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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

Bojan Masanovic[1], Srdja Martinovic[2,3], Gorica Zoric[1], Dragan Bacovic[1], Milena Mitrovic[1], Marina Vukotic[1]

[1]University of Montenegro, Faculty for Sport and Physical Education, Niksic, Montenegro, [2]University of Montenegro, Faculty of Law, Podgorica, Montenegro, [3]Ministry of Defence, Podgorica, Montenegro

Abstract

This study aimed to consolidate body height, body weight, and body mass index data of the entire young male population from the Municipality of Cetinje in order to estimate trends from 1979 to 1987. The sample of respondents includes 2119 young males divided into nine groups: 183 respondents born in 1961, 361 respondents born in 1962, 300 respondents born in 1963, 162 respondents born in 1964, 155 respondents born in 1965, 258 respondents born in 1966, 218 respondents born in 1967, 234 respondents born in 1968, and 248 respondents born in 1969. The measurement sample includes body height, body weight, and body mass index calculated based on two previous measures. The descriptive statistics were expressed as a mean and standard deviation for each variable, while the analysis of nutrition status was done based on body mass index (underweight, normal weight, pre-obese, obese). The results showed that a secular trend in the observed study period is not visible regarding body height and body weight, while it is observable for the body mass index. Therefore, this study will contribute to complementing knowledge about changes in average body height values of young Montenegrins in the previous 120 years and in that way, more precisely monitor the emergence of a secular trend.

Keywords: *Morphological Characteristics, Secular trend, Young males, Montenegro*

Introduction

In recent decades, average adult body height has dramatically increased in most industrialized countries, including in Montenegro (Popovic, 2017). Much better lifestyles, a result of better living conditions and improved nutritional, hygienic, economic, and health status, obviously caused this trend (Hauspie, Vercauteren, & Susanne, 1996; Masanovic, Bavcevic, & Prskalo, 2019a). Trends in men's body height have been analysed around the world for 250 years (NCD Risk Factor Collaboration, 2016), and the unusual height of Montenegrins was recognized by Robert Ehrich, who conducted research at the beginning of the 20th century (Coon, 1939, 1975). Generally, the unusual height of Dinaric Alps inhabitants has historically been well-known (Coon, 1939; Grasgruber et al., 2017, 2019), but the problem is the lack of record-keeping. Recently, studies about body height of Montenegrins have been growing in number; all of them confirm that Montenegrins are one of the tallest nations in the world (Bjelica et al., 2012; Milasinovic, Popovic, Matic, Gardasevic, & Bjelica, 2016; Milasinovic, Popovic, Jaksic, Vasiljevic, & Bjelica, 2016). Nevertheless, between the research and study conducted by Ehrich at the beginning of the 20th century and these recent studies, there is a multi-decade gap of quality data, which will be filled by this study.

Bodyweight and the body mass index (BMI) are parame-

Correspondence:

B. Masanovic
University of Montenegro, Faculty for Sport and Physical Education, Narodne omladine bb, Niksic, Montenegro
E-mail: bojanma@ucg.ac.me

ters that provide information about nutrition, and it is generally known that being underweight, overweight, or obese is associated with adverse health consequences throughout the life-course (NCD Risk Factor Collaboration, 2017). Thus, both excesses and deficiency of adipose tissue have harmful metabolic consequences and represent significant medical and socioeconomic burdens in the world today (Masanovic, Bavcevic, & Prskalo, 2019b). Underweight among children is associated with a higher risk of infectious diseases, while it may impair reproductive capacity in young people (Han, Mulla, Beyene, Liao, & McDonald, 2010, Masanovic, Milosevic, & Corluka, 2018; Masanovic, Corluka, & Milosevic, 2018). In contrast, being overweight is associated with a greater risk of cardiovascular diseases and chronic disorders, such as type 2 diabetes (Singh, Mulder, Twisk, Van Mechelen, & Chinapaw, 2008).

