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Morphological Characteristics and Functional Capabilities of Ground Forces Soldiers and Soldiers of the Navy of Montenegro

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Abstract

The objective of this research is to determine the status and eventual differences in morphological and functional characteristics with soldiers of Ground Forces and Navy soldiers of the Army of Montenegro. The sample of examinees was made of 50 soldiers, 18–45 years old, divided into two groups: 25 professional military personnel of Ground Forces and 25 professional military personnel of the Navy. The sample of measures has been made of the following morphological and functional indicators: body height, body mass, waist size, hip size, thorax size, upper leg size, forearm size, abdomen skinfold, chest skinfold, skinfold of the upper leg, body mass index, body fat percentage, waist-to-hip ratio, Forced Vital Capacity, Forced Expiratory Volume in 1 second, the ratio of Forced Expiratory Volume in 1 second and Forced Vital Capacity and Peak Expiratory Flow. Central and dispersion variables of parameters have been calculated; to determine differences in morphological and functional characteristics, the T-test for small independent samples has been applied. For military personnel of the Ground Forces, it was stated that this is a healthy population without obesity risk and without obstruction in the functioning of the respiratory organs. For military personnel of the Navy, notwithstanding the good respiratory function, the existence of the possibility of adverse effects of hypokinesis was determined on specific segments of their health status. Statistically significant differences between the subsamples of examinees have been determined in the morphological variables abdomen skinfold and body fat percentage; therefore, a conclusion has been made that there is a mutual dependency of the stated differences towards different possibilities of manifesting movement forms with the examined subsamples of examinees.

Keywords: *morphological and functional characteristics, differences, Ground Forces, Navy*

Introduction

The human factor with it morphological characteristics, as well as motor and functional abilities, was and has remained one of the most important objectives and qualities in the national defences worldwide, notwithstanding modern battlefield technology (Maric et al., 2013). During the selection of recruits and potential cadets, as well as during training, the analysis of morphological status tells us that the problem with overweight and excess of body fat is ongoing (Crawford et al., 2011). Such status of forces in the morphological sense, based on research studies worldwide, is a direct consequence of inadequate nutrition and insufficient physical activity, which affects functional abilities and, in a later age, seriously jeopardizes the health status of an individual (Kyrolainen et al., 2008). No soldier can be healthy if he cannot, thanks to his anthropological abilities and characteristics, perform the everyday and extraordinary tasks under increased workload and increased requests on the complete anthropological status of the body. The health of soldiers of the Army of Montenegro should be defined, among other things, by the high or optimal status of

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functional abilities and desired morphological proportions of bodily compositions (Banjevic, 2012).

Morphological characteristics describe the body constitution of a soldier based on a higher amount of anthropometric data (Jukic et al., 2008). There are various opinions regarding the ideal body composition for professional soldiers to optimize the physical fitness necessary to perform multi-purpose military tasks (Crawford et al., 2011). Since the tests of physical fitness are not a perfect indicator of condition potentials, nor do those potentials represent perfect indicators of abilities to perform concrete military duty, for example, the standard of body fat level would be an additional indicator of the level of physical activity and the ability for a certain level of desired physical performances. Furthermore, even with the adequate level of condition capacities, an inappropriately high level of body fat can be a risk factor for the cardiovascular system and musculoskeletal injuries. These risks, at least in the Army and other security services, justify the existence of standards of body size and composition, in addition to fitness standards (Vogel & Friedl, 1992).

Functional diagnostics makes an insight into certain physiological and biochemical characteristics of a soldier's body possible. For the assessment of structurally functional characteristics of the respiratory composition, spirometry tests are used (Jukic et al., 2008). Pulmonary Function Tests (PFTs) are usually used for the assessment of respiratory status and have become part of the routine health research within respiratory, work, and sports medicine (Kaur, Subhedar, Dave, Mishra, & Sharma, 2015). In his historic research, John Hutchinson (the inventor of the spirometer) found that age and height are the most important anthropometric determinants of lung function; since then many research studies have confirmed that lung function increases with the height and reduces with age (American Thoracic Society). Although the effect of body weight on lung function is visible, an additional deviation has been explained by the Body Mass Index (BMI). Lung function is reduced at both extremities of weight (i.e., emaciation or obesity) (Dockery et al., 1985). Few research studies have analysed the size of FM (body fat mass) and FFM (fat-free mass) concerning lung function. For FM, it has been observed that it is negatively connected with lung function, especially with very obese persons, while it is positively connected with FFM (De Lorenzo et al., 2001).

