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Theory & Practice of Physical Culture

Athletic
training

Sport
psychology

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Key issues of the modern sports science for discussion**Federal Sports Training Standards:
dynamic control system
for the Russian sports**

Since 2012, the Russian sports control and management process has been advanced by improvements to the sports-specific training and management systems. The first-generation sports training standards implementation practices and experiences demonstrated their benefits for the training service unification on the federal scale, notwithstanding their natural drawbacks. It was based on these standards that the key theoretically grounded requirements for the training service design and contents in different sports were put in place and facilitated further progress in the specific theoretical and practical provisions for sports training service in every sport discipline. The standards are geared to set a framework for the fitness-, gender-, age- and sport-specific training service.

It should be recognized, however, that not every national sport federation designs and manages the training service on a sound and modern theoretical and practical basis. The sports training service mission is to facilitate an individual athletic progress for competitive success, with the individual training systems being prudently designed in its every element, particularly at the early progress stages. In rather theoretical terms, this progress may be defined as the system transition from one state to another. The system is referred to herein as the athlete acting in the sports environment, with the athlete viewed as the controlled subject and the sporting environment as the combination of factors of influence on the athletic progress including the sports training service. It is important that both of the elements of the system are dynamic in many aspects, with their combinations at certain time points indicative of the momentary system quality.

The above interpretation is supported by modern research and the valid legal and regulatory provisions setting a framework for the sports elite and reserve training systems customizable for the new national and global sports progress trends. It may be pertinent to mention that the new-generation sports training standards should be developed based on the cutting-edge sports theory and practice supported by new experimental data, innovative training models and athletic progress testing and analyzing toolkits, with the sports training service designed on a dynamically advanced basis.

We encourage the sports research community to offer study reports on the new theoretical and practical sports training methods to advance the sports training systems.

***Chief editor of TPPC,
Honored Worker of Physical Culture of the Russian Federation,
Doctor of Pedagogical Sciences, Professor L.I. Lubysheva***



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Mobilizing sprint trainings in precompetitive training periods in swimming sport

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Abstract

Objective of the study was to improve the efficiency of the precompetitive training of swimmers of the university sports perfection group by increasing the number of sprint exercises against the less hours of swimming practices.

Methods and structure of the study. At the first stage of the study, 16 swimmers of the sports perfection group of the university were examined. All the subjects were aged 18-20 years and had the sports qualification of Candidate Master of Sport. The "ART-2" trial facility was used to determine the effects of sprint trainings on the biometric parameters of the training activity. At the second stage, a factor analysis was carried out. Proceeding from the analysis, a 21-day precompetitive training module was designed. It included 18 training sessions, 8 key training sessions with the selective speed-strength orientation of the performed workloads, tests, and 2 start days at the Universiade. Sprint trainings were focused on improving the biometric parameters of the swimming techniques, mobilizing the functional reserves and increasing the absolute swimming speed.

Results and conclusions. It was found that the selective development of the absolute swimming speed at the precompetitive training stage is associated with an increase in the power (W_p), rate (S_{rmax}), mid-cycle force (F_{sr}), and intra-cyclic swimming speed. The representativeness of the precompetitive training module is expressed in the achievement of the peak functional fitness rates, technical performance improvement, and higher competitive performance results. Owing to the mobilization of the resistant reserves and the morphofunctional shifts achieved, 67% of swimmers reached their best shape and improved individual sports results.

Keywords: parameter aggregation, affiliated tools, customized workloads, modulation, integrated biometrics, propulsive efficiency tests, representativeness, competitive fitness, factor analysis.

Background. An essential aspect of competitive swimming is the scientifically substantiated organizational and technological structure of precompetitive training of swimmers aimed to realize their motor functions upon reaching the ultimate result. There are two methodological stages in the genesis of the problem solution. The problem of periodization of sports training, which was especially acute in the 1960-80s, was addressed by S. Gordon, K. Inyasevsky, and D. Kaunsilman, who formulated the logic of indicative planning of the "polarized training" system. The rep-

resentativeness of this approach was confirmed by the results achieved at the World Championships and Olympic Games by the USSR national team managed by I. Koshkin, S. Vaytsekhovskiy, et al [2]. The logic of the second stage (1990-2021) is related to the methodology of project management, which makes it possible to achieve high results by transforming qualitative parameters of the technical skills at the precompetitive stage. O. Alekseeva distinguishes the range of phase transitions to the ultimate readiness that ensures the achievement of peak results [1,



6]. This mainstreams the issues related to the transformation of the structure, allocation of the growth points, and highlighting the key operational points in the design of the swimmers' precompetitive training process.

Objective of the study was to improve the efficiency of the precompetitive training of swimmers of the university sports perfection group by increasing the number of sprint exercises against the less hours of swimming practices.

Methods and structure of the study. The research program was focused on the identification of the factors that form the precompetitive training efficiency growth points. The field studies were carried out in two phases. The first phase included screening of the parameters of motor activity, mental health, and functional fitness of the 19.1 ± 0.3 year-old freestyle swimmers qualified CMS and MS ($n=16$). In particular, the effects of sprint trainings on the biometric parameters of the training activity were determined using "ART-2" trial facility [5, 7, 10]. The 25m and 50m freestyle swimming tests were used to determine the swimming rate (SR), stroke length (SL), maximum swimming speed (V_{max}), and propulsion strength. The swimmers' psychomotor state and competitive fitness level were determined by the balance between the visual-motor reactions: SMT, RMO, and WAM [2]. Within the criteria space – maximum (F_{max}) (N) and average cycle force (F_{cycle}) (N), maximum power (P_{max}) (Wt), and power in the pull phase (P_{pull}) (Wt) – we identified the weaknesses, resource base, and training efficiency growth points.

At the second stage, a factor analysis of 67 aggregative parameters was carried out. The analysis results formed the basis of the precompetitive training module. The domain of the training impact was oriented towards increasing the intensity of training loads achieved by adding partial high intensity loads. Therefore, the module efficiency was evaluated by the points of growth of the effectiveness of the swimming technique, morphofunctional and psychomotor shifts. The functional changes were analyzed using the computer complex "Cardiometer-MT". Heart rate (HR), minute blood volume (MBV), stroke output (SO), cardiac output (CO), Mo, cardiac cycle duration (R-R), isometric contraction (IC), and myocardial tension index (MTI) were measured. The effectiveness of the methodological solutions was assessed using the questionnaire modified by B. J. Cratty [4, 8].

Results and discussion. Proceeding from the factor analysis, 12 growth points were identified and grouped in terms of three factors of reaching the best shape. The 21-day precompetitive training module included 18 training sessions, tests, and 2 start days at the Universiade.

The "training intensification" factor (41.2% of the sample variance) determined 6 poles of transformation of the main (forecasts, objectives, conditions for the accomplishment of the set objectives) and auxiliary processes that ensure the achievement of the upper limits of adaptation to competitive loads. Within this factor, the emphasis was placed on the extraordinariness of the targeted effect of sprint trainings on the adaptive adjustments to the central, motor, and vegetative functions. The metabolic profile of the 8 key training sessions was aimed at increasing the anaerobic alactic power. The scientific "projection" of the "gold standard" in the combinatorics of speed iterations was focused on the selective development of affiliated tools and achievement of the maximal result (T. Bompas, 2012). It should be emphasized that E. Vinogradov's [3] technology was used in the parametric setting of individual speed-mode limits. Accordingly, the amplitude-frequency modulation of the dynamic parameters of the stroke included a number of indicators - maximum (F_{max}) 174.5-178.7 n and average cycle force (F_{cycle}) 89.5-91.1 n; power in the pull phase (P_{pull}) 120.5-121.1 wt. The stratification of the peak modes, aimed to achieve a qualitatively new technical fitness level, was evaluated by the swimmers at 9.2 ± 0.06 on the "reserve mobilization" scale.

In particular, the key trainings included such exercise series as: 2x (4x10 m + 3x15 m freestyle swimming), at maximum speed and rate, with a rest break between the series - 200 m of compensatory swimming; 2x (4x25 m + 4x50 m freestyle swimming) at the specified speed of 1.8-1.9 m/s, maximum rate of 54-56 cycles/min and amplitude of 1,65-1,71 m. The internal typological similarity of the swimming techniques at the distance segments V_{max} 10-25-50 m built synergies between the effects on the selective development of the affiliated tools. As a result, there was an increase in the power W_p , swimming rate S_{rmax} , average force F_{sr} and CO (0.671). E. Vinogradov explained the detected increase in the freestyle swimming speed rate in the 4x25 m test by the associated development of propulsive efficiency, power and dynamic reserves, accuracy of competitive activity (0.502) [3.10].

The detected growth of preferences in the training intensification, evaluated at 9.2 ± 0.04 points on the "satisfaction with trainings" scale, correlated with the improved psychomotor parameters: single motion time (SMT) - 0.11 - 0.12 sec; reaction to a moving object (RMO) - 0.02 - 0.03 sec; number of small-amplitude motions (T-t max) - 69.0 - 72.0 (0.523); readiness to achieve the maximal result - 8.5 - 9.1 points (0.501). The resulting improvement in the competitive fitness level explains the neuro-physiological shifts typical of the peak readiness phase [3]. The data obtained are



proportional to those obtained during the ultra short race pace training (USRPT) for Michael Andrew [4.8].

The operational content of the "transforming" factor (21.4%) is affiliated with 3 points of growth of the technique performance efficiency and improvement of the functional state. The basic configuration of the factor triggers several cascading trajectories of adaptation to physical loads of submaximal power, maintenance of the functional capabilities and power of the energy supply systems.

The "tapering" factor (13.4%) includes 2 growth points associated with the creation of conditions for getting in shape. The consistency in the aggregated factor parameters is manifested in super-compensation of physical working capacity and interiorization of latent states. The relevance of the principle of "load reduction", evaluated at 9.1 ± 0.02 on the "personal achievements" scale, correlates with the functional shifts and improvement of competitive fitness (0.622). This refers to the reduction of the total volume of swimming: from 6 km to 3 km per training session or 8.3 ± 0.01 points on the "rationalization" scale. It should be noted that this methodological solution correlates with the principle of harmonization of the biochemical and physiological constants (pH, HR, BP, RR) and the increase in the level of elastic energy of the working muscle groups (0.502). The swimmers evaluated the improvement of the differentiated parameters of the feeling of water, rate, rhythm at 7.4 ± 0.01 points on the "coordination" scale, which correlated with the decreased muscle stiffness (0.511).

The scientific validity of the precompetitive training efficiency growth model is obvious. The sprint trainings led to the improvement of the quality of coordination structure of the stroke, cumulative increase in the maximum (F_{max}) (N) and average cycle force (F_{cycle}) (N), average cycle power of the stroke, and swimming rate (SR) - the basis for achieving the ultimate result [5]. Owing to the mobilization of the resistant reserves and the morphofunctional shifts achieved, 67% of swimmers reached their best shape and improved individual sports results.

Conclusions. The findings prove the effectiveness of the structural and technological modification of the precompetitive training process through the use of the result-oriented speed exercises of high intensity. The representativeness of the growth points is expressed in the achievement of the peak functional fitness rates, technical performance improvement, and higher competitive performance results.

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New speed training model for 15-17 year-old cross-country skiers

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Abstract

Objective of the study was to theoretically substantiate and test benefits of a new preparatory-period speed training model for the 15-17 year-old cross-country skiers.

Methods and structure of the study. Based on analysis of the reference theoretical and practical study reports, physical fitness systems and practical training experiences, the new speed training model was developed. The new training model testing experiment included two stages. The first stage was designed to train the sample as required by the traditional training system. We sampled for the experiment the 15-17 year-old male cross-country skiers (n=24) who were split at the second stage into Experimental and Reference Groups of 12 people each. The Reference Group was trained by the traditional training method, and in the Experimental Group training was dominated by the new speed training model, with the theoretical and practical training including 5 speed training sessions. Every of the five sessions included the following seven groups of exercises.

Results and conclusion. Comparative analysis of the post- versus pre-experimental test data showed a meaningful progress of the Experimental Group in every test ($p \leq 0.05$) – versus insignificant progress in the Reference Group ($p > 0.05$). The new speed training model testing experiment showed benefits of the model for progress in every speed quality. This finding gives us the grounds to recommend the new speed training model for application in trainings of the 15-17 year-old cross-country skier.

Keywords: speed qualities, response rate, speed training model, cross-country skier, sport training, age-specific progress.

Background. Modern sports are getting younger very fast, with a steady growth of sports achievements and competitiveness. This progress is secured by new physical fitness, technical and tactical training methods and tools [1-4]. The training service modeling technologies give a special priority to the age-specific resources and physical progress facilitation methods for young athletes [5]. Modern cross-country skiing sport training systems take into account the natural unevenness (heterogeneity) of the physical and tech-

nical progress, with a special priority to the endurance, speed-strength and strength training elements for success [2]. The age group analyzed herein is known to progress fast in the speed qualities due to the fast neuromuscular processes and responses with a rapid growth of fast myofibrils in the key muscles (A.V. Karasev, 1994). However, the growing competitiveness of the modern cross-country skiing sport urge the sport community looking for new training methods, models and tools for young athletes.



Objective of the study was to theoretically substantiate and test benefits of a new preparatory-period speed training model for the 15-17 year-old cross-country skiers.

Methods and structure of the study. Based on analysis of the reference theoretical and practical study reports, physical fitness systems and practical training experiences, we developed the new speed training model on the following key provisions:

- The speed training practices should be run in fresh condition till the first signs of fatigue, followed by the speed endurance building practices – normally at the first stage of every training session.
- Different speed training practices need to be reasonably combined for the training process efficiency as they complement different aspects of sports fitness.
- The speed training process should be reasonably customized, with the speed stepped up and slowed down in the most efficient manner.
- The speed trainings are recommended to be started up from the smaller bodily parts (upper limbs) to develop higher movement speeds, and only they are warmed up, the practices should involve the slower moving lower limbs to secure the required movement harmony.

The new training model testing experiment included two stages. At the first stage the sample was trained as required by the traditional preparatory training system. We sampled for the experiment the 15-17 year-old males (n=24) who were split at the second stage into Experimental and Reference Groups (EG, RG) of 12 people each. The RG was trained by the traditional training method, and the EG training was complemented by the new speed training model, with the theoretical and practical training elements including 5 speed training sessions.

Every of the five sessions included the following seven groups of exercises:

1. Starts from different positions after frequency-stepping exercises: prior to skiing, the group practiced high-frequency hand movements mimicking the racing technique; with the fingers, hands, forearms drumming on the knees, hips, wall and floor; followed by high-frequency on-spot run.
2. Top-frequency downhill runs on a slight incline, alternating with runs on a flat surface.
3. Running on marks on a distance marked so as to make every stride shorter than the individual optimum, with every mark stepped on.
4. Stepped-to-top-frequency exercises during the warm-up and preparatory phases of every session.
5. Fast tasks on signal, including single actions (jump), starts and short runs.

6. Fast tasks on varied signals – for example, front jump on a whistle, back jump on a clap; 15m sprint on “hop” exclamation etc.

7. Top-frequency practices in alternating difficult/eased conditions, including 10m resisted runs in couples (in harness) alternating with non-resisted runs; uphill runs by stairs with every step stepped on; flat-surface runs etc.

Progress in the new model testing experiment was tested by the following tests: 30m sprint test; 10s on-spot run test; response test; and 3x10m shuttle sprint test. The EG and RG tests were run prior to and after stage 1 and stage 2 of the experiment.

Findings and discussion. Given in Table 1 hereunder are the pre- versus post-stage-1 speed test data of the sample.

Table 1. Pre- versus post-stage-1 (May and June) speed test data of the sample

Test	Results $x \pm m$		Difference significance rate
	May	June	
10s on-spot run	39 \pm 4,40	40 \pm 4,60	p>0,05
30m sprint, s	5,4 \pm 0,38	5,2 \pm 0,39	p>0,05
Response test, cm	23 \pm 3,10	21 \pm 2,90	p>0,05
3x10m shuttle sprint, s	8,8 \pm 0,34	8,6 \pm 0,35	p>0,05

The above data show the speed qualities being quite even in the 15-17 year-olds prior to the experiment, with pre- versus post-training differences insignificant. Prior to stage 2, the speed test data of the EG and RG were virtually the same: see Table 2.

Table 2. Pre-stage-2 speed test data of the sample (prior to the new speed training model testing experiment)

Test	Results $x \pm m$		Difference significance rate
	RG	EG	
10s on-spot run	40 \pm 4,60	40 \pm 4,30	p>0,05
30m sprint, s	5,3 \pm 0,42	5,2 \pm 0,40	p>0,05
Response test, cm	24 \pm 3,40	23 \pm 3,20	p>0,05
3x10m shuttle sprint, s	8,6 \pm 0,34	8,5 \pm 0,35	p>0,05

Upon completion of the new speed training model testing experiment, we run the final tests that demonstrated a significant progress of the EG compared to the RG: see Table 3.



Table 3. Post-experimental speed test data of the sample

Test	Results $x \pm \delta$		Difference significance rate
	RG	EGL	
10s on-spot run	40±4,70	46±3,90	p<0,05
30m sprint, s	5,2±0,40	4,8±0,32	p<0,05
Response test, cm	23±3,40	17±2,40	p<0,05
3x10m shuttle sprint, s	8,5±0,34	7,9±0,24	p<0,05

Comparative analysis of the post- versus pre-experimental test data showed a significant progress of the EG in every test ($p \leq 0.05$) – versus insignificant progress in the RG ($p > 0.05$). These data demonstrate benefits of the new speed training model for progress in the youth cross-country skiing sport.

Conclusion. The new speed training model testing experiment showed benefits of the model for pro-

gress in every speed quality. This finding gives us the grounds to recommend the new speed training model for application in trainings of the 15-17 year-old cross-country skier.

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Individual somatotypes versus motor skills profiling study of 10-16 year-old handball players grouped by game positions

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Abstract

Modern situational team sports, including handball, require from every player to develop an extensive motor skills set to attain every goal in attacks and defenses. Modern handball is rather versatile in the game actions provisionally classifiable by the individual game positions of functions, with some players traditionally specialized in long-range shooting, others in quick breakthroughs etc.

Objective of the study was to analyze the age- and somatotype-specific motor skills progress of teenage handball players by their game roles.

Methods and structure of the study. We sampled for the longitudinal study the 10-16 year-old male handball players (n=46) with the 7-minus-year sports experiences. We used R.N. Dorokhov (1991) anthropometric test method with a computerized somatotyping capacity; finger dermatoglyphics (patterning) method to obtain delta index (DL10), ridge count (RC); ridge count to DL10 ratio (RC/ DL10); standard clinical physiological test methods; bioimpedance tests using "Diamant-AIST" Body Composition Analyzer; and traditional motor skills test methods.

Results and conclusion. Based on the prior tests, the sample was provisionally split up into midfielders and wingers groups. We used the Dorokhov (1991) somatotyping test to group the 10-13 year-old midfielders with mostly macrosomatic type (74-82%); and the 14-15 year-old midfielders with mostly mesosomatic type (43-62%). The 10-13 year-old wingers were classified with macrosomatic, mesosomatic and micromesosomatic types, with their percentages virtually equal; whilst the 14-16 year-old midfielders were mostly grouped with the micromesosomatic type (53.8-85%) followed by mesosomatic type (15.4-46%). It should be mentioned that a somatotype formation in ontogenesis is dominated by multidirectional changes in body length and mass for this age groups.

Keywords: somatotype, game position, age of motor qualities formation.

Background. Modern situational team sports, including handball, require from every player to develop an extensive motor skills set to attain every goal in attacks and defenses. Modern handball is rather versatile in the game actions provisionally classifiable by the individual game positions of functions, with some players traditionally specializing in long-range shooting, others in quick breakthroughs etc.

Objective of the study was to analyze the age- and somatotype-specific motor skills progress of teenage handball players by their game positions.

Methods and structure of the study. We sampled for the longitudinal study the 10-16 year-old male handball players (n=46) with under 7 years of sports experience. We used R.N. Dorokhov (1991) anthropometric test method with a computerized somatotyping capacity; finger dermatoglyphics (patterning) method to obtain delta index (DL10), ridge count (RC); ridge count to DL10 ratio (RC/ DL10); standard clinical physiological test methods; bioimpedance tests using "Diamant-AIST" Body Composition Analyzer; and traditional motor skills test methods.



Results and discussion. Based on the prior tests, the sample was provisionally split up into two groups: midfielders and wingers. We used the Dorokhov (1991) somatotyping test to rate the 10-13 year-old midfielders with mostly macrosomatic type (74-82%); and the 14-15 year-old midfielders with mesosomatic type (43-62%). The 10-13 year-old wingers were rated with macrosomatic, mesosomatic and micromesosomatic types, with their percentages virtually equal; whilst the 14-16 year-old midfielders were mostly grouped with micromesosomatic type (53.8-85%) followed by mesosomatic type (15.4-46%) due to the pubertal growth variations – in agreement with the study data reported by E.N. Komissarova, T.V. Panasyuk (2009). It should be mentioned that a somatotype formation in ontogenesis is dominated by multidirectional age-specific changes in the body length and mass.