Although body height, body weight, and body mass index trends in adolescents are documented in the majority of countries, there is insufficient data about trends in Montenegro. There are longitudinal studies about body height, but very few monitor average body weight and body mass index (BMI) changes for a longer period, also those studies that monitor underweight, overweight, or obesity problems. This study brings together the body height, body weight, and body mass index data of an entire young male population of the Municipality of Cetinje, to evaluate the trends from 1979 to 1987, for the purpose of collecting information on possible acceleration, as well the trajectories (changes) of nutrition status in young males.

Methods

The population of this study contains all young male citizens of the Municipality of Cetinje, measured during mandatory medical examinations to test their military service ability. Most future recruits underwent this examination before they were 18 years old, but military service could be postponed until the age of 27, so some of the future recruits had their medical examinations later, which increased the average age in each generation.

In the period from 20 February 1979 to 21 April 1987, this examination consisted of 2146 of future recruits, but young males born in 1957 (3 respondents), 1958 (4 respondents), 1959 (6 respondents) and 1960 (14 respondents) were excluded from the analysis because their numbers were not sufficient for their entire generation's characteristics to be reliably described. Consequently, the analysed data in this study covers 2119 future recruits divided into nine groups: 183 respondents born in 1961 (17.97±.99 yrs.), 361 respondents born in 1962 (17.72±.45 yrs.), 300 respondents born in 1963 (17.89±.48 yrs.), 162 respondents born in 1964 (18.46±.67 yrs.), 155 respondents born in 1965 (18.4±.66 yrs.), 258 respondents born in 1966 (18.4±.37 yrs.), 218 respondents born in 1967 (18.35±.22 yrs.), 234 respondents born in 1968 (17.71±.05 yrs.), and 248 respondents born in 1969 (17.76±.04 yrs.).

Anthropometric measurement was implemented in medical infirmaries, and respondents accessed the procedure in their underwear. From the sample measures that were collected, for this research, body height and body weight are isolated; the body mass index is calculated using them. For body height and body weight assessment, a medical scale with moving weights with a stadiometer was used. Anthropometrical measurement was implemented by respecting the basic rules and principles of the International Biological Program (IPB), and the body mass index was calculated based on the protocol handbook for physical form assessment connected to health (Kaminsky, 2013).

The data obtained in the research were processed using SPSS 20.0 software (Chicago, IL, USA) adjusted for use on personal computers. The descriptive statistics were expressed as a mean and standard deviation for each variable, while the analysis of nutrition status was done based on body mass index (underweight, normal weight, pre-obese, obese) (World Health Organization, 2010).

Results

Analysis of the average body height, body mass, and body mass index of young male subjects is shown in Table 1. The average body height of the overall sample of male subjects was 178.38±6.58 centimetres. The tallest group were respondents born in 1962 (179.76±6.62), while shorter ones were respondents born in 1964 (176.55±6.28). The average bodyweight of the overall sample of male subjects was 70.16±9.17 kilograms, while the heaviest respondents were those born in 1969 (71.74±10.35), and the least heavy were respondents from group born in 1961 (68.91±8.83). The average body mass index of the overall sample of male subjects was 22.02, while the highest values had respondents of the group born in 1969 (22.35), and the lowest values had respondents of the group born in 1965 (21.69).

Table 1. Descriptive data of young male from Cetinje enrolled in the study

Year of birth	1961 (n=183)	1962 (n=361)	1963 (n=301)	1964 (n=162)	1965 (n=155)
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Age (yrs.)	17.97±0.99	17.72±0.45	17.89±0.48	18.46±0.67	18.4±0.66
Body Height (cm)	177.93±6.96	179.76±6.62	178.08±6.1	176.55±6.28	179.01±6.99
Body Weight (kg)	68.91±8.83	70.6±8.95	69.25±8.38	69.44±9.71	69.6±8.89
BMI (kg/m^2)	21.74±2.21	21.82±2.27	21.83±2.35	22.26±2.7	21.69±2.23
Year of birth	1966 (n=258)	1967 (n=218)	1968 (n=234)	1969 (n=248)	1961-1969 (n=2119)
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Age (yrs.)	18.4±0.37	18.35±0.24	17.71±0.05	17.76±0.04	18.02±.57
Body Height (cm)	179.09±5.98	177.81±6.46	177.01±7.05	178.92±6.45	178.38±6.58
Body Weight (kg)	70.95±8.99	70.49±9.07	69.59±9.3	71.74±10.35	70.16±9.17
BMI (kg/m^2)	22.11±2.49	22.26±2.33	22.17±2.36	22.35±2.56	22.02±2.4

Trends in mean body height, body weight, and body mass index (BIM) by year of birth are presented graphically (Figures 1, 2, and 3).