Recently, several studies, in Montenegro and throughout the world, have dealt with the analysis of the morphological indicators and functional abilities of soldiers (Collins, Hoberty, Walker, Fletcher, & Peiris, 1995; Rakovic & Savcic, 1999; Harik-Khan, Wise, & Fleg, 2001; Jukic et al., 2008; Banjevic, 2012; Abt et al., 2016). Based on the above-mentioned studies, it was found that significant differences appear in morphological and functional space with reference to ethnographic regions, as well as specificities of formation, age and speciality structure in the armies of the region and the world.

Accordingly, as well as with the need to analyse certain morphological and functional indicators of military personnel of different military branches, the objective of this research has been set. It includes determining the status and defining eventual differences in morphological characteristics and functional abilities of soldiers of Ground Forces and the Navy of Montenegro Army.

Methods

Sample of examinees

The sample of examinees was made of soldiers of Ground Forces and Navy soldiers of Montenegro Army of the ages 18-45. The average age was 32.3±6.5 years for the soldiers of Ground Forces, and 34.2±7.3 years of age for those of the Navy of Montenegro Army. The total number of examinees is 50, and they are divided into two subsamples. The first subsample was made of 25 soldiers from the Mountain Infantry Troop from Kolasin, while the other subsample was made of 25 soldiers of the Command and the Patrol Ship of the Navy of the Montenegro Army from Bar.

Sample of measures

The measuring was done in specially prepared premises of military quarters in Kolasin and Bar, and the examinees were dressed in sports clothing typical for physical training.

The sample of measures was made of the following morphological and functional indicators: body height, body mass, waist size, hip size, thorax size, upper leg size, forearm size, abdomen skinfold, chest skinfold, skinfold of the upper leg, body mass index, body fat percentage, waist-to-hip ratio, Forced Vital Capacity, Forced Expiratory Volume in 1 second, the ratio of Forced Expiratory Volume in 1 second, and Forced Vital Capacity and Peak Expiratory Flow.

For the assessment of morphological status, the following measuring instruments were used: anthropometer (Martin model), 200 cm long with calibrated notches on centimetres and millimetres, which makes possible a precision of measuring to 1 mm; pelvimeter with a scale on horizontal handrails which connects the two arms. The scale has a span of 60 cm, and it was calibrated to 0.1 cm; Martin's drawing compass with a scale with a span of 20 cm, was calibrated to 0.1 cm; scales (transportable), which make possible the precision of measuring to 0.5 kg, with which there is the possibility of regulating the pointer to zero position; a metal measuring tape, 150 cm long with marked centimetres and millimetres, which makes possible the precision of measuring to 1 mm; a calliper (John Bull model), for measuring skinfolds, adjusted so that the pressure of arms tips on the skin is 10 gr/mm^2. Centimetres and millimetres are marked on the calliper scale. The precision of measuring is 0.5 mm.

Parameters of body structure have been calculated in accordance with the following: Body Mass Index BMI=Body mass (kg)/Body height (m^2); percentage of body fat PTM=4.95/body density – 4.50; waist-to-hips ratio KSK=waist size/hip size.

Parameters of functional abilities have been measured employing spirometry. The test is performed in controlled microclimatic conditions. The examinee takes the turbine on which there is the cardboard ending and puts it in the mouth. He then puts the clip on the nose. Through the turbine, several times normally, in a relaxed manner, he inhales and exhales and, after that, maximally fills the lungs with air (inhales maximally). After maximum inhalation, the examinee, strongly and explosively, in as short as time possible, exhales the air from the lungs and continues exhaling, without repeating the inhale, as long as he can. After that, the examinee takes out the cardboard ending from the mouth and removes the clip from the nose.

Anthropometric measuring has been implemented by complying with basic rules and principles regarding the selection of measuring instruments and techniques of measurement, which have been standardized in accordance with the

International Biological Programme (IBP). The parameters of body structure have been calculated based on the Protocol of the Manual for the Assessment of Physical Form Connected with Health (Kaminsky, 2013). Spirometric testing has been realized in accordance with the Protocol of Soldiers Functional Abilities Diagnostic (Jukic et al., 2008).