The 11–12 year-olds' training systems traditional for the Children and Youth Sport Schools (CYSS) give a special priority to the teamwork, spatial orientation, action speed and movement coordination qualities and skills at the beginner training stage, with an individual progress normally managed based on the physical fitness tests. The 11–12 year-olds' physical fitness test set includes: 30m sprint; 100m shuttle sprint; standing long jump; and standing handball throw tests; and the 13-15 year-olds' test set includes: 20m sprint; 20m handball control and standing long jump tests. And the 16 year-olds' test set includes: 30m spring, 30m handball control; and triple jump tests.

Our 7-year longitudinal study found the speed and dexterity evenly and significantly growing in both groups ($p \leq 0.05$). We used a factorial analysis to find correlations between the morphological and functional parameters and growth of motor skills in the sample.

Tests of the 11 year-old wingers found the first factor (43.9%) indicative of the speed and dexterity (tested by the 30m sprint and shuttle run tests) growing in correlation with the somatotype and body-mass-and-length index ($r = 0.38-0.53$). In their midfielder peers, the first factor (45.1%) showed the speed and dexterity growing in correlation with the dynamic strength of the upper and lower limbs (tested by the handball throw and standing long jump tests) ($r = 0.51-0.79$).

Tests of the 12 year-old wingers found the first factor (43.6%) indicative of the running qualities growing in correlation with the somatotype and body-mass-and-length index ($r = 0.47-0.53$). In their midfielder peers, the first factor (47.2%) showed the speed and dexterity growing in correlation with their hereditary predisposition marker (RC/DL10) ($r = 0.48-0.84$).

Tests of the 13 year-old wingers found the first fac-

tor (38.45%) indicative of the movement coordination (30m handball control test) and lower-limb dynamic strength (standing long jump test) growing in correlation with the hereditary predisposition marker (RC/DL10) and energy resource ($r=0,31-0,59$). In their midfielder peers, the first factor (25.1%) showed their handball control skills and lower-limb speed-strength qualities growing in correlation with the somatotype and body-mass-and-length index ($r=0.28-0.31$).

When the handball players reach 13-15 years of age, the sports schools would split them up into the progress-specific groups based on their progress tests at the beginner training stage. This qualification is timed to the key period of the boys' ontogenesis (the pubertal period) with its fast growth and body shaping aspects.

The 13-15 year-old wingers were classified with the mesosomatic and micromesosomatic types. Their progress was tested by the 20m sprint, 20m handball control and standing long jump tests. The mesosomatic type was tested with the highest progress in speed-strength (8.58% and 8.43% in the 20m sprint and standing long jump tests, respectively) and dexterity (18.6% growth in the 20m handball control test). Note that the physical progress of this age group is limited by 1.78-3.33% in the other tests. As for the 13-15 year-old micromesosomatic type wingers group, they were tested with the highest progress in the 20m handball control and standing long jump test (10.5% and 3.42%, respectively).

The 13-15 year-old midfielders were classified with the macrosomatic and mesosomatic types; and their 14-15 year-old peer group was found admixed by the intermediate micromesosomatic type. The macrosomatic type was tested with the highest progress in the speed-strength qualities (6.03-5.67%) and dexterity (11.6%) at 13-14 years of age. The 13-14-year-old mesosomatic type group showed a high progress only in the movement coordination skills (5.5%); followed at 14-15 years of age by a special progress in the speed-strength qualities (3% in the 20m sprint test and 5.66% in the standing long jump test). And the 14-15 year-old micromesosomatic type showed a high progress in the 20m handball control and standing long jump tests (6.0% and 8.3%, respectively).

The 14 year-old wingers were tested with the movement coordination (as verified by the first factor of 36.4%) being correlated with the genetic marker (RC/DL10) ($r = 0.24-0.32$). Their midfield peers were also tested with the movement coordination growth correlated with the genetic marker ($r = 0.2-0.26$) as verified by the first factor (31.2%).



The 15 year-old wingers were tested with the movement coordination and speed-strength growth closely correlated ($r = 0.51-0.85$) with the body mass-and-length index and explosive strength of the nervous system (the first factor of 48%). Their midfield peers were tested (first factor of 41.9%) with progress in the standing long jump, 20m sprint and 20m handball control tests correlated with the body mass-and-length index, hereditary predisposition marker and lower-limb explosive strength ($r = 0.32-0.84$).

The 16 year-old wingers' progress in the handball control and speed-strength qualities, as verified by the first factor (41.6%) was found closely correlated with the lower-limb explosive strength ($r = 0.69-0.74$) and hereditarily resource ($r = 0.8$). Their midfield peer group was tested with the 'functional' first factor (40%) that covers the nervous system functionality and finger dermatoglyphics predictors (RC/ DL10) ($r = 0.48-0.84$). The second factor (25.8%) for this group showed the coordination and speed-strength growth correlated with the somatotype, active cellular mass and response to moving object ($r = 0.24-0.67$).

Conclusion. The study found that the 10-16 year-old handball players' progresses should be tested with consideration for their game positions. This age period was tested quite heterogeneous in the physical qualities and motor skills formation and growth stages correlated with the individual somatotypes.

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Study of stress and coping in sports at perm psychological school: history and modernity

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Abstract

The paper presents an analysis of theoretical and experimental research by Bronislav Alexandrovich Vyatkin who is one of the founders of Russian differential sports psychology, the head of the Perm Scientific Psychological School. Developing the ideas of the outstanding Russian psychologist V. S. Merlin, in the 1970s, the scientist organized a research group that studied mental stress in sports and human individuality manifestations in sports activities. At this time, he was interested in issues of temperament and competitive stress, the role of temperament in the stress influence on various sports activity manifestations – musculoskeletal feeling, volitional activity, interpersonal relationships in collective game activity. The central direction of B. A. Vyatkin's research in the field of sports psychology is the person's individuality manifestation in the sports activity conditions. The article pays special attention to the mental stress concept developed by B. A. Vyatkin as an integral system phenomenon, as well as to the rationale for the process of preparing a person for activity in extreme sports activity conditions. At present, Bronislav Alexandrovich continues systematic research in the field of sports psychology, coping with mental stress in sports competitions. Currently, the scientist is exploring the coping style from the perspective of a polysystem approach: style acts as a system-forming factor of the integral individuality of a person involved in it, at the same time, integral personality acts as a system-forming factor in relation to style. Another line of B. A. Vyatkin's research is the interaction of sports activities subjects "athlete-trainer-psychologist", the integration of the triad subjects' activities allows you to develop a trajectory of the athlete's individual development.

Keywords: *sports, stress, athlete, individuality, sports activities, coping.*

Introduction. In January 2020, Bronislav Alexandrovich Vyatkin, Doctor of Psychology, professor, corresponding member of the Russian Academy of Education, Honored Scientist of the Russian Federation, turned 85 years old. This is the anniversary of the Perm Scientific Psychological School head, a prominent sports psychologist, the author of more than 250 works in the field of stress psychology, personality, individuality of a person and the conditions for its development in various activities, including sports.

Aim. The paper presents an analysis of theoretical

and experimental research of team of scientists of the Perm Psychological School that played a significant role in the sports psychology development.

Materials and methods. The study uses the theoretical analysis of Vyatkin's and his colleagues scientific works on the sports psychology problems.

Results. Bronislav Alexandrovich Vyatkin is the author of numerous scientific papers, an organizer of university science, and one of the Russian differential sports psychology founders. His contribution to the development of sports psychology is really im-



pressive. B. A. Vyatkin's doctoral dissertation "The influence of mental stress on sports activity and its management depending on personality traits" (1981) was carried out under the guidance of the outstanding Russian psychologist Wolf Solomonovich Merlin, the creator of the doctrine of the integral person's individuality, and was presented at the Scientific Research Institute of Scientific Practical Sciences of the USSR Academy of Pedagogical Sciences. Developing V.S. Merlin's ideas in the field of differential psychology, Bronislav Aleksandrovich conducted experimental studies on the sports psychology problems and organized a research group that focused on the study of mental stress in sports and individuality manifestations in sports.

Back in the 1970s, B.A. Vyatkin noted that sport imposes high demands on the human psyche, training and competitions of athletes take place in emotional stress conditions, intense mental activity associated with an accelerating life pace and a variety of external stimuli. The scientist conducted several successful studies of psychodynamic aspects of an athlete's activity from a systemic perspective, and in 1972-1980 worked as a psychologist for the Olympic team of our country.

It should be noted that in line with differential approach, B.A. Vyatkin analyzed the issues of temperament and dynamics of sports activity, namely: temperament and adaptation to the activity requirements in sports, temperament and dynamics of motor skills formation in various conditions. The scientist noted that the different properties of the nervous system, as well as the temperament properties, with the same degree of excellence in activity, determine the uniqueness of its dynamic side. This allows athletes with various properties (regardless of the severity of these properties and activity requirements) to use the individual qualities of their temperament to achieve success [6].

From the differential approach standpoint, the scientist considered the issues of temperament and competitive stress, paid attention to the role of temperament in the stress influence on various sports activity manifestations - musculoskeletal feeling, volitional activity, interpersonal relationships in collective game activity. So, in the laboratory of B.A. Vyatkin, L.V. Likhachev studied the stress effect on the game relationships of basketball players, depending on the strength of the athletes' nervous system. The study found that basketball players with a strong nervous system under stress increase the intensity of communication, management of the sports team as a whole and partners, and censure of partners. Athletes with a

weak nervous system are characterized by a decrease in the communication intensity, an increase in overall team management, censure of partners, a decrease in personal management, and a negative response. Thus, stress worsens the game relationships in the team of athletes with a weak nervous system [8]. Of course, the usual interpersonal relationships violation in a sports team can be an additional stressful factor and it reduces the effectiveness of the game. Therefore, it is necessary to purposefully coordinate the athletes' interpersonal relationships in the game, taking into account the properties of their nervous system in order to increase resistance to competitive stress during important tournaments.

An important scientific and practical aspect of B. A. Vyatkin's research is the development of recommendations for the training process organization, taking into account the athlete's temperament [2]. For example, as for gymnastics trainers, recommendations are specified taking into account the athletes' individual psychological characteristics. In competitive stress conditions, anxious gymnasts need to be kept from excessive waste of energy, and their attention should be focused on beauty, emotionality, and expressiveness of their movements. Non-anxious gymnasts need to be additionally stimulated before the start, and their interest in performing should be increased by setting specific goals and tasks. In addition, B.A. Vyatkin identified the following functions of a psychologist for managing stress in a sports team:

- gnostic - studying the characteristics of the sports and sports specialization, in which they determine the athlete's psyche and personality and impose certain requirements on him/her;
- constructive - planning of general and immediate psychological preparation of athletes for competitions;
- consulting - explanation and interpretation of the athletes' conditions, the features of their behavior in training and competitive practice;
- enlightening - communication to trainers and athletes of information on general and sports psychology necessary for the psychological preparation process;
- educational - education of athletes, the formation of certain personal qualities in them, the impact on the organization of favorable interpersonal relationships in the group;
- practical - implementation of measures to manage mental stress, control the stress level, especially during the athletes' performance in important competitions [2].



In the 1970s-1980s B.A. Vyatkin and his colleagues conducted a number of psychological (empirical) multifaceted studies, which were summarized in two monographs, "The Role of Temperament in Sports Activities," and "Management of Mental Stress in Competitions" [6, 8]. The monograph on managing mental stress was translated and published in Italy in 1984. In it, the scientist presented to the scientific community the author's concept of mental stress as an integral systemic phenomenon defined by several systems of different hierarchical levels. This concept has contributed to changing perceptions of the mental stress nature, and has contributed to the development of specific ways to manage stress, depending on the individual person. In fact, the scientist scientifically substantiated the process of preparing a person for activity in extreme sports activity conditions.

In the 1990s, the focus of B. A. Vyatkin's research was an integral individuality of an athlete and its development in conditions of sports activity. In search of ways to increase the athletes' effectiveness in intense competition, he investigated the problem of athletes' emotional activity [3, 4]. Under the guidance of B. A. Vyatkin, P. V. Tokarev completed a dissertation study that identified individual styles of emotional activity in athletes [10]. On a sample of highly qualified athletes of speed and power athletics, it has been empirically proved that the emotional activity style is a multi-level and multi-component system of competitive motives, personal relationships and emotional experiences, caused by a symptom complex of multi-level individual properties, aimed at achieving the highest sports result. It is proved that the individual style of emotional activity in the athlete's personality structure performs not only an adaptive function in stressful conditions, but also a system-forming function [ibid].

Conclusion. Currently, B.A. Vyatkin continues his research in the field of sports psychology, studying the style of coping with mental stress in sports competitions. The data obtained in V. V. Popova's research under the guidance of B. A. Vyatkin on the styles of coping with mental stress among athletes create the prerequisites for the further development of the style problem, which is referred to as "human style" in psychology. In particular, under the guidance of B.A. Vyatkin V.V. Popova conducted a study of Kyokushinkai karate athletes who are representatives of the teams of the constituent entities of the Russian Federation, having a sports category no lower than the master of sports of Russia [7, 9]. The research design included the study of the ath-

lete's tactical and technical actions in different activity conditions, the study of the multilevel properties of the athlete's personality, the determination of the presence of stress and coping behaviors. Significant differences in the athlete's condition in the background (training) conditions and during the competition were determined using the method of voice spectrographic analysis developed by B. A. Vyatkin [1]. It was found that the athlete as a result of changing the state from background to stress, has an increase in the number of actions of the attacking, counterattacking, and defensive type. Coping with stress during the competition manifests itself in an increase in the number of connections of attacking actions with the properties of the psychodynamic level of an athlete's personality. More complex counterattacking actions of an athlete extend to all levels of his/her personality. It should be noted that in the style study in the research of the Perm Psychological School representatives, led by B.A. Vyatkin, a polysystemic approach was identified, namely: style acts as a system-forming factor of the integral individuality of a person involved in it, at the same time, integral individuality acts as a system-forming factor in relation to style [5, 11].

In recent years, B.A. Vyatkin together with his colleagues, on the basis of the integral individuality theory, has been developing a model for the interaction between subjects of sports activities "athlete-trainer-psychologist" [12]. The model presents the directions of an individual approach to an athlete, which provide a high level of self-realization, taking into account the integration of subsystems of its integral individuality.

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Physical and functional fitness of elementary schoolchildren in modern educational environment

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Abstract

Objective of the study was to assess the physical and functional fitness of elementary schoolchildren of 9-10 years of age.

Methods and structure of the study. The study involved Moscow schoolchildren of 9-10 years of age (n=90). The mean age of the boys was 9.38 ± 0.08 years (n=45), girls - 9.18 ± 0.05 years (n=45). The subjects were apparently healthy and had no medical contraindications for physical trainings.

The test exercise set included the exercises to assess the subjects' physical condition and motor coordination skills. Their functional indicators were evaluated. The schoolchildren were also graded by the level of physical readiness to perform all motor tests, as well as by the level of their functional readiness.

Results and conclusions. The study found that the elementary schoolchildren of 9-10 years of age had gender differences in their physical fitness levels: the boys demonstrated higher results in the speed-strength and strength tests, strength endurance tests, and overall endurance tests. According to the 5-point rating system, 65.1% of the boys had a high (10.8%) and above average (54.3%) levels of physical fitness. 21.7% of the boys had an average physical fitness level, 10.8% - below average, and 2.2% - poor. The boys demonstrated higher results in the Shapovalova test as well. The girls performed better on the flexibility test: 59% of the girls had a high (18.1%) and above average (40.9%) levels of development of flexibility. The average level was observed in 25% of children, below average level - in 11.4%, poor level - in 4.5%.

Keywords: elementary school age, functional fitness, physical fitness, gender differences.

Background. In this day and age, characterized by variability, uncertainty, complexity, and duality of nature, the problem of school education policies is getting more and more critical [6]. The immediacy of the problem is due to the fact that, being on top of modern trends, educational institutions are introducing new disciplines into the educational process, thus overloading the academic curricula [4, 7]. Alongside with this, various social situations (distance learning, appearance of new infectious agents) are actively provoking psych-

oemotional overload in schoolchildren [2, 9]. Besides, elementary school age is the period of active development of physical and functional fitness, which places an additional load on their body's adaptive reserves [3]. The combined effect of all these factors on the child's body may negatively affect the child's health, provoking the development of negative states [8]. It is therefore critical that an individual trajectory for physical education of children is designed based on their individual physical and functional rates [5].



Objective of the study was to assess the physical and functional fitness of elementary schoolchildren of 9-10 years of age.

Methods and structure of the study. The study involved Moscow schoolchildren of 9-10 years of age ($n=90$). The mean age of the boys was 9.38 ± 0.08 years ($n=45$), girls - 9.18 ± 0.05 years ($n=45$). The subjects were apparently healthy and had no medical contraindications for physical trainings.

The test exercise set included the exercises to assess the subjects' physical condition and motor coordination skills. It included: 1) standing long jump; 2) 3x10m shuttle run; 3) 6-min run; 4) 1-min sit-ups; 5) standing forward bends; 6) push-ups. The following functional indicators were evaluated: vital capacity (VC); heart rate (HR); systolic blood pressure (SBP); diastolic blood pressure (DBP). We also conducted Stange's and Ruffier tests, calculated Quetelet, Robinson, Skibinsky, and Shapovalova indices. The statistical processing of the data obtained was carried out using a set of statistical applications. The differences were considered statistically significant at $p<0.05$. All the schoolchildren were ranked according to their physical fitness rates in the motor tests, as well as according to their functional fitness rates in Ruffier test and in terms of Quetelet, Robinson, Skibinsky, and Shapovalov indices on 5 levels: "poor" (1 point), "below-average" (2 points), "average" (3 points), "above-average" (4 points), "high" (5 points). The physical and functional rates were calculated as a result of dividing the total points by the number of tests.

Results and discussion. There is no doubt that the state of the child's health depends on his physical and functional fitness levels. Interestingly, there

are gender differences in the physical condition of children aged 9-10 years. Some studies indicate that this dependence occurs as early as at the age of 5-6 years [1]. Looking at the data obtained in this study, it should be noted that the 9-10 year-old girls were second to boys in almost all the motor tests. The boys had significantly higher rates in terms of speed-strength ($p<0.01$) and strength ($p<0.001$) abilities, strength ($p<0.001$) and overall ($p<0.01$) endurance. The girls had higher flexibility rates ($p<0.001$) (Table 1).

Table 1. Functional fitness rates in elementary schoolchildren, $M\pm m$

Tests	Girls	Boys	p
Shuttle run, sec	8.92 ± 0.03	8.69 ± 0.03	>0.05
Standing long jump, cm	134.91 ± 0.25	144.06 ± 0.21	<0.01
6-min run, m	934.91 ± 0.97	1013.28 ± 0.61	<0.01
Standing forward bends, cm	6.26 ± 0.42	-0.25 ± 0.15	<0.001
Push-ups, reps	13.5 ± 0.38	20.36 ± 0.48	<0.01
1-min sit-ups, reps	33.27 ± 0.22	39.17 ± 0.22	<0.001

The 5-level ranking of the girls according to their physical fitness levels in all motor tests indicated that 18.1% of subjects had a high level, 40.9% - above-average, 25% - average, 11.4% - below-average, 4.5% - poor level.

The boys were ranked according to the above levels in the following way: 54.3% of boys had an above-average physical fitness level, 10.8% - high level. 21.7% of boys were found to have an average level of physical fitness, 10.8% below-average, and 2.2% - poor.

