

MORPHOFUNCTIONAL STATUS OF INSTRUCTORS OF HIGHER EDUCATIONAL INSTITUTIONS DURING THEIR PEDAGOGICAL ACTIVITIES

DOI: 10.36740/WLek202302121

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ABSTRACT

The aim: To research the morphofunctional status of instructors of higher educational institutions of different age groups in the process of their pedagogical activities.

Materials and methods: The research was conducted in the period from 2019 to 2021. The research involved 126 instructor officers (men) of different age groups: under 30 years of age – 21 people, 31-35 years of age – 27 people, 36-40 years of age – 32 people, 41-45 years of age – 27 people, over 45 years of age – 19 people. Morphofunctional status of the instructor officers was assessed by the indicators of their height, body weight, lung vital capacity, wrist dynamometry, heart rate, blood pressure and relevant indices.

Results: It was found that during the study (2019-2020) the Kettle index, vital index, strength index, Robinson index and duration of recovery processes deteriorated among instructor officers of all age groups. However, in instructor officers of 36-40, 41-45 and over 45 years of age most of indices deteriorated reliably ($P < 0.05$). The values of the studied indices are below average or low in most instructors of all age groups, most instructors are overweight.

Conclusions: It was found that the level of morphofunctional status of the instructional staff is insufficient to perform the tasks of their pedagogical activities. Rationally organized health-improving physical training sessions, taking into account the age group, morphofunctional status of instructors and the time of training sessions during the working day can be an effective way to solve this problem.

KEY WORDS: physical training, health, morphofunctional status, instructor officers

Wiad Lek. 2023;76(2):391-397

INTRODUCTION

There is a constant need in society for the training of qualified, highly moral and faithful to the state ideals law enforcement officers [1-4]. Their physical training plays an important role under these circumstances [5-7]. There is a growing need to improve the organization and conduct of physical training sessions with all categories of law enforcement officers in order to improve indicators of their physical fitness, morphofunction status and health [8-10].

The analysis of the work of many scientists [11, 12] has shown that there has been a tendency to reduce the level of physical fitness and health of the population of Ukraine in recent years, and law enforcement officers

are no exception. This is especially true of instructional staff of higher educational institutions of Ukraine with specific learning environment (HEI SLE), whose professional pedagogical activities are characterized by a significant reduction in physical activity.

The professional pedagogical activities of instructor officers of HEIs SLE is accompanied by a significant number of negative factors, including: low motor activity, nervous and emotional stress, mental overload and stress, monogony and forced working posture and others [13-16]. The action of negative factors during service activities causes a set of functional disorders in instructors that affect the functions of the cardiovascular system, respiratory system, nervous system,

musculoskeletal system and results in metabolic disorders. The pedagogical activities are characterised by the fact that instructor officers receive almost no physical load, which leads to a significant reduction in energy expenditure, accumulation of excess nutrients in the body and increase of excess body weight [17-20].

THE AIM

The aim is to research the morphofunctional status of instructors of higher educational institutions of different age groups in the process of their pedagogical activities.

The hypothesis of the research is to study the level and dynamics of indicators of the main life support systems of the body (cardiovascular, respiratory and muscular) of the instructor officers of the HEI SLE of different age groups under the influence of negative factors of their professional activity in order to justify the content of health-improving classes with physical exercises taking into account their age group and morphofunctional status.

MATERIALS AND METHODS

The research of indicators of morphofunctional status of the instructional staff was conducted in the period from 2019 to 2021 at National Academy of Internal Affairs (NAIA, Kyiv, Ukraine). The research involved 126 instructor officers (men) from different departments of NAIA. The studied

contingent was divided into age groups: under 30 years of age – 21 people, 31-35 years of age – 27 people, 36-40 years of age – 32 people, 41-45 years of age – 27 people, over 45 years of age – 19 people. This distribution of officers is determined by the Order of the Ministry of Internal Affairs of Ukraine dated January 26, 2016 No. 50 "On approval of the Regulation on the organization of official training of employees of the National Police of Ukraine" (<https://zakon.rada.gov.ua/laws/show/z0260-16#Text>). Research methods: analysis and synthesis of literature, pedagogical observation, medical and biological methods, methods of mathematical statistics.

