

Adaptation of Ruffier's test for assessment of heart workability of students with health problems

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Abstract

Purpose: to check up experimentally adapted test for assessment of heart workability of students with health problems.

Material: in the research girl students and boy students of 18-20 years age (n=487) participated. The procedure of test was as follows: during 45 seconds students fulfilled torso rising from lying on back position. During this procedure pulse was measured three times. Total time of test fulfillment was 2 minutes. For working out the scale for the received results' interpretation we assessed new version of Ruffier's test for validity. For this purpose 487 absolutely healthy tested students fulfilled, first, adapted test. Then, after complete recreation (in 20 minutes) they fulfilled commonly accepted test with squatting.

Results: it was found that with the help of adapted test it is possible to objectively assess heart workability of students. Correlation analysis of the received results showed average correlation ($r=0.73$).

Conclusions: application of adapted Ruffier's test permits to assess heart workability of students with health problems.

Keywords: students, adapted, test, Ruffier, correlation analysis, heart workability.

Introduction

Modern health condition of future specialists is characterized as negative with tendency to worsening. Many studies of recent years have been registering increase of first year students' with health problems quantity. It is very noticeable in division of students for practical physical culture classes [16; 49, 68]. Annual analysis of applicants' health shows unfavorable dynamic of increasing first year students' with different disorders in cardio-vascular, digestive, urogenital, nervous and other organism's systems quantity. As per different data in special health groups (SHG – group of students with health problems) from 10.45% to 35.34% students were enlisted. In next years of study increment of these indicators is observed, which is characterized by progressing old diseases and emersion of new ones [8, 10, 13, 14]. The researches show that this quantity increases with every year. It results from emersion of new health problems and development of earlier registered [1, 3, 5, 15]. In 15.2-42.5% of students disorders in bone-muscular system were found.

Negative tendencies of students' health worsening require seeking new directions of these problems' solution. Among them there are:

- Increase of motivation component of sports practicing [25, 36] considering students' reactions to physical loads [46];
- Optimization of physical loads' volumes for students, considering their individual fitness [26, 40, 41, 65];
- Reduction of environmental and harmful habits' negative influence [50, 51];
- Application of modern and new training methods [61, 63];
- Organization of proper pedagogic control in trainings of students with different fitness [28, 47];
- Raising of health criteria, considering psychological

factors' influence [48, 52] and health culture formation [71];

- Implementation of physical education pedagogic technologies in the process of training of students with different nosologies [22, 54, 59, 62];
 - Application of health related students' trainings with sport competition elements [57];
 - Individual approach in choice of strategy, tactic and methodological provisioning of physical rehabilitation for students with pathologies [45, 67];
- Important criterion of the listed above approaches to students' health improvement is students' workability. Among approaches to increase students' workability we can name:
- Weakening of chronic fatigue under different loads [39, 43];
 - Determination of motor and sports rank places in students' leisure hierarchy [42];
 - Adaptation to physical loads [37].

With every passing years reduction of physical condition and functional fitness is observed in students. Generalization of medical examination results showed that many universities have own specific features: prevalence of bone-muscular system's diseases. It was found that in Sankt Petersburg universities such diseases are 43%; in Ryazan – more than 19%; in Homel – less than 17%; in Ulyanovsk it does not exceed 15% [20]. Some scientists found that osteoarthritis (OA) of knee joint cover 20% of world population [32, 33, 53].

Physical education of people with such problems has a number of distinctive features [23, 24, 30, 38]. It reflects in organization and fulfillment of practical classes in university conditions. As specialists note [27, 30, 31, 35] knee pain when ascending staircase or walking on even inclined surfaces is an evident factor, limiting physical activity with OA of knee joint. It is proved also be the data of other scientists [64, 69, 70]. The authors found that it is tiresome for people with lower limbs' OA to fulfill ordinary movements, because joint changes can

block transition of potential and kinetic energy of mass centers during walking. Some scientists resume that it is purposeful to develop methods of harmless physical loads for persons with Knee joint OA [34, 55, 56].

It means that additional studies, considering universities; specificities are required.

