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Abzalilov R.Y., Rybakov V.V., Isaev A.P., Erlikh V.V. Adaptation of junior orienteers to loads, developing local-regional and special muscular endurance ................................................................. 200

Individual health related applied activity in special health group girl-students’ way of life in the process of their studying ................................................................. 207

Retrospective analysis of junior female handball players’ priorities ........................................................................... 214

Vasilios F. Giovanis, Panagiotis V. Vasileiou, Evangelos M. Bekris. The diagnosis and comparison of physical abilities of skiers and footballers ........................................................................................................... 221

Hasan Melki, Mohamed S. Bouzid, Aymen Haweni, Mourad Fadhloun, Meher Mrayeh, Nizar Souissi.
Formative assessment: exploring tunisian cooperative teachers practices in physical education .............................. 227

Ivashchenko O.V., Iermakov S.S., Khudolii O.M., Cretu M., Potop V. Level of physical exercises’ mastering in structure of 11-13 yrs age boys’ motor fitness .......................................................................................................................... 236

Kolumbet A.N., Natroshvili S.G., Babyna T.G. Bio-mechanical aspects of elite cyclists’ motor system
adaptation in process of competition activity .................................................................................................................... 244

Popel’ S. L., Tsap I.G., Yatciv Ya. N., Lapkovsky E. Yi., Synitsya A.V., Pyatnichuk D.V. Special aspects of hemo-dynamic and reaction of erythrocytes in blood to standard physical load of different qualification female volleyball players ................................................................................................................................. 251

Information .................................................................................................................................................................... 260
Adaptation of junior orienteers to loads, developing local-regional and special muscular endurance

Abzalilov R.Y.¹, Rybakov V.V.², Isaev A.P.², Erlikh V.V.²

¹Bashkir State Medical University, Russia
²South Ural State University, Russia

Abstract

Purpose: complex assessment of junior sport orientation athletes in conditions of concentrated training of local-regional muscular endurance and stroke loads (final part of preparation for competitions).

Material: in the research sport orientation athletes (n=34, age 13-16 years) participated. The athletes were divided into tested group (n=17) and group of comparison (n=17). In every group there were 17 boys and girls. The tested group consisted of volunteers, who practiced sport orientation. Comparison group included average distance and steeplechase runners.

Results: In system of junior orienteers’ training we found: gender distinctions in carbohydrates and fats consumption (in the ranges of aerobic and anaerobic thresholds; substantial physiological changes in static-kinetic balance (tests with open and closed eyes. Dynamic coefficient of balance in main stance was better in sport orienteers, comparing with runners.

Conclusions: not recommended to fulfill exercises in conditions of stretching, combined with motor actions of speed-power orientation and relaxation.

Keywords: sport orientation, control, adaptation, endurance, run.

Introduction

Modern sports with extreme loads require scientific substantiation and application of training technologies. It is especially important for sportsmen-adolescents. In such conditions diagnostic control is especially required. Unfortunately, by different reasons there appear negative after effects in all parts of physical culture and sports. Profound control is used for assessment of athletes’ training [7, 9, 11].

Important stage of sport orientation training is control over athletes’ physical and special training. Preparation of sport reserve requires creation of basic principles of physical and special endurance training. It is especially important on pre-competition and competition stages and in conditions of effective adaptation’s preservation.

Adequacy of tests acquires great importance in control process [42]; creation of necessary conditions for testing [38, 48]. Avoiding of physical overloading of athletes’ organism is possible at the account: optimization of physical loads and proper planning of training [33, 41]; consideration of athletes’ individual features [37];

Bio-mechanical control includes angle and space-time characteristics of kind of sports’ technique’s mastering. Social-psychological control is connected with study of the following: features of sportsmen’s personalities; their psychic state and fitness; general micro-climate; conditions of training and competition activity. These directions are used in natural integrity. It permits to select for control indicators, which are the basis of the found casual relations. Such relations reflect mechanisms of different indicators’ interconnection. Physiological control envisages assessment of the following: psycho-physiological state and health; reserve potentials and characteristics of different physiological systems; molecular manifestations of different organs and systems, which bear the main load in training and competition activity [14, 21].

Control over adolescents’ fitness permitted to determine:

– Effectiveness of motor actions’ program [34];
– Adequacy of usage of innovative pedagogic approaches [45];
– Adolescents’ motivation for physical exercises’ practicing [51];
– Distinctions in pedagogical principles of junior players’ assessment [52];
– Moderate – intensive physical activity and self-determined children’s motivation. The authors assume that consideration of distinctions in interaction of dominating elements in structure of lesson can permit higher level of physical activity. Such children will have better motivation in the lessons, based on models of tactical games [53].

Pedagogic indicators characterize the following: level of motor and technical tactic fitness; efficiency and stability of performances in competitions; structure and content of training process. Social-pedagogic indicators characterize: conditions of medium; strength and mobility of nervous processes and their ability for perception and processing information; the state of sensor integrations of analyzing functioning. Medical-biological characteristics includes: anatomic-morphological; genetic; physical; biochemical and immune indicators [15].

The used in control process indicators are divided into two groups. First group indicators characterize relatively stable, genetically conditioned, indicators, which change a little in the process of training. Adequate to such attributes indicators are used in stage-by-stage control. In such control the tasks of athletes’ selection and choice of training directions are solved. The second group includes
indicators of stable attributes: body sizes; different fibers in skeletal muscles; type of nervous functioning; speed of some reflexes [17, 30]. Indicators of second group endure substantial pedagogic influence. They reflect: technical tactic fitness; level of different motor qualities; mobility and efficiency of organism’s main life activity systems in different conditions of training [27, 40].

In other works authors provide arguments in favor of working out, testing and assessment of new methods, which can be used for optimization of young people’s training [35]. Authors affirm that new innovative models can be useful tools of training. However, they can not replace reasonable and comprehensive physical education program, based on practice models [43]. Alternative training models are regarded as more suitable approaches to ensuring physical education at high quality. The authors note influence of physical education program on professional activity of future pedagogues [54].

The relevance of the research is conditioned by the fact that up to the present time the problem of physiological substantiation of effective adaptation and technology of sports reserve training in the field of sport orientation has been remained insufficiently worked out. Great number of adolescents has to stop sports practicing due to muscular overloads and disorder of functions. Depending on the used means and methods, control can be of pedagogic, bio-mechanical, social-psychological or physiological character. In the process of pedagogic control the following is assessed: technical-tactic and motor fitness; performances at competitions; dynamic of sport results; structure and content of training process; tolerance to loads.

Hypothesis: it is assumed that consideration of complex control indicators in sport orientation training process facilitates health preservation and improvement of sport efficiency.

The purpose of the research is complex assessment of junior sport orientation athletes in conditions of concentrated training of local-regional muscular endurance and stroke loads (final part of preparation for competitions).

Material and methods
Participants: in the research sport orientation athletes (n=34, age 13-16 years) participated. The athletes were divided into tested group (n=17) and group of comparison (n=17). In every group there were 17 boys and girls. The tested group consisted of volunteers, who practiced sport orientation. Comparison group included average distance and steeplechase runners [31]. The parents of all athletes gave their consent for their children’s participation in experiment.

Organization of the research: athletes of the tested group were trained in conditions of concentrated development of local-regional muscular endurance (sport circles of sport orientation). Experimental group fulfilled exercises during 25 seconds each of them (60 second was the rest after every exercise). Quantity of series varied from 6 to 10.

In control group trainings were conducted by traditional schema, which included 50% of general and 50% of special exercises (with further reduction to 40%). They fulfilled jumps, multiple jumps, imitations of jumps, exercises on simulators) in block of basic training, at first stage exercises took 50%, on second - 40%. At the end of this part athletes practiced stretching and relaxation. Trainings were conducted 5 times a week. Comparison group was trained by programs of SCJSOR [2]. In both groups the volume of loads was the same.

Spiro-metric data (cardio-ling test) were assessed on device «SCHILLER» (Switzerland) [28] with analysis of indicators by Wasserman. Control was fulfilled in period of final training for competitions with interval loads. Ergo-spiro-metric load was increasing with every step: duration – 3 minute; progressively increasing power - 60, 120, 180, 240 W and 60 rpm.

Statistical analysis: was conducted in program «Statistika 10.0». We determined mean values, errors of mean values, criteria of confidence of distinctions by Manna-Whitney.

Results
Testing was fulfilled in basic period of training (see table 1). The tests were passed before and after concentrated development of local-regional muscular endurance (LRME). The tests were combined with crosses, power exercises, stretching and work with map.

As it is shown in table 1, special motor abilities and power endurance confidently increased and corresponded to requirements of sport qualification [29]. Our data are

<table>
<thead>
<tr>
<th>Tests</th>
<th>I examination (n=17)</th>
<th>II examination (n=17)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>m</td>
<td>M</td>
</tr>
<tr>
<td>3000 m cross on uneven terrain</td>
<td>10 min 45 sec</td>
<td>27 sec</td>
<td>9 min 55 sec</td>
</tr>
<tr>
<td>Power endurance, pressing ups (times)</td>
<td>36,24</td>
<td>1,42</td>
<td>43,36</td>
</tr>
<tr>
<td>Quantity of squatting with partner of own</td>
<td>9,32</td>
<td>0,98</td>
<td>13,64</td>
</tr>
<tr>
<td>weight (times)</td>
<td>5,18</td>
<td>0,26</td>
<td>4,90</td>
</tr>
</tbody>
</table>

Notes: M – mean square deviation; m – error of mean value; p – confidence.
in agreement with other work [5] by vector of changes. Critical periods in development of orienteers' endurance is observed between 15 and 15 yrs age; quickness – between 13-14 yrs.; power abilities – between 15-16 yrs. age. It points at need in individual approach to training and perfection of these abilities (accented stimulation) [1, 12, 29].

Orienteering is a durable run on uneven terrain with variable intensity, which is, in average, below anaerobic threshold (AnT). Duration of run depends on the length of distance. The distance depends on the scale of competitions, kind of program and character of terrain.

According to Rules of competitions on orientation, duration of long distances’ run (earlier called “classic”) is from 60 to 100 minutes; on middle distances (earlier – short”) – from 30 to 40 minutes; on sprinter distances of park orientation – from 15 to 20 minutes. On very long distances (marathon) it can be 120-150 and more minutes [5].

Results of the research are given in table 2.

As we can see in table 2 confident distinctions in heart beats rate (HBR) were observed with increase of loads’ power. By gender attribute significant differences were in AT (aerobic threshold) (P<0.05) and AnT (anaerobic threshold) (P<0.05) conditions. Girls reached such values earlier than boys. Volume of oxygen consumption exceeded the same indicators of adolescents (P<0.05). The differences were registered with head turns in visual tests: especially with closed eyes (EC) (P<0.01). In sagittal plane MSD values also confidently differed in favor of adolescents (P<0.01). Differences were also registered in indicators of main stance with open eyes (EO, GCP speed) (P<0.05-0.01). In sagittal plane confident differences were registered with right head turn in tests EO and EC (P<0.05). Confidently differed indicators of ellipse length to its width in all positions (P<0.05). Relation of static kinesiogram length (SKG) to its area significantly differed in EO positions (P<0.03). Confident differences were in carbohydrate consumption (P<0.05-0.01) and fats (P<0.05). Recreation of indicators took place in heterochronic way. HBR recreated quicker. Other indicators recreated depending on contribution to realization of loads, developing special endurance and tolerance. These indicators permit to control loads in different structures of training process, starting from separate trainings and up to many years training process.

Table 2. Ergo-spiro-metry of sport orienteering (n=17 –boys; n=17 –girls)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Unit of measurement</th>
<th>Standard M±m</th>
<th>Sex</th>
<th>In rest state M±m</th>
<th>In conditions of aerobic threshold AT M±m</th>
<th>In conditions of anaerobic threshold AnT M±m</th>
<th>Relations of AT to reference %</th>
<th>Relations of AnT to reference %</th>
<th>Recreation 3 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart beats rate</td>
<td>bpm</td>
<td></td>
<td>B</td>
<td>180,3±0,76</td>
<td>66,0±1,04</td>
<td>160,24±1,44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G</td>
<td>172,3±0,58</td>
<td>68,1±1,35</td>
<td>168,92±1,86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power of load ( W )</td>
<td></td>
<td></td>
<td>B</td>
<td>216,0±0,74</td>
<td>-</td>
<td>210,66±4,69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G</td>
<td>179,7±4,25</td>
<td>-</td>
<td>186,3±4,98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume of oxygen consumption</td>
<td>l/min</td>
<td></td>
<td>B</td>
<td>2,92±0,16</td>
<td>0,34±0,05</td>
<td>2,68±0,17</td>
<td></td>
<td></td>
<td>119±0,06</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G</td>
<td>2,60±0,10</td>
<td>0,39±0,05</td>
<td>1,76±0,09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equivalent of oxygen</td>
<td>Conv.</td>
<td></td>
<td>B</td>
<td>19±13±0,56</td>
<td>21,13±0,64</td>
<td>29,07±0,81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>un</td>
<td></td>
<td>G</td>
<td>21,2±6±0,47</td>
<td>25,16±0,32</td>
<td>25,72±0,45</td>
<td></td>
<td></td>
<td>0,79±0,05</td>
</tr>
<tr>
<td>Energetic value</td>
<td>k.cal/h</td>
<td></td>
<td>B</td>
<td>121,0±2,74</td>
<td>772,4±8,45</td>
<td>1134,7±12,44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G</td>
<td>115,1±3,42</td>
<td>517,72±8,76</td>
<td>598,20±9,98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption of carbohydrates</td>
<td>k.cal/h</td>
<td></td>
<td>B</td>
<td>126,7±1,89</td>
<td>779,6±11,18</td>
<td>1820±58,44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G</td>
<td>116,9±5,62</td>
<td>595,38±11,39</td>
<td>723,22±19,17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: B- boys; G – girls; M – mean square deviation; m – error of mean value; p – confidence.
Table 3. Stabilometric indicators of athletes-orienteers (boys; n=17, M±m)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>MS. EO</th>
<th>Left turn of head, EO</th>
<th>Right turn of head, EO</th>
<th>MS. EO</th>
<th>Left turn of head, EC</th>
<th>Right turn of head, EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean square deviation by frontal plane, mm</td>
<td>12,02±2,16</td>
<td>18,14±1,28</td>
<td>11,03±0,79</td>
<td>22,09±3,14</td>
<td>21,06±1,52</td>
<td>31,62±4,52</td>
</tr>
<tr>
<td>Mean square deviation of GCP, mm</td>
<td>12,05±</td>
<td>16,06±1,27</td>
<td>17,29±2,24</td>
<td>21,24±4,25</td>
<td>8,01±2,07</td>
<td>21,07±2,76</td>
</tr>
<tr>
<td>GCP speed, mm/sec.</td>
<td>2,78±</td>
<td>11,08±0,37</td>
<td>12,09±0,54</td>
<td>17,93±0,78</td>
<td>17,06±0,99</td>
<td>21,94±1,39</td>
</tr>
<tr>
<td>Level 60 % of spectrum power by frontal plane, Hz</td>
<td>0,62±</td>
<td>0,78±0,45</td>
<td>0,44±0,05</td>
<td>0,36±0,12</td>
<td>0,39±0,12</td>
<td>0,39±0,12</td>
</tr>
<tr>
<td>Level 60 % of spectrum power by sagittal plane, Hz</td>
<td>0,03±</td>
<td>0,49±0,05</td>
<td>0,56±0,09</td>
<td>0,36±0,09</td>
<td>0,52±0,03</td>
<td>0,52±0,03</td>
</tr>
<tr>
<td>Area of static-kinesiogram, 90, mm²</td>
<td>85,64±</td>
<td>116,42±7,87</td>
<td>88,32±6,54</td>
<td>143,12±6,9</td>
<td>158,32±9,14</td>
<td>169,53±27,14</td>
</tr>
<tr>
<td>Relation of ellipse length to its width, conv.un.</td>
<td>1,26±</td>
<td>1,23±0,10</td>
<td>1,33±0,09</td>
<td>1,26±0,08</td>
<td>1,56±0,32</td>
<td>1,56±0,32</td>
</tr>
<tr>
<td>Realltion of static kinesiogram to its area, conv.un. 1 mm</td>
<td>4,82±</td>
<td>3,50±0,26</td>
<td>4,60±0,48</td>
<td>3,70±0,24</td>
<td>3,20±0,40</td>
<td>3,20±0,40</td>
</tr>
<tr>
<td>Level 60 % of power by vertical component, Hz</td>
<td>5,60±</td>
<td>5,80±0,12</td>
<td>5,82±0,14</td>
<td>5,72±0,17</td>
<td>6,10±0,17</td>
<td>6,12±0,16</td>
</tr>
<tr>
<td>Indicator of functional stability (IFS) %</td>
<td>94,02±</td>
<td>93,04±0,08</td>
<td>93,50±0,42</td>
<td>92,78±0,49</td>
<td>92,02±0,42</td>
<td>88,32±0,92</td>
</tr>
<tr>
<td>Stability index, conv.un.</td>
<td>35,75±</td>
<td>29,96±1,28</td>
<td>29,89±1,86</td>
<td>22,98±1,24</td>
<td>23,88±1,20</td>
<td>19,89±1,24</td>
</tr>
<tr>
<td>Dynamic component, %</td>
<td>64,96±</td>
<td>70,94±1,34</td>
<td>66,78±1,72</td>
<td>77,94±1,24</td>
<td>76,98±1,20</td>
<td>79,82±1,19</td>
</tr>
<tr>
<td>Mean position of GCP in horizontal plane, mm</td>
<td>1,34±</td>
<td>1,28±1,72</td>
<td>1,72±1,20</td>
<td>1,20±1,18</td>
<td>1,19±1,19</td>
<td>1,19±1,19</td>
</tr>
<tr>
<td>Mean position of GCP in sagittal plane, mm</td>
<td>2,69±</td>
<td>2,85±0,60</td>
<td>2,35±0,27</td>
<td>2,37±0,21</td>
<td>2,18±0,12</td>
<td>2,18±0,12</td>
</tr>
<tr>
<td>Mean position of GCP in sagittal plane, mm</td>
<td>0,54±</td>
<td>0,98±1,01</td>
<td>1,01±1,19</td>
<td>1,20±1,20</td>
<td>1,32±1,32</td>
<td>1,32±1,32</td>
</tr>
<tr>
<td>Mean position of GCP in sagittal plane, mm</td>
<td>16,33±</td>
<td>15,96±14,09</td>
<td>16,92±19,58</td>
<td>19,86±2,57</td>
<td>19,86±2,43</td>
<td>19,86±2,43</td>
</tr>
</tbody>
</table>

Notes: MS –main stance, EO –eyes open, EC –eyes closed; GCP – general center of pressure; M – mean square deviation; m – error of mean value; p – confidence.

EO - (P<0.01); in right turn of head EO - (P<0.05). Level of spectrum power by vertical component confidently differed: in positions MS, EO (P<0.05); right head turn with EC (P<0.05); indicators of functional stability with right head turn (EO) (P<0.01); in all positions with EC (P<0.05-0.01). Index of stability statistically significantly changed in all positions (P<0.05-0.01) with open and closed eyes.

Comparing of age and gender stabilometric indicators (in conditions of special training) of 13-14 yrs and 15-16 yrs athletes showed effective adaptive changes and substantial distinctions in the following values: Romberg’s coefficient (P<0.01); mean square deviation in main stance (P<0.05); in tests with head turns with open and closed eyes (P<0.01); levels 60% of power in position with OE in frontal plane and in sagittal plane (with EO and EC (P<0.05); in relations of ellipse length to its width in all positions (P<0.05); static kinesiogram length to its area in all positions (P<0.01-0.05). We observed distinctions in levels of spectrum density by vertical component in all positions (P<0.05). Head turns caused substantial changes of functional stability and index of balance (EO, EC, P<0.05-0.01). Indicators of stabilometry in orienteers and elite runners were different in positions with head turn in main stance with closed eyes; head turns (P<0.05) [11]. Even greater differences were registered in respect to elite runners (P<0.01). In main stance, dynamic coefficient significantly differed with deprivation (P<0.01) with orienteers’ priority.

Specific postural characteristics of orienteers and runners were found in comparison of indicators in stance (EO, EC) and head turns (P<0.01). We do not present runners’ indicators but show only results of confident distinctions’ comparison. Runners’ results were analyzed in works by V.V. Erlikh [32].