Methods of data processing

The obtained results were first arranged appropriately, and then statistically processed on a personal computer with SPSS 20.0 software. The data were processed using descriptive and comparative statistical procedures. The central and dispersion parameters of variables have been calculated, for determining differences in morphological and functional characteristics; the T-test has been applied for small independent samples with the statistical significance of $p<0.05$.

Results

Tables 1-4 show the basic statistical descriptive parameters of morphological and functional variables of soldiers of the Ground Forces and Navy soldiers of the Montenegro Army.

Given the insight into the descriptive statistics of morphological variables of the parameters of Ground Forces soldiers of the Montenegro Army, shown in Table 1, the discrimination of measurement by the analysis of standard asymmetry ratio has been determined. The skewness value for variables of body height, forearm size and waist-to-hip ratio shows the negative asymmetry with the domination of better results, while the positive asymmetry is visible with the other variables; therefore, it is concluded that the results are in the zones of weaker values with normal or moderate asymmetry. The negative value of kurtosis for six morphological indicators shows the deviations with reference to the platykurtic curve (heterogeneity of results), meaning on more explicit discrimination among examinees, while its positive value for the remaining variables shows leptokurtosis (homogeneity of results). With reference to the measure of thorax skinfold (Kurt=5.02), we can state that the soldiers of Ground Forces of Montenegro Army are the most homogenous (significant leptokurtosis).

Table 1. Central and dispersion parameters of morphological variables of Ground Forces soldiers of the Montenegro Army

Variable	Min	Max	Mean±SD	Variance	Skewness	Kurtosis
body height	170.2	190.6	182.7±6.21	38.56	-.542	-.708
body mass	76.6	125.8	93.2±12.03	144.76	.872	.676
waist size	81.0	114.0	95.8±8.35	69.78	.361	-.419
hips size	83.5	113.0	94.8±6.57	43.22	.844	1.29
thorax size	95.0	119.0	104.9±7.24	52.54	.146	-1.10
upper leg size	50.0	71.0	59.9±4.91	24.18	.350	.272
forearm size	26.0	32.5	29.4±1.69	2.86	-.480	-.324
abdomen skinfold	9.0	40.0	20.1±8.59	73.94	.770	-.215
thorax skinfold	3.0	10.0	5.1±1.42	2.02	1.46	5.02
upper leg skinfold	4.0	18.0	7.6±3.91	15.32	1.31	.701
Body Mass Index	22.4	37.2	28.0±3.33	11.14	.685	.891
percentage of body fat	2.8	16.8	8.8±4.17	17.41	.314	-.888
waist-to-hip ratio	0.9	1.08	1.00±.033	.001	-.087	.508

Legend: Min.–minimum result; Max–maximum result; Mean–arithmetic mean; SD–standard deviation

With further inspection of results in Table 2, which refer to functional indicators of Ground Forces soldiers of the Montenegro Army, the following has been determined: skewness values for the variable regarding the ratio of the Forced Expiratory Volume in 1 second and the Forced Vital Capacity, show the negative asymmetry with the domination of better results, while for other variables, the results are in the zones of weaker values; the positive value of skewness for variables Forced Expiratory Volume in 1 second shows the homogeneity of obtained values, while platykurtosis and heterogeneity of results have been observed.

Table 2. Central and dispersion parameters of functional variables of Ground Forces soldiers of the Montenegro Army

Variable	Min	Max	Mean±SD	Variance	Skewness	Kurtosis
FVC	4.29	6.74	5.43±.672	.453	.097	-.748
FEV1	3.41	6.00	4.46±.630	.398	.882	.627
FEV1/FVC	64.5	99.90	82.65±9.75	95.11	-.367	-.553
PEF	3.50	12.50	7.85±2.80	7.87	.428	-.653

Legend: FVC–Forced Vital Capacity; FEV1–Forced Expiratory Volume in 1 second; FEV1/FVC–ratio of Forced Expiratory Volume in 1 second and Forced Vital Capacity; PEF–Peak Respiratory Flow