Table 2. Morphofunctional indicators in elementary schoolchildren, $M\pm m$

Indicators	Girls	Boys	p
Body length, m	134.56 ± 0.66	134.48 ± 0.88	>0.05
Body mass, kg	31.5 ± 0.18	32.36 ± 0.16	>0.05
Resting HR, bpm	86.32 ± 0.21	85.04 ± 0.19	>0.05
SBP, mmHg	108.86 ± 0.14	109.02 ± 0.15	>0.05
DBP, mmHg	69.11 ± 0.13	68.59 ± 0.13	>0.05
Stange's test, sec	29.5 ± 0.27	34.59 ± 0.28	<0.01
VC, ml	1645.46 ± 0.99	1844.68 ± 0.97	<0.001
HR after load, bpm	111.6 ± 0.44	112.5 ± 0.48	>0.05
HR during the 1st min of recovery, bpm	85.52 ± 0.45	86.44 ± 0.36	>0.05
Quetelet index, c.u.	17.48 ± 0.45	17.53 ± 0.41	>0.05
Robinson index, c.u.	94.61 ± 0.31	93.50 ± 0.29	>0.05
Ruffier test, c.u.	7.82 ± 0.14	8.30 ± 0.12	>0.05
Shapovalova index, c.u.	126.06 ± 0.78	156.80 ± 0.98	<0.001
Skibinsky index, c.u.	582.68 ± 1.15	782.75 ± 1.13	<0.001



The analysis of the subjects' heart rate, systolic blood pressure, and diastolic blood pressure in a state of relative rest, as well as their HR after physical loads and in the recovery period, revealed that their resting hemodynamic indices were consistent with the age-specific rates. The stress test (squats) rates indicated a greater increase in HR in the girls (by 9.6%). The boys had a less pronounced reaction (a 7.4% increase), which indirectly indicated a higher level of training of their cardiovascular system. However, the HR recovery processes in the girls and boys were synchronous – their HR recovered to the baseline values with the recommended time-frame. The analysis of the subjects' respiratory function showed a greater potential in the boys: the vital capacity and Stange's test rates were higher in the boys (12% higher in terms of vital capacity and 17% higher in terms of Stange's test) (Table 2).

The estimates indicate that the girls and boys showed signs of tension of the cardiovascular system (the Robinson index values were at the average level), decreased level of training of the cardiovascular system (the Ruffier index values were at the average level), decreased tolerance to hypoxia (the Skibinsky index values were at the satisfactory level). In terms of the Shapovalova index, the elementary schoolchildren had well-developed motor skills, but there were gender differences: in the boys, this indicator was 26% higher. In terms of the Quetelet index, the subjects' physical development conformed to the normalized age-specific rates.

The 5-level ranking of the girls according to their functional fitness levels showed that 15.5% of girls had an above-average level of functional fitness, 62.2% - average, 20% - below-average, and 2.2% - poor level. None of the female subjects had a high functional fitness level. Ranking of the boys according to the same levels indicated that most of them (45.7%) had an average functional fitness level, 34.8% - above-average, and 4.3% - high level. 15.2% of boys had a below-average level of functional fitness. No poor level was detected among the male subjects.

Conclusion. The study found that the 9-10 year-old elementary schoolchildren had gender differences in the levels of their physical and functional fitness. These differences need to be taken into account when designing individual educational paths of elementary schoolchildren under the "Physical Education" discipline.

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Customizable training system with psychological fitness service for youth belt wrestling sport

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Abstract

Objective of the study was to rate benefits of a new psychological fitness building model to complement standard training systems applied in the youth belt wrestling sport.

Methods and structure of the study. The new psychological fitness building model testing experiment was run at "PGAFKST", with the 18-21 year-old belt wrestling athletes ($n=40$) sampled for the study and split up into Experimental and Reference Groups (EG, RG) of 20 wrestlers. The EG trainings were complemented by the new psychological fitness building model of our own design based on the individual typological features of the energy supply for muscular activity. And the RG was trained as required by the traditional belt wrestling training system. The study included two stages.

Results and conclusion. The study found the following progress in the both groups, with the EG tested with the following growths on the test scales: success motivation - 29.17%; risk tolerance - 45.05%; failure avoidance motivation - 23.98%; mental fitness - 33.43%; trait anxiety - 17.23%; and state anxiety 15.07%, with the progress rated statistically significant ($p < 0.05$). The RG made progress of 2.58%; 6.80%; 7.87%; 8.94%; 7.30% and 5.51% on the same scales, respectively; with the progresses rated statistically insignificant ($p > 0.05$). It should be emphasized that the new psychological fitness building model was tested beneficial as verified by the EG making improvements on the state anxiety, trait anxiety, risk tolerance and failure avoidance motivation test scales to the optimal levels; plus achieved stable integrated mental fitness and success motivation ranges. These test data give us the grounds to recommend the belt wrestling training systems being designed and managed with due consideration for the individual strengths and weaknesses detected by the bioenergetic profiles and, hence types of temperament.

Keywords: youth belt wrestling, training system, psychological fitness.

Background. The growing competitiveness of the modern global sports and regular changes in the rules of competitions urge the belt wrestling sport communities persistently update the existing training systems for success and look for new physical, technical, tactical, psychological and integrated training approaches, methods and tools, including those customizable to somatic types, temperaments and, hence the individual energy supply mechanisms [1-4]. As things now stand in the belt wrestling sport, it is relatively well

studied, analyzed and managed, and this is the reason why the sport leaders are virtually evenly matched in the physical, technical and tactical fitness aspects. Therefore, the sport communities give a growing priority to the psychological fitness as one of the decisive competitive success factors [2, 5].

Objective of the study was to rate benefits of a new psychological fitness building model to complement standard training systems applied in the youth belt wrestling sport.



Results and discussion. The new psychological fitness building model testing experiment was run to rate the following psychological fitness elements: success motivation; risk tolerance; failure avoidance motivation, mental fitness, state and trait anxiety. The study included two stages: pre-experimental stage 1 and experimental stage 2. Given in Table hereunder are the psychological fitness test rates of the sample.

The pre-experimental averaged test data were as follows for the RG: success motivation 13.55±2.06 points; risk tolerance 19.85±7.21 points; failure avoidance motivation - 17.15±2.56 points; mental fitness - 845.80±259.01 points; trait anxiety - 56.20±1.85 points; and state anxiety - 59.90±1.94 points. And for the EG the test data were the following: success motivation 13.20±1.88 points; risk tolerance 20.20±6.90 points; failure avoidance motivation 17.10±1.92 points; mental fitness 831.60±199.78 points; trait anxiety 56.00±2.10 points; and state anxiety 40±2.26 points. These data may be interpreted as indicative of meaningless differences in the EG and RG psychological fitness ($p>0.05$) prior to the new psychological fitness building model testing experiment.

After the prior tests, we tested on the EG the experimental ST model with a special priority to the psychological fitness building elements and with effective combinations of belt wrestling training methods to fully mobilize the individual functional resource. The model analyzes the strengths and weaknesses in the bioenergetic profiles and, hence, temperaments, energy supply mechanisms for muscular activity, tolerance to competitive mental and physical pressures and adaptabilities for the psychological fitness building on an individualized basis.

The post-experimental (stage 2) tests of the sample yielded the following data. The RG was tested with success motivation of 13.90±2.00 points; risk tolerance 18.50±7.00 points; failure avoidance motivation 15.80±2.71 points; mental fitness 770.20±232.26 points; trait anxiety 52.10±2.07 points and state anxiety 56.60±2.37 points. And the EG was tested with success motivation of 17.05±2.11 points; risk tolerance 11.10±4.83 points; failure avoidance motivation 13.00±1.69 points; mental fitness 553.60±154.50 points; trait anxiety 46.35±2.92 points and state anxiety 51.30±2.68 points.

Table 1. Psychological fitness test data of the belt wrestling sample, points, $X \pm \delta$

Groups, statistics	Tests						
	Success Motivation	Risk tolerance	Failure avoidance motivation	Mental fitness	Trait anxiety	State anxiety	
<i>Stage 1</i>							
RG (n=20)	13,55 ±2,06	19,85 ±7,21	17,15 ±2,56	845,80 ±259,01	56,20 ±1,85	59,90 ±1,94	
EG (n=20)	13,20 ±1,88	20,20 ±6,90	17,10 ±1,92	831,60 ±199,78	56,00 ±2,10	60,40 ±2,26	
U, t	0,56	0,16	0,07	0,19	0,32	0,75	
p	>0,05	>0,05	>0,05	>0,05	>0,05	>0,05	
<i>Stage 2</i>							
RG (n=20)	13,90 ±2,00	18,50 ±7,00	15,80 ±2,71	770,20 ±232,26	52,10 ±2,07	56,60 ±2,37	
EG (n=20)	17,05 ±2,11	11,10 ±4,83	13,00 ±1,69	553,60 ±154,50	46,35 ±2,92	51,30 ±2,68	
U, t	4,84*	3,89*	3,93*	3,47*	7,17*	6,63*	
p	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	
Growth	RG	2,58	6,80	7,87	8,94	7,30	5,51
	EG	29,17	45,05	23,98	33,43	17,23	15,07

Note: EG – Experimental Group, RG – Reference Group; X – arithmetic mean; δ – standard deviation; t – Student criterion; U – Mann-Whitney criterion; p – difference significance rate at $\alpha=0.05$; * significant difference



Comparative analysis of the pre- versus post-experimental test data showed benefits of the EG training versus the RG as the EG test rates were higher by the following points: success motivation - 3.15 points; risk tolerance - 7.40 points; failure avoidance motivation - 2.80 points; mental fitness - 216.60 points; trait anxiety 5.75 points and state anxiety by 5.30 points. The mathematical statistics analysis showed the intergroup differences being significant for every test scale ($p < 0.05$).

Conclusion. The study found the following progress in both groups, with the EG tested with the following growth on the test scales: success motivation - 29.17%; risk tolerance - 45.05%; failure avoidance motivation - 23.98%; mental fitness - 33.43%; trait anxiety - 17.23%; and state anxiety 15.07%, with the progress rated statistically significant ($p < 0.05$). The RG made progress of 2.58%; 6.80%; 7.87%; 8.94%; 7.30% and 5.51% on the same scales, respectively; with the progress rated statistically insignificant ($p > 0.05$). It should be emphasized that the new psychological fitness building model was tested beneficial as verified by the EG making improvements on the state anxiety, trait anxiety, risk tolerance and failure avoidance motivation test scales to the optimal levels; plus achieved stable integrated mental fitness and success motivation ranges. These test data give us the grounds to recommend the belt wrestling training systems being designed and managed with due consideration for the individual strengths and weaknesses detected by the bioenergetic profiles and, hence types of temperament.

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Comparative analysis of development of motivation in russian and chinese student basketball players

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Abstract

Currently, student sports mobility is increasingly characterized by internationalization. Russian and Chinese colleges have been engaged in cooperation in student sports via, most importantly, the Shanghai Cooperation Organisation (SCO) Network University.

Objective of the study was to make a comparative analysis of the development of motivation in players on Russian and Chinese student basketball teams from the moment they start playing basketball (at preschool and school age) to the moment they enter university.

Methods and structure of the study. The authors conducted a survey of 48 basketball players from four men's university basketball teams. The survey was carried out during an international student basketball tournament held in Harbin, China, in June of 2019 to mark the 70th anniversary of the establishment of diplomatic relations between Russia and China. The authors employed a set of traditional methods of research, including statistical and comparative analysis, generalization, and juxtaposition, and methods of sociological enquiry. The age of the respondents ranged from 19 to 25 years old, with their experience doing basketball ranging from 14 to 16 years and their qualifications ranging from Class 2 to Candidate Master of Sport. Each team comprised 12 players. All of the players took part in the survey.

Results and conclusion. The authors' analysis of the development of motivation in the student basketball players surveyed from the moment started doing basketball to the moment they entered university helped bring forward a set of uniform approaches to fostering motivation in both Russian and Chinese students, as well as identify a set of distinct national and regional characteristics.

Keywords: *basketball, students sports, motivation, internationalization.*

Introduction. In today's world, sports, especially student sports, play an increasingly important social role in the life of society. According to well-known Russian physical exercise theoretician and practitioner L.I. Lubysheva, doing sports is a form of human activity that shapes a person's physical, moral, and, social traits (Lubysheva, 2019). In this regard, there is added relevance in research into issues related to students' awareness of the role of sports as an area that helps cultivate a set of essential personal quali-

ties and gain some experience in social life. A mechanism that helps shape personality traits in students and youth is motivational behavior. The various aspects of motivation in student basketball players have been explored by scholars T.S. Golovkova (Golovkova & Asadullaeva, 2016), L.N. Koval' (Koval', Alekseeva, & Shevchenko, 2019), and N.S. Shumova (Shumova, Baikovskii, & Siuntse, 2019). This paper brings forward a concept that makes it possible to analyze the development of motivation in Russian and Chinese



student basketball players in the pre-college period. This concept is grounded in the precondition that players on the basketball teams of top Russian and Chinese universities who are showing today good academic progress toward obtaining a bachelor's, specialist's, master's, or doctoral degree have been motivated since childhood to strive for success, develop the qualities of a leader, the ability to efficiently work in a team, the ability to make effective decisions in complex situations, the ability to "take the heat", and the ability to take responsibility for personal decisions. In the development of personal qualities in these students, a major role must have been played by basketball, as a factor that can help integrate and nurture a person's physical, moral, and social personality traits.

Objective of the study was to make a comparative analysis of the development of motivation in players on Russian and Chinese student basketball teams from the moment they start playing basketball (at pre-school and school age) to the moment they enter university.

Methods and structure of the study. The survey engaged players on the basketball teams of the following top Russian and Chinese universities: Saint Petersburg State University (QS world ranking – 234), Ural Federal University named after the First President of Russia B.N. Yeltsin (364), Zhejiang University (54), and Harbin Institute of Technology (277) (QS, 2020). A major contribution in terms of helping arrange and obtain the funding for the tournament was made by Rector of Harbin Institute of Technology Prof. Zhou Yu

and President of the Harbin Association of International Sports Cooperation and Exchanges Zhang Xia. The survey questions were designed by Prof. N.M. Pestereva, based on recommendations from the Student Basketball Association of Russia. To assess the level of statistical significance of the survey results and test the null hypothesis, the authors employed Pearson's chi-squared test.

Results and discussion. A key benefit of this sociological research study is that it has provided the opportunity to analyze in real time the motivation of students who have been quite successful in basketball and in school. Table 1 lists the survey's key questions and possible answers. Table 2 displays the consolidated data on the authors' statistical assessment of the survey results.

It was established that, thanks to their motivation and the fact that they started to play basketball early on in life, the respondents had managed to achieve optimum results. These students, who had been doing an active sport since childhood, had achieved significant athletic results and top physical condition. These basketball players' success in school was evident too – they were attending top universities in Russia and China. The future professional activity of these students is unlikely to be associated with just physical exercise and sports – there could well be future Humanities scholars, economists, managers, IT specialists, engineers, and biotechnologists among them (Pestereva, Kholina, & Qi, 2019). Thus, as a competitive sport, basketball may be stated to have had a significant effect in terms

Table 1. Questions and Possible Answers in the Authors' Survey of Russian and Chinese Student Basketball Players

Question		Possible answers
1	What age did you begin playing basketball?	prior to seven years of age; between seven and 10; between 11 and 15; between 16 and 18
2	Whose idea was it that you choose basketball?	it was my own choice; I was influenced by my buddies; it was a suggestion from my parents (a member of my family); I got into it by accident
3	Where (in what setting) did you first start to play basketball?	a basketball court in the neighborhood I lived in; in preschool; in a children's sports school; in high school; in university
4	What motivated you to do basketball in the pre-college period?	support from my parents and admiration from my friends; my results, awards, certificates, and publicity; deriving pleasure from taking part in tournaments and playing basketball; self-esteem
5	What was the motivation behind your interest in going to a Russian college to get a higher education?	opportunity to play basketball; opportunity to play on a university basketball team; financial support provided by the college for being on its basketball team; opportunity to improve as an athlete
6	What would some of the benefits be if you attended a foreign college?	opportunity to attain a fluent command of the country's language and get to know its culture; opportunity to play basketball in comfortable conditions; opportunity to play on the college's basketball team; opportunity to learn foreign training methodologies; I haven't planned this yet

**Table 2.** The Authors' Test of the Null Hypothesis (H_0) and the Level of Statistical Significance (P) of the Survey Results Using Pearson's Chi-Squared Test

Numbers of the questions from Table 1	Assessment of the null hypothesis for the results of the authors' sociological study					
	Russian students			Chinese students		
	χ^2_{emp}	$\chi^2_{0.01}$	H_j	χ^2_{emp}	$\chi^2_{0.01}$	H_j
1	13.668	11.345 ^{0.01}	$H_1^{0.01}$	18.334	11.345 ^{0.01}	$H_1^{0.01}$
2	11.001	11.345 ^{0.01}	$H_1^{0.05}$	12.334	11.345 ^{0.01}	$H_1^{0.01}$
3	36.000	11.345 ^{0.01}	$H_1^{0.01}$	11.668	11.345 ^{0.01}	$H_1^{0.01}$
4	9.001	11.345 ^{0.01}	$H_1^{0.05}$	26.666	11.345 ^{0.01}	$H_1^{0.01}$
5	4.334	11.345 ^{0.01}	H_0	-	-	-
6	5.042	6.335 ^{0.01}	$H_1^{0.05}$	45.334	11.345 ^{0.01}	$H_1^{0.01}$

Note. Designations: H_j – null hypothesis ($j = 0$, difference between the distributions is not statistically significant, H_0 ; $j = 1$, difference between the distributions is statistically significant, H_1); χ^2_{emp} – empirical frequency, $\chi^2_{0.05}$ – critical value of the theoretical frequency, significance level $P = 0.05$; $\chi^2_{0.01}$ – critical value of the theoretical frequency, significance level $P = 0.01$.

of shaping the students' social, moral, and physical personality traits.

Conclusion. The research reported in this paper helped establish the following: (1) there was a lot in common in terms of why both the Russian and Chinese students chose basketball (e.g., deference to the parents, learning to play basketball mainly in a children's sports school); (2) around 30% of the Russian respondents started to do basketball prior to seven years of age, whereas all of the Chinese respondents started to do it at the age of seven; (3) 70% of the Chinese respondents were motivated to do basketball in the pre-college period by prizes, gifts, etc., whilst a major portion of the Russian respondents (42%) prioritized self-esteem and deriving pleasure from playing basketball; (4) with the Russian respondents, one of the key motives for doing basketball was the opportunity to take part in international tournaments; (5) in choosing a college to attend, many of the Russian and Chinese respondents took account of the opportunity to continue doing basketball, as well as the availability of financial assistance.

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First- and second-year cadets' physicality and functionality analysis

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Abstract

Objective of the study was to analyze physical fitness and physical development rates and progresses of the 1-2-year military cadets with and without prior sporting experiences.

Methods and structure of the study. The two-year study was designed to analyze the physical fitness and physical development in a 1-2-year cadets (n=203). The physical fitness was tested as recommended by the valid Physical Fitness Manual; and the physical development was rated based on the muscle, fat and bone masses, cardio-respiratory system functionality and functional reserve.

Results and conclusion. The sample included 28% of actively sporting individuals qualified Class I-III and Candidate Masters Sport. We analyzed the comparative functionality and physicality progresses of the sporting and non-sporting groups in the sample for the two academic years. The study found the sporting group's progresses being significantly (within 10%) better on the speed qualities, endurance and functionality scales despite the changes in the lifestyle due to academic studies and shortage of time for sports.

Keywords: *cadets, physical fitness, physical development, anthropometrics, functional reserve.*

Background. Physical fitness may be defined as the integral parameter of individual fitness for academic vocational training including the military-service-specific safety and operational skills; and this is why physical fitness is ranked among the key vocational selection criteria for entrants to the national military academies [5]. High individual physical fitness and functionality standards are known to facilitate the cadets' adaptation to active military service [3, 9]. The cadets' physical fitness is largely determined by the individual anthropometric characteristics and physiological, physical and psychological qualities [1, 4, 6]. The cadets' physical fitness and physical development profiling studies with correlation analyses may help rate relative progress of the sporting and non-

sporting entrants to academies as they are critical for success in their further professional service.

Objective of the study was to analyze physical fitness and physical development rates and progress of the 1-2-year military cadets with and without prior sporting experiences.

Methods and structure of the study. The two-year study was designed to analyze the physical fitness and physical development of the 18-35 year-old 1-2-year cadets (n=203). The physical fitness was tested as recommended by the valid Physical Fitness Manual by the pull-ups, 100m sprint and 3km race tests [8]. And the physical development was rated by the muscle, fat and bone masses testing bioimpedance method; cardiac system functionality rating



heart rate, systolic and diastolic blood pressure tests; and respiratory system/ functional reserve reserve rating vital capacity (VC), Stange-Gench Breath-Holding Test and Ruffier tests.

Results and discussion. The sample was split up for comparative analysis into sporting Group 1 (n=57) and non-sporting Group 2 (n= 148) with and without prior sporting experiences and competitive accomplishments, respectively. We analyzed the group functionality and physicality progresses for the two academic years. The study found the sporting group’s progress being significantly (within 10%) better in the speed-rating 100m sprint and endurance-rating 3km race tests. The 1-year Group 1 was tested with the higher neck, shoulder, wrist and inhale/ exhale chest sizes, plus the muscular and bone/ mineral masses; albeit the intergroup differences in the above sizes were actually tested to level down in the second academic year.

