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Original Article

Factors that influence changes in cadets' physical preparation during the first half of study at a military academy

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Abstract:
We defined the structure of boys aged 17-18 who were cadets of the military academy, which marked a change in their physical preparation in the first half of the study. The number of examinees was 112 boys, 34 of whom at the end demonstrated high, others - good and satisfactory levels of professional competence. In each of these two samples of cadets, we studied the structure of changing their physical preparation during the first and second years of study at the military academy. Such preparation was characterized by motor abilities, we determined their development by means of tests recommended by Eurofit specialists in physical education and military training. The data obtained in the first and second years of study indicate that the structure of change in physical preparation in experimental groups is significantly different. Primarily, it concerns the composition of indicators, the value of each contribution to the overall structure of change and the values of the total dispersion of all isolated factors of physical preparation. The obtained data should be taken into account during the improvement of the program of physical training of military academy cadets during each year of study. The basis should be focused on the development of physical qualities, which marked the structure of changes in physical preparation in the sample of exemplary cadets.
Keywords: cadets, military academy, physical preparation, structure of change, factors.

Introduction

Professional competence of military men of different specialties is formed during their training in special institutions of higher education. Such competence depends on the level of preparation of cadets in each direction, which is defined by the content of the program of military training of a certain specialty. Without analyzing the names, the number and content of such areas, we note only that they are all interrelated and interdependent (Gonshovskiy, Fotuima, Iedynak, 2009; Romanchuk et al., 2012; Buns, 2015). The non-evidence fact that one of the leading places in the formation of the components of the professional competence of the military man of any specialty belongs to physical preparation. In addition, the level of preparation in many components of "professional preparation" is in direct accordance with the level of physical preparation (Iedynak, Prystupa, 2012; Rolyuk, et al., 2016). The degree of such dependence has not yet been established, but its presence is not doubt among researchers (Romanchuk, 2012). During the study of physical preparation of young cadets (Iedynak Mysyv, Skavronsky, 2012), their somatic health (Kamaev et al., 2017), we established, among other things, also their factor structure. In particular, we determined the factors that influence the somatic health of boys at the beginning and end of the school year, and the indicators from which the change in physical preparation in the period of 15-17 years depends to a large extent. At the same time, practically out of the attention of researchers remained an approach that involves the use of data reflecting the change in the studied indicators for a certain period, rather than the manifestation of the values of these indicators at the time of obtaining data. In other words, the structure of change in physical preparation is studied, instead of the manifestation of its indicators at a certain moment. The importance and necessity of information on the structure of change in physical preparation is due, first of all, to the ability to improve the content of training programs for physical training of different contingents, including military men of different specialties in general and border guards in particular.

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Materials and methods

The study involved 112 boys, the age of all was within the range of 17.1 ± 1.4 years. With the beginning of the study, 60 boys became cadets of the military academy, the rest (52 boys) - one year later. The study was conducted in compliance with the World Medicine Association declaration of Helsinki: Ethical principles for medical research involving human subjects, 2013. The study protocol was approved by the Ethical committee of the Kamianets-Podilskyi National Ivan Ohiienko University. We studied the structure of change in the physical preparation of cadets during the first half of the study at the academy, but taking into account the level of their professional competence. Such a level was determined by the results of the exams that the cadets made at the end of the training at the academy, that is, after the completion of the entire four-year period. To do this, we first collected information about the physical preparation of the surveyed cadets from the beginning of their studies at the academy to the completion. At the end of the training, namely after completing the final examinations, we formed two samples of all 112 cadets. One was composed of cadets who passed the exam on the rating "excellent" (high level of professional competence - E); there were 34 such cadets. In another sample there were cadets who were rated "good" or "satisfactory" (average professional competence - GS).