Based on the results of the morphological indicators of Navy soldiers of the Army of Montenegro in Table 3, we can see the normality of distribution of the majority of variables. According to the values of skewness, positive asymmetry has been dominantly present with more distinct weaker results, except for the variables body height and waist-to-hip ratio, for which a negative asymmetry is found with better results. The curve ratio indicates the heterogeneity of results and platykurtosis of the curve with the variables body height and upper leg skinfold, while with the majority of the remaining measures the homogeneity of results has been

found and leptokurtosis of the curve. With the inspection of the stated results, a distinctly expressed homogeneity for variables has been expressed: body mass (Kurt=4.63), waist size (Kurt=5.26), hip size (Kurt=8.53) and thorax skinfold (Kurt=6.30).

Table 3. Central and dispersion parameters of morphological variables of the Navy soldiers of the Montenegro Army

Variable	Min	Max	Mean±SD	Variance	Skewness	Kurtosis
body height	162.0	189.5	179.2±7.11	50.62	-.346	-.045
body mass	62.0	147.2	92.5±16.28	265.25	1.30	4.63
waist size	70.0	145.0	99.6±13.39	179.52	1.10	5.26
hips size	80.0	137.5	97.6±10.46	109.55	2.17	8.53
thorax size	93.0	138.0	107.1±9.62	92.58	1.34	3.42
upper leg size	52.5	65.5	57.6±3.34	11.21	.723	.609
forearm size	24.0	34.0	28.8±1.84	3.40	.174	2.95
abdomen skinfold	14.0	53.0	30.4±8.99	80.84	.325	.461
thorax skinfold	4.0	22.0	7.0±4.87	23.75	2.61	6.30
upper leg skinfold	4.0	13.0	8.0±2.56	6.57	.306	-.970
Body Mass Index	22.3	46.0	29.0±4.79	22.96	1.69	5.50
percentage of body fat	4.4	27.0	14.3±5.01	25.19	.491	1.00
waist-to-hip ratio	.87	1.1	1.01±.003	.002	-1.25	3.31

Regarding the descriptive indicators of functional parameters for the subsample of Navy soldiers of the Montenegro Army, shown in Table 4, and based on values of skewness, the following has been found: for variables of Forced Expiratory Volume in 1 second and the ratio of Forced Expiratory Volume in 1 second and Forced Vital Capacity, a negative asymmetry with the domination of better results, and for the remaining two variables, a positive asymmetry with the domination of weaker results. Negative kurtosis for variables Forced Vital Capacity, and Peak Expiratory Flow shows the platykurtosis and heterogeneity of results. With other variables, based on positive values of kurtosis, homogenous results can be seen, especially with the variable of the ratio of Forced Expiratory Volume in 1 second and Forced Vital Capacity (Ku=15.67).

Table 4. Central and dispersion parameters of functional variables of Navy soldiers of the Montenegro Army

Variable	Min	Max	Mean±SD	Variance	Skewness	Kurtosis
FVC	3.62	6.57	5.10±.715	.512	.080	-.262
FEV1	2.80	5.11	4.17±.466	.218	-.576	2.20
FEV1/FVC	5.00	94.70	79.06±17.07	291.57	-3.58	15.67
PEF	4.20	12.50	8.42±2.38	5.67	.404	-.201

Per the obtained results of the T-test for morphological indicators of Ground Forces soldiers and Navy soldiers of the Montenegro Army, shown in Table 5, statistically significant differences have been found in the morphological variables of abdomen skinfold and body fat percentage. It was determined that the Navy soldiers of Monrenegro Army have higher values of abdomen skinfold for 10.32 mm and of body fat percentage for 5.46%.