Dynamic coefficient of balance in main stance with closed eyes was better in orienteers (P<0.01).
Discussion

In our research we found specific influences of kind of sports on postural characteristics in SKB (static-kinetic balance). With it, important role is played by biomechanical motor parameters and reflex of stretching [36, 47]. In motor actions, SKB is regulated by many links’ regulation system. Total body sizes, age, sex, kind of sports influence greatly on athlete’s balance: in main stance; in overcoming obstacles of ascents and descents [44, 46]. In main stance thigh flexors and extensors work simultaneously and it conditions balance when wiggling in sagittal plane (forward-backward in respect to legs). It coincides with received by us postural characteristics. In literature the question of sport efficiency provisioning is still discussible, i.e. about adaptation strategies [36]; role of elastic-viscose properties of muscles; role of breathing muscles [47]. The controlled range of signals’ reacting and convergence correlate regulation’s sensitivity. Somatic sensor cortex controls general levels of sensitivity of stimulated organs (receptors of muscles’, ligaments and joints’ stretching, which are in post central cingulated) [6, 16]. Direct and short signals regulate sensitivity level of sensor input. Posture sustaining in different relieves of terrain results in tension of SKB. Constant differentiation of sensor signals of somatic and other systems is required [31]. V.S. Gurfinkel assumed that main task of vertical posture’s regulation system is sustaining of body mass center’s projection inside of supporting contour of feet (ankle strategy).

It is confirmed by research of D.V. Skvortsov [26]. The work of Nashner L.M. [46] is devoted to studying of Romberg’s posture. The author found postural characteristics of body regulation. The received by us results are of priority, comparing with indicators of control [26]. Finding of individual characteristics of morphological functional state permits to predict potentials of reacting to muscular impacts [50].

Finally, it should be noted that in literature we did not find the researches of such kind (except devoted to physical fitness). Comparison was with runners of the same age and sex: results have been presented in the work. Our results of physical fitness assessment coincide with other authors’ works [11, 5, 1]. The problem of junior athletes’ adaptation characterizes integrative functioning of organism, considering physical fitness, special endurance, bio-energetic potentials and stabilometric indicators. It permits to analyze bio-mechanical parameters of junior athletes’ activity in sport training system. Our data permitted to deepen knowledge about static/kinetic balance of athletes in the regarded kind of sports.

Conclusions

1. Integrative assessment of combined characteristics for development of local/regional and special muscular endurance showed effective adaptation of junior orienteers. It is recommended to fulfill stretching exercises in combination with speed power and relaxation exercises.

2. In system of junior orienteers’ sport training we found the following: gender distinctions in carbohydrates and fats consumption ($P<0.05-0.01$) in the ranges of aerobic and anaerobic thresholds; substantial physiological changes in static/kinetic balance (tests with open and closed eyes) all these shall be considered in athletes’ training.

Conflict of interests

The author declares that there is no conflict of interests.

References

12. Isaev AP, Rybakov VV, Ertlikh VV. Individualization of sport training: state, problems and promising decisions, Chelyabinsk; 2016. (In Russian)
20. Romanov IuN, Isaev AP. Simulation of physical culture-sport informational space on the base of new neuro-physiological...
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Individual health related applied activity in special health group girl-students’ way of life in the process of their studying

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Keywords: questioning, girl students, special health group, leisure activities, life activity, recreation, day regime, physical culture.

Introduction

Studying at higher educational establishment requires from students intensive intellectual, emotional and physical tension. It renders significant impact on their health, which is a pre-condition of future self-realization, ability for further studying and for professional activity.

Research of special health group’s girl students’ value orientations in advance is very important. It is necessary to maintain their healthy life activity [21] in real conditions of educational process with compulsory physical culture application [31]. This, most important kind of human activity, is of great significance in girl students’ system of values.

At present, in foreign researches especial significance of not admittance of any dangers in mastering future profession is noted. It is necessary to exclude dangerous uncertainties in gaining knowledge [4], illogical competences in the field of education [5], in professional training of specialists [6]. Besides, it is necessary to use the experience of teachers in students’ teaching to health protection and physical culture [28].

In HEE educational process it is necessary to envisage technologies for reduction of harmful habits’ proliferation [18], reduce probability of internet addiction’s progressing [19], computer games addiction [20], cultivate students’ habits to healthy life style [10] and formation of healthy life style [9].

Studying in modern HEE to large extent is based on application of computer information technologies. For success in education students shall correctly organize their life activity. Regime of work and leisure shall ensure their sound health [27]. It is very important to plan the kinds of leisure activities. Leisure time shall be devoted to physical exercises [2] and sports activity since adolescents’ age [3].

Spending free time for “rest” with computer, students can loose not only health. They can loose potential for successful studying and for success in future professional activity.

In this connection, it is very important to study the problems of students’ health preservation, i.e. creation of educational technologies, which would exclude students’ immobility [12] and influence positively on their physical and psychic health [30].

Foreign scientists found disturbing tendency to excessive weight [23], obesity progressing [25], absence of physical activity and drawbacks in physical fitness of adolescents [11] and students. Especially important is to consider gender and physical distinctions of different age categories of rising generation [24].

This tendency permits for the authors of this article to agree with sad conclusions of domestic and foreign specialists about insufficient effectiveness of most standard programs of students’ physical education [10]. It is necessary to orient on successfullness of general and special qualities’ training at different stages of students’ education [7].

Analysis of scientific works in the field of health protection, medicine, sports and physical education permits to affirm that there is noticeable weakening of physical condition and health of most of modern young people. The main threats for students’ health are immobile way of life [27] and obesity [25]. Modern scientific works
of scientists, dealing with students’ health protection shall be devoted just to elimination of these global threats [26].

**Hypothesis:** the authors assumed that transition of Russian education to positions of modern education shall be regarded as organized process of healthy personality’s teaching. In this aspect the system of modern education contains the following elements: variability of educational programs, priority of human values, free development of personality, ensuring of personality’s self determination, creation of conditions for personality’s self realization. For this purpose it is necessary to analyze the forms of students’ leisure. Besides, it is necessary to estimate the demands in physical culture practicing, regime of work (rest, eating and sleep) for working out and further realization of measures on organization of health related students’ education.

The purpose of the research is to find out actual life style of special health group girl students in context of their individual health strengthening and improvement, as well as to assess their demands in physical culture practicing.

**Material and methods:**

**Participants:** in the frames of experimental work, at initial stage we fulfilled written questioning of special health group (SHG) girl students (n=300, age 17-19 years) of 1st-2nd year of pedagogical HEE (girl students with health problems).

**Organization of the research:** we tested girl students of Krasnoyarsk State Pedagogical University named after V.P. Astafyev (KSPU). It is explained by the fact that their actual life style in conditions of educational process to large extent influences on girl students’ health.

The relevance of girl students’ health preservation problem is conditioned by specific of social demographic group. Due to different reasons physical and psychic health of young people cause reduction of their cultural-sport activity. For determination of girl students’ actual way of life we conducted research, consisting of three stages.

At first stage we determined the direction of the research. We worked out the project of pedagogic experiment (September-October 2016), selected and tested the methodic of the research.

In compliance with the purpose of the research the following tasks were defined:

1. Specify conception “health”, its meaningful characteristics; criteria; indicators of individual health and healthy life style.
2. Find out how girl students understand “healthy life style”? which its features characterize girl students’ life activity?
3. Clear up, how girl students understand importance of physical culture practicing for health preservation.
4. Find out girl students’ attitude to attending bars, cafes, and so on.
5. Study significance of leisure activities for healthy life style formation.
6. Work out the questions for questionnaires:

   1. Structure of SHG girl students’ leisure.
   2. Day regime of SHG girl students.
   3. Analyze girl students’ activities in the process of mastering knowledge.

For solution of the mentioned tasks, in October-November 2016 we questioned 300 SHG girl students of 1st-2nd years.

**Second stage** (October-November 2016). Girl students questioning was fulfilled. During questioning the content of questionnaire was corrected.

**Third stage** (December 2016 – March 2017). Analysis of results was conducted, as well as their mathematical statistic processing, generalization and analysis of objective information; conclusions were specified.

**Statistical analysis:** we found, calculated and analyzed the following girl students’ percentages: hobbies in leisure time; real picture of their activities in leisure time; their ideas about their preferences in leisure activities, day regime.

Mathematical-statistic processing of girl students’ questioning results was used for assessment of the received data. As a result numerical material was determined in the following way (proportion): \( A/B = M/N \). We found the main attribute of proportion \( A*N=B*M \).

Where \( N \) – is unknown multiplier, \( B = 100 \), \( M \) – known multiplier, \( A \) – known multiplier.

Statistical analysis of leisure and day regime structure is given in tables 1 and 2.

**Results**

Questioning results showed undoubted priority of meetings and walks with friends in the structure of SHG girl students’ leisure (91.3% — constantly and often).

Naturally, communication with peers is characteristic for social-psychological characteristic of young people. A little lower is passive leisure – listening o modern music (78.82%); the third lace is taken by watching TV and video records (53.9%). Special health group girl students of pedagogic HEE like reading fiction (34.6% — often); newspapers and magazines (31.7% — often). Studying of special literature engages constantly 34.6% girl students; often – 25.0%, from time to time – 36.5%, and practically no girl students - 4%. A little part of girl students (28%) devote free time to social life and 41.3% do not participate in it. Girl students often attend disco and bars (22.1%).

Priorities in leisure sphere are an important indicator of young man general culture. Unfortunately, for the questioned girl students it is not connected with physical culture: 71.1% of girl students practice physical culture from time to time. 34% - practically do not practice physical culture.

Physical culture is a kind of human motor functioning. However, in everyday life most of the questioned girl students (36.5%) pay little attention to organized and independent physical culture trainings, sports and hiking. 34.6% of girl students practically do no physical exercises. Only for 28.9% of girl students, physical culture is an integral part of leisure.
Table 1. The structure of 1st, 2nd SHG girl students of pedagogic HEE

<table>
<thead>
<tr>
<th>№</th>
<th>Description of activities</th>
<th>Constantly and regularly, %</th>
<th>Often, %</th>
<th>From time to time, %</th>
<th>Practically no activities, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Listening to audio records</td>
<td>34.6</td>
<td>44.2</td>
<td>21.2</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>Watching TV, video</td>
<td>16.4</td>
<td>37.5</td>
<td>34.6</td>
<td>11.5</td>
</tr>
<tr>
<td>3.</td>
<td>Reading of newspapers, magazines</td>
<td>13.5</td>
<td>31.7</td>
<td>39.4</td>
<td>15.4</td>
</tr>
<tr>
<td>4.</td>
<td>Reading of fiction</td>
<td>39.4</td>
<td>34.6</td>
<td>23.1</td>
<td>2.9</td>
</tr>
<tr>
<td>5.</td>
<td>Participation in social life</td>
<td>16.3</td>
<td>28.0</td>
<td>41.3</td>
<td>14.4</td>
</tr>
<tr>
<td>6.</td>
<td>Physical culture, hiking</td>
<td>18.3</td>
<td>10.6</td>
<td>36.5</td>
<td>34.6</td>
</tr>
<tr>
<td>7.</td>
<td>Attending of disco</td>
<td>6.7</td>
<td>25.0</td>
<td>32.7</td>
<td>35.6</td>
</tr>
<tr>
<td>8.</td>
<td>Attending of theatres, exhibitions, museums</td>
<td>7.7</td>
<td>11.5</td>
<td>53.8</td>
<td>27.0</td>
</tr>
<tr>
<td>9.</td>
<td>Meeting with friends</td>
<td>11.5</td>
<td>79.8</td>
<td>8.7</td>
<td>0</td>
</tr>
<tr>
<td>10.</td>
<td>Attending of sport shows, competitions</td>
<td>2.0</td>
<td>11.5</td>
<td>30.7</td>
<td>55.8</td>
</tr>
<tr>
<td>11.</td>
<td>Collecting, photographing, cinema shooting</td>
<td>3.8</td>
<td>13.4</td>
<td>30.0</td>
<td>52.8</td>
</tr>
<tr>
<td>12.</td>
<td>Study of special literature, participation in scientific work</td>
<td>34.6</td>
<td>25.0</td>
<td>36.5</td>
<td>3.9</td>
</tr>
<tr>
<td>13.</td>
<td>Playing cards, domino, etc.</td>
<td>2.0</td>
<td>22.1</td>
<td>35.6</td>
<td>40.3</td>
</tr>
<tr>
<td>14.</td>
<td>Playing music, writing poems, painting</td>
<td>15.4</td>
<td>18.3</td>
<td>26.0</td>
<td>40.3</td>
</tr>
<tr>
<td>15.</td>
<td>Visiting restaurants, café, bars</td>
<td>2.0</td>
<td>22.1</td>
<td>35.6</td>
<td>40.3</td>
</tr>
<tr>
<td>16.</td>
<td>Amateur art</td>
<td>4.8</td>
<td>11.5</td>
<td>42.3</td>
<td>41.4</td>
</tr>
<tr>
<td>17.</td>
<td>Technical constructing, rationalization</td>
<td>0</td>
<td>8.7</td>
<td>22.1</td>
<td>69.2</td>
</tr>
<tr>
<td>18.</td>
<td>Handicraft, needlework</td>
<td>2.0</td>
<td>6.7</td>
<td>33.7</td>
<td>57.6</td>
</tr>
</tbody>
</table>

Table 2. Day regime of SHG girl students of pedagogic HEE

<table>
<thead>
<tr>
<th>№</th>
<th>Questions</th>
<th><strong>Answers (%)</strong></th>
<th><strong>Weekday</strong></th>
<th><strong>Day off</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>At what time do you awake?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 a.m.</td>
<td>5.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.30 a.m.</td>
<td>31.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 a.m.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.00 a.m.</td>
<td>63.1</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9 a.m.</td>
<td></td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 a.m.</td>
<td></td>
<td>28.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 a.m.</td>
<td></td>
<td>18.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 a.m.</td>
<td></td>
<td>27.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Late</td>
<td></td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Do you do morning exercises?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Every day</td>
<td>36.4</td>
<td>35.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td>63.6</td>
<td>64.4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>How much time your way to HEE takes?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>60 min.</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>90 min.</td>
<td>38.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15-20 min.</td>
<td>11.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Do you have breakfast at home?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I have breakfast at home</td>
<td>30.1</td>
<td>71.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I do not have breakfast at home</td>
<td>69.9</td>
<td>28.8</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Do you have breakfast at HEE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I have breakfast at HEE</td>
<td>54.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I do not have breakfast at HEE</td>
<td>45.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Do you have lunch?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>91.0</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>9.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Do you need afternoon meal?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>22.7</td>
<td>10.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>77.3</td>
<td>89.4</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Do you have supper?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>86.4</td>
<td>91.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>13.6</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>What is your eating?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adequate</td>
<td>49.6</td>
<td>48.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hearty</td>
<td>50.4</td>
<td>51.1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>How much time is taken by home tasks?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 hour (60 min.)</td>
<td>30.4</td>
<td>26.9</td>
<td></td>
</tr>
</tbody>
</table>
Creative activity (play music, poetry, painting) engages only 15.4% of girl students; 53.8 girl students attend theatres from time to time. 7.7% of girl students attend museums and exhibitions and 423% participate in amateur art from time to time.

The second questionnaire was devoted to girl students’ day regime. Correctly organized day regime is a compulsory condition of successful life activity. Rational regime of work and rest shall be an ABC of girl students’ life activity. Girl students shall observe all components of day regime: morning exercises, morning toilet, home tasks’ fulfillment, being in the fresh air, leisure activities, moderate attending of different shows, evening meal, evening walk and preparing for sleep.

However, the questioning showed the following (see table 2). Om weekdays most of girl students (63.1%) awake at 7.00 a.m. 31.7% girl students start their day at 7.30 and 5.2% - at 6 a.m. 36.4% do morning exercises. This fact witnesses that girl students are not interested in health strengthening and preservation.

In 50% of girl students the way to the place of studying takes about one hour. 38.4% spend about one and half hour to get to HEE. The rest of girl students get to HEE for 15-30 minutes. It is quite clear that time and energy losses, connected with going to HEE aggravate the health of most of girl students.

For normal life activity of SHG girl students it is necessary to observe eating regime, which implies its frequency rate during day; definite intervals between taking food. When organizing eating, it is necessary to consider energy value and quantitative correlation of food main components. Questioning results showed that 20.1% of girl students do not have breakfast. Lunch (at HEE) is practiced (after first academic pair) only by 13.6% girl students. After second academic pair 41% have meal. 45.4% of girl students do not have meal at HEE at all. The questioning also showed that 91% of girl students have dinner at home within 14.00-17.00 p.m. 9% of girl students do not have dinner at all. 77.3% of girl students do not need afternoon meal. 86.4% have supper and 13.6% of respondents do not have supper at all. The question “What is your eating? (adequate, hearty) was answered: 49.6% have adequate eating; 50.4% have hearty eating. At first sight there is no danger in these answers. However, in some cases it creates discomfort in academic activity and is dangerous for health. It is connected with the fact that mental, physical and etc. human activity is realized at the account of metabolism in organism.

As a result of our research we found time expenditures for home tasks’ fulfillment and for leisure activities. Most of girl students (41.3%) do home tasks during two hours a day. 5.7% do not do home tasks at all. 12% (from those, who do home tasks) spend one hour for it. Only 9% do home tasks during 4 hours a day. 18.4% spend 1 hour a day for doing home tasks and 13.6% spend 3 hours for this work.

Information about leisure time is also interesting. Most of SHG girl students (46.2%) spend for leisure (hobby) 2 hours a day and 35% - not more than 1 hour. 9.6% — spend 3 hours and 8.7% — 4 hours a day.

Results of our studies show that after intensive working day girl students especially need in adequate sleep to ensure full fledged rest for organism. Physiological demand in sleep duration of girl students with health problems is 8 hours a day. We found that 40.9% of girl students go to bed at 22.00-23.00 p.m.; 45.4 – at midnight; 13.7% of girl students go to bed much later. Shortening of sleep duration is a violation of sleep regime.

Results of our studies show that this research permits to start qualitatively new process of organization of individual, health related applied work with girl students. For example, we cleared up organization of girl students’ life activity in day off. In day off 22% of girl students get up: 8.6% - at 7 a.m.; 4.8% - at 8 a.m. and 8.6% - at 9 a.m. Most of girl students (28%) awake at 10 a.m.; 18.2% - at 11 a.m.; 27% - at noon and 4.8% – at 1 p.m. It is known that excessive sleep facilitates progressing of phlegm, disorders many vitally important functions of organism. Only 35.6% of girl students do morning exercises at day off (by 0.8% less than on weekdays). 2% of girl students do not have breakfast on day off. All 300 girl students have dinner but in different time. 8.6% do not have breakfast on day off. All 300 girl students have dinner but in different time. 8.6% do not have dinner at all. 8.6% do not have breakfast on day off. All 300 girl students have dinner but in different time.
meal before sleep. Household affairs (helping parents, tidying of flat and so on) take 3 hours a day in 31.9% of girl students. 13% spend 1 hour a day for home affairs. Home tasks’ fulfillment in day off takes: 4 hours – in 2% of girl students; 3 hours – in 22.1%. Most of girl students (37.5%) spend 2 hours of free time for doing home tasks. 26.9% spend 1 hour for this work and 11.5% do not do home tasks at all.

**Discussion**

Studying of this topic is conditioned by the fact that works of many authors are directed at formation of the following features in students: proper attitude to own health [15, 16, 29]; long-term support of healthy life style [17, 22]; individual health related applied activity of girl students [2].

Practically every girl student has many obligations and affairs. Sometimes girl student feels deficit of time. As a result, solving little problems, girl student forgets about priorities of health values. She sleeps a little, does not run in the morning, does not practice hiking, takes meal, reading book and so on. For recreation of workability and health strengthening girl students shall have active leisure; be in the fresh air as much as possible; practice physical exercises. In this case the authors of this article do not agree with foreign specialists, who exaggerate the danger of excessive weight [23] and progressing of global obesity [25] in most of adolescents with insufficient motor activity [11] and young people [24]. By results of our researches, youth is not completely physically inactive. Youth reasonably organizes leisure and individual life style in higher educational establishment [2].

Results of our research shows that this research permits to start qualitatively new process of organization of individual, health related applied work with girl students. It complies with studies of other authors, devoted to physical culture health related work with girl students [13], to propaganda of active Judo trainings, which are interesting for students [9, 10].

