The journal represents original scientific researches of scientists from the East-European region. The Journal welcomes articles on different aspects of physical education, sports and health of students which cover scientific researches in the related fields, such as biomechanics, kinesiology, medicine, psychology, sociology, technologies of sports equipment, research in training, selection, physical efficiency, as well as health preservation and other interdisciplinary perspectives.

In general, the editors express hope that the journal “Physical Education of Students” contributes to information exchange to combine efforts of the researchers from the East-European region to solve common problems in health promotion of students, development of physical culture and sports in higher educational institutions.
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Increase in efficiency of professionally applied physical training of pupils of 16-17 years old based on application of informational and methodical systems

Kashuba V.O.1ABCDE, Golovanova N.L.2BCDE
1Department of Biomechanics and Sports Metrology, National University of Physical Education and Sport of Ukraine, Ukraine
2Department of Innovation and Information Technologies in Physical Culture and Sports, National University of Physical Education and Sport of Ukraine, Ukraine

Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: to prove the technology aimed at the development of professionally applied physical qualities of future specialists of sewing industry with use of information technologies.

Material: girls of 16-17 years old (n=40) participated in the experiment. It was defined: level of physical activity of pupils; physical and mental working capacity.

Results: The developed technology included three stages: 1st stage – 16 lessons; 2nd stage – 48 lessons; 3rd stage – 16 lessons. It was detailed professionally applied physical qualities of future specialists of sewing industry taking into consideration the features of specialty. It was developed 4 blocks of physical exercises. Blocks include 14 different complexes for the practical application in different parts of trainings. The technology gives the opportunity to monitoring theoretical knowledge and physical abilities.

Conclusions: the recommended technology promotes: development of professionally significant physical qualities; increase in level of theoretical knowledge; formation of positive motivation of pupils to physical culture classes; preparation of harmonically developed and highly qualified specialists.

Keywords: professionally applied physical training, informational and methodical system, pupils of professional educational institutions.

Introduction

In the system of professional education a lot of factors influence on the formation of professionally applied skills and quality of study. Increases in academic load, irrational nutrition, and insufficient physical activity have negative effect. All this leads to overfatigue, decrease in functional and psychophysiological abilities of pupils [1, 2].

The special place in professional education of future specialists is taken by the professionally applied physical training (PAPT) [2, 3]. The author [3] implemented the systematization of specialists’ fields of study at higher educational institutions. The author considers psychophysiological features of professional activity. It was selected six appropriate groups: data logical, extreme, creatively figurative, technical, naturally agrarian and communicative. In other researches was defined professionally important physical and psychophysical qualities characteristic of other specialties. Such researches could be basic of PAPT students’ program of information logistic group of specialties. Application of the information technologies (IT) in practice of student’s physical training [3,4] give new opportunities for increase in efficiency of physical training process. IT can promote the organization of professionally applied physical training.

In recent years were conducted researches concerning problem of PAPT improvement in different educational institutions [1]. Physical culture classes in professional educational institutions are directed to the training of pupils for future professional activity [5, 6]. At the same time don’t use all opportunities of physical training means...
Total quantity of lessons is 80. According to the curriculum were conducted two 45 min lessons per a week. Ski preparation lessons were conducted 90 min per a week.

In experimental group (EG) girls were studied according to the developed technology which was integrated into the basic program of the state educational institution “Balty vocational-technical agrarian school”.

The level of pupils’ physical activity was determined according to the Fremingemsky study [11]. Calculation of average energy consumption is evaluated by formula:

\[ E_n = \sum_{i=1}^{k} RFA_i \cdot MET \]  

where \( k \) – is the number of levels; \( E_n \) – is average energy consumption, kcal kg\(^{-1}\) per day; \( RFA \) – is level of physical activity, c.u.; \( MET \) – is weight coefficient.

Their physical working capacity was measured by means of Ruffier-Dickson test [12]. The analysis of mental working capacity was measured by the proof test of V. Ya. Anfinov [13]. Pupils need to cross out 2 given letters from the table within 4 minutes. The accuracy value of exercise execution is evaluated:

\[ A = \frac{M}{N}, \]  

where \( A \) – is accuracy value of exercise execution, c.u.; \( M \) – is quantity of cross out letters, pcs; \( N \) – is a total quantity of letters which needed to be cross out in the revised text, pcs. And coefficient of mental productivity is \( P = A \cdot S \),

where \( A \) – is accuracy value of exercise execution, c.u.; \( S \) – is number of revised letters.

We developed technology based on data analysis of scientifical and methodical literature and ascertaining experiment [14]. The technology is aimed at the development of professionally significant physical qualities (PSPQ) of future specialists of sewing industry. One of the technology’s features is use of multimedia system (informationally-methodical system “Health brand-new”).

The diagram of the developed technology is provided on a figure 1.

The purposes of the developed technology are: development of professionally significant physical qualities; increase in level of theoretical knowledge; formation of positive motivation of pupils to physical culture classes; assistance in preparation of harmonically developed and highly qualified specialists.

Tasks of technology are: development and improvement of professionally significant physical qualities; increase in level of theoretical knowledge; formation of positive motivation of pupils to physical culture classes; assistance in preparation of harmonically developed and highly qualified specialists.

The purposes of the developed technology are: development of professionally significant physical qualities; increase in level of theoretical knowledge; formation of positive motivation of pupils to physical culture classes; assistance in preparation of harmonically developed and highly qualified specialists.

Fig. 1. The diagram of the technology aimed at the development of PSPQ of future specialists of sewing industry with use of information technologies.
qualities of pupils; formation of knowledge and maintain of healthy lifestyle (HLS); formation of knowledge of professionally applied physical training and ability to apply it practically; formation of skills to independent training of physical exercises; increase in level of physical health of pupils and so forth.

The developed technology consists of the following principles: social, methodical and principles of classes’ creation in the course of physical training [6].

We developed 4 blocks of physical exercises. Blocks included 14 different complexes for practical application in different parts of lessons. Recommended blocks of exercises were realized at different stages of technology implementation.

The developed technology included three stages of implementation:

1st stage – is preparatory, 16 lessons (September – October). Principal tasks of stage are: interest formation of sewing industry pupils to the offered technology; development of the general physical fitness; acquisition of ability to development the professionally significant physical qualities (PSPQ); acquaintance of girl pupils with informationally-methodical system (IMC) “Health brand-new”.

At the preparatory stage were applied the following blocks of exercises: “Body” and “Flexibility” and acquaintance with the block “Theory”.

2nd stage – is the main, 48 lessons (November – April). Task of the stag are: interest formation of sewing industry pupils to the offered technology; development of the general physical fitness; acquisition of ability to development the professionally significant physical qualities (PSPQ); acquaintance of girl pupils with informationally-methodical system (IMC) “Health brand-new”.

At the preparatory stage were applied the following blocks of exercises: “Body” and “Flexibility” and acquaintance with the block “Theory”.

3rd stage – is final, 16 lessons (May – June). The main tasks of the final stage are formation of skills of PSPQ development and saving and improving of pupils’ motivation to maintain HLS. At the final stage were applied the following blocks of exercises “Body” and “Flexibility” and fixing of material from block “Theory” were applied.

The developed informationally-methodical system “Health brand-new” (fig. 2) [15] is a component of technology. The system is directed to increase in theoretical knowledge and practical skills in the course of PAPT of future specialists of sewing industry.

The informationally-methodical system (IMS) is interconnected set of means and methods which are used for: storage, processings and outputs of information; monitoring and correction of educational process.

During program developing process we considered principles of creation of electronic training programs [16], stages of pedagogical design [17] and ergonomic requirements to materials of electronic study [18].

IMS includes 4 blocks:

♦ block “Theory” contains information concerning bases of HLS and various modern forms of physical activity and so forth;
♦ block “Practical guidelines” includes 14 complexes of different physical exercises (formation of PAPT, prophylaxis of traumatism etc);
♦ block “Monitoring” provides individual registration to each pupil for passing theoretical testing or evaluation of physical state indicators. The database is formed for the teacher according to received information. The database allows to observe the dynamics of above-mentioned indicators;
♦ block “Bonus” includes videos about healthy lifestyle (HLS) and lessons of self massage, library of useful Internet resources devoted to HLS.

During introduction of technology were applied the following types of pedagogical control: previous, operative, current, total, self-checking.

Criteria of efficiency of the offered technology is the level of PSPQ development, level of mental working capacity, indicators of a physical state, level of theoretical readiness and motivation.

Statistical analysis. Statistical processing of research...
materials was conducted by means of Microsoft Excel 2010. The reliability of differences between indicators of samples (according to law of normal distribution of data) was checked by means of Student t-test. The reliability was considered as statistically significant at \( p < 0.05 \).

**Results.**

Statistically significant increase in range of indicators are found in girls of EG: back muscles force increase by 25.85%; the indicator of flexibility improved by 15.59%; the general endurance improved by 8.30%; coordination abilities improved by 7.63%; \( (p < 0.05) \). At the same time indicators of girls from CG changed statistically insignificant: ranging from 0.27% up to 1.86% \( (p > 0.05) \).

Also levels of physical (fig. 3A) and mental (fig. 3B) working capacity considerably improved \( (p < 0.05) \) in EG. In CG augmentation was statistically insignificant \( (p > 0.05) \).

During the experiment took place positive changes in level of girls’ physical activity in EG by 7.80% \( (p < 0.05) \). In CG took place positive changes of physical activity level by 0.53% \( (p > 0.05) \). After the experiment was carried out evaluation of theoretical knowledge level in subject “Physical education”. It was determined the increase of indicator in girls of CG by 0.29 points \( (p > 0.05) \). In girls of EG was determined increase of indicator by 2.52 points \( (p < 0.05) \). Implementation of technology promoted increase in motivation of girls to physical culture classes: in representatives of EG – by 22.5% \( (p < 0.05) \). But in girls of CG the indicator decreased by 1.1% \( (p > 0.05) \).

**Discussion.**

Our data added researches of other specialists [1, 2]. Authors specified the considerable influence of the professionally applied physical training (PAPT) on formation of the highly qualified specialist. So we expanded data of other research [2] in aspect of technical group of specialties. We detailed professionally applied physical qualities of future specialists of sewing industry taking into consideration the features of specialty. Our results confirm data of other scientists [3, 7, 8] about efficiency of use of information technologies (IT) in the course of physical training. At the same time the majority of authors use IT developments only for increase in theoretical knowledge. Our development differs in opportunity to monitoring of theoretical knowledge and physical abilities, existence of video block for increase in motivation to classes.

In other research [5] it is offered to use the modern

![Fig. 3. Distribution of results of CG and EG before and after the experiment (n=40):](image)

* – is statistically significant difference, \( p < 0.05 \); Assessment: C – high; D – good; E – average; F – satisfactory. CG – control group; EG – experimental group. before – before the experiment; after – after the experiment. 5 – perfectly; 4 – well; 3 – satisfactorily; 2 – unsatisfactorily. % – the quantity of girls.
types of gymnastics as means of increase in professional readiness of seamstresses. An algorithm of our technology is directed on development of physical qualities; formations of theoretical knowledge and motivation to lessons. The use of information and methodical system is also component of technology.

The pedagogical control has important role to increase classes’ efficiency [19] which promotes optimization of physical activity [20]. Also important is formation of the students’ positive attitude towards own health and way of life [21, 22]; self-checking of physical activities [23, 24]. In our research during introduction of technology were applied the following types of pedagogical control: previous, operative, current, total, self-checking. It is allowed to increase efficiency of physical training process of students.

Conclusions
The received results of researches confirmed efficiency of the developed technology. The technology is directed on: increase in professionally significant physical qualities of future specialists of sewing industry, motivation of pupils; formation of special skills. The received results, give the grounds to recommend it for use in the course of physical training in professional technical educational institutions.

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

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**Information about the authors:**

Kashuba V.O.; http://orcid.org/0000-0001-6669-738X; kashubavo@gmail.com; Department of Biomechanics and Sports Metrology, National University of Physical Education and Sport of Ukraine; Fizkulture str., 1, Kiev, 03680, Ukraine.

Golovanova N.L. (Corresponding author); http://orcid.org/0000-0002-8837-7501; ngolovanova100@gmail.com; Department of Innovation and Information Technologies in Physical Culture and Sports, National University of Physical Education and Sport of Ukraine; Fizkulture str., 1, Kiev, 03680, Ukraine.

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Physical condition of female students with different level of body mass deficiency

Kolokoltsev M.M.1ABCDE, Iermakov S.S.2ABCDE, Jagiello M.3ABCDE

1Department of the Physical Culture, Irkutsk National Research Technical University, Russia
2Department of Tourism and Recreation, Gdansk University of Physical Education and Sport, Poland
3Department of Theory of Sport and Human Motority, Gdansk University of Physical Education and Sport, Poland

Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract
Purpose: to study the features of morphofunctional and motor characteristics of female students with body mass deficiency and with normal body mass.

Material: it was examined 17-21-year-old female students (n=1937). All students were in the main medical group according to the health condition and attended classes on discipline Physical culture. It was carried out the anthropometrical and physiometrical examination of female students.

Results: It was determined the low integrated criterion of physical fitness of female students with body mass deficiency. It was defined the dependence between the decrease in level of physical fitness and decrease in body mass of female students. It was determined reliable differences between the morphofunctional parameters and results of motor tests of female students with different body mass.

Conclusions: The obtained data allow to correct educational process on physical training of students using integrative pedagogical methods and methods of training.

Keywords: physical training, female students, body mass, morphofunctional, anthropometrical.

Introduction
The body mass of the person is the integrated criterion of levels of metabolic, energy, hormonal, and other processes in a human body [1, 2] and now it is considered by many researchers as one of the key parameters of physical development of the person [3, 4].

Recent researches devoted to the physical development of the students witness about the increase in a number of students with body mass deficiency or excess body mass. The number of students of full-time study with a deviation of body mass reaches 30-40% [5]. There are a few scientific works devoted to problems of students’ body mass deficiency in comparison with works concerning problems of excess body mass [6].

More than 30% students of Volga Technical Institute have problems with body mass: increase and decrease of the norm. 17,7% females and 12,5% males of this institute have a body mass deficiency [7]. According to the authors, it indicates the serious disorder of constructive metabolism processes in the young organism. About 18% students of Moscow Universities have a body mass deficiency. Then females have the body mass deficiency in twice more often than males [8]. Among students of Yaroslavl Medical University, females have body mass deficiency more often than males (25% and 17% respectively) [9].

It is defined that the number of students with body mass deficiency doubles from 15,5% in 18 years up to 30,6% in 23 years [10]. There is a research proved that 63,5% female students of Far Eastern Federal University with body mass deficiency have decrease in working capacity [11].

The considerable deviation of body mass from norm influences on physical and mental activities, the somatic health of the person. Also, it affects negatively on professional activity [8], reproductive system of females [12, 13], complicates pregnancy and childbirth [14, 15].

The modern process of students’ studying becomes more computerized [16] and inactive [17, 18]. It is determined the decrease in the motivation of students to physical culture training [19]. A lot of researchers consider the following reasons of students’ body mass deviation from the norm: hypodynamia [20, 21], a disorder of nutritional status [22], hormonal changes in the organism [23], the influence of psychogenic factors [24]. The increase of intellectual and psychoemotional loads, non-compliance with a base of a healthy lifestyle by students [2, 30], interest in computer games and Internet influence negatively on physical [25, 26], mental [27] and somatic [28, 29] health of the youth.

The body mass of the person responds to the volume, intensity, and regularity of physical culture and sports training [31, 32]. The component structure of a body is the level and harmony of person’s physical development. The component structure of a body is the criterion of health condition and physical activity of the person [33, 34].

It is determined that the physical fitness and physical development of students with body mass deficiency are closely connected with a muscular component of body structure on the basis of the analysis of correlation interrelations [35]. Therefore, such students demonstrate low results in tests of hands’ muscle strength [36, 37] and the general endurance [35] at physical culture training. There are data that students with body mass deficiency have hands’ muscles strength decrease almost twice [11]. It is determined the dependence between the content of muscle mass in the component structure of female
students’ body and the number of classes on discipline “Physical culture” [38].

Studying of questions concerning level’s interrelation of students’ physical development with physical activity, the comparative analysis of morphofunctional characteristics and physical fitness of female students with different body mass is relevant.

Hypothesis. Authors presume that the received results of a research can be used during creation of individual and motivated motor programs for correction of the physical condition of female students with body mass deficiency.

The purpose of the work is to study features of the morphofunctional and motor characteristics of the organism of female students’ with body mass deficiency in comparison with physical conditions of females with normal body mass.

Material and methods.

Participants. It was examined female students of junior courses \((n=1937, \text{17-21-year-old})\) of Irkutsk National Research Technical University. All students were in the main medical group according to the health condition and attended classes on discipline Physical culture. 2 times a week. The performed work doesn’t prejudice the rights and doesn’t endanger the wellbeing of female students according to ethical standards [39].

Organization of a research. The anthropometrical and physiometric examination of female students was conducted using standard techniques [40]. The females were divided into three groups: with the normal body mass “N”; with body mass deficiency “D”; excess body mass “E”. The sample of examined females was divided into 5 sigma classes (gradations) according to the body mass parameter value: \(M\pm0,67 \sigma\) – is “average” value of body mass parameter for sample. If the value of parameter was within the range from \(M\pm0,67 \sigma\) to \(M\pm1,34 \sigma\), the body mass value was estimated as “above average” or “below average”. If the value of an parameter was beyond of \(M\pm1,34 \sigma\), the gradation was estimated as “high” or “low”.

For the characteristic of morphofunctional parameters was measured:
- body length, cm;
- body mass, kg;
- chest circumference (CC), cm;
- circumference of body parts, cm;
- skinfold thickness (caliperometry), mm;
- heart beat rate before load (HBR), beats/10 sec;
- heart beat rate after 20 squats in 30 sec (HBR), beats/10 sec;
- heart rate recovery time after 20 squats, min;
- systolic arterial blood pressure (ABPS), mm Hg;
- diastolic arterial blood pressure (ABPD), mm Hg;
- vital lung capacity (VLC), l;
- dynamometry of both hands, kg.

It was estimated: mass-growth Quetelet index II [41] (BMI = body mass index / body length², kg/m²); Robinson Index [42] (IRob = HBRxABPS: 100, c.u.); vital index \((VI = VLC/body mass [43], ml/kg)\); strength index \((SI = \text{hand muscle strength /body mass x100\%}) [44]\). The average value of absolute and percentage content of fatty and muscular tissue in body was estimated according Ya. Mateyko formulas [45]. The BMI was measured according to the WHO classification (1999) [46]: body mass deficiency, when BMI is less than 18,5 kg/m²; norm, when BMI is within 18,5-24,99 kg/m²; at the excess body mass BMI=25-30 kg/m²; BMI is higher than 30 kg/m² – obesity of different degrees.

The motor qualities of female students were measured using the range of tests. It was used the following tests: 20 m run (sec); 10x5 m shuttle run (sec); 5 min run (m); hung (sec); sit-up (times); trunk flexion (cm); standing long jump, trunk flexion (cm) [47, 48].

Statistical analysis. It was used programs “Microsoft Excel”, “StatSoft Statistica 6.1” and the author’s complex “Analysis of Physical Health Data of Population” (state registration of the program ECM №2010612275, from 3/26/2010). It was defined the arithmetic average value of parameters \((M)\), mean square deviation \((\sigma)\) and standard error \((SE)\). The reliability of distinctions of average values of independent samples was estimated by parametrical methods by means of Student t-test. Statistically significant were considered differences between values of parameters at level \(p<0,05\).

