CONTENTS

PSYCHOSOCIAL INTERVENTION IN PROSTATE CANCER PATIENTS
Jana Potočníková, Tomáš Gregor, Helena Medeková, Aurel Zelko ................................. 5

ACUTE RESPONSE OF BONE METABOLISM TO VARIOUS RESISTANCE EXERCISES IN WOMEN
Jana Kovárová, Dušan Hamar, Milan Sedliak, Ján Cvečka, Peter Schickhofer,
Ľubica Bôhmerová ........................................................................................................... 15

CHANGES IN FUNCTIONAL MOVEMENT SCREEN SCORES OF SLOVAK WOMEN’S NATIONAL FOOTBALL TEAMS
Csaba Gábriš, Martin Kojnok, Marián Vanderka, Milan Kabát ................................. 23

ATTITUDES OF SCHOOLGIRLS TOWARDS PHYSICAL AND SPORT EDUCATION
Tibor Balga, Branislav Antala, Lenka Sabová ............................................................... 31

IMMEDIATE AND RETENTION EFFECTS OF TEACHING GAMES FOR UNDERSTANDING APPROACH ON BASKETBALL KNOWLEDGE
Gabriela Olosová, Ludmila Zapletalová ........................................................................ 41

PHYSICAL CHARACTERISTICS OF FEMALE BASKETBALL PLAYERS ACCORDING TO PLAYING POSITION
Richard Kucsa, Peter Mačura .......................................................................................... 49

BODY IMAGE AND SENSATION SEEKING IN GYM-GOERS
Petr Schlegel, Ludmila Fialová .......................................................................................... 57

EFFICIENCY OF DIFFERENT TEACHING MODELS IN TEACHING OF FRISBEE ULTIMATE
Zuzana Žuffová, Ludmila Zapletalová ........................................................................... 65
PSYCHOSOCIAL INTERVENTION IN PROSTATE CANCER PATIENTS

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Summary: Prostate cancer is the second most common cancer worldwide for males, and the fifth most common cancer overall. Using of autogenic training could reduce the influence of ADT and raise quality of prostate cancer patients. The aim of this study was to determine the effects of autogenic training in patients with prostate cancer. Patients were divided to experimental and control group. Experimental group participated in fourteen weeks long autogenic training program. Control group performed usual daily activities. Every subject of research performed input and output diagnostics which monitored psychical states of patients by psychological standardized tests - Differential questionnaire of depression (DDF) and Questionnaire of anxiety (STAI X1). Our data showed autogenic training program significant improved depressions symptoms and anxiety in experimental research group (p ≤ 0.05), however there was no main change of depression symptoms and anxiety values for control group (p = n.s.).

Key word: oncology patients, autogenic training, depression, anxiety

Introduction

Prostate cancer is the second most common cancer among men (after skin cancer), but it can often be treated successfully. Most prostate cancers are slow growing; however, the incidence in the males of age 80 is estimated at 80 %. Approximately one in six men will be diagnosed with prostate cancer in their lifetime and the number of men, who living with the diagnosis of prostate cancer or are prostate cancer survivors will continually raise.

As the incidence and prevalence of prostate cancer continue to rise, the number of men needing the help and support to assist them in coping with disease and treatment-related symptoms and their psychosocial effects is likely to increase. Treatment of prostate cancer is mostly accompanied with androgen deprivation therapy (ADT), which fundamentally influences physiologic and metabolic regulations of patients. Prostate cancer patients during ADT also frequently suffered changes in behaviour of patient’s personality – symptoms like anxiety, depression, stress and fatigue appear (Cancer Research UK 2012). The side effects of the treatments and the medications used for prostate cancer (such as hormonal therapy and pain medications) caused physical and psychical complications. Typical physical problems are: difficulty in passing urine, pain and sexual dysfunction. Other patients reported side effects which include pain, hot flashes, body image changes, fatigue, and loss
of libido. These problems may cause distress, anxiety, uncertainty or depression and emotional distress (Holzbeierlein, Castle and Thrasher 2004). Confusion over choosing from various interventions often adds to anxiety and depression in these patients (De Sousa et al. 2012). Anxiety tends to be the most often experienced symptom for men with prostate cancer (Roth et al. 1998).

Pirl et al. (2002) analyzed 45 men with prostate cancer receiving ADT. They surveyed oncology patients for depression with the Beck Depression Inventory. The study revealed that the depressive disorders were prevalent in 12.8% of the supervised men with prostate cancer receiving androgen deprivation therapy (ADT). That is eight times higher rate than the national rate of depression in the U.S. men population, and two times higher rate than the rate in men over 65 years. Major depression was not associated with worsening disease, medical response to ADT, receiving chemotherapy, or the type of ADT. Past history of depression was associated with current depression in this population. No first onset cases of depression occurred on ADT in their sample (Roth et al. 2008).

Chipperfield et al. (2013) supported the idea, that depression, anxiety, and cognitive dysfunction are common complaints in men with prostate cancer receiving androgen deprivation therapy (ADT). Their systematic review evaluated the effectiveness of physical activity as an intervention to improve depression and anxiety symptoms, cognitive function, and quality of life in patients receiving ADT for patients with prostate cancer. However, existing evidence is not sufficient to accept or refute adequacy of physical activity as an intervention to improve depression, anxiety, and cognitive function outcomes in prostate cancer patients. Many of researchers agreed with recommendations of physical activity programs, as an excellent partner for the psychosocial interventions (Chien et al., 2013; Parahoo et. al, 2013). However as yet, we do not know how effective, collectively, these interventions are.

Aim

The aim of this study was to determine the effects of autogenic training in patients with prostate cancer.

Methods

In our research we tried to analyze the effects of applied autogenic training on psychical states of cancer patients. Autogenic training (AT) is a relaxation technique, which involves the daily practice. It is a method for influencing the psychical tension, autonomic nervous system and tension of muscles (Kratochvil 2006). This save method is characteristic by practice frequency of three times a day and it consists of 7 standard autogenic training exercises, which patients might precede. AT exercises focus on various physical manifestations of relaxation in the body and mind. Positive effects of autogenic training are: improvements of sleep quality, reduction or elimination of anxiety, mild depression, fatigue, chronic pain, asthma, promotion of functions of the immune system and emotional balance.

Prostate cancer patients treated with ADT were involved into specialized strength training program. Patients were offered by possibility to participate on experiment and by their decisions divided into experimental and control groups. Experimental group participated on fourteen weeks of autogenic training, which could reduce the specific adverse effects of ADT
and raised the quality of patients’ lives. Control group performed only strength training pro-
gram and after that usual daily activities. Both, experimental and control groups included
10 patients, but only 7 patients in experimental group and 7 patients in control group suc-
cessfully end the experiment. Every subject of research performed input and output diag-
nostics, which monitored the psychical states of patients, like depression (Differential ques-
tionnaire of depression – DDF) and anxiety (Questionnaire of anxiety – STAI X1).

To determine statistical significance of differences between the groups we used Mann
Whitney U test (p ≤ 0.05) and Wilcoxon test to determine statistical significance of differ-
ences in the groups.

Results and Discussion

In our experiment we used two clinical psychological standardized questionnaires. The
first was Differential Questionnaire of Depression (DDF). Questionnaire evaluated six symp-
toms of depression – phobic, somatic, hypochondriac, self-tormenting, paranoid and anan-
kastic. We analyzed a single depression symptom in experimental and control group. We
confirmed higher frequency of hypochondriac, anankastic symptom of personality against
clinical flatly persons (Steck 2007).

![Input and output results of depression’s symptoms in experimental group](image)

Figure 1

Input and output results of depression’s symptoms in experimental group

After fourteen weeks of intervention, experimental group (Fig. 1) reached improve-
ments in all depression symptoms values. In each of symptoms we indicated significant
improvements (p ≤ 0.05) in somatic and anankastic symptom (Fig. 2). Anankastic symptom
is characterized by obsessional thoughts and over-expressing of accuracy and compulsive-
ness (Steck 2007). We could conclude that these significant differences between groups of
cancer patients were demonstrations of positive effects of combinations of the specializing
strength training program and the autogenic training.
After fourteen weeks of intervention, control group (Fig. 3) reached improvements in results of self-tormenting, paranoid and anankastic symptoms of depression, but got worse in phobic, somatic and hypochondriac symptoms of depression. Difference analysis between the pre and post diagnostics values didn’t show any statistical significance.
Finally, we compared the results between experimental and control group in input and output diagnostic (Fig. 4). Input diagnostics indicated that patients in experimental group had significantly (p ≤ 0.05) higher values of depression symptoms than control group.

Comparison of input and output diagnostics in experimental group showed that the depression values were lower after the 14 weeks of autogenic training. Control group although achieved lower values in output results against experimental group, but in comparison with input results didn’t achieve marked changes. The results of experimental groups showed that autogenic training has positive influence on patients in experimental group (p ≤ 0.05).

**Figure 4**

*Input and output results of depression – experimental and control group*

Comparison of the values differences measured before and after the intervention showed significance difference (p ≤ 0.05) between experimental and control group (Fig. 5). Based on results of our study, we could conclude that autogenic training improvement cancer patient’s depression and it is active intervention helping with this specific psychical state.

The second questionnaire analyzed the anxiety (STAI X1) of patients. Previous results (Holzbeierlein, Castle, Thrasher, 2004 De Sousa et al., 2012; Chipperfienld et al, 2013) indicated that anxiety is a significant problem of personality of oncology patients.
The second questionnaire analyzed the anxiety (STAI X1) of patients. Previous results (Holzbeierlein, Castle, Thrasher, 2004; De Sousa et al., 2012; Chipperfield et al, 2013) indicated that anxiety is a significant problem of personality of oncology patients.

Our results of patients revealed similar disturbing results (Fig. 6). Input diagnostics of anxiety showed that experimental group has appreciably higher results against control group.

Experimental group achieved significant improvements (p ≤ 0.05) in anxiety after the intervention (significant increase of values, Fig. 7) however, control group showed signifi-
cant decrease in values \((p \leq 0.05)\). These results confirmed the significantly positive effects of autogenic training on prostate cancer patients.

**Figure 7**

*Input and output results of anxiety – experimental group \((p \leq 0.05)\)*

Moreover, we compared the pre-tests and the post-tests in experimental and control groups. Patients in experimental group had significantly \((p \leq 0.05)\) lower results of anxiety after the autogenic training (Fig. 8).

**Figure 8**

*Output results of anxiety – experimental and control group \((p \leq 0.05)\)*
The significance results (p ≤ 0.05) of experimental groups support previous outcomes (Chien 2012) that autogenic training, like psychosocial intervention, has positive influences on anxiety of prostate cancer patients.

Comparisons of input and output results of anxiety on control group didn’t showed any significant differences.

In summary, differences in result of anxiety between experimental and control groups, present in Fig. 9 confirmed significantly higher values in experimental group (p ≤ 0.05). Statistical differences between groups strongly support our idea of AT effectiveness in prostate cancer patients.

Our results confirmed conclusions of other authors about increased depression (Chipperfienld et al. 2013; De Sousa et al. 2012; Roth et al. 2008; Pirl et al. 2002) and anxiety (Chipperfienld et al. 2013; De Sousa et al. 2012; Roth et al. 1998) in oncology patient groups. Besides the small sizes of experimental and control group we could conclude the high practical benefits of our results, especially for multifactorial care in prostate cancer patients.

Conclusions

Many of the advances in treatments will not necessarily improve disease outcomes, but will be implemented primarily to reduce the side effects of treatments. Psychosocial interventions that can be used in prostate cancer patients brought significance improvements in patient’s quality of live. The results of our research confirmed the significante improvements of mental states, especially in states of depression and anxiety. We discovered significant differences between input and output of experimental group in depression and anxiety and significant differences between experimental and control group.
We confirmed that application of autogenic training was suitable choice as a part of treatment for patients with prostate cancer. We can hypothesized, that AT could be the effective instrument in multifactorial therapy of other cancer diagnosis. Based on our findings, we recommended the use of autogenic training as a supportive oncology therapy. Results of our work could be useful in oncology, psychology and sport-medicine departments.

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References
RESUMÉ

PSYCHOSOCIÁLNA INTERVENCIA PACIENTOV S RAKOVINOU PROSTATY

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Rakovina prostaty je druhým najčastejším nádorovým ochorením mužov na svete a celkovo piatou najrozšírenejšou rakovinou. Využitie autogéneho tréningu môže znižovať negatívne dopady ADT a zvyšovať kvalitu života pacientov s rakovinou prostaty. Cieľom tejto práce je zistiť vplyv autogéneho tréningu na pacientov s rakovinou prostaty. Pacienti boli rozdelení do experimentálnej a kontrolnej skupiny. Experimentálna skupina vykonávala štrnásť-týždňový autogény tréningový program. Kontrolná skupina vykonávala obvyklé denné činnosti. Každý subjekt výskumu podstúpil vstupnú a výstupnú diagnostiku, ktorá zaznamenávala psychické stavy pacientov pomocou standardizovaných psychologických dotazníkov - Diferenciálny dotazník depresivity (DDF) a Dotazník úzkosti (STAI X1). Z výsledkov štúdie môžeme konštatovať, že autogény tréningový program signifikantne zlepšil symptómy depresie a úzkosti v experimentálnej skupine (p ≤ 0.05), zatiaľ čo v kontrolnej skupine neboli zaznamenané signifikatné zmeny v sledovaných parametroch (p = n.s.).
ACUTE RESPONSE OF BONE METABOLISM TO VARIOUS RESISTANCE EXERCISES IN WOMEN

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Summary: The study examines the acute response of bone turnover markers to two different single bouts of resistance exercises in women. Serum bone alkaline phosphatase and sclerostin concentration were measured before, 24 and 48 hours after the interventions to detect the dynamics of bone turnover. Subjects performed two exercises and a control experiment without exercise (CONTR) on different occasions, with 3-week breaks between the interventions, in a random order. First exercises protocol had a constant resistance of 75% 1 RM (ISOF). Second, serial stretch loading (SSL), was isokinetic: velocity of concentric and eccentric phase of the movement was 50 and 40 cm/s, respectively. Short stops were incorporated into both phases of the movement after every 20 mm, resulting in a frequency of the force peaks of 10 Hz in concentric as well as in eccentric phase. Both protocols consisted of 6 sets of 6 repetitions and 2-minute resting periods. The exercises interventions had no statistically significant effect on either bone turnover marker concentration at any of the time points.