The authors prove that after intensive working day girl students especially need in adequate sleep to ensure full fledged rest for organism. Here, certain pedagogic control over motor activity of senior school age girls is required. In the future, such control will help to girls to correctly understand physical education and correct life style values [8, 12].

As a result of our research we found time expenditures for home tasks’ fulfillment and for leisure activities. Diagnostic procedure on initial stage included questioning of SHG girl students about their life activity and attitude to health related applied activities. These indicators are important elements of motivation mechanism of girl students’ health related applied education, which is required for working out and realization of adequate pedagogic provisioning of the tested process. Analysis of questionnaires showed that most of students have positive attitude to healthy life style. It is in agreement with other works [1, 10, 21]. About one/third of girls students have negative attitude to healthy life style. As reasons, they named internal factors: absence of demand, will power; absence of appropriate emotional background; presence of harmful habits and external factors: students’ life conditions do not permit, inconvenient time table, great academic load, uncertainty in the future and so on.

Simultaneously we studied special leisure activities. This sphere implies individual preferences and interests, selection of values. The character of leisure is a necessary condition of physical condition’s development and health strengthening; participation in social life and cultural progress of personality. Such day regime influences on girl students’ health and way of life. This problem was solved also by other specialists [29]. They studied interconnections of morphological, functional indicators of students and fulfilled comparative research of exercises’ influence on students’ physical and psychic health [30] and their functional potentials [14].

Organized talks with girl students after questioning and analysis of its results permitted to make other positive conclusions. Our results show that girl students, nevertheless, have moderate demand in individual health related applied activity. One of reasons of it is that sport clubs and other public sport-health related organizations do not involve girl students in their practices. There is discussible contradictory state motivation demand in individual health related applied activity of girl students.

**Conclusions**

Thus, social-pedagogic analysis of SHG girl students of pedagogic HEE showed the following:

— In free time girl students attach great importance to activities, which are not connected with physical culture.

— There is moderate state motivation demand in individual health related applied activity of SHG girl students.

**Conflict of interests**

The authors declare that there is no conflict of interests.
References


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The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive

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Retrospective analysis of junior female handball players’ priorities


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Abstract

Purpose: fulfillment of retrospective analysis of junior female handball players’ tactic priorities.

Material: in the research junior female handball players of 15-16 yrs age (n=60) participated. The researches were conducted in 2006, 2010 and 2016 on the base of sport schools and physical culture colleges of Ukraine. We used author’s programs «Balltest» and «Handball skills».

Results: indicators of junior female handball players' abilities and tactical thinking effectiveness in different periods of the research were received. Correlations of these indicators with physical potentials and throw fitness point at tactical priorities of the players. Comparative characteristic showed that junior female handball players of 2016 year of the research had better abilities for solution of complex team tasks with low sensor indicators.

Conclusions: by universal character of tactic priorities junior female handball players of 2016 year of the research yield to the players of 2006 and 2010 years of the research. Junior female handball players of 2016 year of the research prevail in successful mental solution of position defense tactic tasks, especially in readiness to act as supporters.

Keywords: junior female handball players, tactical priorities, tactical thinking, situational thinking, attack, defense.

Introduction

Striving for show value and records, modern sports reached the level of athletes’ contest at extreme of human potentials. Such athletes’ performances are pointed at a fan as an active participant of sport action [4]. Spectator has a demand – to enjoy the fight of opponents. In this case show value of sports is defined as “fight of characters and tactical plans” [4]. Especially it is noticeable in team kinds of sports. By the words of D. Alberto Lorenzo Calvo [19], sport game teams have their own concept of success. It implies individual sportsmanship of players and their actions’ coordination in constantly changing site situations and resistance of opponent [19]. To ensure such activity in handball the players shall have the following: quickness of perception [39]; ability to predict situations, solve them and take adequate solutions [5]; to have cognitive abilities [17, 18, 20].

Analysis of scientific works showed that study of athlete’s cognitive abilities is still an urgent problem. Such studies have different orientation:

- Study of efficient team thinking, based on non-verbal, emotional solutions [39];
- Tactical thinking with expected feedback of the taken decision. In this case intuitive, analytical and subjectively oriented models of game situations are used [44];
- Intuitive thinking as quicker and more effective mean of taking correct decision in definite game episode [41];
- Emotional component of decision-taking. It is necessary for developing of own behavioral style and confidence in critical game situations [22, 38];
- Testing of perceptive-cognitive differences between age groups, licenses levels of different age coaches [28];
- Correlation between motivation, purpose and perception level of motivation climate and their influence on cognitive and somatic components of young athletes’ contest anxiety [27, 30];
- Success in training of general and special physical qualities at different stages of athletes’ training [31];
- Impulse and subjective indicators of athletes’ reaction to physical load [37];
- Indicators for prediction of martial arts athletes successes [35, 40];
- Optimization of physical loads [34] considering athletes’ individual characteristics [25, 26] and health indicators [42].

Other works were directed at solution of problem of athletes’ cognitive sphere. They expanded knowledge about handball players’ tactical thinking [10, 12, 13]. Tactical thinking is defined as ability to choose rational decision in game situation [14]. It is a complex of brain operations, ensured by potentials of human supreme nervous system’s activity [8] and individual-typological specificities of neuro-physiological processes [10]. The method of handball players’ tactical thinking definition was worked out on the base of these principles [3]. It included game situations’ models, which were displayed with variant of complex and simple tasks’ solution. Usage of virtual board for dynamic presentation of tactic tasks is shown in other methodic [17, 44]. This methodic is characterized by the presence of program algorithm and division into blocks.

Among other researches one can find the following tactical models of athletes’ and teams’ behavior:
- Methodology of assessment of tactical attacking behavior in handball [32];
- Usage of gradient contest. The authors found that usage of gradient contest can increase success of students with higher and lower qualification level [33];
- Working out of strategy: for prevention from young athletes, who are trained in elite educational structures, “burning out”; for facilitating long term participation and increase of welfare in sport activity [36].

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Tactical thinking is a part of athlete’s cognitive strategies [6]. There is interconnection of anthropometric, technical and physical indicators of an athlete and realization of his/her tactical plan [15, 19, 43]. Computer programs permit to find tactical preferences of elite female handball players for controlling over competition functioning [13]. Usage of such program in case of junior female handball players will provide information about tactical priorities. In its turn, it will permit to raise effectiveness of training process.

The purpose of the work is to fulfill retrospective analysis of junior female handball players’ tactic priorities by their tactical thinking, considering physical indicators and throw fitness. For this purpose it is necessary: 1) to study characteristics of tactical thinking, physical indicators and throw fitness of different research periods’ junior female handball players; 2) determine tactical preferences of junior female handball players to actions in different game situations.

Material and methods
Participants: retrospective analysis was fulfilled on identical by age and qualification groups of junior female handball players tested in different periods. In the research junior female handball players of 15-16 yrs (1st sport category) participated. 20 athletes, tested in 2006 and 22 – tested in 2010 – pupils of Zaporozhye and Krivoy Rog sport schools; 18 athletes, tested in 2016, were the students of Kherson and Brovary higher physical culture colleges. The researches were conducted in leading handball schools, which successfully train athletes for teams of masters and combined teams of Ukraine. All participants gave consent for participation in the research.

Organization of the research: junior female handball players were tested by computer program «Handball skills» [13]. The program is based on two tests for handball players’ tactical thinking. These tests were worked out with the help of virtual board for presentation of different complexity game situations’ schemes. First test «Balltest» [3] consisted of 4 blocks: tactical thinking in attack; tactical thinking in defense; situational thinking in attack and situational thinking in defense. Each block consisted of 100 schemes with variants of solution, which were positively assessed by experts. In the process of testing 15 game situations, arbitrary chosen by computer, were displayed. Every schema was displayed during 7.33 sec. for analysis and taking decision. By blocks we determined coefficient of thinking, mean time of correct decision-taking and calculated effectiveness of thinking. The methodic of tactical thinking finding was experimentally tested on handball players, basketball players and football players of different age. Informative value and reliability of this methodic has been proved in other researches [1, 10, 13].

The second test [12] included 400 schemes from «Balltest». The test consisted of three blocks: situations in left, right and central parts of site. 30 schemes of game situations, arbitrary chosen by computer, were displayed (10 situations for every zone). On the base of coefficient and mean time of correct decision taking we determined territory priority of players’ tactical thinking [12].

In creation of «Handball skills» computer program tactical thinking indicators and main factors, which to the largest extent influence on players’ mental actions in different game situations, were considered. They are: body parameters, quickness and accuracy of throws. That is why in formulas of «Handball skills» program the following indicators were introduced: tactical thinking; body length; speed of 28 meters’ run; accuracy and quickness of four throws from 7 meters’ distance to squares 40х40 cm (special screen). At the end of experiment we received information, which permitted to find territorial and tactical preferences of junior female handball players.

Statistical analysis: all experimental data were processed with the help of Excel program.

Results
Before solution of tactical task athletes create own mental plan of actions. Mental planning is interconnected with tactical thinking and player’s potentials in realization of his/her ideas. It forms players’ tactical priorities. Our methodic of tactical priorities determination is not intended for preparation of handball player to game with definite opponent. The methodic informs about mental tactical schema of actions, which can be effectively used by a coach.

We provide the data of junior female handball players’ tactical priorities in retrospective analysis, which are not connected with game with definite opponent. We compared junior female handball players’ indicators of 2006, 2010 and 2016 years of the research. Analysis of the data showed that in 2006 and 2010 years indicators of junior female handball players did not differ noticeably. That is why we present results of 2006 and 2016 years

<table>
<thead>
<tr>
<th>Description of indicators</th>
<th>Periods of the research</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2006 year (n=20)</td>
</tr>
<tr>
<td>Accuracy of 7 meters’ throws from 4 (quantity)</td>
<td>2,78±0,17</td>
</tr>
<tr>
<td>Time of 7 meters throws’ fulfillment (sec.)</td>
<td>4,67±0,20</td>
</tr>
<tr>
<td>Time of 28 meters’ distance run (sec.)</td>
<td>4,59±0,15</td>
</tr>
<tr>
<td>Body length (cm)</td>
<td>169,6±1,42</td>
</tr>
</tbody>
</table>

Note: *p<0.05 – comparing with indicators of 2006
of the research. Difference between indicators was determined in respect to the second group of the tested.

In the process of the researches we found no distinctions in body length and quickness. But handball players of 2006 year of the research had better throw fitness by accuracy by 42% and by quickness – by 43% (see table 1).

Junior female handball players, tested in 2016, demonstrated higher qualitative indicators of tactical thinking in attack – by 54% and in defense – by 45% (solution of complex tactic multiple tasks). Handball players, tested in 2006, had better quality of situational thinking in attack – by 21% and in defense – by 37% (solution of simple tasks). Both groups had equal quality of thinking in attack. With it, handball players of 2006 had better quality of thinking in defense by 6% (see table 2).

Junior female handball players, tested in 2006, demonstrated quickness of correct decision taking in situational tasks’ solution in attack by 11% and in defense – by 12%. Quickness of tactical tasks’ solution (independent on game phase) was equal (see table 3).

Junior female handball players, tested in 2006, demonstrated higher effectiveness of situational tasks’ solution in attack – by 28% and tactical tasks in attack – by 31%. Effectiveness of situational tasks’ solution in defense was on the same level. The players, tested in 2016, had effectiveness of tactical thinking in defense by 60% higher (see table 4).

There is no difference between indicators of the tested groups by territorial advantage in left and right site zones. The players of 2016 were better in central zone by 54%. In group of 2006 priorities by zones were not found. Junior female handball players, tested in 2016, demonstrated higher quality of tasks’ solution in central part of site: by 37% in left and by 48% in right zones (see table 5).

In tactical priorities of 2016 junior female handball players we found the following: preferences to actions in left and right zones was lower by 15%; territorial universality of attacking actions – by 10% and preconditions for attacks were higher in central zone by 10% (see table 6).

Sportswomen of 2016 had lower indicators of territorial universality of defense actions by 20% and defense actions with outcome – by 24%. They have higher indicators in central zone by 20% and interaction in support – by 24%. Readiness for group actions in all tested groups is equal.

In tactical priorities to team actions in attack the best

Table 2. Qualitative indicators of junior female handball players’ tactical thinking

<table>
<thead>
<tr>
<th>Description of indicators (quantity of correct answers)</th>
<th>Periods of the research</th>
<th>2006 year (n=20)</th>
<th>2016 year (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situational thinking in attack</td>
<td></td>
<td>9,21±0,62</td>
<td>7,28±0,50*</td>
</tr>
<tr>
<td>Tactical thinking in attack</td>
<td></td>
<td>4,58±0,63</td>
<td>7,06±0,38*</td>
</tr>
<tr>
<td>Situational thinking in defense</td>
<td></td>
<td>6,25±0,54</td>
<td>3,94±0,45*</td>
</tr>
<tr>
<td>Tactical thinking in defense</td>
<td></td>
<td>3,92±0,27</td>
<td>5,67±0,25*</td>
</tr>
</tbody>
</table>

Note: *p<0.05 – comparing with indicators of 2006

Table 3. Quickness of decision taking by junior female handball players

<table>
<thead>
<tr>
<th>Description of indicators</th>
<th>Periods of the research</th>
<th>2006 year (n=20)</th>
<th>2016 year (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situational thinking in attack</td>
<td></td>
<td>3,38±0,12</td>
<td>3,76±0,19*</td>
</tr>
<tr>
<td>Tactical thinking in attack</td>
<td></td>
<td>3,31±0,18</td>
<td>4,08±0,68</td>
</tr>
<tr>
<td>Situational thinking in defense</td>
<td></td>
<td>3,85±0,16</td>
<td>4,31±0,17*</td>
</tr>
<tr>
<td>Tactical thinking in defense</td>
<td></td>
<td>4,36±0,17</td>
<td>4,11±0,18</td>
</tr>
</tbody>
</table>

Note: *p<0.05 – comparing with indicators of 2006

Table 4. Effectiveness of junior female handball players’ tactical thinking

<table>
<thead>
<tr>
<th>Description of indicators</th>
<th>Periods of the research</th>
<th>2006 year (n=20)</th>
<th>2016 year (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situational thinking in attack</td>
<td></td>
<td>18,17±0,92</td>
<td>13,00±0,87*</td>
</tr>
<tr>
<td>Tactical thinking in attack</td>
<td></td>
<td>9,22±0,73</td>
<td>6,39±0,85*</td>
</tr>
<tr>
<td>Situational thinking in defense</td>
<td></td>
<td>10,82±0,88</td>
<td>11,83±0,78</td>
</tr>
<tr>
<td>Tactical thinking in defense</td>
<td></td>
<td>5,99±0,51</td>
<td>9,61±0,67*</td>
</tr>
</tbody>
</table>

Note: *p<0.05 – comparing with indicators of 2006
and readiness for different plans of actions was on the same level. 55% of handball players plan to improvise; 30% think to act by coach’s plan and 15% demonstrated universality.

In both tested groups we received the same indicators of bent to improvising in defense. Sportswomen of 2016 demonstrated higher readiness for standard actions in defense by 63% and lower bent to universality of actions by 79%.

**Discussion**

Results of our researches comply with high requirements to handball players’ intellectual sphere, put forward by high contest of teams on international level [5]. The received data confirm the opinion [5] that in conditions of strong contest handball players shall be able to promptly perceive large volume of different signals. Our results confirm the importance of cognitive strategies for athletes [6] and show their presence in female handball players. The results, received by «Handball skills» program [13] demonstrate tactical priorities of junior female handball players on the base of tactical thinking coordination, considering physical and technical parameters. The study of tactical thinking was fulfilled with the help of virtual board for dynamic presentation of tactical tasks [3]. Other program models with virtual board for presentation of game situation differ from method «Balltest»: slide tests [17] and video tests [41] for handball players; video tests for basketball players «BasketballTest» [1], video model for football players [18]. They imply presentation of situations in the forms of photos or video segments of real games. The mentioned program models included analysis of game situation, prediction of actions, intuition. M. Raab, S. Laborde [41] point at advantages of handball players’ intuitive solutions in complex and unknown situations. V.A. Tishchenko, A.A. Shipenko [11] are sure in significant influence of players’ anticipation on effectiveness of tactic actions. We think that intuition and anticipation shall be excluded from indicators of tactic thinking. Methodic «Balltest» offers stand displaying of schemes instead of real game’s fragments.

Comparison of «Balltest» methodic with other programs showed their distinctions. In works of P. Weigel, M. Raab, R. Wollny [44] program model DEMATS (decision making in team sports) is presented. The

---

**Table 5. Territorial priority of tactical tasks’ solution by junior female handball players**

<table>
<thead>
<tr>
<th>Description of indicators (quantity of correct answers)</th>
<th>Periods of the research 2006 year (n=20)</th>
<th>2016 year (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solution of tactical tasks in central zone</td>
<td>7,08±0,54</td>
<td>10,89±0,89*</td>
</tr>
<tr>
<td>Solution of tactical tasks in left zone</td>
<td>6,95±0,46</td>
<td>6,86±0,42</td>
</tr>
<tr>
<td>Solution of tactical tasks in right zone</td>
<td>6,19±0,42</td>
<td>5,72±0,48</td>
</tr>
</tbody>
</table>

Note: *p<0.05 – comparing with indicators of 2006

**Table 6. Tactical priorities of junior female handball players**

<table>
<thead>
<tr>
<th>Description of indicators, (%)</th>
<th>Periods of the research 2006 year (n=20)</th>
<th>2016 year (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bent to attacks in central zone of site</td>
<td>20,00</td>
<td>40,00</td>
</tr>
<tr>
<td>Bent to attacks in left zone of site</td>
<td>25,00</td>
<td>10,00</td>
</tr>
<tr>
<td>Bent to attacks in right zone of site</td>
<td>25,00</td>
<td>10,00</td>
</tr>
<tr>
<td>Territorial universality of attacks</td>
<td>30,00</td>
<td>20,00</td>
</tr>
<tr>
<td>Bent to defense actions in central zone of site</td>
<td>40,00</td>
<td>60,00</td>
</tr>
<tr>
<td>Bent to defense actions in left zone of site</td>
<td>10,00</td>
<td>10,00</td>
</tr>
<tr>
<td>Bent to defense actions in right zone of site</td>
<td>10,00</td>
<td>10,00</td>
</tr>
<tr>
<td>Territorial universality of defense actions</td>
<td>40,00</td>
<td>20,00</td>
</tr>
<tr>
<td>Readiness to active defense with outcome</td>
<td>30,00</td>
<td>5,56</td>
</tr>
<tr>
<td>Readiness to defense on line</td>
<td>10,00</td>
<td>10,00</td>
</tr>
<tr>
<td>Readiness for support</td>
<td>60,00</td>
<td>84,44</td>
</tr>
<tr>
<td>Bent to improvising in attacks</td>
<td>55,00</td>
<td>55,56</td>
</tr>
<tr>
<td>Tactical universality in attacks</td>
<td>15,00</td>
<td>16,67</td>
</tr>
<tr>
<td>Bent for realization of standard schemes in attacks</td>
<td>30,00</td>
<td>27,78</td>
</tr>
<tr>
<td>Bent to improvising in defense</td>
<td>5,00</td>
<td>5,56</td>
</tr>
<tr>
<td>Tactical universality in defense</td>
<td>80,00</td>
<td>16,67</td>
</tr>
<tr>
<td>Bent for realization of standard schemes in defense</td>
<td>15,00</td>
<td>77,78</td>
</tr>
</tbody>
</table>
model includes device for recording visual perception of game moment. It permits to register individual speed of information’s perception. «Balltest» methodic does not envisage additional devices. Sensor component of tactical thinking we determine by mean time of correct answers. A Y. Cardin, C. Bossard, C. Buche, G. Kermarrec [21] worked out virtual simulator of football ball CoPeFoot, which stipulates complex registration of decision making elements. Random selection of players does not consider emotional empathy factor that can influence on adequacy of the made decision in phases with ball. «Balltest» methodic is intended for individual testing that permits to avoid emotional empathy influence. By the data of Z. Certel, Z. Bahadir, T. Sönmez Gül [22] in female handball empathy in respect to current emotional state of other player is rather high.

The received by us data about tactical thinking confirm the data of other scientists [21, 24] about dynamic character of game situations in time aspect. Qualitative indicators of tactical thinking witness about changes in mental planning of players’ actions. In 2006 and 2010 junior female handball players successfully solved situational tasks, which were based on individual-group actions with simple choice of decision (independent on game phase). In 2016 they solved more successfully the tasks in attacks, independent on complexity of game situation. Other authors [5, 9] note that attacking actions prevail over defense of high effectiveness. I. T. Gasanov [2] and V. Tsyganok [16] specify changes in tactic and positional attacks, where individual actions with quick transition dominate.