From Table 2, it can be observed that, in the overall sample of subjects, 4.39% were underweight, 86.27% has normal weight, 8.38% were pre-obese, and 0.9% were obese. The highest percentage of underweight is in the group of respondents born in 1963 (7.61%), while the lowest percentage is in the group of

FIGURE 1. Trends in mean body height by year of birth in young males

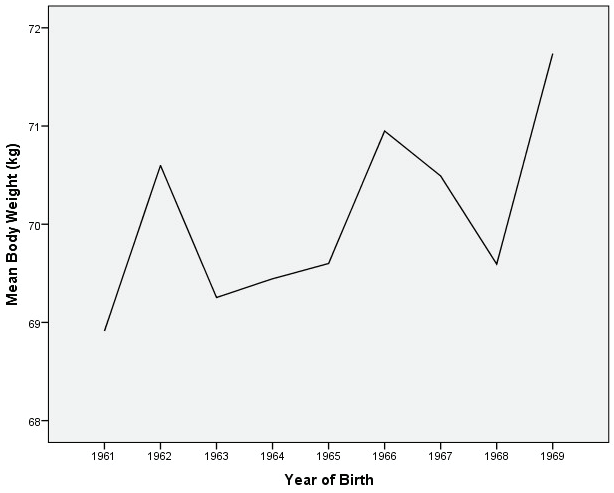

FIGURE 2. Trends in mean body weight by year of birth in young males

FIGURE 3. Trends in mean body mass index (BMI) by year of birth in young males

respondents born in 1967 (2.28%). The highest percentage of respondents with normal body weight is in the group of respondents born in 1962 (91.41%), while the lowest percentage is in the group of respondents born in 1964 (83.33%). The highest percentage of pre-obesity is in the group of respondents born in 1968 (11.97%), while the lowest percentage is in the group of respondents born in 1962 (3.6%). Lastly, the highest percentage of obesity is in the group of respondents born in 1964 (1.85%), while among respondents born in 1961 and 1968, there was not a single obese respondent.

Table 2. The Nutrition status by age and total for the young male enrolled in the study

Year of birth	1961		1962		1963		1964		1965	
	(n=183)	%	(n=361)	%	(n=301)	%	(n=162)	%	(n=155)	%
Underweight	11	6.01	13	3.6	22	7.31	6	3.7	7	4.52
Normal weight	161	87.98	330	91.41	252	83.72	135	83.33	139	89.68
Pre-obese	11	6.01	13	3.6	25	8.31	18	11.11	8	5.16
Obese	0	0	5	1.39	2	0.66	3	1.85	1	0.65
Year of birth	1966		1967		1968		1969		1961-1969	
	(n=258)	%	(n=219)	%	(n=234)	%	(n=248)	%	(n=2119)	%
Underweight	8	3.1	5	2.28	9	3.85	12	4.84	93	4.39
Normal weight	222	86.05	183	83.56	197	84.19	209	84.27	1828	86.27
Pre-obese	25	9.69	26	11.87	28	11.97	23	9.27	177	8.38
Obese	3	1.16	1	0.46	0	0	4	1.62	19	0.9

Trends in all categories of nutrition status (underweight, normal weight, pre-obese, obese) by year of birth are presented graphically (Figure 4).