Key words: serial stretch loading, bone turnover, bone alkaline phosphatase, sclerostin

Introduction

Sedentary lifestyle and insufficient amount of regular physical activity are believed to contribute to the development of metabolic disorders, which lead to atherosclerosis and cardiovascular complications (Booth et al. 2008). Substantial body of evidence exists which prove that physical exercises plays an important role in the prevention of vascular diseases progression (Joyner et al. 2009; Thompson et al. 2003). Apart from that, in recent decades also substantial epidemiological evidence of beneficial effects of strength exercises on bone tissue has accumulated.

The fact that bone responds positively to mechanical loading has been known for more than 100 years and is marked as Wolff’s law. The strains produced by external loading represent the stimulating input for bone adaptive processes. The response of bone turnover varies in relation to different strain characteristics. Animal studies of different types of external loads show that bone tissue does not adapt to static strains (Lanyon et al. 1984). On the other hand, exercises studies using human subjects prove that high strains changing at fast rates and presented in unusual directions result in greater bone adaptive responses than dynamic strains changing at slower rates. Thus high impact activities such as badminton, squash,
triple jumping, etc. cause larger osteogenic responses than swimming or cycling (Nordstrom et al. 1998). It is therefore assumed that the character of the strain-related stimulus rather than particular strain intensity maintains and eventually improves the bone architecture.

A computer-controlled leg press device used in this study is capable of generating fast and precisely defined counter movements, which evoke repetitive force peaks exceeding the strength produced by a maximum voluntary contraction occurring during traditional resistance training. As such, a potential of a more effective means for improvement of bone formation with the use of this novel kind of stimulation exists. Acute response of bone metabolism to a single exercises session can be indirectly assessed by serum level of bone turnover markers. Their concentration values provide information on the acute state and dynamics of bone remodelling. Pronounced disruption of homeostasis by means of mechanical stimulation assumes higher intensity of bone adaptive changes. The magnitude of the changes in these markers can be used for the assessment of the efficiency of tested stimulus.

**Aim**

The purpose of this study was to examine the acute response of serum bone turnover markers (bone alkaline phosphatase and sclerostin) to two single sessions of different resistance exercises in women.

**Methods**

**Subjects**

Seven women (22.7 ± 1.9 years old) participated in the study. None of them were competitive athletes, smokers, nor were they on hormonal or osteoporosis medications. The study was approved by Ethical Committee of Faculty of Physical Education and Sports Comenius University in Bratislava.

**Experimental design**

A familiarization session took place one week prior to the beginning of the study. After the subjects had been informed about the aim of the study, they gave their written informed consent to participate in this study and after that, they familiarized themselves with the resistance exercises equipment. One repetition maximum test (1RM) was carried out on a supine leg press device. The results served for setting the workloads in the subsequent exercises protocols. The individual range of lower extremities motion and the initial position of leg press pedals were also set. This information was recorded for a simpler and time-saving work during the exercises protocols execution itself. The familiarization and one repetition maximum testing was supervised by experienced personnel.

Each subject completed two resistance exercises bouts on an isokinetic leg press dynamometer, either with a constant resistance (ISOF) or a serial stretch loading (SSL) and one control experiment without exercises (CONTR) on different occasions and in a random order. There were 3 weeks between the three experiments.

The subjects were instructed not to perform any high-demanding physical activity within 24 hours before testing and the follow-up blood collections.
Isokinetic leg press dynamometer

Both resistance exercises bouts were performed on a horizontal leg press device, which is operated, by a pair of computer controlled linear motors. Each of them can generate maximal force of 1800 N, velocity up to 10 m/s both forwards and backwards and potentially accelerate at the rate of 15 g. As such, various training modes of this equipment can be set. A constant resistance and a serial stretch loading mode were used in the present study.

Exercises protocol with a constant resistance (ISOF)

The initial position of pedals and the resistance need to be set for this mode. The device generates constant resistance independent of external force produced by the subject. The pedals start to move forward from their starting position only when the force produced by the muscles exceeds the preset resistance value. If the exerted force decreases below the preset resistance, the pedals will move backwards to the starting position. The resistance in this study represented 75% of individual 1 RM and the exercises protocol consisted of 6 sets with 6 repetitions and 2-minute breaks between the sets.

Isokinetic mode

The pedals in isokinetic mode move according to the preset velocity of concentric and eccentric phase of the movement regardless of the force applied by the subject. The range of lower extremities motion during both phases needs to be set in forward. The pedals accelerate from 0 at the initial position to the specified velocity and then move at this speed uniformly during the whole phase. They decelerate to 0 just before the final position is reached. Immediately after that, they accelerate to the preset velocity of the other phase of the movement. The speed is again uniform during the whole phase and the pedals decelerate to 0 just before the initial position is reached. One loading cycle (repetition) represents 1 concentric and 1 eccentric phase of the movement. If more than 1 repetition is set, the whole process described above starts again (fig. 1)

![Figure 1](image)

Force and distance during one isokinetic cycle
Exercises protocol with serial stretch loading (SSL)

However, the equipment in isokinetic mode is also capable of evoking repetitive force peaks of a controllable magnitude and frequency. It is achieved by incorporating short counter movements into concentric and segments of increased velocity into eccentric phase of the movement. The peaks can also be produced by sudden stops during both phases of the movement (fig. 2). The velocity of concentric and eccentric phase of the movement for this study was set to 50 cm.s\(^{-1}\) and 40 cm.s\(^{-1}\), respectively. Short interruptions, lasting few tens of milliseconds, were incorporated into both phases of the movement after every 20 mm. This setting resulted in a frequency of the force peaks of 10 Hz in concentric as well as in eccentric phase. The subjects performed 6 sets of 6 repetitions with 2-minute resting periods between the sets and were instructed to push against the foot pedals with a maximal effort during the whole repetitions.

![Figure 2](image)

*Figure 2*

**Force and distance during one serial stretch loading cycle**

Control protocol (CONTR)

Control experiment was conducted without exercises but using the same time schedule for the blood samples withdrawal (a fasting baseline sample and 2 follow-up samples: 24 and 48 hours after the baseline sample).

Blood sampling

The response of bone metabolism to two exercises protocols and a control protocol was monitored by serum bone turnover markers: bone alkaline phosphatase (bALP) and sclerostin. Medical professionals obtained the blood samples by venipuncture of the antecubital vein at baseline (fasting) after 5 minute seated rest, 24 and 48 hours after the exercises. Baseline blood samples were collected between 7:00 and 8:00 AM.

For both bone turnover markers, 9 ml of blood was taken into a closed system collection tube containing beads coated with a clotting activator (silicate) and a polyacrylic ester gel (Sarstedt AG & Co, Germany). The samples were centrifuged at 2,000 rpm for 10 minutes.
at 4 °C no later than 60 minutes after the blood draw. Sera were stored immediately after the centrifugation at –80 °C for subsequent analyses. The follow-up samples were collected at the same time of day. Serum bone alkaline phosphatase and sclerostin concentrations were measured by enzyme-linked immunosorbent assay (ELISA) kit. All the samples were analysed in one assay.

**An overview of experimental design**

Fasting baseline blood sample → breakfast (provided by the investigators) → warm up (20 minutes after the breakfast) → first exercises protocol (ISOF or SSL) → fasting blood sample 24 hours after the exercises → fasting blood sample 48 hours after the exercises → 3-week break → completion of the second exercises protocol (SSL or ISOF) following the same procedures as during the first one. Control protocol (CONTR) was conducted according to randomized order as either first, second or third protocol.

**Results and discussion**

Repeated-measures multi-factorial ANOVA was used to measure the main effect of exercises and interaction of time. There was no statistically significant effect of SSL protocol on serum bALP (fig. 3) or sclerostin (fig. 4) concentration at any time point.

**Figure 3**

*Effect of SSL protocol on bALP concentration*

![Figure 3](image)

**Figure 4**

*Effect of SSL protocol on sclerostin concentration*

![Figure 4](image)
Neither ISOF protocol had any statistically significant effect on serum bALP (fig. 5) or sclerostin (fig. 6) concentration at any time point.

![Figure 5](image1)

**Figure 5**
*Effect of ISOF protocol on bALP concentration*

![Figure 6](image2)

**Figure 6**
*Effect of ISOF protocol on sclerostin concentration*

No significant differences in the concentration of bALP (fig. 7) or sclerostin (fig. 8) in relation to two interventions and a control protocol were found.

![Figure 7](image3)

**Figure 7**
*Control and intervention bALP concentration*
We expected the force peaks generated during the SSL protocol would disrupt the homeostasis in a more pronounced way than the application of ISOF protocol. Such a condition would result in a more pronounced acute response of the selected bone turnover markers in comparison with ISOF protocol. The assumption was also based on studies confirming that bone adapts to intermittent and dynamic, but not static loadings (Hert et al. 1971; Nordstrom et al. 1998) and that mechanical load applied at frequency 10 to 60 Hz seems to be more osteogenic than the same amount of load applied at the rate of 1 Hz (Rubin et al. 2001).

However, neither of the exercises protocols had significant effect on the serum bone turnover markers concentration. Apart from that, no significant change in their concentration was found within two follow-up days in case of both exercises interventions. The possible reasons of the results could be that the selected markers of bone turnover could not be appropriate to detect minor changes of acute bone metabolism dynamics even though they are widely used in research studies. Another possible reason could be insufficient number of subjects.

References

RESUMÉ

AKÚTNA ODOZVA KOSTNÉHO METABOLIZMU NA JEDNORAZOVÉ SILOVÉ ZAŤAŽENIE ŽIEN

Jana Kovárová, Dušan Hamar, Milan Sedliak, Ján Cvečka, Peter Schickhofer, Ľubica Böhmerová

Štúdia zistovala akútne odzvu kostného metabolizmu žien na 2 rozdielne jednorazové silové zaťaženia prostredníctvom krvných markerov kostného metabolizmu (kostná alkalická fosfatáza a sklerostín) pred, 24 a 48 hodín po zaťažení. Probandky podstúpili dve silové zaťaženia a jeden protokol bez cvičenia (CONTR) v náhodnom poradí a s odstupom 3 týždňov. Odpor prvého silového zaťaženia (ISOF) bol konštantný: 75 % jednorazového maxima. Druhý protokol so sériovými strečingovými stimulmi (SSL) bol izokinetický s rýchlostou koncentrickej fázy pohybu 50 cm.s⁻¹ a excentrickej 40 cm.s⁻¹. Zaradenie niekoľko milisekúnd trvajúcich úsekov zastavenia v obidvoch fázach pohybu malo za následok generovanie silových špičiek. Obidva silové protokoly obsahovali 6 sérií po 6 opakovani a 2 minútovej pauzy medzi sériami. Koncentrácia sledovaných markerov sa vplyvom rozličných zaťažení nezmenila (ani v porovnaní koncentrácie počas protokolu bez zaťaženia).
CHANGES IN FUNCTIONAL MOVEMENT SCREEN SCORES OF SLOVAK WOMEN’S NATIONAL FOOTBALL TEAMS

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Summary: The aim of this study was to assess movement patterns by using Functional Movement Screen in three categories of Slovak women’s national football teams during two occasions interspersed with one year. The reason for this was to answer the questions: 1. if there is a tendency to perform better in the screen with respect to age category, and 2. if the players who did the screen more times and receive recommendations, perform better after a year, irrespective to age category. Our results showed that every category achieved significant improvements (p < 0.10) in total test score when compared the two occasions (2013 vs. 2014), except WU17, where significant decrement was found (p < 0.01). These results probably represent the fact, that the WU17 is the less experienced category regarding FMS™ and the group where the most turbulence occurs in the nomination list. However, when we assessed the group of players who were present at both occasions of screening, irrespectively to age group they belong, results revealed significant overall improvements (p < 0.05). In conclusion, we would suggest FMS™ as a useful tool to reveal potentially weak links in player's movement and therefore determine injury risk. Our results suggest that professional recommendations to remove these are effective and at least as much important as the screening scores alone.

Key words: Functional Movement Screen™, women’s football, age categories

Introduction

The key tool of this study was the Functional Movement Screen (FMS™). We could define it as one of the new generation of screening assessments, which evaluates functional movement patterns to determine potentially risk of injury. In contrast with other/older types of "screens" or prevention programs (like nordic hamstring curls as eccentric strength training or proprioreception programs); it is not a training tool to solve the problem by itself or with practicing it. It is rather a tool/screen to catch fundamental movement pattern compensations and then quickly rank the quality of the movements. The FMS™ was therefore developed as a comprehensive pre-participation and pre-season screen, and consists of seven movements, which challenge an individual’s ability to perform basic movement patterns that reflect combinations of muscle strength, flexibility, and range of motion, coordination, balance and proprioception (Cook 2006).

The recommendations based on the scores achieved in every test are at least as much important as the overall result of the screening. As the goal of the screening is to identify weak links in the given movements and therefore determine risk potential, the screen has
a hierarchy in the tests by which the appropriate solution can be designed. With respect to this hierarchy, the examiner is firstly looking for asymmetries and than for symmetries in the movements where it is possible. Some studies also investigate intrarater reliability of the FMS™ (Smith et al. 2013; Gribble et al. 2013). Findings of these studies show a good intraclass correlation (ICC = 0.89 and 0.87) respectively. Few studies also investigated intrarater reliability in the way, how clinical experience plays a role in the reliability in FMS™. These studies found, that athletic trainers with at least 6 month of experience using the FMS™ had the strongest reliability (ICC = 0.946), while athletic trainers without any experience showed a moderate reliability (ICC = 0.771).