Table 5. The values of T-test between the arithmetic means of variables for the assessment of morphological characteristics of Ground Forces soldiers and Navy soldiers of the Montenegro Army

Variable	Rang	Mean	t	df	Sig.	Mean Dif.
body height	Ground Forces Navy	182.76 179.21	1.87	48	.066	3.54
body mass	Ground Forces Navy	93.26 92.52	.184	48	.855	.744
waist size	Ground Forces Navy	95.84 99.65	-1.20	48	.233	-3.81
hips size	Ground Forces Navy	94.84 97.64	-1.13	48	.263	-2.80
thorax size	Ground Forces Navy	104.93 107.10	-.898	48	.374	-2.16
upper leg size	Ground Forces Navy	59.90 57.65	1.88	48	.065	2.24
forearm size	Ground Forces Navy	29.42 28.86	1.11	48	.269	.560

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Variable	Rang	Mean	t	df	Sig.	Mean Dif.
abdomen skinfold	Ground Forces Navy	20.12 30.44	-4.14	48	.000	-10.32
thorax skinfold	Ground Forces Navy	5.12 7.00	-1.85	48	.070	-1.88
upper leg skinfold	Ground Forces Navy	7.64 8.08	-.470	48	.640	-.440
Body Mass Index	Ground Forces Navy	28.01 29.09	-.924	48	.360	-1.07
percentage of body fat	Ground Forces Navy	8.86 14.32	-4.18	48	.000	-5.46
waist-to-hip ratio	Ground Forces Navy	1.00 1.01	-.807	48	.424	-.009

Legend: t–t value; df–degrees of freedom; Sig.–significance; Mean Dif.–differences of arithmetic means;

Based on the obtained results of T-test for functional indicators of Montenegro Army soldiers of the Ground Forces and Navy, shown in Table 6, statistically significant differences have not been found.

Table 6. The values of T-test between arithmetic means of variables for the assessment of the functional characteristics of Montenegro Army soldiers of the Ground Forces and Navy

Variable	Rang	Mean	t	df	Sig.	Mean Dif.
FVC	Ground Forces Navy	5.43 5.10	1.65	48	.104	.325
FEV1	Ground Forces Navy	4.46 4.17	1.86	48	.068	.293
FEV1/FVC	Ground Forces Navy	82.65 79.06	.912	48	.366	3.58
PEF	Ground Forces Navy	7.85 8.42	-.782	48	.438	-.576

Discussion

Body height, as the most reliable parameter of following the growth and development with soldiers of Ground Forces of the Army of Montenegro, has the average value of 182.7 cm, which is the tallest compared to soldiers of foreign armies, whose body height has been determined by research in the Army of Serbia (Glavac, 2015), USA Army (Steed, Krull, Morgan, Tucker, & Ludy, 2016), the Army of Finland (Kyrolainen et al., 2008), the Army of Canada (Tingelstad, Theoret, Spicovck, & Haman, 2016), the Army of Turkey (Tugcu, Ozaslan, Ozaslan, & Koc, 2016) and the Army of Belgium (Mullie, Vansant, Mieke, Clarys, & Degrave, 2008). Based on that, a conclusion can be made that Montenegrin soldiers are typical representatives of their national corps, by which are confirmed the results of studies that show that Montenegrins are among the tallest nations in Europe (Bjelica et al., 2012; Milasinovic, Gardasevic, & Bjelica, 2017).

The progression of acceleration phenomenon regarding body height of soldiers can be determined by comparing the results of this research with the study realized in the 1980s in the Yugoslav National Army (Todosijevic, 1989); in 1982, the recruits from Montenegro had an average height of 176.6 cm, and in 1989 an average height of 178.9 cm. If we also take in consideration the results obtained in this study, it can be concluded that the differences found are completely in compliance with the commonly held notion that the last fifty years have brought a significant acceleration of growth in population: on average, 1–1.2 cm per decade. The increase of longitudinal dimension of the Montenegro Army Ground Forces soldiers was followed by a significant increase of their body mass and thorax size, which compared to indicators from the study (Todosijevic, 1989): 24.5 kg and 13.2 cm, respectively.

Regarding skinfolds, which are the main indicators of body fat percentage, there are lower values for soldiers of our study compared to the study or Ivkovic and Pejic (1989). Also, significantly lower values of body fat percentage have been confirmed with Montenegrin soldiers compared to the candidates of the Military Academy in Brazil. Specifically, by comparing the values of this component of body composition obtained in the study of Avila et al. (2013) with equivalent values in our study, we come to the data that the soldiers of Ground Forces of Montenegro Army are with lower values of body fat for 4.82 %. In addition, compared to the fat tissue percentage, and in accordance with the norms for the assessment of fat tissue of the Couper Institute (Kaminsky, 2013), the soldiers of the Army of Montenegro have been classified as "excellent". Regarding the level of nutritional status, based on the value of body mass index (BMI), according to Kristoforovic-Ilic (2001), the Montenegrin soldiers are classified in the category of excess body weight.

