45±2.71
1968 (N=439)	18.10±0.37	175.50±6.89	68.29±9.87	22.16±2.90
1969 (N=525)	17.79±0.17	176.75±7.07	69.09±9.80	22.06±2.38
Total (N=3,670)	18.19±0.69	175.82±7.04	68.33±9.73	22.06±2.58

sample of 3,670 recruits was 175.82±7.04, the average body weight was 68.33±9.73, and the average value of body mass index was 22.06±2.58. The highest body height was in the group of recruits born in 1960 (178.06±8.67). The lowest body height was in the recruits born in 1958 (174.76±6.61). Recruits born in 1957 had the highest body weight (75.14±5.87), and recruits born in 1961 had the lowest body weight (66.68±9.11). The value of the body

mass index of all recruits shows that everyone was in the zone of normal weight. The highest body mass index was found in the respondents of group born in 1957 (23.96±1.84), and the lowest body mass index was found in the respondents of group born in 1961 (21.66±2.19).

The trend of average body height on a total sample of 3,670 recruits, born from 1957 to 1969 is shown graphically in Figure 2.

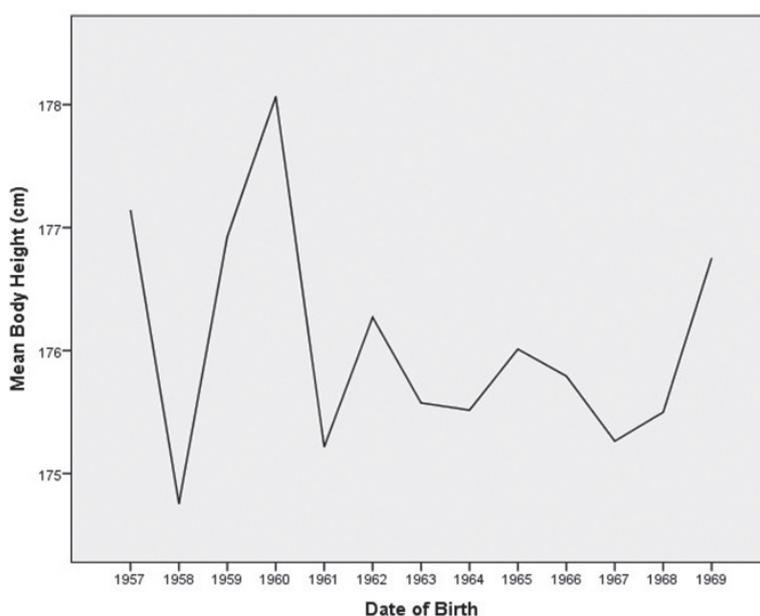


FIGURE 2. The trend of average body height of Bar recruits born from 1957 to 1969

The trend of average body weight on a total sample of 3,670 recruits, born from 1957 to 1969 is shown graphically in Figure 3. In relation to the limit values of the categories of nutrition

(underweight, normal weight, overweight and obesity) prescribed by the World Health Organization, it can be seen from Table 1 that all respondents here belonged to the category of normal weight.

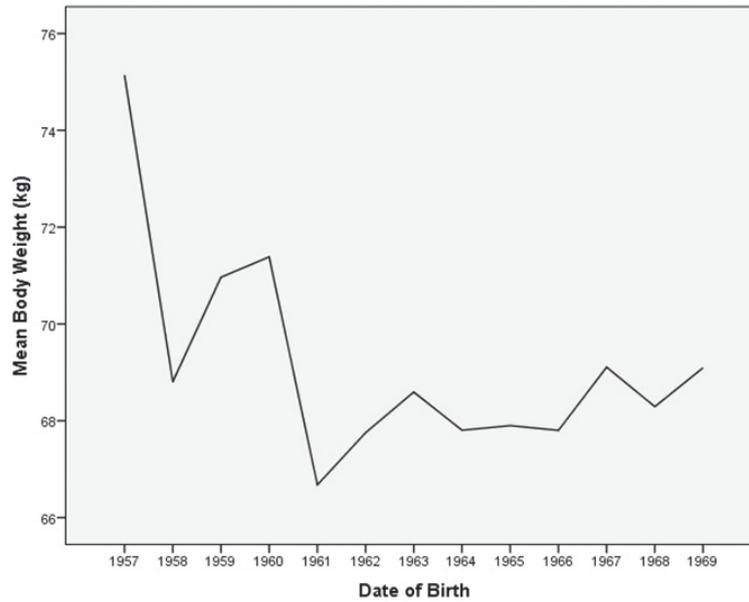


FIGURE 3. The trend of average body weight of Bar recruits born from 1957 to 1969

The limit values for normal weight are values of body mass index from 18.5 to 24.9. The trend of the average body mass index on a

total sample of 3,670 recruits, born from 1957 to 1969 is shown graphically in Figure 4.