For these reasons the FMS™ is widely considered as a useful tool, what helps in designing individual training programs and player care procedures with respect to individual limitations, age and performance level/category, and therefore allows to reach maximal performance potential and decrease injury risk. This is probably even more important in women football, where the risk of injuries in some segments of the body is higher than in males. The average injury incidents in professional football were investigated by Ekstrand et al. (2011). They found that the average rate of injury is 8.0/1 000 h and the players are injured 2-times per season. It is also well documented that female athletes participating in jumping and cutting sports demonstrate a four-to sixfold higher incidence of knee injury than do male athletes participating in the same sports. Most of the studies therefore investigate knee injuries (ACL), because of the relatively long rehabilitation time, regardless if the injury needs a non-operative treatment, surgery or both (Hewit et al. 1999). Majority of these occur via non-contact mechanism during landing from jump. According FIFA Medicine Group (Tscholl et al. 2007; Junge-Dvorak 2007), the most common injuries in women’s football are mostly associated with ankle (24 %), head (16 %) and thigh (12 %).

**Aim**

The aim of our study was to determine the level of FMS™ in the meaning of total score within three age categories of national women’s football teams:

a) regarding the age category, to find out, if there is a tendency between the consecutive years to perform better in the required movement tasks (to demonstrate a given picture of the players who are invited to join the national team, according to total score achieved in FMS™),

b) to demonstrate the usefulness of the screening and the positive effect of the recommendations on the group of players, who were at both screenings and therefore receive correction program in 2013.

**Methods**

Participants of our study were Slovakia women’s national football team players. The screening was carried out in three national women’s football categories (Women’s A-team – WA, Women’s under 19 – WU19, Women’s under 17 – WU17) at two different events interpressed with one year. Both procedures were made during official team meetings at the end of November in the years 2013 and 2014. More detailed characteristics of the players/categories with respect to the year of screening are reported in Table 1 (2013) and 2 (2014).
Table 1

Number of subjects within each category with their average ± SD age, height and weight in the year 2013

<table>
<thead>
<tr>
<th>2013</th>
<th>Subjects [no.]</th>
<th>Age [yr]</th>
<th>Body height [cm]</th>
<th>Body weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA</td>
<td>19</td>
<td>20,84 ± 2,8</td>
<td>171,4 ± 6,9</td>
<td>63 ± 8,3</td>
</tr>
<tr>
<td>WU19</td>
<td>20</td>
<td>16,35 ± 0,49</td>
<td>167,5 ± 5,7</td>
<td>59,05 ± 6,6</td>
</tr>
<tr>
<td>WU17</td>
<td>19</td>
<td>14,42 ± 0,5</td>
<td>163,8 ± 4,7</td>
<td>55,16 ± 5,2</td>
</tr>
</tbody>
</table>

Table 2

Number of subjects within each category with their average ± SD age, height and weight in the year 2014

<table>
<thead>
<tr>
<th>2014</th>
<th>Subjects [no.]</th>
<th>Age [yr]</th>
<th>Body height [cm]</th>
<th>Body weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA</td>
<td>17</td>
<td>22,53 ± 2,8</td>
<td>170,24 ± 5,55</td>
<td>62,94 ± 7,24</td>
</tr>
<tr>
<td>WU19</td>
<td>20</td>
<td>16,15 ± 0,67</td>
<td>168,5 ± 5,61</td>
<td>58,2 ± 5,34</td>
</tr>
<tr>
<td>WU17</td>
<td>22</td>
<td>14,77 ± 0,43</td>
<td>165,52 ± 7,23</td>
<td>58 ± 7,85</td>
</tr>
</tbody>
</table>

As the goal of our study was not just to monitor the progression of the total score which was achieved during FMS\textsuperscript{TM} in each category, but also their progression during one year in the group of players who participated in both occasions of the screening procedure. Therefore, to examine the effectiveness of prescribed recommendations, we have also assessed the players irrespectively to which group they belonged. Table 3 presents the characteristics of these players.

Table 3

Characteristics of the group of players, who perform the screening in both occasions (2013 and 2014)

<table>
<thead>
<tr>
<th>Year</th>
<th>Subjects [no.]</th>
<th>Age [yr]</th>
<th>Body height [cm]</th>
<th>Body weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>30</td>
<td>17,17 ± 3,58</td>
<td>168,1 ± 5,85</td>
<td>58,5 ± 7,91</td>
</tr>
<tr>
<td>2014</td>
<td>30</td>
<td>18,1 ± 3,53</td>
<td>169,57 ± 5,46</td>
<td>60,33 ± 6,85</td>
</tr>
</tbody>
</table>

The Functional Movement Screen\textsuperscript{TM}, developed by Cook and Burton, was used in this study. The standardized version of the testing procedures, instructions and the scoring process were followed in order to ensure the scoring accuracy. The FMS\textsuperscript{TM} consists of seven movement tests, described by Cook et al. (2006) that include Deep Squat, Hurdle Step, In-Line Lunge, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability Push-Up, and Rotary Stability. Each participant was given three attempts on each of the seven tests. The
participants did not do any warm up procedure before testing. Each attempt was scored on a scale from 0 to 3. The score 0 indicated that pain was reported during the movement. The score 1 indicated the failure to complete the movement or loss of balance during the movement. The score 2 completing the movement with compensation and the score 3 performing the movement without any compensation. For each test, the highest score from the three attempts was recorded and used to generate an overall total FMSTM score with a maximum value 21. For the tests, that were assessed bilaterally, the lowest score was used. Three of the tests (shoulder mobility, trunk stability push-up and rotary stability) also have associated clearing exams that are scored as either positive or negative, with a positive response indicating that pain was reproduced during the examination movement.

Both screening procedures were performed at the end of November (2013 vs. 2014) in the National Training Centre of the SFA in Senec. Teams were tested after three consecutive days, in the following order: WA, WU19 and WU17. Participants wore their usual clothing and footwear. The fitness coach of Women’s national football team, who passed the Level 1 Certification of FMSTM collected the data, and then designed the corrective exercise program for the players.

To provide sufficient description of our sample/participants, descriptive statistic methods of location (average) and dispersion (standard deviation) were used. Mann-Whitney’s non-parametric test was used to compare the same age category at 2013 and 2014, because the composition of the teams changed during the year. To answer our second question, thus, whether the prescribed corrective exercises were effective or not (according total score), T-Test for 2 dependent means (Paired Samples t-test) and Cohen’s d (effect size) was used. All calculations were performed using SPSS (version 16.0), where the level of significance was set at $p < 0.05$, $p < 0.01$ and to reveal even a tendency in total score to increase or decrease, we also use significance level at $p < 0.10$. Cohen’s d was also used to determine effect size.

**Results and Discussion**

Total score for all teams together was 14.91 ± 2.15 in 2013, and in 2014, it was 15.04 ± 1.88, however these improvements do not express any level of statistical significance. To clarify this situation, we also assessed each team separately. In this case we found out significant improvements in the group of WA (14.84 ± 2.61 vs. 15.94 ± 1.29) and W U19 (14.35 ± 2.08 vs. 15.4 ± 2.04) at the significance level $p < 0, 10$, what should be qualified just as a tendency to increase (Figure 1). However if we put together these two teams, we get the results at the higher level of significance ($p < 0, 05$). On the other hand significant decrement ($p < 0, 01$) was found in the group of WU17 (15.58 ± 1.54 vs. 13.84 ± 1.57).

To clarify this situation could help just simple view on the list of nominated players in WU17 category between the two testing occasions. After this it is clear, that exactly the WU17 category was the group in which the most players moved forward ($n = 8$) to the next/older category, or simply dropped out ($n = 5$) of nominations. These facts also mean that WU17 was the category where the most novice players come. These players did not meet FMSTM procedure, and that is why they did not receive recommendations before, which was probably the major reason of given results.
We have examined the effect of prescribed/recommended corrections throughout the monitored year in the group of players, who received the program in 2013, and we have compared the results of these subjects. Firstly irrespective to the category they belong. In this group (n = 30) we found significant improvements (p < 0.05), where the total average score was 14.43 ± 2.30 vs. 15.5 ± 2.11 in 2013 and 2014, respectively. Cohen’s d was calculated as 0.50 what suggests a moderate effect size, probably because of the need of larger sample size. Similar findings were also reported by Kiesel et al. (2011), where the screening scores improved after a standardized 7-week long off-season intervention program in professional football players. The main positive effect of the program was associated with more players above the cut-off score (14 points) at post test (41 vs. 31).

Our program, or the time between the two screenings lasted more than 7-weeks, so our players worked with the correction program for a longer time, what includes not just a period of off-season, but also pre- and competitive season. Competitive season could be an important factor alone when deals with FMS™. Sprague et al. (2014) examined the effect of complete competitive season in soccer and volleyball on FMS™ scores. The study shows significant changes during the season, with respect to individual tests scores and to the number of asymmetries. The participants of this research were males at collegiate level what are inconsistent with our study. However, according Schneiders et al. (2011) there are no significant differences in total scores between males and females in FMS™. The results of the screening are therefore probably more related to sport specialization than gender.

When we separate this group again, but this time according to the age category, they belong, we get different results. The two older/higher categories (WA, WU19) achieved significant improvements (p < 0.05), while the youngest (WU17) decrement (15.36 ± 1.50 vs. 15 ± 2.57) although on non-significant level (Figure 2).
In this case it is important to note, that despite the non-significant decrement in the WU17, their average total score was still above the total score of WU19 and also the crucial cut-off score (14 <). It is also possible, that because of the higher average initial scores, which were higher than at WA and WU19, the players probably do not respect the prescribed correction in extent as the players from older categories, although this may be considered just as a speculation. It is more important to note, that the average age of our youngest category was under the age of 15, despite the possibility to have older players in the team (nearly more than 2 years). In this case, it is likely, that the relatively high initial scores of this group were also associated with their age related biological advantages, like higher flexibility and relative strength (Teyhen et al., 2014).

In addition Grygorowicz et al. (2013) found differences in FMS™ scores between female soccer players from different sports level, where the professional players had significantly higher total score, than players from the first division (16.0 ± 0.46 vs. 15.5 ± 0.58, respectively). In our study, we could consider the older age category as a higher sports level. In this case, there is an agreement with our results, where the oldest category performs at the second screening better than the two younger categories.

Similarly Minthorn et al. (2014) also emphasize the importance of appropriate movement patterns in sports and mainly during high intensity activities, which could be improved by individualized training program based on FMS™ results.

**Conclusion**

The findings of this study show, that there are significant differences between the given categories of national women’s football teams in the meaning of total score achieved in FMS™ during two screening occasions through one year. Statistical analysis revealed, that in the older categories (WA, WU19) the tendency is to perform better during the required movement tasks of the screening, while the youngest category (WU17) had tendency to perform worse. The cause of this is probably, that some players drop-out or move up to the higher categories, so the composition of the teams changed during the year. This is the most evident in the group of the youngest players, where the new players never met FMS™ and although does not recieve recommendations from the fitness coach before. This could mean...
that some of the FMS™ experienced players moved to the older categories or drop-out, while the novices were tested in 2014 for a first time. This was supported with our statistical findings that show improvement in every category (WA, WU19) except WU17. To isolate this effect and to demonstrate the effectiveness of prescribed correction program, we compared the results of players, who were on both occasions of screening procedures. These result showed significant improvements (p < 0.05), what confirmed our assumption, that the prescribed program will be effective. For these reasons, we could recommend using FMS™ during the year as a useful tool to detect injury risk, while the specifically designed individual corrections can effectively affect the screening results, and therefore remove weak links of the players and decrease injury potential. During this process the same emphasis must be imposed on the specificities of given categories, regarding to their calendar, biological and sport age, performance level or FMS™ experience, what could help to incorporate it to the process of player selection/care in a more reliable manner.

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Acta Facultatis Educationis Physicae Universitatis Comenianae LV/I
ZMENY FMS™ SKÓRE SLOVENSKÉJ ŽENSKEJ REPREZENTÁCIE VO FUTBALE

Csaba Gábriš, Martin Kojnok, Marián Vanderka, Milan Kabát

Predmetom našej práce bolo hodnotenie pohybových vzorcov prostredníctvom Functional Movement Screen (FMS™) v troch kategóriách ženských futbalových reprezentácií Slovenskej republiky počas dvoch meraní oddelených jedným rokom. Prostredníctvom týchto meraní sme chceli zodpovedať otázky: 1. či existuje určitá tendencia dosahovania lepších výsledkov v FMS™ v rámci jednotlivých kategórií v zmysle dosiahnutia vyššieho celkového skóre; 2. či hráčky, ktoré boli pri oboch testovaniach a dostali individuálne navrhnutý ko-rekčný program, dosiahli po roku lepšie výsledky v FMS™. Výsledky našej práce ukázali, že kžm kategórie WA a WU19 dosiahli po roku štatisticky významné prírastky (p < 0,10), v najmladšej kategórii sme zaznamenali štatisticky významné zhoršenie (p < 0,01). Tieto výsledky pravdepodobne reprezentujú skutočnosť, že WU17 je z hľadiska FMS™ najmenej skúsenejšia kategória, ktorá sa zároveň zarába najvyššie obmenou hráčok. Pri porovnaní skupín hráčok, ktorá sa zúčastnila oboch meraní, však výsledky odhalili štatisticky významné prírastky (p < 0,05). V závere by sme chceli odporučať FMS™ ako užitočný prostriedok vhodný na odhalenie potenciálnych slabých pohybových článkov športovca, ako aj na včasné určenie možného rizika zranenia. Naše výsledky naznačujú, že odborné odporúčania, ktoré sa týkajú odstránenia uvedených rizikových faktorov, sú efektívne a prinajmenšom rovnako dôležité ako samotné výsledky testu.
ATTITUDES OF SCHOOLGIRLS TOWARDS PHYSICAL AND SPORT EDUCATION

Tibor Balga, Branislav Antala, Lenka Sabová

Department of Sport Educology and Sport Humanities, Faculty of Physical and Sport Educations, Comenius University in Bratislava

Summary: This paper presents the results of research focused on the attitudes of schoolgirls at the 5th and 9th grade of primary schools towards physical and sport education. The aim of this project was to find out the level of the attitudes of schoolgirls at primary schools in the Bratislava Region. The research sample consisted of 247 schoolgirls attending urban and village primary schools. The basic research tool we have used was the standardized attitudinal questionnaire designed for the primary schools pupils. We have found out that in the 5th and 9th grade of primary schools the positive attitudes toward physical and sport education prevail over the indifferent attitudes. At primary schools in the Bratislava Region, the schoolgirls in the 5th grade showed more positive attitudes than schoolgirls in the 9th grade.