Results.

The examined female students \((n=1937)\) were divided into three groups according to the body mass parameter value. Group “N” \((n=1010, \text{females with normal body mass – 52,14\%})\) in which the value of parameter is within interval of sigma deviation \(M\pm0,67 \sigma\) (tab. 1); group “D” \((n=526, \text{females with body mass deficiency – 27,15\%})\); group “E” \((n=401, \text{females with excess body mass – 20,7\%})\). Females of group “E” didn’t participate in further work.

It was determined the decrease of BMI parameter value by 14,9% in females of group “D” in comparison with females of the group “N”.

Females of groups “N” have better somatometrics and physiometrics parameters, than all females with body mass deficiency \((p<0,05)\). Females of groups “D” with gradation “below average” have lower value of parameters of flexibility and trunk muscle strength tests (tab. 2). In this group muscle strength of shoulder girdle were higher, than in females of groups “N” \((p<0,05)\).

Females of group “D” with gradation “low” of body mass have the lowest parameters in four of seven physical fitness tests (shuttle run, 20 m run, 5 min run, sit-up). Strength parameter in the test “hung” was higher, than in females of groups “N”.

Results of research of body structure component (fig. 1) shown the difference of quantitative content of muscular (MM) and fatty (FM) mass between females with body mass deficiency and female students with normal body mass \((p<0,05)\).

In body component structure of females of group “D”
Table 1. Morphofunctional characteristics (M±m) of females with a different gradation of body mass parameter value

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Normal body mass (group «N»)</th>
<th>Body mass deficiency (group «D»)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gradation Average (M=±0,67 σ), n=1010</td>
<td>Below average (from M= –0,67 σ to M= –1,34 σ), n=412</td>
</tr>
<tr>
<td><strong>Somatometrics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>body length, cm;</td>
<td>165,2±0,15</td>
<td>163,0±0,21*</td>
</tr>
<tr>
<td>body mass, kg;</td>
<td>55,5±0,08</td>
<td>48,7±0,05*</td>
</tr>
<tr>
<td>chest circumference, cm</td>
<td>86,7±0,11</td>
<td>84,2±0,18*</td>
</tr>
<tr>
<td><strong>Physiometrics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VLC, ml</td>
<td>2700,0±1,10</td>
<td>2650,0±1,0*</td>
</tr>
<tr>
<td>dynamometry of right hand, kg</td>
<td>24,4±0,17</td>
<td>23,9±0,23</td>
</tr>
<tr>
<td>dynamometry of left hand, kg</td>
<td>23,4±0,16</td>
<td>22,7±0,22*</td>
</tr>
<tr>
<td>HBR at rest, beats/10 sec</td>
<td>11,2±0,02</td>
<td>11,8±0,04*</td>
</tr>
<tr>
<td>HBR after 20 squats in 30 sec, beats/10 sec</td>
<td>20,9±0,08</td>
<td>21,1±0,12</td>
</tr>
<tr>
<td>HBR recovery time after 20 squats in 30 sec, min</td>
<td>1,43±0,01</td>
<td>1,46±0,03</td>
</tr>
<tr>
<td>ABPS, mm Hg.</td>
<td>104,4±0,28</td>
<td>105,3±0,46</td>
</tr>
<tr>
<td>ABPD, mm Hg.</td>
<td>68,8±0,17</td>
<td>69,1±0,32</td>
</tr>
<tr>
<td><strong>Indexes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>20,2±0,07</td>
<td>18,0±0,09*</td>
</tr>
<tr>
<td>Robinson Index, c.u.</td>
<td>70,2±0,22</td>
<td>74,5±0,39*</td>
</tr>
<tr>
<td>Vital index, ml/kg</td>
<td>48,6±0,12</td>
<td>54,4±0,27*</td>
</tr>
<tr>
<td>Strength index of right hand, %</td>
<td>43,9±0,11</td>
<td>49,1±0,22*</td>
</tr>
<tr>
<td>Strength index of left hand, %</td>
<td>42,1±0,10</td>
<td>46,6±0,20*</td>
</tr>
</tbody>
</table>

Note: * – reliable differences between parameters of “N” and “D” groups (P<0,05)
# – reliable differences of parameters in group “D” (P<0,05)

Table 2. Results of motor tests (M±m) of females with different gradation of body mass parameter value

<table>
<thead>
<tr>
<th>Tests</th>
<th>Normal body mass (group «N»)</th>
<th>Body mass deficiency (group «D»)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gradation Average (M=±0,67 σ), n=1010</td>
<td>Below average (from M= –0,67 σ to M= –1,34 σ), n=412</td>
</tr>
<tr>
<td>20 m run, sec</td>
<td>3,93±0,05</td>
<td>3,95±0,07</td>
</tr>
<tr>
<td>10x5 m shuttle run, sec</td>
<td>21,10±0,06</td>
<td>21,16±0,09</td>
</tr>
<tr>
<td>5 min run, m</td>
<td>909,7±6,06</td>
<td>902,2±7,82</td>
</tr>
<tr>
<td>hung, sec</td>
<td>9,93±0,17</td>
<td>11,0±0,27*</td>
</tr>
<tr>
<td>sit-up (times)</td>
<td>23,6±0,22</td>
<td>22,2±0,38*</td>
</tr>
<tr>
<td>trunk flexions, cm</td>
<td>15,8±0,22</td>
<td>14,0±0,34*</td>
</tr>
<tr>
<td>standing long jump, cm</td>
<td>153,6±0,54</td>
<td>152,2±0,87</td>
</tr>
<tr>
<td>integral criterion of physical condition, points</td>
<td>3,4±0,01</td>
<td>2,97±0,01*</td>
</tr>
</tbody>
</table>

Note: * - reliable differences between parameters of “N” and “D” groups (P<0,05)
# - reliable differences of parameters in group “D” (P<0,05)
with gradation of body mass “below average” content of muscular (in 9.3%) and fatty (in 12.3%) mass is less, than in females of group “N” with gradation “average”. Females of groups “D” with gradation of body mass “low” have less content of muscular (in 14.8%) and fatty (in 27.2%) mass in body component structure, than in female students of group “N” with norm body mass.

**Discussion**

Body mass characterizes level of metabolic, energy, plastic and other processes in a human body [1, 49]. According to the WHO classification, the body mass index parameter value <18.5 kg/m\(^2\) is considered as chronic energy insufficiency or body mass deficiency [46]. Study of the body mass deficiency distribution among youth, especially females as future mothers, is relevant [12, 50]. According to our data, approximately 27.15% of females students of Baikal Technical University have body mass deficiency. This parameter is within the sigma deviation from \(M = -0.67 \sigma\) to \(M = -1.34 \sigma\) and below that will comport with results of other researchers in various regions of Russia [9, 10].

The analysis of our results showed the difference between somatometric and physiometric parameters of females with normal body mass and body mass deficiency. Females of groups “N” have better somatometric parameters (length and body mass, CC) and physiometric parameters (VLC, dynamometry of hands’ muscle strength, HBR at rest and HBR recovery time after 20 squats, Robinson’s Index), than all females of groups “D” (p<0.05). Among females of group “D” higher results of somatometric and physiometric parameters have females with gradation “below average”, than females with gradation “low” (p<0.05; except the characteristic of HBR after 20 squats in 30 sec). Results of our researches are confirmed by scientific works concerning the interrelation between body mass deficiency, a disharmony of physical development and low physical working capacity among students of Far Eastern Federal University [11] and Ural Federal District of Russia [51].

According our data all females with body mass deficiency have reliable low parameter of cardiovascular system condition (HBR at rest and HBR recovery time after 20 squats), than females with normal body mass (p<0.05). It will comport with results of research of cardiorespiratory system in students of Volga Institute [36].

According to some authors [11] one of the reasons of low physical efficiency of females with body mass deficiency is the insufficient efficiency of cardiovascular system. Decrease in overall performance of cardiovascular system of an organism of females of group “D” is confirmed by increase in 13.9% of Robinson Index parameter value in comparison with value of this parameter in females of group “N” (81.6±0.52 and 70.2±0.22 c.u. respectively), p<0.05. Our data will comport with researches concerning the definition of Robinson Index in women of the first mature age with normal body mass index [52].

According to our data, the physical fitness of females with body mass deficiency is much lower in comparison with test results of students with normal body mass. It is confirmed by researches of other authors [7, 11]. We have found dependence between decrease in level of physical fitness and decrease of female students’ body mass. Females of group “D” with gradation of body mass “below average” have lower values of motor tests parameters (sit-up, trunk flexion), than females of group “N”. Females of group “D” with gradation of body mass “low” have rather lower parameters in tests of physical fitness (shuttle run, 20 m run, 5 min run, sit-up), than females of group “N” (p<0.05).

The mean score of integral criterion of physical fitness (fig. 2) of females of group “D” with gradation of mass “below average” and “low” is 2.97±0.01 and 2.68±0.23 points respectively. It is lower in 13.4% and in 21.8% of mean score of students with a normal body mass (p<0.05).
We presuppose that low characteristics of physical condition of females with body mass deficiency are caused by weak work of myocardium and small content of muscular tissue in body structure. It will comport with the results of other researchers [31, 38]. The insufficient content of muscular component in females of group “D” leads to decrease in results in motor tests of strength, high-speed and general endurance. These results were lower, than in students with a normal body mass. The muscle mass deficiency doesn’t significantly influence on working capacity in the static mode of shoulder girdle muscles [7]. It explains rather high values of parameters in all females with body mass deficiency in the test “hung”, in comparison with parameters of students with a normal body mass.

Teachers of physical culture at the universities are recommended to use the individual differentiated approach to the choice of aerobic physical exercises of average intensity for the females with body mass deficiency. It should be used the exercises on the basis of sports and game technologies for the development of speed, strength and dexterity. It adapts the females’ cardiovascular system to physical activities. It also will increase high-speed and general endurance of female students. The further comprehensive study of questions concerning physical fitness of females with body mass deficiency will increase in efficiency of physical training.

Conclusions
1. 17-21 year-old females with body mass deficiency have rather lower somatometric and functional characteristics of organism (the content of muscle and fatty mass, motor qualities), than in females with a normal body mass (p<0.05). It is determined the less body mass of females, the lower is the level of their physical fitness.
2. The obtained data concerning features and interrelations of the morphofunctional characteristics and motor qualities of females with different body mass allow to correct educational process on physical training with use of integrative pedagogical methods and methods of training.

Conflict of interests
The author declares that there is no conflict of interests.

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Information about the authors:

Kolokoltsев M.М. (Corresponding author); http://orcid.org/0000-0001-6620-6296; mihm49@mail.ru; Irkutsk National Research Technical University; ul. Lermontov 83, Irkutsk, 664074, Russia.

Iermakov S.S.; http://orcid.org/0000-0002-5039-4517; sportart@gmail.com; Department of Tourism and Recreation, Gdansk University of Physical Education and Sport; Kazimierza Gorkiego 1, 80-336 Gdansk, Poland.

Jagiello Marina; http://orcid.org/0000-0001-5591-4537; wjagiello1@wp.pl; Department of Theory of Sport and Human Motority, Gdansk University of Physical Education and Sport; Kazimierza Gorkiego 1, 80-336 Gdansk, Poland.

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Biomechanical justification of the choice of optimum mode for passing the individual pursuit race

Kolumbet A.N.1BCE, Dudorova L.Y.1ACE, Babina N.A.2BCE, Natroshvili S.G.2ACE, Chernovsky S.M.1CDE

1Department of Physical Education and Health, Kiev National University of Technology and Design, Ukraine
2Department of Economics, Kiev National University of Technology and Design, Ukraine

Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: biomechanical justification of the choice of optimum mode of passing competitive distance of 4 km individual pursuit on track.

Material: The qualified cyclists (n=14) participated in researches. The modified stationary cycle “Monark” was used.

Results: The mode “B” is physiologically more favorable. The mode “B” should be considered as a model of passing a distance in preliminary races of individual pursuit. Work in the mode “A” demands terminal mobilization of organism functions. Work in the mode “A” is more effective in the achievement of sports result. It can be used only once in the final race of competitions.

Conclusions: The received data should be considered as a demonstration of specific features of passing a distance in the competitive modes. The tactical variant of competitive program creation is defined by the individual functional state.

Keywords: bicycle sport, biomechanics, electromyography, tactics.

Introduction

Recently the considerable attention of experts is paid on the development of the optimum structure of athletes’ competitive activity. The functionality of the person is fully realized in the competitive exercise by means of sports result [1-3]. The sports result is a systemically important factor which provides selection and degree of involvement in certain components. The research of structure of competitive activity concerns the number of issues of increase in efficiency of the technology of cover a distance. It also allows creating models of optimal technical and tactical variant of conducting a race [4].

In the analysis of competitive activity features are used the approach which consists in the evaluation of the efficiency of covering a certain part of a distance [5, 6]. Their duration is caused by the length of a distance and dimensions of the sports construction. In this approach, the efficiency of covering a certain part of a distance is completely ignored. The speed of distance at the same time becomes predominating.

Majority of researches conditionally distinguish starting, distant and finishing parts in the structure of competitive activity [7, 8]. It reflects the result of the most external demonstrations of muscular activity of cyclists. Certain parameters of the athlete organism functioning during cover a competitive distance are connected with sports result. The sports result is set of the interconnected and independent components of competitive activity [9, 10]. Every component is defined by various motor qualities, abilities, and functional mechanisms.

Such method terminates search of the main regularities of process optimization of sports improvement. The new approach is studying of sports result structure from system positions [11]. This approach presupposes to consider the result as a reflection of complex activity of the vital systems of athlete’s organism. Studying of structure competitive activity of highly-qualified athletes from this point of view allows getting more deeply into the structure of sports result [12, 13].

The athletic technique is one of the factors which terminate sports result [14]. It is observed the considerable variability of separate elements of motor actions’ structure of cyclists in equal working effect. It is defined quantitative and qualitative changes in physical actions structure of cyclists influenced by the set of factors [15]. These factors define external and internal conditions of realization the motor potential of athletes in the course of competitive activity. Winners of top competitions which demand sports endurance don’t decrease the speed at the end of a distance and increase it under the condition of the increasing exhaustion [16]. At the same time, the technology of the main sports motor action is significantly changed [17, 18]. However, there is a question: what factors influence on the maintenance of high distance speed in the exhaustion state? [19].

The development of biomechanical prerequisites of optimization of competitive activity structure is important [12, 20, 21]. This problem consists of a wide range of questions. These questions are connected with a search of regularities of demonstration the individual adaptive reactions in the system of motor actions [22]. The differentiated nature of their demonstration depends on the structural features of various physical qualities development [23, 24].

The search of regularities of demonstration the adaptive reorganizations in the system of motor actions will promote the increase in efficiency of cyclists’ technical training process. At the same time are considered: specific...
features, level of readiness, specifics of competitive activity structure.

The research hypothesis is the following: it was presupposed that the biomechanical and electromyographic analysis of cyclists pedalling technique in 4 km individual pursuit race allow setting the most optimum mode of passing a distance.

The purpose of the research is biomechanical reasons of the choice of optimum mode of passing competitive distance of 4 km individual pursuit on track.

Material and methods

Participants. The qualified cyclists (n=14) participated in researches. In conducting surveys with the participation of athletes adhered to the Helsinki Declaration of 2000, directive № 86/609 of the European Society on the participation of people in biomedical researches.

Organization of a research. In vitro athletes performed work in two modes “A” and “B”. The modified stationary bicycle “Monark” was used. Athletes performed work identical in volume, but different in the modes of passing a distance. The work in the mode “A” tended to increase in speed of pedalling to the middle of a distance and its step-by-step decrease by the end of the work. The work in the mode “B” had opposite direction – a pedalling speed decrease to the middle of a distance and increase it by the end.

It was applied a complex method to carrying out biomechanical researches [25, 26]. Dynamics of kinematic and dynamic characteristics of horizontal and vertical efforts of the athlete was analyzed. The features of bioelectric activity were also analyzed: quadriceps femoris and biceps femoris muscles of the thigh; calf muscles and tibialis anterior muscle of the right leg. It was defined: amplitude and oscillation frequency of biopotentials; rhythm structure of bioelectric activity; the integrated bioelectric activity of muscles. Indicators of efficiency and profitability of physical activity were calculated. The variability of the researched characteristics of motor actions was defined.

Statistic analysis. In processing the experimental data we defined average values of indicators and their errors (X±m), a level of distinction of averages and reliability of distinctions (t, p), set value of dispersion variant around average (σ, CV), defined a correlation level between the researched indicators (r).

Results

The feature of cyclists’ work in the mode “A” is a higher average speed of passing a competitive distance (in comparison with the mode “B”). The distinction of speeds was 7,5%. Work in the mode “A” is characterized by increase in pedalling speed by the end of the first half of a distance (fig. 1, in comparison with an initial part) for 5%; decrease in the speed of pedalling by the time of end of the 3rd km; stabilization of pedalling speed on the last kilometer of a distance.

Performance of work in the mode “B” is connected with essential (in comparison with an initial part) decrease by 15% of pedalling speed by the end of the second kilometer of a distance; with stabilization of pedalling rate on 3rd km; essential increase in pedalling rate on the finish (fig. 1). Work in the mode “A” is accompanied by the essential increase (by 15,4%, in comparison with work in the mode “B”) in values of a total impulse of force (tab. 1). The volume of external mechanical work of cyclists was identical. The high efficiency of muscular activity was shown by athletes in the mode “B”. It is occurred due to change of pedalling type. The characteristic feature of pedalling was increased in the relative use of horizontal efforts (forwardstroke).

On the first kilometer of a distance in the mode “A” the total impulse of forces is defined by the value of efforts of downstroke and backstroke (38,7% and 32,7% respectively, tab. 2). On the 2nd km there is a redistribution of a relative impulse force towards essential increase in efforts of forwardstroke (up to 54,6%). At the same time the force impulse of backstroke decreases (up to 2,1%).

It is observed the considerable decrease in a total

Figure 1. Dynamics of speed of passing 4 km distance in various modes of muscular activity. Note: initial speed is considered as 100%.
impulse of force in a pedalling cycle on the second half of a distance in the mode “A”. It occurs due to decrease in force impulse of forwardstroke by 10.6%. On this part of a distance the relative share of efforts of backstroke decreases (up to 23.0%), upstroke (up to 43.4%) and the downstroke (up to 23.0%). It is observed the further decrease in values of a total impulse of forces by the end of a distance. It is caused by the decrease in efforts of upstroke and backstroke (tab. 2).

On the 1st km of a distance in the mode “B” the total forces impulse is significantly less, than in the mode “A”. It is connected with the insignificant use of downstroke and upstroke efforts. At the same time, there is an essential increase in forwardstroke efforts (up to 40.4%). On the 2nd kilometer there is a redistribution of a relative forces impulse towards the decrease in efforts of forwardstroke (up to 34.8%), backstroke (up to 16.9%) and increase in force impulse of downstroke (up to 27.5%) and upstroke (up to 20.8%). At the same time, the total impulse of force in the mode “B” is less in 28.0%, than during the work in the mode “A”.

The total forces impulse during pedalling in the mode “B” considerably increases in the second half of a distance (in comparison with the mode “A”). It is defined by an increase in a force impulse of downstroke (up to 40.4%) and upstroke (up to 31.3%). On a finishing part is observed the decrease in a total force impulse. The impulse value doesn’t depend on the modes of passing a distance. In the work of the mode “B” this decrease is more expressed (tab. 2). It is observed the considerable increase in the value of horizontal efforts in the mode “B”.