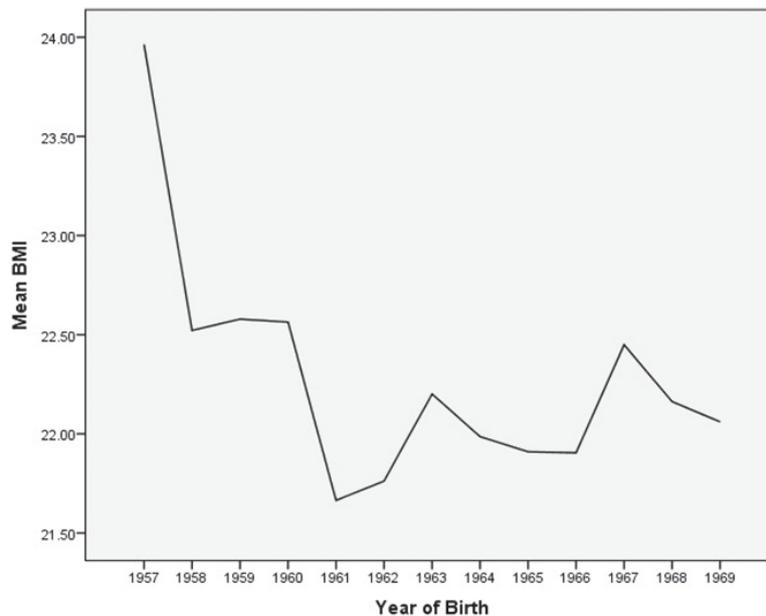


FIGURE 4. The trend of average body mass index (BMI) of Bar recruits born from 1957 to 1969

**Discussion**

The aim of this study is to contribute the increase in the number of studies that have followed the change in body height in Montenegrins in the last century. According to research by Robert Ehrich at the beginning of the last century, the average body height of Montenegrins was 177 cm (Coon, 1975). Our research showed that, eighty years later, the inhabitants of Bar, the Montenegrin city on the coast, were tall 175.82 in average from 1979 to 1987. This is lower average body height compared to the average body height found in the research conducted by Masanovic et al. (2020) and Gardasevic et al. (2020). Masanovic et al. (2020) found the body height of recruits of Cetinje were 178.39 cm, and Gardasevic et al. (2020) found the body height of recruits of Niksic were 178.58 cm measured from 1979 to 1987. This is evidence

of the secular trend and increase in average body height in the population of Montenegro. It should be noted that some of these respondents were measured before the age of 18. This means that their growth was not complete. There is a possibility that they on average had a higher body height with the completion of growth and development than this research shows.

Montenegrin researcher Popovic (2017) found that Montenegrins are one of the tallest nations in Europe with an average body height of 183.36 cm. He based his results on a survey of the average body height of young men from 13 Montenegrin municipalities, and based on his results, this positive secular trend of average body height can be seen. In our study, it can be seen that Bar recruits born in 1958 had the lowest body height (174.76 cm), and those born only a two years later had the highest body height

(178.06 cm) in the total sample of respondents. The reason for this difference in just two years certainly lies in the fact that the small number of respondents in this study were from these two groups of respondents (41 respondents born in 1958 and 31 respondents born in 1960). If these two groups had a larger number of respondents, their body height ratio would probably be different.

According NCD Risk Factor Collaboration (2017) in the previous 40 years, in 189 countries, an average body height, body weight, body mass index (more than 0.05 kg/m<sup>2</sup> for every 10 years) are increased for children and adolescents. Obesity increased for 6.9%. The percentage of underweight decreased. The results of this study do not show a trend of increase or decrease in the variables body weight and body mass index of all young men born from 1957 to 1969. The reason for this is the fact that 13 years is not a long period to discuss it. The results show that all generations of young men from Bar were at that time of normal weight. This fact is not surprising because it is known that life was different then than it is now. Sedentary lifestyle was less represented, virtual life was not led through social networks, much greater physical activity was represented among young people and a much healthier diet than today. These are some of the reasons for today's increase in body mass index among young people. If we analyse the body weight and body mass index in this study, it is noticeable that these are the highest values in the first age group, born in 1957 (23.96 kg/m<sup>2</sup>). But again, the reason, as with the average body height, should be found in the fact that these age group had the lowest number of respondents. Montenegrin researchers Gardasevic et al. (2015) found that in Montenegrins of age of 17 the average body mass index was 24.9 kg/m<sup>2</sup>, and in Montenegrins of age of 18 the average body mass index was 22.8 kg/m<sup>2</sup>. If these values are compared with the values from this study, it is clear that the secular trend among Montenegrin youth is noticeable in this variable as well.

The results of this study are very important in monitoring the trend of these 3 variables in the Montenegrin population, but they also have some limitations. As mentioned above, the rule for recruiting future soldiers was to be tested before age of 18, when growth and development were not complete yet. It can be stated with certainty that they did not reach their final growth then. Table 1 shows that the average age of the complete sample was 18.19±0.69. The reason for this average age of the total sample of respondents, which was slightly higher than 18 years, are those respondents who were tested after the age of 18. It has already been mentioned that military service could be postponed until the age of 27 of respondent, and thus the recruitment was moved a few years later. Probably forty years ago, when this measurement was made, the average values of body height in the subjects would be even higher if the measurement was realized when the growth and development of all subjects were completed. Based on this, it can be concluded that the data from this study are not completely reliable. However, these results make a major contribution to the small amount of trend data in these three variables over the past century, from the research of Robert Ehrlich, to the last years when research on this topic has intensified.