In the researches of 2016 we obtained indicators of high effectiveness of situational and tactical thinking in defense. It permits for junior female handball players to successfully solve defensive positional tasks. It is in agreement with opinion of T. Debanne, V. Angel, P. Fontayne [24] that junior athletes’ coaches prefer defensive strategy of tactical training. Such strategy can reflect in athletes’ mental plans. Collective game in defense with some moments of individual realization of tactic task creates difficulties for opponent [20, 24].

Study of tactical thinking sensor components showed that quickness of decision making in complex game situations does not differ in the tested groups. Junior female handball players, tested in 2016, were slow in solution of simple tasks with little quantity of players. Other data [17] show that quickness of decision making in team tasks is higher that quickness of thinking about decision. Here we can appeal to Z. Certel, Z. Bahadir, T. Sönmez Gül [22], who noted that for young athletes alert style of decision making is characteristic. This style includes carefulness and responsibility of complex situations’ assessment.

For junior handball players of 2016 it was difficult to limit time for fulfilment 7 meters’ throws. They had low accuracy and great time losses. Short time for information processing by junior athletes negatively influences on actions and reduces their effectiveness [44].

Study of territorial priority in tactical tasks’ solution showed that focusing on central zone is characteristic for all tested groups. But they are more expressed in 2016. These data are confirmed by the data of other researches [7, 23]. With constant players’ concentration in center their actions’ elements are better perceived.

In tactical priorities of junior female handball players, tested in 2016, we observed bent to successful solution of tasks in the center of site (independent on game phase). As L. Červar [23] notes dynamic game requires quickness of tactic responding. But the players’ cognitive potentials [39, 44] do not permit to successfully solve the tasks in complex and badly known zones of site. N. Rogulj, V. Srhoj, L. Srhoj [43] note that limited physical or technical data of players correct their functioning. It influences on thinking stereotype [44]. In tactical priority of junior female handball players, tested in 2016, there is readiness to realize standard schemes in defense. To improvise [29] it is necessary to be ready for variable actions. It requires ability to think in space from athlete. In junior female handball players cognitive and emotional uncertainty appears due to high responsibility in defense [22]. That is why the game by standard tactical schemes permits to observe tactical plan of coach [24]. It releases pressure on decision making [29].

Conclusions
We found tactical priorities of junior female handball players in different research periods by tactical thinking indicators, considering physical potentials and throw fitness. We determined, that handball players, tested in 2016, universality in tactical preferences yield to players of 2006 and 2010. Junior female handball players, tested in 2016, have higher bent to solve tactical tasks in central zone of site in attack and defense as well as to solve tactical tasks of positional defense. They also are ready to act on support. In junior female handball players of 2006 and 2010 we observed abilities for successful solution of tactical tasks, which do not depend on site zone. They are ready: to defend with outcome and on support; to improvise in attack.

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Conflict of interests
The authors declare that there is no conflict of interests.


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The diagnosis and comparison of physical abilities of skiers and footballers
Vasilios F. Giovanis, Panagiotis V. Vasileiou, Evangelos M. Bekris

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Abstract

Purpose: The purpose of this research was to diagnose the physical abilities such as speed, strength, agility and endurance of alpine skiers and footballers through the same country tests. Also, the purpose was to compare the performance and test results of the above tested against one another.

Material: The sample of 58 individuals came from two groups of men of different sports: skiing (n = 29) aged 18-26 (20.97 ± 2.08 years) and football (n = 29) aged 18-25 (21, 28 ± 1.56 years), while the level in each group was the advanced and the beginner respectively. Until the trials, the ski and football teams had a training program exercising physical abilities and skills three days a week for the specialties and one day a week the select skiing session and the compulsory football session according to the curriculum. In order to diagnose and compare the physical abilities of ski students and football students, the following four tests of Alpine skiing on dry ground were used after the ski season on this day in April 2014: A) Route speed test (route 20m with flight start). B) Explosive power tests of the lower limbs (eightfold with alternating tossing of feet). C) Agility Tests (Slalom’s track on a “folder” 5m x 5m). D) Anaerobic test (jumping obstacle 20cm height for 60sec).

Results: In the skiing specialty we have a great correlation between speed tests and other physical abilities and agility with endurance (r = -0.72). In football specialty there was a great correlation between speed and power tests (r = -0.65) and agility with the power (r = -0.69). In optional skiing, we have a moderate correlation between the tests, while in the ‘A’ year football students the correlation between speed and strength (r = -0.81) is distinguished.

Conclusions: It is noteworthy that the students of the first year of football as well as the specialists do not have as good results in endurance as compared to the students of the skiing, even though the football game lasts 90 minutes compared to Alpine skiing 1-2 minutes.

Keywords: physical abilities, alpine skiers, footballers, tests.

Introduction

Several researchers present the issue of diagnosing physical fitness and individual physical abilities through various tests outside the laboratory area, in racing conditions in winter sports e.g. in skiing, and in summer sports e.g. at football. By the term test of the skier (or footballer) we mean the tool that controls and measures the elements of the motor skills and physical abilities of the trainee from the technical or physical standpoint respectively, while the assessment and evaluation is done by the teacher or coach through the test result or “norm” [8]. Alpine skiing requires relatively slow eccentric and concentric movements that produce forces up to 3G, lasting from 40 seconds to over two minutes. As the ultimate control of snow contact and the ability to limit speed distance requires dynamic balance through a wide range of mobility of the lower limbs and hips. Endurance and preparation should focus on hypertrophy, maximal endurance development, balance, dynamic mobility and anaerobic capacity [13]. Soccer is a high-intensity sport that requires players with high levels of aerobic and anaerobic ability, force, velocity, power, skill, coordination and flexibility so as to become competitive [22]. Soccer is characterized by short sprints, rapid acceleration or deceleration, turning, jumping, kicking, and tackling [1, 3, 33] and are directly related with the power production capacity of the neuromuscular system. Soccer players, as well as many other athletes on the field and the court, execute multiple sprints during the course of a match [20]. The capacity of soccer players to produce varied high-speed actions is known to impact a soccer match performance [18], can be categorized into actions requiring maximum speed, acceleration, or agility [17] and are critical to the outcome of the game. During a typical game, a 2- to 4-second sprint occurs every 90 seconds [2, 23]. Sprinting occupies some 3% of playing time and accounts for 1-11% of the distance covered during a match. Some 96% of sprints are shorter than 30m, and 49% are 10m [15, 26].

Purpose of the research

The purpose of this research was to diagnose physical abilities such as speed, strength, agility and endurance of alpine skiers and footballers through the same country test. Also, the purpose was to compare the performance and test result of the above tested against one another.

By performance, we mean the behavior of the tested person during the test (e.g. technique, heart rate, etc.), while top result means the end result.

Research questions and assumptions

The enunciation of the assumptions was based on the following research questions:
1) Is there a comparison between alpine skiers and footballers?
2) If so, then which tests and physical abilities present the difference?
3) Is the difference due to the effect of training or other random factors?
4) Is there a criterion for selecting tests that can be a
reliable “simulation” test for skiing or football?

**Delimitation, restrictions and conditions**

The measurements and constraints included in the survey were carried out in the same way: (a) in the same geographical area, in the same weather conditions and at the same time of day; (b) in a sample of individuals with the same characteristics as status, age and sex.

**Material and methods**

**Participants:**

The sample of 58 individuals came from two groups of men of different sports: skiing (n = 29) aged 18-26 (20.97 ± 2.08 years) and football (n = 29) aged 18-25 (21, 28 ± 1.56 years), while the level in each group was the advanced and the beginner respectively.

**The measuring instruments**

In the physical abilities test, the following measuring instruments were used: timer with an accuracy of 0.01 sec, 20 cm height cones and 1 mm precision tape measure.

**Means of data collection**

The following tests are based on the general ICSPFT international test [9, 34] with eight general tests (it was released prior to the Eurofit test [6]) and the Haczkiewicz test [12, 16]. The criterion for selecting a test was the result of the published research or the nominated research, which will answer if the test for skiing is valid and reliable [21, 31] and football [28, 29, 30]. Special tests of dry land in skiing were selected by researchers and authors, who presented the results of some tests with norms [8, 12, 16].

**Measurement procedure**

Until the trials, the ski and football teams had a training program exercising physical abilities and skills three days a week for the specialties and one day a week the select skiing session and the compulsory football session according to the curriculum. The training program included methods and exercises of all forms: general, mimetic on dry ground and snow specific for skiing ([8, 9] and exercises of all forms for football [25]. In order to diagnose and compare the physical abilities of ski students and football students, the following four tests of Alpine skiing on dry ground [8, 9] were used after the ski season on this day in April 2014: A) Route Speed test (Route 20m with flight start). We perform two attempts and count the best. B) Explosive power tests of the lower limbs (Eightfold with alternating tossing of feet). We make two efforts and measure the distance of the best effort. C) Agility Tests (Slalom’s track on a “folder” 5m x 5m). We are trying to make two consecutive rounds in one attempt. D) Anaerobic test (Jumping of an obstacle of 20cm height by 60sec). We measure the number of repetitions in an attempt (endurance to jumps).

**Statistical analysis**

Planning was implemented, where there were 4 research teams. For all characteristics of the tested, the mean (M) and the standard deviation (SD) were measured. The mean value of the test results per group in the individual tests has been correlated to each other by the following design: Test A with B, A-C, A-D, B-C, B-D and C-D. The statistical analysis was done with the Excel 2007 statistical program.

**Results**

**Analysis of anthropometric data**

The age, sex and the anthropometric characteristics of the ski and football teams that participated in the research are presented in Table 1 and Table 2. In the group of advanced skiers (Table 1) 11 were 22-26 year old specialty students (22,64 ± 1,21 years), height 1,70-2,00m (1,83 ± 0,08) and weight 64-85kg (75,45 ± 5,79), whereas in the group of the beginners, 18 were students 18-23 years of age in the optional course (19,94 ± 1,83 years), 1,62-1,84m (1,76 ± 0,06) and weighing 65-100kg (75,83 ± 9,51).

In the group of advanced football (Table 1), 14 were 22-25 year old specialty students (22,29 ± 0,04 years), height 1,64-1,82m (1,76 ± 0,05) and weighing 56-90 kg (72,07 ± 7,60). The body mass index (BMI) of the skiers had the following values: 24,46 ± 2,45 in the advanced and 22,69 ± 1,87 in the beginners, while the football team of the advanced and the beginners had the following corresponding values: 23,19 ± 1,76 and 23,14 ± 1,87.

**Differences between the physical abilities of skiers and footballers**

**Specialization teams**

In the physical fitness tests and individual physical abilities, the skiing specialty had better results in explosive power (“eightfold”) and anaerobic test (altitude endurance), while football specialty had better results in

<table>
<thead>
<tr>
<th>TEAMS</th>
<th>SAMPLE</th>
<th>AGE (years)</th>
<th>HEIGHT (m)</th>
<th>WEIGHT (kg)</th>
<th>BMI (kg/ m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>SPECIALIZATION SKIING</td>
<td>11</td>
<td>22,64</td>
<td>1,21</td>
<td>1,83</td>
<td>0,08</td>
</tr>
<tr>
<td>SELECTION SKIING</td>
<td>18</td>
<td>19,94</td>
<td>1,83</td>
<td>1,76</td>
<td>0,06</td>
</tr>
<tr>
<td>SUM</td>
<td>29</td>
<td>20,97</td>
<td>2,08</td>
<td>1,80</td>
<td>0,08</td>
</tr>
<tr>
<td>SPECIALIZATION FOOTBALL</td>
<td>14</td>
<td>22,29</td>
<td>0,04</td>
<td>1,76</td>
<td>0,05</td>
</tr>
<tr>
<td>SELECTION FOOTBALL</td>
<td>15</td>
<td>20</td>
<td>1,50</td>
<td>1,79</td>
<td>0,09</td>
</tr>
<tr>
<td>SUM</td>
<td>29</td>
<td>21,28</td>
<td>1,56</td>
<td>1,78</td>
<td>0,08</td>
</tr>
</tbody>
</table>
speed and agility (Table 2).

In the skiing specialty we have a great correlation between speed tests and other physical abilities and agility with endurance. In football specialty there was a great correlation between speed tests and strength and agility with strength (Table 3).

Selection teams

In fitness tests and individual physical abilities, optional skiing had better results in all tests with emphasis on anaerobic test (altitude endurance - Table 4). In optional skiing, we have a moderate correlation between the tests, while in the “A” year football students we can see the correlation between speed and strength (Table 5).

Discussion

Comparison of results between skiers and footballers

In the skiing specialty we have a great correlation between speed tests and other physical abilities and agility with endurance. In football’s specialty there was a great correlation between speed tests and strength and agility with strength. In optional skiing, we have a moderate correlation between the tests, while in the A ‘year’s students the correlation between speed and strength is distinguished. It is noteworthy that the students of the first year of football as well as the specialists do not have as good results in endurance as compared to the students of the skiing, even though the football game lasts 90 minutes compared to Alpine skiing 1-2 minutes.

Comparison of study results with other surveys

In skiing:

The performance of alpine skiing is closely related to both aerobic and anaerobic ability. Gross, et al., [10, 11] have investigated the seasonal variation of maximum oxygen uptake and the rate of oxygen uptake among the top skiers. During the racing season, skiers greatly reduce strength training and weight use, while snow training is predominant. In order to substantiate the above assumption, the performance of the top men’s athletes has been compared to intensive biking on a ramp, jumps (SJ, CMJ) before and after the racing season. The results of the above study were as follows: 1) the maximum oxygen uptake (VO2max) relative to body weight was higher in the pre-racing period (55.2 ± 5.2 vs. 52.7 ± 3.6 ml/kg/min, p <0.01), 2) on the respiratory limit (VT), the absolute and the relative percent of the work was similar, while the heart rate was slower, 3) the height of the jump was higher at SJ, (47.4 ± 4.4 vs. 44.7 ± 4.3 cm, p <0.01) and in CMJ (52.7 ± 4.6 vs. 50.4 ± 5.0 cm, p <0.01). Aerobic ability and leg strength were limited to the pre-competitive period and that the improvements observed were mainly due to the mid-competitive recovery from the exhaustion situation in the pre-competitive period. Staying at high altitude in

---

**Table 2.** Comparison of physical abilities between skiing and football specialization teams

<table>
<thead>
<tr>
<th>TESTS PHYSICAL ABILITIES (Measurement unit)</th>
<th>SKIING</th>
<th>FOOTBALL</th>
<th>Difference</th>
<th>Group with improved performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>SD</td>
<td>r (p&lt;0.05)</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>A</td>
<td>20 m – Speed (sec)</td>
<td>2,83</td>
<td>0,16</td>
<td>A-B = -0,64</td>
</tr>
<tr>
<td>B</td>
<td>«Eightfold» – Explosive power (m)</td>
<td>18,60</td>
<td>1,54</td>
<td>A-C = -0,70</td>
</tr>
<tr>
<td>C</td>
<td>Slalom - Agility (sec)</td>
<td>25,11</td>
<td>1,16</td>
<td>A-D = -0,64</td>
</tr>
<tr>
<td>D</td>
<td>Jumping 60 sec-Endurance (number of repetitions)</td>
<td>92,73</td>
<td>20,77</td>
<td>B-C = -0,44</td>
</tr>
</tbody>
</table>

**Table 3.** Correlation coefficient between tests in ski and football specialization teams

<table>
<thead>
<tr>
<th>TEST Physical Abilities</th>
<th>SKIING</th>
<th>Correlation coefficient (r)</th>
<th>FOOTBALL</th>
<th>(p&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Speed</td>
<td>X</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>B</td>
<td>Strength</td>
<td>-0,64</td>
<td>X</td>
<td>B</td>
</tr>
<tr>
<td>C</td>
<td>Agility</td>
<td>0,70</td>
<td>-0,44</td>
<td>X</td>
</tr>
<tr>
<td>D</td>
<td>Endurance</td>
<td>-0,64</td>
<td>0,39</td>
<td>-0,72</td>
</tr>
</tbody>
</table>
the pre-competitive season could also affect the results. Aerobic fitness and leg explosiveness can be maintained during the racing season, but may be jeopardized by heavy or excessive pre-competitive practice.

At football:

It is estimated that between 1000 and 1500 discrete movement changes occur within each match at a rate of every 5-6s, having a pause of 3s every 2min [14, 22, 27]. The starting speed (10-15 meters) is a necessary skill in the football game since it assists in claiming the ball, in the unmanned and generally gives an advantage to the appearance of qualitative aggressive and defensive actions, [14]. Surveys show that elite & sub elite players stand out from the amateurs at 10m but not at the speed of 30m [5, 2]. Agility is often recognized as the ability to change direction and start and stop quickly [7] and has been proven as agility performance is a powerful factor that distinguishes them skill levels in soccer [24, 14, 19, 32]. At the high level (Premier League) the players performed the equivalent of 726 ± 203 turns during the match; 609 ± 193 of these being of 0° to 90° to the left or right [4].

<table>
<thead>
<tr>
<th>TESTS PHYSICAL ABILITIES (Measurement unit)</th>
<th>SKIING</th>
<th>FOOTBALL</th>
<th>Difference</th>
<th>Group with improved performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>SD</td>
<td>r (p&lt;0,05)</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>A</td>
<td>20 m – Speed (sec)</td>
<td>2,64</td>
<td>0,21</td>
<td>A-B = -0,44</td>
</tr>
<tr>
<td>B</td>
<td>«Eightfold» – Explosive power (m)</td>
<td>18,71</td>
<td>1,35</td>
<td>A-C = 0,01</td>
</tr>
<tr>
<td>C</td>
<td>Slalom-Agility (sec)</td>
<td>24,89</td>
<td>1,62</td>
<td>B-C = -0,45</td>
</tr>
<tr>
<td>D</td>
<td>Jumping 60 sec - Endurance (number of repetitions)</td>
<td>94,54</td>
<td>10,22</td>
<td>B-D = -0,45</td>
</tr>
</tbody>
</table>

Table 4. Comparison of physical abilities between selection skiing and football teams

Table 5. Correlation coefficient between the tests in the selection ski and football teams

<table>
<thead>
<tr>
<th>TEST Physical Abilities</th>
<th>SKIING</th>
<th>FOOTBALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Speed</td>
<td>X</td>
<td>A</td>
</tr>
<tr>
<td>B Strength</td>
<td>-0,44</td>
<td>X</td>
</tr>
<tr>
<td>C Agility</td>
<td>0,01</td>
<td>-0,45</td>
</tr>
<tr>
<td>D Endurance</td>
<td>-0,35</td>
<td>-0,45</td>
</tr>
</tbody>
</table>

Conclusions – Proposals

Based on the results of the above survey we can conclude that:

1) It is possible to diagnose and compare the tests in both sports.
2) Skiing Specialization has had better results in explosive power and endurance to jumps, while football specialty has had better results in speed and agility.
3) Selection Skiing has had better results in all tests with emphasis on endurance to jumps.
4) It is remarkable that the students of the “A” year football as well as the specialty do not have as good results in the endurance as compared to the students of the skiing, although the football game lasts 90 minutes compared to Alpine ski 1-2 minutes.
5) Appropriate and documented variety with a wide range of tests may be the test selection criterion that can be a reliable “simulation” test for skiing or football.

Conflict of interests

The authors declare that there is no conflict of interests.
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Formative assessment: exploring Tunisian cooperative teachers practices in physical education

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Abstract
Purpose: This article is based on questions related to the formative assessment of preparatory trainee ship in the professional life of Physical Education teachers. In general, in the first training program, the traineeship represents an integral part of training. In this sense, the traineeship offers a vital opportunity for future teacher to gain practical experience in the real environment, given that formative evaluation is a process of collecting evidence from trainees by cooperative teachers to make decisions about their knowledge and skills, to guide their own instructional activities and to control their behavior. Accordingly, this study proposed to explore practices of Tunisians cooperative teachers in relation to the formative assessment.

Material: To verify our proposed object, we conducted a research using a questionnaire distributed among 96 cooperative teachers in different educational institutions located in the region of the greater Tunis. During the school year 2015-2016, the questionnaire was the subject of a statistical analysis using frequencies and percentages.