To obtain the necessary data, a battery of tests was formed. These tests met the established requirements (Serhiyenko, 2001; Turvey, Fonseca, 2009; Schmidt, & Lee, 2013) and contained the most common in the practice of physical education motor tasks (Eurofit, 1993; Fitness testing, 2017; Thomas, Nelson, & Silverman, 2011; What is physical fitness, 2017). The battery included tests that allowed to explore such physical qualities: dynamometry (handgrip Camry dynamometer, back dynamometer from Baseline Products) - maximum isometric strength; jump in length from place, pitching 1 kg ball with two hands from behind the head sitting legs apart - speed force of the muscles of the lower and upper extremities; 100-metres race - speed endurance; 3000-metres race - aerobic endurance; bent suspension - static strength endurance; forward tilt, dislocation of a ruler behind the back with two hands, without bending them in the elbow joints - flexibility; high-speed endurance in complex coordination motor activity - special exercise for the military men (general control exercise on the barrier of obstacles); 20- metres run test - to evaluate the complex development of two independent components of speed qualities, namely the speed of the individual movement and the frequency of movements; in this case, another independent component (the time of the motor reaction) in the test was isolated so that it did not affect the result. Taking into account the recommendations, we also studied some manifestations of coordination, in particular of cyclic locomotion (shuttle run 3x10 metres), of acrobatic motions (three somersaults forward) (Omorczyk, Lah, 2009).

All statistical analyses were performed using SPSS Version 21. Test results were processed with the help of factorial analysis, which envisaged the definition of the main components of the use of varimax rotation for the normalization of data (Khalafian, 2007; Ivashchenko, & Nosko, 2016).

Results

The change in the physical preparation of cadets from sample E in the first year of study was characterized by a structure of six statistically independent factors. The contribution of the five factors to the overall dispersion was 72.4%, not considered factor - 27.6% (fig. 1). There were also six factors in the GS sample, but the contribution of the five was 58.6%, not considered factor - 41.4% (fig. 2).

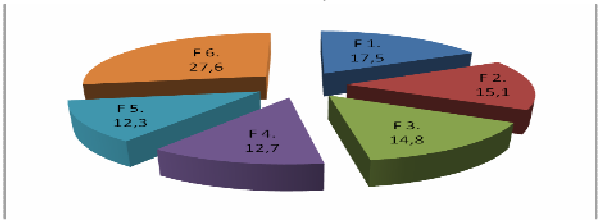

Fig. 1. Factorial structure changes in the physical preparation of cadets from sample E during the first academic year. F_1- first factor, F_2- second factor, F_3- third factor, F_4- forth factor, F_5- fifth factor, F_6 - not considered factors

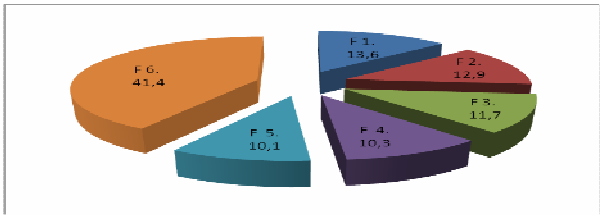

Fig. 2. Factorial structure changes in the physical preparation of cadets from sample GS during the first academic year. F_1- first factor, F_2- second factor, F_3- third factor, F_4- forth factor, F_5- fifth factor, F_6 - not considered factors

There were also different results in the experimental samples. Thus, in the sample E the most important indicators of the first factor were jump in length from place and 3000-metres race, and their factor loads were r =

0.879 and r = 0.726 respectively. The contribution of this factor to the total dispersion was 17.5%. In the GS sample, the most important indicator of the first factor was only the jump in length from place (r = 0.659), and the contribution to the total dispersion was 13.6%. The contribution of the second factor to the total dispersion in sample E was 15.1%, in sample GS - 12.9%. The most important indicator in sample E - sit and reach (r=0.659), GS - two indicators: dynamometry of a wrist (r=0.741) and 20-meters race (r=0.753). The contribution of the third factor to the overall dispersion was as follows: E - 14.8%, GS - 11.7%; the most important indicators in sample E - dynamometry of a wrist (r=0.812) 20-metres race (r=0.903), in sample GS - dynamometry of back muscles (r=0.755) and special exercise for the military men (r=0.781). The fourth factor was characterized by the following features: In sample E its contribution to the general dispersion was 12.7%, in sample GS - 10.3%; the most important indicator of factor in sample E - dislocation of a ruler behind the back (r=0.869), in sample GS - bent suspension (r=0.715). Contribution of the fifth factor was: in sample E - 12.3%, in sample GS - 10.1%; in sample E the most important indicators of this factor were dynamometry of a wrist (r=0.723) and pitching 1 kg ball (r=0.747), in sample GS - only 3000 metres race (r=0.704).