In the course of work performance of in various modes, there is a constant redistribution of shares of the relative use of efforts. The average data values of the relative use of forces impulse of downstroke, upstroke and forwardstroke in the mode “A” are equal. The value of backstroke decreases a little. It witnesses about a tendency to “spin” pedalling. It was the reason of more effective work in the mode “A”. The work in the mode “B” is characterized by the emphasis on the use of efforts
of downstroke and forwardstroke. At the same time values of upstroke and backstroke are decreased a little. It witnesses about a tendency to “impulse” pedalling. It was the reason of more economic work in the mode “B”.

The spatially-temporal characteristics of efforts remain not changed. They don’t depend on the modes of muscular activity.

Distribution of total bioelectric effect of muscles on every part of a distance in various modes is unequally (tab. 3). It is observed the gradual increase and achievement of a maximum of total bioelectric effect in the mode “A”. It is observed the increase in total bioelectric effect to the middle of a distance and the subsequent decrease to the finish in the “B” mode. There is a redistribution of the relative bioelectric effect of muscles in the first half of a distance in the mode “A” in a pedalling cycle. It is shown in the increase in activity of biceps femoris (up to 43%) and of the anterior femoral head (up to 27,2%). It is revealed the decrease in the bioelectric effect of calf muscles and tibialis anterior muscle (up to 15,7% and 13,2 % respectively).

It is observed the redistribution of the relative activity of muscles on the third kilometer of a distance in the mode “A”: is watched. The redistribution leads to the increase in the bioelectric effect of a calf muscle (up to 25,4%) and an anterior tibialis muscle (up to 18,9%). At the same time, the bioelectric effect of biceps femoris considerably decreases (up to 28,5%). The increase in the bioelectric effect of biceps femoris is observed on the final straight of a distance (up to 38,5%).

It is observed the considerable decrease of the relative activity of anterior head of quadriceps femoris (up to 15,0%) by the end of the first half of a distance (in comparison with the first kilometer) in the mode “B”. Also, there is an increase in the bioelectric effect of anterior tibialis muscle (tab. 3). It is observed the decrease of relative activity of biceps femoris (up to 23,6%) on the third kilometer. It is also observed the increase in this indicator (up to 29,9%) of the calf muscle. By the end of a distance, it is observed: essential increase in activity of biceps femoris; the decrease of the value of the bioelectric activity of calf muscle (up to 18,8%) and anterior tibialis muscle (up to 10,8%). At the same time, the activity of anterior head of quadriceps femoris remains unchanged (throughout the duration of 3/4 distances).

Equal values of total bioelectric effect are reached by redistribution of the relative bioelectric activity value of muscles. The high shiftability of muscles is most characteristic of work in the mode “B”. It should be considered as the demonstration of the expressed coordination reorganizations in the system. The purpose of such reorganization is saving a resultant dynamic component of work. The average value of amplitude and oscillation frequency of biopotentials of the researched muscles remain unchanged.

The work in the mode “A” is less efficient than in the mode “B”. Increase in efficiency of motor actions in the mode “B” is defined by more active involvement in the operation of efforts of downstroke and backstroke. The work in the mode “A” is characterized by the equal distribution of efforts in a pedalling cycle. The possibility of equal making efforts is less favorable type of pedalling.

Discussion.
Individual races are divided into two stages. It depends on tasks and the nature of the activity. At the first stage (in the preliminary race) the racer has to pass a distance the most rationally with the planned result. In the subsequent races, it is necessary to create the schedule to ensure win ahead of the opponent.

There are three the most widespread variants of efforts regulation during overcoming 4 km distance by the racer. In the first variant, the athlete passes the most part of a distance with a equal speed. The second variant presupposes moderate fast start, the subsequent decrease of speed and finishing acceleration on the last third of a distance. In the third variant, the racer tries to create a certain stock of time in the first half of a distance. On the

Table 3. Dynamics of indicators of bioelectric activity of muscles in a pedalling cycle during passing a 4 km distance, X±m)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Total bioelectric activity of muscles</th>
<th>Distance, km</th>
<th>Relative bioelectric activity of muscles, (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Anterior head of quadriceps femoris</td>
</tr>
<tr>
<td>Mode «A»</td>
<td></td>
<td></td>
<td>23,8</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>27,2</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>31,2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td>19,0</td>
</tr>
<tr>
<td>Average values of a distance</td>
<td>25,3</td>
<td>33,9</td>
<td>23,4</td>
</tr>
<tr>
<td>Mode «B»</td>
<td></td>
<td></td>
<td>37,7</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td>22,7</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td>23,7</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td>23,2</td>
</tr>
<tr>
<td>Average values of a distance</td>
<td>26,9</td>
<td>32,7</td>
<td>23,7</td>
</tr>
</tbody>
</table>
second half of a distance, the athlete keeps the speed which decreases a little. In practice there is the fourth variant of passing a distance: it is irregular work. But it is rarely applicable. It is connected with numerous oscillations of speed which lead to decrease in the result.

The considerable impact on the choice of the variant is exerted by the weather conditions, track covering; position a track in relation to sea level; readiness of the racer; knowledge of the own opportunities; detailed data about the opponent [27, 28]. The most effective is rather equal distribution of efforts in a distance. It serves as a positive factor for the achievement of the good result [4]. Equal schedules should be applied in preliminary races under conditions of insufficient preparation. Equal schedules should be applied by racers with excellent endurance, but insufficient high-speed qualities [29]. There are no absolutely equal schedules of passing a distance. Throughout a distance, the athlete periodically gets to various conditions of physical laws, centrifugal and centripetal forces [30]. It influences on the athlete’s speed and intensity of work.

Recently the strongest athletes began to win in the World Cups and Olympic Games due to use of the second and third variants of schedules of passing a distance [5]. It has formed the basis for the choice as models the specified modes.

The highly-qualified cyclists have a variable distribution of efforts in the pursuit race. It is defined by specific features. Our data will be agreed with results of researches of other authors. Authors clarified that the beginning of a distance practically doesn’t influence on the final result in 4 km individual pursuit race [4, 5, 31]. The highly-qualified athletes aren’t able to keep identical motor characteristics during the whole time of passing a distance. The various researches observed different distinction of power types of pedalling [32-34]. Authors specify that work in an impulse mode promotes more efficient power consumption. It is necessary to In practice by a natural method to calculate average between “spin” and “impulse” type of pedalling [34].

The important point in the distribution of muscular efforts at the specific moment of passing a distance is the ability of athletes to correlate sporting technique to the functional capabilities of an organism.

The scientists determined [16, 17] that highly-qualified cyclists speed in the period of exhaustion is supported preferentially due to compensatory changes in contractions activities of muscles. In the period of the strong exhaustion, athletes keep pedalling speed due to increase of efforts of working muscles [35]. It is one of the factors which define efficiency of motor actions [1, 20, 16, 17]. However, Ragimov RM [36] revealed that work with shifting is less effective. Pedalling with the considerable amplitude of shifting is less productive [34]. The more the intensity of oscillation amplitude increases in different options of variable work, the fewer time examinees are capable to stand it.

Conclusions

1. Received data should be considered as demonstration of specific features of passing a distance in the competitive modes.
2. The tactical variant of the competitive program creation is defined by a personal functional status.
3. The mode “B” is physiologically more favorable. The mode “B” should be considered as a model of passing a distance in preliminary races of personal pursuit.
4. The work in the mode “A” requires the limit mobilization of organism functions. The work in the mode “A” is more effective in the achievement of the sporting result. The work in the mode “A” can be used only once in the final race of competitions.

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Conflicts of interest

The authors declare that there is no conflict of interests.
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Information about the authors:

Kolumbet A.N. (Corresponding author); http://orcid.org/0000-0001-8775-4232; re_play@3g.ua; Department of Physical Education and Health, Kiev National University of Technology and Design; st. Nemirovich-Danchenko, 2, Kiev, 14013, Ukraine.

Dudorova L.Y.; http://orcid.org/0000-0002-6263-4995; vykh46@i.ua; Department of Physical Education and Health, Kiev National University of Technology and Design; st. Nemirovich-Danchenko, 2, Kiev, 14013, Ukraine.

Babina N.A.; http://orcid.org/0000-0001-9777-4827; babynatg @3mail.ru; Department of Economics, Kiev National University of Technology and Design; st. Nemirovich-Danchenko, 2, Kiev, 14013, Ukraine.

Natrophvili S.G.; http://orcid.org/0000-0002-1598-4589; babynatg @3mail.ru; Department of Economics, Kiev National University of Technology and Design; st. Nemirovich-Danchenko, 2, Kiev, 14013, Ukraine.

Chernovsky S.M.; http://orcid.org/0000-0002-1927-9203; chernovskij.sm@knudt.com.ua; Department of Physical Education and Health, Kiev National University of Technology and Design; st. Nemirovich-Danchenko, 2, Kiev, 14013, Ukraine.

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

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Body mass index and body image anxiety in a sample of undergraduate students

Pop Cristiana Lucretia

Physical Education and Sport Department, Bucharest University of Economic Studies, Romania

Abstract

Purpose: The study purpose is to estimate in which range the body image dissatisfaction affects the young women in our research group and to determine how objective these perceptions are. The main question this research raises is if the body image acceptance, which is a subjective variable is in a significant correlation with BMI as an objective parameter?

Material: This cross-sectional study was undertaken on a sample of 160 white female first-year undergraduate students, homogenous, with a mean age of 20.3 years (SD = 0.68), attending physical education classes. BMI and BDI were calculated on anthropometrical measurements and questionnaires.

Results: 79% of the questioned girls have difficulties in accepting their body image, even 87.7% of the subjects have been in normal and underweight category. A strong and significant correlation between BMI and BDI was found r=64 (p<.0005). 41% of body dissatisfaction index is determined by body mass index and subsequent by weight and fat deposits. Both these parameters could be improved through physical education means and a healthy lifestyle.

Conclusions: Summarizing the study results is acceptable to consider BMI values as useful predictors of body dissatisfaction risk among young female. Through physical education they gain confidence and positive body awareness alleviating anxiety related to physical appearance.

Keywords: physical appearance, health, well-being, physical education, weight management.

Introduction

The physical appearance is one of the first individual characteristics noticed by others and has an important impact in social interactions. Appearance in general and body image in particular have become very important constructs in contemporary Western societies [1]. Body image is not just a cognitive construct, but also a reflection of attitudes in interaction with others. The tendency to link physical attractiveness with positive personal qualities became a cultural stereotype not only in western culture, but globally also. The avalanche of perfect bodies in mass media, advertising and social media is an overburden for our subconscious, determining us to accept that “what is beautiful is good and desirable”; physical attractiveness being often linked with success.

In present times the personal physical image is a form of gaining a distinct place in the social environment and for achieving this status the investments in body appearance (cosmetics products and procedures, piercing and tattoos, plastic surgeries, sport materials and equipment, etc) are notably for both: women and men.

As they grow up children are building a picture or image of themselves. This image develops through the things that they can or cannot do and by how other people see them. Poor opinion of our body can cause low self esteem and self confidence, eating disorders and even depression. A recent study has concluded that 61.6% of adolescents with BID endorsed depressive symptoms [2]. An important contribution in constructing the youth’s body image has the media. Constantly watching ‘perfect’ bodies can feed their insecurities over attractiveness and weight. Studies show that idealized body image contributes to eating disorders as anorexia nervosa or bulimia, steroid use, protein supplements [3] and eventually plastic surgery.

During adolescence girls, more than boys, have particular concerns about weight, body shape and self image. There are scientific evidence that body image is experienced negatively by the majority of women and girls [4, 5]. Many are dissatisfied with their body size and weight because slimness is seen as the desirable standard and as the beauty pattern especially for young women. In adulthood also the underweight is much more prevalent among women compared with men [6].

Physical activity is of fundamental importance for maintaining the life functions and it is an essential part of having a healthy lifestyle. It has been proven that a certain level of physical activities has a protective role in the prophylaxis and development of cardiovascular disease, metabolic and skeletal disorders, and even mental illness [7]. Leisure and physical activity has been shown to be an effective intervention for improving body image and having beneficial emotional effects across all ages and both genders. In an extensive meta-analysis of 35 studies Reel and colleagues [8] examined the association between exercise and body concerns and the outcome was a medium overall size effect (ES=0.45 – 0.47). The authors concluded that exercise has a significant, positive effect on body image, body esteem and physical self concept. This statement is encouraging for PE teachers to design and deliver programs with this specific goal in mind: improving student’s body image for their physical and emotional well-being.
This study purpose is to estimate in which range the body image dissatisfaction affects the young women in our research group and to determine how objective these perceptions are. The main question this paper raises is if the body image acceptance, which is a subjective variable, is in a significant correlation with BMI as an objective parameter? Therefore I estimate the average BMI for 19-24 years old female student population and the share of different weight sub-groups in the study sample. In the discussion section a case was made out for exercise intervention on changing body image and overcoming young females anxiety related with physical appearance.

Materials and methods
This cross-sectional study was undertaken on a sample of 160 white female university students. The age of the participants ranged from 19 to 24 years; the mean age was 20.3 years (SD = 0.68) and the low coefficient of variance (CV=3.45%) demonstrate a high sample homogeneity. The participants were randomly selected from those attending physical education classes in tertiary economic education. Therefore we assumed to have a healthy, cooperative, young women research sample with an urban lifestyle. The students’ inclusion in the research sample was voluntary agreed.

The measurements and questionnaire were applied in a context related with physical activities, health, fitness and body shape improvement.

The anthropometrical measurements – high and weight - enable us to calculate the Body Mass Index (BMI) as an objective reference data. We consider the participants on this study as young adults as time the height values for the sample we measured are definitive. The female growth speed trails off to zero at about 15 or 16 years. We preferred direct measurement against self-reported height and weight. The subjects were measured and weigh in light sport equipment, barefooted, using measurement bar and electronic weight scale. The subjects were measured against self-reported height values for the sample we measured are definitive. The female growth speed trails off to zero at about 15 or 16 years. We preferred direct measurement against self-reported height and weight. The subjects were measured and weigh in light sport equipment, barefooted, using measurement bar and electronic weight scale. The majority of participants (66%) were within the normal BMI interval: between 18.5 and 24.9 kg/cm² and body shape improvement.

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The subjects completed anonymously a questionnaire aimed to assess their range of body size satisfaction / dissatisfaction. For assessing body dissatisfaction we used the Contour Drawing Rating Scale [9]. The CDRS consists of nine drawings of a female figure, each drawing increasing in size from extremely thin (1) to very obese (9). The young women were asked to rate their ideal figure (how they ideally expected to look like) and their current size (perceived figure). The discrepancy between the ideal and current size scores (current - ideal > 0) represents the index of body size dissatisfaction (BDI).

Using descriptive statistics for each variable we analysed summaries about the sample and about the collected data. For the pared variables we calculated the Pearson correlation coefficient (r) and further we tested its statistical significance using the “t” test. Then we compared the “t” score figured for the actual correlation in the study, using the standard t table cutoffs (df = N-2).

Using the correlation coefficient values we calculated the coefficient of determination: $r^2$ - in order to determine the proportion of variance explained by one of the variables. We used graphical method to represent the gap between objective BMI data and subjective body image reported by respondents.

Results
BMI is a measure of body fat based on height and weight, and the normal range for women is usually considered as 18.5 to 24.9 kg/cm², with anything over 25 considered overweight and over 30, obese. Values less than 18.5 kg/cm² are related with thin bodies or being underweight. In our research sample, the distribution of BMI (see Table 1) shows a prevalence of normal range (88.75%).

The BMI mean value - 20.93 kg/cm² (SD = 3.30) is equivalent with a slender figure, corresponding to an average high of 1.65 m (SD = 0.06) and an average weight of ~ 57 kg (56.99 kg; SD = 9.70).

However 79 % of the questioned girls have difficulties accepting their body image, and the first reason they gave is weight (13% want to gain weight and 66% want to lose weight). Just 21% of subjects positively evaluate the shape and size of their body. The next table (Table 2) illustrates the distribution of body dissatisfaction answers relative to BMI:

More interesting is that 46% from subjects in the underweight group are not satisfied with their body size, willing to lose more weight. From the normal weight group just 13,125 % young women are pleased with their physical appearance. The mean value of body dissatisfaction index in our sample is BDI = -1.2 - considering that in average each young women reported an ideal thinner shape and a slander figure comparing with the actual perceived silhouette.

Testing the study hypothesis we find that body dissatisfaction (M=-1.2; SD = 1.4) is strongly correlated with BMI: r (158)= .64, p<.0005. Because r ≠ 0 the null hypothesis was rejected and the alternative hypothesis might be accepted.

Computing also the statistical significance of this result we obtained a “t” value higher than “t critic”: t (158)= 8.49<3.35; p < .0005. The coefficient of determination $r^2 = 0.41$, implies that 41% of variance in body dissatisfaction is explained by body mass index and physical appearance.

<table>
<thead>
<tr>
<th>BMI</th>
<th>Underweight</th>
<th>Normal weight</th>
<th>Overweight</th>
<th>Obese</th>
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<tr>
<td>Units</td>
<td>37</td>
<td>105</td>
<td>15</td>
<td>3</td>
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<tr>
<td>%</td>
<td>23,125%</td>
<td>65,625%</td>
<td>9,375%</td>
<td>1,875%</td>
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Table 1. BMI distribution
This results support physical activity, which has certain results in improving body shape and its functional efficiency.

**Discussion**

Comparing the BMI results with other studies on female samples in Europe we find similarities and differences. An extensive study on females aged between 18 and 34 years [6], in Sweden (n = 1967) returns a different distribution (see Table 3):

The prevalence of underweight decreases naturally with age, as time the percentage is growing in the overweight and obese section. There are similarities regarding the normal weight percentage.

In a recent study on a sample of 884 teenagers (M = 14, 29 years old, SD = 1,29), from Spain the average BMI for girls was 21,98, with average values of 1,59 m high and 56,09 kg weight [10]. Considering the age difference (from 14,29 to 20,3), and the lower BMI value, we consider the prevalence of normal weight and underweight in our sample as being confirmed.

We kept the BMI comparison in European geographical space and Caucasian racial typology because a study on female students of same age (M=19,99, SD=4,79) in USA returns significantly bigger values – M=24,52 kg/m² (SD=5,69), with approximately 30% of the sample maintaining a BMI of 25 or greater, indicating that they were overweight or obese [11].

Negative body image has usually been defined as dissatisfaction with one’s physical appearance. Body image dissatisfaction is a reality for a large share in our research sample. 79% of the young women questioned, wanted to change something on their body shape and size and eventually to lose weight. Even 87,7% of the subjects have been in normal and underweight category, most of them, 66% wanted to lose weight, for an ideal, slimmer silhouette. This data confirm the thesis that landmarks that society promotes are very severe for most girls and young women and put them in a position of inferiority, repercussions on self esteem and self confidence [12].

The following graph (see Fig. 1) reflects the difference between BMI values and the weight perception and how young women tend to distort their physical dimensions. In this research sample 66% of the girls had normal weight and 66% of them wanted to lose weight; while the BMI results had a normal distribution, the body dissatisfaction index (BDI) had an ascendant trend. This difference between the two trend lines represents the body image disturbed perception. In percentage it can be quantified in around 55% of subjects with normal weight, but perceiving their self body mostly too heavy.