Results: The analysis of such data revealed a range of practices about formative estimation among cooperative teachers. In particular, each teacher acknowledged the value of guiding and encouraging student's self-assessment. So that they could lead their students to assume a share of evaluative activity.

Conclusions: Both theoretical and practical implications of these findings are discussed, and some recommendations are made for future practice.

Keywords: Preparatory traineeship, Physical Education, trainee, Cooperative teacher, formative assessment.

Introduction

The first physical education (PE) training in Tunisia has characterized by a dual aspect characteristics: a set of theoretical courses offered by university teacher and practical on the ground experience led by a cooperative teacher (CT) [1]. These collaborative cooperative teachers put their courses available to students so that they could lead teaching activities, guide students in their learning process and manage the class effectively. However, for [2], if a trainee is guided, supervised and trained, he could be able to teach. Through his research, [3] claimed that almost researches on teacher education have showed what kind of teacher intervention affects the success of a course. This cooperative teacher acts as a guide rather more than a model, in which he has to integrate different kinds of theory and practice in any particular lesson. He is also a reflective practitioner and a professional supporter of Skill-developing trainee [4]. Apart from these tasks, cooperative teachers are usually focusing on their pupils and simultaneously on their trainee [5]; therefore, the teacher’s role is not uncomplex. Moreover, it has a great influence on the professional development of the trainee [6].

Although the cooperative teachers [4] are the key players in the vocational education, some of them are facing difficulty when they are serving the trainees [7]. Since they are only acting as teachers, they are not likely to feel like an accompanist [8]. In fact, Clerc [9] reported that a good teacher is not necessarily a good mentor. Since the skill of both the cooperative teacher and the ordinary teacher. The cooperative teacher must assume the role of evaluator and certify the level of the future teachers’ competence even though these trainees feel not at ease before the challenge to match the task that accompanies, and they are under pressure unimaginable when attacking a terminal phase [10]. Assessment performance can be used in different ways by teachers as well as by students [11]. Teachers can use assessment results to identify the students’ strengths and weaknesses so that they can tackle them motivate students, and enhance the condition of learning and satisfy their needs from each ability [12]. A formative evaluation is defined as an informal and continuous process embedded in teaching and learning; it is conducted by teachers as a part of their everyday classroom work [13]. In fact, there exists a certain gap between the actual and the desired levels of performance while evaluating the comprehension of students, and it is not expressed in marks or grades [12]. In light of this definition, formative assessment is a vital tool for educators to be used integrating accelerative practices and capacity grouping into the traineeship [14]. Assessment embodies a central role in the process of teaching and learning; therefore, its formative function has received regular and remarkable consideration. In fact, some influential works shed light on the vital role of assessment. For example, Clark [15] have demonstrated that formative evaluation is such a powerful way that it can enhance student’s learning process in generally-educated situation. Following Tomlinson [16], formative assessment provides educators facts to support immediate decisions about grouping and stimulation for optimal learning conditions. In addition, the assessment remains a source of concern for many teachers. Delisle and Cantin [17] defines assessment, whether formative or summative, is a very delicate task since teachers are left with their
own professional judgment without the appropriate tools to confirm their results; it may cause very different and unfamiliar kinds of assessments. Due to the lack of measuring instruments, the cooperative teacher intuitively evaluates trainees’ performance creating a risk of bias and injustices [18]. According to Gagné [19], a teacher can use formative assessment to ease decision-making through quickening practices. The same author reclaims that many teachers may be unaware of the merits of formative assessment or the ways these practices can be used interactively to adjust instruction effectively. Brookhart [20] said that formative assessment provides teachers information for instructional decisions while it gives pupils information for progress. Many studies have showed that the assessment is a sophisticated task with many challenges for teachers who act as supervisors of the course, and it seems that assessment complexity is partly explained by the different functions it occupies like diagnostic, formative and summative ones [21]. It should also be noted that the assessment responsibility lies not only on the shoulders of the cooperative teacher, but rather on the university supervisor who shares responsibility for evaluating teachers [10]. Gosselin [22] shows that both actors of supervision are not always on the same wavelength. Moreover, the lack of common language is a communicative impediment within the team concerned with supervision [23]. More specifically, formative assessments are used to offer a variety of information for cooperative teachers to make immediate planning decisions about the needs of trainees [24]. To identify needs to inform teachers’ practice [25]. To Hughes [26], there are a variety of assessment types, whether formal or informal, among them we can mention stimulating the student’s learning through discussions or granting formative feedback of lessons which can be the basis for decision-making in the educational process. Based on their results, Black and Wiliam [25] affirmed that the assessment must be carried out through identifying students’ strengths and weaknesses in comprehension as well as in the subject application. As mentioned before, formative assessment is a complex phenomenon influenced by a number of variables [14]. A recent literature have found that to develop successful assessment approaches, it is important to take into consideration teachers’ attitudes toward innovations, tools or practice exercises, without mentioning their conceptions of assessment [27]. It is important to take account that an effective formative assessment practice requires a number of conditions to come together such as teachers ‘cognition skills and traineeship environment [26]. Formative assessment has been recommended in traineeship as a means of providing information [28], and most researches describe its benefits for underperforming students in areas where extra support or reinforcement is needed [29]. Seen in this light, cooperative teachers often use tools that restrict their evaluative correctness. Similarly, Howe and Ménard [30] asserted that traineeship supervisors would make assessments without the existence of evaluative tools. Furthermore, a cooperative teacher is obliged to assume a dual role with trainees, the role of a guide and that of an assessor [22]. Indeed, they must inform trainees of their strengths and weaknesses. The quality problem is to increase the relationship among actors of supervision and cut the impact of help. In this respect, several cooperative teachers are experiencing discomfort during the period of evaluating trainees [31]. According to these authors, these cooperative teachers are left to their individual professional judgment, because they lack the assessment tools to confirm what they have recorded. They check student’s performances and knowledge with guiding feedback acting as a kind of intervention, when assessments show that measuring instruments are absent [17]. As part of the traineeship, the cooperative teachers are generally observing what seems particularly useful for formative assessment [32]. Considering these findings and suggestions, in this article it is better to understand the daily problems and challenges encountered trainees during practices, to support them to resolve their training difficulties and to guide them to develop their pedagogical approaches. Consequently, in this current research, the literature reviews lead us to the following research question: What are the formative assessment strategies used by cooperative teachers as an integral part of the preparatory traineeship to the professional life in EP?

Material and methods

Design of the Research: The first training in Tunisia was taken over a period of three years ago and entitled to the degree of license in the teaching of physical education. A single preparatory training for a professional life was only held during the third year of training for a period of one continuous school year. The methodological approach is descriptive [33] since it will pave us the way to generate digital data obtained through questionnaires, which in turn will help us give a more accurate picture of the situation [34].

Participants: Participants were 96 cooperative teachers from different educational institutions located in the greater Tunis, who taught a range of grade levels and supervised futures teachers (Table 1). The mean years experience was 9.68 (SD = 08.42) years (ranging from 0-5 to 20 years). There was an equal distribution of participants across all categories of this variable, ranging from 19.79% of the sample at an early stage of their careers to 27.08%. This cross-tabulation between gender and years of experience shows that the majority of respondents were males (62.5%) while females were (37.5%). They are all volunteers accepting to take part in this research study during the school year 2015-2016. We opted for self-administrated questionnaire method in which our participants answered the questionnaire in a way to ensure anonymity. In addition, the average time to complete the task took only 20 minutes.

Procedures: To identify formative assessment practices of cooperative teachers, we inspired to a validated questionnaire of Beauchamp (2013), which used as part of a research on attitudes and behavior evaluation in training at the college level. We have translated and
adapted the questionnaire to our samples of Tunisians cooperative teachers. Data from closed and open questions were analyzed to identify specific categories related to (a) Identifications of cooperative teacher’s roles (b) fixing methods of collecting information (c) knowledge of the impact of different types of assessment practices and (d) moments of formative assessment. For each measure, we developed specific items to address the respective categories. To validate the questionnaire relevant to the new research context, we asked 12 collaborative teachers who both teach and mentor students. They have made constructive comments which enabled us to check, clarify and simplify the questionnaire for the best results when placing the appropriate tools. To avoid response bias in the research, these cooperative teachers have not answered the last questionnaire.

**Measures:** Participants responded to 33 items on a 5-point Likert-type scale ranging from 1 (very low) to 5 (very high) and they respond to 3 open questions. In fact, we used these second kinds of questions to qualify and clarify the participants’ responses as well as to better understand their interpretation of the problem and its impact on the practice. That targeted views that 14 items were retained to identify cooperative teacher’s roles, fixing methods of collecting information with 6 items, knowledge of the impact of different types of assessment practices with 5 and 8 items were kept for moments of formative assessment (Table 2). As a result of the quantitative data obtained from the closed questions in the questionnaire, we analyzed such material using the statistical software –SPSS 16 (Statistical Package for social science). Open-end questions as qualitative data were categorized and condensed using word software [27, 35].

**Results**

**Identifications of cooperative teacher’s roles:**

A descriptive statistics used to display data and evidence was summarized in the second table, which shows all participants’ responses due to the integral roles that the cooperative teachers had played in their formative assessment of future teachers in preparatory traineeship to the professional life. The data demonstrate that there was a broad agreement among participants with the statement that dealt with the fundamental teachers’ roles in evaluation. As we can see in table 2, most of the CTs who participated in the survey (60%) were in agreement with this statement. Therefore, 58 of 96 cooperative teachers are occupying valuable roles of guidance, encouragement, self-evaluation, motivation and establishing a trusting relationship with students. The consensus among our participants aligns with the results of Acheson and Damien Gall [36] who both insisted upon the necessity of boosting active listening, creating constructive exchange to build a trusting relationship between the student and the teacher, which is the pillar of any relationship. In addition, it is remarkable that 22 Cooperative teachers (23%) gave a high priority to the roles of supporting and collaborating with the university supervisor and providing feedback to trainees. In this regard, our results match more the findings of a study conducted by Arpin and Capra [37] whom they claimed that support involves the sharing of experiences between a cooperative teacher and a university supervisor. These authors well praised the interactive relationship and the character of a cooperative teacher. Similarly, Paul [38]

### Table 1. Characteristics of the participants included in the study (n = 96).

<table>
<thead>
<tr>
<th>Years of experience</th>
<th>Women</th>
<th>Men</th>
<th>Total</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td>10</td>
<td>16</td>
<td>26</td>
<td>27.08</td>
</tr>
<tr>
<td>6-10 years</td>
<td>05</td>
<td>14</td>
<td>19</td>
<td>19.79</td>
</tr>
<tr>
<td>11-15 years</td>
<td>10</td>
<td>15</td>
<td>25</td>
<td>26.04</td>
</tr>
<tr>
<td>16-20 years</td>
<td>11</td>
<td>15</td>
<td>26</td>
<td>27.08</td>
</tr>
<tr>
<td>Over 20 years</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>36</td>
<td>60</td>
<td>96</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table 2. Reliability and Descriptive Statistics for the formative assessment practices of cooperative teachers.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Sample items</th>
<th>Nb. of items</th>
<th>α</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identifications of cooperative teacher’s roles</td>
<td>Evaluating trainees’ learning. Encouraging self-assessment of trainees.</td>
<td>14</td>
<td>0.72</td>
<td>7.15 (0.61)</td>
</tr>
<tr>
<td></td>
<td>Guiding students in their developing skills.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-assessment of the trainee. Triad discussion.</td>
<td>6</td>
<td>0.72</td>
<td>7.10 (0.52)</td>
</tr>
<tr>
<td></td>
<td>Dyad discussion.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Fixed methods of collecting information.</td>
<td>Encouraging exchanges with trainees. Responding to trainees questions.</td>
<td>5</td>
<td>0.61</td>
<td>6.24 (1.22)</td>
</tr>
<tr>
<td></td>
<td>Questioning trainees.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Knowledge of the impact of different types of assessment practices.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
praised a working relationship based on mutual respect between the cooperative teacher and the university supervisor. Therefore, 6% of teachers attributed an average importance to the relationship between theory and practice and promoted linkages between university training and practical training during traineeship. We note that this low percentage allocated to this role explained by the training absence: they are not abreast of recent changes in physical education, ware of the nature of the student-offered courses during their training. The same percentage of cooperative teachers (6%) also attribute low importance to roles based on promoting development of student’s self-government and favored the reflexive analysis of trainees. A few teachers, just (4%), gave a very low importance to the role of mediator between an academic supervisor and interns. As a result of this brief presentation of the various roles and tasks of Tunisians teachers and framers, we are able to notice the complex role of the teacher in framing the process of learning. In fact, planning a lesson is a complicated task whether talking from the position of a teacher or of a trainee supervisor as we are dealing with different learning abilities and various skills in a classroom. The complexity can also be due to the kinds of the adopted strategies by a teacher or due to the teaching practices to which the trainees can refer to learn like practices for internship programs.

In this present study, our significant quantitative findings were supported by qualitative data. So, for the raised question, “Are there other important roles of the cooperative teacher?,” we had 10 answers which are as following: Firstly, Two cooperative teachers (20%) encouraged other teachers to submit a concern form as following: Secondly, Four others (40%) announced that both the psychological and the physical protection of students should be taken into account. Ultimately, a cooperative teacher is someone who mobilizes students in real situations so that they can face challenges and difficulties and is the one who takes responsibility to solve the students’ problems during lessons of physical education.

Identification of information collection methods for CT:

Regarding the question, “do you think of preserving the effectiveness and the efficiency of these methods of gathering information?,” it is raised to show the various methods used to collect data from the student’s progress toward the fulfilled goals of any particular lesson or toward any faced learning difficulties. Our findings suggest that during a lesson self-assessment was the most commonly chosen teaching method with 26 replies (27%), followed by a method of trainees’ direct observation (26%). This shows that there is a statistically significant difference in the efficiency of information collection methods for cooperative teachers. It proves that the highest level of cooperative teachers (21%) engaged dyadic discussion (teacher and teacher trainee), 15 people (16%) used the discussion in dyad (CT and US) and that 10 cooperative teachers used the triad discussion. We found that CTs lead students to assume a share of assessment activity. They actively involve students in the process of evaluation and lead them to make their reflexive assessment.

Effectiveness of information gathering tools:

“What tools used to gather information about students’ progress and difficulties?”

Our results show that descriptive matrix, (CT 64, or 67%) and class newspaper (20%) occupied the first rank as the most used teaching tools, whereas self-assessment was found the least as a teaching and learning task (just 8 participants opted it for). The final rank was for checklist (5%). Among the responses about the effectiveness of an information gathering tool to assess students’ progress and difficulties, only 20 cooperative teachers have used professional evaluative judgments while the rest have avoided answering the question.

### Table 3. Degree of importance of cooperative teacher roles.

<table>
<thead>
<tr>
<th>title</th>
<th>Very low (4%)</th>
<th>Low (6%)</th>
<th>average (6%)</th>
<th>High (23%)</th>
<th>Very high (60%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collaborating with the university supervisor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>2. Supporting the university supervisor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>3. Mediating between the university supervisor and trainees.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>4. Guiding students in their developing skills.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>5. Gathering information on the progress trainees.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>6. Promoting the development of trainees’ autonomy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>7. Establishing a relation between theory and practice.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>8. Accompanying reflective analysis of trainees.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>9. Providing feedback to trainees.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>10. Maintaining a relationship of trust with trainees.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>11. Encouraging professionalism.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Mobilizing trainees’ difficulties.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Evaluating trainees’ learning.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>
Impact of various types of the cooperative teacher practices:

On the basis of the findings set out in Table 3, we can conclude the following: firstly, various kinds of cooperative teacher’s practices were adopted to determine the impact evaluation of skills development on the trainees. In fact, most of the cooperative teachers’ assessment responses to these practices had a medium, high or very high impact. Secondly, only three practices were identified as having the largest influence, and only 9 CT (9.37%), whom they acted as experts with the students, gave their opinions on the interventions of the trainees. Finally, the last practice influence was very low to reinforce trainees to develop their personal and professional competence.

To support our results, we asked a cooperative teacher an open question; “What is the key moment of the formative evaluation internship for you?”

On the basis of the results set out in Graph1, we can deduce that most cooperative teachers opted for the mid-stage as the perfect period of formative assessment. It was also noted that 16 participants (16.66%) chose the observation reinvestment in learning during training activities, while others (9.37%) preferred direct observation in the field with immediate feedback during a lesson. In short, formative assessment can be an effective teaching process to check students’ understanding if it is performed during and before traineeship. In light of our results, we can say that most teachers believe that cooperative strategies, halfway through the course, are now essential to the formative assessment of the traineeship.

Discussion

Our task was to know formative assessment methods, not only to show the most comfortable emotional conditions for successful implementation of cooperative teachers’ supervision activities, but also to bring these conditions to the real monitoring situation process. In this proposed article, we chose to focus on the practices of Tunisians teachers’ and coaches in relation to the formative assessment methods used as preparatory traineeship to the professional life. It is these essential actors in the field that grant real training courses to students without the official status of cooperative teachers and take paramount roles in the curriculum construction of instruction [39]. We believe that they have the sufficient resources they need to well perform their roles, to adopt their interventions in the context of the internship, to analyze and justify their practices as competent social actors [40] reflecting

Table 4. Impact of CT practices on developing trainees’ skills

<table>
<thead>
<tr>
<th>title</th>
<th>Very low (%)</th>
<th>Low (%)</th>
<th>Average (%)</th>
<th>High (%)</th>
<th>Very High (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 Promoting the equal exchange of ideas with trainees</td>
<td>4.16</td>
<td>9.37</td>
<td>30.2</td>
<td>35.41</td>
<td>20.83</td>
</tr>
<tr>
<td>6.2 Replying on trainees’ questions</td>
<td>00</td>
<td>00</td>
<td>9.37</td>
<td>52.05</td>
<td>38.54</td>
</tr>
<tr>
<td>6.3 Giving their opinion in trainees’ interventions</td>
<td>00</td>
<td>4.16</td>
<td>28.12</td>
<td>52.05</td>
<td>15.67</td>
</tr>
<tr>
<td>6.4 Providing tools for reflection</td>
<td>00</td>
<td>00</td>
<td>15.67</td>
<td>30.33</td>
<td>54.00</td>
</tr>
<tr>
<td>6.5 Assessing student’s performance</td>
<td>00</td>
<td>00</td>
<td>20.63</td>
<td>41.17</td>
<td>38.2</td>
</tr>
<tr>
<td>6.6 Questioning trainees</td>
<td>00</td>
<td>10.8</td>
<td>00</td>
<td>37.33</td>
<td>51.87</td>
</tr>
<tr>
<td>6.7 Acting as expert with trainees</td>
<td>00</td>
<td>4.16</td>
<td>43.8</td>
<td>34.28</td>
<td>17.76</td>
</tr>
<tr>
<td>6.8 Asking trainees to justify their choice of intervention</td>
<td>00</td>
<td>00</td>
<td>15.67</td>
<td>52</td>
<td>32.33</td>
</tr>
</tbody>
</table>

Figure 1. Moment of formative assessment training.
on their practice to help participants [41] and to control
the reflective practitioner [42]. In addition, they pave
the way for students to assume a share of evaluative activity.
Similarly, Misset et al [14] indicated that cooperative
teachers need to perform self-assessment to their trainees
so that they could become autonomous and reflective
thinking power. Like many researches who have claimed
that formative assessment in training is complex and
challangeable task for cooperative teachers acting as
supervisors of traineeship [21], these roles are based
promoting development of student's self-government
and come along with the reflexive analysis of trainees.
In their research, Charpenter and Duchene [43] came to
the conclusion that a cooperative teacher must work to
allow trainees to become autonomous by developing their
own professional skills. Besides, it has been believed
that mistakes can develop the personality of a trainee
and provide opportunities for better self-improvement
and learning. However, Altet, Paquay et al[44] argued
that a cooperative teacher should take into consideration
that a trainee is not a perfect being, but can turn mistakes
into opportunities for a better rebound. Brookhart [20]
commented that CTs must help their students to find
solutions despite the complex and challengeable tasks.
Consequently, they will be capable to develop their
resourcefulness through the flexibility to adapt to any
kind of faced problem. In this sense, Robillard and St.
Louis [45] emphasized on the importance of the training
relationship between a practitioner and a trainer. Moreover,
Black et al. [25] have clearly identified peer assessment
as one of the key features of formative assessment.
We also learned that the main methods used to collect
information about the progress and difficulties of trainees
toward learning goals are self-assessment, followed by
a method of direct observation during the placement
support. We found that cooperative teachers encourage
students to assume a share of evaluative activity. They
actively involve students in the process of assessment and
leading them to reflective thoughts. Andrade & Cizek,
[24] highlighted the same point indicating that the field of
traineeship needs self-evaluation so that we could develop
autonomy and reflexivity in the character of trainees. For
Gaudreau [46], observation is an efficient process or tool
to collect information about trainees. In his study, he put
a great emphasis on the trainee’s observation to prevent
any rupture and interference. Similarly, Tomlinson
[16] claimed that if observation is performed to gather
information, it must be done under specific conditions
by using instruments developed for the use of real life
situations. Furthermore, we have learned that the narrative
assessment grid and the school are the most used tools by
cooperative teachers to gather information about students.
The less used were the self-assessment and checklist. Our
analysis leads us to the Scallon’s [47] affirmation which
mentioned that the descriptive assessment grid is one of
the most formative assessment tools. It should also be
noted that class newspaper is among the suggested tools by
Leroux [48] that occupies an integral part in the formative
assessment. Regarding the discussion between the trainee
and the cooperative teacher, Vanhulle [49] sheds light
on the paramount role of teachers in helping students
develop a balanced personality through the recognition
of different styles of learning and contributing teacher
trainer in the teaching practices and vice versa. The
interactions between the student and the cooperative
teacher must take place with respect to an appropriate
learning environment. Similarly, Black & Wiliam [13]
spoke of joint construction activities that take place in
clear and harmony environment and involve alternating
initiatives. Hence, our analysis leads us to the affirmation
of Pelpel [8] , which defined the formative observation
of the trainee as a care process that goes beyond the
look and left before the assessment or intervention. He
also claimed that an instrumented observation provides
direct access to the practice of the intern and analysis of
educational activities to improve certain aspects. We must
also remember that the grid of a descriptive assessment
is one of the most appropriate formative evaluative tools,
according to Scallon [47] . It is worth noting that the class
journal is also among the tools offered by Leroux [48]
as an integral part of formal assessment. Based on the
results of the raised question about the effectiveness of an
information gathering-tool, only 20 cooperative teachers
have used professional evaluative judgments while the rest
have avoided answering this question.
In addition we have found that our result is compatible
with that Lafoutine [50] definition that he has defined
professional judgment as a process that leads to a
professional ability. Availability, communication skills,
respect, understanding and the ability to listen are the
major qualities of cooperative teachers who perceived
as having the high impact of teaching practices while
involving with trainees during traineeship. These qualities
are essential to establish a climate of confidence and to
help to make sure that students feel comfortable with
the placement supervisor [50]. Otherwise, we know
that a defensive attitude for students contributes to a
non-receptivity to comments, which much affects their
learning [26].