During the second year of study in the sample E, the structure of change in the physical preparation of the cadets was represented by six statistically independent factors. The contribution of the five factors to the total dispersion was 60.8%, the not considered - 39.2% (fig. 3). There were also six factors in the sample GS, but the contribution of the five was 55.9%, the not considered - 44.1% (fig. 4).

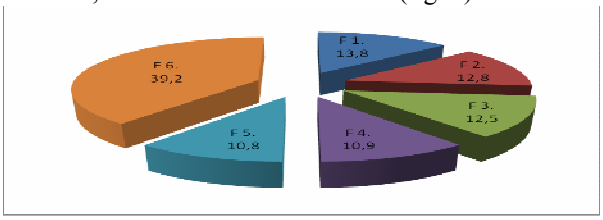

Fig. 3. Factorial structure changes in the physical preparation of cadets from sample E during the second academic year. F_1- first factor, F_2- second factor, F_3- third factor, F_4- forth factor, F_5- fifth factor, F_6 - not considered factors

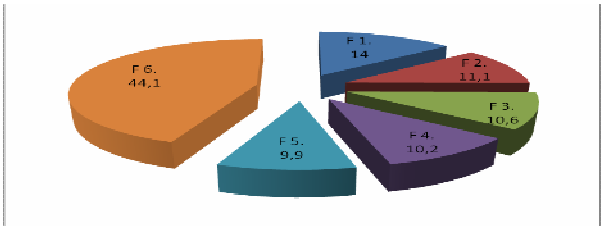

Fig. 4. Factorial structure changes in the physical preparation of cadets from sample GS during the second academic year. F_1- first factor, F_2- second factor, F_3- third factor, F_4- forth factor, F_5- fifth factor, F_6 - not considered factors

In the sample E the most important indicator of the first factor was bent suspension, and factor load - r=0.826. In the sample GS the most important indicators of the first factor were 100-metres race (r=0.832) and special exercise for the military men (r=0.811). The contribution of the second factor to the general dispersion in sample E was 12.8%, in sample GS - 11.1%; the most important indicator - dislocation of a ruler behind the back (r=0.837) and dynamometry of back muscles (r=0.734). Contribution of the third factor in sample E was 12.5%, in sample GS - 10.6%; the most important indicators in sample E - 100-metres race (r=0.826) and special exercise for the military men (r=0.754), in sample GS - pitching 1 kg ball with two hands from behind the head sitting (r=0.691). The fourth factor was characterized by the following features: in sample E its contribution to the total dispersion was 10.9%, in sample GS - 10.2%; the most important indicator of the factor – respectively dynamometry of a wrist (r=0.817) and standing long jump (r=0.747). Contribution of the fifth factor in sample E was 10.8%, in sample GS - 9.9%. In sample E the most important indicator of this factor was 3000-metres race (r=0.792), in sample GS — 3000-metres race (r=0.717) and sit and reach (r=0.725).

Discussion

The interpretation of the data of each factor that has been accentuated allows to understand them better. In this regard, the following was taken into account: each indicator should be considered as a certain physical quality; if there are several indicators, then initially we are looking for the existing common things, or what they can be combined with, usually based on the logic of things; if it is impossible to realize, then we choose the specified one, namely, with a larger factor load (Khalafian, 2007; Greenfield, Almond, Clarke, & Edwards, 2015; Bliznevsky, Kudryavtsev, & Yermakova, 2016; Kamaev et al., 2017). Taking into account the above it was found that samples E and GS differ significantly from each other by the composition of indicators, the magnitude of the contribution of each to the overall structure of change in physical preparation and the values of the overall dispersion of all isolated factors. This concerns the all first half of the training of young men at the