Disturbed self perception is usually associated with preoccupation, insecure attitude or seeking reassurance in peer’s opinion. An explanation for this insecurity is the fashion industry’s controversial promotion of underweight models and unrealistic imagery, which in time created the Western cultural pattern. The question which arises is how could this postmodern society to overcome the twenty-first century frustration, depressions, anxieties and psychoses when natural beauty has been annulled by botox’s dictatorship [4], the cult of anorexia and emaciated super models?

An important part (41%) of body dissatisfaction is determined by body mass index and subsequent by weight and fat deposits. It means that body image can be enhanced in 41% with physical education means, being in know that the most commonly mentioned PE objective are improving the state of health and a harmonious physical development. Even body image acceptance is a subjective issue, depending on cultural and social factors, yet we find a consistent, statistical significant correlation with BMI (r (158) = 0.64, p< .0005). The explanation could consist in body composition representing the body fat and muscle mass ration. Fat tissue contains no water and is bigger in volume comparative with muscle tissue which has higher density [13]. A higher percentage of body fat increase the

<table>
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<tr>
<th>Table 2. Body size satisfaction / dissatisfaction</th>
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<tr>
<td><strong>Body size perception/ideal</strong></td>
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<td></td>
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<td><strong>Units</strong></td>
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<td><strong>%</strong></td>
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<td><strong>BMI</strong></td>
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<td><strong>Normal weight</strong></td>
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<td><strong>Overweight &amp; obese</strong></td>
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<th>Table 3. Comparing BMI distribution</th>
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<td><strong>BMI</strong></td>
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<td><strong>Sweden</strong></td>
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overall body volume regardless the BMI values.

Summarizing the obtained data is acceptable to consider that BMI values could be useful predictors of body dissatisfaction risk among young female. Our conclusion are confirmed by others studies’ results investigating women samples, generally students, in divers cultural and ethnic regions. Jaworowska and Bazylak [14] have found in a sample of Polish female students almost the same percentage (65.6%) of body dissatisfaction. In Brazil women seems to be more indulgent with their appearance, whereas the prevalence of dissatisfaction reported was 47.3% [15]. Among a Pakistani students sample body dissatisfaction was complete: 45.6% of the respondents perceived their self body as too heavy, while 54.4% perceived it as too thin [16]. In a different cultural environment, in Saudi Arabia, among a group of young female students aged 21.02 (± 1.48 SD) with a BMI mean value of 22.79 (± 4.71 SD) 26.4% reported to be satisfied, 18.6% perceived self body as too thin, while 55% perceived as being too heavy and wanted to lose weight [17]. These results are close to the percentage obtained in our study: 21% satisfied, 13% wanted to gain weight and 66% wanted to lose weight.

There are scientific studies which are linking women’s body dissatisfaction and low self-esteem for physical appearance [13, 18]. This perception can have repercussions in lowering self-esteem for physical appearance especially around 20 years of age, when young women are still studying, but right before important life choices as a career or a life partner. A systematic review concluded that weight management and behavioral interventions could be successful by boosting self-esteem and increasing satisfaction with body areas too [19].

Practical interventions and scientific studies demonstrate without any doubt the potential positive effect for exercise to improve both physical and psychological well-being. In the psychological well-being category we can frame the perceptions, opinions and feelings related with body image, health condition, self esteem, etc, all of them improvable through physical exercise. Three different meta-analyses [20–22] draw the same consistent conclusion: exercise has significant positive effects on body image. More interesting seems to be the mechanism that could moderate the effects of exercise on body image.

Changes in objective indices of physical fitness play a minor role in body image change, whereas improvements in perceived fitness and self-efficacy appear to be important mechanisms by which exercise improves body image. There is no direct correlation between objective progress in fitness level and the subjective perception of being fit or more functionally efficient [23]. The PE teacher can inspire students with self body acceptance and self confidence by shifting the focus away from appearance and emphasizing the physical and mental benefits of exercise. This study discloses the unbreakable relationship between mind and body, meaning that every intervention at physical level will have effects on emotional and physical well-being too. This holistic approach offers us a subtle instrument for changing mentalities and attitudes in addition to physical skills and abilities [12].

The exercise intervention on changing body image depends on frequency and intensity of training [24]. The changes in body image are positively when the exercise are performed on more days per week and at least at a moderate intensity. Aerobic exercise, strength-training, and combined aerobic/strength-training interventions are equally effective. The type of exercise depends more on preferences and personal goals. A sensitive task for a teacher dealing with students with a low self image

![Fig. 1. Body dissatisfaction index versus BMI distribution](image-url)
acceptance is to help them to set realistic and achievable goals through appropriate exercise.

The satisfaction gained from exercising can eventually become an intrinsic motivation, especially when the practitioner internalizes the idea that effort has positive effects on enhancing perceptions about body shape and self-image.

Conclusions

Regarding subjective young women’s body image perception we conclude that it surpass the normal anthropometrical references regarding average body mass. Under the social and cultural patterns pressure a majority of women are not satisfied with their body shape regardless the BMI values and identify their ideal body with a thinner version. Even underweight persons are willing to lose weight in order to correspond to an expected physical attractiveness standard. The normality body with a thinner version. Even underweight persons are willing to lose weight in order to correspond to an expected physical attractiveness standard. The normality for female students around 20 years of age seems to be a constant preoccupation for losing weight and an ultrathin body is their beauty ideal.

41% of body dissatisfaction index is determined by body mass index and subsequent by weight and fat deposits. Both these parameters could be improved through physical and health education. An increased number of adequate physical activities, spending time outdoors, a healthy lifestyle or cutting out unhealthy foods are a few steps to take for increasing the female student’s physical tonus and could offer an alternative to this eternal and quasi-globalised body dissatisfaction.

Using just one parameter for estimating body fat is a limitation of this study. There is a credible possibility that other measurements as body composition, waist – hip ratio or height – waist ratio in relation with body dissatisfaction in young women sample to return different result.

Conflict of interests

The author declares that there is no conflict of interest.

References


**Index of difficulty which is an effective factor on especial skill formation in basketball free throw: index of learning difficulty hypothesis**

Roohollah Talebi\textsuperscript{ABCDE}, Hamid Reza Taheri\textsuperscript{ABCDE}, Mahdi Sohrabi\textsuperscript{ABCDE}

Physical Education Faculty and Sports Sciences, Fedowsi Mashad University, Iran

Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

**Abstract**

**Purpose:** The purpose of this study is to examine the specific memory representation in special skill of Basketball Free Throw in distances (a “set shot”) except 4.5 m distance. It is aimed to examine the role of the Index of Difficulty (ID) in creating the specific memory in other distances except the distance of penalty shoots.

**Material:** Fifteen skilled basketball players (M age = 21.6 years, SD = 2.45 years) were chosen from sixty players; they performed 70 trials from 7 different distances on the first day (10 SHOTS from each distance toward the basket). The next day, each player performed 10 SHOTS from each distance, but this time, it was different in terms of the baskets’ sizes and their quantities.

**Results:** The result of linear regression on trials score on the first day revealed the representation of special skill in penalty point and on the second day, representation of special skill was seen in 3 different distances from the ring (manipulated ring). These results indicate that Index of Difficulty protection can be a factor of private memory representation in distances except 4.5 m distance.

**Conclusions:** Results suggest that mass training stabilizes the ratio of target distance and width (Index of Difficulty) in mind and this ratio is the main reason of specific memory representation in basketball free throw.

**Keywords:** Index of difficulty, memory representation, special skill, basketball, free throw.

**Introduction**

One of the important challenges in motor learning is the way of learning and conditions of motor memory representations [1]. Some researchers emphasized on the generality of learning and believe that the learned motors have the capacity to be parameterized and be performed in various environmental conditions and even with other organs [2, 3]. In contrast with this theory, some scientists believe on the specificity of motor skills learning. In other words, movements will be specified according to their learning conditions and followed by dedicated memory representation [4]. Recent studies about darts, baseball, and basketball skills support these kinds of theories, in which the increase in distance will decrease the performance and skillful persons have special performance in a single distance [5-8]. An especial skill is when the performance of a single action from within a class of actions produces an advantage in performance. This advantage is in a single action over others in the same class of actions and is said to result from massive amounts of practice in performing the specific action [9]. An especial skill effect was first demonstrated by Keetch et al. [9], where in highly skilled basketball players executing the set shot from the FT (15 ft [4.57 m] from the basket) were found to be more accurate than at closer distances as predicted by a single linear regression equation. Keetch et al. [9] attributed the uniqueness of an especial skill to the accumulation of large amounts of practice at a specific distance. Significantly, these experiments led the authors to suggest two features about the memory representation underlying the set-shot skill, that the set-shot representation was sufficiently general as to allow set SHOTS to be taken from many different distances on the court and that the representation had a specific component such that an advantage in outcome accuracy was obtained whenever a set shot was attempted from one specific distance of 15 ft from the basket, the distance at which massive amounts of practice had been performed. Several explanations have been proposed describing the contents of the memory representation underpinning the especial skill effect [10], however, it remains unknown at what point the development of the especial skill emerges in a basketball player.

These results distinguish motor learning and memory representation in that this distance from the other distances is in contrast with the beliefs of theoreticians about the generality of motor memory and general motor learning [11]. Adams attempted to present a model with the name closed-loop to show that the findings related to the specificity of learning a movement consist of background and environmental information. He said that perceptual trace is responsible for learning and memory representation that is performed very specifically. A new view about motor control and learning is proposed which is in contrast with the basis of the motor program. This attitude which is called dynamic system perspective looks at the motor system of human from the perspective of being dynamic and non-linear [12]. From the perspective of this view, the state of steadiness in dynamic condition is called stability. It will start running when a perturbation and disorder occurs in the system and it will lead the system to a steady state [12-15]. By adjusting the condition for establishing special skill and performing it in various distances, it points to the fact that throw in different distances creates...
a kind of disorder. This instability will be stable at the standard distance of special skill throw. In this regard, experienced players throws toward targets follow a non-linear pattern. The special skills will be closed from unstable state to steady state. In the views of researchers, establishing a particular skill requires frequent training in that distance. Training a special skill such as free throw follows Fitts’s Law as a one way targeting skill that the time and accuracy of movement are dependent on the distance and its change. At the time of learning, a motor plan is created in mind that has the specific time and space scale of that task. Hacker [16] said that the ratio between the size and accuracy of movement can be examined. He considered it as an important and main nature in motor control and transition of learning. Nowadays, this issue is studied with the concept of index of difficulty. It can be said that the result of movement is dependent on the ratio of size and distance from the target. This ratio will remain fixed when the accuracy and size are changed together at the time of performing a movement [15]. Although this consistency does not directly refer to a common strategy, Hacker’s results indicated that the ratio between size and accuracy and also the form of movement must be considered as an important feature of motor control and transition [16]. He also reported that this law is true about various targeting movements and the involved muscles play no role in that [17]. According to Thelen et al. [14], the form of movement which is defined by the ratio of size and accuracy in 1-D space determines the time of movement. Taheri et al. [15] examined the effect of parameter change on the result and performed a jump shot of basketball. Results showed that the accuracy of throw decreased as a function of task limitations. The angle of release of ball decreased due to the increase of distance. The speed of release of ball is increased by the increase of distance. Also, Kwon et al. [17] examined the role of the ratio between the accuracy and size of movement (ID) in transfer learning. Transfer of skilled movement is better when both the size and accuracy of movement are changed by the same factor (ID is constant) than when only size or accuracy is changed. They infer that the size–accuracy ratio captures the control strategies employed during practice and thus promotes efficient transfer. Berslin et al. [18] in a survey examined the representation of a special skill and perceived that a special skill can be established even in short term. The type of training can be one of the effective factors of the formation of dedicated memory and increase of special skill. Newell [19] and Stoeckel [20] examined the visual context effect on performing and learning free throw skill. The results revealed that one of the conditions of establishing a special skill and showing it in free throw performance is trained visual context. It is possible that during training, a ratio distance-accuracy (difficulty index) task takes form in the mind of the learner. This task and visual context and parameter can establish a special skill in learning which will validate the dedicated memory hypothesis.

Hypothesis and Purpose: Now the question is whether adjustment of index of difficulty is an effective factor in motor learning for dedicated memory representation? And can we create the performance of a skillful person in special skill in other distances by preserving task difficulty?

Material and Methods

Participants: Fifteen male basketball players were chosen from 60 Master League point guards (M age = 21.6 years, SD = 2.45 years) from Iran basketball national team and they partook in the experiment. All of them were Shooting guard and were selected purposefully, their height and weight were important in their selection and homogeneity of the group.

Research Design: All participants gave written informed consent to participate in the experiment, ethical approval was granted by the lead institution. For conducting the test, number 7 standard ball of basketball made by Molten Company, standard basket and backboard of basketball and a basket size by 53 and 39 cm were used. In this experiment, 15 people participate in one group. They were requested to perform their SHOTS with the standard ball (size 7 of Molten company) based on the regulations of FIBA of a standard basket which is located at the distance of 3.05 m from the ground. They were instructed not to separate their foot from the ground during the SHOTS (do not jump). The procedure was in this form that the group performs the SHOTS from 7 different distances on a direct line exactly in the face of the basket. According to the figure, 7 distances have been determined by white adhesive tape (2×5 cm), 3 distances were close to the basket and less than 4.5 m (free throw standard distance) and 3 distances were more than 4.5 m. In these distances, the difficulty index of each distance was different because the size of the basket is stable and the distance is changing. For determining the distances domain of SHOTS, we referred to the studies of Taheri et al. [15] in which non-change of a motor pattern of free throw consists of not separating the subjects foot from the ground and using one hand throw. The desired distance was determined by that.

After warm up, all the participants performed 10 SHOTS from each distance toward the basket. The participants rested for 5 minutes between each 10 SHOTS of a block and after that they went to perform the next block. After the performance of participants in this mission, the next day, they performed 10 SHOTS from each distance, but this time, it was different in terms of the size and number of the baskets. This time, two baskets were used, one of the baskets was more than the standard size (53 cm diameter) and the other was smaller than the standard basket (39 cm diameter) and the SHOTS were performed in the distances of 2 and 6 toward the baskets. In the distances of 2 and 6, with the change of the width of the basket, the index of difficulty of throw was similar to the FT. The participants just like the previous day rested for 5 minutes after performing the 10 shot of a block, they again went to the next block in the next distance. Conduction of the experiment was in an individual form and three examiners were used. The first examiner gives
necessary instructions to the performers, the second examiner records the scores and the third examiner delivers the ball to the subject immediately after each shot (18). Each participant performs 10 SHOTS for warming up and then releases three SHOTS from each distance toward the basket. The SHOTS number was totally 70 SHOTS per day [9]. Task performance was assessed using a 2-point scoring system in which each shot was registered as hit or miss according to official basketball rules. For each trial, mean score of SHOTS were calculated across the 10 trials from each position.

Statistical Analysis: The statistical method of this study is ANOVA, linear regression on the score of the group in each distance and paired t-test. ANOVA was used to determine the difference in scores of the group in different distances and to determine the place of these differences. Pearson’s correlational statistic was used to examine the relation between distance and throwing performance. To test specifically for the presence of the especial skill, individual linear regressions were calculated on the basis of the four positions other than the actual FT position at 4.5 m to generate predicted values for the FT distance (see Keetch et al. [9], for this procedure). The predicted values for the FT distance were then compared with the actual percentage of SHOTS from that position. A t-test was used to compare all throws of this two day. All the statistical analyses were done by Excel and SPSS 20.

Results

Actual mean score of SHOTS at each of the seven positions as well as the predicted values for the FT position at 4.5 m are presented in Figure 2 for two days. The mean score of SHOTS decreased with increasing distance in all positions in the first day (except FT), which was supported by negative linear correlations (all rs < –0.24, ps < 0.001) and a significant distance effect, t(9,132) =

![Figure 1: SHOTS from various distances toward the standard basket by subjects](image1)

![Figure 2: SHOTS from various distances during the manipulation of second and sixth distances by the subjects.](image2)
-6.551, \( p < .001 \), \( \eta^2_p = .894 \) and the mean score of SHOTS decreased with increasing distance in all positions in the second day (except 3 distance), which was supported by negative linear correlations (all \( rs < -0.24, ps < 0.001 \)) and a significant distance effect, \( t(9,132) = -6.551, p < .001 \), \( \eta^2_p = .894 \). An analysis of variance was run on the performance scores for the six nonfuel line and fuel line locations to standard ring. Normality and equality of dependent variable variance were examined by Leven's test (\( f(63, 6) = 0.281 \) and \( P = 0.944 \)). The results of ANOVA on the scores of free throw from different distances toward the basket showed a significant difference between the scores of the group in SHOTS from different distances (\( f(63, 6) = 85.745 \) and \( P = 0.000 \)). According to the Tukey post hoc test, the place of all these differences between all states can be seen except 3 m with 4.2 and also FT with 3.6 and 3.9. Also, an analysis of variance was run on the performance scores for the six nonfuel line and fuel line locations to ring with different size. Normality and equality of dependent variable variance were examined by Leven's test (\( f(63, 6) = 0.66 \) and \( P = 0.999 \)). The results of ANOVA on the free throw toward the basket with different sizes showed that there is a significant difference between all states except FT and 3.9 m distance- FT and 5.3 m – 3.9 and 5.3 m. By examining the average scores of groups, it was determined that no significant difference among these distances showed the same performance of subjects in these distances (3.9, 4.5, and 5.3), although this lack of difference was not observed in the state of throwing from different distances toward the standard basket. Paired t-test was used to compare the performance of the group in the state of throwing from a determined distance toward standard and manipulated basket. The performance of group from the distances of 3.9 and 5.3 m toward standard and manipulated basket was compared. The results showed that there is a significant difference in subjects’ performance in 5.3 m.

The linear regression results and the R^2 value in the first test of a shot from different distances toward standard basket showed that 89.4\% of the variance of performance is determined by the distance from the basket. Linear regression coefficient from the basket on the performance (\( = \beta -0.946 \)) based on the value of t test (-6.551) is significant (0.001). It showed that the distance from the target can predict the performance negatively. Hence, the increase in distance from target reduces the performance. According to the calculated line equation for the first test (\( Y = 1.76 -0.240x \)) and the value of the gradient of a line, we can say that by increasing the distance from the basket by 30 cm, their performance is decreased by about 0.072 scores on the average. The difference of real performance of subjects in comparison with predicted score by regression equation in a shot toward standard basket showed the establishment of a special performance at the distance of each throw. The results of a linear regression on the scores of SHOTS toward manipulated baskets on the second day revealed that 57.4\% of performance variance is determined by the distance from the basket.

**Table of paired t-test comparison of the performance of group’s free throw in different conditions of distance and width of target**

<table>
<thead>
<tr>
<th>Condition of throw</th>
<th>Average</th>
<th>Standard deviation</th>
<th>T</th>
<th>Degrees of freedom</th>
<th>Level of significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-B'</td>
<td>-0.040</td>
<td>0.0966</td>
<td>-1.309</td>
<td>9</td>
<td>0.223</td>
</tr>
<tr>
<td>D-D'</td>
<td>0.030</td>
<td>0.0949</td>
<td>1.00</td>
<td>9</td>
<td>0.343</td>
</tr>
<tr>
<td>F-F'</td>
<td>-0.300</td>
<td>0.0471</td>
<td>-20.125</td>
<td>9</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Figure 3.** Actual success rates (blue line) from each of the seven positions for the group and predicted values based on regression analysis are displayed (red line) on the first day.
The regression coefficient of distance from the basket on the performance of $\beta = -0.519$ according to the value of $t$-test ($t = -2.601$) is significant ($0.048$). It showed that the distance from the target can predict the performance negatively. Therefore, the increase in distance from target causes decrease in the performance. According to the numerical value of $R^2$, there is a low correlation between the two variables. The calculated line equation ($Y = 1.568 - 0.189x$) indicated that by increasing the distance from the basket by 30 cm, their performance is decreased by about 0.058 scores on the average (according to the negative sign of gradient). The real scores of the group in the second test (shot toward baskets with different size) were different from the predicted scores by regression equation at the distance of 5.3 m. This difference indicates better performance of the subjects than the predicted performance in that distance.