Conclusion
Our research results allow us to draw a valid
conclusion about the importance of formal assessment in
internship and the role of the teacher as a facilitator of the
learning process. In fact, formative assessment strategies
considered to be more effective instructional strategies
because they carry discussion in dyad and triad, the
feedback from construction as well as strategy-promoting
question and reflection. In terms of the impact of different
CT practices on the development of the trainees’ skills, we
have found that most of the supporting practices are those
perceived as the most effective for instructing teachers
[12]. The data have also showed that the practices
that generate trainees’ interrogation and reflection are
generally qualified as having a significant impact. They
are also among the best supporting and encouraging
teaching strategies since accompanying strategies
instilling reflection were proposed by Van Nieuwenhoven
and Labeu [51] and supporting analysis in practice were presented by Guillemette and Lapointe [52] . For their part, the practices which put EA as an expert have more varied opinions. We see the same phenomenon for the practice of trade on equal terms with the trainees. This leads us to think that authority question within the trainer and trainee is complex. All participants in our research consider that CT qualities proposed in the questionnaire have a major impact on the effectiveness of interventions. The relationship of trust between the cooperative teacher and students occupy a fundamental place. Ultimately, the midterm review is the perfect time of performing formative assessment in traineeship. Therefore, it would be interesting to focus on the point of view of students and the development of their skills during the trainship, which could be a prospect to deepen.

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Conflict of interests
The authors declare that there is no conflict of interests.

References
7. Durand M. L’enfant et le sport. [Children and sport]. Presses universitaires de France; 2000. (in French)

233
towards professionalization]. 1993. (in French)
27. Azano A. The Possibility of Place: One Teacher’s Use of Place-Based Instruction for English Students in a Rural High School. Journal of Research in Rural Education (Online), 2011;26(10):1-10.
41. Desgagné S. Le concept de recherche collaborative: l’idée d’un rapprochement entre chercheurs universitaires et praticiens enseignants [The concept of collaborative research: the idea of a rapprochement between university researchers and teaching practitioners]. Revue des sciences de l’éducation, 1997;23(2):371-393. (in French)

234
Formative assessment: exploring Tunisian cooperative teachers practices in physical education.

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Level of physical exercises’ mastering in structure of 11-13 yrs age boys’ motor fitness

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2Kazimierz Wielki University, Bydgoszcz, Poland
3University of Pitesti, Romania
4Ecological University of Bucharest, Romania

Abstract

Purpose: to find the place of physical exercises’ mastering level in structure of 11-13 yrs age boys’ motor fitness.

Material: in the research 11 yrs age boys (n=58), 12 (n=76) and 13 years age (n=93) participated. Testing program included well-known tests: “Forward roll”, “Backward roll”, “Vault”, “Climbing rope (three attempts)”, “Bridge”, “Stance on shoulder blades”.

Results: By indicators of physical condition 11-13 yrs age boys statistically confidently differ one from another (p<0,001). Level of mastering of gymnastic exercises “Backward roll”, “Vault”, “Climbing rope (three attempts)”, “Bridge”, “Stance on shoulder blades” with age statistically confidently increases (p<0,001).

Conclusions: In factorial structure of motor fitness, level of physical exercises’ mastering has weight 17,5% (11 yrs age), 36,6% (12 years), 28,5% (13 years). Analysis of communities showed that in 11-13 yrs age boys training of motor abilities is effective (if they become a component of mastered motor skills).

Keywords: motor abilities, level of mastering, factorial analysis, 11-13 yrs age boys.

Introduction

The problem of optimization of schoolchildren’s physical education was regarded in works of Bodnar I. [1], Vas’kov Iu.V. [2], Krucевич T. et al. [9], Ivashchenko O.V. [8]. Bodnar I. stresses on need in searching new approaches to integrated physical education of different health groups’ schoolchildren [1]. The authors defined urgent problems of educational process’s perfection at physical culture lessons. Theoretical aspects and conditions of implementation in educational process of such innovative approaches as culturologic, competence, synergetic, axiologic, acheologic and other are regarded. The ways of the mentioned approaches’ implementation in real educational process are open. The results of innovative approaches implementation in personality oriented educational process are analyzed. It was proved that implementation of innovative approaches facilitates rising of educational process’s organization. Its basis is personality oriented approach to pupils. Besides, certain difficulties in educational process’s organization in comprehensive schools were found [2]. Methodic materials for planning of physical education process in comprehensive schools have been worked out [9]. Conception of physical education, which was built on the base of physical education’s simulation, motor abilities’ training and pedagogic control has been created. This conception includes: application of factorial and discriminant models of functional state age changes and motor fitness. The purpose of this conception is: planning of educational material, current, finalizing and stage-by-stage control of children’s fitness; modes of loading in a lesson and in series of lessons; regimes of alternation of relaxation and exercises [8].

In schoolchildren’s physical education there marked out directions of researches, which are connected with studying of motor abilities [5, 6, 7] and process of motor actions’ training [17, 20, 28]. Peculiarities of functional, coordination and power fitness of children and adolescents have been found [4, 11]. Dependence of training of power loads’ effects on regime of exercises’ fulfillment and relaxation has been determined [18, 23]. The process of motor actions’ training was studied from position of interdisciplinary connections [12, 13]; formation of motor competence [14, 15]; formation of meta-cognitive behavior [16]; verbal perception in mastering of sport movements [19]; optimization of regimes of exercises’ repetitions and rest intervals [20, 26, 28].

However, in available scientific literature there is a little data about wholeness of motor abilities’ development and children’s and adolescents’ training [27, 29]. Thus, study of motor fitness influence on level of physical exercises’ mastering is rather relevant. In other works training of motor fitness and dynamic of physical exercises’ mastering in 11-13 yrs age girls were regarded [31, 32]. In our work we have studied motor fitness and dynamic of physical exercises’ mastering in 11-13 yrs age boys.

The purpose of the research is to find the place of physical exercises’ mastering level in structure of 11-13 yrs age boys’ motor fitness.

Material and methods

Participants: in the research 11 yrs age boys (n=58), 12 (n=76) and 13 years age (n=93) participated.

Organization of the research: we used the following methods of research: analysis of scientific-methodic literature, pedagogic testing, methods of mathematical statistic. Testing program included well known tests. We registered: body length and mass, vital capacity of lungs (VCL), right and left hand dynamometry. We registered...
results in the following tests: “Pressing ups”, times”, “legs” rising in hanging on Sweden wall position, times”, “Angle on parallel bars, sec.”, “Torso rising in sitting position from lying on back position during 1 min.”, “Forward torso rising from sitting position (legs apart), cm”, “Hanging on bent arms, sec.”, “Torso rising from lying on abdomen position during 30 sec., times”, “Long jump from the sport, cm”, “Throw of filled ball (1 kg) in sitting position”, “Shuttle run 4 х 9 m, sec.” [25].

We studied mastering level of exercises: “Forward roll”, “Backward roll”, “Vault”, “Climbing rope (three attempts)”, “Bridge”, “Stance on shoulder blades”. [27].

Statistical analysis: the data were processed with the help of statistical analysis program IBM SPSS 20. The used factorial analysis included implied method of principle components. Method of rotation implied Varimax with normalization of Keiser. For every variable we calculated components. By indicators of physical condition 11-13 yrs age boys confidently differ one from another (p<0,001). Body length increased by 8,6%, by 30,9% — body mass, by 32,3% — vital capacity of lungs, by 39,7% — strength of right hand and by 38,3% — strength of left hand.

12 yrs boys show confidently better results than 11 yrs boys in tests: “Chin ups in lying position, times”, “Legs’ rising, hanging on Sweden wall, times”, “Angle on parallel bars, sec., times”, “Forward torso bending in sitting position (legs apart), cm”, “Hanging on bent arms, sec.”, “Torso rising from lying on abdomen position during 30 sec., times”, “Long jump from the sport, cm”, “Throw of filled ball (1 kg) from sitting position, cm”.

13 yrs boys show confidently better results in the following tests: “Pressing ups, times”, “Chin ups, times”, “Legs’ rising, hanging on Sweden wall, times”, “Angle on parallel bars, sec., times”, “Torso rising from position lying on back during 1 minute, times”, “Torso rising from lying on abdomen position during 30 sec., times”, “Long jump from the spot, cm”, “Throw of filled ball (1 kg) from sitting position, cm”.

### Table 1. Testing results of 11-13 yrs boys

<table>
<thead>
<tr>
<th>№№</th>
<th>Description of parameters</th>
<th>Age</th>
<th>N</th>
<th>X</th>
<th>m</th>
<th>Difference of mean values</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Height, cm</td>
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<td>143,172</td>
<td>.857</td>
<td>-7,182 — -5,654*</td>
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<td>Body mass, kg</td>
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<td>45,951</td>
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<td>VCL, cm3</td>
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<td>36,838</td>
<td>-270,599 — -5,055</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Right hand dynamometry, kg</td>
<td>11</td>
<td>58</td>
<td>18,448</td>
<td>.360</td>
<td>-3,485 — -4,220</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Left hand dynamometry, kg</td>
<td>11</td>
<td>58</td>
<td>22,784</td>
<td>37,880</td>
<td>-556,080 — -9,245</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>6</td>
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<td>58</td>
<td>21,934</td>
<td>.667</td>
<td>-3,850 — -4,031</td>
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<tr>
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<td>58</td>
<td>17,586</td>
<td>.646</td>
<td>-2,295 — -2,319</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Legs’ rising, hanging on Sweden wall, times</td>
<td>11</td>
<td>58</td>
<td>17,386</td>
<td>.512</td>
<td>-4,441 — -4,536</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Angle on parallel bars, sec., times</td>
<td>11</td>
<td>58</td>
<td>24,322</td>
<td>.668</td>
<td>-6,736 — -6,814</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Lying on back during 1 minute, times</td>
<td>11</td>
<td>58</td>
<td>20,224</td>
<td>.679</td>
<td>-1,657 — -1,416</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Forward torso bending in sitting position (legs apart), cm</td>
<td>11</td>
<td>58</td>
<td>23,422</td>
<td>.710</td>
<td>3,305 — 3,431</td>
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<td>Hanging on bent arms, sec.</td>
<td>11</td>
<td>58</td>
<td>19,881</td>
<td>.512</td>
<td>-4,441 — -4,536</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Shutue run 4 х 9 m, sec.</td>
<td>11</td>
<td>58</td>
<td>18,448</td>
<td>.360</td>
<td>-3,485 — -4,220</td>
<td>&lt;0,001</td>
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<tr>
<td>16</td>
<td>Legs’ rising, hanging on Sweden wall, times</td>
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<td>Angle on parallel bars, sec., times</td>
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<td>19,881</td>
<td>.512</td>
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<td>&lt;0,001</td>
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<td>18</td>
<td>Torso rising from position</td>
<td>11</td>
<td>58</td>
<td>17,386</td>
<td>.512</td>
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</tr>
<tr>
<td>19</td>
<td>Lying on back during 1 minute, times</td>
<td>11</td>
<td>58</td>
<td>17,586</td>
<td>.646</td>
<td>-4,441 — -4,536</td>
<td>&lt;0,001</td>
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<tr>
<td>20</td>
<td>Forward torso bending in sitting position (legs apart), cm</td>
<td>11</td>
<td>58</td>
<td>24,322</td>
<td>.668</td>
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<td>Hanging on bent arms, sec.</td>
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<td>58</td>
<td>19,881</td>
<td>.512</td>
<td>-4,441 — -4,536</td>
<td>&lt;0,001</td>
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Table 1 (Continued)

<table>
<thead>
<tr>
<th>№</th>
<th>Description of parameters</th>
<th>Age</th>
<th>N</th>
<th>X</th>
<th>m</th>
<th>Difference of mean values</th>
<th>t</th>
<th>P</th>
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<tbody>
<tr>
<td>13</td>
<td>Torso rising from lying on abdomen position during 30 sec., times</td>
<td>11</td>
<td>58</td>
<td>19,137</td>
<td>399</td>
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<td>Torso rising from lying on abdomen position during 30 sec., times</td>
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<td>93</td>
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<td>488</td>
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<td>Long jump from the spot, cm</td>
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<td>58</td>
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<td>15</td>
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<td>15</td>
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<td>93</td>
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<td>4,427</td>
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<td>58</td>
<td>11,526</td>
<td>1,093</td>
<td>1,010</td>
<td>1,016</td>
<td>&gt;0.05</td>
</tr>
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<td>16</td>
<td>Shuttle run, 4x9 m, sec.</td>
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<td>76</td>
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<td>1,093</td>
<td>1,010</td>
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<td>16</td>
<td>Shuttle run, 4x9 m, sec.</td>
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<td>93</td>
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<td>1,010</td>
<td>1,010</td>
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<tr>
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<td>58</td>
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<tr>
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<td>&lt;0.05</td>
</tr>
</tbody>
</table>

* comparison of 11-12 years; ** comparison of 12-13 years; *** comparison of 11-13 years

Table 2. Matrix of factorial analysis of 11 yrs boys’ testing. Rotation method: Varimax with Keiser’s normalization

<table>
<thead>
<tr>
<th>№</th>
<th>Description of parameters</th>
<th>Component 1</th>
<th>Component 2</th>
<th>Component 3</th>
<th>Component 4</th>
<th>Component 5</th>
<th>Component 6</th>
<th>h2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VCL, cm3</td>
<td>.778</td>
<td>.379</td>
<td>.803</td>
<td>.827</td>
<td>.633</td>
<td>.784</td>
<td>.788</td>
</tr>
<tr>
<td>2</td>
<td>Right hand dynamometry, kg</td>
<td>.702</td>
<td>.343</td>
<td>.318</td>
<td>.741</td>
<td>.693</td>
<td>.693</td>
<td>.577</td>
</tr>
<tr>
<td>3</td>
<td>Left hand dynamometry, kg</td>
<td></td>
<td>.318</td>
<td>.741</td>
<td>.633</td>
<td>.784</td>
<td>.784</td>
<td>.577</td>
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<tr>
<td>4</td>
<td>Pressing ups, times</td>
<td>.530</td>
<td>-.606</td>
<td>.633</td>
<td>.827</td>
<td>.633</td>
<td>.784</td>
<td>.784</td>
</tr>
<tr>
<td>5</td>
<td>Chin ups, times</td>
<td>.373</td>
<td>-.693</td>
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<td>.784</td>
<td>.577</td>
<td>.577</td>
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<tr>
<td>6</td>
<td>Legs’ rising, hanging on Sweden wall, times</td>
<td>.706</td>
<td></td>
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<td>.706</td>
<td>.706</td>
<td>.706</td>
<td>.706</td>
</tr>
<tr>
<td>7</td>
<td>Angle on parallel bars, sec., times</td>
<td>.803</td>
<td>-.346</td>
<td>.897</td>
<td>.897</td>
<td>.897</td>
<td>.897</td>
<td>.897</td>
</tr>
<tr>
<td>8</td>
<td>Torso rising from position lying on back during 1 minute, times</td>
<td>.534</td>
<td>-.472</td>
<td>.326</td>
<td>.719</td>
<td>.719</td>
<td>.719</td>
<td>.719</td>
</tr>
<tr>
<td>9</td>
<td>Forward torso bending in sitting position (legs apart), cm</td>
<td>.777</td>
<td></td>
<td>.706</td>
<td>.706</td>
<td>.706</td>
<td>.706</td>
<td>.706</td>
</tr>
<tr>
<td>11</td>
<td>Torso rising from lying on abdomen position during 30 sec., times</td>
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<td></td>
<td>.639</td>
<td>.639</td>
<td>.639</td>
<td>.639</td>
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<tr>
<td>12</td>
<td>Long jump from the spot, cm</td>
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<td>-.382</td>
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<td>-.449</td>
<td>.854</td>
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<tr>
<td>13</td>
<td>Throw of filled ball (1 kg) from sitting position, cm</td>
<td>.725</td>
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<td>.602</td>
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<td>.602</td>
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<tr>
<td>14</td>
<td>Shuttle run, 4x9 m, sec.</td>
<td>.627</td>
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<td>.510</td>
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<tr>
<td>15</td>
<td>Forward roll, level of mastering</td>
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Table 2 (Continued)

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<th>5</th>
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<th>h2</th>
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<td>16</td>
<td>Backward roll, level of mastering</td>
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<td>615</td>
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<td></td>
<td>750</td>
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<tr>
<td>17</td>
<td>Vault, level of mastering</td>
<td>759</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>685</td>
</tr>
<tr>
<td>18</td>
<td>Climbing rope (three attempts), level of mastering</td>
<td>778</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>750</td>
</tr>
<tr>
<td>19</td>
<td>Bridge, level of mastering</td>
<td>834</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>815</td>
</tr>
<tr>
<td>20</td>
<td>Stance on shoulder blades, level of mastering</td>
<td>850</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>21</td>
<td>Bridge, level of mastering</td>
<td>532 ,412</td>
<td>366</td>
<td></td>
<td>390</td>
<td></td>
<td></td>
<td>759</td>
</tr>
<tr>
<td>22</td>
<td>Stance on shoulder blades, level of mastering</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>706</td>
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</table>

Table 3. Full explained dispersion

<table>
<thead>
<tr>
<th>Component</th>
<th>Interpretation</th>
<th>Sum of squares of rotation loads</th>
<th>% of dispersion</th>
<th>Cumulative %</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Level of mastering and motor fitness</td>
<td>17,505</td>
<td>17,505</td>
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<tr>
<td>2</td>
<td>Physical condition</td>
<td>17,108</td>
<td>34,613</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Strength of hand</td>
<td>13,390</td>
<td>48,003</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Functional state of respiratory system</td>
<td>8,954</td>
<td>56,957</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Motor coordination</td>
<td>8,896</td>
<td>65,853</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Static power</td>
<td>6,920</td>
<td>72,773</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Matrix of actorial analysis of 12 yrs boys’ testing. Rotation method: Varimax with Kwiser’s normalization

<table>
<thead>
<tr>
<th>№</th>
<th>Description of parameters</th>
<th>Компонента 1</th>
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<th>3</th>
<th>4</th>
<th>h2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Height, cm</td>
<td>821</td>
<td></td>
<td></td>
<td></td>
<td>781</td>
</tr>
<tr>
<td>2</td>
<td>Body mass, kg</td>
<td>-364</td>
<td></td>
<td>703</td>
<td></td>
<td>719</td>
</tr>
<tr>
<td>3</td>
<td>VCL, cm3</td>
<td>533</td>
<td>511</td>
<td></td>
<td>588</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Right hand dynamometry, kg</td>
<td>776</td>
<td>300</td>
<td></td>
<td>768</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Left hand dynamometry, kg</td>
<td>729</td>
<td></td>
<td></td>
<td>659</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Pressing ups, times</td>
<td>632</td>
<td>431</td>
<td></td>
<td>687</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Chin ups, times</td>
<td>761</td>
<td>441</td>
<td></td>
<td>842</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Legs’ rising, hanging on Sweden wall, times</td>
<td>654</td>
<td>525</td>
<td></td>
<td>783</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Angle on parallel bars, sec., times</td>
<td>455 ,309</td>
<td></td>
<td>665</td>
<td></td>
<td>761</td>
</tr>
<tr>
<td>10</td>
<td>Torso rising from position lying on back during 1 minute, times</td>
<td>806 ,354</td>
<td></td>
<td></td>
<td>803</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Forward torso bending in sitting position (legs apart), cm</td>
<td>-513 ,609</td>
<td></td>
<td></td>
<td>707</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Hanging on bent arms, sec.</td>
<td>549</td>
<td>629</td>
<td></td>
<td>788</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Torso rising from lying on abdomen position during 30 sec., times</td>
<td>696 ,433</td>
<td></td>
<td></td>
<td>723</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Long jump from the spot, cm</td>
<td>699 ,328</td>
<td></td>
<td></td>
<td>613</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Throw of filled ball (1 kg) from sitting position, cm</td>
<td>341</td>
<td>712</td>
<td></td>
<td>640</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Shuttle run, 4x9 m, sec.</td>
<td>-596 ,438</td>
<td>-371</td>
<td></td>
<td>708</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Forward roll, level of mastering</td>
<td>887</td>
<td></td>
<td></td>
<td>812</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Backward roll, level of mastering</td>
<td>927</td>
<td></td>
<td></td>
<td>902</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Vault, level of mastering</td>
<td>806 ,315</td>
<td></td>
<td></td>
<td>772</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Climbing rope (three attempts), level of mastering</td>
<td>858</td>
<td></td>
<td></td>
<td>778</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Bridge, level of mastering</td>
<td>572 ,547</td>
<td>309</td>
<td></td>
<td>762</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Stance on shoulder blades, level of mastering</td>
<td>860</td>
<td></td>
<td></td>
<td>817</td>
<td></td>
</tr>
</tbody>
</table>
sitting position, cm”, “Shuttle run 4x9 m, sec”.