Morphofunctional status of the instructor officers was assessed by the indicators of their height, body weight, lung vital capacity, wrist dynamometry, Kettle index, vital and strength indices, Robinson index, heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP), time of restoring heart rate to baseline after 20 squats for 30 seconds. The research of the indicators of morphofunctional status of the instructors was conducted at the Central Polyclinic of the Ministry of Internal Affairs of Ukraine (Kyiv) during the medical examination by medical staff in the morning. The following devices were used: electronic scales (TEFAL Atlantis, REF: PP-3019 B6, max 160 kg) with an accuracy of 100 g, height meter (P No. 175, value of the smallest graduation in 1 cm), manual dynamometer (DRP-90; value of the smallest graduation in 2 kgf), electronic spirometer ("SPIROPRO", BTL-08), electronic tonometer ("SANITAS", SBM-07).

The Kettle index (KI) characterizes the features of the body-build of the instructors, defined in g / cm as the

Table I. The assessment of the Kettle index for 30-59 year-old-men (g / cm)

The value of the KI	The indicator of body weight
≥ 540	Adiposity
451-540	Overweight
416-450	Excess weight
400	Good weight
360-399	Average weight
320-359	Insufficient weight
300-319	Extremely insufficient weight
200-299	Exhaustion

Table II. The assessment of indices that characterize the morphofunctional status of instructor officers

The level of indices values	Studied indices				
	KI, g / cm	VI, ml / kg	SI, %	RI, c.u.	TRHRB, s
Low	501 and >	50 and <	60 and <	111 and >	180 and >
Below average	451-500	51-55	61-65	95-110	120-180
Average	450 i <	56-60	66-70	85-94	90-120
Higher than average	-	61-65	71-80	70-84	60-90
High	-	66 and >	81 and >	69 and <	59 and <

Table III. The dynamics of morphofunctional status of instructor officers of different age groups in the process of their pedagogical activities (n=126, Mean±SD)

Years of research	Age groups				
	Under 30 years of age	31-35 years of age	36-40 years of age	41-45 years of age	Over 45 years of age
	n=21	n=27	n=32	n=27	n=19
KI (g / cm)					
2019	415.35±7.60	433.28±8.69	457.08±6.88	460.68±7.29	463.67±8.46
2020	430.21±10.21	440.48±8.82	469.02±7.03	472.76±7.90	476.15±9.42
2021	434.60±8.77	448.80±8.50	481.84±6.70	483.58±7.68	488.94±9.27
P ₁₉ -P ₂₀	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
P ₂₀ -P ₂₁	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
P ₁₉ -P ₂₁	> 0.05	> 0.05	< 0.05	< 0.05	< 0.05
VI (ml / kg)					
2019	56.19±2.06	55.79±1.43	54.81±1.50	54.46±1.14	52.31±1.31
2020	55.65±1.28	54.32±1.47	52.77±1.53	52.26±1.18	51.45±1.45
2021	54.75±1.66	52.79±1.42	50.48±1.49	50.17±1.27	48.02±1.39
P ₁₉ -P ₂₀	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
P ₂₀ -P ₂₁	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
P ₁₉ -P ₂₁	> 0.05	> 0.05	< 0.05	< 0.05	< 0.05
SI (%)					
2019	61.94±2.20	60.38±1.43	57.76±1.40	56.08±1.45	55.01±1.44
2020	59.98±2.36	58.37±1.39	55.34±2.12	54.86±1.46	53.67±1.56
2021	59.05±1.96	57.77±1.20	54.42±1.54	52.25±1.49	50.10±1.50
P ₁₉ -P ₂₀	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
P ₂₀ -P ₂₁	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
P ₁₉ -P ₂₁	> 0.05	> 0.05	> 0.05	> 0.05	< 0.05
RI (c. u.)					
2019	88.36±0.95	91.55±1.37	93.18±1.45	94.30±1.90	95.51±2.41
2020	89.17±1.25	92.01±1.58	94.27±1.76	95.72±1.55	96.36±1.61
2021	89.86±0.85	92.96±1.81	94.97±2.05	96.43±1.32	97.65±1.41
P ₁₉ -P ₂₀	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
P ₂₀ -P ₂₁	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
P ₁₉ -P ₂₁	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
TRHRB (s)					
2019	110.43±5.62	123.44±5.64	135.56±7.01	137.26±5.40	140.21±8.02
2020	109.81±6.19	126.78±5.43	141.38±7.29	142.44±6.41	147.79±6.95
2021	111.14±5.97	131.11±6.88	146.33±6.72	147.25±5.86	148.03±6.93
P ₁₉ -P ₂₀	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
P ₂₀ -P ₂₁	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05
P ₁₉ -P ₂₁	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05