**Discussion**

Results of the present study regarding free throw of 15 skillful players’ performance toward standard and manipulated (width of the target is changed) basket from 7 distances showed that just like many studies, the performance of players follows the line equation except at the FT in which it will be decreased by the distance from the target. By considering the fact that the width of the target was increased and the difficulty index was the same as FT, the results revealed that the performance of each person at a distance except free throw line violates from the predictive line equation of performance and has a significant difference with their shot performance from that distance to the standard basket. In general, the results showed the lack of significant difference between the performance of group at the distances of 2, 4 and 6 (same index of difficulty).

A sport skill performed by highly trained athletes provides a clear demonstration of both the specific and general capabilities of exceptional human motor performance. Research has demonstrated that the basketball shot is one of such sport skill. This shot is almost always practiced from a line that is 15 feet from a point directly beneath the basket (i.e., a free throw from the FT). The set shot is rarely practiced from other locations because of its limited usefulness in game play. The finding that a highly specific exemplar (the free throw) could exist amid the background of a very general performance capability (set SHOTS), which we termed an especial skill, poses a real and significant problem for theories of motor control, including Schema theory [1]. The existence of an especial skill (the foul shot) is problematic because according to the theory, the foul shot should belong to a class of motor skills (set SHOTS) that becomes increasingly generalized with advanced skill. These findings suggest that years of practice at the FT produce a skill that has a specific motor control advantage at that particular distance that provides little or no detectable advantage for any other distance, irrespective of its proximity to the FT [9].

One interpretation in terms of Schema theory is that the foul shot from the free throw line is represented by one specific, exceptionally well-learned motor program. A separate GMP is developed and represents the set SHOTS from the non–FT locations [19]. The evidence for the existence of especial skills would be weakened if it were found only to exist for one class of motor skills (basketball set SHOTS). In the study that we presented here, two alternative explanations for the existence of especial skills were examined. One possibility is that massive amounts of practice at one specific instance within a class of skills improve the parameter-specification process for that unique instance. We call this the learned parameters hypothesis. An alternative suggestion is that embedded within the learned representation for the free throw and is a unique visual context for the performance of that particular set shot (which we term the visual-context hypothesis). Breslin [10] showed that special skill can be established by 300 SHOTS and it may not require mass
training. Studies showed that a motor program can create some movements for a special movement in a category. Formation of dedicated memory and representation of that is dependent on the kind and conditions of training.

The findings suggest that visual context information influences the presence of specificity effects in experienced performers. The findings have theoretical implications for explaining the memory representation underlying the especial skill effect in basketball [20]. Of course, a key issue here is the definition of what a “condition” is, and how the effect of changing these conditions would affect the performance of motor skill. One attempt has classified these specificity effects as sensory-motor specificity, context specificity, or processing specificity [1]. An example of altered sensory-motor conditions is seen in experiments in which sensory information (e.g., vision) is systematically added or removed at the time of test [21, 22]. These experiments have shown that either removing or adding sensory information, and thus changing the information that had been available during the learning trials, had a degrading effect on the performance of the test trials. Additionally, data revealed that the degrading effect was more pronounced as the number of practice trials increased [23].

It can be said that training of a skill causes memory consolidation of that movement and creates an image of the size of the target and distance from the target and environmental condition in our memory. Perhaps, the index of difficulty of the task can be a sign for representation of this image in the person’s mind. When the index of difficulty is preserved, the performance will be preserved too. This study assumed that one of the reasons of creating especial skill at an especial distance is the consolidation and effect of index of difficulty and the ratio of distance to the width of the target. The human brain uses it as a factor for creating motor adjustments and motor command. However, in spite of the frequent demonstration of specificity in motor control and learning, there have been few attempts to model these effects in theories. One exception was Adams [4] closed-loop theory, in which he represented the accumulation of skill as the learning of a specific representation in memory. According to Adams’s theory, the learning of a blindfolded positioning movement resulted from the strengthening of memory of a specific underlying neural representation, which he termed the perceptual trace. We have shown that those with experience of basketball free-throw shooting will demonstrate the especial skill effect but instead, their performance will not follow a linear pattern where in performance outcome decreases as distance from the basket increases in the second experiment. We have also shown that players developed an especial skill demonstrated by a less linear type trend in shooting performance across distance. We presented two ways of analyzing and explaining the presence of the especial skill effect. The first uses two straight lines as regression functions. The second employs a non-linear model in which an especial skill is represented by a ratio between width and distance target at D=4.5, 5.1 m. However, our results make us to suggest that once an especial skill is developed, it can be generalized to other distances. This conclusion is different from the results of previous studies on especial skills [7,9,24] and the parameter component of Schema theory [1].

The variability of force is one of the mentioned principles by Schmidt et al. [1] which is about fast movements. As the performer take distance from the target, his targeting performance will be decreased. But it is questioned by recent studies regarding especial skill. Numerous studies show lack of performance coincidence in FT with predicted score. In this study, this lack of coincidence was seen in another distance in addition to the FT (the far distance from the basket, 5.3) in which we keep the index difficulty of FT by manipulating the width of the basket and the performance in that distance has no difference with the FT. These results are considered as a kind of challenge for the principle of variability of force in fast movements. We agree that some factors such as the amount of training and type of training (fixed and variable) can affect the formation of especial skill. In this study, we mentioned another principle factor (index of difficulty) and preserved it. And also, transfer of skill is better when both the size and distance of throw are changed by the same factor (ID is constant) than when only size or distance is changed. We suggest that the width–distance ratio captures the control strategies employed during practice and thus promotes efficient transfer. This factor can cause presentation of dedicated memory and increase of especial skill in other distances. One of the possible reasons is the visual context which is created in individuals at different distances. It is established at the distance of 4 and 6 because of the similarity of this image. Because of the size variation in target size and distance, the index of difficulty is same as the FT. According to Tau law, the emission of light from two corners of an object to our eyes forms an angle named theta. This angle remains fixed by keeping the ratio between the width of target and distance fix. We keep this angle fix by manipulating the width of the target. The results confirmed the hypothesis of parameter learning for the special skill which is the sign of the difference in predicated and real performance in FT. But our question was about the difference of players’ performance in the shot state toward the standard and manipulated basket from 5.3 m distance in which the index of difficulty of the basketball free throw was kept. According to the view of dynamic systems, it can be said that stability can be accomplished by the transition from a chaotic situation to a stable state and frequent training in FT. This state is created by stabilizing environmental conditions such as distance from the target and visual context. The ratio of the distance from the target to the width of target creates a stable pattern in mind violation that causes turbulence, thus keeping it in any condition followed by a kind of stability [24, 25].

**Conclusion**

Envisaged that it is possible that training from a specific distance and throw toward a basket with specific
size over the years will lead to the formation of especial skill and dedicated memory within which a ratio of distance from target and width of target is stabilized in the mind, in other words, the mind uses index of difficulty as a factor for stabilizing the learning and essential sign for creating dedicated memory.

Finally, it can be suggested that paying attention to parameter learning hypothesis, the visual context in the representation of the dedicated memory of index of difficulty and also preserving it can lead to the representation of dedicated memory. It can be used as a new factor for representation of memory.

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

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**References**


An analysis of psychological endurance and personality traits of individuals doing sports and not doing sports by various variables

Şar Nuriye Şeyma 1ABCDE, Soyer Fikret 2ABCDE, Koç Mustafa 3ABCDE

1High School of Physical Education and Sports, Mustafa Kemal University, Turkey
2Physical Education and Sports Science Faculty, Sakarya University, Turkey
3Education Faculty, Psychological Counseling and Guidance Service, Sakarya University, Turkey

Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: The aim was to examine the psychological endurance and personality levels of the students studying at Faculty of Education and students studying at Faculty of Sports Sciences.

Material: Target population of the study was composed of students studying at Sakarya University in the academic year 2015-2016. The sample of the research consisted of a total of 365 (n = 197 males, n = 168 females) participants. They were educated at Faculty of Education (n=166) and Faculty of Sports Sciences (n=199) at Sakarya University. “Personal Information Form” by the researcher, Turkish adapted version of “Personality Inventory” were implemented. Also, Turkish adapted version of “Psychological Endurance Scale for Adults” were implemented. T-test was used for paired comparisons. Pearson Product-Moment Correlation (r) Coefficient was employed to determine the relationship between psychological endurance and five factor personality traits of the participants.

Results: There was a significant difference between sporting situations, sporting year, sports branches of students in terms of total scores of psychological endurances. There was also a significant difference between gender, sporting situation, sporting year and socio-economic situations in terms of the personality traits of the students.

Conclusions: The results show that the psychological endurance levels of those who do not play sports are lower than those who do any of the individual sport branches or team sports. In short, it can be said that doing sports affects psychological endurance positively.

Keywords: psychological endurance, doing sports, personality, sporting year, sports branches.

Introduction

In addition to being in good relationships with people to survive, they need to be healthy and fit. They need to have a good mindset and bodily development. The World Health Organization (WHO) thinks that a person can be a healthy individual if biologically, psychologically, and socially efficient. It is not only being healthy with physical competence; it means that the individual must be healthy both psychologically and sociologically. Individuals with healthy biological, physiological and psychological structures have the opportunity to create a positive personality structure. In situations where the conditions are incomplete or inadequate, negative personality structures emerge. It can be said that sports enable the person to develop in sociological, physical and psychological sense and contribute to the personality development. The individual struggling to adapt to the environment faces a number of problems in her/his life. These can be the loss of a loved one, dismissal from work, a fatal disease, and the destruction of family integrity. If one does not have strength to protect oneself, one feels weak against problems and experiences psychological depression and physical discomfort. There are also people around, who continue to live their lives even against the greatest disasters they have faced in their lives. They themselves produce the necessary energy and power to bind themselves to life. These individuals who have succeeded in surviving against the difficulties experienced by their living skills are individuals who are aimed at being healthy. They have individual goals and they aim to live a more meaningful and quality life [1]. Psychological endurance is defined as “having good results despite serious threats to the person’s development and cohesion” [2]. Psychological endurance is not a property that remains unchanged from birth to death. The strength of the individual is variable, and the effects of events that he or she has experienced are also important. The person may be durable in one development area but not in another development area [3, 4]. Psychological endurance deals not only with survival, but also with the cognitive, emotional attitudes and behaviors required to enrich life during development. The concept is explained by the existentialist approach. According to the existentialist approach, the individual must have the ability to make decisions, to take initiative. They need it to make life meaningful in the possibilities that exist and continue in life. This approach is to be highly effective in discriminating people. These are who have high level of psychological endurance, who can cope with stress and difficulties, and who struggle with behavioral attitudes that cause disease [5]. There are many personality traits that can be associated with psychological endurance. These; related to psychological endurance, self-esteem, hope, learned optimism, life satisfaction, positive emotionality, optimism. However, psychological endurance does not
only refer to all or nothing, but also to be unstable [6].

Nowadays, we can define personality as the mental, emotional, and physical reactions that lead to the life of the individual. It is also the whole behavioral patterns that distinguish the individual from others and show a certain consistency, while not having any common personality definition that scientists agree on [7]. The main factors that constitute a person’s personality are thought, ability, interest, attitude, behavior and actions. These elements are reflected out by the person’s appearance, movements, facial expressions, gestures and harmony with their surroundings. Within the integrity of the personality, each person has his or her own unique features that make it different from other people. These features are linked to some of the major items of personality and are reflections of them. For example; good or bad remembrance, quick emotion, anger, irritability, good speech are different features that distinguish people from each other. Besides these, the dressing style of the person, walking, hand and arm movements, voice tone and likings are part of the personality [8].

When we look at the relationship between personality and sport, sport is a form of behavior that meets basic needs at the same time. Allowing the individual to achieve the goals of the drives that are caused by the biological instincts. Sport is not only a physical activity, but also the process of socialization and fitting in the society. The interaction in the sporting environment, then, provides suitable possibilities for emotional emptying and control. The individual participating in sportive activities has the opportunity to express their feelings through movements. It provides a way to empty emotions characterized as maladaptive behavior, such as aggression, anger, shyness, jealousy, and help them be controlled. Thus, it also has a positive impact on the adaptation process. At the same time, sport has a positive effect on the neurovegetative nervous system, helping it to function in a balanced manner. This helps to overthrow excitement, aggression, and anger. Achievements in sports increase the confidence of individuals in themselves [9].

Two different groups emerged in the study of the relationship between personality and sportive performance. Morgan defines the first group as the adopters who admit the pure idea that the personality has a significant relationship with sporting success. He defines the other group as a skeptical group that advocates the idea that the personality has no effect in sporting success. Neither the pure nor the skeptical opinion turned out to be true. Rather, it can be said that there is a relationship between personality and sporting success. However, this relationship is far from perfect. Even if knowing the personality traits and the special circumstances involved helps to predict sporting behavior and success, this prediction is not certain.

Material and Method

Participants
Participants consists of the students of the Faculty of Sports Sciences and the Faculty of Education of Sakarya University in the academic year 2015-2016. The sample of the research consists of 365 students (n(male)=197, n(female)=168). They were selected by random sampling method among the students of Sakarya University Hendek Education Faculty (n = 166) and Sports Sciences faculty (n = 199) students in 2015-2016 academic year. The questionnaire was tried to be applied to the students in the sampling group. The students who were not there and the students who did not want to participate in the questionnaire were not surveyed. The data were obtained by random sampling method.

Measurements and Procedures

Personal Information Form
A personal information form consisting of 9 questions has been prepared by the researcher to gather information about the personal characteristics of the students. It was to establish independent variables which are subject of examination of the research.

Personal information form has been developed by the researcher to find out whether the students doing sports, the year of the sport and the sports branches they do.

Five Factor Personality Features Scale
The five-factor personality scale was developed by Benet-Martinez and John [10] under the name “The Big Five Inventory” and consists of 44 items. This scale that are prepared short in terms of effective and rapid evaluations for researchers. It measures the dimensions of “neuroticism”, “extroversion”, “developmental openness”, “compatibility” and “self-discipline” among the personality traits. The factors of “neuroticism” and “extroversion” are measured by 9 items, “compatibility” and “self-discipline” by 9 items, and “development openness” by 10 items. The adaptation of the scale to the Turkish language was carried out by Sumer et al [11]. It was within the context of Turkey in a study Schmitt et al [12] on self-definition profiles and patterns of people within 56 countries. The reason for selecting the five-factor personality scale in the study is the validity and reliability of the study in the intercultural context. In the study, the five-factor personality scale showed “neuroticism”, “extrovertedness”, “openness to development”, “compatibility” and “self-discipline” factors as Cronbach Alpha reliability values of .79, .77, .76, .70 and .78 respectively Schmitt et al [12]. In some studies, with the same scale, the five factor personality dimensions were found to vary between .64 and .77 (Sumer, Lajunen and Ozkan), [13] and between .67 and .83 (Ülke) [14].

Psychological Endurance Scale
The Psychological Endurance Scale is a measure developed by Friborg et al. [15] It is tested by Basım and Çetin [16] for reliability and validity in the study “Reliability and Validity Study of Adult Psychological Endurance Scale”. Then, it was adapted to Turkish.

The Psychological Endurance Scale for Adults was developed by Friborg et al. [15] It includes dimensions of ‘personal power’, ‘structural style’, ‘social competence’, ‘family adjustment’ and ‘social resources’. A later study (Friborg et al., 2003) shows that the six-dimensional
structure of the scale provides a better explanation of the psychological endurance model. In the study by Friborg et al [15], the ‘personal power’ dimension was divided into ‘self-perception’ and ‘future perception’ and six-dimensional structure emerged. In the scale, ‘structural style’ (3,9,15,21) and ‘future perception’ (2,8,14,20) are measured in four items. ‘Family adjustment’ (5,11,17,23,26,32), ‘self-perception’ (44,17,13,19,28,31) and ‘social competence’ (4,10,16,22) are measured in six items, 25,29). ‘Social resources’ (6,12,18,24,27,30,33) are measured in seven items. Printing and Çetin, [16]

**The reliability and validity of the Psychological Endurance Scale**

In the scale, a format is used in which the positive and negative attributes are on different sides. For responses, there are five separate quotes in order to avoid prejudiced evaluations of preferences of the items. Scoring style is set free in measuring psychological endurance high or low in schematic assessment. Confirmatory factor analysis was performed for the validity study of the scale and a total of 57% variance was reported with six factors. Internal consistency values of the structural equation model for reliability of the scale; ‘Self-perception’, 80, ‘Future Perception’, 75, ‘Social Competence’, 82, ‘Family Compatibility’, 86, ‘Social Resources’, 84 and ‘Structural Style’, 76 Basım and Çetin. [16] The Cronbach Alpha Internal consistency coefficient was calculated. It was to determine the scale’s reliability at the end of the study with the teachers of the special education school. This value is determined to be 87 for all of the scale. Internal consistency coefficients of scale subscales were found to vary between 66 and 81. Test-retest reliability was between 68 and 81 by Basım and Çetin [16]. The total score the participants can get from the scale is 165. It was accepted that the participants with high scores had high psychological endurance and those with low scores had low psychological endurance (Basım and Çetin) [16].

**Statistical Analysis**

Data analysis was done in two steps. In the first stage, it is intended to present the situation as it is. To reach this aim, frequency and percentages from descriptive statistics are used.

In this context, the medium and standard deviations were calculated. It was to determine how personality traits and psychological endurance levels that constitute the dependent variables of the research differ according to the demographic variables of the study’s independent variables. The t test was conducted. It was to determine whether the personality traits and psychological endurance levels differed according to the independent variable of the study, sport and non-sport. It was also to determine whether the present difference was significant. The t test, the f test and the analysis of variance tests were used to determine whether there is a variation depending on demographic variables’ situation. They were also used to determine whether this variation was significant. In order to determine the relationship between personality traits and psychological endurance, the correlation coefficient was calculated.

The obtained data were analyzed on a computer by SPSS (Statistical Package for Social Scientists for Windows Release 18.0) program, tested at a significance level of 0.05. Other significance level was specified separately and the results were presented in tabular form for the purpose of research.

**Results**

When the psychological endurance levels of the participants were compared according to the sporting situation, there was no statistically significant difference (t=1,533 P>0.05).

When the subjects’ sporting situation is examined in terms of their personality traits, openness to development, extroversion and compatibility were not significantly different to the findings. It was determined that the self-discipline mean scores of the individuals who did and did not perform sports differ significantly (t = 2,362; P <0,05). Also, the self-discipline scores of the sportsmen have a higher average than those who do not.

Participants’ mean scores of neuroticism, openness to development, and psychological endurance differ significantly depending on the sport year. In general, the average of the scores of neuroticism (t = 3,549; P<0,05), openness to development (t = 4,171; P<0,05) and psychological endurance (t = 3,184; P<0,05) it seems that there is a significant difference. There is no significant difference when looking into personality’s self-discipline, extroversion and compatibility sub-dimensions.