The level of mastering the exercises “Forward roll”, “Backward roll”, “Vault”, “Climbing rope (three attempts)”, “Bridge”, “Stance on shoulder blades” statistically confidently increases with age (p<0.001) (see table 1).

Thus, in 11-13 yrs age boys we noted positive dynamic of physical condition, motor abilities and gymnastic exercises’ mastering level indicators.

For specifying motor fitness influence on physical exercises’ mastering level we fulfilled factorial analysis.

Results of factorial analysis are given in tables 1-7. In the process of analysis in 11 yrs boys we marked out six factors, which explain 72.773% of total dispersion (see table 2-3). Factor 1 has the highest weight (21.735%) and
correlates with the following tests’ results:
• Climbing rope (three attempts), level of mastering.
• Vault, level of mastering, 834.
• Backward roll, level of mastering, 778.

The factor was named level of mastering and motor fitness.

Factor 2 has weight 17,108% and correlates with the following results:
• Height, cm, 778.
• Body mass, kg, .702.

The factor was named physical condition.

Factor 3 has weight 13,390% and correlates with the following:
• Right hand dynamometry, kg — .606.
• Left hand dynamometry, kg — .693.

The factor was named hand’s strength.

Factor 4 has weight 8,954% and correlates with the following:
• VCL, cm³ — .741.

The factor was named functional state of respiratory system.

Factor 5 has weight 8,896% and correlates:
• Forward torso bending in sitting position (legs apart), cm — .635.
• Shuttle run, 4x9 m, sec. — .615.

The factor was named motor coordination.

Factor 6 has weight 6,920% and correlates with the following tests’ results:
• Hanging on bent arms, sec. — .449.

The factor was named static power.

Analysis of communities showed that in motor fitness structure of 11 yrs boys the biggest influence is rendered by: “Chin ups— .897”; “Climbing rope (three attempts), level of mastering— .860”; “Hanging on bent arms— .854”; “Vault, level of mastering— .815”.

Analyzing 12 yrs boys we marked out 4 factors, which explain 74,607% of total indicators’ dispersion (see table 6, 7).

Factor 1 has the highest weight (36,646%) and correlates with:
• Backward roll, level of mastering— .927.
• Forward roll, level of mastering — .887.
• Climbing rope (three attempts), level of mastering — .858.
• Vault, level of mastering — .806.

The factor was named level of mastering and motor fitness.

Factor 2 has weight— 14,067% and correlates with physical condition indicators:
• Right hand dynamometry, kg — .776.
• Left hand dynamometry, kg — .729.
• VCL, cm³ — .533.

The factor was named physical condition.

Factor 3 has weight— 12,639% and correlates with the following:
• Long jump from the spot, cm — .699.
• Angle on parallel bars, sec — .665.
• Hanging on bent arms, sec. — .629.

The factor was named speed power.

Factor 4 has weight— 11,255% and correlates:
• Height, cm — .821.
• Body mass — .703.

The factor was named physical condition.

Analysis of communities showed that in motor fitness structure of 12 yrs boys the biggest influence is rendered by: “Backward roll, level of mastering— .902”; “Chin ups, times — .842”; “Forward roll, level of mastering — .812”.

Analyzing 13 yrs boys we marked out 5 factors, which explain 78,737% of total indicators’ dispersion (see table 6, 7).

Factor 1 has the biggest weight (28,497%) and correlates with the following results:
• Forward roll, level of mastering — .904.
• Backward roll, level of mastering — .889.
• Vault, level of mastering — .886.
• Climbing rope (three attempts), level of mastering — .881.

The factor was named level of mastering and motor fitness.

Factor 2 has the biggest weight— 20,299% and correlates with the following results:
• Angle on parallel bars, sec — .791.
• Legs rising on Sweden wall, times — .766.
• Hanging on bent arms, sec — .728.

The factor was named strength of abdomen muscles.

Factor 3 has weight— 16,126% and correlates with the following:
• Left hand dynamometry, kg — .950.
• Right hand dynamometry, kg — .937.
• Body mass, kg — .762.
• Height, cm — .706.

The factor was named physical condition.

Factor 4 has weight— 6,994% and correlates with the following results:
• Forward torso bending in sitting position (legs apart), cm — .821.

The factor was named flexibility.

Factor 5 has weight— 6,821% and correlates with the following tests’ results:
• Throw of filled (1 kg) ball from sitting position, cm — .796.

The factor characterizes speed power.

Analysis of communities showed that motor fitness of 13 yrs. boys is influenced to the largest extent: “Left hand dynamometry, kg — .921”; “Vault, level of mastering— .895”; “Stance on shoulder blades, level of mastering— .917”; “Forward roll, level of mastering — .883”.

Discussion
In our work we studied assumption about wholeness of motor abilities processes’ development and training from position of systemic approach [3, 8]. We found that variation of results in total dispersion of 11-13 yrs boys by 72,773%, 74,607%, 78,737% depends on the regarded factors. Mastering level in factorial structure has weight 17,505% (11 years), 36,646% (12 years), 28,497% (13
years). Analysis of communities showed that in 11-13 yrs boys development of motor abilities is effective if they are a component of the mastered motor skills.

The same dynamic of physical exercises mastering we observed in 11-13 yrs girls. We found that variation of results in total dispersion of 11-13 yrs girls by 81,259%, 79,353%, 71,019% is conditioned by the following factors: physical condition, level of motor abilities and level of physical exercises’ mastering. In factorial structure level of physical exercises’ mastering has weight 16,435% (11 years), 27,963% (12 years), 17,010% (13 years) [31].

In 11-13 yrs boys we observed higher contribution of mastering level in motor fitness structure.

The presented data supplements the results of Xu X. and Ke F. [30], Repko E. et al. [10], Khudolii O.M. et al. [28].

The conducted factorial analysis permitted to regard development of motor abilities and training as holistic process. It supplements the data of Ivashchenko O. et al. [21], Ivashchenko O. et al. [22] about effectiveness of factorial analysis application in physical education. Analysis of communities in factorial analysis permits to find the role of one or another indicator in factorial structure of the process. It points at demand in application of multidimensional mathematical statistic methods in studying of children’s and adolescents’ physical education laws [8, 24, 25, 33].

Conclusions
In 11-13 yrs boys we found positive dynamic of physical condition, indicators of motor abilities’ development and mastering level of gymnastic exercises.

We found that variation of results in total dispersion of 11-13 yrs boys by 72,773%, 74,607%, 78,737% depends on the regarded factors. Mastering level in factorial structure has weight 17,505% (11 years), 36,646% (12years), 28,497% (13 years). Analysis of communities in factorial analysis permits to find that in 11-13 yrs boys development of motor abilities is effective if they are a component of the mastered motor skills.

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Conflict of interests
The authors declare that there is no conflict of interests.

References
1. Bodnar I. Integrative physical education of different health groups’ schoolchildren. Lviv: LSUPC; 2014. (in Ukrainian)
8. Ivashchenko OV. Modelling of physical education students: Monograph. Kharkiv: OVS; 2016. (in Ukrainian)
10. Repko E, Kozin S, Kostyrko A. Training of pre school age and junior school age children to motor actions on the base of their psychological and physical characteristics on example of rock climbing. Zdorov’e, sport, reabilitacija, 2016; 2:46–50. (in Ukrainian)
16. Chatzipanteli A, Digelidis N, Karatzoglidi C, Dean R. A tactical-game approach and enhancement of metacognitive
32. Ivashchenko OV. Classification of 11-13 yrs girls’ motor fitness, considering level of physical exercises’ mastering. Pedagogics, psychology, medical-biological problems of physical training and sports, 2017;21(2), 65-70. doi:10.15561/18189172.2017.0203

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243
Bio-mechanical aspects of elite cyclists’ motor system 
adaptation in process of competition activity

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Kyiv National University of Technologies and Design, Ukraine

Abstract

Purpose: to study the laws of motor structure adaptation of elite cyclists, specializing in 4 km individual pursuit racing on track.

Material: in the research 18 elite athletes participated. We studied special aspects of athletes’ coordination structure in experiment, which simulated competition activity.

Results: at start segment of distance high speed depends on effectiveness of right leg's pulling; on pressing and pushing of left leg. At initial stage of distance high efficiency of pedaling is ensured by pressing and pulling of right and left legs. At middle segment high workability depends on movement of right leg; pressing, pulling and pushing of left leg. On finish speed depends by effectiveness of pressing, pulling and moving of right leg; pressing and pulling of left leg.

Conclusions: the presented material creates real pre-conditions for development of bio-mechanical models of cyclists’ pedaling technique. The received data can be used for special searching of optimal movement, considering competition tactic. The received results can be used for choosing of means and methods of athletes' movements' pedagogic re-constructions.

Keywords: fatigue, bicycle sport, electromyography, bio-mechanics, model.

Introduction

Competition activity of elite athletes is regarded as important factor of pedagogic and physical influence. Competition is characterized by extreme conditions for manifestation of special fitness’s different sides. Competition is an effective mean of maximal realization of athletes’ functional potentials [8].

Most specialists mark out conventionally start, distance and finish segments [19, 27]. Such division is a result of pedagogic observations. Recent years more detail division of competition distance has been offered [8, 26].

Optimization of competition activity's structure implies searching of the most effective variants of qualitative and quantitative interconnections of athletes’ special fitness different sides [28]. For example in cyclists’ 4 km pursuit racing on track it can be reduced to solution of the following tasks: rational fulfillment of start acceleration; transition to distance speed; finish acceleration [18].

Effectiveness of the mentioned elements can influence on final sport result [9]. Especially it is noticeable in competitions of athletes of approximately the same level [5]. However, in elite athletes’ training, work with the mentioned elements takes rather modest place.

In other works it was found: Influence of pedal’s speed and crank length on pedaling mechanic in period of sub-maximal load. The authors found that distribution of joint torques and powers is mainly sustained in different conditions of pedaling [2]; For assessment of joint and segment movements working load of from 65 to 95% from maximal output power of separate cyclists can be used [3]; Dependences of power pedal’s output and electromyography (EMG) of lower limb in different cyclic position. Besides, in this work the authors determined indicators of bilateral asymmetry of pedaling force and EMG. These results show that cyclists can “re-switch” between sitting and standing positions during competitions, for increasing race efficiency in different situations [6]; Professional cyclists increase pulling force in the phase of recreation for sustaining the same output power [12]; Effectiveness of cycling is influenced by profiles of foot angle. This factor is one of the most important and directly correlates with effective force, applied to bicycle [32].

Solution of the following problems is very important in athletes’ training: Control of physical loads [17]; Optimization of physical loads [1, 15]; Consideration of athletes’ individual characteristics [10, 11]; Determination of successfulness factor in sports [16, 22, 23]; Athlete’s ability to distribute load being on distance. Such ability is required for prevention from too early fatigue [25].

In numerous studies there were found quantitative and qualitative changes of cyclists’ motor actions’ structure under influence of complex of factors. These factors determine external and internal conditions of realization of athletes’ motor potential in the process of competition activity [13, 27]. Winners of elite competitions in kinds of sports for endurance do not reduce speed at the end of distance but increase it in state of rising fatigue [29].

With it, technique of main sport movement changes [4, 18]. However it is still not cleared up: what factors influence on sustaining of high distance speed in the state of fatigue [7]. Besides, working out of bio-mechanical pre-conditions for optimization of competition activity’s structure is of great practical importance [21]. This problem touches wide circle of questions. These questions are connected with searching of laws of individual adaptive reactions in motor system [24]. Differentiated character of their manifestation depends on specificities of different physical qualities’ development [30, 31].

The purpose is to study the laws of motor structure adaptation of elite cyclists, specializing in 4 km individual pursuit racing on track.
Material and methods

Participants: in the research 18 elite athletes participated. (12 international masters of sports and 6 honored masters of sports).

Organization of the research: we applied complex method to bio-mechanical researches. The athletes were tested in laboratory and natural conditions (4 km individual pursuit racing). We studied dynamic of kinematic and dynamic characteristics of horizontal and vertical components of forces, applied by cyclist. Besides, we studied bio-electrical activity of the following muscles: quadriceps and biceps of thigh; shin and frontal tibialis of right leg. We registered amplitude and frequency of bio-potentials; rhythm structure of electric activity; integrated bio-electrical activity of muscles. Besides, we calculated indicators of effectiveness and efficiency of motor functioning and determined variability of the studied motor characteristics [20].

Statistical analysis: in statistical processing we found mean values of indicators and their errors (X±m), difference between mean values and confidence of differences (t, p), correlation between the studied indicators (r); and the value of dispersion (variant around mean value (σ, CV)).

In our complex pedagogic, bio-mechanical and biological athletes’ examinations we observed legislation of Ukraine about health protection; Helsinki declaration 2000 and directive №86/609 of European community about human participation in medical-biological researches.

Results

In the course of our researches we determined dynamic of interconnections of pedaling technique and cyclist’s speed in individual pursuit racing. We found the indicators, which influence on cyclist’s speed to the largest extent. They are: coefficient of force efficiency (r=0.726-0.836), the spent forces (r=0.694-0.883), useful efforts (r=0.713-0.911), total impulse of force (r=0.723-0.892), indicators of symmetry in legs’ functioning (r=0.566-0.829), relative impulses of efforts in pedaling zones (r=0.551-0.891), maximal (r=0.512-0.893) and average (r=0.542-0.913) efforts; space time (r=0.500-0.931) characteristics of cyclists’ efforts.

Integral indicators of pedaling technique (effectiveness, efficiency and symmetry of cyclist’s work) are highly stable (see fig. 1).

Realization moments of forces maximums are in constant definite zones of pedaling cycle (see table 1). It is interpreted as specific characteristic of elite cyclists. The constancy is achieved owing to many years’ process of special training. The moments of beginning and end of vertical forces are highly stable. Space characteristics of horizontal forces gradually increase from the beginning to the end of distance.

Characteristic feature of distance’s finish segment is significant increase of zone of application of both legs’ forces’ horizontal components. It should be regarded as a method of sustaining high speed on finish segment in conditions of rising fatigue.

Time indicators of vertical forces are also highly stable (see table 2). Time characteristics of pushing increase with approaching finish. Increase of pushing forces duration (by left and right legs) is connected with increase of duration of force’s reduction phase. Duration of forces’ increase up to maximal value is constant on all distance segments. Time indicators of right leg’s moving reduce by 32% by the middle of the distance. In the second half of the distance time indicators of right and left legs’ moving also increase. On finish segment time indicators of right and left legs’ moving exceed average level on distance by 40%. Duration of left leg’s moving has opposite direction.

Maximal forces of both legs’ pressing and left leg’s pulling up are highly stable (see table 3). Maximal forces of right leg are pulling up increase by 41% by the end of distance. Forces of both legs’ pushing and moving reduce by 15% by the end of distance.

The character of pedaling technique’s adaptive reconstructions changes, depending on athletes’ individual characteristics (see Fig. 1).

Reconstructions in pedaling technique depend on the following:

- share participation of many factors in pedaling technique’s structure;
- Compensation of insufficient level of one movement’s characteristics by hypertrophied level of other;
- Variability of motor system’s adaptive reconstructions, which appear under influence of fatigue.

Speed at different segments of distance is conditioned by the structure and quantitative characteristic of interconnection with pedaling technique. Multiple correlation analysis determined the influence of more than 120 indicators of cyclists’ pedaling technique on competition distance. On some distance segments one-side influence of certain indicators’ groups is observed. It permits to unite separate segments of distance. They are:

- Start segment (up to 19% from total distance or 285.77-400.00 m, depending on the structure of bicycle track);
- Main portion, which consists of three segments: initial (11-30 % or from 285.77-400.00 m to 1143-1333.32 m), middle (31-50 % or from 1143-1333.32 m to 1999.98-2000.39 m) and final (51-80 % or from 1999.98-2000.39 m to 3429.24 m); finish segment (81-100 % or from 3429.24 m to 4000.00 m).

Conventionally we marked out the groups of indicators, which condition pedaling speed on different distance segments. High speed on start segment depends on effectiveness of right leg’s pulling up and pressing/moving of left leg. On initial part of distance segment high efficiency and effectiveness of pedaling technique is ensured by legs’ pressing and pulling up. On middle part effectiveness of left leg’s pushing is important. With rising of fatigue, importance of horizontal components of forces increases. On final part of distance segment high workability depends on the following: right leg’s moving; left leg’s pressing, pulling up and pushing. Finish segment requires great mobilization of athlete’s
Fig. 1. Dynamic of integral indicators of elite cyclists’ pedaling technique on model distance of pursuit racing: V – speed, km/hr; F – spent forces, N; K – coefficient of force efficiency, %; I – total impulse of force, N•s; Ks – symmetry indicator by coefficient of force efficiency, %; Fs - symmetry indicator by spent forces, %; L – length of distance, %.
functions for sustaining high speed. Passing this segment is characterized by fatigue’s rising. Significant reconstructions in motor structure take place on finish segment. Speed on this segment is determined by right leg’s pressing, pulling up and moving; as well as by left leg’s pressing and pulling up.

**Discussion**

Changes of pedaling technique’s time characteristics shall be regarded as adaptive reconstructions of cyclists’ motor structures. It witnesses about gradual transition of cyclists’ technique to qualitatively new coordination level by the end of distance [5]. With fatigue’s emersion correction of external motor characteristics occurs. With fatigue, significance of horizontal elements of pedaling technique increases. At finish effectiveness of cyclists resulting forces increases [27]. Our results concord well with other data and are confirmed by them [2, 3, 6]. Increase of pedaling power is conditioned by change of applied forces. Choice of biomechanically the most reasonable zone of maximal force application in pedaling cycle is a decisive condition, determining pedaling technique’s effectiveness [31]. Horizontal components of forces are of special significance. Duration of horizontal components of forces is less than in vertical components. It is confirmed by other researches [2, 32].