Note: P₁₉-P₂₀, P₂₀-P₂₁, P₁₉-P₂₁ - the significance of the difference between the officers' indicators in 2019-2020, 2020-2021, 2019-2021 respectively, determined by means of Student's t-test

ratio of their body weight to their height. The assessment of the Kettle index for 30-59 year-old-men was carried out according to Table I and Table II.

The vital index (VI) is an important criterion for the reserve of external respiration functions, defined as the ratio of vital capacity of the lungs to body weight

(ml / kg). The strength index (SI) characterizes the state of the muscular system. It is determined by the ratio of the dynamometry of the stronger hand to body weight (%). The Robinson index (RI) characterizes the reserve and economization of cardiovascular functions. Decreasing of the indicator determines the improvement of a par-

ticular system. The Robinson index was determined by the formula: $RI = (\text{heart rate} \cdot \text{SBP}) / 100$, where heart rate is the heart rate at rest for 1 minute (beats / min), SBP is systolic arterial blood pressure (millimetre of mercury). The assessment of vital, strength indices, Robinson index and time of restoring heart rate to baseline (TRHRB) was carried out in accordance with Table II.

The methods of mathematical statistics were used to check, systematize and correctly process the received data and present them in tabular form. The significance of the difference between the studied indicators was determined by means of Student's t-test. The significance for all statistical tests was set at $p < 0.05$. All statistical analyses were performed with the IBM SPSS Statistics 21 software, adapted to medical and biological researches.

This study followed the regulations of the World Medical Association Declaration of Helsinki – ethical principles for medical research involving human subjects. The procedure for organizing this study was previously agreed with the committee on compliance with Academic Integrity and Ethics of the NAIA. The topic of the study was approved by the Academic Council of the NAIA (No. 12 dated 28.08.2020). Informed consent was received from all participants who took part in this study.

RESULTS

The study of the Kettle index gives the right to conclude that no significant difference between the average indicators of the instructor officers of age groups under 30 years of age and 31-35 years of age was identified during 2019-2021 ($P > 0.05$). In instructors of 36-40, 41-45 and over 45 years of age during 2019-2021 indicators of the Kettle index significantly ($P < 0.05$) worsened by 24.76 g / cm, 22.90 g / cm and 25.27 g / cm respectively (Table III). Comparing the KI in the instructors under 30 years of age and over 45 years of age at the end of the research (2021) it can be noted that the index value is significantly worse by 54.34 g / cm in the instructors of the older age group ($P < 0.05$). The assessment of the KI shows that only the instructors under 30 years of age at the beginning of the research (415.35 g / cm) were characterised by the index at the average level of its fullness for men and corresponded to the indicator of "good weight". The instructors under the age of 30 in 2020 and 2021, as well as the instructors of 31-35 years of age were characterised during the research as those having "excess weight". The KI of the instructors of other age groups indicated "overweight" in the instructional staff of the HEI SLE. The research conducted showed that the pedagogical activities of the instructor officers in the HEI SLE are characterized by a hypodynamic regime and an increase in body weight in the process

of their service. This indicates the need to improve the instructional staff's physical fitness in order to stabilize their body weight.