According to the branch variable, there was no statistical difference in the personality characteristics of participants who did not play sports, or did individual and team sports in terms of the difference between psychological endurance and personality traits. The psychological endurance levels differ statistically depending on the individuals not doing sports, or doing individual and team sports. The ones doing team sports

**Table 1.** T-test results between psychological durability score averages of individuals who do sports and who do not.

<table>
<thead>
<tr>
<th>Psychological Endurance</th>
<th>Sporting Situation</th>
<th>N</th>
<th>Average</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>216</td>
<td>3.95</td>
<td>.59</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>149</td>
<td>3.86</td>
<td>.49</td>
</tr>
<tr>
<td></td>
<td>t-test</td>
<td></td>
<td>t</td>
<td>sD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Psychological Endurance</td>
<td></td>
<td>1,533</td>
<td>363</td>
<td>.126</td>
</tr>
</tbody>
</table>

*.05 significance level
Table 2. T-test results between personality traits score averages of individuals who do sports and who do not.

<table>
<thead>
<tr>
<th>Sporting Situation</th>
<th>N</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness to Self-development Yes</td>
<td>224</td>
<td>3.77</td>
<td>.50</td>
</tr>
<tr>
<td>No</td>
<td>141</td>
<td>3.73</td>
<td>.42</td>
</tr>
<tr>
<td>Self-discipline Yes</td>
<td>222</td>
<td>3.13</td>
<td>.48</td>
</tr>
<tr>
<td>No</td>
<td>141</td>
<td>3.26</td>
<td>.50</td>
</tr>
<tr>
<td>Extroversion Yes</td>
<td>224</td>
<td>3.38</td>
<td>.48</td>
</tr>
<tr>
<td>No</td>
<td>140</td>
<td>3.34</td>
<td>.38</td>
</tr>
<tr>
<td>Compatibility Yes</td>
<td>224</td>
<td>3.55</td>
<td>.47</td>
</tr>
<tr>
<td>No</td>
<td>141</td>
<td>3.56</td>
<td>.55</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>Sd</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness to Self-development</td>
<td>.851</td>
<td>363</td>
<td>.395</td>
</tr>
<tr>
<td>Self-discipline</td>
<td>-2.362</td>
<td>361</td>
<td>.019</td>
</tr>
<tr>
<td>Extroversion</td>
<td>.878</td>
<td>362</td>
<td>.381</td>
</tr>
<tr>
<td>Compatibility</td>
<td>-.158</td>
<td>363</td>
<td>.875</td>
</tr>
</tbody>
</table>

Table 3. F-test results regarding the difference between psychological endurance and personality characteristics according to the year of sport variance.

<table>
<thead>
<tr>
<th>Sporting Year</th>
<th>N</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism 0-5 year</td>
<td>224</td>
<td>3.23</td>
<td>.49</td>
</tr>
<tr>
<td>6-10 year</td>
<td>100</td>
<td>3.08</td>
<td>.48</td>
</tr>
<tr>
<td>11-15 year</td>
<td>41</td>
<td>3.17</td>
<td>.51</td>
</tr>
<tr>
<td>Openness to Development 0-5 year</td>
<td>224</td>
<td>3.70</td>
<td>.44</td>
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<td>6-10 year</td>
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<td>.51</td>
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<td>11-15 year</td>
<td>41</td>
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<td>.49</td>
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<td>Self-discipline 0-5 year</td>
<td>223</td>
<td>3.62</td>
<td>.50</td>
</tr>
<tr>
<td>6-10 year</td>
<td>100</td>
<td>3.55</td>
<td>.59</td>
</tr>
<tr>
<td>11-15 year</td>
<td>41</td>
<td>3.62</td>
<td>.51</td>
</tr>
<tr>
<td>Extroversion 0-5 year</td>
<td>223</td>
<td>3.35</td>
<td>.40</td>
</tr>
<tr>
<td>6-10 year</td>
<td>100</td>
<td>3.37</td>
<td>.52</td>
</tr>
<tr>
<td>11-15 year</td>
<td>41</td>
<td>3.39</td>
<td>.49</td>
</tr>
<tr>
<td>Compatibility 0-5 year</td>
<td>224</td>
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<td>.50</td>
</tr>
<tr>
<td>6-10 year</td>
<td>100</td>
<td>3.58</td>
<td>.52</td>
</tr>
<tr>
<td>11-15 year</td>
<td>41</td>
<td>3.55</td>
<td>.47</td>
</tr>
<tr>
<td>Psychological Endurance 0-5 year</td>
<td>224</td>
<td>3.86</td>
<td>.51</td>
</tr>
<tr>
<td>6-10 year</td>
<td>100</td>
<td>4.00</td>
<td>.60</td>
</tr>
<tr>
<td>11-15 year</td>
<td>41</td>
<td>4.04</td>
<td>.65</td>
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</table>

Table 4. F-test results regarding the difference between psychological endurance and personality characteristics according to the year of not doing sports variable.

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<tr>
<th>Sporting Year</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Averages of Squares</th>
<th>F</th>
<th>Sig.</th>
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</thead>
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<td>Between Groups</td>
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<td>2</td>
<td>.837</td>
<td>3,549</td>
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<tr>
<td></td>
<td>Inside Groups</td>
<td>85,426</td>
<td>362</td>
<td>.236</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>87,100</td>
<td>364</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Openness to Development</td>
<td>Between Groups</td>
<td>1,793</td>
<td>2</td>
<td>.897</td>
<td>4,171</td>
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<td></td>
<td>Inside Groups</td>
<td>77,807</td>
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<td>.215</td>
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<td></td>
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<td>79,600</td>
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<td></td>
</tr>
<tr>
<td>Self-discipline</td>
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<td>363</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extroversion</td>
<td>Between Groups</td>
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<td>2</td>
<td>.039</td>
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<td></td>
<td>Total</td>
<td>72,429</td>
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<td></td>
</tr>
<tr>
<td>Compatibility</td>
<td>Between Groups</td>
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<td>2</td>
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<td></td>
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<td>Total</td>
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*.05 significance level
Table 5. Findings related to the difference between psychological endurance and personality characteristics according to sport branch variables.

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<tr>
<th>Sports Branch</th>
<th>N</th>
<th>Average</th>
<th>Standard Deviation</th>
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<td>Neuroticism</td>
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<td></td>
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<td>Non-sporting</td>
<td>141</td>
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<td>.49</td>
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<tr>
<td>Team sports</td>
<td>113</td>
<td>3.11</td>
<td>.46</td>
</tr>
<tr>
<td>Individual sports</td>
<td>111</td>
<td>3.18</td>
<td>.51</td>
</tr>
<tr>
<td>Total</td>
<td>365</td>
<td>3.18</td>
<td>.49</td>
</tr>
<tr>
<td>Non-sporting</td>
<td>141</td>
<td>3.73</td>
<td>.41</td>
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<tr>
<td>Team sports</td>
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<td>3.74</td>
<td>.53</td>
</tr>
<tr>
<td>Total</td>
<td>365</td>
<td>3.75</td>
<td>.47</td>
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<tr>
<td>Openness to Development</td>
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<td></td>
</tr>
<tr>
<td>Non-sporting</td>
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<td>3.79</td>
<td>.46</td>
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<tr>
<td>Team sports</td>
<td>113</td>
<td>3.75</td>
<td>.61</td>
</tr>
<tr>
<td>Individual sports</td>
<td>111</td>
<td>3.75</td>
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<tr>
<td>Total</td>
<td>365</td>
<td>3.75</td>
<td>.52</td>
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<td>Non-sporting</td>
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<td>.45</td>
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<td>364</td>
<td>3.56</td>
<td>.52</td>
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<tr>
<td>Self-discipline</td>
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<tr>
<td>Non-sporting</td>
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<td>.54</td>
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<tr>
<td>Total</td>
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<td>3.60</td>
<td>.52</td>
</tr>
<tr>
<td>Non-sporting</td>
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<td>Total</td>
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<tr>
<td>Extroversion</td>
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<tr>
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<td>3.33</td>
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</tr>
<tr>
<td>Team sports</td>
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<td>3.33</td>
<td>.49</td>
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<td>Individual sports</td>
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<td>3.33</td>
<td>.49</td>
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<tr>
<td>Total</td>
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<tr>
<td>Non-sporting</td>
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<td>Individual sports</td>
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<th>KO</th>
<th>F</th>
<th>P</th>
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<td>,219</td>
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<tr>
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</tr>
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<tr>
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<td></td>
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<tr>
<td>Between Groups</td>
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<td>1,094</td>
<td>3,570</td>
</tr>
<tr>
<td>Inside Groups</td>
<td>110,930</td>
<td>362</td>
<td>,306</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>113,118</td>
<td>364</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*.05 significance level

Table 5. Findings related to the difference between psychological endurance and personality characteristics according to sport branch variables.

Have higher average than the ones doing individual sports. The ones doing individual sports have higher ($t = 3,570; P < 0.05$) average than the ones not doing sports.

**Discussion**

The study that was conducted to examine the psychological endurance and personality traits of the individuals who do and do not perform sports according to various variables had these results. The results of psychological endurance and sub-dimensions of the students are considered relating the personal characteristics of students. It is seen that there is no significant difference
in terms of psychological endurance between sporting and non-sporting individuals. In such a conclusion, it can be considered that the psychological process in which the individual is involved is influential. Indeed, there are many studies that overlap with the results we have arrived. When Bulbul (2015) was researching with basketball and tennis players, the psychological endurance did not show any significance for the athlete. In addition, Sezgin [17], Sönmezer [18] and Tümülü and Recepoglu [19] have found that psychological endurance is not significant in terms of individuals. Even though the teachers are in different branches when they study the teachers and academicians. The results of the students’ personalities and sub-dimensions are taken into consideration. It was in accordance with the personal characteristics of the students of the sports science faculty and the education faculty. There was a meaningful difference in terms of the Self Discipline Sub-dimension. However, there was no significant difference in terms of the Five Factor Personality Scale’s Openness to Development, Extroversion and Compatibility subscales. Looking at the average scores of openness to development, extroversion and compatibility subscales, the average score of the sportsmen are higher than those of the non-sportsmen. However, it is seen that the average scores of self-discipline sub-dimension for non-sporting are higher than those who do sports. Some parallel works are as follows. Cameron et al [20] found that there was some consensus on the positions of players in different positions according to the results of their research. The research had 578 male ice hockey players (163 defenders, 305 attackers and 110 scorers) to determine the personality characteristics of the ice hockey athletes according to the position they played. It has been observed that offensive players are more extrovert, incomprehensible, without self-discipline and experiment-oriented than defenders and scorers. After examining the personality traits and psychological endurance levels of the students in terms of the variation of sporting years, there was no significant difference in terms of Self Discipline, Compatibility and Extroversion. However, it was found that there was a significant difference in terms of Psychological Endurance (It is observed that those who play sports between 6-10 years and 11-15 years have higher Psychological Endurance levels than those who play sports between 0-5 years), Openness to Development (It is seen that those who play sports between 6-10 years and 11-15 years have a higher level of openness to development than those who play sports between 0-5 years) and Neuroticism Sub-dimension (It is observed that those who play 0-5 years have higher levels of neuroticism than those who play between 6-10 years and 11-15 years). According to the results obtained, in terms of the increase in sporting year, it was observed that there is an increase in openness to development and the psychological endurance levels. Whereas, the increase in the level of neuroticism was observed in those with less sports years. Kurtipek [21] had a study about “The personality structures of the high school students who are training in sports and the comparison with the students in other high schools”. It shows that the results are parallel to our study in terms of scale point averages considering the year of sporting. The personality traits and the psychological endurance levels of the students from the perspective of branch variation were examined. The results of psychological endurance and personality levels and scale sub-dimensions of students are considered. Examining the personality traits and psychological endurance levels from the point of the sport branch variables, no significant difference was observed in terms of Openness to Development, Self-Discipline, Compatibility, Extroversion and Neuroticism. There was a significant difference in terms of Psychological Endurance. The psychological endurance levels of those who do not play sports are lower than those who do any individual sports or team sports. In short, it can be said that doing sports affects psychological endurance positively. Our findings of the study are parallel to the study of Salar, Hekim and Tokgöz [22]. If sportsmen who do team and individual sports in the age group of 15-18 years are regularly doing sports for 3-4 days, they feel emotionally good. In the same study, the levels of emotional well-being of the individuals who do both team and individual sports are similar.

Conclusion

It is seen that psychological endurance levels of participants are not statistically different when compared to sporting situations. Psychological endurance levels of sportsmen have a higher average than who does not do sports. The participants’ sporting situation is compared in terms of their personality characteristics. There was no statistically significant difference in the openness to development, extroversion and compatibility characteristics. It has been determined that the self-discipline average scores of the individuals who do and do not sports differ significantly from the statistically significant level. The self-discipline scores of the sportsmen have a higher average than those who do not. According to the branch variable, there was no statistically difference in the personality characteristics in terms of the difference between psychological endurance and personality traits. Participants were who did not play sports and who did individual and team sports. It is observed that psychological endurance levels differ statistically depending on the individuals not doing sports, doing individual and team sports. Individuals who perform team sports have higher average than individuals who do individual sports. Individuals who do sports have higher than those who do not. According to the sport year variable, the average scores of neuroticism, openness to development and psychological endurance differ significantly depending on the sport year. As the duration of sports in general increases, the average scores of neuroticism, openness to development and psychological endurance increase.

Conflict of interests

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

Information about the authors:

Şar Nuriye Şeyma (Corresponding author); Research assistant; http://orcid.org/0000-0003-0460-2263; nseysmasar@gmail.com;
High School of Physical Education and Sports, Mustafa Kemal University; serinyol campus Hatay/Antakya, Turkey.

Soyer Fikret; Assoc.Prof.Dr; http://orcid.org/0000-0002-8528-3622; fikretsoyer@sakarya.edu.tr; Physical Education and Sports Science Faculty, Sakarya University; Esentepe campus Sakarya/Adapazari,Turkey.

Koç Mustafa; Assoc.Prof.Dr.; http://orcid.org/0000-0002-8644-4109; mkoc@sakarya.edu.tr; Education Faculty, Psychological Counseling and Guidance Service, Sakarya University; Hendek campus, Sakarya/Hendek,Turkey.

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Exercise-induced arterial hypoxemia in aerobic and anaerobic trained athletes during incremental exercise

Selcen Korkmaz Eryılmaz1,2, Metin Polat1,2

1School of Physical Education and Sports, Cukurova University, Adana, Turkey
2School of Physical Education and Sports, Erciyes University, Kayseri, Turkey

Abstract

The purpose of this study was to examine and compare the occurrence of exercise-induced arterial hypoxemia (EIAH) in aerobic and anaerobic trained athletes during an incremental treadmill exercise test.

Material:

International level male junior skiers including ten cross-country skiers and ten alpine skiers took part in the study. All participants performed an incremental treadmill exercise test to determine maximal oxygen uptake (VO2max), and oxyhemoglobin saturation (SaO2) was continuously measured using a pulse oximetry. Maximal minute ventilation (VEmax), maximal heart rate (HRmax), ventilatory equivalent for oxygen (VE/VO2) and carbon dioxide (VE/VCO2) were determined during the last stage of the incremental exercise test. EIAH was assumed to have developed when SaO2 decreased by at least 4% (∆SaO2 ≤ −4%) from the baseline values.

Results:

VO2max, VE, maximal running speed and test time were higher in the cross-country skiers than in the alpine skiers (p < 0.01), whereas HRmax, VE/VO2 and VE/VCO2 showed similar values in both group (p > 0.05). All the athletes in both groups exhibited EIAH. SaO2 was significantly decreased from 97.5 ± 0.9% at rest to 89 ± 2% at exhaustion in alpine skiers and from 97.8 ± 0.7% at rest to 88.1 ± 2.4% at exhaustion in cross-country skiers (p < 0.001). There were no differences in resting and lowest %SaO2 values between two groups (p > 0.05).

Conclusions:

EIAH may occur in endurance athletes as well as anaerobic trained athletes. Well-trained athletes who have different aerobic fitness levels may exhibit similar EIAH during the incremental maximal exercise.

Keywords:
desaturation in athletes, oxyhemoglobin saturation, pulse oximetry, cross-country skiers, alpine skiers.

Introduction

Earlier studies found that many healthy athletes experience exercise induced arterial hypoxemia in a normoxic environment [1]. This finding is indicating that the lungs may be a limiting factor [2]. Exercise-induced arterial hypoxemia (EIAH) is known to occur in be approximately 50% of endurance athletes and developed especially at high exercise intensities [2-4]. EIAH is manifested as a reduced partial pressure of arterial oxygen (PaO2) or as a reduced saturation of hemoglobin in some athletes [2]. PaO2 is reduced below resting levels due to an excessive widening of the alveolar to arterial oxygen difference. A diffusion limitation and inadequately hyperventilation have been cited as the cause of the excessively widened arterial oxygen difference during exhaustive exercise [2, 5]. Reductions in arterial oxyhemoglobin saturation (SaO2) below resting levels are usually due to a combination of a reduction in PaO2, metabolic acidosis and increasing body temperature induced shifts to the right in oxygen-haemoglobin dissociation curve [2, 5].

SaO2, which depends mainly on gas exchange and characterized by the oxygen-hemoglobin dissociation curve, is a determinant of the oxygen supply to contracting skeletal muscle. Decreases in arterial content of oxygen result in decreases in SaO2 and, subsequently, systemic oxygen transport and maximal oxygen uptake are negatively affected [6]. EIAH contributes to local muscle fatigue [7]. Development of EIAH has been observed to be more common among athletes with high maximal oxygen uptake (VO2max > 60 ml/kg/min) [2-4, 6, 8]. It has been shown that preventing reductions in SaO2 via a small increase in the fraction of inspired oxygen (FIO2) increased VO2max and exercise time to exhaustion in most subjects [6, 9].

EIAH defined as a decrease in SaO2 of greater than 4% from rest [2]. On the other hand, EIAH can be classified as mild (93–95% SaO2), moderate (88–93% SaO2), and severe (< 88% SaO2) [2]. The mechanism underlying of EIAH are still unclear. Several mechanisms have been proposed to explain the phenomenon of EIAH, including inadequate alveolar hyperventilation related to training adaptation, ventilation-perfusion mismatch (VA/Q), oxygen diffusion limitation based on low pulmonary capillary blood transit time or interstitial edema and intra- and extra-pulmonary shunts or an interaction among these factors [2, 10, 11].

Previous research using pulse oximetry indicated that EIAH is more common in aerobic trained individuals and not appear in untrained healthy males [3, 4, 12]. Studies examining EIAH have primarily focused on aerobic trained individuals [4, 8, 12-18]. Interestingly, no studies have examined the EIAH in anaerobic trained athletes. The purpose of this study was to examine and compare the occurrence of exercise-induced arterial hypoxemia in aerobic and anaerobic trained athletes during an incremental treadmill exercise test.
Material and methods

Participants

International level twenty-two male junior skiers including ten cross-country skiers (mean ± SD; age 17.2 ± 1.7 years, height 170.2 ± 5.2 cm, weight 60 ± 6.9 kg) and ten alpine skiers (mean ± SD; age 17.2 ± 2.2 years, height 175.6 ± 3.7 cm, weight 67.3 ± 9.1 kg) from the Turkey national team took part in the study. Erciyes University Medical Faculty Ethics Committee approved the study (217/554). All testing procedures were fully explained, and written informed consent was obtained for each subject. All measurements took place at the High Altitude and Sports Science Research and Implementation Center at Erciyes University.