According to the results of descriptive statistical indicators of functional abilities for the subsample of Montenegro Army Ground Forces soldiers, the middle value of their Forced Vital Capacity is for 0.83 l higher than the determined value according to Guyton (1985), i.e., 0.65 l higher than the determined value towards Comroe, Forster, Dubois, Briscoe,

and Carlsen (1965). It is found that the Forced Expiratory Volume in 1 second accounts for 82.65% of vital capacity, which is a feature of healthy people with good respiratory function according to R. Medved, Heimer, Kesic, and V. Pavišic-Medved (1979). This value represents the so-called Tiffeneau Index, whose normal (reference values), according to Davidovic et al. (1975), are higher than 70%. The values of Peak Expiratory Flow, confirm the diagnosed status of lung infection and show that there is no danger from any type of airways obstruction.

Regarding the morphological indicators of Navy soldiers of the Montenegro Army, in addition to the fact that on average they are 3.5 cm shorter than the military personnel of Ground Forces, we can confirm that they are taller than the subjects the majority of previously mentioned studies.

In addition, bearing in mind the domination of longitudinal dimensions, there is also a difference in the majority of anthropometric measures in favour of soldiers of the Montenegro Army: body mass (11.9 kg), waist (10.1 cm), Body Mass Index (3.4) (Rakovic-Savcic, 1999); thorax size (1.1 cm) (Glavac, 2015). However, with the Navy sailors, a lower percentage of body mass by 4.81% has been registered compared to the Chieftains of the Army of Serbia (Rakovic-Savcic, 1999), and, in accordance with the norms for the assessment of tissue of the Couper Institute (Kaminsky, 2013), they are being classified in the category with the descriptive mark "very good". The same as the soldiers of Ground Forces, according to Kristoforovic-Ilic (2001), they belong to the population with excessive body weight. Bearing in mind that waist-to-hip ratio, with military personnel of the Navy of Montenegro Army at >0.95, they have the dominant distribution of fat tissue in the upper part of the body (Collins et al., 1995). Based on that, and in compliance with the results of the study by Harik-Khan et al. (2001), we can conclude that there is the possibility of a negative influence of fat tissue in the abdomen on the diaphragm and thoracic walls.

The obtained parameters of functional abilities of Navy soldiers of the Montenegro Army are somewhat lower than the equivalent parameters with Ground Forces soldiers, but it can be concluded that these are also healthy persons with good respiratory function, without the possibility of its obstruction on any basis. The obtained values of functional indicators with the Montenegrin Navy soldiers are lower compared to parameters of lung function of pilots of the Croatian Armed Forces (Jukic et al., 2008), in the following: Forced Vital Capacity-0.83 l, Forced Expiratory Volume in 1 second-0.48 and Tiffenau Index-1.45. Bearing in mind that our examinees are sailors, it is presumed that the stated differences are subject to specific needs and selection, which is being implemented in the Air Force.

By applying the T-test, it was determined that among the subsamples of examinees, there are statistically significant differences in morphological indicators (i.e., abdomen skinfold and percentage of body fat) in favour of Montenegro Navy soldiers. Bearing in mind the fact that these are the military personnel of the Navy Command of one of the Patrol Ships of the Montenegro Army, their limitation is stated in the sense of regular implementation of adequate physical activities, which would also condition lower values of the said morphological measures. In contrast, the military personnel of Ground Forces from the Mountain Infantry troop in Kolasin have physical training every day accompanied by specific-purpose tasks, which include the high energy activities (mountaineering, alpinism, skiing, camping in winter conditions, etc.). These differences indicate one of the basic problems in the Army of Montenegro regarding personnel employed on static working positions and spaces limited for movement (Headquarters, Unit Command structures, administration, Navy vessels, radar positions, mountain networking node etc.). The insufficient movement activity and inadequate habits of these persons condition numerous health problems and system disorders in the work-active process. These conclusions were made by numerous studies in the army, among which is the research Kyrolainen et al. (2008), which emphasizes that insufficient muscular functionality and aerobic abilities, as well as the high BMI of soldiers, are risk factors in the sense of possible absence from work due to sickness leave and inadequate performance of set tasks. The authors especially point out obesity as a factor that has social and economic and health implications in the sense of limiting functional abilities, increased mortality, and premature pension with soldiers in Finland.