Hypothesis was built on assumption that adapted Ruffier's test with torso rising from lying position during 45 seconds will be valid in respect to commonly accepted squatting during 45 seconds. It will permit for specialists to completely assess heart workability of students with lower limbs OA.

The purpose of the work is to check up experimentally adapted test for assessment of heart workability of students with lower limbs OA and substantiate it.

Material and methods

Participants: in the research girl students and boy students of 18-20 years age from main health group (without health problems) (n=487) participated. All participants were familiarized with "Helsinki declaration of world health protection organization" and gave written consent for participation in experiments [72].

Organization of the research: Ruffier's test is used for the following: assessment of heart workability before sport trainings; working out training programs; assessment of sport training programs' effectiveness; assessment of person's physical fitness by his/her cardiovascular system's reaction to physical load.

At present time several functional tests with squatting are known. Martinet's test implies 20 squatting during 30 sec.; Ruffier's test assesses heart functional reserves with 30 squatting during 45 seconds. All they imply bending and unbending of lower limbs. But such exercises are difficult for most of persons with lower limbs' OA. That is why adapted variant of Ruffier's test, especially for students with lower limbs OA, was worked out.

According to adapted Ruffier's test students shall be in lying position in relaxed state. His pulse is counted for 15 seconds (P1). Then student fulfills 30 torso risings from lying on back position. Arms are crossed on chest with hands on shoulders. Legs are fixed and bent in knees under angle 80-90°. When rising torso it is necessary to touch elbows by knees, when descending legs – lie on back completely. For exact dozing of rising frequency we used metronome with frequency 80 beat/min. Every torso movement corresponded to one strike of metronome. After test's finishing the tested took lying position and his pulse was measured during first 15 seconds (P2) and last 15 seconds (P3) in the first minute of rest.

Coefficient was calculated by the following formula:

$$C = \frac{4 \times (P1 + P2 + P3) - 200}{10}$$

For working out interpretation scale of the received results we assessed new variant of Ruffier's test for validity. For this purpose 487 absolutely healthy students fulfilled,