The tests rated the group functional reserve fair on average; albeit the sporting Group 1 was tested higher (good) by the functionality tests on the heart rate, systolic blood pressure, diastolic blood pressure, body mass and length test scales – versus the average fair test rates in Group 2. The squatting Ruffier test found the physiological costs and recovery periods being shorter in Group 1. And the Stange-Gench Breath-Holding Test found the Group 1 respiratory system functionality 10% better on average than in Group 2.

The physical fitness / physical development correlations were rated by a factorial analysis of the test data. We estimated the cumulative variance of five dominant factors at 80% of the total. The factorial structure of physical fitness and functionality was dominated by five specific factors (see Table 1). We sorted the factors in the Table by their weights in the total factorial structure.

Dominant Factor 1 with the highest 32% input to the total variance covered the body mass and length, basic metabolism, skeletal muscle mass, intra- and

intercellular liquid, proteins, bone/ mineral mass indices. Factor 2, with the 17% input to the total variance, characterized the vegetative regulation by the Kerdo, Ruffier, Reed and physicality indices. Factor 3, with the 14% input to the total variance was indicative of the individual metabolism including the fat mass/ percentage and body mass index. Factor 4, with its 9% input to the total variance, was indicative of the functional reserve rated by the Stange-Gench Breath-Holding Test and Bogomazov test. And Factor 5, with the 9% input to the total variance, was indicative of the strength component of physical fitness rated by the pull-ups test and arm strength indices. Total inputs of the above five factors to the cumulative total variance was estimated at 80%.

Therefore, the two-year study data and analyses found the cadets reporting prior sporting experiences making higher progress in the speed and endurance rating tests and tested higher on the skeletal muscle mass, basic metabolism and functional reserve tests scales than their non-sporting peers. The sporting cadets are better fit for physical pressures and, hence, better adapt to the service-specific conditions and lifestyle changes since their adaptation mechanisms are pre-formed at the cellular level to facilitate the adaptive responses progressing from the system level to more perfect tissue level so as to avoid notable falls in the working capacity [2]. Trained young males are known better fit for the overnight service and less susceptible to fatigue. Habitual physical trainings help the bodily tissues fast adapt to hypoxic conditions and still maintain high performance despite some shortage of oxygen [7, 10]. Special physical fitness trainings are critical for military cadets as they secure their progress in studies and success in the further military service with high environmental adaptability and professional service standards.

Conclusion. The study found the sporting cadets (having the pre-academic sporting experiences and

Table 1. Physical fitness of the sample: factorial structure

Factor	Input to the total variance, %	Test rates
1. Anthropometric characteristics	32	Body mass and length, basic metabolism, skeletal muscle mass, intra- and intercellular liquid, proteins, bone/ mineral mass
2. Autonomic regulation	17	Kerdo, Ruffier, Reed indices, physicality
3. Metabolic	14	Fat mass and percentage, body mass index
4. Functional reserve	9	Stange-Gench Breath-Holding Test, Bogomazov index
5. Strength	7	Pull-ups, arm strength indices



accomplishments) demonstrating higher progress in the speed, endurance and functional reserve tests. Based on the study data, we ranked the progress factors by priorities as the anthropometrics factor indicative of the vegetative regulation, metabolic factor indicative of the individual functional reserve and strength factor as dominant for the military cadets' physical training system. The cumulative variance of these factors was estimated at 80% of the total – that may be interpreted as indicative of the high validity of the study approach and test methods.

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Conditions for increasing effectiveness of public administration in academic physical education

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Abstract

Objective of the study was to identify the necessary conditions for increasing the effectiveness of the public administration in the field of physical education of Russian students.

Methods and structure of the study. The study included a structural-functional analysis of the current physical education system of the Russian Federation that made it possible to develop a cybernetic model of public administration in the field of physical education of Russian students; analysis of the available scientific data and key characteristics of the administrative process under consideration: continuity of the original purpose at different levels of physical education and provision of the feedback mechanism.

Results and conclusions. The author proposes a cybernetic model of public administration in the field of physical education of students of the Russian Federation. It addresses the two key components of any administrative process: purpose and feedback. The analysis of the expert survey results and current practice of physical education of Russian students revealed a correlation between the physical training goals at the country and university levels. The ways to organize feedback during public administration in the field of physical education of students were determined through a critical analysis of the process of evaluation of the state policy in this sector, in particular, in the selection of its quality indicators. It was concluded that a range of measures is needed to improve public administration in the field of physical education of students and increase the efficiency of the appropriate state policy. Firstly, it is necessary to ensure that the physical education goals pursued by the state and university physical education teachers are in harmony. Secondly, there is a need to develop up-to-date integrated indicators of effective physical education model implementation at universities, along with an appropriate methodology for their evaluation. Finally, it is required to conduct regular monitoring according to the developed indicators and methodology.

Keywords: *academic physical education, physical education, public administration, state policy.*

Introduction. Physical training was first introduced in Russia as a compulsory discipline at the Moscow School of Mathematical and Navigation Sciences, opened in 1701. Later - in the secondary school of Gluck, the Maritime Academy, the cadet corps. By decree of Alexander I, a fencing school was opened under a separate guard corps, which became the first military sports school. In the future, the military department and the Ministry of Education continued norm-setting in the field of physical educa-

tion and sports: the Ministry of Education - through the comprehensive development of the personality of the younger generation, the military department - in the direction of physical training in the army. In the second half of the 19th century, fencing, gymnastics, bayonet fighting were mandatory items in the guards. Since 1872, gymnastics appeared as a compulsory discipline in real schools. After the October Revolution, the development of the physical education and sports system has remained in the focus of attention



and interests of the state; the process of forming the physical education and sports management system has begun. Since 1930, physical education has become an obligatory subject in the programs of all higher educational institutions of the USSR in the first two courses of study, having an optional character in senior courses [7]. Today, the discipline "Physical Education" is mandatory in higher education programs in 4 courses of all directions and training profiles, and considerable attention is paid to the physical education of students from state policy [6]. The institutionalization of physical education in the educational environment of Russia, which has gone all the way to the 3rd century, indicates that the state throughout this time has considered and continues to consider physical education of students as a value. The question arises: what does the state see for itself this value and is this only a Russian phenomenon?

The aim of the study is to reveal the value potential of students' physical education from the perspective of national priorities based on an analysis of current trends in the socio-economic and socio-political development of countries.

Methods and structure of the study. In order to answer the question, an analysis was made of the development of physical education of students from different countries. From the standpoint of modern trends in the development of society, based on the theory of human capital, the knowledge economy and the existentially-humanistic approach to human health, the modern value potential of students' physical education is revealed, aimed at achieving the national priorities of the state.

Results and discussion. Consider the foreign experience of institutionalizing the physical education of students. In Polish higher education institutions, the idea of students' physical training arose in the 17th century. In the first half of the 19th century, significant steps were taken in Poland towards the introduction of physical education of students in the educational programs of universities. Already in 1817, sports training was included in the curriculum at the Jagiellonian University. In 1838, a gymnastic school was established at the university. Later, in the 20th century, universities were charged with giving students the opportunity to play sports in the prescribed minimum hours. In 1950 physical education was first introduced into the curriculum of individual universities in Poland as a compulsory discipline [1].

Indicative, given the peculiarities of the country's development and its role in the world economy, is China's attitude to the physical education of students.

The compulsory nature of the physical education of students is enshrined in Order No. 8 of the PRC Ministry of Education dated 03.03.1990 as part of the "Program for the Development of Physical Culture and Sports in Educational Institutions", expressing the PRC state policy in this area. In 2012, a resolution was issued by the Main Directorate of the State Council of China, submitted to it for approval jointly by the Ministry of Education, the Ministry of Finance, the National Development and Reform Commission, and the General Directorate of China for Sports. The decision postulates the high importance of measures to strengthen the physical education of students, states that it is unacceptable to reduce the amount of hours allocated in educational programs for physical education, steps are taken to increase state investment in this area [10].

For the United States, due to the peculiarities of the organization of the higher education system, the absence of uniform state requirements for educational programs of the country's universities is characteristic. Accordingly, the physical education of students in the United States a priori may not be mandatory. At the same time, about 60% of professional educational institutions in the United States consider physical education an obligatory component of the educational process [2].

The above examples indicate that the institutionalization of physical education of students has deep historical roots and wide international coverage. This indicates the value potential that states see in the physical education of students. It should be noted that, depending on the socio-economic and socio-political factors operating in a particular historical period on the territory of a country, this potential is revealed in different ways. So, for example, the pronounced military-applied nature of the physical education of students in the USSR before the start of the Great Patriotic War later, after it ended and the USSR was included in the International Olympic Committee, gave way to the tasks of sports improvement, and even later to the tasks of shaping the physical culture of a person. The goals of physical education in Japan, due to the variability of the vector of national policy, have passed, as V.I. Stolyarov shows in his monograph, at least three phases of the change of their guidelines (before 1945, from 1945 to 1989, after 1989) [8]. Thus, we can observe the multivariance of the goals of states in the matter of physical education of students. The relevant question is what state problems physical education in universities today is aimed at.



Currently, health capital, first included in the human capital by G. Becker, which is along with education capital, its universally recognized fundamental element, is considered as an object of economic investment [5]. Moreover, at the present stage, researchers emphasize the significant superiority of the value of investments in human capital over investments in technology and note a paradigm shift in social development [9]. Introduced in the second half of the 20th century by the economist F. Mahlup, the concept of the knowledge economy was widely used in the scientific community, becoming the most important theoretical and methodological foundation of the modern theory of economic development. The term "knowledge economy" is intended to emphasize the role that has arisen in the determinants of economic development from material and natural factors towards knowledge and human capital. Finally, the thesis that in connection with the transition to a knowledge economy and the growing role of human capital, higher education is at the present stage a key factor in economic development is considered universally recognized. The content, development and effectiveness of higher education are today under the scrutiny of scientists [4]. As a result, despite the initially high role of the higher education system in the formation of human capital, associated with the saturation of the labor market with highly qualified specialists, its importance in the knowledge economy increases many times over.

Given the above, we emphasize that the physical education of students is able to provide a significant contribution to the formation of human capital, both through education capital and health capital. The scientific and educational process implemented in higher education exposes future specialists to the intense impact of the educational environment. Adapting to it takes health resources, which during the course of training have a dynamics of deterioration. This cannot but affect the quality of the formation of professional competencies. At the same time, the skills and culture of self-preserving behavior, formed during the period of study at the university by means and methods of physical education and training, are able to exert a directed effect on strengthening the health of not only the student, thereby increasing the effectiveness of his educational process, but also of the future specialist in the process of his labor activity, allowing you to maximize the disclosure and maximum use of human capital. The issues of the interdependence of labor productivity and the level of health of the population

were developed in detail in the writings of A. Smith, D. Ricardo, C. Marx, A. Marshall, T. Schulz, G. Becker and others. Today we can say that physical education of students through its health potential leads to positive changes in the quality of the country's labor force and a decrease in the load on the health-care system and social support [3].

However, it would be erroneous to associate the potential of students' physical education only with economic indicators. Modern humanistic tendencies fix for the man himself a central place in the system of cultural values. It is important to preserve and develop the person himself. Such an approach is concretized in the global trend of public health policy, where there is a paradigm shift from "treatment of diseases" to "health care". If successful, such an approach leads to the implementation of the second epidemiological revolution. In this regard, it is difficult to overestimate the role of physical education of students, innovative approaches to which are based on the need for its humanization.

Conclusion. Given the current role of higher education in the development of the economy, the fact that human capital is considered as a key component of the knowledge economy, and also, given the described mechanism of the influence of students' physical education on the formation of human capital, it can be argued that the potential of students' physical education is largely directed today on the issues of socio-economic development of states. On the other hand, the value of this potential is in providing the necessary grounds for the implementation of the second epidemiological revolution, as well as in the development and preservation of the person himself, his quality of life, in the formation of his identity, which is an absolute national priority. At the same time, the value potential of physical education of students is equally realized today in these two areas in all countries where the current economic development takes place within the framework of the paradigm of the knowledge economy, and the system of cultural values meets the principles of humanism.

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Hemodynamic features of athletes' physical working capacity in view of autonomic regulation type

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Abstract

Objective of the study was to identify hemodynamic features of the physical working capacity of highly-skilled athletes under aerobic and anaerobic physical loads taking into account the type of autonomic regulation.

Methods and structure of the study. Sampled for the study were 51 qualified athletes: 17 handball players aged 18-29 years with 10-15 years of sports experience; 34 racing cyclists aged 22-26 years with 7-10 years of sports experience. Both groups were taken as the Experimental ones (EG-1 and EG-2). The study also involved the Control Group (CG), which consisted of 17 healthy young males aged 18-29 years who were not actively involved in sports. The systolic and diastolic ventricular function was evaluated by Doppler echocardiography performed using the ultrasonic scanners "GEVIVIDE 95", "GEVIVIDI". The left ventricular remodelling indices were measured. The hemodynamic parameters of the diastolic function were assessed based on the transmitral flow indices. The racing cyclists (n=34) were subjected to the heart rate variability test (at rest) using the "VNS-Micro" device. We also analyzed the temporal and spectral (frequency) parameters of HRV that reflect the state of autonomic regulation in the athletes. In addition, we determined the differences in the overall endurance rates (Cooper's test) between the athletes and non-athletes, as well as the cardiac wall motion and cardiac hemodynamic indices.

Results and conclusions. The diastolic indicators of the transmitral flow (E/A, IVRT, ET) at rest can be considered as predictive measures in determining the exercise capacity (both aerobic and anaerobic) of an individual. In terms of the properly organized training process, the athletes' autonomic regulation, left ventricular geometry, and hemodynamic parameters of the diastolic function at rest did not go beyond the limits of the physiological norm. At the same time, the athletes' physical load tolerance was significantly higher than that of the non-athletes.

Keywords: adaptation, myocardium, transmitral flow, remodelling, physical load, elite athletes.

Introduction. Body adaptation mechanisms to physical activity are traditionally considered from the integrated approach position [8]. In the sport of setting records, the assessment of the cardiovascular system (CVS) adaptation includes systolic and diastolic blood circulation, cardiac activity autonomic regulation of indicators. Vegetative (neurohumoral) regulation reflects possibilities of influence of the sympathetic and parasympathetic nervous system taking into account humoral factors' action on heart rhythm [3].

The assessment of muscular activity metabolic changes reflects readiness of CVS to glycolytic loads, with glycolytic capacity's determination and its relationship with morphometric and hemodynamic indices of sports heart adapted to load [5,6].

Objective of the research was to study hemodynamic performance characteristics of elite athletes taking into account autonomic regulation when performing aerobic and anaerobic loads.



Methods and structure of the study. The study involved 51 qualified athletes: 17 handball players aged 18-29 years with the sports experience from 10 to 15 years, and 34 cyclists (track) aged 22-26 years with the sports experience from 7 to 10 years. Both groups were experimental (EG -1 and EG-2). The study also involved a control group (CG), which consisted of 17 healthy young people who were not actively involved in sports, aged 18-29 years.

The myocardial systolic diastolic parameters were estimated using ECHO dopplercardiography (ECHO-KG). Diagnostic equipment was used: ultrasonic scanners "GE VIVID E 95," "GE VIVID I." Parameters of left ventricular remodeling (LV) [2] were measured: left ventricular myocardial mass (LVMM) g; LVMM index (iLVMM), g/m². Normal LV geometry was considered to be relative wall thickness (RWT) < 0.42-0.45 at normal LV parameters iLVMM less than 115 g/m² in men, for women - less than 95 g/m² [2.6]. To evaluate the hemodynamic parameters of the diastolic function, transmitral blood flow indices were used: maximum speed of early diastolic filling (Peak E), m/s; maximum atrial system filling rate (Peak A), m/s; ratio of peaks E and A (E/A) u.e.; LV isovolumic relaxation time (IVRT) in milliseconds (ms); ejection time (ET) (in ms).

In order to study the heart rate variability (HRV) at rest on the VNS-micro device (Company "Neurosoft" Russia), measurements in the group of qualified cyclists (p = 34) were made. Time and spectral (frequency) parameters of HRV reflecting the state of athletes' rhythm's autonomic regulation are analyzed.

In addition, the study determined the difference in the level of total endurance (Cooper's test) of

athletes and those not involved in sports, and the morphometric and hemodynamic heart indicators [8]. To identify the level of special operability and glycolytic capacity, the test "Running 300 meters" (s) was carried out as recommended in the training program for qualified handball players of the Republic of Hungary [6].

Results and discussion. Cardiac myocardial remodeling parameters belonged to the normal type of LV myocardial geometry in all the groups examined. Statistically significant differences between athletes and non-athletes do not go beyond the physiological norm. With a competently constructed training process, athletes can achieve high qualification without violating the parameters of normal cardiac geometry. This statement is supported by the results of the data from ECHO-KG, analysis of the influence of sympathetic and parasympathetic departments of ANS, and the results of pedagogical testing [5.6]. Athletes with the predominance of classical components of the sports heart at rest can be in the best form while maintaining the parameters of normal LV geometry for a long time [2].

In order to assess neurogumoral influences on the cardiac rhythm regulation, cardiac rhythm variability indices (HRV), as well as cardiac mechanics remodeling index in diastole [4] were investigated. Measures of heart rate variability of individuals are EG 2 shown in comparison with measures of average data for young men. Data were obtained as part of the work of the experimental "platform" of biomedical support of cyclic athletes (presented in Table 1) [7].

Variability parameters make it possible to notice the predominant parasympathetic influence on the

Table 1. Statistical and spectral indicators of HRV ($X_{avg} \pm SE$)

	RRNN, MS	SDNN, MS	pNN50, %	TP, MS ²	VLF, %	LF, %	HF, %
EG 2 (n=34) cycling	906,47±143,27	96,55±48,13	40,36±20,85	3636,7±2114,0	31,34±14,74	32,08±10,95	36,06±15,01
HRV average data [7]	800±56	110±35	22±13,6	3150±1018	28,65±11,24	33,68±9,04	35,79±14,74

Table 2. Blood flow rates at examined individuals ($X_{avg} \pm SE$)

№	criteria	groups		
		EG 1 (n=17) handball	EG2 (n=17) cycling	CG (n=17)
1.	HR b/min.	64,5±7,62*	63,2±5,81*	75,5±4,2
2.	E/A cu	2,33±0,42*	2,22±0,20*	1,43±0,41
3.	IVRT ms	100,27±19,76*	95,33±21,45*	65,5±22,5
4.	ET ms	605,16±155,21*	635,18±170,45*	380,3±100,54

* – accurate of differences with the control group (p<0,05)

generating of sinus rhythm pulses with uniform exposure to humoral and sympathetic components. As seen from the given data, preferential influence of the parasympathetic nervous system on the generating of the sinus node's pulses makes it possible to consider group of examined athletes being sufficiently ready for high intensity loads and high sports results' achievement [2].

The ratio of transmission blood flow E/A, in persons not engaged in sports, is inferior to athletes at an accurate level. In the indicators IVRT and ET (ms.), an accurate advantage of athletes is also defined [3]. The time-determining values for the duration of diastole are shown in Table 2.

The obtained results of transmitral blood flow can be interpreted as a hemodynamic marker of a sports heart with a "Supernormal" configuration of transmitral blood flow at normal LV geometry [5.6]. As our studies showed, when evaluating general and special performance, this indicator reflects the athlete's fitness for various loads, as well as determines the level of anaerobic glycolytic capacity. The latter was confirmed by the results of testing individuals EG1 and CG (when performing the tasks "Cooper Test" (m) and "Running 300 m" (s)). According to Cooper's test results, athletes showed a reliable advantage of more than 680 m compared to CG persons [5]. The comparison in the test "Running 300 m" (s) EG1 and CG was considered as incorrect, since the test is associated with the manifestation of glycolytic (high-speed) endurance. Athletes showed anaerobic glycolytic capacity at lactate titer 9-11 mmol/l, which was observed for 3 min of recovery after test [1.5].

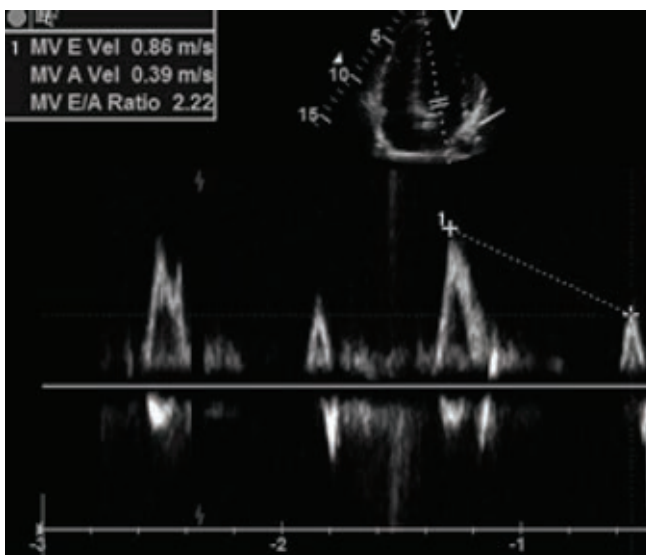


Figure 1. *The ratio of E/A flow rates in the form of «Supernormal» remodeling of diastolic filling [4].*

Under physiological conditions (60-85%) of blood, it enters by transit from pulmonary veins to the phase of passive early diastolic filling, and (15-30%) enters the period of atrial systole. In conditions of rhythm deceleration, there is a smaller contribution of atrial contraction to the late diastole component. Since the contribution of the atrial systole to the late diastole component [3] also increases with an increase in HR, diastolic parameters with an increase in HR lose their economy, and the time to restore the LV myocrade. This can be seen from the parameters of diastole of KG persons, which in turn is manifested by a decrease in the transmitral E/A ratio less than 2.0 cu (average value of 1.43 cu) [5.6].