Sustaining of pedaling high speed on distance is determined by possibilities and purposefulness of motor system’s adaptive reconstructions. The mentioned reconstructions are pre-conditioned by changes of motor activity’s regime. It is connected with involvement of additional muscular motor units in work. On finish
reconstruction of separate muscles’ innervations happens as well as re-distribution of their activity.

The material, presented in this article, creates real pre-conditions for working out of elite cyclists’ pedaling technique’s models. The received data can be used for special searching of optimal movements’ variant, considering competition tactic. The received results can be used for choosing of means and methods of pedagogic reconstructions of elite athletes’ movements.

Conclusions
High speed on start segment depends on effectiveness of right leg’s pulling up; pressing and left leg’s pushing.

On initial part of distance segment high efficiency and effectiveness of pedaling technique is ensured by pressing and pulling up. On middle part of distance segment left leg’s pushing is effective. High workability on final part of distance segment depends on right leg’s moving and left leg’s pulling up and pushing. Speed on finish of distance is determined by effectiveness of right leg’s pressing, pulling up and moving as well as pressing and pulling up of left leg.

Conflict of interests
The authors declare that there is no conflict of interests.
Special aspects of hemo-dynamic and reaction of erythrocytes in blood to standard physical load of different qualification female volleyball players

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Abstract

Purpose: to study the aspects of organism's cardio-hemo-dynamic and blood erythrocytes reaction of female volleyball players to standard physical load.

Material: with functional methods we studied cardio-hemo-dynamic and with the help of scanning electronic microscopy – erythrocytes' structure in 18 female volleyball players of different qualification (age – 22.0±0.60 years).

Results: it was found that maximal physical load causes substantial changes in cardio-hemo-dynamic, which depend on female volleyball players’ qualification. These changes have intrinsic to them type of blood circulation system reacting, which is manifested in the following: appropriate changes of some indicators; natural changes of periphery blood erythrocytes. In the article possible mechanisms of realization of female volleyball players’ organism's typological features, depending on blood circulation type and erythrocytes' conformation, are discussed.

Conclusions: In relaxed state all female volleyball players have non-uniform cardio-hemo-dynamic of blood circulation. With hyper-dynamic blood circulation type, higher indicators of strike and minute blood volume were observed. With hypo-kinetic blood circulation type the opposite picture was observed: indicators of strike and minute blood volume, heart index, load on cardio-vascular system in different periods of day were low.

Keywords: female volleyball players, blood circulation, heart index, physical load, erythrocytes.

Introduction

The level of human organism’s responding to physical load illustrates health condition and ability to sustain workability in professional functioning. For such assessment different approaches are used, selection of which depends on category of population. For assessment of students’ reaction to physical load appropriate tests for motor activity are used [24, 50]. The tests application facilitates the following: optimization of physical loads [19, 30]; correction of training process [37, 52]; improvement of motor skills [29, 41]; proper organization of pedagogic control [28, 36].

For determination of athletes’ reaction to physical loads other approaches are used. Their aim is finding of the following: level of motivation to sports practicing [16, 43]; successfulness in sports [20, 31]; individual approaches to training [22, 25]; working out of training models [21, 27].

Among such approaches proper place is taken by tests, based on finding of cardio-hemo-dynamic indicators. Such approaches are frequently used in sports. It permits to find athletes’ reaction to physical loads and correct the process of preparation for competitions.

By the range of heart index (HI) oscillations central cardio-haemo-dynamic (CHD) is divided into hypo-kinetic (HK), eukinetic (EK) and hyper-kinetic (HrK) types of blood circulation. They are variants of hemo-dynamic norm [1, 3, 5].

Physical load of maximal intensity (PL\textsubscript{max}) can result in CHD changes and create pre-conditions for disorder of erythrocyte homeostasis [4, 12, 13]. With it, CHD has definite typological features and depends on quickness of system blood circulation’s reacting. In such case changes of periphery blood erythrocytes (EPB) with PL\textsubscript{max} are determined by bio-chemical reactions. Such reactions lead to reduction of acid/alkaline balance. In its turn, acidosis causes deformation of EPB [46].

Reactions of athletes’ organisms to maximal and standard physical loads are shown in the following directions:

- Study of blood bio-chemical indicators and their influence on health of 100 meters’ runners [33];
- Finding of energy supply mechanisms of athletes’ high workability by blood bio-chemical indicators [17];
- Finding of physical effects of football referees’ workability by lactate content in blood [18];
- Quantitative assessment of training load in team kinds of sports (testing on run track for quickness and lactate concentration in blood). The authors found that individualized impulse training can be used for improvement of aerobic indicators in competition season [45];
- Distribution of professional mini-football athletes’ load. The research of blood bio-chemical indicators permitted to find mechanisms of physical workability improvement [48];

Adaptation to physical loads permitted to determine:

- Mechanisms of muscular strength and muscular mass age reduction, connected with chronic inflammation. Physical activity causes anti-inflammation effect, but it is modulated by additional factors [26];
- Regular physical exercises facilitate reduction...
of oxidation stress and cause some changes in metabolism of iron. These changes were connected with reduction of blood ferrite. The authors offer the program of Nordic walking (12 weeks, thrice a week) [38];

- Nordic Walking reduces resistance to insulin [40];
- Nordic Walking significantly reduces ferrite concentration in blood that explains the registered reduction of iron in organism [39].

As some specialists point non uniformity of CHD types is conditioned by body constitution and is a physiological norm of health [2, 6, 9]. Study of EPB changes with \( PL_{\text{max}} \) depending on CHD type is still out of scientists’ attention. Which correlations of different EPB conformation forms are in athletes with different blood circulation hemodynamic type has not been clear [2, 13]. The data of some authors point at same type of organism’s reaction to \( PL_{\text{max}} \) in people with hypo and hypertonic blood circulation type [1, 2, 3]. By the data of other authors [7, 8] – prevails one of them [4, 7, 10]. The question about role of EPB in origin of such reactions is still unsolved [8, 11, 13]. Studies of CHD types in children resulted in idea that they are genetically determined [12]. But not equal percentage of these types in different age groups contradicts to it [3, 9, 14]. With it, the question about special aspects of CHD and EPB reactions to single standard physical load, depending on athletes’ sportsmanship and CHD type still remains to be out of specialists’ attention [6, 8].

**Hypothesis:** it was assumed that athletes with different CHD type have different organism’s sensitivity to standard physical load, that is manifested as different conformative EPB changes.

The purpose of the work is to study the aspects of organism’s cardio-hemo-dynamic and blood erythrocytes reaction of female volleyball players to standard physical load, depending on qualification level.

**Material and methods**

**Participants:** 18 girl students of 20.0±0.6 yrs age, who practiced volleyball, participated in the research. Depending on girls’ qualification, they were divided into two groups. First group consisted of 11 girls who attend volleyball training, but have no sport category. Group 2 included female volleyball players of supreme league team (masters of sports) – members of team of Vasyl Stefanyk Precarpathian National University.

**Organization of the research:** application of \( PL_{\text{max}} \) of 3.5 W/kg of body mass is the most optimal methodic for ergo metric testing (ET) of different age athletes’ physical workability [12-14]. For determination of CHD indicators we used ergo meter Kettler (Germany) and computer diagnostic complex “CardioLab+”. Cardio-hemo-dynamic mechanisms of short term adaptation to \( PL_{\text{max}} \) we assessed by indicators HI; systolic (SBP) and diastolic (DBP) blood pressure; average blood pressure (ABP). By changes of heart beats rate we found: stroke blood output (SBO); minute blood output (MBO). By value of load on cardio-vascular system in different periods of day (PD) we determined energetic characteristics of heart functioning and myocardium demands in oxygen [14]. It is calculated by formula: \( PD = (BP \cdot HBR)/100 \), where BP is blood pressure and HBR – heart beats rate.

For studying erythrocytes’ conformation and biochemical characteristics we took capillary blood by protocol of determination of glucose concentration in blood plasma. Taking of material was fulfilled just before \( PL_{\text{max}} \) and after 1-3 minutes of recreation period. Concentration of hemoglobin was tested by standard method. The quantity of erythrocytes was tested by unified method of calculation in Goryaiev’s chamber. Morphological studies of erythrocytes were carried out with the help of scanning electronic microscope «JEOL-25M-T220A» (Japan) by commonly accepted methodic [23]. All studies were fulfilled at the end of academic year.

**Statistical analysis:** the received quantitative indicators were processed with the help of STATISTICA 6.0 program.

**Results**

The studies showed that in relaxed state volleyball players of both groups (see tables 1, 2) have non uniform CHD different types.

Typological analysis [2, 9, 11] showed that 42% of the tested female volleyball players have hypo-kinetic, 31% – eukinetic and 27% – hyper-kinetic type of CHD.

In volleyball players of 2\(^{nd}\) group with HrBC type we observed confidently higher indicators of HBR, SBO, MBO, HI and PD (p<0.05). In case of HBC type initial values were the lowest. EBC indicators were at average level. In relaxed state, in 2\(^{nd}\) group female volleyball players with HrBC type indicators SBO, MBO and HI were high (p<0.05) and PD indicator was low. In relaxed state PD indicator took intermediate position between hyper and hypo-kinetic types of CHD.

\( PL_{\text{max}} \) was followed by changes in hemo-dynamic of different expressiveness. These changes have certain typological specificities of blood circulation’s reacting. In tables 1 and 2 we can see that \( PL_{\text{max}} \) from the first minute causes noticeable increase of SBP in both groups’ volleyball players with different CHD. ABP is substantially changed after first minute of load. HBR became maximal up to the end of the fifth minute of \( PL_{\text{max}} \). HBR increased depending on CHD: accordingly, 2.27; 2.18 and 2.14 times (P<0.05). Concerning 1\(^{st}\) group volleyball players with he same reactions of blood circulation to \( PL_{\text{max}} \), their HBR was the lowest (accordingly by 9.26%, 10.38% and 14.77%; p<0.05).

Thus, increase of SBP under \( PL_{\text{max}} \) in 1\(^{st}\) group took place at the account of SBO increasing. It is known that increase of SBO results in reciprocal inhibition of sinus node automation. It reduces HBR [3, 9]. It is observed in 1\(^{st}\) groups volleyball players with blood circulation of different type.

\( PL_{\text{max}} \) in 1\(^{st}\) group volleyball players with HrBC causes insignificant (in average by 5.3±0.11%, P <0.05) increase of EPB. In 2\(^{nd}\) group there happens statistically significant
increase of EPB. It is facilitated by hemo-concentration (15% volleyball players with HBC). In 85% girl students with EBC it causes reduction of their quantity. It is conditioned by destructive influence of factors, which accompany muscular activity. It is observed with weakening of cardio-respiratory system’s adaptation potentials. They are: increased blood circulation; rising of temperature and acidosis [21].

In contrast to 1st group (see fig. 1a) in 2nd group’s volleyball players with HBC there appear some reversibly changed forms of EPB (see fig. 1b). In girls students with EBC erythrocytes remain unchanged after PL_max (see fig. 2a, b). Fig.1 Structural reconstruction of periphery blood erythrocytes in 1st (a) and 2 (b) groups’ volleyball players with hypo-kinetic hemo-dynamic type after single maximal physical load. Legend: 1 – normal forms of erythrocytes; 2 – reversibly changed forms of erythrocytes; 3 – irreversibly changed forms of erythrocytes. The method is – scanning electronic microscopy, scale: 1500:1.

In 2nd group’s volleyball players with HrBC we observed increase of EPB aggregation ability (content of aggregates increased by 15%) and increase of coefficient of their deformation (by 18%). It is a result of muscular work (see fig. 3).

**Discussion**

The conducted earlier studies showed [11, 53], that at the end of academic year female volleyball players of 2nd group have low level of functional reserves. It requires more careful attention of different specialization scientists to students’ physical condition, who practice intensive trainings in parallel to main studies.

PL of different intensity plays great role in formation of organism’s general endurance. Such endurance is especially required for the following: in different competitions; in trainings; in everyday life of students-athletes [42, 53]. In such case EPB is a convenient object for such researches: they participate in processes, connected with sustaining of the whole organism’s homeostasis [34, 44, 49]. In our research we found that in 57% of 2nd group’s volleyball players, under influence of PL_max negative morphological changes of EPB appear. It is conditioned by dis-metabolic disorders. The basis

### Table 1. Indicators of different types of cardio-hemo-dynamic of 1st group’s volleyball players before and after standard physical load and in recreation period (M±m, n=7)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Blood circulation type</th>
<th>Duration of physical load</th>
<th>Recreation time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 min</td>
<td>3 min</td>
</tr>
<tr>
<td>HBR, bpm</td>
<td>HBC</td>
<td>71,8±2,3</td>
<td>118,3±2,8*</td>
</tr>
<tr>
<td></td>
<td>EBC</td>
<td>75,8±2,5</td>
<td>120,7±2,6*</td>
</tr>
<tr>
<td></td>
<td>HrBC</td>
<td>85,0±3,1</td>
<td>124,0±3,4*</td>
</tr>
<tr>
<td>SBP, mm/merc.col</td>
<td>HBC</td>
<td>117,0±3,2</td>
<td>144,0±3,2*</td>
</tr>
<tr>
<td></td>
<td>EBC</td>
<td>118,0±2,1</td>
<td>151,9±2,9*</td>
</tr>
<tr>
<td></td>
<td>HrBC</td>
<td>126,0±1,1</td>
<td>160,6±2,6*</td>
</tr>
<tr>
<td>DBP, mm/merc.col</td>
<td>HBC</td>
<td>60,0±1,2</td>
<td>65,0±1,4</td>
</tr>
<tr>
<td></td>
<td>EBC</td>
<td>65,0±1,4</td>
<td>70,0±1,7</td>
</tr>
<tr>
<td></td>
<td>HrBC</td>
<td>67,0±1,2</td>
<td>68,0±1,1</td>
</tr>
<tr>
<td>ABP mm/merc.col</td>
<td>HBC</td>
<td>88,5±3,4</td>
<td>106,5±4,1*</td>
</tr>
<tr>
<td></td>
<td>EBC</td>
<td>91,5±2,3</td>
<td>111,2±3,3*</td>
</tr>
<tr>
<td></td>
<td>HrBC</td>
<td>96,0±2,1</td>
<td>114,3±4,2*</td>
</tr>
<tr>
<td>SBO, ml</td>
<td>HBC</td>
<td>64,1±2,1</td>
<td>90,1±2,5*</td>
</tr>
<tr>
<td></td>
<td>EBC</td>
<td>78,9±1,4</td>
<td>93,0±2,3*</td>
</tr>
<tr>
<td></td>
<td>HrBC</td>
<td>4,2±0,4</td>
<td>6,4±0,5*</td>
</tr>
<tr>
<td>MBO, l</td>
<td>EBC</td>
<td>5,3±0,3</td>
<td>7,8±0,4*</td>
</tr>
<tr>
<td></td>
<td>HrBC</td>
<td>7,2±0,4</td>
<td>10,6±0,7*</td>
</tr>
<tr>
<td>HI, l/min/m</td>
<td>EBC</td>
<td>3,4±0,2</td>
<td>5,2±0,4*</td>
</tr>
<tr>
<td></td>
<td>HrBC</td>
<td>4,3±0,4</td>
<td>7,8±0,6*</td>
</tr>
<tr>
<td>PD, conv.un.</td>
<td>EBC</td>
<td>88,9±2,7</td>
<td>201,7±9,6*</td>
</tr>
<tr>
<td></td>
<td>HrBC</td>
<td>109,9±3,2</td>
<td>211,8±10,2*</td>
</tr>
</tbody>
</table>

Notes: 1) HBC – hypokinetic blood circulation; EBC – eukinetic blood circulation; HrBC – hyperkinetic blood circulation; 2) * – difference is confident at p<0.05. Absence of mark means that difference is not confident. In all cases confidence was found in comparison with relaxed state.
of such changes is exhaustion of functional potentials of organism's bio-systems. It is facilitated by negative influence of combined increased mental and physical load during academic year [53].

The peculiarity of 2nd group volleyball players' with HBC hemodynamic reacting to PL max was active involvement of mechanism of periphery blood circulation regulation mechanism in work. It increases local blood flow at the account of widening of working muscles’ vessels.

The main mechanism of ABP sustaining for HeBC is high values of HI. They are determined by contracting ability of left ventricle with low values of total periphery resistance (TPR) of vessels.

Heart works in ineffective mode that is why its high activity of sympathic-adrenaline system is characteristic. In case of HBC, in homeostasis sustaining tonus of hemo-vessels of blood systems artery part dominates. In our research we observed high TPR, but power of left ventricle’s contraction is minimal [1, 3, 13]. This type of blood circulation is the least effective and has low adaptation potential [12, 47].

As a number of authors notes [2, 11, 13], organism of people with different blood circulation type reacts to PL max by increasing of HI: from hypo-kinetic to hyper-kinetic type. Independent on group, in volleyball players with HrBC we observed the highest HI indicators under PL max. However, comparing with relaxed state they increase only 1.79 times in 1st group and 2.46 times in 2nd group (p<0.05).

The received data show that in relaxed state, the presence of EBC and HrBC set high requirements to energy supply of heart functioning.

Intensive external heart work (especially in 1st group’s volleyball players with HrBC) can be explained prevailing of SBP indicators, which is accompanied by increase of myocardium demand in oxygen [1, 3, 7]. With high myocardium demand in oxygen [1, 3, 7], power of left ventricle’s contraction is minimal [1, 3, 13]. This type of blood circulation is the least effective and has low adaptation potential [12, 47].
ventricle’s contraction and stroke output quickness.

Under such conditions damage of EPB structural wholeness appears. It facilitates their in-vessels’ lysis and can result in progressing of anemia [46]. Such changes negatively influence on somatic health, sport efficiency and educational progress of students. It requires appropriate correction of educational and training process. Besides, it is necessary to liquidate negative after-effects. It is important to work out and use in due time adequate measures, directed at removal of possible pathological changes in organisms of students-athletes.

In opinion of some authors [49], EPB changes facilitate increase of viscosity of circulating blood. It will negatively influence on CHD type and saturation of tissues with oxygen. In the whole such bio-chemical and conformation changes of EPB are very unfavorable for realization of oxygen/transportation function of blood. They witness about insufficient organism’s adaptation of
2nd group’s volleyball players (especially with HrBC to PLmax at the end of academic year).

We have found interconnection between sportsmanship of volleyball players after PLmax by CHD type. It points at demand in its value’s gradation by quantitative-qualitative changes of EPB. Such approach can be used as a criterion for determination of adequate volume of training loads during academic year. It is in agreement with analogous criteria, found by other authors [32].

Conclusions
1. All tested female volleyball players in relaxed state demonstrate cardio-hemo-dynamic non uniformity of blood circulation. With hyper-kinetic blood circulation type we observed higher indicators of stroke and minute blood output and index of load on cardio-vascular system in different periods of day. With hypo-kinetic type of blood circulation’s regulation we observed the opposite picture: indicators of stroke and minute output, heart index and load on cardio-vascular system in different periods of day were low.

2. In the process of 2nd group’s volleyball players’ with HBC adaptation to maximal physical load we observed standard increase of stroke blood output already in the first minute of muscular functioning. With it periphery part of blood circulation’s regulation was actively involved in work.

3. In case of eukinetic blood circulation type to larger extent cardio-hemo-dynamic reacting to maximal physical load manifested. In 1st group’s volleyball players’ indicators of systolic blood pressure and load on cardio-vascular system in different periods of day reached significant values. In 2nd group’s volleyball players indicators of minute blood output were higher. In 1st group intensification of external work of heart was realized at the account of high systolic blood pressure. In 2nd group it happened due to increase of minute blood output.

4. In 1st group’s volleyball players with hyper-kinetic blood circulation type, under maximal physical load we observed significant increase of systolic blood pressure and stroke blood output. In 2nd group, since the 1st minute stroke blood output increased noticeably. With it, in the work of periphery blood circulation’s regulation we observed weakening of functional reserves. It was illustrated by increased quantity of deformed erythrocytes; by reduction of their size; increase of “adhesion threads” and small erythrocyte aggregates.

Conflict of interests
The authors declare that there is no conflict of interests.
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