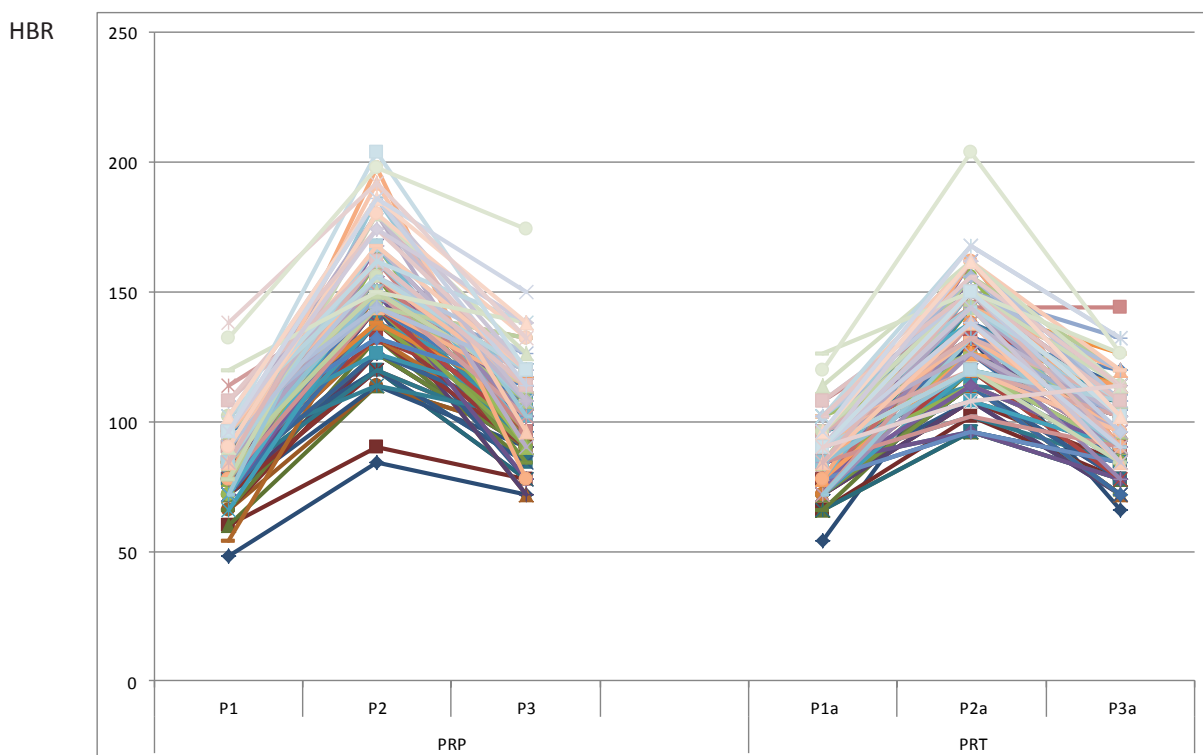


Fig.1. Results of heart beats rate registration (HBR) in Ruffier's test with squatting and torso rising from lying on back position: PRP – Ruffier's test with squatting; PRT - Ruffier's test with torso rising; P1, P2, P3 – HBR values in Ruffier's test; P1a, P2a, P3a – HBR in adapted Ruffier's test. .

first, adapted test. Then, after complete restoration (in 20 minutes) they fulfilled commonly accepted test with squatting.

Statistical analysis was fulfilled with the help of SPSS 22 program.

Results

For working out interpretation scale of the received results for students with lower limbs OA we fulfilled correlation analysis of the received data. These data were analyzed for finding statistical correlations in this sample. In fig. 1 there are presented the received results. Analysis of the obtained data shows regularity in heart beats rate distribution in both versions of Ruffier’s test. Alongside with it we formed correlation field (see fig.2). Analysis of this field showed direct positive correlation in the studied data. We found that with higher value of one attribute the value of other also increases. With reduction of one

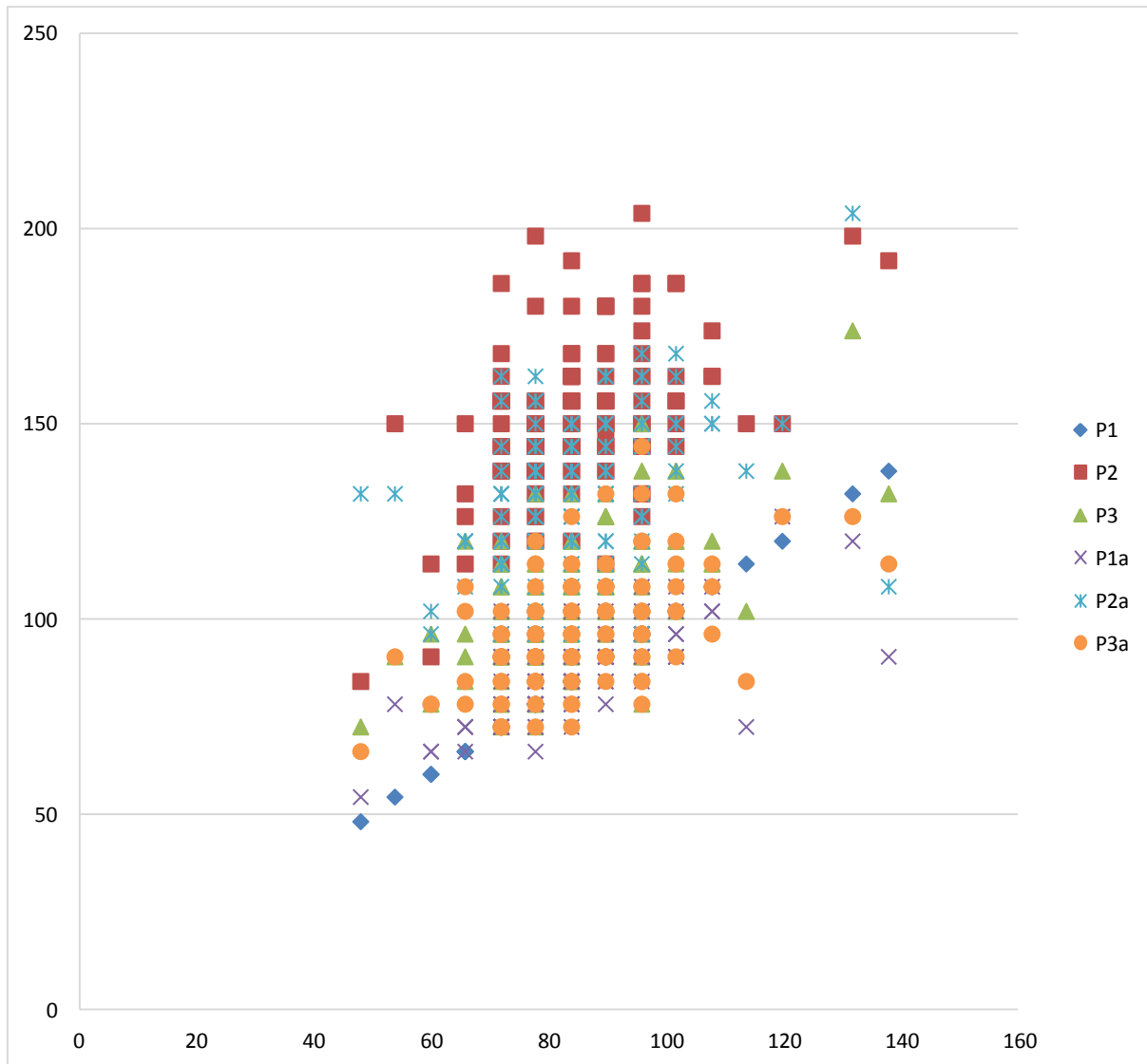
attribute the other also decreases. Thus, we can note average correlation between two samples ($r=0.73$).