Incremental exercise test

Incremental exercise test was performed on a motorized treadmill (h/p/Cosmos Quasar med, Nussdorf-Traunstein, Germany). Oxygen uptake (VO\textsubscript{2}), carbon dioxide output (VCO\textsubscript{2}) and minute ventilation (VE) were measured online using a breath-by-breath cardiopulmonary exercise testing system (Quark PFT Ergo, Cosmed Srl, Rome, Italy). Before each test, ambient conditions were measured and the gas analyzers and turbine flowmeter were calibrated with known certified gas concentrations (16 %O\textsubscript{2}, 5 %CO\textsubscript{2}, and balance N\textsubscript{2}) and a 3 L calibration syringe, respectively, following the manufacturer’s instructions. During the incremental testing period, heart rate (HR) was monitored continuously using a wireless HR monitor (S610i, Polar, Finland) and was synchronized to ventilatory signals. Breath-by-breath data was smoothed using a five-step average filter and then reduced to 15 s stationary averages.

To make sure the athletes were properly warmed up, prepared, and accustomed to the treadmill, each athlete had to warm up for 6 min at their own pace. Then the athletes were allowed to stop and stretch for about 3 min. Following the warm-up, athletes started running at 7 km/h with speed increments of 1 km/h (at constant 5% incline) every minute until they could no longer keep pace. The athletes were instructed to run until voluntary exhaustion, and given strong verbal encouragement throughout the test to elicit their best performance.

The VO\textsubscript{2max} was defined as the highest 15 s VO\textsubscript{2} value reached during the incremental test. Achievement of VO\textsubscript{2max} was considered as the attainment of at least two of the following criteria: 1) a plateau in VO\textsubscript{2} despite increasing speed, 2) a respiratory exchange ratio (VCO\textsubscript{2}/VO\textsubscript{2}) above 1.10, and 3) a HR within 10 beats per minute of age-predicted maximum HR (220 – age). The VO\textsubscript{2max} value was expressed as a relative value (milliliters per minute per body mass; ml kg⁻¹min⁻¹). Test time was recorded as the time from the start of the run until the point of exhaustion. Ventilatory equivalent for O\textsubscript{2} (VE/VO\textsubscript{2}) and CO\textsubscript{2} (VE/VCO\textsubscript{2}), maximal minute ventilation (VE\textsubscript{max}) and maximal respiratory exchange ratio (RER\textsubscript{max}) were expressed as the highest 15 s average value obtained during the last stage of the incremental exercise test.

SaO\textsubscript{2} was assessed continuously and recorded every 15 s during the incremental exercise test, using a finger pulse oximeter (Spiropal 6MWT; COSMED, Rome, Italy). For most accurate readings, the sites were vigorously cleaned with alcohol and gauze pads. EIAH was assumed to have developed when SaO\textsubscript{2} decreased by at least 4 % (ΔSaO\textsubscript{2} ≤ -4 %) from the baseline values [2].

Statistical analyses

Data are reported as means ± standard deviation (SD). Statistical significance was accepted at p < 0.05. The normality of the data was examined by assessing the Shapiro-Wilk test on all measured variables. SaO\textsubscript{2} data were not normally distributed and so comparisons between the groups were made using the Whitney-U test. As the other data showed normal distribution, the differences in measures between groups were evaluated by unpaired t-test. To allow a better interpretation of the results, effect sizes were also calculated using Cohen’s d [19]. Effect sizes were interpreted as negligible (d ≥ 0.2), small (0.2 ≤ d ≤ 0.5), medium (0.5 ≤ d ≤ 0.8) or large (0.8 ≥ d). IBM SPSS 21 software (IBM SPSS Statistics 21 Inc. Chicago, IL) was used for the statistical analysis.

Results

Table 1 shows the athletes’ responses to incremental test of the alpine skiers and cross-country skiers.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Alpine skiers</th>
<th>Cross country skiers</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO\textsubscript{2max} (L/dak)</td>
<td>52.6 ± 5.6</td>
<td>66.8 ± 4.3*</td>
<td>0.001</td>
<td>3</td>
</tr>
<tr>
<td>VE\textsubscript{max} (L/dak)</td>
<td>142.6 ± 5.1</td>
<td>157.8 ± 12.4*</td>
<td>0.003</td>
<td>1.69</td>
</tr>
<tr>
<td>Test time (min)</td>
<td>7.6 ± 0.6</td>
<td>10.3 ± 0.6*</td>
<td>0.001</td>
<td>4.74</td>
</tr>
<tr>
<td>Speed\textsubscript{max} (km h⁻¹)</td>
<td>14.3 ± 0.6</td>
<td>17 ± 0.6*</td>
<td>0.001</td>
<td>4.74</td>
</tr>
<tr>
<td>RER\textsubscript{max}</td>
<td>1.2 ± 0.02</td>
<td>1.1 ± 0.03*</td>
<td>0.014</td>
<td>4.13</td>
</tr>
<tr>
<td>HR\textsubscript{max} (beat min⁻¹)</td>
<td>210 ± 14.2</td>
<td>207 ± 11.3</td>
<td>0.57</td>
<td>0.25</td>
</tr>
<tr>
<td>VE/V\textsubscript{O2}</td>
<td>40.7 ± 4.17</td>
<td>38.8 ± 5</td>
<td>0.36</td>
<td>0.44</td>
</tr>
<tr>
<td>VE/V\textsubscript{cCO2}</td>
<td>34.5 ± 2.8</td>
<td>33.6 ± 3.57</td>
<td>0.53</td>
<td>0.3</td>
</tr>
<tr>
<td>ΔSaO\textsubscript{2} (%)</td>
<td>8.5 ± 1.7</td>
<td>9.3 ± 2.8</td>
<td>0.75</td>
<td>0.36</td>
</tr>
</tbody>
</table>

Values are mean ± standard deviation. * Significantly different from alpine skiers. VO\textsubscript{2max} = maximal oxygen uptake, RER\textsubscript{max} = maximal respiratory exchange ratio, Speed\textsubscript{max} = maximal running speed, HR\textsubscript{max} = maximal heart rate, VE/V\textsubscript{O2} = ventilatory equivalent for O\textsubscript{2} at maximal exercise intensity, VE/V\textsubscript{CO2} = ventilatory equivalent for CO\textsubscript{2} at maximal exercise intensity, ΔSaO\textsubscript{2} = difference between rest and maximal exercise values of oxyhemoglobin saturation.
treadmill exercise tests. VO\textsubscript{2max}, VE, maximal running speed and test time were higher in the cross-country skiers than in the alpine skiers (p < 0.01). There were no significant differences between the two groups in HR\textsubscript{max}, VE/VO\textsubscript{2} and VE/VCO\textsubscript{2} (p > 0.05). RER\textsubscript{max} was higher in alpine skiers than in cross-country skiers (p < 0.01) (Table 1). All the athletes in both groups exhibited EIAH (as defined by ΔSaO\textsubscript{2} ≤ −4 %) (Figure 1). By comparison there were no differences in resting % SaO\textsubscript{2} values and delta of SaO\textsubscript{2} (ΔSaO\textsubscript{2}, difference between rest and maximal exercise values) between two groups (p > 0.05) (Table 1). SaO\textsubscript{2} was significantly decreased from 97.5 ± 0.9% at rest to 89 ± 2% at exhaustion in alpine skiers (p < 0.001, d = 5.78) and from 97.8 ± 0.7% at rest to 88.1 ± 2.4% at exhaustion in cross-country skiers (p < 0.001, d = 5.78). No significant differences were observed in the lowest % SaO\textsubscript{2} values occurred at or near maximal exercise intensity between the two groups (p > 0.05, d = 0.43). EIAH was begun at 71.2 ± 16.1% of maximal exercise intensities in cross-country skiers and at 73.8 ± 12.2% of maximal exercise intensities in alpine skiers. There were no significant differences in the exercise intensity of began to experience EIAH between two groups (p > 0.05, d = 0.19).

**Discussion**

EIAH has been reported to more often occur in aerobic trained athletes who have a high VO\textsubscript{2max} [2-4, 6]. We questioned whether EIAH occurs in anaerobic trained athletes who have lower VO\textsubscript{2max} than aerobic trained athletes. Our results indicated that EIAH occurs in both aerobic and anaerobic trained athletes with varying aerobic capacities. VO\textsubscript{2max}, VE, maximal running speed and test time were higher in the cross-country skiers than in the alpine skiers, reflecting the cross-country skiers have higher aerobic fitness levels. On the other hand, lowest SaO\textsubscript{2} values were not significant difference between in two groups during the incremental exercise test. These findings suggest that although cross-country skiing and alpine skiing require different physical demands and aerobic fitness levels, they may exhibit similar EIAH during the incremental treadmill exercise.

Previous studies have demonstrated that inadequate hyperventilation, pulmonary diffusion limitation and ventilation-perfusion mismatch contributed to EIAH [2, 5, 10, 11]. Most studies have reported that EIAH can occur in only endurance trained individuals with VO\textsubscript{2max} greater than 60 ml kg\textsuperscript{-1} min\textsuperscript{-1} [2-4, 6, 8]. It has been also demonstrated that training-induced increases in VO\textsubscript{2max} were accompanied by EIAH [1, 20]. Interesting is the observation that EIAH is not occur in all highly trained athletes. Powers et al. studied the prevalence of EIAH using pulse oximetry in 68 males with varying fitness levels during incremental cycle exercise test. In their study, 52% of the highly trained subjects developed significant EIAH, whereas none of the untrained or moderately trained subjects demonstrated EIAH [4]. We found that EIAH occurred in all athletes consist of both cross-country skiers and alpine skiers. Anaerobic power is the best predictor of alpine skiing performance [21]. Traditionally, training programs for alpine skiers include anaerobic exercises such as resistance training, speed, change of direction and plyometric training [22, 23]. On the other hand, cross-country skiing performance relies heavily on the aerobic capacity [24]. Aerobic endurance training has always been the major component of training program in cross-country skiing [25, 26]. SaO\textsubscript{2} values were not significantly difference between in cross-country skiers and alpine skiers; this may have been due to fact that both groups consisted of the athletes trained regularly. Studies examining EIAH have primarily focused on endurance athletes. However, to our knowledge, there is no previous study examining the occurrence of EIAH in anaerobic trained athletes. Hence, our data represent a rather novel finding that could be of considerable importance for showing the occurrence of EIAH in sports with different physiological demands.

Pulse oximetry has been used extensively the literature to determine EIAH and was deemed a valid and reliable tool to monitor %SaO\textsubscript{2} continuously during exercise [27-

![Figure 1](image-url)

**Figure 1.** Changes in the percent of oxyhemoglobin saturation (%SaO\textsubscript{2}) for each subject at different percentages of exercise time during incremental exercise in (A) cross-country skiers and (B) alpine skiers.
Previous research using pulse oximetry indicated that %SaO\textsubscript{2} values fall in the range between 84% and 93% [6, 8, 13, 30, 31]. Similar changes were observed in our study with the % SaO\textsubscript{2} decreased in the range between 85% and 92% during incremental exercise test. The %SaO\textsubscript{2} decreased by approximately 9% from rest in both groups. Likewise, Alis et al. have reported an 8.25% decrease in SaO\textsubscript{2} from rest during incremental treadmill exercise test [12]. Powers et al shown the difference % SaO\textsubscript{2} between resting and at the 100% VO\textsubscript{2max} ranged from 4% in one subject to 16% in another [31]. On the other hand, it appear that the mean SaO\textsubscript{2} values in our study are lower than have been reported in some previous studies [14-17] yet are similar to those from others [6, 8, 30, 31]. The degree of EIAH is affected the muscle mass engagement in the exercise and the exercise modality [16, 32]. Previous studies have shown a greater drop in the SaO\textsubscript{2} at both maximal and sub-maximal exercise during treadmill running compared with ergometer cycling [16, 33]. In the present study, we used incremental treadmill exercise while some studies used incremental exercise on cycle ergometers that have displayed higher SaO\textsubscript{2} values during exercise and the exercise modality [16, 33]. The degree of EIAH is affected the muscle mass engagement in the exercise and the exercise modality [16, 32]. Previous studies have shown a greater drop in the SaO\textsubscript{2} at both maximal and sub-maximal exercise during treadmill running compared with ergometer cycling [16, 33]. In the present study, we used incremental treadmill exercise while some studies used incremental exercise on cycle ergometers that have displayed higher SaO\textsubscript{2} values than our values. Galy et al., Amann et al., Vogiatisiz et al., Gaston et al. and Gratoloup et al. using pulse oximetry, have shown reductions in %SaO\textsubscript{2} ranging between 94% and 91% during the cycle ergometer test to exhaustion in the endurance athletes [13-17]. Differences of exercise modality and protocol types used may help to explain the differences in SaO\textsubscript{2} measured.

During the incremental exercise, EIAH begins to occur even in submaximal exercise in some subjects and usually peaks at or near maximal exercise intensity [3, 18, 31]. EIAH in many trained athletes may begin at moderate intensity workloads due to a widened alveolar-to-arterial oxygen difference and inadequate hyperventilation [2, 3, 18]. Athletes were considered to have developed EIAH when SaO\textsubscript{2} decreased by at least 4 % (ΔSaO\textsubscript{2} ≤ − 4 %) from the baseline values [2]. In this study, we followed the time course of SaO\textsubscript{2} from rest to intensities at exhaustion during the incremental treadmill exercise test. EIAH developed at the about 71 and 73 % of maximal exercise intensities for the cross-country skiers and alpine skiers, respectively, and SaO\textsubscript{2} decreased over time with increasing intensity. There were no difference in the exercise intensity of began to experience EIAH between two groups. The lowest % SaO\textsubscript{2} occurred at or near maximal exercise intensity in both group with no significant difference between cross-country skiers and alpine skiers. Similar to our findings, Powers et al. shown that SaO\textsubscript{2} begins to fall at exercise intensities above 70% VO\textsubscript{2max} with the greatest decline occurring at intensities greater than 90% VO\textsubscript{2max} [31]. Rice et al. indicated that EIAH occurred at approximately 40% VO\textsubscript{2peak} and inadequate hyperventilation is the most likely mechanism at low exercise intensities with a smaller contribution from ventilation-perfusion mismatch [18].

Conclusions

The results of this study showed that EIAH may occur in endurance athletes with high aerobic capacity as well as anaerobic trained athletes. EIAH showed similar values between cross-country skiers and alpine skiers, which may have been due to both groups of athletes who trained regularly. These findings suggest that well-trained athletes who have different aerobic fitness levels may exhibit similar EIAH during the incremental maximal exercise.

Financing

No financial support was received for the investigation.

Conflict of interests

The authors declare that there is no conflict of interests.

References


Repercussions of behavior of cooperative teacher’s on health and attractiveness of Tunisian student teachers

Wadii Zayed1ABCD, Naila Bali 2BC, Nizar Souissi 3AD

1High Institute of Sport and Physical Education, University of Gafsa, Gafsa, Tunisia
2,3High Institute of Sport and Physical Education, University of Manouba, Manouba, Tunisia

Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract
Purpose: This study was to explore the repercussions of the cooperative teacher’s (CT) behavior on health and attractiveness of Physical Education student teachers (PE-ST) believed to be important for a successful preparatory traineeship and training device in the professional life. The CT is considered a person of alternation between academia and training, contributing to the formation by advice and support. The Cooperative Teacher’s must have a style; develop a training contract, master interview techniques and make evaluation. However, questions remain as to how well Higher Education Institutions prepare the Student Teachers to meet the challenges and requirement of work environments.

Material: Data were collected with 302 student teachers (202 males and 100 females) before professional training. A descriptive/exploratory methodology based on a questionnaire consisting of eighteen questions was used. The value of Cronbach alpha index is 0.857.

Results: globally supported the hypotheses. Male and female student teachers in the internship shared several perceptions. However, significant differences emerged. Student teachers perception of CT behavior and supports developed relatively professional skills, personal life as well as the feeling of discomfort which can lead to work stoppage. However, the repercussion of CT behavior on health and attractiveness was significant. The negative relationship between actors in the professional life and several aspects of CT behavior are provided. In addition, data are provided indicating that overall there are more similarities than differences between male and female student teachers students over a response number. Data also suggest that females who participate in the internship may be at risk for discomfort and anxiety problems.

Conclusions: This study will encourage Teacher’s to reflect on their own behaviors, support practices and to include them in the process of educational development.

Keywords: Physical Education, traineeship, tutor, accompanying practices, discomfort.

Introduction
Studies on professional skills have received significant attention in the last decade. However, questions remain as to how well Higher Education Institutions prepare the Student Teachers (PE-STs) to meet the challenges and requirement of work environments [1, 2]. Concerns remain that the accomplishment practices may not be equipping (PE-STs) with the key skills needed to confront real teaching problems [3]. Perez-Roux [4] and Bali [5] claimed that the cooperative Teachers (CT) are contributing to their integration in the professional life. The CT is considered a person of alternation between academia and training, contributing to the formation by advice and support [6, 7] . CT must have a style; develop a training contract, master interview techniques and make evaluation [8]. This is corroborated by a number of studies in different disciplines. For instance, Mella [9] and Hasan [10] found that the accomplishment is a function of following a PE-ST and to walk with them for a period in order to exchange about them action, thinking together and evaluate it. Kosnik [11] found that internship can be a stressful moment and anxiety provoking. This is affirmed by Desbiens et al. [12] that during this time the PE-STs will attempt to meet unrealistic expectations. This experience may become a source of discomfort, exhaustion and confusion [11, 13]. It is against this backdrop that earlier [14] averred that the current context of education in what will immerse future graduates is certainly not positive.

Thus, university education and the workplace training need to identify different working patterns that CT might engage in and ensure that they possess employability skills that meet the employer’s requirements [2]. Boutin and Camaraire [15] claimed that HEIs should develop the criteria for selecting EA. Faingold [16] found that the important points of training are the quality of discussion, listening, the type of questions and the relationship between PE-ST and CT. However, Boutet [17] opined that the characteristics of an effective EA: experience, self-confidence, openness to theoretical contributions and reflection, coherence and acceptance to be questioned. Further, in the case of interaction between PE-ST and CT in post-lesson interviews, Trohel et al. [18] described each actor involved in these interactions. They noticed that the CT is not trained in the role of tutor; they act according to their professional experience in teaching physical education. Beau-Antoine and al. [19], also, studied the characteristics of the CT’s professional activity and try to identify the difficulties encountered during PE-ST supervision. They found that tutoring is a difficult function to perform because the CT is not well trained. Earlier [8] assumed that the CT and PE-ST exchange academic and practical knowledge to guide the verbalization of PE-ST’s
action by asking questions that they have put in place. He suggests that CTs recognize the existence of two types of knowledge and try to exploit them optimally. This is proved by Vandercleyen and al. [20] that the success of training depends on the type of intervention with PE-ST. They highlight the dual role of EA, to be able to explain their own pedagogical concepts to PE-ST and help them to clarify their thoughts, actions and decisions. Boutet and Pharand [21] noted that PE-ST want to be guided. They want to take the initiative and accept critique. Rayou and Ria [22] state that PE-ST has a clear awareness of the reasons of failure or success in their interventions.

In Tunisia, university aims is to help PE-STs to integrate professional life. We answered through this research the following questions are: the behaviors of the CT transformed in to discomfort? What repercussions do they have PE-STs?