Bearing in mind that this was a higher number of applied morphological indicators, there is no basis for any general statement about morphological differences between the stated groups of examinees. Furthermore, there is the fact that the results of the T-test for functional parameters have not shown statistically significant differences, bearing in mind their close connection with certain segments of morphology and body composition.

In accordance with the obtained results, it is possible to make certain conclusions. The Montenegrin soldier is taller than his counterparts from the armies of the region and throughout the world. This confirms the assumptions that this soldier is a typical representative of his people, and that Montenegrins are among the tallest people in Europe. It was found that the examined soldiers of Ground Forces of Montenegro Army are a healthy population at no risk regarding the occurrence of obesity or obstructions in the functioning of respiratory organs. With the military personnel of the Navy of Montenegro Army, notwithstanding the good respiratory function, there is a possibility of negative effects of hypokinesis on certain segments of their health status.

Accordingly, the conclusion is that the soldiers of Ground Forces of Montenegro Army can professionally and efficiently perform demanding multi-purpose military tasks without endangering their health, which is very important from the aspect of organization and realization of training. It would eventually produce a soldier who would, in accordance with all relevant standards, be compatible with his counterparts of the most developed members of NATO.

The results of this research represent the contribution in the direction of shedding light on the status of morphological and functional parameters of soldiers in the Army of Montenegro. It would be significant to implement a wider study in which comparisons would be performed of morphological and functional indicators of soldiers according to age, all branches of the army, and military specialty. Bearing in mind the size of the analysed sample, it is not possible to make additional conclusions that would be in compliance with the general principles of statistics and kinesiology. However, this does not diminish the value of this study which has indicated the great importance of following the morphological space and functional abilities of soldiers.

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Conflict of Interest
The authors declare that there is no conflict of interest.

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References

Abt, J., Perisweing, K., Nagai, T., Sell, T., Wirt, M., & Lephart, S. (2016). Effects of Age and Military Service on Strenght and Physiological Characteristics of U.S. Army Soldiers. *Military medicine, 181*(2), 173-179.

Avila, J.A., Barros Lima Filho, P.D., Pascoa, M.A., & Tessutti, L. (2013). Effect of 13 Weeks of Military Exercise Training on the Body Composition and Physical Performance of EsPCEx Students. *Revista Brasileira de Medicina do Esporte*, *19*(5), 363-366.

American Thoracic Society (1991). Lung function testing: selection of reference values and interpretative strategies. *American Review of Respiratory Disease*, *144*, 1202-1218.

Banjevic, B. (2012). *Model values of motor and morphological status of military personnel of the Air Force Base of Montenegro Army and their influence on complex motor activities*. Unpublished master thesis. Niksic: University of Montenegro.

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.

Collins, L., Hoberty, P., Walker, J., Fletcher, E., & Peiris, A. (1995). The effect of body fat distribution on pulmonary function tests. *Chest*, *107*(5), 1298-1302.

Comroe, J., Forster, R., Dubois, A., Briscoe, A., & Carlsen, E. (1965). *The lung, p. 10*. Chicago: Year Book Medical Publishers.

Crawford, K., Fleishman, K., John, P., Sell, T., Lovalekar, M., Nagai, T., Deluzio, J., Rowe, R., & Lephart, S. (2011). Less Body Fat Improves Physical and Physiological Performance in Army Soldiers. *Military medicine, 176*(6), 35-43.

Davidovic, J., Rajsic, R., Radovic, A., Debijadi, R., Risavi, A., Kolak, A., Popovic, R., & Dzelajlija, S. (1975). *Aviation medicine*. Belgrade: Command of Air Force and Anti-Aircraft Artillery Defence.

De Lorenzo, A., Maiolo, C., Mohamed, E., Andreoli, A., Petrone, P., & Rossi, P. (2001). Body composition analysis and changes in airways function in obese adults after hypocaloric diet. *Chest*, *119*(5), 1409-1415.