Key words: attitudes, physical and sport education, schoolgirls, primary school

Introduction

Many literary sources and practical research results show, that the current generation of children and young people do not have such a positive attitude towards sport and movement as it was in the past and do not have enough physical activities. Their interests but also duties are much wider than they were in the past. Once, playgrounds full of kids waiting for “their turn” are much more abandoned. Today we do not see young girls playing volleyball, dodge ball, jumping over an elastic rope or doing other physical activities. Antala (2014) also thinks that in the last 20 years, there has been a considerable increase of kids and the lesson of physical and sport education at school is the only place where they can do some physical activities. At present, there are about 25 % of boys and girls, in comparison with the past; on average, it was only 8.5 % of boys and 11.3 % of girls. Unlike in the past there is a threefold increase in boys and more than double among girls. At present, we can observe the trend in children between 11 – 15 years old that with increasing of age there is an increase of number of boys and girls for whom the lessons of physical and sport education are the only places where they can do some physical activity.

Research also shows that 70 % of schoolchildren and youth spend more than four hours of free time working on computers, using the internet, watching TV, playing computer games and playing with cell phones (Antala 2014). Psychology defines the attitudes as a relatively permanent system of positive or negative evaluation, feelings and tendencies to act for or against social objects (Oravcová 2004).
By Boroš (2001) attitudes are relatively permanent characteristics of individuals, which express their attitudes (positive or negative) to a certain area of reality and reflect not only the basic cognitive orientation but also the value system and aiming his effort at them. This means, that to all things, phenomena, people and us we produce a certain position – we have certain opinion (we evaluate the object of attitude), we have a relation to something (we like it or dislike it), and we have a different attitudes towards them (we try to get it or we escape from it). In this sense, factors are in the position, which strongly influence the behaviour of an individual. Poliach (2003) states the attitudes influence the behaviour of the children. Attitudes are closely related to personal values and have something common with knowledge, experience and motivation. The attitude has several components. In the literature, they show mostly these components of attitude (Boroš 2001; Bartík 2005; Oravcová 2004):

- **The Cognitive component (exploring)** – is associated with a rational assessment of the subject position. This includes what knows the entity object knows about its position. It consists of thoughts, opinions of the individual about a subject or phenomenon, and it is regarded as the most complex view on the evaluations, which includes comments regarding of the evaluation, which involves desirable and undesirable characteristics.

- **Emotional component (emotional, affective)** – refers to the emotions associated with the object or phenomenon, while emotions express dynamics of attitudes to favourite or non-favourite subject. It expresses the emotional relationship to the subject position within the meaning do love and do not love, joy and sadness, sympathy and antipathy.

- **Conative component (behavioural predisposition)** – it is about the reaction of behaviour associated with the attitude. Attitudes formed in connection with activity are clearly defined, stable in time, better fixed in memory and thus more change resistant. This is reflected in the tendency to act, react in some way to the subject of attitude, in aspect of what I want and what I do not want.

Research shows that physical and sport education no longer belongs among the most popular subjects as it was in previous years. This is demonstrated in the attitudes of pupils towards physical and sport education. They vary from positive to indifferent. So it is in decreasing of physical performance, increasing number of not participating pupils (pupil sitting on the bench) and exempt pupils. It is significant especially in girl’s groups. Many research results in this problem area show, that in the vast majority of schoolgirls, they have less positive attitude toward physical and sport education than boys have, that girls are less active in locomotion than boys are and also the increase of not participating pupils is mostly in girls’ way (Bartík 2009/a, b, c; Bendíková 2009, 2011; Zapletalová et al. 2011).

The issue of the survey of attitudes of pupils to school physical and sport education in primary schools in the past dealt with such. Antala and Dorošová (1996); Görner and Starší (2001); Bartík (2005, 2007, 2009/a, b, c); Bartík and Mesiari (2009, 2011); Palička (2009, 2010).

Bartík and Mesiari (2009) exploring attitudes of pupils in the primary school level to the physical and sport education, the Banská Bystrica Region. They found that for more than 60 % of the respondents prevail indifferent attitudes.
One of the strong points how we could give children reason for movement is their participation in physical and sport education lessons at school. Physical and sport education as a subject is a space where you can influence their values, attitudes and beliefs of pupils towards healthy and active lifestyle consisting of regular physical activities.

We incline to the opinion of Dobrý (2006) that the most effective formation instrument of positive attitudes of children towards physical and sport education is well-maintained process characterized by versatility, adequate intensity, originality and proper emotionalism. The teacher of physical and sport education, who significantly affects his pupils to follow physical activities, plays an important role in this process. It happens many times, that the less physically fit child performs better than his performs technically and tactically better teammate. The difference is in the attitude, i.e. in ambition, combativeness, in action in the performance of tasks. Therefore, it is very important that the teachers of physical and sport education are aware of the fact that the importance to get sports and physical experience gained during puberty, especially around the 12th year of age, may significantly affect attitudes that young person will adopt an approach to physical activity and to exercising in general (Dobrý 2006).

School age, especially period of child development in primary school, is the key period for obtaining positive attitudes towards physical and sport education and it is a good baseline for physical performance. Therefore, we focus our attention on girls attending 5th to 9th class of primary schools. The aim of our research was to identify attitudes toward school physical and sport education of schoolgirls from the fifth and ninth class of selected urban and village primary schools in the Bratislava Region. We assume that schoolgirls from 5th classes of primary schools will have more positive attitudes toward schools physical and sport education than schoolgirls from 9th classes of primary schools.

**Methodology**

Our sample consisted of schoolgirls from 5th and 9th class of primary schools. Research took place in village primary schools in the Bratislava’s Region and urban primary schools in Bratislava. Overall, the research involved 247 schoolgirls. 145 of these schoolgirls were from class 5 and 102 from class 9 (Table 1).

<table>
<thead>
<tr>
<th></th>
<th>URBAN</th>
<th>VILLAGE</th>
<th>TOGETHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS 5</td>
<td>88</td>
<td>58</td>
<td>146</td>
</tr>
<tr>
<td></td>
<td>66.66%</td>
<td>50.43%</td>
<td>59.11%</td>
</tr>
<tr>
<td>CLASS 9</td>
<td>44</td>
<td>57</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>33.33%</td>
<td>49.57%</td>
<td>40.89%</td>
</tr>
<tr>
<td>TOGETHER</td>
<td>132</td>
<td>115</td>
<td>247</td>
</tr>
<tr>
<td></td>
<td>53.44%</td>
<td>46.56%</td>
<td>100%</td>
</tr>
</tbody>
</table>
The main research method was attitudinal questionnaire showed by Sivák et al. (2000) approved by the Ministry of Education of the Slovak Republic on the 6th of July 2000 as an educational standard for the 2nd stage of primary school with effect from the 1st of September 2000. The questionnaire contains 51 items and focuses on three separate components attitude – cognitive, emotional and conative components of attitudes. For each of these components is for 17 items. The maximum number of points for the entire questionnaire is 102 points. The intensity of attitudes towards physical and sport education determines the overall score points, namely:

- negative attitude – 0 – 34 points,
- indifferent attitude – 35 – 68 points,
- positive attitude – 69 – 102 points.

The results of the questionnaire were evaluated at the percentage of analysis and we applied relational analysis and used the chi-square test ($\chi^2$) to find links between selected indicators.

**Results and discussion**

Our research in the area of attitudes toward physical and sport education shows, that on the sample of 247 schoolgirls we found out predominantly positive attitudes toward physical and sport education (58.3 %) over the indifferent attitudes (38.46 %). Negative attitudes was experienced occasionally (3.24 %) (Figure 1).

![Figure 1](image)

*Attitudes of schoolgirls from primary schools to physical and sport education*

In that respect, we showed the predominance of positive attitudes of schoolgirls toward physical and sport education over indifferent attitudes in the 2nd stage of primary schools, which is consistent with the results of several studies in Slovakia.

Görner and Starší (2001) dealt with examining attitudes toward physical and sport education for pupils from classes 6 and 8 in selected primary schools of the Central Slovakia Region. Using attitude questionnaire and the questionnaire’s sheet, which the authors themselves compiled, they identified in pupils in the 6th and the 8th class of each school their predominantly positive attitudes toward physical and sport education. Comparing the results
in the 8th class schoolgirls from selected urban and village primary schools have documented the positive attitudes of indifferent attitudes toward physical and sport education far outweigh girls from village schools compared to girls from urban schools.

Bartík (2005) in his research has found in the 2nd stage pupils at selected schools in Eastern Slovakia in Stara Lubovna and Jakubovany predominance of very positive and positive attitudes over indifferent attitudes, negative and very negative.

Based on data from Figure 2 we can see the difference in attitudes toward physical and sport education at schools and sport among schoolgirls from the 5th and 9th class of the primary schools in the Bratislava Region. Of the total number of schoolgirls from the 5th class of the primary schools, 92 respondents adopt a positive attitude what is 63.45 %, 51 respondents with indifferent attitude, it means 35.17 % and two schoolgirls took a negative attitude it means 1.38 % (Figure 2).

By schoolgirls from the 9th class of primary schools, we considered the negative fact that only 43.14 % of respondents have an indifferent attitude toward physical and sport education and 5.88 % of respondents had negative attitude. Of the total number of schoolgirls from 9th class of primary schools, just over one half of schoolgirls adopted a positive attitude it means 52 respondents what is 50.98 % (Figure 2).

The attitudes of pupils from the 9th class to physical and sport education and physical activity at the primary schools in Martin and its surroundings was examined by Bartík (2009/a). From all of the surveyed schoolgirls from 9th class in villages and urban primary schools in the region of Martin 41 respondents showed positive attitudes what is 70.7 %, 17 was indifferent what is 29.3 % and no pupil took a negative attitudes.

In further investigations Bartík and Mesiari (2009) while examining the attitudes of 1 110 pupils, and Bartík (2009/b,c) who examined 1 606 pupils from 9th class of schools in the Central Slovakia, they found out mostly indifferent attitude to physical and sport education.
Attitudes of pupils in the 9th class of the primary schools in the Spiš Region to school physical and sport education was also concerned by Palička (2009, 2010). Of the 460 girls had toward the school physical and sport education a positive attitude only 29 %, 56 % had indifferent attitude and negative attitude had 15 % pupils.

Comparing the results of schoolgirls from the 5th and the 9th class, we can see the differences in orientation of attitudes toward physical and sport education. The results of relational analysis confirmed a significant relation between the attitudes of schoolgirls according to the age or class they attended. When comparing the attitudes of schoolgirls in the 5th and 9th class from schools in the Bratislava Region, the results show, that more older the schoolgirls are, the less they have positive attitudes towards schools physical and sport education and sport, on the other hand there is an increase of mainly indifferent attitudes, but also negative attitudes.

A similar research results were achieved by Bartík (2007), who dealt with the same question in the eastern part of Slovakia. Research done in primary schools in Kežmarok and surrounded area showed that pupils in the 2nd stage of the primary schools had a positive attitude to physical and sport education. Research has found out that the 5th class pupils had more positive attitudes toward physical and sport education than pupils did in the 9th class. It was particularly significant among girls.

Further research results carried out by Bartík and Mesiariik (2011) came to the conclusion: they compared the attitudes of pupils from the 4th, 5th and 9th classes of primary school. The find that when the pupils are getting older their positive attitudes towards school physical and sport education is decreasing and on the contrary, there was an increase mainly in indifferent attitudes, and negative attitudes.

In addition to the overall attitude of schoolgirls in the 5th and 9th classes of primary school to physical and sport education, we also investigated the different levels of intensity and attitudes of schoolgirls in aspect of their physical activity. The intensity of attitudes toward physical and sport education in the group of schoolgirls doing the performance sports (n = 75) was as follows: Total 66.67 % schoolgirls had toward physical and sport education positive attitudes. Indifferent attitudes had 32 % schoolgirls. Interesting fact is that in this group was a schoolgirl who showed negative attitudes towards physical and sport education (1.33 %) (Figure 3).

The intensity of attitudes toward physical and sport education in the group of schoolgirls doing sport activities at recreational level (n = 152) was as follows: Total 59.21 % schoolgirls had toward physical and sport education positive attitudes. Indifferent attitudes had 39.47 %. The negative attitudes had 1.32 %.

The good news is that out of the total number of schoolgirls (n = 247) was in the category of no sporting at all only 20 girls. The disturbing fact, however, is that only 20 % of them reflected positive attitudes. Indifferent attitudes had 55% and negative attitudes towards physical and sport education reflected 25% schoolgirls who do not do any sport activity. As can be seen in figure 3, results of the relational analysis of all group confirmed significant relation (p < 0.01) between attitudes to schoolgirls of physical and sport education for their physical activities.
Conclusion

Our research was realized at primary schools in the Bratislava Region where the schoolgirls in the 5th and 9th classes showed their interest in physical activities. We have found some interesting facts about the relationship between schoolgirls and physical and sport education. We found that schoolgirls in the 5th and 9th classes of primary school had mostly positive attitudes (58.30 %) to physical and sport education, and less indifferent attitudes (38.46 %). One thing that teachers as well as the parents should be worried about is the finding that only 43.14 % of schoolgirls from the 9th class had indifferent attitudes toward physical and sport educations and 5.88 % of respondents even negative attitudes.

We assumed that schoolgirls in the 5th classes of primary schools would prefer positive attitudes towards physical and sport education than schoolgirls from 9th classes of primary schools. Based on the results of our research, we conclude that the hypothesis was confirmed. Schoolgirls from the 5th classes had more positive attitudes toward physical sport education than schoolgirls from the 9th classes (p < 0.05).