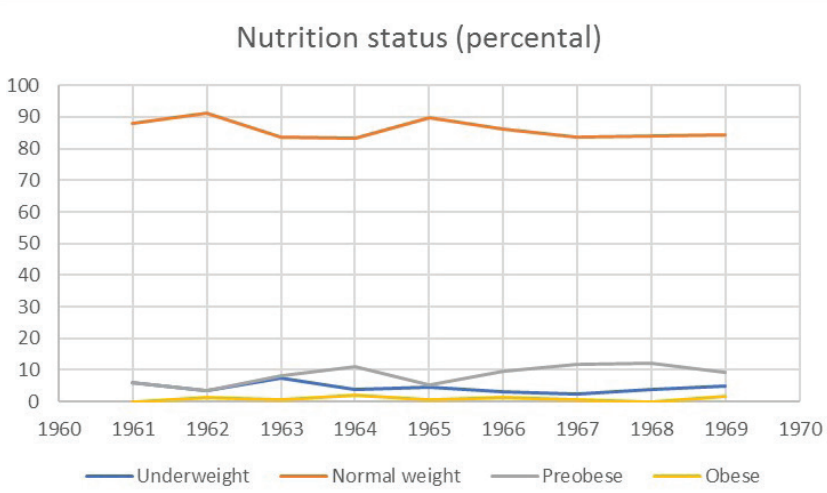

FIGURE 4. Trends in the nutrition status by year of birth in young males

Discussion

This study contributes to the previous knowledge about changes in average body height values of young Montenegrins in the previous 120 years and, in that way, more precisely tracks the secular trend. As in the beginning of the 20th century, the average body height of young Montenegrins, according to Robert Ehrich, was 177 cm (Coon, 1939) and, in the period from 1979 to 1987, young Montenegrins enrolled in this study were 178.38 cm tall, it is possible to conclude that for this period a secular trend is visible, and that body height has increased by 1.38 cm in average. Further, adding this to the results of Popovic (2017), who established that average body height of young male from 13 municipalities all over Montenegro is 183.36 cm, it is clear that the trend in this period is also ascending, and that the height of young Montenegrins increased by 4.98 cm in the last 30 years. For the period from 1979 to 1987 covered by this study, changes are not visible, which is logical, because an eight-year period is too short for a noticeable secular trend.

In accordance with body height changes, other parameters (average body weight, body mass index value, and global obesity frequency) increased for children and adolescents in the previous 40 years (NCD Risk Factor Collaboration, 2017). According to the results of the previously mentioned study, in that period, in 189 countries, the average body mass index value increased for young male respondents by more than 0.05 kg/m² for every 10 years. Furthermore, obesity in last 40 years, for children and adolescents, increased from 0.9% to 7.8%. Lastly, the percentage of underweight for young males decreased from 14.8% to 12.4%.

The present study's results indicate that in the period from 1979 to 1987, the increase in body mass index values of young male Montenegrins is visible, which can be seen in Figure 3. Therefore, respondents born from 1961 to 1965 have lower body mass indexes than respondents born from 1966 to 1969, whose body mass index value is always above 22 kg/m². This result is in accordance with the aforementioned study (NCD Risk Factor Collaboration, 2017), which indicates that obesity frequency is increasing in all countries, even if that increase is no significant in countries with high income. Furthermore, it is interesting to compare the average body mass index of respondents from this study (measured from 1979 to 1987), whose value is 22.02±2.4 kg/m², with respondents measured by Gardasevic et al. (2015), whose average body mass index value was 24.9 kg/m² (17 yrs.) and 22.8 kg/m² (18 yrs.), because can conclude that the secular trend is also evident here.

One limitation of this study is the fact that respondents' average age was 18,02 years, so it can be reasonably concluded, that at the time of measurement, their growth still had not finished. Considering this fact, it is assumed that, their body height data would progress, and would have been higher if they were measured one year later. Of course, then the difference would be greater between them and respondents who were measured at the beginning of the century, which is supported by the fact that the vast majority of young men have completed this examination before the age of 18, which practically means that the vast majority of them were underage at the time of measurement, so it can be said with certainty that they had not reached its final growth. However, military service may have been postponed until the age of 27 of each individual, which some future recruits did, and a medical examination was performed much later, and therefore raised the average age of the entire sample. Consequently, data about their final characteristics are not completely reliable. Certainly, this does not diminish the contribution of this study, which contributes to alleviating the lack of data about trends body height, body weight, and body mass index, bridging the gap of almost 100 years, in which data about such morphological characteristics of young male Montenegrins were not recorded.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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