Based on the HR values in EG 1 and 2 (Table 1), it can be concluded that with the predominance of the parasympathetic component on the generation of sinus node pulses, the time of early and late diastole increases, forming a time reserve for myocardial recovery before subsequent effective reduction. With the previously noted values of HR EG 1 and 2, it is obvious that the diastole of the sports heart, represented by the "Super Normal" remodeling of cardiac mechanics [4], under the influence of the parasympathetic regulation link [2], forms a reserve for different loads types. That is confirmed by us as a result of tests with determination of level of general (aerobic) and special (anaerobic glycolytic) performance in qualified athletes [5, 6].

Conclusions:

1. The parasympathetic contribution to the rhythm regulation, with the "Super Normal" version of cardiac mechanics remodeling is the indicator of fitness for aerobic and anaerobic loads with the highest glycolytic capacitance result;

2. Vegetative regulation parameters, myocardial geometry and transmitral blood flow indicators are promising application points of both non-drug and legal pharmacological means of recovery in sports.

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Water balancing method for functional progress of elite athletes

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Abstract

Objective of the study was to analyze benefits of Prolom mineral water for physical performance and functionality in elite powerlifting sport.

Methods and structure of the study. We sampled for laboratory tests 20 elite powerlifters qualified CMS and MS and split up the sample into Experimental and Reference Groups (EG, RG) of 10 people each. The EG took Prolom mineral water prior to and after trainings and in the post-training rehab periods for six months, whilst the RG took standard drinking water. The group progresses were tested by the following psycho-physiological tests: complex sensorimotor response; three colors (red, yellow, green) critical distinguishing frequency; hydrodynamometric (static endurance); and physical working capacity tests; plus vegetative functionality tests including the heart rate test; and water minerals versus physical working capacity tests including the aerobic capacity tests by PWC₁₇₀ method adapted by V.L. Karpman and Z.B. Belotserkovsky.

Results and conclusion. The study data and analyses demonstrated benefits of the Prolom mineral water consumptions and water balancing method as verified by improvements in the aerobic capacity and blood pressure under varied physical stresses. The water minerals were found to improve functionality of the central regulation mechanisms and step up the heart performance. Note that pre-experimental tests found no meaningful intergroup physical working capacity differences. The Prolom mineral water consumption with dietary water balancing method was tested beneficial and harmless and, therefore, may be recommended for application for the sports elite's physical performance and functionality improvement purposes.

Keywords: mineral water, redox index, functionality, physical working capacity, powerlifting, psycho-physiological tests, water minerals, aerobic capacity, cycle ergometer test, physical stress test.

Background. Mineral water with its trace elements is increasingly popular for its facilitating effects on physical and mental progress in sports [1]. In view of the recent doping scandals, mineral water may be ranked high on the list of the potential "safe doping" alternatives due its composition being fairly close to the human biochemistry. It was found by the latest studies that functionality of muscle and brain cells may be improved by the dietary water balancing methods with a special attention to the water quality including its redox index. When daily

water is well balanced, the trace water minerals are known to be most effectively consumed. Many study reports have demonstrated that growths in metabolic activity are normally associated with increased consumption of trace elements critical for glycolytic regulation and oxygen transmission by erythrocytes. Therefore, high-alkaline natural water with the negative redox index and balanced trace elements may help cope with deficiencies of the key proteins due to many positive effects including an accelerated regeneration under physical stress

– that heavily contributes to the competitive performance and progress [1, 3].

Objective of the study was to analyze benefits of Prolom mineral water for physical performance and functionality in elite powerlifting sport.

Methods and structure of the study. Prolom mineral water is natural mineral dietary water of sodium bicarbonate category with traces of silicon, alkalines and oligominerals. Its key characteristics are: low mineralization of 0.2 g/l, high alkalinity of pH 9.2, traces of silicon and natural bicarbonates. It is rapidly excreted acting as a diuretic, increases urinal output and reduces acidity of urine and gastric juice, increases the secretory function of the liver, improves bile secretion and gallbladder function; and increases the blood alkalinity to maintain pH at optimal levels for respiration and cellular nutrition. Prolom mineral water is recommended for treatment of metabolic disorders and for oxidative stress control, and is known to facilitate the post-training rehab processes [4].

We sampled for laboratory tests 20 elite powerlifters qualified CMS and MS and split up the sample into Experimental and Reference Groups (EG, RG) of 10 people each. The EG took Prolom mineral water prior to and after trainings and in the post-training recovery periods for six months, whilst the RG took standard drinking water. The group progress was tested by the following psycho-physiological tests: complex sensorimotor response; three colors (red, yellow, green) critical distinguishing frequency; hydrodynamometric (static endurance); and physical working capacity tests; plus vegetative functionality tests including the heart rate (HR) test; and water minerals versus physical working capacity tests including the aerobic capacity tests by PWC_{170} method adapted by V.L. Karpman and Z.B. Belotserkovsky.

Results and discussion. The pre-experimental physical working capacity tests using the PWC_{170} method rated the physical working capacity in RG and EG moderate at 1076 ± 53 kgm/ min and 1152 ± 88 kgm/ min, respectively. The post-experimental tests found the PWC_{170} rates in the RG (n=8) averaging at 980 ± 67 kgm/ min – versus 1201 ± 87 kgm/ min in the EG (n=7). The meaningful difference in the group progresses may be due, as we believe, to the positive influences of mineral water on the aerobic capacity ($p < 0.05$) for the related samples. The EG progress may be interpreted as facilitated by the functionality economizing effects– as demonstrated, among other things, by the HR improvements in the EG only. On the whole, the aerobic capacity in the EG (PWC_{170} test) was tested to grow for the experimental period by

8-12% due to the HR reduction and 25-35% progress in the cardiovascular system performance under physical stress, plus reductions in the post-training rehab times (from 5 to 3 min).

Given of Figures 1-3 hereunder are the cycle ergometer test data of the sample –indicative of the Prolom mineral water benefits for aerobic capacity under physical stress. Note that the central regulatory mechanisms are particularly sensitive to water minerals. The mineral water consumption by the EG was tested to improve the heart performance as verified by the systolic pressure growth, with special benefits for vascular tone i.e. positive effects on the regulatory centers including the sympathetic and parasympathetic divisions: see Figures 1, 2. The test data were processed by STATGRAPHICS software: see the confidence intervals and meanings of the differences on the Figures. The RG was tested with virtually no progress in the tests, save for some insignificant improvement in the physical stress tolerance.

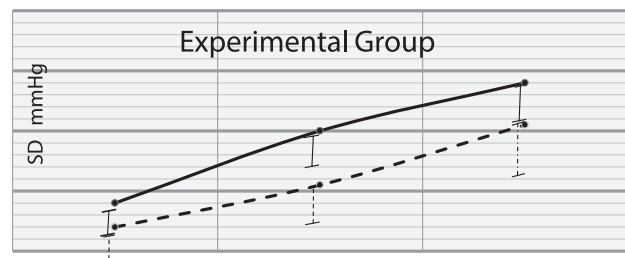


Figure 1. Pre- versus post-experimental systolic pressure test data (mmHg) of the EG and RG after moderate (1) and high (2) physical stress

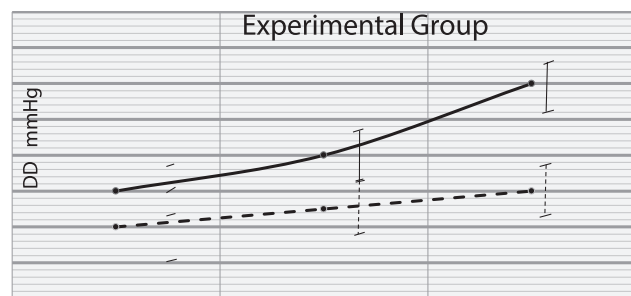


Figure 2. Pre- versus post-experimental diastolic pressure test data (mmHg) of the EG and RG after moderate (1) and high (2) physical stress

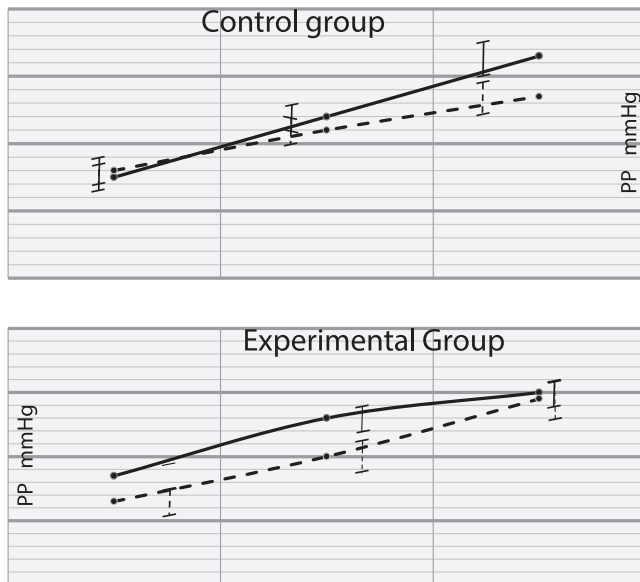


Figure 3. Pre- versus post-experimental pulse pressure test data (beats/ min) of the EG and RG after moderate (1) and high (2) physical stress

Note that pre-experimental tests found no significant intergroup physical working capacity differences.

Conclusion. The Prolom mineral water consumption with the dietary water balancing method was tested beneficial and harmless and, therefore, may be recommended for application for the sports elite's physical performance and functionality improvement purposes.

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Pain tolerance versus competitive success in youth kickboxing

UDC 796.8



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Abstract

Objective of the study was to rate and analyze the pain tolerance versus competitive progress in the youth kickboxing sport.

Methods and structure of the study. We used special research literature analyses, synthesis and analyses of the competitive records and training process observations as a basis for the tests. The pain tolerance of the 6-12 year-old sample ($n = 40$) was tested by I.I. Kuznetsov test system with a blood pressure gauge. The system air pump exerts pressure on the subject's skin till refusal, with the top pressure fixed instantly n mm Hg. The pain tolerance was also rated by the Verbal Pain Rating Scale and Modified Facial Pain Rating Scale in points [3]. The pain tolerance rating tests were complemented by the competitive records analyses and practical observations. Individual fight styles with the pain tolerance elements were rated as follows: refusal to fight was scored by 0 points; uncontrolled pre-fight fever scored by 1 point; pre-fight fever followed by shaky confidence scored by 2 points; stable behavioral self-control scored by 3 points; and courage, initiative and full confidence in the fight scored by 4 points. The study was run at Patriot Sports Club in Belgorod and University of Innovation and Technology of Western Kazakhstan in Uralsk. The test data were collected and processed in 2018-2020 with conversion into non-parametric values, followed by a Spearman rank correlation analysis.

Results and discussion. The study found a highest correlation between the individual pain tolerance test rates obtained by the Kuznetsov skin pain test and competitive fight style ($r_s = 0.875$). The pain tolerance versus fight style correlations for the Verbal Pain Rating Scale and Modified Facial Pain Rating Scale tests were somewhat lower ($r_s = -0.783$ and $r_s = -0.756$, respectively); although still indicative of the significant correlation between the pain tolerance and competitive success in the youth kickboxing sport. The arithmetic means and standard deviations give the grounds to rate the junior sample pain tolerance as mean. The study data and analyses demonstrate the pain tolerance being in strong correlation with the competitive fight style. The findings and study data are recommended for application in the theoretical and practical trainings and competitions in youth kickboxing.

Keywords: *physical pain, pain tolerance, bouts, kickboxing, junior athletes.*

Background. Studies of pain and the relevant aspects have long been ranked among the priorities by medical and other sciences [2, 5-7]. Modern sports communities, with the growing athletic workloads, competitiveness and exposure to injury risks, are increasingly interested in the physical pain research. Competitive bouts in modern full-contract kickbox-

ing imply power punches and kicks to head and body allowed by the competition rules, with a successful competitor expected to be highly tolerant to pain. As demonstrated by practical success histories, the individual pain tolerance is critical for progress in modern full-contract martial arts on the whole and kickboxing in particular, although the relevant issues are still un-



derexplored by the research community. Therefore, we believe that an analysis of the pain tolerance test rates versus competitive progress could be beneficial for the youth kickboxing sport.

Objective of the study was to rate and analyze the pain tolerance versus competitive progress in youth kickboxing sport.

Methods and structure of the study. The pain tolerance of the 6-12 year-old sample (n = 40) was tested by I.I. Kuznetsov test system with a blood pressure gauge. The system air pump exerts pressure on the subject's skin till failure, with the top pressure fixed instantly n mm Hg. The pain tolerance was also rated by the Verbal Pain Rating Scale and Modified Facial Pain Rating Scale in points [3]. The pain tolerance rating tests were complemented with the competitive records analysis and practical observations. Individual fight styles with the pain tolerance elements were rated as follows: refusal to fight was scored by 0 points; uncontrolled pre-fight fever scored by 1 point; pre-fight fever followed by shaky confidence scored by 2 points; stable behavioral self-control scored by 3 points; and courage, initiative and full confidence in the fight scored by 4 points. The study was run at Patriot Sports Club in Belgorod and University of Innovation and Technology of Western Kazakhstan in Uralsk. The test data were collected and processed in 2018-2020 with conversion into non-parametric values, followed by a Spearman rank correlation analysis.

Results and discussion. The study was designed to complement the prior studies of the subject [1, 3, 4] that have partially addressed the issues of pain tolerance versus competitive fight styles in youth kickboxing. Subject for those prior studies, however, were only the maiden training bouts, whilst the pain tolerance versus competitive progress analysis was made solely on logical considerations of the individual qualitative characteristics. In this study, we expanded the sample and the number of bouts (24 bouts for every subject) and applied a standard mathematical statistics toolkit to put the analysis on a sound basis.

Having processed the data arrays, we found correlations of the pain tolerance rates yielded by the

Kuznetsov test with the Verbal Pain Rating Scale and Modified Facial Pain Rating Scale test rates, to verify the test data validity. We also found a clear correlation between the skin pain tolerance test rates and the actual individual fight styles: see Table 1 hereunder.

Our calculations rejected the null hypothesis and found a relatively high correlation of the test rates (rs = 0.875) for the Kuznetsov test – that means that the individual pain tolerance and competitive success rates are closely correlated for the age group. This result was then verified by the correlations between the Verbal Pain Rating Scale test rates and fight styles that was also high at rs = -0.783); and a slightly lower correlation for the Modified Facial Pain Rating Scale test data (rs = - 0.756). The negative sign is explained by the fact that the lower are the points on the test scales, the higher is the pain tolerance and more confident is the fight style. We also analyzed the study data by analyzing the arithmetic means and standard deviations, followed by the average pain tolerance calculations for every athlete. Thus the Kuznetsov test yielded the high pain tolerance correspondent to the mean pain tolerance in the Verbal Pain Rating Scale and Modified Facial Pain Rating Scale tests.

Conclusion. The study found a highest Spearman's rank correlation between the individual pain tolerance test rates obtained by the Kuznetsov skin pain test and competitive fight style (rs = 0.875). The pain tolerance versus fight style correlations in the Verbal Pain Rating Scale and Modified Facial Pain Rating Scale tests were somewhat lower (rs = - 0.783 and rs = - 0.756, respectively); although still indicative of the significant correlation between the pain tolerance and competitive success in the youth kickboxing sport. The arithmetic means and standard deviations give the grounds to rate the junior sample pain tolerance as mean.

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Table 1. Pain tolerance versus competitive progress/ fight style correlations

Pain tolerance test	Correlation ratio, r _s	M±m., points	Average pain tolerance
Kuznetsov test	0,875	19,17±0,31	High pain tolerance
Verbal Pain Rating Scale test	- 0,783	7,65±0,25	Mean pain tolerance
Modified Facial Pain Rating Scale test	- 0,756	7,45±0,30	Mean pain tolerance



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Daily calorie intake, level of physical activity and morphological status of children and adolescents in three cities of Russian Federation

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Abstract

Objective of the study was to identify the intergroup variability of morphological characteristics, as well as indicators of physical activity and nutritional status in modern adolescents.

Materials and methods. The paper provides the results of a comprehensive examination of adolescents in the cities of Elista, Arkhangelsk and Moscow. The analysis included morphological characteristics, body composition indicators, as well as personal data, taking into account the calorie daily calorie intake, as well as the amount of time spent on physical activity and work in conditions of hypodynamia.

All calculations were performed with the Statistica 12.0 software package. The choice of data processing methods was determined after checking the normality test for the number of indicators, therefore, to compare the means in the case of metabolic parameters, as well as indicators of the caloric content of the diet and the level of physical activity, the Kruskal-Wallis test was used (the non-normal distribution was confirmed by the Kolmogorov-Smirnov test). In other cases, the assessment of intergroup differences was carried out using the methods of one-way ANOVA

Results and conclusion. It has been recorded that the overweight in Arkhangelsk adolescents of both sexes determines the high values of basal metabolic rates in this group. At the same time, a low level of physical activity has a negative effect on the development of the musculoskeletal component, that is, increased body weight values are associated in this group to a greater extent with its fat component. Residents of the capital have intermediate values among the three groups surveyed for most of the morphological indicators and minimum indicators of exchange. In this case, however, it is this group that is characterized by the maximum amount of time allocated to physical activity. The results obtained indirectly indicate the presence of a certain level of socio-economic differences in the surveyed cities.

Keywords: *modern children and adolescents, physical activity, calorie intake, body composition, anthropometry.*

Introduction. The study of the relationship between the body composition and lifestyle is of great interest for a number of scientific disciplines. Most of the works on this topic (Dayan et al., 2019; Merhout, Doyle, 2019 and others) are devoted to determining the relationship between the calorie intake and the level (and quality) of physical activity with body composition and body mass index (BMI) indices. This is

of a certain value in the context of the term “obesogenic” environment, which has been frequently used in recent years (Rendina et al., 2019), as a complex of factors leading to a decrease in the level of physical activity (up to hypodynamia) and a steady increase in the calorie intake (it has been proved that BMI is negatively related to the distance to the nearest fast food restaurant (Wilkins et al., 2019)).



Objective of this study was to identify intergroup variability in morphological characteristics, as well as indicators of physical activity and nutritional status in modern adolescents living in different locations of the Russian Federation.

Methods and structure of the study. The results of comprehensive anthropological examinations of 15-17-year-old schoolchildren in the cities of Elista, Arkhangelsk and Moscow, were taken for this study. In Arkhangelsk and Moscow the investigated children were of Russian origin, in Elista – Kalmyck children and adolescents were investigated. All measurements were carried out according to the standard method.

Calorie intake and level of physical activity were assessed using a questionnaire; body composition indices and metabolic rates (basal and specific) were determined by bioimpedance analyzer according to the standard method (Smirnov et al., 2009).

The collection of data was carried out with the signing of consent protocols, subsequently the data were depersonalized.

All calculations were performed with the Statistica 12.0 software package. The choice of data processing methods was determined after checking the normality test for the number of indicators, therefore, to compare the means in the case of metabolic parameters, as well as indicators of the caloric content of the diet and the level of physical activity, the Kruskal-Wallis test was used (the non-normal distribution was confirmed by the Kolmogorov-Smirnov test). In other cases, the assessment of intergroup differences was carried out using the methods of one-way ANOVA.

Results and discussion.

Morphological characteristics

The larger values of the considered traits were characteristic of adolescents in Arkhangelsk, the min-

imum values were recorded among the residents of Elista (Table 1).

At the same time, the intergroup differences in body height for both sexes are statistically significant (but not for the schoolchildren in Moscow (M) and Elista). For body weight and BMI, the significance of the obtained differences was confirmed only when comparing girls from Elista and Arkhangelsk. For boys, statistically confirmed differences were demonstrated for Kalmyks who had the lowest values of the studied traits.