Due to the decline in positive attitudes toward school physical and sport education, especially in higher classes of primary school schoolgirls, we suggest that we need to engage our pupils more in physical activities and sports for example through schools competitions. We should increase the opportunities for extra school activity groups particularly for girls and pupils of higher classes of the 2nd stage of primary schools.
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RESUMÉ

POSTOJE ŽIAČOK ZÁKLADNÝCH ŠKÔL
K TELESNEJ A ŠPORTOVEJ VÝCHOVE

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IMMEDIATE AND RETENTION EFFECTS
OF TEACHING GAMES FOR UNDERSTANDING APPROACH
ON BASKETBALL KNOWLEDGE

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Summary: Teaching Games for Understanding (TGfU) links tactics and skills by emphasizing
the appropriate timing and application within the tactical context of the game. It has been linked
to the development of enhanced tactical knowledge. The purpose of the study was to determi-
ne immediate and delayed effects of TGfU on procedural and declarative knowledge of basket-
ball and to compare it with a technical approach. Experimental group (EG) (11 fifth graders
+ 18 sixth graders) was taught by TGfU and a control group (CG) (16 fifth graders + 24 sixth
graders) was taught by a technical approach for 8 weeks in Physical Education (PE) classes,
both. A written test was constructed to evaluate pupils’ declarative and procedural knowledge
of basketball. The test was applied after the intervention to determine immediate effects and
8 months after the intervention to determine retention effects of the experimental programme.
Shapiro-Wilk test, Wilcoxon T-test, Man-Whitney U-test were used for statistical analysis of
obtained data. Cohen’s d was used to calculate effect size. Generally basketball knowledge was
better in EG than in CG after the intervention (p < 0.05) what confirms moderate effect size.
When declarative and procedural knowledge were analysed separately there was no significant
difference between EG and CG. Nevertheless, moderate effect sizes indicate that the data are
particularly meaningful in terms of school practice. Retention effects of both approaches were
similar. Total knowledge and declarative knowledge were worse after 8 months than imme-
diately after the intervention in both groups (p < 0.01). In both groups, there was no significant
difference in procedural knowledge between the test written immediately after the interven-
tion and 8 months later. Differences of changes were not significant between the groups.

Key words: Physical Education, basketball, Teaching Games for Understanding approach

Introduction

Physical Education has lifelong value and purpose and it lends itself to a creative tool
to learning and teaching. Such approach means teaching essential knowledge, skills and
understanding within creative contexts where the focus is developing pupils' capacity to be-
come highly active explorers of knowledge, ideas and strategies and in enabling and moti-
vating them to apply knowledge and skills by making choices and decisions (Pickard and
Maude 2014). Despite that, some may think that it is safer to teach in a traditional, didactic
manner where learners are viewed as 'empty vessels’ (Piaget 1952). Such model of games
teaching, known as a technical approach, involves teaching the skills required for a game in

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isolation before playing the game. This method suits those learners capable of mastering technical skills at that moment in time, but does not always enable less physically competent learners to succeed. While there is an important place for practice and performance technically accurate skills, these alone do not make games players. Griffin and Butler (2005) suggest that pupils would become more proficient players if they learned to understand the decisions to be made during the game. Furthermore, this model of teaching relies more on teacher orders and less on learner participation. However, children enjoy, engage with and learn from creative teachers, and learn most from teachers who support and challenge their thinking (Pickard and Maude 2014).

On the other hand, there is a TGfU which focuses on problem-solving, and situated and pupil-centred learning, thereby maximising player enjoyment (Griffin and Butler 2005). Kirk and MacPhail (2002) argue that TGfU enables the learner to be actively engaged with the learning environment, resulting in an increased ability to make sense of new knowledge, which in turn fosters the development of intelligent game players. Given the active engagement of the learner, the TGfU is an ideal vehicle to help with the development of higher-order cognitive processes. When the TGfU approach is used, the learner develops an appreciation for a game, which serves as a foundation for making good decisions (Oslin and Mitchell 2006). McBride and Xiang (2004) have suggested that the TGfU supports the development of metacognitive processes, such as decision-making, critical thinking and problem solving.

**Methods**

For better understanding of a research, design there is a figure below (Fig. 1). At the time t₀ basket basketball skills and somatic characteristics had been measured but this is not relevant to this paper. Afterwards the intervention was conducted in duration of 8 weeks. Importantly, a knowledge test was applied after the intervention at the time t₁ and the same test was applied 8 months later at the time t₂. Tests of basketball skills and game performance were applied along with the knowledge test but these are not the subject of this study.

![Figure 1](image_url)

*Figure 1*

*Research design*
The aim of our study was to determine the immediate and retention effects of the TGfU on procedural and declarative knowledge in basketball and to compare it with the technical approach.

EG consisted of 11 fifth-graders (year of birth 2002 – 2003) and 18 sixth-graders (year of birth 2001 – 2002) and CG consisted of 16 fifth-graders and 24 sixth-graders. During 8 weeks of the intervention EG was taught by the TGfU approach and CG by the technical approach twice a week for 45 minutes in basketball classes, both. Afterwards both groups continued having regular PE classes for 6 months what was followed by 2-month summer break. To increase the validity of the experiment PE classes during the intervention were conducted by the same teacher in every group and none of the groups played basketball in PE between knowledge test 1 and 2.

To collect data the knowledge test was applied firstly after the intervention (t1) and secondly 8 months later (t2). Seven out of 12 questions were concerned to basketball rules (declarative knowledge) and five questions to tactics (procedural knowledge) of basketball. Both closed and open questions were used.

The obtained data were processed by Shapiro-Wilk test to determine normal distribution. Since only 1/3 of the data were normally distributed, nonparametric tests Mann-Whitney U-test and Wilcoxon T-test were applied for further analysis. SPSS Statistics programme, v. 17 was used. Cohen d was used to calculate effect size which was interpreted as small at cut point of 0.2, moderate at cut point 0.5 and large at cut point 0.8 (Cohen 1988). Declarative and procedural knowledge were evaluated separately and together as total knowledge. A level of significance was set on 5 %.

**Results and Discussion**

A level of total knowledge was higher by 6.47% in EG than in CG (p < 0.05). The calculated effect size between EG and CG was moderate (d = 0.5). The mean value was 9.28 point/pupil in EG and 8.5 point/pupil in CG. Declarative and procedural knowledge were higher in EG than in CG but the difference was not significant (Fig. 2). Nevertheless moderate effects sizes of both declarative (d = 0.4) and procedural knowledge (d = 0.4) indicate that the data are particularly meaningful in terms of school practice. Therefore, we can presume that TGfU approach has greater influence on the knowledge in basketball than in the technical approach. Similarly, Turner and Martinek (1999) reported that students in a TGfU group scored higher measures of declarative and procedural knowledge in field hockey than a CG that was taught with more technique-oriented approach. Popelka (2012) identically reported that pupils in a TGfU group scored higher measures of procedural knowledge in volleyball than a CG that was taught with a technical approach. Similarly, Allison and Thorpe (1997) reported that students who were taught invasion games with the TGfU showed improvements in knowledge and understanding of when to pass, shoot or dribble, and how to make effective decisions to provide support off the ball. Grade six students in two separate studies reported higher levels of tactical knowledge in invasion (Mitchell, Griffin and Oslin, 1995) and net/wall games (Griffin, Oslin and Mitchell, 1995). Combined, our research supports the positive influence that TGfU can have on the development of knowledge and understanding across many different types of games.
In EG mean value of total knowledge was 9.28 point/pupil after intervention (t₁) and 7.78 point/pupil 8 months after intervention (t₂) what is decrease by 12.5 % (p < 0.01). The significant decrease is supported by large effect size (d = 1.1). Mean value of declarative knowledge was 4.93 point/pupil in t₁ and 3.62 in t₂ what is a significant decrease by 18.72 % (p < 0.01). Calculated effect size was also large (d = 1.1). Procedural knowledge decreased only by 3.8% what was not significant (Fig. 3). However small to moderate effect size (d = 0.3) indicates that there might exist some practical significance of the data.

In CG mean value of total knowledge was 8.5 point/pupil in t₁ and 7 point/pupil in t₂ what is a decrease by 12.5 % (p < 0.01). Effect size was large (d = 0.8). Mean value of declarative knowledge was 4.4 point/pupil in t₁ and 2.98 in t₂ what is a decrease by 20.36 % (p < 0.01). Large effect size (d = 1.0) supports the decrease of basketball rules. Procedural knowledge decreased only by 1.5% what was not significant (Fig. 4). There was no practical significance confirmed by calculation of the effect size (d = 0.1).

Results showed that during 8 months of not playing basketball pupils generally forgot some basketball rules no matter what approach we have taught them. On the other hand, the level of their procedural knowledge remained almost unchanged. A possible explanation why procedural knowledge did not decrease could be due to a transfer within invasion games (football, floorball, and handball) which pupils were playing in PE classes between test 1 and test 2. It could be interesting to see whether and how much the tactical thinking and decision-making changed in the game and not only in knowledge test.

When comparing EG knowledge changes to CG knowledge changes, EG declarative knowledge decreased by 1.64 % less in comparison with CG. EG procedural knowledge decreased by 2.3 % more in comparison with CG, on the contrary. Total knowledge changes were same in both groups. According to the results, we can see that none of the groups worsened more than the other one in 8-month period without playing basketball. Therefore, we could state that both approaches have similar retention effects on declarative and procedural knowledge in basketball.
Immediate and retention effects of teaching games for understanding approach on basketball knowledge

**Figure 3**
Comparison of basketball knowledge between time $t_1$ and $t_2$ in EG

**Figure 4**
Comparison of basketball knowledge between time $t_1$ and $t_2$ in CG

**Conclusions and Recommendations**

In general, we can confirm that the TGfU approach develops basketball knowledge more than the technical approach. Retention effects of both approaches on basketball were similar, declarative knowledge decreased but procedural knowledge did not change during 8 months without basketball classes. For further research, we can recommend to apply more difficult questions on tactical knowledge and more measuring tools for data collection. For practical basketball settings at school, we could recommend to use game-based approaches, which seem to be more effective in acquiring game knowledge and understanding.
References


The study is a part of VEGA 10386/13 “Learning effects of different teaching approaches to sports games in relation to gender, age and game experience.”

RESUMÉ

OKAMŽITÉ A DLHODOBÉ EFEKTY HERNE ORIENTOVANÉHO MODELU NA ŠPECIÁLNE VEDOMOSTI Z BASKETBALU

Gabriela Olosová, Ludmila Zapletalová

Herne orientovaný model vyučovania športových hier spája osvojovanie taktiky a herných zručností prostredníctvom pripravných hier a herných cvičení. Cielený nácvik herných zručností v pripravných cvičeniach nastupuje vtedy, keď učiteľ zdiagnostikuje nedostatočnú...
úroveň ovládania techniky herných činností jednotlivca, ktorá limituje ich úspešnosť v hre, resp. v zápase. Cieľom práce bolo overiť účinnosť herne-orientovaného modelu na špeciálne vedomosti z basketbalu a porovnať ju s účinnosťou tradičného vyučovacieho modelu. Cieľom bolo aj overiť retenciu experimentálneho a kontrolného podnetu. Výskum sme realizovali na hodinách telesnej a športovej výchovy s 2 skupinami žiakov piateho ročníka a so 4 skupinami žiakov šiesteho ročníka vybraných základných škôl. Experimentalne skupiny (ES) (n = 11 piatkov + n = 18 šiestakov) sa basketbal učili herne-orientovaným modelom a kontrolné skupiny (KS) (n = 16 piatakov + n = 24 šiestakov) sa učili tradičným modelom, obe v trvani 8 týždňov. Na hodnotenie špeciálnych vedomostí z basketbalu sme zostavili písomný test, ktorý sme aplikovali po intervencii a po 8 mesiacoch. Na vyhodnocovanie výsledkov sme použili Shapiro-Wilkov test, Wicoxonov T-test a Man-Whitneyho U-test. Na overenie praktickej významnosti sme použili Cohenovo $d$. Ak $d = 0,2$ hovoríme o malej praktickej významnosti, ak $d = 0,5$ hovoríme o strednej praktickej významnosti a ak $d = 0,8$ hovoríme o veľkej praktickej významnosti. Po intervencii dosiahla ES lepšiu úroveň špeciálnych vedomostí v porovnaní s KS ($p < 0,05$; $d = 0,5$). Pri osobitnom hodnotení vedomostí z pravidiel a taktiky sa sice nepreukázali štatisticky významné rozdiely medzi skupinami, avšak $d = 0,4$ naznačuje, že dátia majú praktický význam. Z hľadiska dlhodobého efektu sa znížila úroveň špeciálnych vedomostí v oboch skupinách ($p < 0,01$; $d = 0,8$; resp. $1,1$). Rovnako sa znížila úroveň vedomostí z pravidiel basketbalu ($p < 0,01$; $d = 1,0$; resp. $1,1$), avšak úroveň vedomostí z taktiky sa oproti prvemu testovaniu významne nezmenila ($d = 0,2$; resp. $0,1$).
Summary: Physical characteristics play an important role in the selection of young basketball players and the progress in their playing performance. The aim of the study was to analyze differences in chosen physical characteristics of Slovak U17 female basketball players with respect to their playing positions. We assumed, that there will be statistically significant differences between playing positions in each performance tests results. Chosen characteristics were analyzed for 14 players (mean/SD, age 16.34 ± 0.82; body height 179.72 ± 8.04 cm; body weight 67.62 ± 7.10 kg; body fat 16.59 ± 2.04 %; VO₂max 46.20 ± 4.71 ml.kg⁻¹.min⁻¹) according to their playing positions (guard, forward, center). Five specific performance tests for each player were conducted as a 3/4 Basketball court sprint, 10 x 5m Shuttle test, Lane agility drill, No-step vertical jump and Maximum vertical jump. The differences in tests results by playing positions were evaluated by one-way ANOVA. There were no significant differences found in results of chosen performance tests between playing positions (p > 0.05). In spite of fact, that there were no significant differences, we found interesting results between playing positions in physical characteristics. Guards had better results in speed (3.73 ± 0.16 s), quickness (17.43 ± 0.56 s) and both lower-body power tests (47.16 ± 3.06 cm; 57.00 ± 3.40 cm) than forwards and centers. Forwards had the best results in agility test (12.54 ± 0.43 s). The results of this study produce useful information about physical characteristics of young basketball players according to their playing position and help to diagnose and improve their performance.