The received data permitted to develop the following interpretation scale for adapted Ruffier’s test results for persons with lower limbs OA:

- The results are interpreted in the following way [18].
- Less than 0 – athletic heart;
- 0.1-5 – “excellent” (very good heart);
- 5.1-10 – “good” (good heart);
- 10.1-15.0 – “satisfactory” (moderate heart deficiency);
- 15.1-20 – “bad” (strong heart deficiency).

Finally, it should be noted that the fulfilled research of students hearts workability permitted to prove validity of the worked out adapted Ruffier’s test. The collected by that time empiric material proves that with the help of adapted Ruffier’s test specialists can objectively and with high quality assess heart workability of students with lower limbs OA.

HBR



HBR

Fig.2. Correlation field of heart beats rate registration results in commonly accepted Ruffier’s test P1, P2, P3) and in adapted version (P1a, P2a, P3a).

Discussion

Annual observations of physical education specialists find that there is significant quantity of students with chronic diseases of joint-ligament apparatus, in particular lower limbs OA [6, 17, 60, 66]. This category has a number of significant limitations in respect to physical loads and requirements to physical activity [7, 11, 12, 19]. Nevertheless, it is very important for these persons to sustain physical activity for ensuring normal functioning of organism's important systems. For this purpose it is necessary to develop special methodic and programs of physical education [9, 21, 58]. When choosing load it is necessary to know initial potentials and realize systemic control over them during long time [2, 4, 20, 44]. Widely used for this purpose Ruffier's test is intended for people with healthy lower limbs. Application of developed by us adapted version of Ruffier's test permits for specialists to assess at high quality heart workability of students with

lower limbs OA. Analysis of cardio-vascular workability of students with lower limbs OA permitted for us to prove validity of the worked out adapted Ruffier's test. The results permit to assume that application of this adapted test is possible for different age groups as well as for people without lower limbs OA.

Conclusions

The worked out by us adapted version of Ruffier's test has potentials for wide application by specialists in physical culture and sports. This variant of the test permits for physical culture pedagogues to completely assess heart workability of students with lower limbs OA, as well as of students without health problems.

Conflict of interests

The author declares that there is no conflict of interests.

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Cite this article as: Drogomeretsky VV, Kopeikina EN, Kondakov VL, Iermakov SS. Adaptation of Ruffier's test for assessment of heart workability of students with health problems. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2017;1:4–10. doi:10.15561/18189172.2017.0101

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Received: 11.01.2017

Accepted: 25.01.2017; Published: 24.01.2017