The research of the dynamics of the VI in the process of pedagogical activities of the instructional staff gives the right to state that the indicators of the instructor officers of all age groups tend to decrease, but did not change significantly during the research ($P > 0.05$) in instructors of age groups of under 30 years of age and 31-35 years of age. In instructor officers of 36-40, 41-45 and over 45 years of age during 2019-2021 indicators of the VI index significantly ($P < 0.05$) worsened by 4.33 ml / kg, 4.29 ml / kg та 4.29 ml / kg respectively (Table III).

Comparing the indicators of the VI in the officers of different age groups, it can be noted that in 2021 a significant difference was found only between the values of the instructors under 30 and 40-45 and over 45 years of age in 2019 ($P < 0.05$; $P < 0.01$). The highest indicators of the VI were recorded among the instructor officers under 30 years of age i. e. the value was assessed as "below average" (56.19 ml / kg) at the beginning of the research, and as "below average" (54.75 ml / kg) at the end of the research. The instructors of other age groups had below average level of the VI at the beginning of the research and below average and below (instructor officers over 45 years of age) levels at the end of the research. All this indicates the weakening of the functional capabilities of the respiratory system in the instructional staff, both in the process of their pedagogical activities and with increasing age group.

The analysis of the strength index showed that its value in instructor officers of all groups decreased in the process of their pedagogical activities, but did not differ significantly in all age groups at the beginning and the end of the research ($P > 0.05$) except instructori over 45 years of age. The difference between SI indicators at the beginning and at the end of the research in this group of instructor officers is 4.91 % and is significant ($P < 0.05$) (Table III). The indicators of the SI reduced in the instructor officers over 45 years of age compared to the instructors under 30 years of age by 6.93; 6.31; and 8.95 %, respectively ($P < 0.05$ - $P < 0.01$) and were the lowest. Analysing the SI indicators, it can be noted that only the instructors under 30 years of age were characterised in 2019 by its value below average, and in 2020 and 2021 and during the research the level of reserves of muscular system functions was estimated as "low" in all other groups of the instructor officers.

The research of the RI in the instructor officers showed a deterioration of the indicators from 2019 to 2021 in all study groups ($P > 0.05$): the difference between the indicators of 2019 and 2021 for instructor under 30 years of age is 1.50 c. u., 31-35 years of age – 1.41 c. u., 36-40

years of age – 1.79 c. u., 41–45 years of age – 2.13 c. u., over 45 years of age – 2.14 c. u. (Table III). The research of the dynamics of the RI indicators showed that the cardiovascular system of the instructor officers deteriorated with increasing instructional experience i. e. the value of the indicator for the officers over 45 years of age was significantly worse than for the instructors under 30 years of age by 7.15 c. u. in 2019, by 7.19 c. u. in 2020 and by 7.79 c. u. in 2021 ($P < 0.01$). The indicators of the functionality of the cardiovascular system of most of the instructional staff were at the “average” and “below average” levels.

The research of the dynamics of TRHRB shows a decrease in the indicator of the instructors of all age groups during the research ($P > 0.05$) (Table III). There was a deterioration of this indicator with the increase of the age group of the instructors, which indicates the weakening of their cardiovascular system in the process of their pedagogical activities. Thus, if in 2019 the average indicator of TRHRB for the officers under 30 years of age was 1 minute 51 seconds, then it made 2 minutes 28 seconds for the instructors 36–40 years of age ($P < 0.001$). The results of the officers 36–40 years of age, 41–45 years of age and over 45 years of age did not differ significantly ($P > 0.05$). The instructors under 30 years of age were characterised as those having the level of functional capabilities of the cardiovascular system in terms of TRHRB values as “average”; the level of the rest of the studied groups was assessed as “below average”.