Key words: female, youth basketball, physical characteristics, playing position

Introduction

Basketball is a team sports game that can be represented as an ordered series of jobs that each player should do with respect to the position and role within a particular model of tactics (Trninić 2006). Motor abilities play an important role in the selection of young basketball players and the progress in their playing performance (Erčulj et al. 2003). Basketball players with better abilities as speed, strength, agility have a great advantage in full-court as well as half-court game situations (Foran and Pound 2007). A number of studies confirm that better physical abilities has profitable effect on better basketball skills (Hoffman et al. 1996; Taylor 2004; Erčulj et al. 2010). Each of the playing positions has its own characteristics and team role. Studies have shown significant differences among playing position for body size, speed, agility, vertical jump, maximum oxygen consumption (Hoffman et. al. 1996; Sallet 2005; Cormery et al. 2008; Bielik and Tománek 2009; Mačura et al. 2013). For
example Abdelkrim et al. (2010) indicated that there may be a dependence of age and court position differences in fitness performance in men’s basketball. Ostojic et al. (2006) showed that a strong relationship exists between body composition, aerobic fitness, anaerobic power, and position roles in elite basketball. Players may be in great shape to reach their full potential in the game. The physical characteristics of an athlete are important predictive factors of whether the athlete will reach the top level of their chosen sports discipline (Sallet et al. 2005). The aim of the study was to analyse differences in chosen physical characteristics of Slovak U17 female basketball players with respect to their playing positions. Because of differences in body weight and body height between players and different playing roles requirements in each playing positions we assumed, that there will be statistically significant differences between playing positions in each performance tests results.

### Methods

**Participants and Procedure**

The participants were 14 members of Slovak U17 female basketball team. The participants were divided into three groups according to their playing position: center (n = 4), forward (n = 4) and guard (n = 6). The classification by playing position was made by the coaches. Table 1 shows a comparison of the three groups of players in terms of their age, body height, body weight, body fat and VO$_2$max. The subjects were examined during the first two days of national team practice camp in final preparation phase of the team for the U17 Word Championship. It was therefore assumed that all subjects were in good basketball condition. The players were tested in the National Sports Center in Bratislava.

### Table 1

<table>
<thead>
<tr>
<th>Position</th>
<th>Age [years]</th>
<th>Body height [cm]</th>
<th>Body weight [kg]</th>
<th>BFP* [%]</th>
<th>VO$_2$max [mml/L]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X±SD (min–max)</td>
<td>X±SD (min–max)</td>
<td>X±SD (min–max)</td>
<td>X±SD (min–max)</td>
<td>X±SD (min–max)</td>
</tr>
<tr>
<td>Center (n =4)</td>
<td>15.64±1.98 (14.74-16.74)</td>
<td>186.73±3.20 (185.40-188.80)</td>
<td>73.05±9.25 (68.40-79.40)</td>
<td>17.85±3.84 (16.70-19.90)</td>
<td>44.68±8.90 (38.40-48.70)</td>
</tr>
<tr>
<td>Forward (n = 4)</td>
<td>16.92±0.30 (16.79-17.11)</td>
<td>183.50±3.43 (182.10-186.20)</td>
<td>70.82±8.87 (66.80-77.70)</td>
<td>16.27±2.44 (15.10-17.60)</td>
<td>45.42±6.77 (40.00-47.60)</td>
</tr>
<tr>
<td>Guard (n = 6)</td>
<td>16.42±0.69 (15.20-17.05)</td>
<td>172.55±7.25 (164.60-182.90)</td>
<td>61.86±5.77 (55.00-69.20)</td>
<td>15.96±2.41 (11.60-18.50)</td>
<td>47.73±5.71 (40.40-55.30)</td>
</tr>
<tr>
<td>All players (n = 14)</td>
<td>16.34±0.82 (14.63-17.11)</td>
<td>179.72±8.04 (164.60-188.80)</td>
<td>67.62±7.10 (55.00-79.40)</td>
<td>16.59±2.04 (11.60-19.90)</td>
<td>46.20±4.71 (38.40-55.30)</td>
</tr>
</tbody>
</table>

*BFP = Body Fat Percentage
Statistical analyses

All data were analyzed with SPSS for Windows, version 17.0 (SPSS Inc., Chicago, IL). Shapiro-Wilk test was used to test if data were normally distributed. The data were presented using standard descriptive statistic methods as mean, standard deviation, minimum and maximum. One-way univariate analysis of variance (ANOVA) was used to assess differences between basketball players in all the groups of players. The statistical significance was maintained at 5% level.

Tests

The study consisted of 5 specific performance tests (Foran and Pound 2007) – Table 2. Testing was preceded by a thorough warm-up including some jumps, acceleration and deceleration moves and starts.

- **3/4 Basketball court sprint (22.2 meters).** The players were instructed to run fast as possible from starting line (baseline) through finish line (free throw line). Start from a stationary position behind the court baseline, with one foot up to the line (a two-point stance). The time needed to get from a starting point to finish line was measured with photocells. Two trials were allowed and the best time was recorded.

- **10 x 5m Shuttle test.** The players were instructed to run fast as possible the marked distance between two lines (run to the opposite marked line, turn and return to the starting line). Start from a stationary position behind the starting line, with one foot up to the line (a two-point stance). Players both feet had to fully cross the lines. The time needed to run the whole distance was measured with hand held stopwatches. Two trials were allowed and the best time was recorded.

- **Lane agility drill.** The players were instructed to run the pattern marked with cones. The starting and finishing line was extended to the left corner free throw line. Players start from a stationary position behind the starting line, with one foot up to the line (a two-point stance) facing the baseline. The pattern consists of: sprint to the baseline past the cone, defensive-shuffle to the right corner of the lane and past the cone, backpedal to the free throw line past the cone, defensive-shuffle to the left and touch the change-of-direction line with left foot. Than change direction back to right, defensive-shuffle and run with the same motions back through the finish line. One foul was allowed without penalty and the player had the chance to start over. A foul includes knocking down or moving a cone, crossing the feet during defensive-shuffle, not touching the change-of-direction line, sprinting instead of defensive-shuffle or falling down. The time needed to run the whole pattern was measured with photocells. Two trials were allowed and the best time was recorded.

- **No-step vertical jump.** The standing reach and vertical jump of players were measured in shoes and with Vertec device. The players were instructed to jump (two legs) straight up as high as possible with a straight arm without taking a step and tap the Vertec device. Two attempts were allowed. If the second attempt was higher a third attempt was allowed. The no-step vertical jump result was the difference between the standing reach and the jump reach distance.

- **Maximum vertical jump.** The standing reach and vertical jump of players were measured in shoes and with Vertec device. The players were instructed to jump (two legs or one leg) straight up as high as possible, taking as many steps toward the Vertec as necessary.
to acquire a maximum vertical jump. Two attempts were allowed. If the second attempt was higher a third attempt was allowed. The maximum vertical jump result was the difference between the standing reach and the jump reach distance.

Table 2

Description of the performance tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Main Ability</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 Basketball court sprint</td>
<td>Speed</td>
<td>Time [s]</td>
</tr>
<tr>
<td>10 x 5m shuttle test</td>
<td>Quickness</td>
<td>Time [s]</td>
</tr>
<tr>
<td>Lane agility drill</td>
<td>Agility and quickness</td>
<td>Time [s]</td>
</tr>
<tr>
<td>No-step vertical jump</td>
<td>Lower-body power</td>
<td>Jump height [cm]</td>
</tr>
<tr>
<td>Maximum vertical jump</td>
<td>Lower-body power</td>
<td>Jump height [cm]</td>
</tr>
</tbody>
</table>

Results and Discussion

Shapiro-Wilk test showed that data was normally distributed. Players’ characteristics and test performance results are reported in Table 1 and Table 3. The tallest (186.73 ± 3.20 cm) and the heaviest (73.05 ± 9.25 kg) players on average, as expected, were the centers. The guards had the lowest body fat percentage (15.96 ± 2.41 %) and the best results in maximal oxygen uptake (47.73 ± 5.71 ml.kg⁻¹.min⁻¹).

No statistically significant differences (p > .05) were found for running speed, quickness, agility and both lower-body power between any playing positions (Table 4). Guards had better results in speed (3.73 ± 0.16 s), quickness (17.43 ± 0.56 s) and both lower-body power tests (47.16 ± 3.06 cm; 57.00 ± 3.40 cm) than forwards and centers, on average. Comparison of our findings from our 3/4 Basketball court sprint test (mean 3.78 s) with findings (mean 3.40 s) from Drinkwater et al. (2008) showed close results. The best results in Lane agility drill test (12.54 ± 0.43 s) had the forwards. The lowest average measured values of No-step vertical jump and Maximum vertical jump were surprisingly, found in centers (43.00 ± 4.69 cm and 53.00 ± 3.86 cm) and the highest by guards (47.16 ± 3.06 cm and 57.00 ± 3.40 cm). The highest maximal vertical jump performance was achieved by playing positions guard and forward, with values of 62.00 cm. Greene et al. (1998) found that the average vertical jump (using the same Vertec device as we) of female basketball players with age mean 16.02 year, was 46.36 cm. This result is compared to our Maximum vertical jump results (55.78 cm) lower (Table 3). Comparing the 3/4 Basketball court sprint and no-step vertical jump results with Erčulj et al. (2010) which tested sixty-five female basketball players from different European countries aged between 13 and 15 during international FIBA camps for the best European U15 basketball players, we can state that their results in 3/4 Basketball court sprint (3.6 ± 0.21 s) and no-step vertical jump (26.34 ± 5.15 cm) compared with our findings (3.78 ± 0.14 s) and (45.57 ± 4.43 cm) were better in 3/4 Basketball court sprint performance test. We consider that the difference (19 cm) in no-step vertical jump is effecting due to age of tested players.
Physical characteristics of female basketball players according to playing position

**Table 3**

*Descriptive statistics of performance test results by playing positions*

<table>
<thead>
<tr>
<th>Test</th>
<th>3/4 S*</th>
<th>10x5 T°</th>
<th>Lane Drill°</th>
<th>NVJ°</th>
<th>MVJ°</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X±SD (min–max)</td>
<td>X±SD (min–max)</td>
<td>X±SD (min–max)</td>
<td>X±SD (min–max)</td>
<td>X±SD (min–max)</td>
</tr>
<tr>
<td><strong>Center (n = 4)</strong></td>
<td>3.89±0.04 (3.85-3.95)</td>
<td>17.95±0.37 (17.40-18.20)</td>
<td>13.65±0.36 (12.92-13.65)</td>
<td>43.00±4.69 (37.00-48.00)</td>
<td>53.00±3.86 (48.00-57.00)</td>
</tr>
<tr>
<td><strong>Forwards (n = 4)</strong></td>
<td>3.75±0.12 (3.88-3.75)</td>
<td>17.70±0.20 (17.30-17.70)</td>
<td><strong>12.54±0.43</strong> (12.19-13.18)</td>
<td>45.75±5.79 (38.00-52.00)</td>
<td>56.50±7.14 (47.00-62.00)</td>
</tr>
<tr>
<td><strong>Guards (n = 6)</strong></td>
<td><strong>3.73±0.16</strong> (3.58-4.01)</td>
<td><strong>17.43±0.56</strong> (16.70-18.20)</td>
<td>12.73±0.40 (12.25-13.21)</td>
<td><strong>47.16±3.06</strong> (45.00-52.00)</td>
<td><strong>57.00±3.40</strong> (53.00-62.00)</td>
</tr>
<tr>
<td><strong>All players (n = 14)</strong></td>
<td>3.78±0.14 (3.58-4.01)</td>
<td>17.60±0.46 (16.70-18.20)</td>
<td>12.83±0.47 (12.19-13.65)</td>
<td>45.57±4.43 (37.00-52.00)</td>
<td>55.78±4.74 (47.00-62.00)</td>
</tr>
</tbody>
</table>

*3/4 S = 3/4 Basketball Court Sprint, 10x5 T = 10 x 5m Shuttle Test, Lane Drill = Lane agility drill, NVJ = No-step Vertical Jump, MVJ = Maximum Vertical Jump*

**Table 4**

*Differences between performance tests (ANOVA)*

<table>
<thead>
<tr>
<th>Test</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 Basketball court sprint</td>
<td>0.06</td>
<td>2</td>
<td>0.03</td>
<td>1.93</td>
<td>0.19</td>
</tr>
<tr>
<td>10 x 5m Shuttle Test</td>
<td>0.68</td>
<td>2</td>
<td>0.33</td>
<td>1.73</td>
<td>0.22</td>
</tr>
<tr>
<td>Lane agility drill</td>
<td>1.21</td>
<td>2</td>
<td>0.60</td>
<td>3.81</td>
<td>0.06</td>
</tr>
<tr>
<td>No-step vertical jump</td>
<td>41.85</td>
<td>2</td>
<td>20.92</td>
<td>1.82</td>
<td>0.48</td>
</tr>
<tr>
<td>Maximum vertical jump</td>
<td>36.61</td>
<td>2</td>
<td>18.30</td>
<td>0.85</td>
<td>0.22</td>
</tr>
</tbody>
</table>

**Conclusions**

Performance testing provides feedback about players actual shape, feedback for evaluating a training program and information for recovery assessment. Players physiological characteristics differ according to their position on court, and need specific training to developed the skill needed by each playing position. However, in our study we no significant differences found in results of chosen performance tests between playing positions. Findings of the study indicated that the results of physical performance tests of Slovak female U17 basketball players do not significantly differ between playing positions guard, forward and center. This fact could be used by coaches stuff to determine tactics to opponents. Small differences in physical characteristics between players gives more options using players in several playing positions. On the other hand, with this kind of playing positions homogeneity, should be treated with caution in the future selection of players for basketball in general and also for national teams.
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RESUMÉ

POHYBOVÉ SCHOPNOSTI BASKETBALISTIEK
RÔZNYCH HRÁČSKYCH FUNKCIÍ

Richard Kucsa, Peter Mačura

Motorické schopnosti zohrávajú dôležitú úlohu pri výbere mladých basketbalistiek a v procese ich výkonnostného rastu. Cieľom štúdie bolo analyzovať a zistiť rozdiely vo vybraných pohybových schopnostiach basketbalistiek reprezentácie Slovenska do 17 rokov s ohľadom na ich hráčske funkcie. Predpokladali sme, že rozdiely medzi hráčskymi funkciami vo výsledkoch jednotlivých výkonnostných testoch budú štatisticky významné. Výskumný súbor tvorilo 14 hráčok (x̅ ± SD, vek 16,34 ± 0,82; telesná výška 179,72 ± 8,04 cm, telesná hmotnosť 67,62 ± 7,10 kg, telesný tuk 16,59 ± 2,04 %, VO2max 46,20 ± 4,71 ml.kg⁻¹.min⁻¹) rozdelených podľa hráčských funkcií (rozohrávačky, krídla, pivotky). Každá hráčka absolvovala testy: beh na 3/4 basketbalového ihriska, 10 x 5 m beh, Lane agility test, vertikálny výskok bez výkroku a maximálny vertikálny výskok. Rozdiely vo výsledkoch sme vyhodnocovali pomocou jednofaktorovej analýzy rozptylu (ANOVA). Rozohrávačky dosiahli najlepšie výsledky v teste rýchlostných schopností, rýchlostí so zmenami smeru a v oboch testoch výbušnej sily dolných končatín. Krídla malí najlepšie výsledky v testovaní agility. Zistené rozdiely medzi hráčskými funkciami vo výsledkoch vybraných výkonnostných testov však štatisticky významné neboli. Výsledky tejto štúdie obsahujú užitočné informácie o pohybových schopnostiach mladých basketbalistiek podľa hráčských funkcií, ktoré sú námopomenú pri diagnostike a zlepšovaní výkonnosti hráčok.
BODY IMAGE AND SENSATION SEEKING IN GYM-GOERS

Petr Schlegel, Ludmila Fialová

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Summary: This research aimed to explore a relation between Body image (PSPP) and Sensation Seeking (SSS-V) and to determine gym-goers based on these entities. The research file (N = 182) consisted of gym-goers aged between 24 – 45. The comparison of the tests showed a weak relation (0.25) between PSPP and SST tests and also among the individual subscales. The comparison of men and women did not come up with any significant differences. In terms of Body image, the file showed above-average results, in the case of Sensation Seeking, its score was average. The outcome of our findings is that there is no marked relation between PSPP and SST and the same goes for men and women.