Data from the questionnaires. The results (Table 2) suggest that the schoolgirls of Elista when compared to the other groups spend more time to work in conditions of hypokinesia and less - for physical activity. At the same time, the maximum daily calorie intake has been confirmed for them. For the boys, the trend is somewhat different: for example, the increased energy value of food consumed in this group is combined with minimal time spent on physical activity and sedentary work. Arkhangelsk and Moscow schoolchildren were almost the same in calorie intake but demonstrated different patterns for the daily routine. Thus, female residents of the capital spent more time working in conditions of hypokinesia, and young men have the highest value of this indicator among all groups. As for the level of physical activity, Moscow schoolchildren are ahead of their peers from other cities, and the inhabitants of the Russian North take an intermediate position, according to the amount of time spent on it.

Intergroup pairwise comparisons recorded the differences in the amount of time spent on hypokinetic work for boys: schoolchildren in the capital of Russia paid more attention for this type of leisure, residents of Arkhangelsk were in second place, followed by those from Elista. The maximum number of statistically significant differences was also confirmed for physical

Table 1. Descriptive statistics ($M \pm S$) of the following morphological traits in the three groups studies (A – Arkhangelsk, M – Moscow, E – Elista)

	N		Height, cm		Weight, kg		BMI, kg/m ²	
	♀	♂	♀	♂	♀	♂	♀	♂
A	184	64	160,4±6,6 *	168,0±9,8 *	51,1±7,8 *	58,2±13,3 *,**	19,8±2,4*	20,4±3,6 *,**
M	48	42	156,7±11,3	162,9±15,1	48,4±12,4	54,8±16,0	19,4±3,4	20,2±3,4
E	168	287	155,9±11,1 *	161,6 ±14,3 *	47,6±11,9 *	52,3±15,0 *,**	19,3±3,2 *	19,6±3,6 *,**

Note: * – differences are significant when comparing the values of the indicator among Arkhangelsk and Elista, ** - differences are significant when comparing the values of the indicator among Moscow and Elista, *** - differences are significant when comparing the values of the indicator among Arkhangelsk and Moscow



Table 2. Descriptive statistics ($M \pm S$) of calorie intake, time spent on hypokinetic work and physical activity in the three groups studied (A – Arkhangelsk, M – Moscow, E – Elista)

	Kcal/day		Hypokinetic work. min/day		Physical activity, min/day	
	♀	♂	♀	♂	♀	♂
A	2312,4±1136,8	2630,2±790,4	754,1±124,7 *, ***	754,9±146,0	12,3±12,9 ***	26,0±15,4 ***
M	2368,6±824,2	2629,5±1028,3	760,9±150,9 **, ***	822,8±174,9	35,8±16,6 **, ***	35,6±16,4 **, ***
E	2681,8±697,6	2664,8±710,5	766,1±290,9 *, **	683,7±180,1	12,1±6,2 **	25,4±13,1 **

Table 3. Descriptive statistics ($M \pm S$) of metabolic indicators in the three groups studied (A – Arkhangelsk, M – Moscow, E – Elista)

	Basal metabolic rate, kcal		Specific metabolic rate, kcal/m ²	
	♀	♂	♀	♂
A	1269,4±154,71 *, ***	1391,1±191,36 *, ***	837,6±78,36 **	860,3±51,41 **
M	1145,1±179,59 ***	1244,4±240,89 ***	927,2±110,42 **, ***	934,4±84,06 **, ***
E	1157,2±134,98 *	1298,6±230,50 *	856,7±77,21 ***	887,6±70,40 ***

activity: in the groups of girls - between Muscovites and those living in Elista, as well as between the latter and the inhabitants of Arkhangelsk. In groups of boys - between the residents of the capital at one pole and the residents of Elista and the city of Arkhangelsk on the other (between the last two groups the differences are very small).

Metabolic indicators. As can be seen from Table 3, the maximum values of basal metabolic rate were found in girls and boys of Arkhangelsk, while the specific metabolic rate was the highest in groups of Moscow schoolchildren of both sexes.

From Table 3 it can be concluded that schoolchildren in the Northern region as individuals with the highest values of body weight among the surveyed groups also have the highest values of basal metabolic rate. At the same time, the level of specific metabolic rate in this group is quite low, possibly because this indicator is calculated per unit of body surface, depending on height, which, in turn, reaches the highest values in this group. The hypothesis about the possible effect of high calorie intake on high body weight values in schoolchildren of Arkhangelsk was not confirmed (on the contrary, the maximum values of this indicator were recorded in the residents of Elista). This fact,

combined with a relatively low level of physical activity, can cause elevated body weight values.

To support this hypothesis, the amount of skeletal-muscle and fat mass in the groups surveyed was also compared (Table 4). According to the results, the girls of Arkhangelsk are characterized by the minimum values of skeletal-muscle mass, both in absolute and relative expression. At the same time, a high proportion of the fat component allows to conclude that it is it that contributes more to the maximum body weight observed in this group. As for the Arkhangelsk boys, the percentage of skeletal-muscle mass in this group is minimal, but in its absolute amount they occupy an intermediate position. The fat component in this group is higher than in the other two. Moscow schoolchildren are characterized by a greater amount of skeletal-muscle component and the minimum values of fat mass for the three groups studied. Teenagers from Elista are characterized by intermediate values of skeletal-muscle mass in the case of girls and minimal in the case of boys. The fat component shows a slightly different picture: its absolute value is minimal in teenagers of both sexes, and the relative one has intermediate values among the groups.



Table 4. Descriptive statistics ($M \pm S$) of body mass components in the three groups studied (A – Arkhangelsk, M – Moscow, E – Elista)

	Skeletal-muscle mass, kg		Skeletal-muscle mass, %		Fat mass, kg		Fat mass, %	
	♀	♂	♀	♂	♀	♂	♀	♂
A	16,6±4,3 *, ***	27,8±5,1	33,2±9,9 *, ***	48,4±6,8	14,0±5,1	12,2±6,4	27,4±10,0 *, ***	20,6±6,8 *, ***
M	20,9±2,8 ***	28,3±4,8	38,1±4,5 ***	46,8±5,3	13,8±5,1	10,9±6,4	24,6±5,5 ***	17,4±7,5 ***
E	19,0±2,1 *	26,7±4,5	37,8±4,0 *	48,3±5,6	13,3±5,3	10,4±6,0	25,3±5,5 *	17,8±6,9 *

Conclusions. The increased body weight of the Arkhangelsk adolescents also determines the high values of the basal metabolic rate in this group. At the same time, the low level of physical activity has a negative impact on the development of the skeletal-muscle component, that is, the increased weight values are associated in this group more with fat component. Residents of the Russian capital have intermediate values among the three groups studied in the values of most morphological characteristics and minimum metabolic rates. However, this group is characterized by the maximum amount of time allotted to physical activity. This does not contradict previous data showing that there are more leisure opportunities for residents of larger cities (Bogin et al., 2019; Godina et al., 2019). In the case of Elista schoolchildren, with minimal or intermediate values of the most studied characteristics, it is also important to consider the impact of the traditional way of life (primarily, diet habits) of the indigenous population of the region (Kalmyks) on their physique.

Acknowledgements

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Beginner adaptive swimming model for psychophysical progress of children with down syndrome

UDC 796.012.2



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Abstract

Objective of the study was to analyze benefits of an ontokinesiological knowledgebase building professional pObjective of the study was to develop and test benefits of a new beginner adaptive swimming model for children with Down syndrome.

Methods and structure of the study. We sampled for the new adaptive swimming model testing experiment the 9-12 year-olds with Down syndrome (n=20: 6 girls and 14 boys) and trained them for two years by 60min adaptive swimming sessions 3 times a week. We used the following research methods: theoretical and practical research data analyses and generalizations; family interviews; training process observations; and psychophysical progress tests. The new three-stage multilevel adaptive swimming training model included modern aquatic rehabilitation and aquatic aerobics elements and other special exercises. The adaptive swimming trainings were reasonably customized to the **individual health conditions and progress needs to encourage good progress of every child.**

Results and conclusion. The new beginner adaptive swimming model for children with Down syndrome was tested beneficial as verified by the actual progress of the sample, with every child making success in the trainings. The psychophysical progress was associated with progresses in the movement coordination and speed-strength skills. We have good reasons to conclude that the aquatic rehabilitation and special adaptive swimming practices are beneficial for psychophysical and cognitive performance correction goals with special socialization benefits to facilitate the children's adaptation to social environments outside the swimming groups.

Keywords: Down syndrome, children, adaptive swimming, psychophysical development, adaptive physical education.

Background. Modern theoretical and practical publications and analyses of the Down-syndrome-related health disorders give reasons to qualify people with Down syndrome with a special health group [1, 2]. Clinics diagnose congenital hypotonia, joint hypermobility, impaired balance and spatial controls, proprioceptive data flow processing disorders and impairments of the key motor skills that tend to evolve into wrong motor stereotypes [3, 6, 8, 9]. The motor dysfunctions provoke concomitant diseases including instability of the cervical vertebrae, cardiac defects,

impaired vision and hearing, and immune system disorders.

Adaptive physical education methods are commonly ranked among the most efficient tools for the underage psychophysical development correction services. Psychophysical progress is known to be directly correlated with the child's primary research activity since the adapted physical education models facilitate the brain formation and development process [5]. Every child with Down syndrome needs an individualized training service with special corrective



exercises. Modern aquatic rehabilitation and adaptive swimming methods offer a wide range of versatile tools to physically activate children and encourage their physical progress on a positive motivational emotional background.

Modern adaptive swimming sport records still mention no one Special Olympics, World and European champions among people with intellectual disabilities. In was only the 2017 World Swimming Championships (Mexico) that offered a few special events for competitors with Down syndrome; and Anastasia Petrova from Russia was successful in winning bronze in the 200m butterfly event.

As reported by Tatyana Olkhovskaya, Russian People with Intellectual Disabilities Sports Federation Director, the global people with intellectual disabilities sport communities are still in need of standard training methods for children with Down syndrome [7]. One of the promising solutions is to mobilize the existing experiences and methods to build up a training database with an efficient training toolkit for people with Down syndrome [10].

Objective of the study was to develop and test benefits of a new beginner adaptive swimming model for children with Down syndrome.

Methods and structure of the study. We sampled for the new adaptive swimming model testing experiment the 9-12 year-olds with Down syndrome (n=20: 6 girls and 14 boys) and trained them for two years by 60min adaptive swimming sessions 3 times a week. We used the following research methods: theoretical and practical research data analyses and generalizations; interviews; training process observations; and psychophysical progress tests. The progress was tested by (1) freestyle board swimming; (2) backstroke board swimming; (3) underwater breath control; (4) chest asterisk floating; (5) back asterisk floating; (6) jump to the pool; (7) breath-controlling board swimming; (8) longitudinal "screw" rotation; (9) 25m backstroke; (10) 25m freestyle; (11) exercises on commands; and (12) counted repetitions tests.

The individual progress test scores were recorded in the personal diaries as follows: tests 1-3: able/ unable; tests 4-8 were scored by 0 to 3 points, with a refusal scored by 0 point; instructor-assisted execution scored by 1 point; execution with technical errors scored by 2 points; and error-free execution scored by 3 points; tests 9-10 were scored by distance times; and tests 11-12 were scored by 0-2 points, with a refusal scored by 0; occasional execution by 1 point; and good counted execution scored by 2 points.

Results and discussion. Having interviewed the families, we found only 2 children out of 20 having basic swimming skills and 2 more having some aquatic practicing experiences, with all the others being newcomers to the pool. The families were found virtually unaware of the health benefits of aquatic rehabilitation methods, with most of them having no idea of the educational and developmental benefits of the modern adaptive swimming service and actual progress needs and resources of their children. Given in Table 1 hereunder are the progress test data of the sample.

As demonstrated by the above Table, the arithmetic mean test scores of the sample grew a few times in the post- versus pre-experimental tests – e.g. an eightfold progress was fixed in the screw rotation test. Given on Figure 1 hereunder is the visualized pre- versus post-experimental test data. It should be emphasized that every child in the sample was tested with a significant individual progress.

The progress tests and observations showed that children with Down syndrome are quite trainable, with 90% of the sample demonstrating success in the basic swimming skills mastering process. Our analyses of the age-specific progress test data found no correlation between ages and actual progresses, with the qualitative changes and progress rates apparently more dependent on the individual characteristics. This finding should not be interpreted as a contraindication for early adaptive swimming trainings as it is never too late to for the children with Down syndrome to join adaptive swimming groups.

Table 1. Pre- versus post-experimental test data of the sample

Test	Chest asterisk floating		Back asterisk floating		Jump to the pool		Breath-controlled board swimming		Longitudinal "screw" rotation	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
M, points	0,9	2,0	1	2.6	0,7	2.0	0,4	2,2	0,2	1,6

Note: tests were scored by 0 to 3 points, with a refusal scored by 0 points; instructor-assisted execution scored by 1 point; technically deficient execution scored by 2 points; and an error-free execution scored by 3 points; M – arithmetic mean

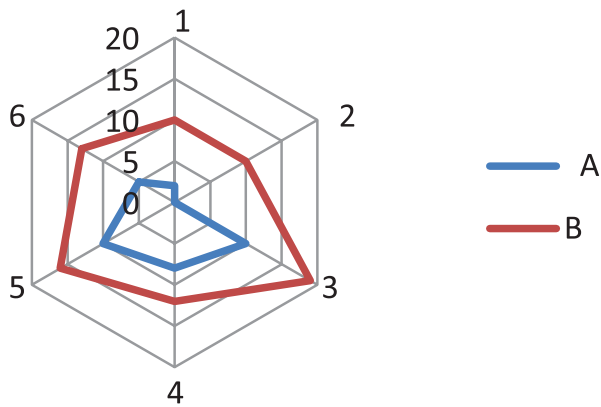


Figure 1. Pre- (blue) versus post-experimental (red) individual successes (headcount): 1 – 25 m backstroke; 2- 25 m freestyle; 3- exercise on command; 4- counted repetitions; 5- standing long jump; and 6- gymnastic ladder climbing tests

Conclusion. The new beginner adaptive swimming model for children with Down syndrome was tested beneficial as verified by the actual progress of the sample, with every child making success in the trainings. As things now stand, the sample easily swims 25m and continues trainings in an inclusive health-improving swimming group with the healthy peers. This fact demonstrates benefits of the new adaptive swimming model for socialization of children with Down syndrome and their psychophysical progress agendas.

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Physical and functional fitness rates in highly-skilled female footballers with hearing impairments

UDC 796.085



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Abstract

Objective of the study was to analyze the levels of physical and functional fitness of female footballers with hearing impairments.

Methods and structure of the study. The study was carried out in the preparatory period of the annual training cycle. Sampled for the study were 14 female footballers - members of the Russian deaf national football team: 3 Masters of Sport, 2 World Class Masters of Sports, and 9 Honored Masters of Sport. The degree of hearing loss ranged from total deafness to moderate hearing loss with at least 55 dB per ear. The subjects' mean age was 25 years, and their sports experience - 13 years.

Results and conclusions. The functional fitness rates in the female footballers with hearing impairments, in particular running speed at HR at the anaerobic threshold level, maximum HR, indicated that the level of training of the hearing-impaired female footballers was lower than that of the healthy female athletes. It is, therefore, necessary to increase the volume and intensity of physical loads in the preparatory period of the annual training cycle to achieve high sports results in the major competitions of the season. While the threshold HR, being 90% of the maximum, can be used as a criterion for performing training loads aimed to develop aerobic capabilities.

The data obtained can be used as the criteria of effective management of the process of training of highly-skilled athletes with hearing impairments.

Keywords: *football, hearing impairments, physical fitness, functional fitness,*

Background. The system of training of highly-qualified athletes is based on the development of their physical fitness as a cornerstone of the system [2, 5]. In turn, the high physical fitness level means the high level of adaptation of the functional systems of the female athletes' body to training and competitive loads [3, 6]. In the course of their playing activity, female footballers are constantly forced to make short-distance moves, various turns, rolls, and rotations, keep their balance in the difficult game situations when the ball is hit with a foot or head in a single-support or unsupported position while counteracting against an opponent.

The physical and functional fitness tests will enable coaches to find optimal ways to increase the level of training of female athletes, structure a rational annual training cycle, choose an effective strategy of training of female footballers with hearing impairments for the major competitions of the season.

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national football team: 3 Masters of Sport, 2 World Class Masters of Sports, and 9 Honored Masters of Sport. The degree of hearing loss ranged from total deafness to moderate hearing loss with at least 55 dB per ear. The subjects' mean age was 25 years, and their sports experience - 13 years.

The research program included pedagogical testing of the physical fitness level: 30m run, 2000m run, standing high jump with no arm swing, standing long jump, standing triple jump, unsupported pistol squat on a take-off foot. The Conconi test (a 2-3-km run with an incrementally-increasing speed performed on a racetrack of the stadium) was conducted to assess the functional fitness level of the female footballers with hearing impairments. They were tested for the running speed at the anaerobic threshold level, HR at the anaerobic threshold level, and maximum HR.

Results and discussion. In football, as in any other sport, athletes' anthropometric data cannot

be disregarded when analyzing their physical and functional fitness levels. The anthropometric measurements taken as part of this study indicated the average values of height, weight, vital capacity and body mass, birth-death ratio and muscle mass percentage (Table 1) [4].

The data on the physical fitness of the Russian deaf national football team were compared with the data provided by the Federal Sports Training Standard for football at the sport specialization, sport mastery excellence, and top sport mastery stages [4]. According to the Federal Sports Training Standard for deaf football, sports results largely depend on the level of development of athletes' speed qualities and endurance skills, to a lesser extent – on their muscle strength, flexibility, coordination skills, and vestibular tolerance, while their body build has a very slight impact.

Given in Table 2 are the results obtained in the tests.

Table 1. Anthropometric measurements in highly-qualified female footballers with hearing impairments (n=14)

Parameters			
Age, years	Height, cm	Weight, kg	VC, ml
25	167.5± 3.3	59.7± 4.5	272.3 ± 345.8
Indices			
Body mass index, kg/m ²	Muscle mass, %	Birth-death ratio, ml/kg	
21.16±2.8 (normal)	55.8±1.2	45.6±1.9 (lower than normal)	

Table 2. Physical fitness rates in female footballers with hearing impairments

Physical qualities	Tests	Russian deaf national football team	Sport specialization stage*	Sport mastery excellence stage*	Top sport mastery stage*
	Sport category	HMS, WCMS	Non-category footballers	Class I	CMS
Agility (distance speed)	30 m run from standing start, sec	4.7±0.11	4.8	4.55	4.3
Speed-strength qualities	Standing long jump, cm	187.7±13.01	170	190	210
	Unsupported pistol squat on a take-off foot, reps	9.5±1.41	10	12	18
	Standing high jump with no arm swing, mm	125.9±5.86	100	120	180
Coordination skills (vestibular tolerance)	Standing triple jump, cm	678.4±12.6	580	680	680
Endurance	Running, min sec	2000 m – 7 min 9 sec	800 m – not more than 4 min	1500 m – not more than 6 min	1500 m – not more than 5 min
Distribution of the female footballers with hearing impairments by their physical fitness level based on the test rates					
High (corresponds to the stage of top sport mastery of healthy female athletes)		Average (corresponds to the stage of sport mastery excellence of healthy female athletes)		Below-average (corresponds to the stage of sport specialization of healthy female athletes)	
34%		40%		26%	

*Standard values in the healthy female footballers [4].



Table 3. Functional fitness rates in female footballers with hearing impairments (2-3 km run with an incrementally-increasing speed)

Indicators	Vat	HRat	HRmax	HRat/HRmax x100%
HMS	3.67±0.32	175.9±6.4	197.6±7.2	89.0±4.7
WCMS	3.54±0.23	179.3±7.2	195.8±6.2	91.6±2.6
MS	3.52±0.12	181.7±7.2	196.9±6.8	92.3±3.3
Team average	3.58±0.22	178.9±6.9	196.8±6.7	91.0±3.5

It was found that the running speed rates in the 30 m test (4.7 sec) and speed-strength rates in the standing high jump test (125.9 cm) corresponded to the stage of sport specialization of healthy female athletes.

In terms of endurance rates in the 2000 m run (7 min 9 sc), speed-strength rates in the standing long jump test (187.7 cm), and coordination rates in the standing triple jump test (678.4 cm) corresponded to the sport mastery excellence stage.

A certain gap (2-3-year retardation) between healthy and hearing-impaired female footballers is due to the slow progress of the latter in the motor skills mastering process (insufficiently developed coordination skills, uncertain movements), which becomes noticeable in the childhood [1, 6].

Having summarized all physical fitness rates in the hearing-impaired female footballers and having compared them with the standard values in the healthy female athletes, the female footballers with hearing impairments were distributed within the team in the following way: high physical fitness level - 34%, average - 40%, and below-average - 26%.