military academy. As one of the global causes of such a result, we considered the peculiarity of cadets, according to which they were divided into two samples; it is to be recalled that this is the level of professional competence (high or average) that the cadets demonstrated after completing their studies at the academy. This peculiarity was largely due to the discrepancy in the state of the formation of the motivation of students to achieve the highest level of professional competence. The result depends to a large extent on internal factors, if the external ones are the same (Gonshovskiy, Fotuima, Iedynak, 2009; Iedynak, Mysyv, Skavronsky, 2012; Derkach, Iedynak, 2014). One of the internal factors that determines the result achieved by the individual is his motivation, namely the state of its formation (Ajzen, 2005; Rintaugu, Ngetich, 2012; Stanley, Cumming, Standage, & Duda, 2012; Makarowski, 2013; Iedynak, Galamandjuk, & Yurchyshyn, 2017).

Another reason was related to the discrepancy in the development of the studied physical qualities of cadets of the sample E and GS before the beginning of studies at the academy. The use of the same training programs by young people peers leads to a different result in the development of their physical qualities. This happens if the level of development of these qualities of young people was different before the beginning of the training program usage (Dick, 2007; Gonshovskiy, Fotuima, Iedynak, 2009; Iedynak, Mysyv, Skavronsky, 2012; Schmidt, & Lee, 2013). The main cause for this result is the dispersed cumulative adaptation that occurs when using training programs that involve the development of not one (two), but many physical qualities (Wilmore, Costill, Kenney, 2012; Iedynak, Galamandjuk, & Chopik, 2017).

Regarding the most important indicators that were set in sample E, GS in the first and second years of study, then their interpretation, taking into account all available information, led in such a result. In the first year of study, the factor structure showed that improvement of the physical preparation of the cadets depended on the development of such physical qualities: sample E - from aerobic endurance, flexibility in different parts of the body, speed qualities, speed force of the upper extremity muscles; sample GS - speed force of the lower extremities muscles, speed qualities and endurance types, namely the force in complex coordination motor activity, power in the static mode and aerobic endurance. In the second year of training, the improvement physical preparation in sample E depended on the development of different types of endurance, namely, power in static mode, high speed in complex coordination motor activity, aerobic, as well as flexibility and maximum isometric strength of cadets. In the sample GS, the improvement of high-speed endurance in the complex coordination activity, the maximum isometric strength, speed force of the muscles of the lower extremities, upper extremities, and aerobic endurance was crucial for improving physical preparation. Apparently, the most important indicators that characterize the structure of changing the physical preparation of cadets from samples E and GS, differ between themselves in the first as well as in the second year of study at the academy. The divergences found were due to a set of reasons, some of which were as follows: in the first year of study, the result provided a cross-effect, which formed the basis of cumulated adaptation formed in cadets (Wilmore, Costill, Kenney, 2012); in sample GS, this effect was more pronounced than in sample E, but it was caused by lower values of physical preparation indicators at the beginning of studies at the academy (Gonshovskiy, Fotuima, Iedynak, 2009; Turvey, Fonseca, 2009; Gagea, 2010). The essence of the cross-sectional effect is that influencing a certain physical quality is the development of not only this, but also of a different quality or even several ones, to which such influence was not exercised (Iedynak, Mysyv, Skavronsky, 2012; Schmidt, & Lee, 2013). The result, obtained at the end of the second year of training, was consistent with the information that the adaptation of the organism to specific loads the performance of the cross-effect become weaker, but the process of forming functional systems intensifies. Such systems provide the implementation of specific types of muscle activity at a higher stage of long-term adaptation (Wilmore, Costill, Kenney, 2012; Katzmarzyk, Silva, 2013).

Conclusions

The changes in the physical preparation of the cadets who at the end of the military academy attained high and lower levels of professional competence, differ from each other during the first two-year half of the training. The changes revealed in each sample during the first and second years of study lead to the development of unequal physical qualities. To develop the efficiency of the program for improving the physical preparation of cadets throughout the period of training at the military academy, it is advisable to make adjustments to the content of the program. Such adjustments should include an emphasis on the development of physical qualities, which marked the structure of change in physical preparation in the sample of exemplary cadets.

Conflicts of interest

No conflicts of interest exist.

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