Key words: body image, physical self perception profile, sensation seeking, gym-goer

Introduction

When researching how people act, regardless of which particular area is being covered, it is hardly possible to separate one area from another. There is a sense of unity between people and their environment just as much as there is a certain level of integrity within themselves. In the field of psychology, various spheres trying to grasp and explain human behaviour are known. However, it is not always clear how these areas of human behaviour are linked.

In a discourse on personality psychology, various ways of defining links across all kinds of spheres are offered: e.g. a relation between intelligence and motivation or self-esteem and personal characteristics (cf. Blatny 2010). Those who were researching into relations between self-esteem and temperament were, for instance, Heimpel and Eliot (2006) – behavioural systems in relation to neuroticism and self-esteem; Campell (2004) – sensation-seeking and narcissism; Llewellyn et al. (2008) – self-efficacy and a propensity for risk behaviour.

In our case the research deals with a relation between sensation seeking and body image. Murtaza et al. (2011a, 2012) dealt with Sensation seeking and physical self-perception of weightlifters and bodybuilders. The research is, however, just a descriptive one and does not mention any deeper relations of the aspects observed. Apart from this one, we are not familiar with any other studies.

Body image in terms of mental representation of one’s own body involves three parts: cognitive, emotional and behavioural (Fialová 2001). These parts influence one another and create a single entity, which is essential in the overall self-esteem. The importance of body
and its presentation is crucial in today’s society, as seen in media and the way body is treated. It is becoming a marketing device with an emphasis on its perfection and flawlessness. The following interiorisation of the performed ideals influences perception and the actual relation with one’s body. This often results in dissatisfaction with body image and yearning for a change.

The survey research method Physical Self Reception Profile (PSPP) (Fox, Corbin 1989) was chosen for the evaluation. It contains 30 questions that are further divided into five subdomains: Sport competence, Physical condition, Attractive body, Physical strength, and Physical self-worth.

Seeking new, strong and extraordinary experiences or taking a certain risk which might lead to consequences in physical and social sphere is labelled by Zuckerman (1994) as Sensation Seeking. Research usually focuses on the spheres with a high objective degree of risk. Nevertheless, this is a complex personality trait that is related to further areas and beyond. The subscale Disinhibition is, for instance, related to addictions and/or Boredom Susceptibility influences decision-making and the ability to judge situations. (Breen, Zuckerman 1999; Roberti 2004).

The questionnaire (SST) (Zuckerman 1994) is used to define a degree for seeking sensations. 40 items are divided into 4 subscales: Thrill and adventure seeking (TAS), Experience seeking (ES), Disinhibition (Dis), Boredom susceptibility (BS).

**Body image in the case gym-goers**

One peculiarity of exercising in the gym is the focus on changing an outward look of one’s own figure – fitness centre themselves stated this as the main reason (Rayn 1997; Stackeová 2009). Men care to tone up through muscle hypertrophy, while women care more to become slimmer and strengthen some of their weak areas. Boos et al. (1998) found out that men are particularly interested to build muscles and improve their appearance. Another important motive is to become fitter – this has been only generally assessed but it is possible to interpret it as an urge to develop skills related to strength and stamina. What is, however, likely to be behind this motive is the first reason – i.e. optical appearance improvement, but quite a lot of people feel ashamed of this reason and do not admit it (Cash 2004).

The nature of exercise calls for high concentration on the actual technique and, at the same time, individual muscles. Stackeová (2006) states that a better differentiation of individual parts of body and feelings in them is achieved as a result. This is to lead to positive changes of body schema (Lowen 2002).

Thanks to exercising in the gym and following a nutrition plan, it is quite easy to achieve changes in some anthropometric measurements. Changes in body outline, weight loss etc. lead to changes in the way the body is perceived. This state is further strengthened by the fact that the body simultaneously becomes stronger and fitter. The hypothesis has it that the benefits mentioned above should reflect well on the creating of body image (Thompson 2011).

There are no, however, definite conclusions when comparing bodybuilders/gym goers to the general population. In some cases, we are able to observe positive changes in body image, while in the others, we observe pathological tendencies (Hallsworth et al. 2005; Pickett et al. 2005; Goldfield 2006; Braun, Graham 2008; Schlegel, Fialová 2013).
**Sensation seeking in the case of gym-goers**

According to the division of movement activities in relation to sensation seeking (Kuban 2006) exercising in a fitness centre is found at the very end of the proposed spectrum; in contrast to mountaineering, snowboarding, parachuting and so on. As a result, we report a lower degree of objective risk and, at the same time, we predict a low score in SST test.

The nature of exercise is, however, more complicated. What occurs is a lot of strain, increased blood circulation, pain in muscles and exhaustion. All this is a source of strong emotions that influence the way a certain activity is experienced (Lowen 2002; Stackeová 2008).

We can see gym-goers pay more attention to their own bodies and concentrate on it so much that it can sometimes lead even to narcissism. Narcissism, an exaggerated esteem of one’s own body and impulsive behaviour correlates with the results from the subscales Disinhibition and Boredom susceptibility (Emmons 1987; Breen, Zuckermann 1999). On the other hand, it is also possible to find a positive relation between sensation seeking and positive self-view (Campell et al. 2004).

**Design of the study**

**Objective** – Determining the relationship between body image and sensation seeking in gym-goers.

**Aims**

– comparison of tests Physical self perception profile (PSPP) and Sensation seeking tendency (SST),
– comparison of selected subscales of tests PSPP and SST,
– determination of the research group in terms of body image,
– determination of the research group in terms of sensation seeking,
– gender determination in PSPP and SST.

Czech gym-goers aged between 24 and 45 (average = 30.8; SD = 6.9) participated in the survey (N = 182) and these were represented by 93 men (average 30.8; SD = 7.1) and 89 women (average 30.7; SD = 6.8). The basic condition was that they had to exercise at least twice a week and for at least one year. The choice of the fitness centre (N = 7) was limited to large cities (more than 80 000 inhabitants), it had to meet specific requirements to obtain the homogeneity of the sample: area covering at least 400 m², a gym hall, whole body exercise machines, dumbbells and weights, cardio zone with training machines.

**Methods**

Physical self perception profile (PSPP) (Fox, Corbin 1989) is a questionnaire focused on perception, presentation and evaluating abilities and body appearance. It was validated for the Czech population by Tomešová (2005). The questionnaire consists of 30 items – sentences, which a participant completes by choosing one of four options based on the one that fits them best.
Sensation seeking tendency (SSS-V) (Zuckermann 1994) is a questionnaire serving to find out a degree of tendency of seeking sensations in various spheres of life. Kuban (2006) validated it through the Czech sample. A participant chooses between two options in forty items, based on the one that fits them best.

**Procedure**

The questionnaires were given out right in the gyms and always on one randomly chosen day. The data collection was taking place from August to October in 2013. The content and the procedure were both in accordance with ethic and scientific norms.

**Data management and analysis**

To process the data the programme NCSS 2007 was used, including descriptive statistics and graphs. Out of statistics methods Spearman’s correlation coefficient was applied to find out a correlation of two signs. T-test used to compare arithmetic average of two independent variants. Kruskal-Wallis test used to verify homogeneity of dividing the sign in question in several populations with independently random choices.

**Results**

What can be inferred from the final figures is that in both tests the participants achieved a score above average. When correlating the tests just a weak link was uncovered (\(PC = 0.25\)). In the graph 1 the linear correlation is shown. The results in the table 1 show the comparison between men and women. The correlation was higher in the case of women (\(PC = 0.21\)), but, overall, there is a weak relation in both sexes.

**Table 1**

*The results of the correlation tests PSPP and SST*

<table>
<thead>
<tr>
<th></th>
<th>count</th>
<th>mPSPP</th>
<th>mSST</th>
<th>PCS</th>
<th>CronA</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>182</td>
<td>78.3</td>
<td>62.1</td>
<td>0.253</td>
<td>0.4</td>
</tr>
<tr>
<td>Man</td>
<td>93</td>
<td>82.5</td>
<td>63</td>
<td>0.15</td>
<td>0.26</td>
</tr>
<tr>
<td>Women</td>
<td>89</td>
<td>73.9</td>
<td>61.1</td>
<td>0.21</td>
<td>0.35</td>
</tr>
</tbody>
</table>

*Note: mPSPP: the average of results in the test PSPP, mSST: the average of results in the test SST, PC – Pearson’s correlation coefficient, CronA – Cronbach’s alpha*

Certain subscales were selected from the tests and they were further compared to one another (see table 2). The values PC run from 0.1 up to 0.19. Going by the results of the correlation, there is a weak relation among them all.
The aim of the research was to determine gym-goers by means of PSPP and SST tests and find out a relation between these tests. The results of PSPP test show an above-average satisfaction with body, which concerns all the components of body image. This is in accordance with the conclusions of the surveys carried out among sport population (Cash, Pružinsky 2002; Grogan 2008; Schlegel, Fialová 2013). Once again it has been proven that all those worries about negative effects of exercise in a gym mainly concern professional body-builders. In the case of common exercise, they have a positive effect on body image and self-esteem (Pope et al. 2006; Mosley 2009). The research file did not reveal any high values in any of the subscales. Although the nature of exercise and social environment might pre-
dict higher values in subscales Strength and Attractivity, such a thing did not occur. The propensity to narcissism and exaggerated self-objectivity is likely to be true for certain individuals and professional bodybuilders (Pickett et al. 2005; Brown, Graham 2008).

Exercising in a gym belongs to the sports with a low physical risk and those working out this way should be marked with lower values in the test SST (Goma-i-Freixanet 2012; Kuban 2006). Our findings, however, do not entirely confirm this assumption. The results were only average and it is, therefore, impossible to state firmly that gyms are visited by people with a low tendency to sensation seeking. No particular deviation in the subscales was detected, which means that gym-goers cannot be ruled out based on SST.

Only a weak relation results from the outcomes of the comparison between PSPP and SST tests. The correlation coefficient reached the value 0.25. This means that we cannot presume a positive dependence of these signs in the case of the research sample. Although an assumption of a possible dependence emerged in some other researches (Zuckerman 1984; Emmons 1987; Crozier 1995; Miller 2003; Cambell 2004; Heimpel et al. 2006; Llewellyn 2008), we were not able to prove this in ours.

Individual subscales are also tested independently in SST (see Breen, Zuckerman 1999) and, therefore, the chosen subscales of both tests were compared. The table 2 shows the pairs where such a correlation occurred. None of them pointed to a strong dependence. The highest value was scored by the correlation Physical Self Worth – Disinhibition (0.19), but still this is just a too low value for a significant relation.

Comparing groups of men and women in PSPP test yielded significantly better results in the case of men (p = 0.05). The outcomes of the test bear out the earlier assumption that women are less satisfied with body image. Sociocultural conditions and media pressure play a central role (Grogan 2008; Hobza, Rochlen 2009; Sirra, Ballard 2011 ad.). The Gender comparison of SST produced results without a significant deviation. The values were comparable to one another, which differs from the conclusions of other studies in which men scored higher than women. (Twenge 1997; Wood Eagly 2012).

**Conclusions**

The findings of this study have been proven both right and wrong by some other researches. Czech gym-goers are marked with above-average satisfaction with body and, at the same time, there is no marked difference of values among the subscales. In terms of Sensation Seeking all the participants achieved an average score without any marked difference among the subscales.

The correlation of PSPP and SST tests showed a weak dependence. The significant relation cannot be stated in the chosen subscales either (Physical Self Worth – Disinhibition, Strength – Disinhibition, Physical Self Worth – Thrill and Adventure Seeking, Strength – Experience Seeking, Strength – Boredom Susceptibility). The results of men and women differed as revealed in the earlier findings. Men achieved significantly better results in PSPP, the values in SST were comparable to one another.

With regard to the size of the file and its specific character, it is impossible to generalize the findings and apply them to general population. It would be necessary to carry out further research to conclude this.