In the management of the training process of elite female footballers with hearing impairments, it is advisable to assess their functional fitness based on the indicators of adaptation of the oxygen transport and muscle systems during the Conconi test (Table 3).

The results of testing of the hearing-impaired female footballers in vivo indicated that the anaerobic exchange threshold was reached at HR of 178.9 bpm. It is generally believed that during long-distance runs qualified athletes reach the anaerobic threshold at HR of about 170 bpm. Our findings indicated that the female footballers with hearing impairments reached the anaerobic threshold level at a much higher HR. This leads to the conclusion that in the preparatory period of the annual training cycle, hearing-impaired female footballers tend to work in the aerobic more, even under high HR (176-188 bpm).

However, despite the aerobic energy supply of the work performed at the high HR values, such

loads may lead to the depletion of the body's adaptive reserves. The threshold HR is reduced with the increase in the volume and intensity of training loads, which needs to be carried out throughout the entire preparatory period of the annual training cycle.

The ratio of the threshold HR to the maximum HR in the highly-qualified female footballers with hearing-impairments was 91-92% (Table 2).

Conclusions. The physical fitness level of the highly-qualified footballers with hearing impairments slightly lagged behind the physical fitness level of healthy female athletes (by 2-3 years). Their agility rate corresponded to the stage of sport specialization of healthy female athletes; the endurance, speed-strength, and coordination rates – to the stage of sport mastery excellence.

Footballers with hearing impairments should be distributed within a team based on the level of their physical fitness in the following way: high physical fitness level - 34%, average - 40%, below-average - 26%.

The subjects' functional fitness level also indicated a lower level of training of the female football with hearing impairments as opposed to healthy female athletes. The anaerobic threshold level in the hearing-impaired female footballers was reached at the high HR - 178.9 bpm, thus indicating the need to increase the volume and intensity of training loads in the preparatory period of the annual training cycle. HR of 91% of the maximum can be used as a criterion for performing training loads aimed to develop aerobic capabilities of elite female footballers with hearing impairments.

The data obtained can serve as model characteristics of physical and functional fitness of female footballers of women's national deaf football teams.

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Personality progress and social adaptation facilitating physical activation model for disabled university students

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Abstract

Objective of the study was to theoretically substantiate a new personality progress and social adaptation facilitating physical activation model for disabled university students.

Methods and structure of the study. We have theoretically analyzed for the purposes of the study 127 sources describing the physical activity practices for students with disabilities and health limitations classified by the physical activity models and types including textbooks, monographs and study reports. We also made a qualitative analysis of the on-standardized observations of the disabled students' physical activity at Tyumen and Yugra State Universities, with the sample including people with cerebral palsy, musculoskeletal system disorders of different diagnoses and severity classes, people with visual and auditory system impairments, etc. Based on the above data and analyses, we designed the new physical activity model customizable for the special physical activity service goals.

Results and discussion. We designed the new progress and social adaptation facilitating physical activation model with special goals that includes the general, socializing and creative physical activity classes, with the general physical activity interpreted as the motor activity geared to protect and improve health; socializing physical activity as the movement system focused on socially important goal(s) achievable in compliance with the relevant social rules or standards; and creative physical activity as the movement system geared to generate a creative original product in some arts (music, dances), technologies, household service domain etc. The new progress and social adaptation facilitating physical activation model implies, among other things, the disabled students' engagement in special field training, competitive and other events at other educational institutions for the academic mobility encouragement purposes.

Keywords: *physical activity, disabled students, inclusive education, academic mobility.*

Background. The national legislation, pedagogical and psychological research communities, many public and non-governmental organizations give more and more attention to the needs of people with disabilities and health limitations [2, 4, 6]. The World Health Organization (WHO) defines physical activity as "bodily movements executed by skeletal muscles at some energy cost" and sets age-specific physical activity levels in its "Global recommendations for healthy physical activity" [3]. We believe that this very broad definition may be put on a more specific basis, including the physical activity of people with

disabilities and health limitations trained in the inclusive education system, with a special emphasis on the personality progress, socialization needs and academic mobility of these health groups.

Objective of the study was to theoretically substantiate a new personality progress and social adaptation facilitating physical activation model for disabled university students.

Methods and structure of the study. We have theoretically analyzed for the purposes of the study 127 sources describing the physical activity practices for students with disabilities and health limita-



tions classified by the physical activity models and types including textbooks, monographs and study reports. We also made a qualitative analysis of the on-standardized observations of the disabled students' physical activity at Tyumen and Yugra State Universities, with the sample including people with cerebral palsy, musculoskeletal disorders of different diagnoses and severity classes, people with visual and auditory system impairments, etc. Based on the above data and analyses, we designed the new physical activity model customizable for the special physical activity service goals.

Results and discussion. The new progress and social adaptation facilitating physical activation model was designed with specific physical activity goals with the muscular movements viewed as a specific vital system for students with disabilities. This physical activity model classifies physical activity into the general, socializing and creative physical activity classes.

General physical activity may be defined as the common and traditional motor activity for physical health improvement purposes with its traditional sets of health rehabilitation, therapeutic and adaptive physical practices. The goal of the general physical activity is to protect and improve health by the traditional movement culture.

Socializing physical activity, as we would define it, is the movement system focused on socially important goal(s) achievable in compliance with the relevant social rules or standards. Ranked with the socializing physical activity may be modern sports plus social events including games, competitions, etc. Goal of the socializing physical activity is to meet some social affiliation needs, help people assert themselves within some social environment

(group, community, association etc.) as dictated by their self-respect and personality progress agendas.

And *creative physical activity* may be defined as the movement system geared to generate a creative original product in some arts (music, dances), technologies, household service domain etc.; with such physical activity dictated rather by the creative subject than the social environment and designed to find some creative options and solutions (including fully independent design ideas), with the creative movements, their sequences and characteristics being fully controlled by the subject. Such creative physical activity heavily contributes to the personality progress, healthy living standards and individual self-assertion agendas.

It should be emphasized that the above physical activity specifications help put on a more categorical basis the socio-cultural benefits of physical activity, as the general physical activity protects, improves and rehabilitates health of the active social groups; the socializing physical activity encourages healthy social practices that contribute to the social cohesion and humanism; and the creative physical activity enriches the individual spirituality and social culture on the whole.

We would mention in this context that some studies have empirically proved that "students' physical inactivity negatively affects their psychological well-being and, hence, undermines their adaptability to the academic environments" [1, p. 128]. It was also demonstrated by a progress facilitating experiment using training machines with a biofeedback capacity, that such motor practices help the disabled students improve their physical wellbeing and, as a result, activate them for physical progress and social

Table 1. Chess training system digitalization history analysis: key points

Period	Innovations	Applications	Developers
1985 till now	ChessBase project	BigData service for chess training system and tournaments	ChessBase GmbH, Germany
1991	World Wide Web project	Chess trainings and competitions	Berners-Lee, United Kingdom
1996 till now	ChessAssistant project	BigData service for chess training system and tournaments	Convekta, Ltd, Russia
1996-1997	DeepBlue vs. World Champion Match	3.5- 2.5 win by DeepBlue	IBM, Japan
1996 till now	Chess play-and-learn software projects	Chess trainings and competitions	ChessBase GmbH, Germany; Convekta, Ltd, Russia
1999 till now	Chess game portals	ICC; PlayChess; Chess Planet; Chess.com for chess trainings and competitions	USA, Germany, Russia
2017 till now	AI AlphaZero project	BigData service for chess training system and tournaments	DeepMind, USA
2020	Magnus Carlsen Chess Tour: global online event	Chess tournament in a digital environment	International Chess Federation, Magnus Carlsen



adaptation to the academic environment [1, p. 134].

The new progress and social adaptation facilitating physical activation model was designed to address every of the above physical activity classes on a combined and synergized basis for the personality progress of the disabled students, with the general physical activity geared to encourage the social adaptation and creative activity, socializing physical activity complementing the general physical activity and contributing to the creativity, and the creative physical activity inspiring the both above physical activity classes by the aesthetic dimension of the movement culture and new movement improvement options with a special priority of the life values, missions and meanings. For the progress and social adaptation facilitating physical activation model being successful, we recommend due support from the relevant specialists including doctors, sports coaches, teachers, psychologists, sport managers, etc.

One of the benefits of the progress and social adaptation facilitating physical activation model viewed as a driver for conscious self-developmental activity of the disabled students is the notable growth of their vocational and academic mobility, with the latter considered as the tree physical activity classes unification tool. It facilitates the physical activity acting as a determinant for the general, socializing and creative physical activity as it activates and expands the individual social contacts thereby mobilizing and physically activating students for the socially appreciated goals achievable within the framework of the social norms, standards and rules (with the socialization benefits). It should also be emphasized that every educational situation associated with academic mobility requires special performance effectiveness to produce an original product, with the creative domain being mobilized.

The physical activity specialists' efforts to socialize and develop the disabled students need to be synergized in the individualized psychological and pedagogical support service provided on a systemic basis to attain the preset goals; with a special priority to facilitating the physical-activity-driven self-development process. Such facilitation will be free of special goal setting, as it will be designed to "stimulates progressive changes rather than attain an expected outcome: it just stimulates and liberates internal healthy processes by removing strict limitations" [5, p. 37].

Conclusion. The new progress and social adaptation facilitating physical activation model addressing every of the three physical activity classes gives the means not only to maintain the physical resources of disabled students in their efforts to cope with the spatial control and environmental barriers, improve health and working capacity, but also to ef-

fectively stimulate their socializing processes, with a special attention to their physical-activity-driven self-development mechanisms mobilization by systemic and determined physical efforts geared to attain socially appreciated goals and generate creative products.

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Academic physical education and sports for special health groups: universal competencies building model

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Abstract

Objective of the study was to theoretically substantiate the decomposition of universal competence into a cluster of detailed competences of top priority for the special health group students in the modern university environment.

Methods and structure of the study. The analysis of specialized literature and first-hand teaching experience enabled to decompose universal competence into the following competences: correctional-and-rehabilitation, applied professional, mental health improvement, sports-and-recreational, reflexive-and-self-control. We modeled the descriptors to indicate how to test each indicator (competence): theoretical tests (knowledge), physical fitness tests (physical health level), exercise complexes (training experience) of different orientations aimed to build certain competences.

Results of the study and conclusions. During the decomposition of universal competence, we developed a universal competence matrix reflecting the logic of its formation through a set of incoming competences, their indicators and descriptors that result from the physical education of the special health group students. The level of universal competence formation was assessed based on the detailed elaboration of the levels and criteria of its evaluation. We drew up the protocols for monitoring the indicators on development in students of the competence indicators and descriptors, based on which we conducted an expert evaluation. The universal competence decomposition provided a means for simulating physical training of the special health group bachelor students to improve their psychophysical conditions, increase their motivation to physical activities, and build the associated competences.

Keywords: special health group, universal competences, physical education, competency-building approach, modeling.

Background. Modern social demand for the top-skilled, healthy and competitive specialists is getting higher with time, and this is the reason why the national universities give a growing priority to the students' health programs with the physical education / health competences and personal physical culture encouragement elements [1, 3, 8]. However, more than 50% of national student population is diagnosed with health disorders and, hence, qualified for the special health groups largely released of the standard physical education service [4]. These bachelor

groups need special managerial and practical provisions with the special physical education service to give them special knowledgebase, skills and competences in the health rehabilitation and corrective physical education methods and tools to effectively design and manage their self-reliant individual physical progress systems as required by their health issues and progress needs [8, 9].

It may be pertinent to emphasize in this context the following contradictions: between the demand of the modern labor markets for competent and healthy



professionals on the one hand and the rapidly sagging psychophysical health standards of the university student population on the other hand; between the newly introduced competency-building higher education model on the one hand and the still underdeveloped universal competences-7 formation algorithm on the other hand; and between the “physical fitness management skills for full-fledged social progress and professional service” secured by the academic physical education service on the one hand and the actual theoretical and practical physical education service formats to give the self-reliant physical progress knowledgebase and skills on the other hand.

The educational expert community tends to believe that the universal competences indiscriminately set by the Ministry of Education as standard for the higher education system on the whole are still underdeveloped in terms of the physical education missions and progress criteria and, therefore, the faculties have to develop their own universal competences formation and progress rating systems [7].

Objective of the study was to theoretically substantiate the need for the universal competences UC-7 standard being revised (decomposed) and classified into clusters of specific competences including

the priority universal competences for the academic special health group to meet the modern social demand.

Methods and structure of the study. Since the universal competences generated by the educational system may be customized for the actual personality and socio-professional situations, we made an attempt to decompose the universal competences UC-7 into a cluster including a pool of the following priority competences for the special health group students:

- *Corrective/ rehabilitation competence* that implies good knowledge, skills and experience in the physical progress control and somatic disorders prevention and correction service;
- *Leisure-time physical education competence* with the physical qualities improvement knowledge, skills and experience and high motivations for habitual physical training/ rehabilitation practices including adaptive team sports like bocce, goalball, bowling, seated volleyball etc.;
- *Professional applied competence* that implies special knowledge, skills and experience in the creative design and management of the individualized physical practices to relieve mental stresses, increase intellectual endurance for daily labor efficiency, pre-

Table 1. Newly designed universal competences universal competences UC-7 matrix for the special health group physical education service

	UC-7 elements	Indicators	Descriptors
	Physical fitness management skills for fully-fledged social progress and professional service		
7.1	Corrective/ rehabilitation	Adaptive physical education / rehabilitation service methods customized for the individual physical health correction, rehabilitation and progress needs	Adaptive physical education progress tests: - 6-min run, standing leans, alternative limbs raising, prone push-ups and Romberg tests; - Diagnose-specific adaptive physical education practices; - Rehabilitation adaptive physical education practices.
7.2	Professional applied	Knowledge, skills and experience in the professional applied physical education domain; healthy lifestyle for professional health	- Standard and professional fitness tests, healthy lifestyle surveys; - 6-min run, standing leans, alternative limbs raising, prone push-ups and Romberg tests; - Standard physical fitness tests; - Professional applied physical education tests.
7.3	Mental health management	Knowledge, skills and experience in the mental resetting and positive mindset/ emotionality control domain	- Online mental self-control tests; - 6-min run, standing leans, alternative limbs raising, prone push-ups and Romberg tests; - Mental fitness test set; - Dance plastics physical education test set.
7.4	Leisure-time physical education	Knowledge, skills and experience in the adaptive recreational sports for physical fitness and intellectual efficiency	- Online adaptive recreational sports basics tests; - 6-min run, standing leans, alternative limbs raising, prone push-ups and Romberg tests; - Adaptive recreation toolkits; - Adaptive recreation toolkits.
7.5	Reflexive progress control	Progress self-testing mobile applications: usage skills and experience	- Mobile applications and tools knowledge tests online; - Health Portfolio check.



vent postural disorders and occupational diseases and effectively manage health;

- *Mental health management competence* to help the students master efficient mental resetting tools and skills to control the psycho-emotional health for the whole lifetime; and

- *Reflexive progress control competence* that implies good knowledge and skills in the physical health monitoring, test and control domain to effectively manage physical stressors in the academic physical education sessions and other classes on a daily basis followed by the effective and active professional service control and management skills.

Since the universal competences are commonly tested by sets of descriptors i.e. clear manifestations (actions, behavior) indicative of the competence being well mastered, we modeled our set of descriptors as the individual competences rating sample algorithms including theoretical knowledge and physical fitness/ health tests – i.e. physical exercises (with the relevant physical education experiences) to rate every element of the tested competence.

Results and discussion. Having decomposed the standard universal competences UC-7, we produced the following universal competences UC-7 matrix driven by the elementary competences building logics with the health-group-specific universal competences indicators and descriptors: see Table 1.

For the universal competences UC-7 test purposes, we detailed the progress levels and test criteria with the observation protocols to profile the students' progress by the universal competences indicators

and descriptors, with the progress scored by experts based on the tests [2]. The UC-7 cluster with the competences ranked by the functionalities was developed on a complementary basis to secure the desired combined outcome – i.e. good occupational health standards for professional service and social progress: see Table 2.

It should be emphasized that the above competences will be formed not only by the special physical education service, but also on an extracurricular basis with application of the modern IT/ digital technologies.

Conclusion. The universal competences for the academic special health group will be designed to secure good knowledgebase, skills and experiences in the health management domain with the self-reliant physical training/ health management elements, professional service specific mental and physical health control skills, plus well-rooted healthy lifestyle with due motivations for healthy and productive service and social progress for the whole lifetime. The standard universal competences UC-7 decomposing attempt to form a cluster of specific priority competences made it possible to develop the competency-building adaptive physical education model for the special health group students.

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Table 2. Special health group competences formation on an integrated basis by the education service

Academic year	1	2	3	4	5	6	7	8	9	10	11	12	13
Module 1													
Module 2													
Module 3													
Module 4													

Note: – Professional applied competence; – Corrective/ rehabilitation competence; – Leisure-time physical education competence; – Mental health management competence; – Reflexive progress control competence; 1-13 – practical training sessions in every mod



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Corporate human resource health and physical activation programs: efficiency analysis

UDC 613, 614, 796/799



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Abstract

Objective of the study was to substantiate the methodology for assessing the effectiveness of the introduction of the corporate health and physical activation program of the working-age population of the country.

Methods and structure of the study. The study was designed to contribute to the National "Demography" Project and complementary Federal "Forming motivations for healthy lifestyle including healthy diets and immunity to bad habits" Project; make an analysis of the corporate health and physical activation program; and rate their progress and actual benefits for the personnel.

Results and conclusion. The benefits of the corporate health and physical activation program were rated based on standards of the Federal "Forming motivations for healthy lifestyle including healthy diets and immunity to bad habits" Project. The corporate health and physical activation program progress was tested by the personnel health and well-being surveys, labor effectiveness and payroll analyses, wages, morbidity statistics with cost estimates; plus the following corporate progress factors: HR health initiatives; labor inefficiencies due to the sick leaves, staff turnover reductions, labor efficiency analyses, corporate image, etc. We should also emphasize that the benefits of the corporate health and physical activation program may be rated by the program-facilitated improvements in the professional knowledge, skills and healthy lifestyle of the personnel.

Keywords: *corporate health and physical activation program, benefits, efficiency, progress analyses, healthy lifestyle, personnel health standards, human resource, personnel health management system.*

Background. Corporate human resource health programs need to prudently factor in the workplace conditions, environments and specifics. Corporate management shall take every effort to improve the human resource health standards by special working conditions management initiatives. Healthy labor environments are recommended to be designed and managed on a cluster basis to effectively protect and improve the human resource health at work. The corporate health and physical activation program will be designed with application of the best innovative practices for the personnel progress in the physical and

mental health and social wellbeing metrics. The leading foreign companies, for example, give a special priority to the human resource obesity and chronic non-communicable disease prevention/ control, mental health and smoking cessation services and initiatives [12].

Objective of the study was to offer a corporate health and physical activation program efficiency rating and analyzing method with a special emphasis on the human resource health surveys.

Findings and discussion. Corporate health is increasingly ranked among the dominant components



of the corporate culture, image and operational efficiency the world over. Our national companies also tend to give more and more attention to the personnel health management and healthy lifestyle encouragement systems in their industrial and office spaces. Most popular at present are the human resource health screenings at work and visits to the outpatients clinics (known as the Health Days); occupational stress/ burnout prevention/ control programs; physical training and health sports groups trained in the corporate health facilities; bad habits prevention/ control programs; healthy lifestyle / healthy diets encouragement initiatives, etc. [15].

The human resource health management systems may be highly effective when designed and managed on an interdisciplinary basis with due analysis and synthesis of the available knowledgebase and experiences accumulated in modern medicine, sociology, psychology, pedagogy, cultural studies, jurisprudence and other sciences [5, 8, 11, 14].

The corporate health management initiatives normally use standard corporate health and physical activation program with the human resource health screenings, chronic non-communicable disease risk management, bad habits control, healthy lifestyle / health diets encouragement, motivating for physical activity, mental and physical health and well-being management, workplace optimization, physical trainings facilitation and other elements. Such corporate health and physical activation programs are increasingly in need of the corporate health and physical activation program progress and efficiency rating and analyzing methods and tools.

The corporate health and physical activation program efficiency rating and analyzing methods will be based on the National "Demography" Project complemented by the Federal "Forming motivations for healthy lifestyle including healthy diets and bad habits control" Project. The national Health Ministry classifies the corporate health/ healthy lifestyle programs into the following cost groups [6]: (1) Low-cost and free; (2) High fixed and low variable costs; (3) Low fixed and high variable costs; and (4) High fixed and high variable costs. In addition, the corporate health and physical activation program efficiency may be rated by the relevant long- and short-term medical service and economic performance criteria [3]

It should be mentioned that any social program efficiency may be rated by its benefits in the inter-related economic and social domains. Economic benefits of social programs may be rated by a wide

range of economic efficiency test methods applicable to every program element and program on the whole. As for the situation with the social benefits test methods, it is much more difficult as they should factor practical impacts of the initiatives on the life quality and living standards, health, life expectancy, etc. Therefore, it is quite common to rate social benefits of such programs by a range of objective (e.g. cigarettes smoked per day, average body weights, etc.) and subjective criteria (e.g. well-being, activity, mood, sleep and other improvements).