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#### Conflict of Interest

The authors declare that there are no conflicts of interest.

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#### References

- Arifi, F., Bjelica, D., Sermahaj, S., Gardasevic, J., Kezunovic, M. & Popovic, S. (2017). Stature and its estimation utilizing arm span measurements in Kosovan adults: National survey. *International Journal of Morphology*, 35(3), 1161-1167.
- 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.
- Coon, C. (1975). *The races of Europe*. Westport, Conn: Greenwood Press.
- Gardasevic, J., Vasiljevic, I., Bjelica, D., & Popovic, S. (2015). Analysis of nutrition of boys and girls, adolescents from Montenegro. *Journal of Physical Education and Sport*, 15(4), 702-704. doi: 10.7752/jpes.2015.04107
- Gardasevic, J. (2019b). Body height in Kosovo population and its estimation from tibia length: National survey. *Anthropological Notebooks*, 25(3), 77-86. ISSN 1408-032X
- Gardasevic, J. (2019a). Standing height and its estimation utilizing tibia length measurements in adolescents from western region in Kosovo. *International Journal of Morphology*, 37(1), 227-231.
- Gardasevic, J., Martinovic, S., Vasiljevic, I., Bubanja, M., Malovic, P., & Vrevic, E. (2020). Analysis of Trends in Anthropometric Characteristics of Montenegrin Young Men from Niksic from 1957 to 1969. *Sport Mont*, 18(2), 55-59. doi: 10.26773/smj.200616
- Han, Z., Mulla, S., Beyene, J., Liao, G., & McDonald, S.D. (2010). Maternal underweight and the risk of preterm birth and low birth weight: a systematic review and meta-analyses. *International Journal of Epidemiology*, 40(1), 65-101. doi: 10.1093/ije/dyq195
- Masanovic, B., Corluca, M., & Milosevic, Z. (2018). Comparative Study of Anthropometric Measurement and Body Composition of Junior Soccer and Handball Players from the Serbian National League. *Kinesiology Slovenica*, 24(3), 37-46.
- Masanovic, B., Milosevic, Z., & Corluca, M. (2018). Comparative Study of Anthropometric Measurement and Body Composition between Junior Handball and Volleyball Players from Serbian National League. *International Journal of Applied Exercise Physiology*, 7(4), 1-6. doi: 10.30472/ijaep.v7i4.313
- Masanovic, B., Bavcevic, T., & Prskalo, I. (2019a). Regional differences in adult body height in Kosovo. *Montenegrin Journal of Sports Science and Medicine*, 8(1), 69-76. doi: 10.26773/mjssm.190310
- Masanovic, B., Bavcevic, T., & Prskalo, I. (2019b). Comparative study of anthropometric measurement and body composition between junior handball and basketball players from the Serbian national league. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 23(2), 90-95. doi: 10.15561/18189172.2019.0206
- Masanovic, B., Martinovic, S., Zoric, G., Bacovic, D., Mitrovic, M., & Vukotic, M. (2020). Trends in Body Height, Body Weight, and Body Mass Index from 1979 to 1987: An Analysis of the Young Male Population from the Municipality of Cetinje. *Journal of Anthropology of Sport and Physical Education*, 4(2), 3-7. doi: 10.26773/jaspe.200401
- Milasinovic, R., Popovic, S., Matic, R., Gardasevic, J., & Bjelica, D. (2016). Body Height and its Estimation Utilizing Arm Span Measurements in Male Adolescents from Southern Region in Montenegro. *Sport Mont*, 14(2), 21-23. udc 796.012-053.6(497.16)
- Milasinovic, R., Gardasevic, J., & Bjelica, D. (2017). Body height and its estimation utilizing arm span measurements in male adolescents from northern region in Montenegro. *Acta Kinesiologica*, 11(Supp. 2), 75-80.
- NCD Risk Factor Collaboration (2016). A century of trends in adult human height. *eLife*, 5:e13410. doi: 10.7554/eLife.13410
- NCD Risk Factor Collaboration (2017). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *The Lancet*, 390(10113), 2627-2642. doi:10.1016/s0140-6736(17)32129-3
- Pineau, J. C.; Delamarque, P. & Bozinovic, S. Average height of adolescents in the Dinaric Alps. *C. R. Biol.*, 328(9):841-6, 2005.
- Popovic, S. (2017). Local Geographical Differences in Adult Body Height in Montenegro. *Montenegrin Journal of Sports Science and Medicine*, 6(1), 81-87.
- Singh, A.S., Mulder, C., Twisk, J.W.R., Van Mechelen, W., & Chinapaw, M.J.M. (2008). Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obesity Reviews*, 9(5), 474-488. doi: 10.1111/j.1467-789x.2008.00475.x
- World Health Organization. (2010). *Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide*. Geneva: WHO pres.