**Material and methods**

**Participants**

The participants in this study are 302 PE-STs (202 males and 100 females) from total 314 PE-STs studying in the Higher Institute of Sport and Physical Education (ISSEP) Tunis (there are only 3 ISSEP in Tunisia each has its own teaching practice modality). All participants in this study were volunteers’. They were recruited from a single Higher Institute of Sport (Tunis). The group of participants consisted of the third year PE-ST. All were aged between (22 ± 1 years) registered in an introductory practicum to professional training in Tunisia (introductory practicum applied to pedagogy), that is, ended in the last year, by the Fundamental License of Physical Education. This activity has serves as an introduction to professional life. The activity lasts two semesters: four hours per week on Tuesday or Thursday for a cumulative total time of 116 hours of teaching. Participants are not paid to participate in the research. They were not informed about the purpose and conception of the research.

**Table 1: Sample of Tunisian PE-ST**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>PE-ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questioning</td>
<td>302</td>
</tr>
<tr>
<td>Males questioned</td>
<td>202</td>
</tr>
<tr>
<td>Females questioned</td>
<td>100</td>
</tr>
<tr>
<td>Aged</td>
<td>Between 20 and 23 years</td>
</tr>
<tr>
<td>Level of study</td>
<td>BAC +3</td>
</tr>
</tbody>
</table>

Three main reasons justified the choice of this sample. First, this study is part of the professional training of PE-ST. The CT is considered an person intermediate between the university and the training environment, which will allow us to recognize the nature of PE-ST preoccupation of accompaniment practice of CT. Second, there is a social difference between the academic and the professional. This allowed us to hypothesize that this difference can be translated into shock and preoccupation. Third, this study is part of the academic program, which enabled us to hypothesize the preoccupation between PE-ST and CT’s accompaniment practices to spoil PE-ST learning. Our work sample meets these three parameters as indicated in the table N° 1 below.

**Measure**

This quantitative study explored the PE-STs conceptions about professional training. It identified the repercussions of the cooperative teacher’s behavior on health and attractiveness of student teachers. We used the questionnaire consisting of two dimensions in which we have grouped the different types of questions to clarify and give PE-STs the opportunity to share their preoccupation such as CT behavior repercussions. The questions focus on the preoccupation of PE-STs of the CT accompaniment practices after the internship. Participants responded to 18 items on a 4-point Likert-type scale ranging from 4 from 1 (never) to 4 (usually) that were tested in a pilot study. Following the quantitative responses obtained from the questionnaire, we analyzed these data using the statistical software SPSS 16 (Statistical Package for social science).

**Procedures**

First of all, the permission was granted by the Director of ISSEP Tunis and teachers to realize the current study. Then, the researcher collected the PE-STs, explained the stages of the study and the different questions in the questionnaire for PE-STs, oversaw the privacy and uniqueness of answers. In this study, we presented to the PE-STs the different steps of this research to know the phases of the questionnaire. PE-STs were not informed of the purpose and design of the research. PE-STs are questioned by allowing them the freedom to respond, they can express themselves at their ease. Our data was analyzed using a statistic constant. By SPSS 16 (Statistical Package for social science) program. The following variables were calculated using descriptive statistic: frequencies, percentages, and Cronbach alpha index. Assessment of statistical significance between male and female student teachers was performed using a Chi-square. Correlation between CT behavior on health and attractiveness of PE-ST was applied. A p value less than 0.05 was considered statistically significant.

**Result**

**The CT behavior**

Eight items emerged from the data collected and were illustrated in Table 2: Item 1) CT gets angry, Item 2) CT verbally assaults PE-ST, Item 3) CT insults PE-ST for the mistakes, Item 4) CT does not behave the same attitude with PE-ST, Item 5) CT sends a way that demoralize, Item 6) CT does not congratulate PE-ST, Item 7) CT emits PE-ST negative remarks, Item 8) CT undervalue the work of PE-ST.

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The dimension under the “behavior” of CT includes eight items: Item 1: “CT gets angry” (S/U =32.8/8.9 %); Item 2: “CT verbally assaults PE-ST” (S/U =16.6/6 %); Item 3: “CT insults PE-ST for the mistakes” (S/U =20.2/16.6 %); Item 4: “CT does not behave the same attitude with PE-ST” (S/U =15.2/10.9 %); Item 5: “CT
The CT behavior repercussions

Life repercussions (LR)

Three items emerged from the data collected and were illustrated in Table 3: Item 1) repercussions of the problems on your personal life, Item 2) Anxiety relatives about your problems in training, item 3) At night, your work prevents you from sleeping.

The "PE-ST life repercussions" includes three items: Item 1: "repercussions of the problems on your personal life" (Sometimes/Usually = 25.5/16.2%); Item 2: "Anxiety relatives about your problems in training" (S/U = 30.8/13.9%); Item 3: "At night, your work prevents you from sleeping" (S/U = 34.1/24.2%).

Data supported the positive correlation between all the CT behavior and the PE-ST life repercussions. However, "the work prevents PE-ST from sleeping" was not significantly associated with "the differentiation of CT behavior from PE-STs" (r=0.022; p=0.353) (see Table 4 for details).

Health repercussions (HR)

Three items emerged from the data collected and were illustrated in Table 4: item 1) consult a doctor, item 2) a psychologist, item 3) an unanticipated leave.

The "PE-ST Health repercussions" includes three items: Item 1: "consult a doctor" (S/U = 8.3/4.6%); Item 2: "Consult a psychologist" (S/U = 7.6/5.6%); Item 3: "An unanticipated leave" (S/U = 20.2/16.6%).

No significant gender differences were found for PE-ST consult a doctor (X² = 0.658, P = 1.606), PE-ST a psychologist (X² = 0.415, P = 2.854.) and an unanticipated leave (X² = 0.389, P = 3.016.).

Correlations supported the positive, significant relationship between all the CT behavior and the PE-ST Health. However, "the consult a doctor" was not significantly associated with CT demoralizes (r=0.093; p=0.053) and consult a psychologist was only not significantly associated with the negative remarks emitted by CT (r=0.44; p=0.221). An unanticipated leave was not significantly related with CT congratulations; negative remarks and the differentiation of behavior from PE-STs (see Table 6 for details).

The attractiveness of the profession repercussions (AR)

Four items were identified from the data collected and illustrated in Table 7: item 1) Having considered another professional orientation, item 2) Having considered a work stoppage, item 3) The feeling of strong anger, the urge to cry, item 4) Having thought to be in a bad situation.

The " The attractiveness of the profession repercussions " of PE-ST from CT includes five items: Item 1: "Consider another professional orientation " (S/U = 13.9/8.6%); Item 2: " Having considered a work stoppage" (S/U = 33.1/25.5%); Item 3: " The feeling of strong anger, the urge to cry" (S/U = 27.5/22.5%); Item 4: " Having thought to be in a bad situation" (S/U = 32.8/24.2%); Item 5: " The attractiveness of the profession repercussions " (S/U = 32.8/24.2%).

---

Table 2: The different items of the CT behavior

<table>
<thead>
<tr>
<th>Items</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Usually (%)</th>
<th>X²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CT gets angry</td>
<td>37.7</td>
<td>20.5</td>
<td>32.8</td>
<td>8.9</td>
<td>0.21</td>
<td>9.728</td>
</tr>
<tr>
<td>2. CT verbally assaults PE-ST</td>
<td>63.2</td>
<td>14.2</td>
<td>16.6</td>
<td>6</td>
<td>0.341</td>
<td>3.346</td>
</tr>
<tr>
<td>3. CT insults PE-ST for the mistakes</td>
<td>32.8</td>
<td>30.5</td>
<td>20.2</td>
<td>16.6</td>
<td>0.627</td>
<td>1.747</td>
</tr>
<tr>
<td>4. CT don’t behave the same attitude with PE-ST</td>
<td>49.3</td>
<td>23.8</td>
<td>15.9</td>
<td>10.9</td>
<td>0.766</td>
<td>1.145</td>
</tr>
<tr>
<td>5. CT sends a way that demoralizes PE-ST</td>
<td>33.4</td>
<td>29.1</td>
<td>25.8</td>
<td>11.6</td>
<td>0.991</td>
<td>0.108</td>
</tr>
<tr>
<td>6. CT does not congratulate PE-ST</td>
<td>32.8</td>
<td>24.5</td>
<td>27.2</td>
<td>15.6</td>
<td>0.637</td>
<td>1.700</td>
</tr>
<tr>
<td>7. CT emits negative remarks</td>
<td>14.9</td>
<td>27.5</td>
<td>35.8</td>
<td>21.9</td>
<td>0.334</td>
<td>3.403</td>
</tr>
<tr>
<td>8. CT undervalue the work of PE-ST</td>
<td>32.5</td>
<td>21.9</td>
<td>32.8</td>
<td>15.6</td>
<td>0.097</td>
<td>6.331</td>
</tr>
</tbody>
</table>

Table 3: The different items of life repercussions

<table>
<thead>
<tr>
<th>Items</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Usually (%)</th>
<th>X²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Repercussions of the problems on your personal life</td>
<td>33.1</td>
<td>25.2</td>
<td>25.5</td>
<td>16.2</td>
<td>0.438</td>
<td>2.712</td>
</tr>
<tr>
<td>2. Anxiety relatives about your problems in training</td>
<td>27.5</td>
<td>27.8</td>
<td>30.8</td>
<td>13.9</td>
<td>0.106</td>
<td>6.108</td>
</tr>
<tr>
<td>3. At night, your work prevents you from sleeping</td>
<td>19.2</td>
<td>22.5</td>
<td>34.1</td>
<td>24.2</td>
<td>0.019</td>
<td>9.926</td>
</tr>
</tbody>
</table>
Table 4. Correlations between the CT behavior and the life repercussions

<table>
<thead>
<tr>
<th>Items</th>
<th>Pearson Correlation</th>
<th>LR 1</th>
<th>LR 2</th>
<th>LR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoppage “ (S/U =15.9 /4.6 %); Item 3: “ The feeling of strong anger, the urge to cry” (S/U =32.1 /14.6 %); Item 4: “ Having thought to be in a bad situation “ (S/U =32.5 /13.9%).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant gender differences were found for PE-ST Consider another professional orientation (X2 = 8.66, P = 0.732), having considered a work stoppage (X2 = 0.227, P = 4.339), CT remains in the classroom (X2 = 0.501, P = 2.362), having thought to be in a bad situation (X2 = 0.909, P = 0.544). Correlations supported the positive, significant relationship between all the CT behavior and the</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. The different items of health repercussions

<table>
<thead>
<tr>
<th>Items</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Usually (%)</th>
<th>X2</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Consult a doctor</td>
<td>74.8</td>
<td>12.3</td>
<td>8.3</td>
<td>4.6</td>
<td>0.658</td>
<td>1.606</td>
</tr>
<tr>
<td>2. Consult a psychologist</td>
<td>77.5</td>
<td>9.3</td>
<td>7.6</td>
<td>5.6</td>
<td>0.415</td>
<td>2.854</td>
</tr>
</tbody>
</table>

Table 6. Correlations between the CT behavior and the PE-ST Health repercussions

<table>
<thead>
<tr>
<th>Items</th>
<th>Pearson Correlation</th>
<th>HR 1</th>
<th>HR 3</th>
<th>HR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consider another professional orientation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Consider stopping work in an internship</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Have The feeling of strong anger, the urge to cry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Have thought to be in a bad situation at the internship</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7. The attractiveness of the profession repercussions

<table>
<thead>
<tr>
<th>Items</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Usually (%)</th>
<th>X2</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Consider another professional orientation</td>
<td>54.6</td>
<td>22.8</td>
<td>13.9</td>
<td>8.6</td>
<td>0.866</td>
<td>0.732</td>
</tr>
<tr>
<td>2. Consider stopping work in an internship</td>
<td>58.9</td>
<td>20.5</td>
<td>15.9</td>
<td>4.6</td>
<td>0.227</td>
<td>4.339</td>
</tr>
<tr>
<td>3. Have The feeling of strong anger, the urge to cry</td>
<td>31.1</td>
<td>22.2</td>
<td>32.1</td>
<td>14.6</td>
<td>0.000</td>
<td>22.00</td>
</tr>
<tr>
<td>4. Have thought to be in a bad situation at the internship</td>
<td>23.2</td>
<td>30.5</td>
<td>32.5</td>
<td>13.9</td>
<td>0.909</td>
<td>0.544</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (1-tailed).
* . Correlation is significant at the 0.05 level (1-tailed).
attractiveness of the profession. However, having

table considerations another professional orientation was only

significantly associated with CT demoralizes (r=0.117;
p=0.021), congratulations (r=0.148; p=0.005) and the
differentiation between the CT’s and the PE-STs behavior
(r=0.099; p=0.043) (see Table 8 for details).

Discussion

The role of CT is to provide a training quality in
terms of accompaniment for students trainees that meets
the challenges and requirements of work environment
as a whole, which have not been recognized. Thus, the
purpose of this research was to identify and analyze the
repercussions of CT behavior on health and attractiveness
of student teachers (PE-STs) (assiduity, attitude and
valorization) which are believed to be important for a
successful Tutoring and training device in the workplace.

According to our results, Paquay [23] suggests a
personal and relational development between CT and
PE-STs. He proposed to do courses or workshops and
developing skills to express themselves, communicate,
analyze relationships, develop listening, to lead a group
and improve self-confidence. Buyse et al. [24] emphasize
the importance of establishing a positive relationship
between teacher and students in the classroom. According
to Hamre and Pianta [25], PE-ST must make efforts to
stabilize the classroom climate. They add that the teacher
must establish a relationship of trust with students by
using effective classroom management practices. At the
welcome of the PE-STs, Zayed and al. [26] opined that
the major concern of CTs is the PE-ST behavior. Monfette
and Grenier [27] suggest that we let PE-ST take charge of
groups, some CT offered self-development opportunities
to PE-STs by helping them to develop their independence
and their ability to adapt.

Our results showed a discomfort, stress, distress,
exhaustion in the workplace. In a period of professional
integration, Ndorera and Martineau [28] report that
stress in work environment affects the interest of PE-
ST in the teaching profession. Gaudreau et al. [29]
adds that inappropriate behavior in the work context has
an effect on the teacher’s effectiveness and makes him
vulnerable to stress and burnout. In this sense, Gilbert
and al. [30] suggests understanding the various origins
of this situation. Suffering indices are many; they are
the cause of the abandonment of the profession. Distress
and exhaustion are indicators of the pain experienced by
teachers. Houffort & Sauvé [31] found that depression and
burnout are perceived as a problem of the organizational
environment. This is shown by Doudin [32] who proved
the existence of the problem of stress and exhaustion. He
confirms the presence of distress among teachers in Europe.
Doudin [32] adds that the European teachers are most
affected by stress at work. He concludes that depression
is a deterioration of the well-being of the individual.
However, Gilbert [30] cleaned that violence is the cause
of the suffering of teachers in the workplace. She can take
a physical, verbal form of the order of intimidation. She
confirms that teachers in Quebec (17.1%) are the second
most professions affected by violence in the workplace.

Our results, Also, showed health problems among
teachers. Bauer and al. [33] noted that in Germany there are
healths problems among teachers and that psychological
disorders are the major cause of abandonment. They
confirm that teachers play an important role in the training
of students. They think that the profession is far from
being recognized by society. In this sense, Mukamurera
[34] adds that the teaching profession suffers from a lack
of political and social awareness.

The attractiveness of the profession can be provided by

Table 8. Correlations between the CT behavior and the PE-ST attractiveness of the profession repercussions

<table>
<thead>
<tr>
<th>Items</th>
<th>AR 1</th>
<th>RETRq8</th>
<th>RETRq9</th>
<th>RETRq10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correlation</td>
<td>Correlation</td>
<td>Correlation</td>
<td>Correlation</td>
</tr>
<tr>
<td>Pearson</td>
<td>.117</td>
<td>.306**</td>
<td>.408**</td>
<td>.441**</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.021</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td>Pearson</td>
<td>.148**</td>
<td>.275**</td>
<td>.354**</td>
<td>.413**</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.005</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td>Pearson</td>
<td>.048</td>
<td>.197**</td>
<td>.293**</td>
<td>.337**</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.203</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td>Pearson</td>
<td>.087</td>
<td>.361**</td>
<td>.364**</td>
<td>.437**</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.004</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td>Pearson</td>
<td>.088</td>
<td>.225**</td>
<td>.208**</td>
<td>.366**</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.044</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
<tr>
<td>Pearson</td>
<td>.099</td>
<td>.283**</td>
<td>.358**</td>
<td>.474**</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.099</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>302</td>
<td>302</td>
<td>302</td>
<td>302</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (1-tailed).
*. Correlation is significant at the 0.05 level (1-tailed).
CT behavior. Our results demonstrate that the repercussion of CT behavior and attractiveness was significant. Early in his career, Mukamurera [34] mentioned that the percentage of dropout professional teachers is worrying. He says that, in the first five years, one in five teachers give up practice and about 43% consider the option to leave teaching. According to Ingersoll and Smith [35], in the United States, the percentage of dropout is 40 to 50% among new teachers. Half of the teachers leave the teaching profession in the first years of teaching. Parmentier [36] suggests valuing PE-ST in their interventions. They must express themselves by attaching the content of the training to their lived experiences or their knowledge. They will either retain it or integrate it. Otherwise, they will just pile up knowledge they will quickly forget. If we want, the PE-ST to express themselves, these interventions must be lived not as a constraint or a judgment but as a valorization of their experience. This valorization intervenes from the beginning of the internship by the interest that CT carries with the PE-ST, and lasts throughout the internship, by the attentive reaction of their interventions. Monfette & Grenier [27] suggest letting their trainees take charge of the groups, they confirm that some CTs have offered self-development opportunities to their trainees by helping them to develop their autonomy and their ability to adapt.

In training, the PE-ST is motivated if he becomes a real actor by feeling valued and secure. The CT must secure and support the PE-ST, both materially and psychologically. Rajuana et al. [37] opined to introduce trainees to students and to give them as much information as possible about the program and materials. In this sense, Gold [38] offered two categories of support: support for teaching (pedagogical support) and psychological support. Teaching support consist of assisting with the acquisition of knowledge, skills and strategies for success in the school. This support can consist of information support (advice, information) and evaluative feedback (feedback). Psychological support comes from a humanistic perspective. It includes both emotional support (listening, encouragement and trust), evaluative support (need to be reassured and confirmed) and support for identity development (self-confidence, sense of effectiveness, positive self-esteem and stress management). Psychological support can help ES to develop resilience to difficult career conditions (insecurity, heavy work, difficult group-classes), to develop a positive self-image and to maintain a positive relationship with the profession.

Conclusion
The questions addressed in this study will encourage CT to reflect on their own behaviors, support practices and to include them in the process of accompaniment of PE-STs. Our results reflect the views of all the population of PE-ST exercising their traineeship in schools of Tunis. In light of our results, it is possible to make a statement concerning CT accompaniment practices and preoccupations of PE-ST. We are far from an ideal accompaniment situation and PE-ST problems that life must draw the attention of the priority of the internship responsible. Furthermore, the hypothesis is verified: CT accompaniment practices can be characterized by a high variability, namely behavior on a scale Frequency converter.

In Tunisia, we saw that accompaniment practices offer relatively favorable climate training. This statement should hold the attention of CT, supervisors, university teachers and people in charge of training, and get them to think a light of PE-STs preoccupation. So accompaniment practices are called for new developments in the near future. Data from PE-STs provide lighting and additional lines of investigation to improve accompaniment practices.

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

References


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- full name of organization (place of work or study);
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- Key words for the three languages: (1-2 lines of words. Do not use word combinations).
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CONTACT INFORMATION
box 11135, Kharkov-68, 61068, Ukraine
phone. +38 099 430 69 22
http://www.sportpedu.org.ua
e-mail: sportart@gmail.com

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