DISCUSSION

The analysis of a large number of literature sources [21–23] shows that the high level of morphofunctional status, health and efficiency of professional activities of law enforcement officers largely depends on the level of their physical fitness, formed in the process of regular physical training sessions. The analysis of the normative documents on the organization of physical training in the HEI SLE allowed to reveal a number of shortcomings that reduce the impact of physical training on physical fitness, morphofunctional status and health of instructor officers, including: insufficient consideration within the guiding documents of the peculiarities of the service activities of the scientific and instructional staff; the main focus during training sessions is on improving the indicators of special physical training and preparation for inspections; the time planned for scheduled physical education training sessions and the lack of clear organization of the training sessions cause a low percentage of attendance by the instructor officers and do not allow to address issues of improving physical

fitness and promoting the health of instructional staff in the process of their pedagogical activities; the time allotted for scheduled physical training sessions in the afternoon does not allow conducting classes with sufficient load and density for the effective development of physical qualities; the duration and frequency of training sessions are insufficient to increase the level of physical fitness and maintain the required level of morphofunctional status and health; performance of the tasks of service activities, the functional duties, the orders of commanders in extracurricular time which is allocated for independent physical training sessions; there are not enough factors in the guiding documents that would stimulate an increase in the level of general physical fitness of instructor officers; a large number of appeals to the medical department and a constant increase in the number of instructor officers who belong to the group of medical physical culture due to their state of health.

The analysis of the system of organization of physical training with the instructional staff of higher educational institutions of other law enforcement agencies showed the presence of similar shortcomings [9, 24]. In particular, the instructor officers of theoretical departments in higher military educational institutions are forced to miss scheduled physical training sessions because they are involved in conducting classes with cadets. Some scientists point to the presence of a number of occupational diseases in the instructors of HEIs [25].

Our research revealed that the level of morphofunctional status of the instructional staff of the HEI SLE at the present stage is insufficient to fulfil the instructional tasks and needs to be improved. The experts [5, 7, 21, 22] note that one of the ways to solve the above problem is to improve the physical training of instructor officers in the HEI SLE based on the use of general physical training, taking into account the age group and time for such training sessions during the working day. Our results complement and expand existing scientific data on the level of physical fitness and health of law enforcement officers.

CONCLUSIONS

It was found that during the study (2019–2020) the Kettle index, vital index, strength index, Robinson index and duration of recovery processes deteriorated among instructor officers of all age groups. However, in instructor officers under 35 years of age, the deterioration of most indices turned out to be unreliable ($P > 0.05$). But in instructor officers of 36–40, 41–45 and over 45 years of age most of indices deteriorated reliably ($P < 0.05$). The

most pronounced changes were found in the indicators of Kettle index (22.90-25.27g / cm), vital index (4.29-4.33 ml / kg), strength index (3.34-4.91 %), Robinson index (1.79-2.14 c. u.). This indicates a negative trend in the indicators of morphofunctional status of instructor officers in the process of their pedagogical activities.

It was set that the values of all studied indices in the instructors of older age groups are significantly worse than in the instructors of younger age groups, which also indicates the deterioration of instructors' morphofunctional status. The values of the studied indices are below average or low in most instructors of all age groups; most instructors are overweight. All this confirms the negative impact of factors of professional activities of instructors on the state of their main life support systems of the body: cardiovascular, respiratory and muscular. In our opinion, the main negative factor that caused the deterioration of the indicators of the

morphofunctional status of instructors is insufficient motor activity.

It was found that the level of morphofunctional status of the instructional staff of the HEI SLE is insufficient to perform the tasks of their pedagogical activities and needs to be improved. This problem is especially acute for the instructor officers under the age of 40 and older. Rationally organized health-improving physical training sessions, taking into account the age group, morphofunctional status of instructors and the time of training sessions during the working day can be an effective way to solve this problem.

THE PROSPECT OF FURTHER RESEARCH

It is planned to investigate the level and dynamics of the indicators of physical health and mental working capacity of the instructors of the HEI SLE in the process of their pedagogical activities.

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Conflict of interest:

The Authors declare no conflict of interest.

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Received: 25.08.2022

Accepted: 20.01.2023

A - Work concept and design, **B** - Data collection and analysis, **C** - Responsibility for statistical analysis, **D** - Writing the article, **E** - Critical review, **F** - Final approval of the article

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