Objective variations may be rated by different social health metrics, questionnaire surveys, etc.; and subjective variations are ratable by expert psychometric analyses. In this context, the corporate health and physical activation program benefits may be rated on the individual and corporate levels as follows:

Individual level:

- Health improvements, progress in wellbeing;
- Working capacity growths acknowledged by the labor remuneration scheme;
- Reduced medical service costs, etc.

Corporate level:

- Falling morbidity statistics;
- Reductions in the sick leaves;
- Reductions in the human resource turnover;
- Improved labor efficiency;
- Growing corporate image, etc.

Individual progress in the corporate health and physical activation program benefits rating analyses may be rated by questionnaire surveys prior to and after some corporate health and physical activation program progress period on a monthly, quarterly or yearly basis, and upon the corporate health and physical activation program implementation is completed. Such analyses may be complemented by specific corporate health and physical activation program progress tests focused on specific health/ efficiency aspects and deliverables.

Another approach implies the corporate health and physical activation program benefits being rated by a 4-level system: overview, analysis, reform and improvement. Such leveled approach offers sets of the level-specific corporate health and physical activation program benefits test methods with the human resource knowledge, skills, healthy lifestyle and occupational health tests and surveys. It should be also mentioned that the Health Ministry's website offers the relevant toolkits including the corporate health and physical activation program Monitoring and Efficiency Rating Guidelines with the "Corporate health



and physical activation program conditions and progress evaluation" and "Sample corporate health and physical activation program outcomes evaluation" matrices [4].

Conclusion. The study analyzes a standard corporate health and physical activation program with its health/ physical activity benefits rating methods and tools; with a special consideration for the human resource health concepts and management methods. Based on the analyses, we offer a corporate health and physical activation program benefits rating and analyzing methodology with the physical activation and health improvement elements and the relevant progress test criteria and analyses.

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Motivating university students for sport competitions

UDC 796.01



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Abstract

Objective of the study was to analyze benefits of the Belgorod State National Research University academic incentives system for the GTO Complex trainings and tests.

Methods and structure of the study. The study was run in 2015-2020 at Belgorod State National Research University using analyses of the relevant research literature; questionnaire surveys; physical fitness tests for the GTO qualifications; and the incentives system piloting experiment; with the survey data processed by a standard mathematical statistics toolkit; and with more than 12,000 Belgorod State National Research University students sampled for the study.

Results and discussion. The study found that the academic incentives system for the GTO Complex trainings and tests should include (1) moral and psychological and (2) material incentives modules, with the leading role played by the moral and psychological one that include: social appreciation of the GTO Complex trainings and tests; personal physical and mental health improvement agenda in the GTO progress context; awards; progress opportunities; competitiveness; role models provided by the academic sports leaders; communal appreciation; trust; interest; and emotional motivations.

Keywords: *incentives system, university students, GTO Complex.*

Background. Presently the national universities are looking for the most efficient ways to lure students into the physical education system with a special priority to the GTO Complex trainings and tests [1, 3]. Belgorod State National Research University has been successful in finding solution to this socio-educational problem on a humanistic basis, with a special emphasis on the motivational rather than enforcement tools as recommended by the modern pedagogical stimulation theory and practice [5]. Benefits of the Belgorod State National Research University incentives system have been proved, among other things, by the competitive accomplishments of the university athletes in a few federal events. The

BSNRU team is a two-time champion of the Federal GTO Complex Festival of 2018 (Belgorod) and 2019 (Chelyabinsk) [2]. The 2020 GTO Complex Champions Festival "GTO Games" in Kislovodsk was won by the Belgorod Oblast team, with four out of six team members recruited at Belgorod State National Research University.

Objective of the study was to analyze benefits of the Belgorod State National Research University academic incentives system for the GTO Complex trainings and tests.

Methods and structure of the study. The study was run in 2015-2020 at Belgorod State National Research University using analyses of the relevant



research literature; questionnaire surveys; physical fitness tests for the GTO qualifications; and the incentives system piloting experiment; with the survey data processed by a standard mathematical statistics toolkit; and with more than 12,000 Belgorod State National Research University students sampled for the study.

Results and discussion. A foundation for the academic incentives system for the GTO complex trainings and test system was laid by the 2015 "Statute of incentives for the Belgorod State National Research University student and faculty leaders of the GTO Complex tests". The Statute offers a certificate of honor for the GTO Gold Badge winners; potential special increased academic scholarships; plus extra points and automatic high examination points in the academic Physical Education discipline for the GTO badge winners. The incentives system was put under control of the newly established GTO Complex Test Center of Belgorod State National Research University.

One of the key incentives are competitions formatted as university festivals including two stages, with the first stage offering mass scheduled GTO Complex tests. Individual points scored in the tests are fixed and added to the "piggy bank" of the relevant institute. Since 2018, the points are scored as provided by the "Practical Recommendations for the Physical Education and Sports Event Organizations in the Federal GTO Complex System" approved by the Minister of Sports Order of 09.21.2018 [4]. The GTO scoring system is rather beneficial for students for the following reasons: (1) the ones who are unfit for the GTO badges may still score points in competitions and tests; and (2) the academic sports leaders who are fit better than required by the GTO Gold Badge test standards are still interested to score as high as possible for the academic credits. Total points scored by competitors from some institute are averaged for the number of full-time competitors. This means that the incentives system offers the moral and psychological and material incentives modules.

As was found by the study, the key role is played by the moral and psychological incentives including: social appreciation of the GTO Complex tests; physical and mental health improvement and physical fitness benefits of the GTO Complex tests and trainings; GTO awards: badges, certificates of honor for the GTO Gold Badge winners; academic progress opportunities – since the scores are accounted by the elective academic physical education and sports disciplines as credits; competitions; role models pro-

vided by the academic sports leaders, champions and trainers successful in the GTO Complex system; public appreciation; trust; interest; emotional motivations for the mass competitions, GTO festivals with their great emotional climate; etc. And the material incentives module includes: potential increments to the academic scholarships; and extra points scored for the academic Physical Education discipline with automatic high credits in the Physical Education tests. As demonstrated by the six-year academic incentives system piloting experiment, the students' interest in the GTO Complex trainings and tests has grown significantly.

In December 2020, we run an online questionnaire survey of the Belgorod State National Research University students (n=4408) [3]. 70% of the sample was found to enjoy the GTO Complex events; and 90% satisfied with the GTO event organization and services. It should be mentioned that the yearly GTO Complex events are attended by more than 5,000 people that make up above 40% of the total full-time student population. For the last year, 1233 students won GTO badges. The questionnaire survey found the GTO competitions being of special interest for the sample. Thus competing in the annual Belgorod State National Research University GTO Champions Finals are at least 160 people with many more enthusiastically supporting them.

Conclusion. The study data and analyses found the academic incentive system for the GTO Complex trainings and tests having the following benefits:

- Interest- and needs-specific differentiated services with the students categorized into: "sporting" group, with the high intrinsic motivations for physical education, partially driven by the social appreciation; "players" group with the high success motivations and a special priority for competitions; "nihilists" group, with the high intrinsic physical education motivations dominated by the individual physical progress agendas; and "formalists" group, with the high failure avoidance motivations, dominated by the need for peer appreciation and academic progress;
- Incentives are recommended being applied on an integrated rather than specific basis;
- The combined incentives should be complemented by motivational situations/ events including competitions, festivals, GTO Champions finals, etc;
- Universities are recommended to build up their special motivational environments/ incentives systems withing the relevant material, technical, human resourcing, servicing, emotional, competitive, re-



search and other specific environments and provisions.

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Future physical education teachers' marketing business motivations survey

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Abstract

Objective of the study was to survey marketing business motivations of future physical education teachers.

Methods and structure of the study. The survey was run in 2018-2020 at Belgorod State National Research University. It included an analysis of the scientific literature on the subject, questionnaire survey and observations to rate the marketing business motivations in the sample, and standard statistical data processing toolkit. We sampled for the survey the 3-4-year students (n=186) of the Pedagogical Institute's Physical Education Department of Belgorod State National Research University.

Results and conclusions. Having analyzed the questionnaire survey data, we found 39%, 15% and 46% of the sample giving positive, negative and uncertain responses. It should be emphasized that above 61% of the sample acknowledged being unfit for marketing business responsibilities in their physical education teachers service in the theoretical and technological aspects. A special survey of this subsample found that the key difficulties associated with the still poor marketing business awareness and competence – that cannot but be of hampering effect on their personality and vocational progress agendas [3]. It should be also noted that the sample showed a wide variation in the actual marketing business motivations. Thus 8% of the sample was tested optimal on the marketing business motivations scale i.e. realizing the role and contribution of marketing business motivations in the professional progress and fit for the marketing business in vocational education service; 31% of the sample was tested satisfactory on the marketing business motivations scale i.e. realizing the role and contribution of marketing business motivations in the professional progress albeit unwilling or unfit for the marketing business service for they doubt it can be efficient in their vocational education service. We also rated 46% of the sample marginal on the marketing business motivations scale i.e. not fully understanding the importance of marketing business and unwilling or unfit for the marketing business service for they doubt it can be efficient in their vocational education service; although passively prepared to meet their marketing business responsibilities when necessary and applicable. And 15% of the sample was tested poor on the marketing business motivations scale i.e. non-accepting marketing business on the whole as part of their vocational education service responsibilities. It should be emphasized that the still unclear understanding by some students of the role and importance of modern marketing business service in their vocational education service responsibilities and, hence, shortage of marketing business motivations may effectively hamper their academic progress and professional growth upon graduation from the physical education institution.

Keywords: *marketing business motivations, future physical education teacher, vocational education service.*

Background. Modern socio-economic progress challenges set new requirements to the modern physical education teachers service that include specific marketing business responsibilities to promote new

educational technologies, services, theoretical and practical physical education materials, equipment and tools, disseminate advanced physical education experiences, contribute to the competitiveness and



prestige of the educational institution; and secure own professional progress [3]. These new requirements urge the academic communities give a special priority to the marketing business motivations and competences of the future physical education teachers in the university curricula.

Objective of the study was to survey marketing business motivations (of future physical education teachers).

Methods and structure of the study. The survey was run in 2018-2020 at Belgorod State National Research University. It included an analysis of the scientific literature on the subject, questionnaire survey and observations to rate the marketing business motivations in the sample, and standard statistical data processing toolkit. We sampled for the survey the 3-4-year students (n=186) of the Pedagogical Institute's Physical Education Department of Belgorod State National Research University.

Results and conclusions. Having analyzed the relevant research literature [2, 4], we run an experimental survey of the 3-4-year student sample at the Pedagogical Institute's Physical Education Department of Belgorod State National Research University. The study of 2018-2020 was staged as follows. First we surveyed the actual awareness of the sample of the physical education teachers marketing business responsibilities; and then rated the actual marketing business motivations of the sample by a few online questionnaire survey forms. The future physical education teachers marketing business motivations were rated by the following complementary tests: G. Volkovitsky Key Vocational Qualities Self-rating Test; N. Fetiskin Professional Progress Motivations Test; and T.D. Dubovitskaya Learning Motivations Test [4]. When developing our own questionnaires, we were governed by the V.I. Andreev questionnaire survey design guidelines [1]. At the next stage of the study we (a) processed and classified the survey data and (b) made conclusions. The online questionnaire surveys were designed to accurately rate the future physical education teachers marketing business motivations in context of their actual educational service responsibilities.

Having analyzed the questionnaire survey data, we found 39%, 15% and 46% of the sample giving positive, negative and uncertain responses. It should be emphasized that above 61% of the sample acknowledged being unfit for marketing business responsibilities in their physical education teachers service in at least the theoretical and technological aspects. A special survey of this subsample found

the key barriers for the still poor marketing business awareness and competency – that are actually of hampering effect on their personality and vocational progress agendas [3].

It should also be noted that the sample showed a wide variation in the actual marketing business motivations. Thus 8% of the sample was tested optimal on the marketing business motivations scale i.e. realizing the role and contribution of marketing business motivations in the professional progress and fit for the marketing business in their vocational education service; 31% of the sample was tested acceptable/ satisfactory on the marketing business motivations scale i.e. realizing the role and contribution of marketing business motivations in the professional progress albeit unwilling or unfit for the marketing business service for they doubt it can be efficient and beneficial in their vocational education service. We also rated 46% of the sample marginal on the marketing business motivations scale i.e. misunderstanding the importance of marketing business and unwilling/ unfit for the marketing business service for they doubt it can be efficient and beneficial in their vocational education service; although passively prepared to meet their marketing business responsibilities when necessary and applicable. And 15% of the sample was tested poor on the marketing business motivations scale i.e. non-accepting marketing business on the whole as part of their vocational education service responsibilities. It should be emphasized that the still unclear understanding by some students of the role and importance of the modern marketing business service in their vocational education service responsibilities and, hence, shortage of marketing business motivations may effectively hamper their academic progress and professional growth upon graduation from the physical education institution.

Conclusion. The study classified the future physical education teachers sample into the following four marketing business motivations groups. 39% of the sample was rated optimal and acceptable on the marketing business motivations scale i.e. perceiving a marketing business service as an efficient tool applicable exclusively for commercial goals although largely or partially alien to their vocational education service and progress agendas; with their marketing business concept mainly associated with sales and non-core business needs; at the same time, they acknowledge the need for modern marketing business motivations and competences for the physical education teacher's professional progress. And



61% of the sample was tested marginal or poor on the marketing business motivations scale i.e. uncertain on the marketing business concept and mission and opposing to the marketing business studies at schools – for the marketing business can unlikely be combined with the physical education teacher service because it is ‘primarily about money making’ as they say. This is the reason for their primarily negative attitudes to marketing business as part of their vocational education service responsibilities in a physical education teacher position. On the whole, the study confirmed the prior hypothetical assumption on the growing need for the marketing business motivations and competence formation in the future physical education teachers to facilitate their professional progress.

The study was completed on the State Contract with Belgorod State National Research University № 0624-2020-0012 for 2020-2022 “Integrated academic education methodology: future education specialists’ universal competences, social skills and versatility formation service’.

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Physical activity in preschoolers' values system: questionnaire survey

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Abstract

Objective of the study was to analyze the preschoolers' values system and role of physical activity in the values system.

Methods and structure of the study. We sampled for the study run in September-November 2020 the 5-7 year-old preschoolers ($n=679$) from the Belgorod, Samara and Tomsk Oblasts and Krasnodar Territory. The values system of the sample was surveyed by the L.N. Voloshina "Want to be healthy?" questionnaire survey.

Results and conclusion. Our questionnaire survey found the children being well aware of the role of healthy lifestyle for wellbeing. Ranked on top was healthy diet as a basis for good health, and ranked second was the physical activity (versus the 2010 questionnaire survey when it was ranked the third). The medicine-assisted health model – viewed as the need for therapy and visits to a doctor – was ranks only third in 2020 versus the first place in 2010. Due hygiene and healthy lifestyle (including habitual walking, daily regimen, immunity to bad habits, aerobic activity, water drinking etc.) was ranked fourth and fifth, respectively. It may be due to the COVID-19 pandemic that the questionnaire survey found new health ideas like "wear a face mask" and "stay home" ranked 8th and 17th among the health factors. The questionnaire survey data analysis showed that healthy socio-cultural environment with due emphasis on the cultural and transformative aspects of the teaching service at preschool educational establishment facilitates the healthy values system with due physical activity elements formation efforts.

Keywords: *preschoolers, values system, health, physical activity.*

Background. Modern concepts of an underage physical activity are largely contributed by cultural contexts since the systemic and spontaneous physical activity is normally dictated by the values system and traditions of the social environment with its expectations as to the core motor skills and motor experiences. It is quite common to rank physical activity with the social physical education system and interpret is as the total individual movements for certain life periods [2]. The individual physical activity standards evolve under influences of external social environ-

ments and education. When physical activity is ranked high in the individual values system since childhood, it provides good motivations for an active lifestyle and harmonized physical and mental progress within the relevant social physical education framework.

Preschool age, as provided by N.Y. Savelyeva, is the most favorable time for healthy lifestyle cultivation efforts. The child's self-identification, world outlook and attitudes to the social environment largely depend on how efficient, loving, caring and competent the teaching service is at that time. The key goal of the



education efforts is to help the child develop with no excessive pressure applied so as to facilitate reflections, thinking and self-exploration agenda rather than snowing under flow of still poorly understood information [5].

Many national analysts have addressed the need to form the key health conceptions in preschool population [4, 7] to give definitions of the age-specific values system; analyze the key personality qualities critical for the values system formation; educational provisions need to be put in place for the healthy lifestyle cultivation in preschoolers; set principles for the teaching service at preschool educational establishment; rate the potential benefits of the Russian folk tales on the preschool values system formation process; etc. [6].

Modern research community gives a special priority to the preschool values system formation issues in the health improvement contexts. Thus L.P. Kudalanova analyzes the relevant theoretical studies and practical experiences to specify the key health competences and their components for preschoolers and prioritize an individual vital experience as a basis for the child's values-system-driven learning activity [3].

The cultural and transformative components of a child's physical activity are dominated by the personality physical and mental resource mobilization and development aspects in the healthy lifestyle cultivation process. It is also important for the transformative components of the individual physical activity being efficient at the early stages of ontogenesis that they are formed by the healthy progress-facilitating socio-cultural environment with its values, ideals and sensitivity to the modern social needs [2, 8].

G.V. Serdyukova, S.I. Sysoeva, N.A. Mishukova have studied the preschool health culture and healthy lifestyle formation issues at a preschool educational establishment to underline the role of special provisions to facilitate the children's motivations for healthy lifestyle and natural need to protect and improve health by focused educational influences on the consciousness of preschoolers [6]. Y.M. Isayenko believes that the preschool values system and healthy lifestyle formation efforts need to be facilitated by special family education courses and games-driven interpersonal communication skills building elements to complement the standard physical education service at a preschool educational establishment [1].

Objective of the study was to analyze the preschoolers' values system and role of physical activity in the values system.

Methods and structure of the study. We sampled for the study run in September-November 2020 the 5-7 year-old preschoolers (n= 679) from the Belgorod, Samara and Tomsk Oblasts and Krasnodar Territory. The values system of the sample was surveyed by the L.N. Voloshina "Want to be healthy?" questionnaire survey, with the responses ranked by importance using the following formula:

$$\sum = \frac{(n+1)n}{2} = \frac{(22+1)22}{2} = 253$$

n – questions; and $\sum = 253$ – total number of questions equal to the total ranking points.

Results and discussion. Our prior analysis of the questionnaire survey data showed the sample being in active formation of a socio-biological health model: see Table 1 hereunder.

Table 1. Highest-ranking health concepts of the preschool sample

Values	Rank (n=22)	
	2010	2020
Healthy diets	2	1
Physical activity	3	2
Medicine-assisted health model	1	3
Individual hygiene and healthy lifestyle	4-5	4-5

The questionnaire survey found the children being well aware of the role of healthy lifestyle for well-being. Ranked on top was healthy diet as a basis for good health, and ranked second was the physical activity (versus the 2010 questionnaire survey when it was ranked the third). The medicine-assisted health model – viewed as the need for therapy and visits to a doctor – was ranked only third in 2020 versus the first place in 2010. Due hygiene and healthy lifestyle (including habitual walking, daily regimen, immunity to bad habits, aerobic activity, water drinking etc.) was ranked fourth and fifth, respectively. It may be due to the COVID-19 pandemic that the questionnaire survey found new health ideas like "wear a face mask" and "stay home" ranked 8th and 17th among the health factors. The questionnaire survey data analysis showed that healthy socio-cultural environment with due emphasis on the cultural and transformative aspects of the teaching service at preschool educational establishment facilitates the healthy values system with due physical activity elements formation efforts.

Conclusion. The survey data and analyses confirmed the modern research findings that the existing



preschool education service being generally compliant with the Federal State Preschool Education Standards in the healthy values system and healthy lifestyle formation domains, with the preschoolers and their families found to develop good theoretical knowledge and accumulate practical experiences in the health protection and improvement issues. It should be mentioned, however, that the children's physical activity resource and motivations are still under-mobilized and underdeveloped, with some still being only passive objects of the educational process rather than active contributors to the health values formation efforts. Having compared the questionnaire survey data of 2010 and 2020, we found a shift in the preschool values system from the medicine-assisted health model towards the socio-biological one; with the healthy diets and physical activity now ranked higher on the list of priority values in the health protection and improvement domain.

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