Dockery, D., Ware, J., Ferris, G., Glicksberg, D., Fay, M., Spiro, A., & Speizer, F. (1985). Distribution of forced expiratory volume in one second and forced vital capacity in healthy, white, adult never-smokers in six U.S. cities. *American Review of Respiratory Disease*, *131*(4), 511-520.

Glavac, B. (2015). *Motor abilities, morphological status and life habits with military personnel of the Army of Serbia*. Unpublished doctoral thesis. Belgrade: University of Belgrade.

Guyton, A. (1985). *Medical Physiology*. Belgrade-Zagreb: Medical book.

Harik-Khan, R., Wise, R., & Fleg, J., (2001). The effect of gender on the relationship between body fat distribution and lung function. *Journal of Clinical Epidemiology*, *54*(4), 399-406.

Ivkovic, Z., & Pejic, R. (1989). *Effect of Training on the Development, Nutrition and Physical Ability of Soldiers.* Belgrade: Surgeon General Office of the Main Quarters of Yugoslav National Army-Federal Secretariat for Public Defence.

Jukic, I., Vucetic, V., Aracic, M., Bok, D., Dizdar, D., Sporis, G., & Krizanic, A. (2008). *Diagnostics of Fitness Readiness of Soldiers*. Zagreb: Faculty of Kinesiology.

Kaminsky, A. (2013). *Manual for the Assessment of Physical Form connected with Health*. Belgrade: Data Status.

Kaur, A., Subhedar, R., Dave, P., Mishra, P. & Sharma, D. (2015). Physiotherapeutic study analyzing the relationship between body composition and lung function. *International Journal of Physiotherapy and Research*, *3*(5), 1233-1238.

Kristoforovic-Ilic, M. (2001). *Hygene-Manual with practicum*. Novi Sad: OrtoMedics.

Kyrolainen, H., Hakkinen, K., Kautiainen, H., Santtila M., Pihlainen, K., & Hakkinen, A. (2008). Physical fitnes, BMI and sickness absence in male military personel. *Occupational Medicine*, *58*(4), 251-256.

Maric, L., Krsmanovic, B., Mraovic, T., Gogic, A., Sente, J., & Smajic, M. (2013). The effectiveness of physical education of the Military Academy cadets during a 4-year study. *Military Medical Review*, *70*(1), 16-20.

Medved, R., Heimer, S., Kesic, B., Pavišic-Medved, V. (1987). *Sports Medicine*. Zagreb: JUMENA.

Milasinovic, R., Gardasevic, J., & Bjelica, D. (2017). Body heiht and its estimation utilizing arm span measurements in male adolescents from northern region in Montenegro. *Acta Kinesiologica*, *11*(2), 75-80.

Mullie, P., Vansant, G., Mieke, H., Clarys, P., & Degrave, E. (2008). Evaluation of Body Fat Estimated from Body Mass Index and Impedance in Belgian Male Military Candidates: Comparing Two Methods for Estimating Body Composition. *Military medicine, 173*(3), 266-270.

Rakovic-Savcic, L. (1999). *Anthorpometric Indicators of Obesity in a Targeted Detection of Risk from Cardiovascular Diseases of Chieftains*. Unpublished doctoral thesis. Belgrade: VMA.

Steed, C., Krull, B., Morgan, A., Tucker, R., & Ludy, M-J. (2016). Relationship between body fat and physical fitness in Army ROTC cadets. *Military medicine, 181*(9), 1007-1012.

Tingelstad, H., Theoret, D., Spicovck, M., & Haman, F. (2016). Explaining Performance on Military Tasks in the Canadian Armed Forces: The Importance of Morphological and Physical Fitness Characteristics. *Military medicine, 181*(11/12), 1623-1629.

Todosijevic, M. (1989). *High Psychophysical Ability of Recruits Necessary for Quality Filling of Most Branches and Services of the Yugoslav National Army and the Effect on the Ones with Limited Ability*. Belgrade: Federal Secretariat for National Defence.

Tugcu, H., Ozaslan, A., Ozaslan, I., & Koc, S. (2006). Estimation of Stature from Upper Extremity. *Military medicine, 171*(4), 288-291.

Vogel, J., & Friedl, K. (1992). *Body Composition and Physical Performance Applications for Military Services*. Washington: National Academies Press.