Comenius University in Bratislava, Faculty of Physical Education and Sport
References


RESUMÉ

BODY IMAGE A SENSATION SEEKING NÁVŠTEVNÍKOV FITNES CENTRA

Petr Schlegel, Ludmila Fialová

Tento výskum mal za cieľ preskúmať vztah medzi Body image (PSPP) a Sensation seeking (SSS-V) a determinovať návštevníkov fitness centra na základe týchto subjektov. Súbor výskumu (N = 182) sa skladať z návštevníkov vo veku 24 až 45 rokov. Porovnanie testov ukázalo slabý vztah (0,25) medzi testami PSPP a SST a aj medzi jednotlivými subškálami. Porovnanie mužov a žien neprineslo žiadne významné rozdiely. Pokiaľ ide o vnímanie vlastného tela, súbor ukázal nadpriemerné výsledky, v prípade Sensation Seeking bolo skôre v priemere. Výsledkom našich zistení je, že neexistuje významný vzťah medzi PSPP a SST, a to isté platí particulárne pre mužov a aj pre ženy.
EFFICIENCY OF DIFFERENT TEACHING MODELS IN TEACHING OF FRISBEE ULTIMATE

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Summary: The aim of the study was to verify the efficiency of two frisbee ultimate teaching models at 8-year grammar schools relative to age. In the experimental group was used a game based model (Teaching Games for Understanding) and in the control group the traditional model based on teaching techniques. 6 groups of female students took part in experiment: experimental group 1 (n = 10, age = 11.6), experimental group 2 (n = 12, age = 13.8), experimental group 3 (n = 14, age = 15.8), control group 1 (n = 11, age = 11.7), control group 2 (n = 10, age = 13.8) and control group 3 (n = 9, age = 15.8). Efficiency of the teaching models was evaluated based of game performance and special knowledge results. Game performance was evaluated by the method of game performance assessment based on GPAI (Game Performance Assessment Instrument) through video record. To verify level of knowledge, we used a knowledge test, which consisted of questions related to the rules and tactics knowledge of frisbee ultimate. To perform statistical evaluation Mann-Whitney U-test was used. Game performance assessment and knowledge level indicated higher efficiency of TGfU in general, but mostly statistically insignificant. Experimental groups 1 and 2 were significantly better in the indicator that evaluates tactical aspect of game performance – decision making (p < 0.05). Experimental group 3 was better in the indicator that evaluates skill execution – disc catching. The results showed that the students of the classes taught by game based model reached partially better game performance in general. Experimental groups achieved from 79.17 % to 80 % of correct answers relating to the rules and from 75 % to 87.5 % of correct answers relating to the tactical knowledge in the knowledge test. Control groups achieved from 57.69 % to 72.22 % of correct answers relating to the rules and from 51.92 % to 72.22 % of correct answers relating to the tactical knowledge in the knowledge test.

Keywords: PE, TGfU, game performance, knowledge level, frisbee ultimate

Introduction

Due to acceptance of the state educational programme in 2008, a change of aims in the subject PE was noticed. The subject is more focused on development of the competences and attitudes. The objective is to create a permanent relation to the physical activity as a part of the lifestyle and assumption for lifelong health care (Antala et al. 2012). Change of aims in PE requires change in habitual teaching models. At present, we also occurs effort to search for alternative, more efficient models than the traditional model based on the preferred techniques of game skills to help teachers to achieve the desired objectives.
Knowledge that the results of sport game teaching are insufficient, and the progress at lessons is minimal was motivation for the authors to find an alternative to the traditional model of teaching (Thorpe et al. 1986). An alternative to "technical" – the "traditional" model of teaching are game-based teaching models which emphasize cognition of game performance and development of game performance in conditions close game. These models are, for example – Teaching Games for Understanding – TGfU (Griffin et al. 1997; Mitchell et al. 2003; Griffin and Butler 2005; Mitchell et al. 2006; Psotta 2010), Games Based Approach – GBA (Kirk, McPhail 2002; Mandigo et al. 2007; Rossi et al. 2007; Gabbet et al. 2009) and Integrated Game Practice (Dobrý et al. 2011) etc.

Change of the teaching model required also new game performance assessment methods, which would affect mainly tactical aspect of game performance. GPAI (Game Performance Assessment Instrument) could be considered a suitable method of game performance assessment for PE. GPAI is a flexible, authentic tool of game performance assessment, which can be easily used and adjusted to what students learnt (Mitchell and Oslin 1999). GPAI is, according to Memmert and Harvey (2008), one of the best methods of game performance assessment. Through this method, it is possible to assess such indicators that demonstrate tactical thinking as well as technical aspect of game performance (Oslin et al. 1998). It is a method suitable for the category of children and youth of school age. General model of GPAI consists of assessment of 7 components of game performance: decision-making, skill execution, adjust, cover, support, mark and base, out of which it is possible to choose suitable for the various sport games.

Currently is available a number of research results, which compared the effectiveness of different teaching models of sports games (Wrisber and Liu 1991; Turner and Martinek 1999; Dan Ota and Vickers 1998; Blomqvistová 2001; Dalton 2009; Olosová a Zapletalová 2012; Popelka 2012; Žuffová 2012; Kuchárik 2014; Olosová a Zapletalová 2014). We lack such knowledge about teaching a less known sports game - frisbee ultimate. That's reason we decided to verify the effectiveness of two teaching models currently in this sport game, both in terms of development of game performance and acquire specific knowledge of the rules and tactics of the game.

Aim

The aim of the study was to verify and compare efficiency of two teaching models (TGfU and the traditional one) of frisbee ultimate with female students of different age categories at 8-year grammar school.

Methods

The experiment was performed with the girls of 3 age groups of grammar school, i.e.: experimental group 1 (n = 10, age = 11.6), experimental group 2 (n = 12, age = 13.8), experimental group 3 (n = 14, age = 15.8), control group 1 (n = 11, age = 11.7), control group 2 (n = 10, age = 13.8), control group 3 (n = 9, age = 15.8). Experimental group was taught by TGfU and control group by traditional model. The experiment was carried out at lessons of school PE in total amount of 12 lessons.

Game performance assessment was performed through the method of GPAI (Game Performance Assessment Instrument) according to Žuffová and Zapletalová (2014). 6 games
were analyzed and each player played for 20 minutes. The ability of decision-making, the disc and skill execution was evaluated.

1. **Decision making**: who to pass, where in the final zone to pass

   **Assessment:**
   - **suitable**: a pass to a free team-mate, resp. the team-mate who cooperates actively – releases and offers himself for the pass
   - **unsuitable**: a pass to an occupied team-mate who is being closely defended and who is not releasing for the pass

2. **Skill execution**: pass, final pass and disc catching

   **Assessment:**
   - **successful**: a processable pass that is directed to the area of the trunk or the head it is possible to catch it easily; it is assessed as successful even if it is not caught
   - **unsuccessful**: an unprocessable pass, that is directed either high or low, out of the area of the trunk; it is assessed as unsuccessful even if it is caught

   **Final pass**
   - **Assessment:**
     - **successful**: caught pass in the final zone
     - **unsuccessful**: not caught pass, caught or struck to the ground by the defender

   **Disc catching**
   - **Assessment:**
     - **successful**: catching of the disc, possibility to continue in the offence
     - **unsuccessful**: the forward touched the disc, but he managed it badly and he/she did not catch the disc or dropped it, the players cannot continue in their offence, they are becoming defenders

Knowledge level was checked through the knowledge test, which consisted of 8 questions, 4 of them were related to the rules and 4 to tactical knowledge. Man-Whitney U-test was used for statistical processing of the results at the 5 % significance level.

**Results and discussion**

In the first part of our study game performance of female students of the first, third and fifth class that were educated through TGfU model (experimental group – EG 1, 2 and 3) and traditional model (control group – CG 1, 2 a 3) was evaluated.

EG 1 was statistically significantly better in suitable decision-makings than CG 1 (p < 0.05) in the indicator that evaluates tactical aspect of game performance. On the other hand, CG 1 reached significantly lower number of unsuccessfully caught discs than EG (p < 0.05), what was caused by lower total number of caught discs (84 CG and 152 EG) due to lower activity and support of teammate during the game. EG1 was, in general, better in the other indicators of game performance, but there were not proved statistically significant differences (Fig. 1).
EG 2 was also statistically significantly better in the indicator that evaluates tactical aspect of game performance – decision making. They reached significantly less unsuitable decision-makings than CG 2 (p < 0.05). As well as with the previous two groups, CG 2 also had proportionally less uncaught discs than EG (153 CG, 253 EG), but again it can be due to lower activity and support of the teammates during the game. EG2 was, in general, better in the other indicators of game performance, but there were not proved statistically significant differences (Fig. 2)
EG 3 was statistically significantly better in successful disc catching where 83.38% of EG represents 286 successfully caught discs and 85.43% of CG represents 129 successfully caught discs. As well as with the previous groups, CG 3 had again proportionally less uncaught discs than EG (151 CG, 343 EG) which is again due to lower activity and support of the teammates during the game. EG2 was, in general, better in the other indicators of game performance, but there were not proved statistically significant differences (Fig. 3).

![Figure 3: Game performance of experimental and control group 3](image)

**Figure 3**

*Game performance 15-year-old students after intervention*

The obtained results indicate that the students of the classes taught by model TGfU (Teaching Games for Understanding) reached partially better game performance. Our results were not, mostly, statistically significant which was due to low number of the girls in the groups. Nearly in all groups, there were students with passive approach to the game, which affected evaluation of the whole group. These negative aspects could be partially eliminated by watching higher number of games or exclusion of the passive players from the total evaluation.

The level of game performance in our research increased in both experimental and control groups. Based on our observation of the classes as well as evaluation of the level of game performance we can conclude that, in general, all experimental groups taught through the TGfU model, regardless the age, reached better quality of game performance than the control groups. Kuchárik (2014) provides similar results in mini handball, Žuffová (2012) in frisbee ultimate, Popelka (2012) in volleyball as well as Olosová and Zapletalová (2012) in mini basketball.

In the second part of the study, we focused on knowledge level. Three areas – declarative knowledge (rules), procedural knowledge (tactics) and total knowledge were evaluated. In general, all experimental groups reached better results of the knowledge test than the control groups. Significantly important difference was seen only between EG 1 and CG 1 in the area of procedural knowledge ($p < 0.05$) and total knowledge ($p < 0.05$) (Fig. 4, 5, 6).
Similar results were concluded in the studies of Olosová and Zapletalová (2014) where the group taught through the TGfU model reached proportionally better results that the group taught through the traditional model. Significantly better results were proved in the area related to the rules – declarative knowledge ($p < 0.05$) and as well as in our study in total knowledge level ($p < 0.05$). Research was performed with the boys in the sixth year of primary school, which is equal to our experimental, and control group 1. Higher level of tactical knowledge of the students taught through TGfU model is stated by Blomqvistová (2001).
in badminton, Dalton (2009) in basketball, Turner and Martinek (1999) in field hockey. In general, these researches prove positive effects of TGfU not only in the area of game performance but also in obtaining of special knowledge.

![Figure 6](image)

**Figure 6**
Knowledge level of 15-year-old students after intervention

**Conclusion**

The aim of our study was to verify efficiency of two teaching models – TGfU model and the traditional one. Our research proved, that TGfU model is more efficient from the point of view of the game than the traditional model. In general, female students taught through TGfU model reached better results in game performance assessment but the differences compared to the control groups were not always statistically significant. The same is true for the level of special knowledge. However, observation during the lesson showed that the students taught through TGfU model were more active during the game, they were more involved in the game and more combined what we did not do in our assessment.

For the future, we would recommend to integrate other indicators of game performance into the game performance assessment – for example cover and support, which would help to better assess the activity of each players. Regarding the fact that nowadays it is more and more difficult for teachers of PE to interest students and learn them to adopt physical activity as a part of their lives, we recommend to provide as big space for different forms of games at teaching of sport games as possible, and for this purpose it is possible to use, for example, the mentioned teaching model TGfU (Teaching Games for Understanding).
References


Efficiency of different teaching models in teaching of frisbee ultimate


The study is part of VEGA 10386/13 “Learning effects of different teaching approaches to sports games in relation to gender, age and game experience.”

RESUMÉ

EFEKTIVITA RÔZNYCH VYUČOVACÍCH MODELOV PRI VYUČOVANÍ FRISBEE ULTIMATE

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Cieľom štúdie bolo overiť efektivitu dvoch modelov vyučovania frisbee ultimate na osemročných gymnáziách. Vyučovanie experimentálnych skupín bolo realizované herným modelom (Teaching games for understanding) a vyučovanie kontrolných skupín tradičným modelom. Vyučovania sa zúčastnilo 6 skupín žiakov: experimentálna skupina 1 (n = 10, vek = 11,6), experimentálna skupina 2 (n = 12, vek = 13,8), experimentalna skupina 3 (n = 14, vek = 15,8), kontrolná skupina 1 (n = 11, vek = 11,7), kontrolná skupina 2 (n = 10, vek = 13,8) a kontrolná skupina 3 (n = 9, vek = 15,8). Efektivitu vyučovacích modelov sme hodnotili na základe herného výkonu a špeciálnych vedomostí. Herný výkon sme hodnotili pomocou metódy hodnotenia herného výkonu založenej na GPAI (Game Performance Assessment Instrument) prostredníctvom videozáznamu. Na overenie úrovne vedomostí sme použili vedomostný test, ktorý sa skladal z otázok týkajúcich sa pravidel a taktiky vedomostí frisbee ultimate. Na štatistické vyhodnocovanie výsledkov sme použili Mann-Whitneyho U-test.
Hodnotenie herného výkonu a úrovne vedomostí naznačilo vo všeobecnosti vyššiu efektívitu TGfU. Experimentálne skupiny 1 a 2 boli signifikantne lepšie v ukazovateľi, ktorý hodnotí taktickú stránku - rozhodovanie sa (p < 0.05). Experimentálna skupina 3 bola signifikantne lepšia v ukazovateľi, ktorý hodnotí hernú činnosť jednotlivca - chytenie disku (p < 0.05). Výsledky ukázali, že žiačky vyučované herným modelom dosiahli vo všeobecnosti čiastočne lepší herný výkon. Experimentálne skupiny dosiahli vo vedomostnom teste od 82,14 do 79,17 % správnych odpovedí týkajúcich sa pravidiel a od 87,5 do 75 % správnych odpovedí týkajúcich sa taktických vedomostí. Kontrolné skupiny dosiahli vo vedomostnom teste od 57,69 do 72,22 % správnych odpovedí týkajúcich sa pravidiel a od 51,92 do 72,22 % správnych odpovedí týkajúcich sa taktických vedomostí.